HYDROLOGICAL AND HYDROGEOLOGICAL RISK ASSESSMENT REPORT

FOR

STRATEGIC HOUSING DEVELOPMENT

AT

WAYSIDE, ENNISKERRY ROAD, KILTERNAN, DUBLIN 18

June 2022

ON BEHALF OF

LISCOVE LIMITED

Prepared by
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1 INTRODUCTION

Enviroguide Consulting (hereafter referred to as EGC) was appointed by Liscove Limited (hereafter referred to as the Applicant) to prepare a hydrological and hydrogeological risk assessment for the Proposed Strategic Housing Development (SHD) at Wayside, Enniskerry Road and Glenamuck Road, Kilternan, Dublin 18 (referred to hereafter as the Proposed Development and the Site).

1.1 Project Objective

The project objective was to undertake a risk-based assessment of any potential impacts on the receiving water environment and in particular:

- the sites protected and designated under the Habitats Directive (92/43/EEC) and Birds Directive (2009/147/EC); and,
- the Water Framework Directive (WFD) status of waterbodies assigned under the European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003).

The Habitats Directive (92/43/EEC) seeks to conserve natural habitats and wild fauna and flora by the designation of Special Areas of Conservation (SACs) and the Birds Directive (2009/147/EC) seeks to protect birds of special importance by the designation of Special Protection Areas (SPAs). SACs and SPAs are collectively known as Natura 2000 or European sites (referred to hereafter as Natura 2000 sites).

The EU Water Framework Directive (2000/60/EC) was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003). It applies to rivers, lakes, groundwater, and transitional coastal waters and provides for the protection of the quality status of all waters.

The risk-based assessment of any potential impacts on water and specifically on Natura 2000 sites assumed the absence of any avoidance and mitigation measures including those embedded in the design that will be implemented during the Construction and Operational Phases of the Proposed Development.

1.2 Project Scope

To undertake the assessment, the project scope included the following tasks:

- A desk-based study that comprised a review of published environmental information;
- A review of the Proposed Development design details provided by the Applicant;
- Develop a preliminary Conceptual Site Model (CSM) to describe potential source-pathway-receptor (SPR) linkages for the Site;
- Assess the potential impacts that the Proposed Development may have on the receiving water environment including Natura 2000 sites; and,
- Identify and assess the potential for any significant impact on Natura 2000 sites.

1.3 Professional Competency

This report was written by Candice Serbu BSc. MSc. and Gareth Carroll BAI and reviewed by Claire Clifford BSc., MSc., PGeo, EurGeol, who is Technical Director with Enviroguide Consulting, who is professionally competent and accredited to undertake environmental risk assessments and is listed on the Institute of Geologists of Ireland 'Register of Professional Qualified Geoscientist/competent persons: Regulated and Unregulated Waste Disposal/ Contaminated Land Assessments'.

This assessment is reliant on the information pertaining to the Proposed Development provided by the Applicant.

2 METHODOLOGY

2.1 Standards and Regulations

The methodology adopted for this assessment takes cognisance of the relevant standards and regulations pertinent to undertaking a hydrological and hydrogeological assessment in particular the following:

- Council Directive 2006/118/EEC, 2006. On the protection of groundwater against pollution and deterioration. European Parliament and the Council of European Communities;
- Commission Directive 2014/80/EU of 20 June 2014 amending Annex II to Directive 2006/118/EC of the European Parliament and of the Council on the protection of groundwater against pollution and deterioration;
- Dún Laoghaire-Rathdown County Development Plan 2022-2028 (Dún Laoghaire-Rathdown County, April 2022).
- EU Water Framework 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 with amendments;
- European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003)
- Environmental Protection Agency, December 2011. Guidance on the Authorisation
- of Discharges to Groundwater;
- Department of the Environment, Heritage and Local Government, Environmental Protection Agency and Geological Survey of Ireland, 1999. Groundwater Protection Schemes (Groundwater Protection Schemes, 1999);
- Local Government, July 1990. No. 21 of 1990. Local Government (Water Pollution) (Amendment) Act, 1990;
- S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010 and as amended; and,
- S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009 and as amended.

2.2 Desk-based Study

A desk-based study was undertaken including a review of relevant information from the following publicly available sources and information provided by the Applicant:

- Ordnance Survey Ireland Online mapping (OSI, 2022);
- Geological Survey of Ireland Online mapping (GSI, 2022);
- The Office of Public Works website and Online mapping (OPW, 2022);
- Environmental Protection Agency Online mapping (EPA, 2022);

- National Parks & Wildlife Services, Protected Sites Webmapping (NPWS, 2022);
- The Office of Public Works (OPW, 2022);
- DBFL Consulting Engineers, March 2019. Glenamuck District Roads Scheme Environmental Impact Assessment Report.
- Department of Environment, Community and Local Government Online Mapping (DECLG, 2022); and,
- Relevant drawings and design reports for the Proposed Development provided by the applicant.

2.3 Risk Based Impact Assessment

A risk-based and receptor-focussed approach was adopted for this assessment. The assessment involves a determination of the potential risk of impact to identified receptors (i.e. water bodies and Natura 2000 sites). The basis for a risk assessment is the Conceptual Site Model (CSM) or source-pathway-receptor (S-P-R) model which underpins the Water Framework Directive (WFD) and Irish water quality legislation as well as EPA guidelines on the assessment and protection water resources and associated aquatic ecosystems and human health receptors (e.g., groundwater supply users).

A risk-based assessment of the CSM and S-P-R linkages for a site is undertaken to provide an understanding of any potential risk associated with the infrastructure or activities on a site (the source). If one or more of the three elements of the S-P-R linkage are missing, the linkage is considered incomplete and there is no risk associated with the site (i.e., there is no means of transport or exposure to receptors).

The ‘prevent or limit’ objective of the WFD requires that the first line of defence is to restrict inputs of pollutants from the Proposed Development (i.e., ‘source’ removal) and thereby avoiding or reducing any potential impact to the receiving water environment and requirement for mitigation.

In this assessment all three elements (S-P-R) of the CSM will be considered and any potential linkages with receptors, including Natura 2000 sites hydraulically connected to the Proposed Development Site, will be assessed to determine if the Proposed Development either individually or in combination could potentially result in a significant impact to water quality and the integrity of any the identified Natura 2000 sites in the absence of mitigation.

3 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The Applicant, intend to apply to An Bord Pleanála for permission for the SHD (the Proposed Development) at lands at Wayside, Enniskerry Road and Glenamuck Road, Kilternan, Dublin 18 (the Site), which include a derelict dwelling known as 'Rockville' and associated derelict outbuildings, Enniskerry Road, Kilternan, Dublin 18.

The Proposed Development Site is 11.153Ha which includes 10.8Ha of developable land plus the works areas for drainage and

The Proposed Development will principally consist of: the demolition of 573.2m^2 of existing structures on site comprising a derelict dwelling known as 'Rockville' and associated derelict outbuildings; and the provision of a mixed use development consisting of 383No. residential units (165No. houses, 118No. duplex units and 100No. apartments) and a Neighbourhood Centre, which will provide a creche (439m^2), office (317m^2), medical (147m^2), retail (857m^2), convenience retail (431m^2) and a community facility (321m^2). The 383No. residential units will consist of 27No. 1 bedroom units (19No. apartments and 8No. duplexes), 128No. 2 bedroom units (78No. apartments and 50No. duplexes), 171No. 3 bedroom units (108No. houses, 3No. apartments and 60No. duplexes) and 57No. 4 bedroom units (57No. houses). The proposed development will range in height from 2 No. to 5 No. storeys (including podium/undercroft level in Apartment Blocks C and D and in the Neighbourhood Centre).

