HYDROLOGICAL & HYDROGEOLOGICAL QUALITATIVE RISK ASSESSMENT

for

A PROPOSED LARGE-SCALE RESIDENTIAL DEVELOPMENT (LRD) AT GOATSTOWN, ROEBUCK, GOATSTOWN ROAD, DUBLIN 14

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Technical Report Prepared For

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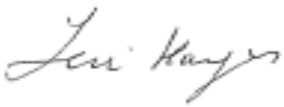
Signature		
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1.0 INTRODUCTION

1.1 Background

AWN have been requested by Orchid Residential Ltd. to carry out a Hydrological and Hydrogeological Qualitative Risk Assessment for a Large-Scale Residential Development (LRD) on a site (formerly Victor Motors), located at Goatstown Road, Roebuck, Goatstown, Dublin 14.

The development will consist of demolition of the existing building (c.960sqm) and hard surface parking area on site and construction of a purpose - built student accommodation development (including use as tourist or visitor accommodation outside the academic term) comprising:

- 220 no. student bedspaces (including 10 no. studios), all within a part single storey, part 4 no. storey and part 6 no. storey 'U'-Shaped building;
- The building is single to 4 no. storeys along the southern boundary, part 5 and 6 storeys along Goatstown Road and northern boundary (with setbacks) and roof terraces at fourth and fifth floor levels fronting onto Goatstown Road;
- Amenity space equating to c. 1,785 sqm is provided across the site consisting of c. 1,247 sqm of external amenity in the form of a central courtyard at ground level and roof terraces at 4th and 5th floor levels;
- Internal amenity space equating to c. 538 sqm is provided in the form of 2 no. ground floor lounge/study areas, kitchen/tearoom, laundry, and concierge/office space;
- Provision of 218 no. bicycle parking spaces distributed across the central courtyard and northern boundary and adjacent to the front boundary of the site (north-west);
- Provision for 6 no. carparking spaces comprising 2 no. disabled parking spaces and 4 no. setdown parking spaces adjacent to the front entrance to the site;
- Vehicular access to the site is via Goatstown Road from 2 no. entrance points [reduction from 3 no. entrances currently];
- Ancillary single storey ESB substation and switch room and refuse store are provided at ground level;

Provision of surface water and underground attenuation and all ancillary site development works including site wide landscaping works, lighting, planting and boundary treatmentsThe potential impacts on the receiving water environment considered are:

- Connection to foul sewer and stormwater sewer during operation. Due to the residential nature of the proposed development, there will be no bulk oil storage during the operational phase.
- Management of foul, surface water run-off and accidental oil leaks during construction.

1.2 Hydrological & Site Setting

The proposed development site (formerly Victor Motors) of approximately 0.344 hectares, is located at Goatstown Road, Roebuck, Goatstown, Dublin 14. It is situated approximately 0.6 km north of Goatstown town centre and 1 km south-west of the UCD Belfield Campus.

The surrounding land is predominately in residential use. The site is bounded (a) to the north and east, by Trimbleston residential housing and apartment buildings, (b) to the south, by Willowfield Park residential housing, and (c) to the west by Goatstown Road and associated residential buildings. Access to the site is gained via Goatstown Road from 2 no. entrance points.

There is no direct discharge to ground or surface water body proposed as part of this development. There are no surface water features in the immediate vicinity of the proposed development site. The nearest hydrological feature is an unmarked watercourse flowing c. 580 m north-west of the site. This watercourse is culverted in sections and discharges into a water feature named “The Lake” within the UCD Belfield Campus, before discharging to the ELM Park Stream via underground connection. The River Slang is located c. 0.9 km west and the Elm Park Stream is located c. 0.6 km to the north of the proposed development site. Refer to Figure 1.1 below.

A review of historical maps of this zone was conducted (Geohive, 2024), which does not show any additional historical rivers in the vicinity of the proposed development site.

Figure 1.1 *Site Location and Hydrological Environment (EPA, 2024)*

It is proposed that stormwater from the proposed development site, following interception and attenuation (SuDS), will be discharged into the existing public surface water pipe running along the Goatstown road to the west of the site.

Foul water will be discharged into an existing 225mm diameter sewer running also along the western boundary of the site, falling northwards along the Goatstown Road. This foul sewer eventually discharges to the Ringsend Waste Water Treatment Plant (WWTP) where it is treated and ultimately discharges to Dublin Bay.