Vehicular access will be provided from the Enniskerry Road, the approved Part 8 Enniskerry Road/Glenamuck Road Junction Upgrade Scheme on Glenamuck Road (DLRCC Part 8 Ref PC/IC/01/17) and to the approved Glenamuck District Roads Scheme (GDRS) (ABP Ref:HA06D.303945) on the Glenamuck Link Distributor Road (GLDR).

The Proposed Development will also provide pedestrian access, car, motorcycle and bicycle parking, bin storage, provision of new telecommunications infrastructure at roof level of the Neighbourhood Centre including shrouds, antennas and microwave link dishes, private balconies, terraces and gardens; hard and soft landscaping; sedum roofs; solar panels; boundary treatments; lighting; substations; plant; and all other associated site works above and below ground.

The Proposed Development Site layout is provided in Figure 3-1.

Figure 3-1. Proposed Development Site Layout

3.1 Surface Water Drainage

2022a), the surface water drainage for 9.92Ha of the Proposed Development Site has been divided into two (2No.) catchment areas (Catchment 1 and Catchment 2) as described below. Surface water runoff from the site will be managed in accordance with the principles and objectives of Sustainable Drainage Systems (SuDS) and the Greater Dublin Sustainable Drainage System (GDSDS) to treat and attenuate water prior to discharge to the outfall points from the Site (Roger Mullarkey & Associates, 2022a). A full SuDS treatment train approach has been implemented in accordance with the CIRIA SuDS Manual and includes filter drains, permeable paving, swales, tree pits, green roofs, bio-retention area, Stone lined voided arch retention storage devices, silt trap manholes, petrol interceptor and hydrobrake (Roger Mullarkey & Associates, 2022a). The remaining areas of the Site will be outside of these catchments and will continue to discharge to ground.

- Catchment 1:
    - It is proposed that attenuated surface water drainage from 9.63Ha of the Proposed Development will outfall to the existing 300mm Rockville sewer in the adjoining Rockville development (Planning Ref. D17A/0793, D18A/0566 and D20A/0015).
    - The surface water from the existing 300mm Rockville surface water sewer discharges to the existing roadside drainage channel located on Glenamuck Road. It is understood that this drainage channel flows approximately 1.4km downstream in a north-easterly direction along Glenamuck Road before discharging to the Glenamuck North Stream.

- The existing 300mm Rockville sewer will eventually be diverted into the regional attenuation pond for the surface water drainage network of the permitted Glenamuck District Roads Scheme (GDRS) project (ABP Ref: ABP-303945-19). Dún Laoghaire Rathdown County Council (DLRCC) confirmed that capacity to drain the lands at the Proposed Development have been included in regional attenuation ponds of the GDRS (Roger Mullarkey & Associates, 2022a).

- Catchment 2:
  - It is proposed that treated and attenuated surface water drainage from 0.29Ha of the Proposed Development will outfall to the surface water drainage network of the permitted GDRS project at Glenamuck Road (ABP Ref: ABP-303945-19).

The GDRS project has been designed by DLRCC to facilitate the surface water drainage connection from the Site, subject to a successful grant of planning for the Proposed Development (Roger Mullarkey & Associates, 2022a). Attenuated and treated surface water from the GDRS project will ultimately outfall to the watercourses within the catchments of the Carrickmines Stream (IE_EA_10C040350) and the Shanganagh River (IE_EA_10S010600). The Environmental Impact Assessment Report (EIAR) for the GDRS project (DBFL, March 2019) that assess the overall scheme including surface water drainage concluded that 'the significance of the identified impacts will be reduced to a "Not significant" residual impact on the identified hydrological/ hydrogeological receptors'.

The proposed onsite catchment areas and surface water management strategy for the Proposed Development Site is present in Figure 3-2.

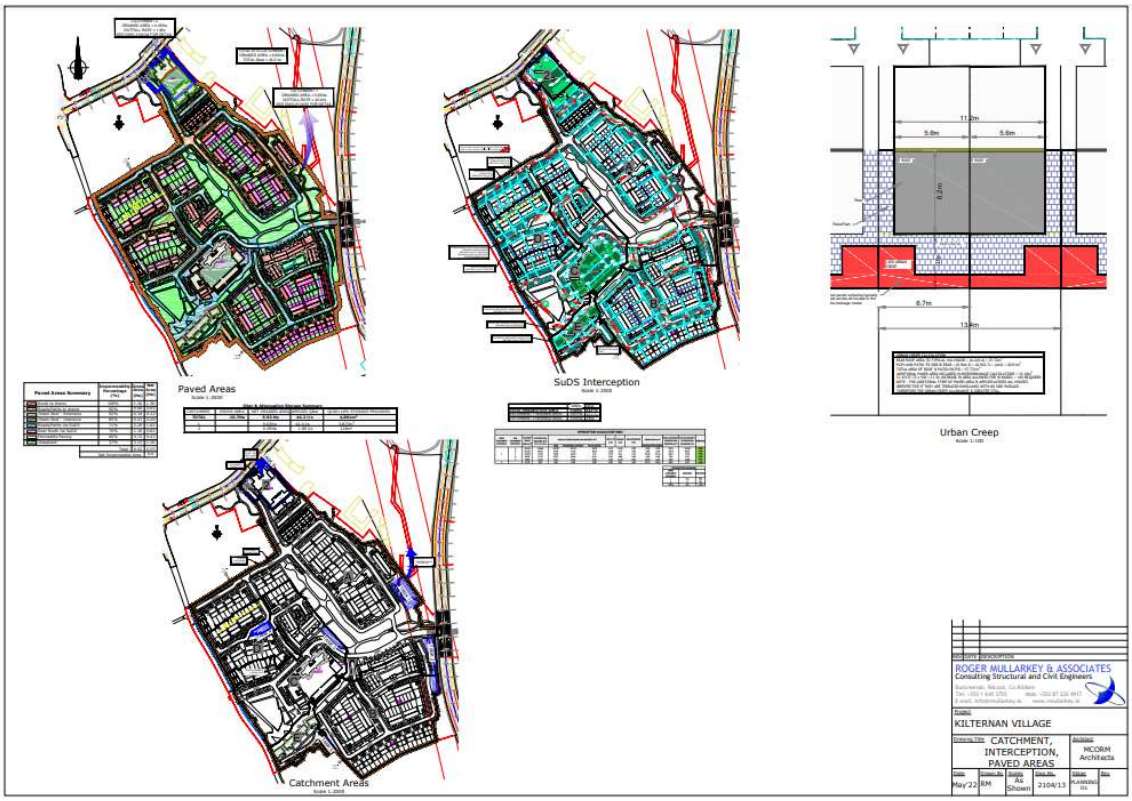

Figure 3-2. Catchment, Interception and Paved Areas (Source: Roger Mullarkey & Associates, 2022a. DWG. No. 2104/13)

3.2 Foul Water Drainage

Foul water from the Proposed Development will be managed within two separate foul drainage catchments and will ultimately discharge to Shanganagh Wastewater Treatment Plant (WWTP). The proposal for foul water from the two catchments is as follows:

- Foul water from 10.5Ha of the Site will outfall to via the existing Rockville foul sewer in the adjoining Rockville development (Planning Ref. D17A/0793, D18A/0566 and D20A/0015). This existing Rockville foul sewer connects into the Irish Water (IW) foul sewer on Glenamuck Road.
- Foul water from 0.3Ha of the Site will outfall to the foul sewer network of the permitted GDRS project in Glenamuck Road (ABP Ref: ABP-303945-19). The GDRS project has been designed by DLRCC to facilitate the foul drainage connection from the Site, subject to a successful grant of planning for the Proposed Development (Roger Mullarkey & Associates, 2022a).

The foul water drainage infrastructure for the Proposed Development will be designed and constructed in accordance with current IW Code of Practice for Wastewater Infrastructure (Roger Mullarkey and Associates, 2022a).

IW issued a Confirmation of Feasibility (COF) (Ref.CDS20006509 dated 30th May 2022) that the proposed connections to IW mains foul water from the Site are 'feasible without infrastructure upgrade by Irish Water'. Subsequently, a full design submission was made for the foul water infrastructure and IW have issued the Statement of Design acceptance (SODA) letter (Ref.CDS20006509 issued on the 1st June 2022) (Roger Mullarkey & Associates, 2022a).

The foul water drainage infrastructure at the Proposed Development will be designed and constructed in accordance with current IW Code of Practice for Wastewater Infrastructure (Roger Mullarkey and Associates, 2022a).

3.3 Water Supply

Water supply to the Proposed Development will be from the two (2No.) existing IW water supply mains located on Enniskerry Road and on Glenamuck Road.

IW issued a Confirmation of Feasibility (COF) (Ref.CDS20006509 dated 30th May 2022) that both water supply connections from the Site are 'feasible without infrastructure upgrade by Irish Water'. Subsequently, a full design submission was made for the water infrastructure and IW have issued the Statement of Design acceptance (SODA) letter (Ref.CDS20006509 issued on the 1st June 2022) (Roger Mullarkey & Associates, 2022a).

The water supply infrastructure at the Proposed Development will be designed and constructed in accordance with current IW Code of Practice for Water Infrastructure (Roger Mullarkey and Associates, 2022a).

4 PROPOSED DEVELOPMENT SITE SETTING

4.1 Site Location and Description

The Proposed Development site is located at Wayside, Enniskerry Road and Glenamuck Road, Kilternan, Dublin 18 and approximately 1.9 km southwest of the M50 and Carrickmines Retail Park. The Proposed Development Site location is presented in Figure 4-1.

The Proposed Development site is accessed from the Enniskerry Road (R117) and currently comprises undeveloped lands and agricultural lands (grazing of cattle) with a derelict dwelling known as 'Rockville' and associated derelict outbuilding within an overall site area of 11.153Ha including 10.8Ha of developable land**.** The Proposed Development Site is located within Kilternan Village with the surrounding land use comprising predominantly residential housing and agricultural lands.

The Proposed Development Site is bounded by Glenamuck Road, Kilternan Country Market and the Sancta Maria property to the north and northwest, by Enniskerry Road to the west and southwest, by residential dwellings to the south and southeast and by agricultural lands and the Rockville residential development to the east and northeast.

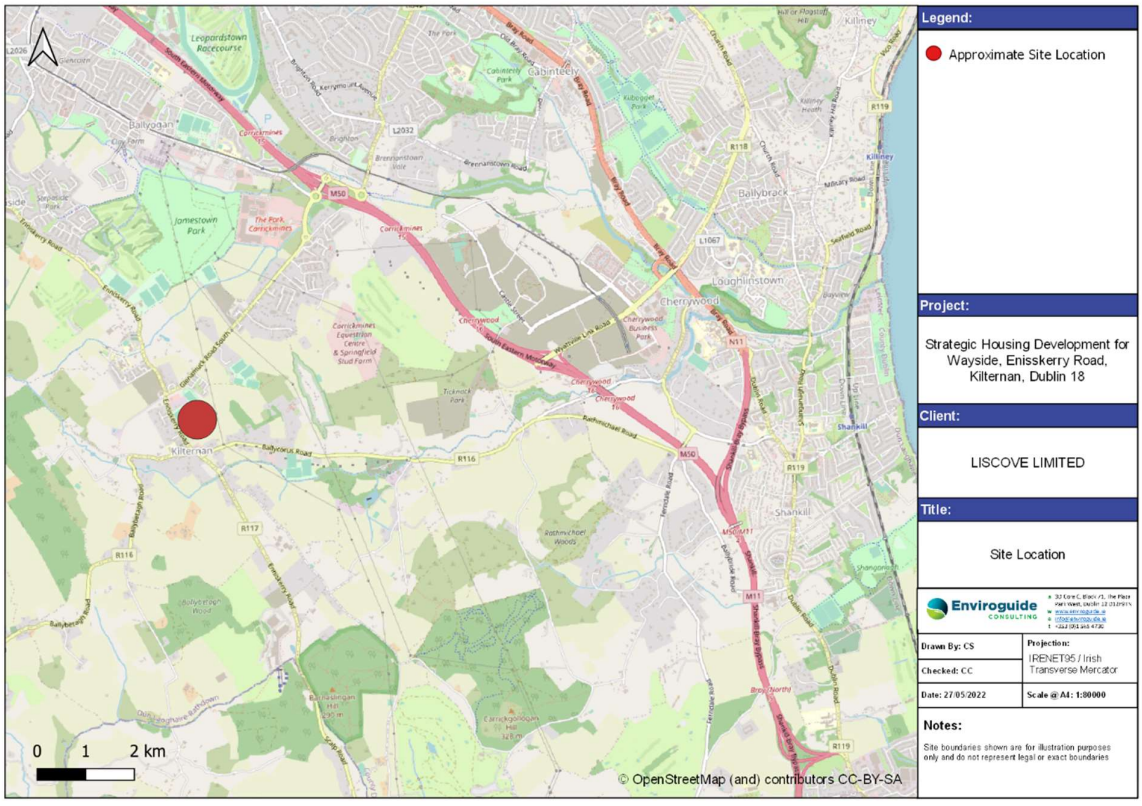

Figure 4-1. Site Location

4.2 Topography

The topography surrounding the Proposed Development site is generally toward the east and northeast towards the coast.

As documented in the Engineering Infrastructure Report (Roger Mullarkey & Associates, 2022), the topography at the Proposed Development site is generally a gradually increasing slope downwards from Enniskerry Road (western boundary) in a north-easterly direction and then falls off sharply toward the eastern boundary of the Proposed Development site at a gradient of approximately 10%. Ground elevations at the site range from approximately 143.07mOD in the southwest to 132.85mOD in the northeast of the Proposed Development site (Roger Mullarkey & Associates, 2022a).

4.3 Hydrology

4.3.1 Surface Water Drainage

The Site has been mapped by the EPA (EPA, 2022) to be within the Ovoca-Vartry WFD Catchment (ID: 10), the Ovoca-Vartry Hydrometric Area (HA10), the Dargle_SC_010 Sub-Catchment, (Sub-catchment ID: 10_5) and the Carrickmines Stream_010 WFD River Sub Basin (IE_EA_10C040350).

The closest surface water feature is recorded on the EPA database (EPA, 2022) as the Shanganagh River (IE_EA_10S010600), named locally as the Loughlinstown River, which is located approximately 0.3km south / southeast of the Proposed Development Site and flows eastwards, discharging to the Irish Sea (South Western Irish Sea - Killiney Bay - IE_EA_G_076), approximately 5.3km east of the Site.

The Glenamuck North Stream (IE_EA_10C040350) is located approximately 0.4km north of the Proposed Development Site and flows eastwards before converging with the Carrickmines Stream (IE_EA_10C040350) approximately 2.0km east of the Site. The Carrickmines Stream flows approximately 3.2km downstream in a south-easterly direction before converging with the Shanganagh River approximately 3.9km east of the Site (EPA, 2022). The Shanganagh River flows approximately 1.8km downstream in a south-easterly direction before discharging to the Irish Sea approximately 5.3km east of the Site.

The surface water features mapped by the EPA within a 2km radius of the Proposed Development Site are presented in Figure 4-2.