Therefore, there will be an indirect discharge to the Dublin Bay coastal waterbody from the proposed development site through the stormwater and foul water site drainage as described in Section 1.4 below.

A review of the EPA (2024) and NPWS (2024) on-line databases, indicates that there are no areas of conservation in the vicintiy of the proposed development site. The nearest designated lands are as follows:

- Fitzsimons Wood pNHA (Site Code: 001753) – c. 3 km south of the site (at its nearest location);
- Booterstown Marsh PNHA (Site Code: 001205) – c. 2.6 km north-east of the site (at its nearest location);
- South Dublin Bay SAC (Site Code: 000210) – c. 2.7 km north-east of the site (at its nearest location); and
- South Dublin Bay and River Tolka Estuary SPA (Site Code: 004024) – c. 2.7 km north-east of the site (at its nearest location).

1.3 Objective of Report

The scope of this desktop review is to assess the potential for any likely significant impacts on receiving waters and protected areas during construction or post development, in the absence of taking account of any measures intended to avoid or reduce harmful effects of the proposed project (i.e. mitigation measures).

In particular, this review considers the likely impact of construction and operation impacts (construction run-off and domestic sewage) from the proposed development on water quality and overall water body status within the Dublin Bay (where the relevant European Sites are located). The assessment relies on information regarding construction and design provided by Barrett Mahony (BM) Civil and Structural Consulting Engineers as follows:

- Civil Engineering Infrastructure Report & Flood Risk Assessment for Planning, (Barrett Mahony Consulting Engineers, April 2024);
- Civil Engineering Infrastructure Report & Flood Risk Assessment for Planning, (Barrett Mahony Consulting Engineers, September 2024);
- Goatstown Development – Ground Investigation Report (Causeway Geotech Ltd, April 2020); and
- Various Site Plans and Drawings.

This report was prepared by Alan WiIson (BSc), and Teri Hayes (BSc MSc PGeol EurGeol). Alan is an Environmental Consultant at AWN. Alan holds a BSc Honours in Environmental Management in Agriculture/ Environmental and Geographical Sciences. Alan has worked on a range of large scale projects involving EIA reports, site specific flood risk assessments, baseline studies, hydrological and hydrogeological risk assessments, environmental due diligences, site investigations and groundwater and surface water monitoring on various operational developments and greenfield and brownfield sites. Alan has over 3 years' experience as an Environmental Consultant including roles in Ecology and Forestry related work. Alan is a member of the International Association of Hydrogeologists (IAH) Irish Group and the Institute of Geologists of Ireland (IGI). Teri is a hydrogeologist with over 25 years

of experience in water resource management and impact assessment. She has a Masters in Hydrogeology and is a former President of the Irish Group of the Association of Hydrogeologists (IAH) and has provided advisory services on water related environmental and planning issues to both public and private sector bodies. She is qualified as a competent person as recognised by the EPA in relation to contaminated land assessment (IGI Register of competent persons www.igi.ie). Her specialist area of expertise is water resource management eco-hydrogeology, hydrological assessment and environmental impact assessment.

1.4 Description of Current and Proposed Drainage

Existing and Proposed Foul Water Drainage

There is an existing 225mm diameter sewer running along the western boundary of the site, falling northwards along the Goatstown Road. This foul sewer eventually discharges to the Ringsend Waste Water Treatment Plant (WWTP) where it is treated and ultimately discharges to Dublin Bay.

It is proposed to connect the foul water network to the existing foul sewer using a 225mm pipe. All foul effluent will leave the site via gravity. As this site is intended solely for student accommodation the wastewater produced per person is reduced to 100l/day, as per Irish Water Code of Practice.

The peak flow calculated for the proposed development is 1.56l/s. The 225mm diameter sewer pipe has a capacity of 34 l/s and is sufficient for all foul pipework.

Refer to Civil Engineering Infrastructure Report (Barrett Mahony Consulting Engineers, September 2024), included as part of the planning application for further details on the existing and proposed surface water drainage systems.

Existing and Proposed Surface Water Drainage

There is an existing car showroom to the north of the proposed development site, with the remaining area consisting of tarmac surfacing. Surface water drains via a series of gullies and surface drains to the existing public sewer under the Goatstown Road west of the site.