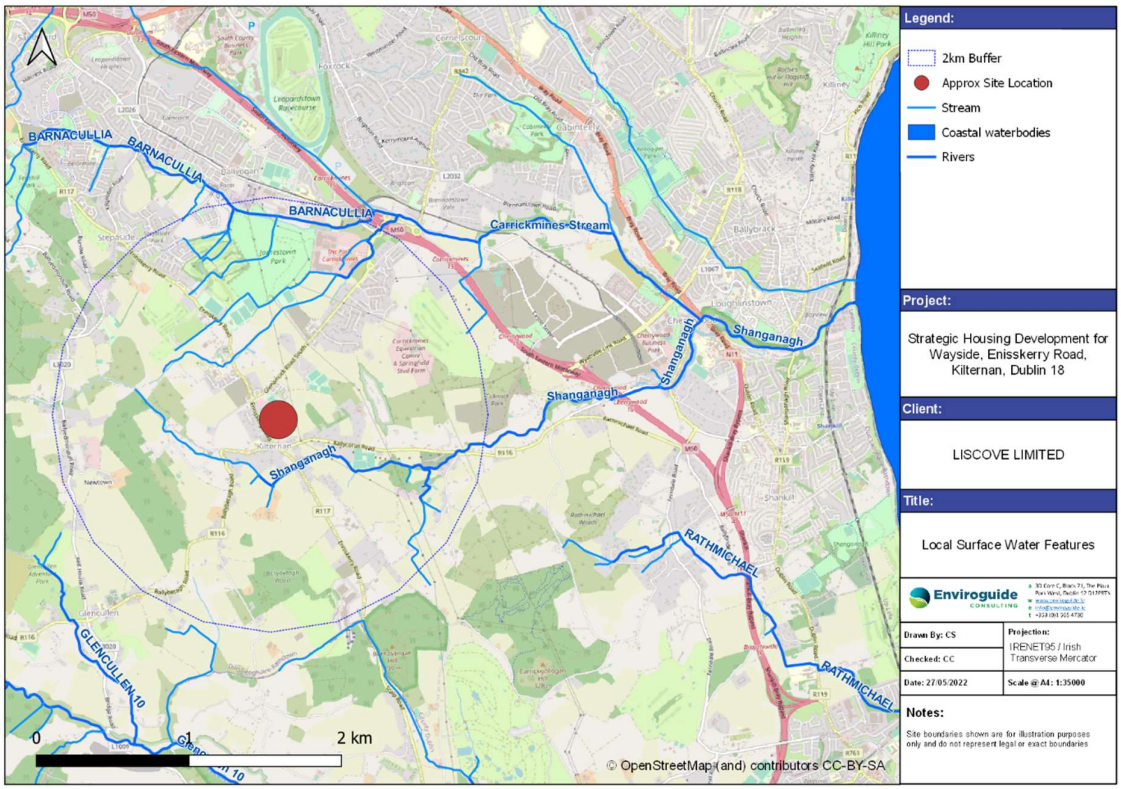

Figure 4-2. Local Surface Water Features

4.3.2 Existing Surface / Storm Drainage

There is no surface water drainage at the Site and no direct hydraulic connection with any water courses and surface runoff at the Site discharges to ground (Enviroguide Consulting, 2022a).

There is an existing roadside drainage channel located approximately 0.02km north of the Site along Glenamuck Road. It is understood that this drainage channel flows approximately 1.4km downstream in a north-easterly direction along Glenamuck Road before discharging to the Glenamuck North Stream. The Glenamuck North Stream flows approximately 0.6km downstream in a north-easterly direction before converging with the Carrickmines Stream.

4.4 Flood Risk

A site-specific preliminary flood risk assessment (SFRA) for the Proposed Development (Roger Mullarkey & Associates, 2022b) states that the Proposed Development Site is outside the 10% AEP, 5% AEP, 1%AEP and 0.1% AEP flood extents for fluvial and coastal flooding of the Shanganagh River. The report concludes that the Proposed Development Site is regarded to be of low flood risk and is suitable for development (Roger Mullarkey & Associates, May 2022b).

4.5 Soil and Geology

The soils beneath the Site are mapped by Teagasc (Teagasc, 2022) as imperfectly drained peat over lithoskelatal acid igneous rock of the Carrigvanagh (0410a) soil series and Urban' beneath the northern part and the southeast corner of the Site.

Subsoils beneath the Site are mapped by the GSI (GSI, 2022) as 'till derived from granites (TGr)' with 'bedrock outcrop or subcrop (Rck)' mapped beneath the southern and northern parts of the Site. Previous site investigation records indicate that cohesive soils comprising clay / silt was encountered to a maximum depth of 2.9mbGL (SII, 2006, GII, 2010 and GII, 2017).

Bedrock is beneath the Site is mapped by the GSI (GSI, 2022) as Granite - Type 3 Muscovite Porphyritic Formation (Stratigraphic Code: Nt3; New Code IDNLGR3). Previous site investigation records indicate that bedrock was encountered as weathered Granite at depths below 0.8mbGL and 2.9mbGL (SII, 2006, GII, 2010 and GII, 2017).

4.6 Hydrogeology

4.6.1 Site Investigation and Groundwater Levels

Groundwater strikes were recorded during drilling of boreholes at the Proposed Development Site (SII, 2006; borehole logs are appended to the Roger Mullarkey & Associates, 2022a Drainage Infrastructure Report however a location map for boreholes is not included). The groundwater strikes where encountered were recorded at depths ranging from 2.6mbGL to 2.9mbGL and typically within the sandy gravelly clays / silts above the granite bedrock.

4.6.2 Aquifer Classification and Groundwater Vulnerability

The GSI (GSI, 2022) has classified the bedrock of the Type 3 Muscovite Porphyritic Formation beneath the Proposed Development Site and surrounding area as a Poor Aquifer (Pl) (i.e. bedrock which is generally unproductive except for local zones). Poor aquifers are capable of supplying 'moderate' to 'low' yields (<100m3/day) and Groundwater flow occurs predominantly through a limited and poorly-connected network of fractures, fissures and joints (GSI, 2017).

There are no gravel aquifers mapped within a 2.0km radius of the Proposed Development site (GSI, 2022).

The GSI have assigned a groundwater vulnerability rating of "High" (H) for the groundwater beneath the Proposed Development Site (GSI, 2022) indicating approximately 3m to 10m of overburden.

As documented in the site investigation reports (SII, 2006, GII, 2010 and GII, 2017 included in the Roger Mullarkey & Associates, 2022a Drainage Infrastructure Report), weathered bedrock was encountered at depths below 0.8mbGL and 2.9mbGL. Therefore, the vulnerability rating of can be considered to be locally extreme based on available data for the Proposed Development Site.

The bedrock aquifer map is presented in Figure 4-3 and the GSI Groundwater Vulnerability Map is presented in Figure 4-4.

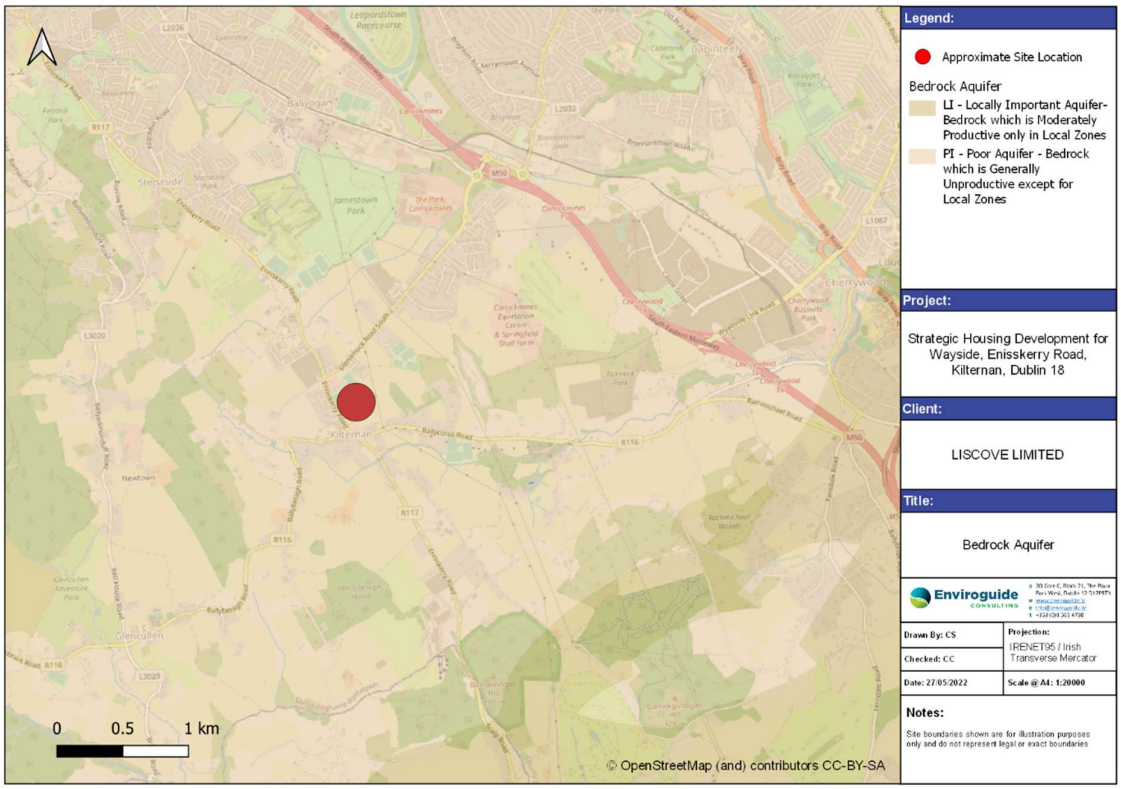

Figure 4-3. Bedrock Aquifer

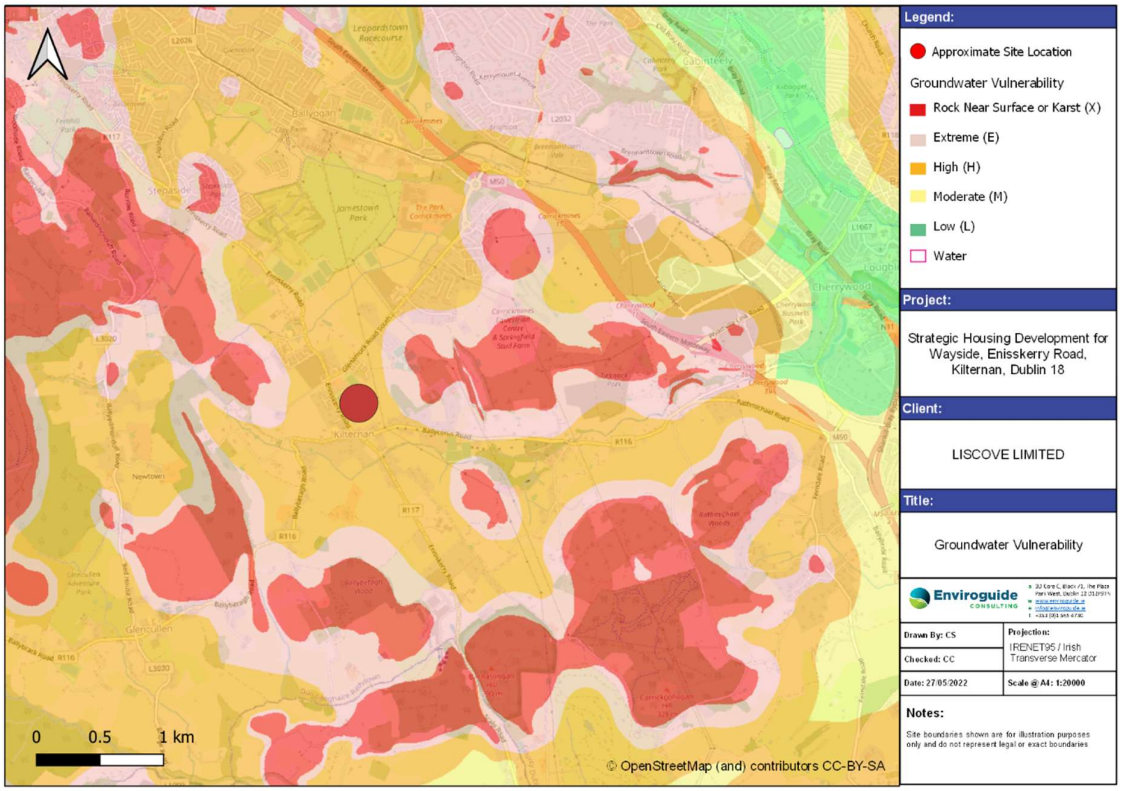

Figure 4-4. Groundwater Vulnerability

4.6.3 Groundwater Body and Flow Regimes

The bedrock aquifer beneath the Site is within the Wicklow Groundwater Body (GWB) (EU Code: IE_EA_G_076). that covers some 1396km^2 and occupies an area across Co. Dublin, Co. Wicklow and Co. Wexford (GSI, 2022).

Recharge in the vicinity of the Proposed Development is diffuse through overlying tills into the aquifer. The granite aquifer beneath the Site is classified as a poor aquifer which is characterised by a lower capacity to accept recharge via infiltration of rainfall. A recharge coefficient of between 20% and 60% of effective rainfall with a capped recharge value of 100mm/year has been assigned to the aquifer (GSI, 2022).

The GSI (Wicklow GWB Report) identifies that the majority of groundwater flow direction in the aquifer will take place in the upper 3m of the rocks. Site investigation results indicate that shallow groundwater, where encountered, was recorded at depths ranging from 2.6mbGL to 2.9mbGL and typically within the sandy gravelly clays / silts above the granite bedrock (SII, 2006, GII, 2010 and GII, 2017).

Regionally groundwater flow is towards the Irish Sea with local flow towards streams and rivers (GSI, 2022). Groundwater flow in the vicinity of the Site is likely to be towards the Carrickmines Stream and the Shanganagh River although baseflow contributions are noted to be low within the Wicklow GWB.

4.6.4 Water Use and Source Protection

The Proposed Development Site is located within an area serviced by mains water supply. The GSI groundwater wells and springs database (GSI, 2022) lists one (1No.) groundwater well (domestic use) within a 2km radius located 0.9km south of the Proposed Development Site.

There are no Groundwater Source Protection Areas (SPAs) located within a 2km radius of the Proposed Development Site. The closest Groundwater SPAs to the Proposed Development Site are the Ballyfolan Group Scheme Preliminary SPA and the Roundwood Public Water Supply (PWS) which are located approximately 15.1km west and 18.5km south of the Proposed Development Site respectively.

The Shanganagh River which is located approximately 0.3km south / southeast of the Proposed Development Site is mapped by the EPA (EPA, 2022) as a surface water drinking water source under Article 7 of the Water Framework Directive. There are no other surface water drinking water sources identified by the EPA (EPA, 2022) within a 2km radius of the Proposed Development Site.

4.7 Water Quality

The EPA Q-Value is a system of water quality rating based on the biological quality of the water body and abundance for specific invertebrate species. A summary of the Q-value for the operational and historic EPA monitoring locations along the Carrickmines Stream and the Shanganagh River is presented in Table 4-1. The EPA data indicates that there is an upward trend in total ammonia and ortho-phosphate (as P) for the water course for the period 2013-2018 (EPA, 2022).

It is noted that the Ballyogan Landfill facility (Licence Number W0015-01) is located approximately 1.3km north of the Site and upstream from where the Glenamuck North Stream converges with the Carrickmines Stream. The most recent available Annual Environmental Report (AER) for the Ballyogan Landfill indicates no non-compliance issues for the 2020 reporting period.