There is no evidence of flow control devices restricting discharge rates from the site. As the existing site consists entirely of impermeable surfaces the unattenuated outflow has been calculated as 47.8 l/s, the proposed drainage system will restrict the peak flow rate during the 100-year storm event to 1.57l/s, representing a very significant improvement on the current situation.

The proposed development will receive rainfall onto a mix of surfaces, such as green roofing, harvested roofing, permeable paving and soft landscaping. Infiltration tests carried out on site show that the site is underlain by boulder clay of insignificant permeability and so soakaways are not considered feasible. Further soakaway tests will be carried out prior to construction of the drainage infrastructure and if infiltration is found to be available in certain areas it will be utilised as appropriate to minimise the volume of run-off discharged from the site.

Run-off generated will be partially intercepted by the various surface finishes and the overflow will discharge to a concrete attenuation tank or lined stormtech system, with a hydrobrake manhole restricted to the QBAR value for the site. Discharge from the tank will subsequently fall via gravity to the existing public surface water pipe running along the Goatstown road to the west of the site.

In order to both reduce and attenuate the flow and improve run-off water quality, the proposed development will be designed in accordance with the principle of the Sustainable Urban Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS). The SuDS features include permeable paving, intense biodiverse and extensive green roofing, intensive paved green roofing, rainwater harvesting and an underground stormtech attenuation system.

Full interception storage will be provided, and growth factors will not be applied to the allowable discharge for the 100-year event. This means that both treatment storage and long-term storage (neither of which would be practical on this urban site) are not required. As full interception storage has been provided, treatment storage is not required. The proposed stormwater management will replicate the characteristics of greenfield run-off, which will result in a positive development impact compared the current situation where stormwater run-off flows unchecked, unfiltered and unattenuated off the existing brownfield site.

Where provided, interception storage will ensure that, at a minimum, the first 5 mm and preferably the first 10 mm of rainfall on a site should be intercepted so that it does not find its way to the receiving water. The total area (hardstanding, roofs & permeable paving) discharging to the drainage system is 2,834 m^2 requiring a minimum interception storage volume of 28.3m^3 (10mm over the site). The total provided interception storage is 36.5 m^3 which is 29% more than the minimum requirement.

Refer to Civil Engineering Infrastructure Report (Barrett Mahony Consulting Engineers, September 2024) and Figure 1.2 below (Drawing Ref: 19289-BMD-ZZ-XX-DR-C-1021), included as part of the planning application for further details on the existing and proposed surface water drainage systems.

Figure 1.2 *Proposed SuDS Strategy Layout (Barrett Mahony Consulting Engineers, 2024)*

Flood Risk Assessment

According to the Stage 3 Flood Risk Assessment carried out by Barrett Mahony Consulting Engineers (2024), the proposed development site is located entirely within Flood Zone C (where the probability of flooding is low i.e. less than 0.1% AEP or 1 in 1000 for both river and coastal flooding).

The River Slang is located along the Dundrum Road approx. 0.9km west of the site. The map shows that Pluvial Flooding of the public pipe network (both surface water & foul) has occurred at the junction of Trimblestown & Larchfield Road approximately 70m north of the site but the road level in that location is approximately 1m lower than the northern end of the site and the road falls in a northerly direction so any pluvial floodwaters will flow away from the site down Goatstown road.

The flood risk assessment was carried out in accordance with the OPW publication "The Planning System and Flood Risk Assessment Guidelines for Planning Authorities" and it has shown that there is no significant risk of flooding due to the development.

Given the SuDS measures incorporated in the proposed development, there will be a reduction in both volume and rate of surface water discharge from the site which will reduce the risk of flooding to public infrastructure post development.

Refer to Civil Engineering Infrastructure Report and Flood Risk Assessment for Planning (Barrett Mahony Consulting Engineers, April 2024), included as part of the planning application for further details on the existing and proposed surface water drainage systems.

2.0 ASSESSMENT OF BASELINE WATER QUALITY, RIVER FLOW AND WATER BODY STATUS

A reliable Conceptual Site Model (CSM) requires an understanding of the existing hydrological and hydrogeological setting. This is described below for the proposed development site and surrounding hydrological and hydrogeological environment.