It is also noted that the available 2020 AER for the Shanganagh WWTP indicates that discharges from the WWTP to the Irish Sea were compliant with the Emission Limit Values (ELVs).

There is no available published groundwater quality data for the Wicklow GWB in the vicinity of the Site.

Table 4-1: EPA Monitoring Stations within 2km of the Proposed Development

River I.D.	Sample Location / Monitoring Station	Q-Value (WFD Status)
Shanganagh River (0.63km upstream)	Shanganagh Middle Bridge Cabinteely Park Station I.D.: RS10S010100	3 (Poor) in 1990
Shanganagh River (0.27km downstream)	Shanganagh Kilternan Bridge Enniskerry Road Station ID: RS10S010440	3-4 (Moderate) in 2000
Shanganagh River (1.45km downstream)	Shanganagh Bridge North of Ballycorus Lead Works Station I.D.: RS10S010450	4 (Good) in 1994
Shanganagh River (4.6km downstream)	At Commons Road Station I.D.: RS10S010600	4 (Good) in 2020
Shanganagh River (4.9km downstream)	At Commons Road Station I.D.: RS10S0107000	3 (Poor) in 1984
Carrickmines Stream (2.0km downstream)	Carrickmines Stream Glenamuck Road Bridge (Friarsland / Priorsland) Station I.D. RS10C040200	3 (Poor) in 2003
Carrickmines Stream (2.9km downstream)	Carrickmines Stream Bridge near Glendruid House Station I.D. RS10C040300	3-4 (Moderate) in 1990
Carrickmines Stream (3.7km downstream)	Carrickmines Stream Upstream Overpass Station I.D. RS10C040350	4 (Good) in 2020
Carrickmines Stream (3.9km downstream)	Carrickmines Stream Bridge at Loughlinstown Station I.D. RS10C040400	3 (Poor) in 2003

4.8 Water Framework Directive

The Water Framework Directive status for surface water, groundwater, transitional and coastal water bodies relevant to the Site as recorded by the EPA (EPA, 2022) in accordance with European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003) are provided in Table 4-2.

Table 4-2. Water Framework Directive Status

Waterbody Name	Water body; EU code	Location from Site	Distance from Site (km)	WFD water body status (2013-2018)	Hydraulic Connection to the Site
Surface Water Bodies					
Shanganagh River	IE_EA_10S010600	South / Southeast	0.27	Moderate	Cross-gradient of the Proposed Development Site
Glenamuck North River	IE_EA_10C040350	North	0.42	Moderate	Cross-gradient of the Proposed Development Site
Carrickmines Stream	IE_EA_10C040350	North	2.0	Moderate	Cross-gradient of the Proposed Development Site
Coastal Water Bodies					
Southwestern Irish Sea -Killiney Bay	IE_EA_100_0000	East	5.21	High	Downstream of Shanganagh River
Groundwater Bodies					
Wicklow Groundwater Body	IE_EA_G_076	N/A	N/A	Good	Underlying groundwater-body

4.9 Designated and Protected Areas

The Habitats Directive (92/43/EEC) seeks to conserve natural habitats and wild fauna and flora by the designation of Special Areas of Conservation (SACs) and the Birds Directive (2009/147/EC) seeks to protect birds of special importance by the designation of Special Protection Areas (SPAs). SACs and SPAs are collectively known as Natura 2000 or European sites (referred to hereafter as Natura 2000 site).

Designated and protected areas located within 15km of the Proposed Development Site are identified in Figure 4-5 and listed in Table 4-3 with the Natura 2000 sites that are potentially hydraulically connected to the Site identified.

Table 4-3. Natura 2000 sites within 15km of the Site

Site Code	Site Name	Distance and Direction from Proposed Development Site	Potential for Hydraulic Connection
Special Areas of Conservation (SAC)			
002122	Wicklow Mountains SAC	4.4km Southwest	No - Located within with Wicklow GWB but upgradient of the Site.
001209	Glenasmole Valley SAC	10.5km West	No - Located within with Wicklow GWB but upgradient of the Site.
000725	Knocksink Wood SAC	3.0km South	No Located with the Wicklow GWB but within a different hydrological catchment and cross gradient (based on regional groundwater flow towards the Irish Sea).

Site Code	Site Name	Distance and Direction from Proposed Development Site	Potential for Hydraulic Connection
000713	Ballyman Glen	3.6km Southeast	No Located within Enniskerry Gravels GWB and within a different hydrological catchment and cross gradient (based on regional groundwater flow towards the Irish Sea).
000714	Bray Head SAC	8.2km Southeast	Potential hydraulic connection via the Irish Sea., located 6.1km north along the coast from the discharge point from the Shanganagh River
003000	Rockabill to Dalkey Island SAC	6.9km Northeast	Potential hydraulic connection via the Irish Sea.
Special Protection Areas (SPA)			
004040	Wicklow Mountains SPA	4.5km Southwest	No Located within with Wicklow GWB but upgradient of the Site.
004024	South Dublin Bay and River Tolka Estuary SPA	7.8km North	Potential hydraulic connection via the Irish Sea, however this is located 5.7km along the coast from the discharge point from the Shanganagh River.
004006	North Bull Island SPA	12.1km Northeast	Potential hydraulic connection via the Irish Sea. However, this is located 11.2km north along the coast from the discharge point from the Shanganagh River.
004172	Dalkey Island SPA	7.8km Northeast	Potential hydraulic connection via the Irish Sea.

There are other protected sites within the 15km and downstream of the site that are not within the Natura 2000 sites including twenty-three (23No.) sites that are identified as proposed National Heritage Areas (pNHAs) (refer to Figure 4-5). Of these sites the Loughlinstown Wood pNHA is considered to be hydraulically connected to the Site via the Shanganagh River.

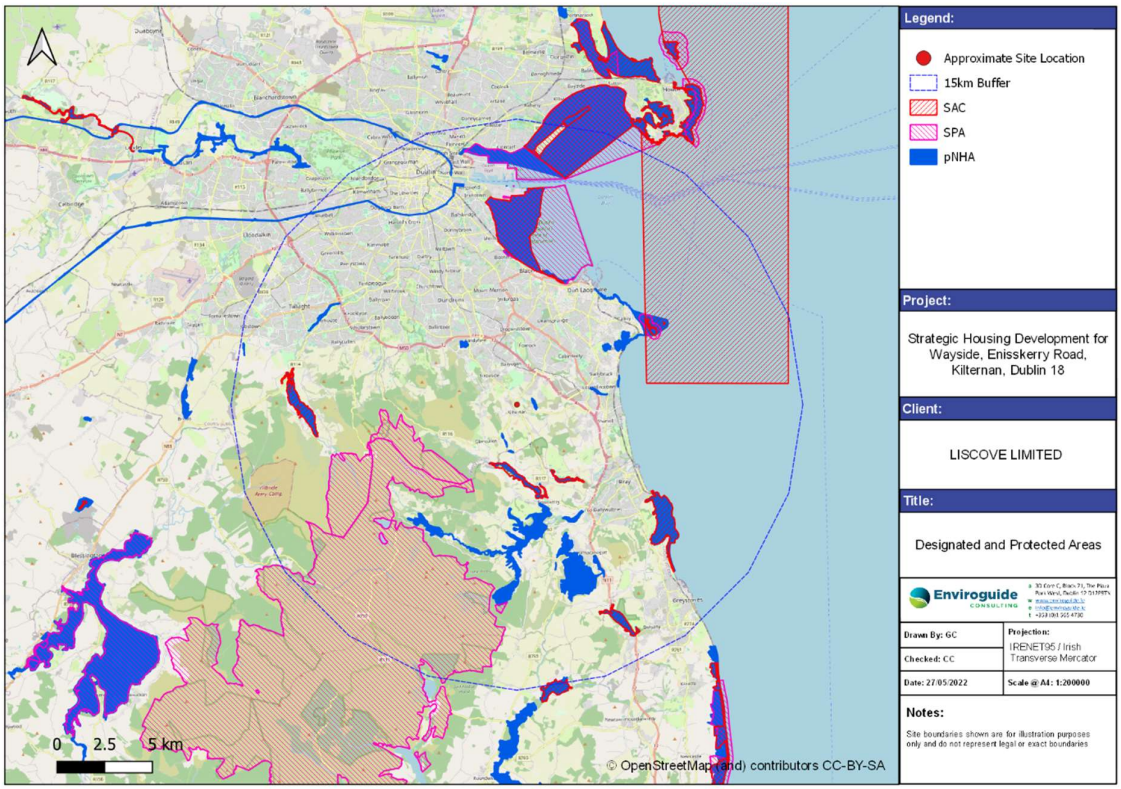

Figure 4-5. Designated and Protected Areas

5 ASSESSMENT OF POTENTIAL IMPACTS

5.1 Conceptual Site Model

A CSM has been developed identifying possible sources, potential pathways and receptors. The CSM enables a risk-based evaluation of the S-P-R linkages associated with the Proposed Development Site and to identify any potential significant risk to associated receptors.

5.1.1 Potential Sources

Potential sources during both the Construction and Operational phases have been evaluated considering any hydrological / hydrogeological S-P-R connections. The scenario considered for this assessment was a worst-case source scenario without mitigation measures. These comprised short term Construction sources and long-term Operational sources as described below.

5.1.1.1 Construction Phase

During the Construction Phase there will be no direct discharges to surface water or groundwater at the Proposed Development with the exception of rainfall which will continue to infiltrate to ground during the Construction Phase.

There may be a requirement for management of surface water (rain water) and shallow groundwater where encountered during groundworks. There will be no unauthorised discharge of water (groundwater or surface water runoff) to ground, drains or water courses during the Construction Phase.

Foul water discharge from the temporary welfare units at the Site during the Construction Phase will be either tankered offsite in accordance with waste management legislation or discharged under temporary consent to the IW mains foul network for treatment at Shanganagh WWTP subject to agreement with IW.

The most plausible, albeit worst case, source scenario are considered to be :

- Suspended sediment entrained in runoff arising from groundworks and other construction works at the Site;
- Fuels or potentially other hazardous materials including foul water accidentally released, through the failure of secondary containment or a materials handling accident; and
- Release of cementitious materials to groundwater of surface runoff construction works that could result in an increased pH on the receiving water environment.

These potential sources are considered to be short-term events in a worst-case scenario and deemed unlikely to occur. The Construction Phase will be managed in accordance with the procedures in the Outline Construction Management Plan (CMP) (Atkins Ireland, 2022), Outline Construction and Environmental Management Plan (CEMP) (Enviroguide Consulting, 2022b) and CDWMP (Enviroguide Consulting, 2022a). Regardless, these potential sources are considered in the unmitigated scenario for this assessment.

Operational Phase:

During the Operational Phase there will be no direct discharges to surface water courses and only rainfall on unpaved or permeable areas will discharge to groundwater.

The Proposed Development will be serviced by newly constructed separate surface water and foul water drainage networks that will connect to mains sewers in accordance with appropriate consents from IW and DLRCC.

Surface water runoff from the Proposed Development will be managed in accordance with the principles and objectives of SuDS and GDSDS and treated and attenuated prior to discharge from the Site to offsite surface water network.

Foul water from the Proposed Development will be discharged to the IW foul drainage network infrastructure, which was identified by IW to have sufficient capacity to accept foul water from the Proposed Development.

There will be no requirement for bulk storage of petroleum hydrocarbon-based fuels during the Operational Phase as the main operating system for heating will be gas based / air to water heat pump.

The most plausible, albeit worst case, source scenario is outlined:

- Fuels or other potentially hazardous materials released in the event of an accidental spill or leak from a vehicle (assumed 500 litres) is considered a worst-case source at the Site. This potential source is considered to be short-term event in a worst-case scenario and while unlikely to occur, this scenario is considered in this assessment; and
- Suspended sediment entrained in runoff is considered a low-risk source at the Site for the Operational Phase.

5.1.2 Pathways

The following potential pathways are identified and evaluated below:

- **Vertical migration to the underlying bedrock and lateral migration within the aquifer to downgradient receiving surface water bodies**

  The Site is underlain by a Poor Aquifer (Pl) within the granite bedrock with limited capacity to accept recharge and only localised flow paths. However, groundwater flow paths and potentially contaminants could enter the aquifer and flow locally within the aquifer and migrate towards local watercourses within the catchments of the Carrickmines Stream and the Shanganagh River.

- **Surface water runoff and migration offsite via water courses to downstream surface water bodies**

  There is no direct pathway via surface runoff (open water courses) to any surface water body for the Construction Phase and Operational Phases.

  This pathway is therefore not considered further in this assessment.

- **Surface water discharge to mains surface water sewer and downstream receiving surface water bodies**

  There will be a pathway for surface water runoff discharged via onsite drainage network:

  - Surface water from Catchment 1 of the Proposed Development will be discharged to the existing 300mm Rockville sewer that discharges to the existing roadside drainage channel located on Glenamuck Road which ultimately discharges to the Glenamuck North Stream and associated downstream watercourses.
  - Surface water from Catchment 2 of the Proposed Development will be discharged to the mains drainage network within the GDRS scheme that ultimately outfalls to the watercourses within the catchments of the Carrickmines Stream and the Shanganagh River.

  Therefore, the pathways to the Glenamuck North Stream, the Carrickmines Stream, Shanganagh River and associated downstream watercourses and receptors is considered valid for this assessment.

- **Foul water discharge to mains sewer and receiving surface water bodies**

  Foul water during the Construction Phase will be either removed by tanker in accordance with waste management legislation and managed accordingly or discharged under consent to the mains IW foul sewer network. Foul water during the Operational phase will also be discharged to the IW foul drainage network infrastructure and ultimately discharged to the Irish Sea via the Shanganagh WWTP. Therefore, the indirect pathway to the Irish Sea is considered in this assessment.

5.1.3 Receptors

The receptors considered in this assessment include the following:

- Groundwater Bodies:
  - Bedrock Granite Poor Aquifer (Pl).
- Surface Water:
  - Glenamuck North Stream;
  - Carrickmines Stream; and
  - Shanganagh River.
- Coastal Water Bodies:
  - Irish Sea and Killiney Bay.
- Natura 2000 Sites:
  - Rockabill to Dalkey Island SAC; and
  - Dalkey Island SPA.

It is noted that there are other Natura 2000 sites with a potential hydraulic connection to the Site however, those hydraulically closest to the Site are considered as the most sensitive Natura 2000 sites for this assessment.

5.2 Risk Evaluation of Source-Pathway-Receptor Linkages

The possible S-P-R linkages are considered and evaluated below.

5.2.1 Worst-case source scenario and vertical migration to the underlying bedrock and lateral migration within the aquifer to downgradient receiving water bodies

There is limited potential for discharge of contaminants to ground and migration offsite via groundwater during the Construction and Operational Phases taking account of the embedded design avoidance and mitigation measures. During the Construction Phase, a detailed CEMP prepared in accordance with industry best practice standards including CIRIA - C532 will detail measures to protect water quality and associated ecological habitats and receptors will be implemented by the contractor during the construction phase. The CEMP prepared by the contractor will take account of measures outlined in the outline CMP, CEMP and CDWMP submitted as part of the planning application. These measures will address the main activities of potential impact which include:

- Control and management of water and surface runoff;
- Control and management of groundwater during excavation and dewatering if required;
- Management and control of imported soil and aggregates from off-site sources;
- Fuel and Chemical handling, transport and storage; and,
- Accidental release of contaminants.

In a worst-case scenario during either the Construction or Operational Phases in the absence of any mitigation measures there is potential for discharge of contaminants to groundwater. The groundwater within the Wicklow GWB may be impacted locally in the immediate vicinity of the Site however taking account of the characteristics of the poor granite bedrock aquifer it is unlikely that there would be widespread impact within the Wicklow GWB. Taking account of the local hydrogeological regime including the distance downgradient to the closest water courses and fact that groundwater flow paths are localised and baseflow is limited within the granite aquifer (GSI, 2022) it is considered that there is a negligible risk to watercourses within the catchments of the Carrickmines Stream and the Shanganagh River and associated water bodies via groundwater flow from the Site.

5.2.2 Worst-case source scenario and surface water runoff and migration offsite via water courses to downstream water bodies

There is no direct pathway via surface runoff (open water courses) to any water body and therefore as there is no identified pathway there is no risk associated with this S-P-R linkage.

5.2.3 Worst-case source scenario and surface water discharge to mains surface water network and downstream receiving water bodies

There is limited potential for discharge of any contaminated runoff to the receiving water courses during the Operational of the Proposed Development associated with surface water

runoff from the Site. The embedded design avoidance including SuDS measures will treat and attenuate surface water runoff from the Proposed Development prior to discharge from the Site.

The unmitigated worst-case source scenario where the treatment and attenuation of surface water via the SuDS measures incorporated in the design was not considered. In the unmitigated scenario the discharge of surface water from Catchment 1 of the Proposed Development could result in a potential impact on the receiving water quality of the roadside drainage channel on Glenamuck Road, the Glenamuck North Stream and within the Carrickmines Stream locally at the point of discharge to the Carrickmines Stream. However, it is considered that there would be no impact to water quality downstream where the Carrickmines Stream confluences with the Shanganagh River taking account of the nature of the incident, the separation distances and the potential for assimilation within the receiving water bodies. There would also be no potential impact on water quality where the Shanganagh River discharges to the Irish Sea. Accordingly, in the event of an unmitigated worst-case source scenario there is no identified potential impact on the closest hydraulically connected Natura 2000 sites (i.e., Rockabill to Dalkey Island SAC and Dalkey Island SPA) associated with surface water runoff from Catchment 1 of the Proposed Development Site.

Surface water from Catchment 2 of the Proposed Development will be discharged to the mains drainage network within the GDRS scheme which has been designed to incorporate discharges from the Proposed Development site (Roger Mullarkey & Associates, 2022a). The EIAR (DBFL, March 2019) prepared for the GDRS identified that discharges from the GDRS incorporating connections from the Proposed Development will have no impact on the receiving water environment. Therefore, in the unmitigated worst-case source scenario, the discharge of surface water from Catchment 2 of the Proposed Development would be treated and attenuated within the GDRS surface water drainage network prior to discharge to receiving waters and there would be no impact on the receiving water quality downstream of the Site.

5.2.4 Foul water discharge to mains sewer and receiving water bodies

All below (below ground) drainage infrastructure will be constructed in accordance with current IW requirements to ensure that there will be no potential impacts to groundwater quality. Foul water from the Site will ultimately discharge via the Shanganagh WWTP to the Irish Sea via the long sea outfall and short sea outfall. Foul water from the Site will only be discharged to the IW network under the appropriate consents from IW. The Shanganagh WWTP is operated in accordance with relevant statutory approvals and therefore, there is no identified potential impact on baseline conditions at any Natura 2000 sites associated with foul discharges from the Proposed Development Site individually of in-combination including the Rockabill to Dalkey Island SAC.

5.2.5 Potential Impact on Natura 2000 Sites

Based on the findings of this assessment, it is considered that in applying the precautionary principle and assessing a worst-case scenario there is no identified potential negative impact associated with the Proposed Development on the closest hydraulically connected Natura 2000 sites in particular Rockabill to Dalkey Island SAC (Site Code: 003000) and Dalkey Island SPA (Site Code: 4172) individually or in-combination.

5.2.6 Potential Impact on Water Framework Directive Status

The findings of the risk-based assessment identified that in the absence of any mitigation and avoidance measures there could be a potential impact on the water quality within receiving water bodies associated with the Proposed Development, specifically within a local zone of the Wicklow Groundwater Body, within the Glenamuck North Stream and locally within the Carrickmines Stream. There is no identified potential impact to the Shanganagh River and the Irish Sea attributed to the separation distances and potential for assimilation within the receiving water bodies and taking account of the existing baseline conditions and WFD Status.

Based on the design of the Proposed Development, embedded avoidance measures and the identified mitigation measures, that will prevent or limit impact and deterioration of the receiving water bodies, the identified potential impact on WFD status of the receiving water bodies will be prevented.

There will be no impact to the existing WFD status of water bodies associated with the Proposed Development including the Glenamuck North Stream, the Carrickmines Stream, the Shanganagh River, the Southwestern Irish Sea – Killiney Bay and the Wicklow GWB as a result of the Proposed Development taking account of embedded design avoidance and mitigation measures.

6 CONCLUSIONS

Enviroguide Consulting carried out a risk-based hydrological and hydrogeological impact assessment for the Proposed Development at Wayside, Enniskerry Road, Kilternan, Dublin 18 to determine if there is any potential for significant impacts on the receiving water environment and designated Natura 2000 sites in the absence of avoidance and mitigation measures.

A CSM was developed identifying plausible S-P-R linkages for the Proposed Development and receiving water environment. The CSM formed the basis of the evaluation of any potential impacts to receptors including water bodies and Natura 2000 sites associated with the Proposed Development. The assessment assumed a worst-case scenario (individually and in-combination) and in the absence of any mitigation measures intended to avoid or reduce potential harmful effects.

Based on the findings of this assessment the following can be concluded:

- There is a potential risk of impact to local groundwater quality at the Site and taking account of the local hydrogeological regime, there is no identified potential impact on the receiving surface water bodies via groundwater flow from the Site.
- There are no identified direct pollutant linkages between the Site via surface water courses to receiving water bodies.
- There is a potential risk associated with the indirect (mains drainage) discharge of surface water runoff from Catchment 1 of the Proposed Development on the receiving water quality of the roadside drainage channel on Glenamuck Road, the Glenamuck North Stream and potentially locally within the Carrickmines Stream. However, considering the separation distances and the potential for assimilation within the receiving water bodies there is no identified impact to the downstream Shanganagh River and the Irish Sea.
- There is no potential risk associated with the indirect (mains drainage) discharge of surface water runoff from Catchment 2 of the Proposed Development which will be diluted, treated and attenuated within the GDRS surface water drainage network prior to discharge to receiving surface watercourses within the catchments of the Carrickmines Stream and the Shanganagh River and associated downstream waterbodies and receptors.
- There is no identified risk to water quality via foul water drainage or discharges from Proposed Development that will ultimately be discharged to the Irish Sea via Shanganagh WWTP under consent from IW.
- The appropriate standard design measures for the Construction and Operational Phases of the Proposed Development including implementation of the CMP, CEMP and CDWMP and SuDS measures within the drainage design will prevent, limit and mitigate any the potential for the worst-case scenario to occur. These embedded measures will ensure there is no risk to water quality of the receiving watercourses.
- In the unmitigated worst-case scenario, there is no identified negative impact on the closest hydraulically connected Natura 2000 sites in particular Rockabill to Dalkey Island SAC (Site Code: 003000) and Dalkey Island SPA (Site Code: 4172) associated with Proposed Development either individually or in-combination.

- There is no identified impact to the existing WFD status of water bodies associated with the Proposed Development including the Glenamuck North Stream, Carrickmines Stream, Shanganagh River, Southwestern Irish Sea – Killiney Bay and the Wicklow GWB as a result of the Proposed Development taking account of design avoidance and mitigation measures that will be implemented.

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