2.1 Hydrological Catchment Description

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, 2024). The nearest hydrological feature is an unmarked watercourse flowing c. 580 m north-west of the site. This watercourse is culverted in sections and discharges into a water feature named "The Lake" within the UCD Belfield Campus, before discharging to the ELM Park Stream via underground connection. The River Slang is located c. 0.9 km west and the Elm Park Stream is located c. 0.6 km to the north of the proposed development site.

The River Slang is a tributary of the River Dodder. The River Slang flows through Ticknock, eventually cascading down a man-made stone structure resembling steps before reaching an M50 motorway junction. Continuing its course, it passes Ballinteer and flows north to Dundrum, where it merges with the Wyckham Stream just south of the town centre. The river then meanders east, north, and west, with additional tributaries joining along the way. Upon reaching the Dundrum Town Centre retail complex, the main channel of the Slang runs alongside it, while an old millrace supplies water to a former mill pond, now a prominent feature within the shopping facility. The Slang stream proceeds north through Windy Arbour, encountering a few sections that are culverted, until it finally converges with the River Dodder at Milltown, near the Nine Arches viaduct.

The River Dodder, is one of Dublin's three main rivers. It is the largest tributary of the Liffey and stretches for 26 km. The River Dodder originates from various streams on the northern slopes of Kippure in the Wicklow Mountains. As it flows through the Dublin suburbs of Tallaght, Firhouse, Templeogue, Rathfarnham, Rathgar, Milltown, Clonskeagh, Donnybrook, Ballsbridge, and Sandymount, it eventually joins the Liffey near Ringsend. The river becomes tidal around the Lansdowne Road bridge, and it is an essential part of Dublin's water supply system. Alongside the River Tolka, the Dodder is one of Dublin's largest rivers, second to the River Liffey. The River Dodder ultimately discharges to the Liffey Estuary Lower transitional waterbody which in turn discharges into Dublin Bay coastal waterbody.

The Elm Park Stream is culverted for part of its course and discharges through UCD before emerging in Elm Park Golf Course, from where the water course finally discharges to Dublin Bay coastal waterbody just south of Merrion Gates.

The Environmental Protection Agency (EPA, 2024) on-line mapping presents the available water quality status information for water bodies in Ireland.

The River Slang and River Dodder belong to the Dodder_050 WFD surface waterbody which has a '*Moderate*' WFD Status (2016-2021) and its WFD risk score is '*At risk'* of not achieving good status'. The '*Moderate*' status is attributable to its biological status (invertebrate and fish). The current pressures identified by the EPA on the Dodder_050 surface waterbody are from anthropogenic pressures, urban run-off and urban waste water. The latest EPA data available for the Elm Park Stream shows that it belongs to the Brewery_Stream_010 WFD surface waterbody, which had a '*Moderate'* Status (EPA, 2022) and a WFD risk score under '*Review*'.

The Liffey Estuary Lower Transitional Waterbody has a WFD status (2016-2021) of '*Moderate'* WFD risk score of *'At Risk'*, while Dublin Bay coastal waterbody has a WFD status (2016-2021) of '*Good*' and a WFD risk score of '*Not at risk*'. The '*Moderate*' status is attributable to its ecological status or potential. The current pressure identified by the EPA on the Liffey Estuary Lower transitional waterbody is from urban waste water.

The most recent data on the ecological status (which comprises biological and chemical status) of transitional and coastal water bodies during 2016-2021 for Dublin Bay coastal waterbody is classified as '*Good*' (although the chemical status failed to achieve '*good*' status). The most recent surface water quality data for Dublin Bay on trophic status of estuarine and coastal waters indicate that they are '*Unpolluted*' - based on Water Quality in 2022. Under the 2015 'Trophic Status Assessment Scheme' classification of the EPA, 'Unpolluted' means there have been no breaches of the EPA's threshold values for nutrient enrichment, accelerated plant growth, or disturbance of the level of dissolved oxygen normally present.

As stated in Section 1.4 above, the existing site consists entirely of impermeable surfaces with the unattenuated outflow calculated as 47.8 l/s, the proposed drainage system will restrict the peak flow rate during the 100-year storm event to 1.57l/s, representing a very significant improvement on the current situation. The proposed development will therefore, have a reduction in stormwater run-off and increased water quality (as a result of SuDs), when compared with the current situation. This will have a positive impact on the water quality in an overflow situation at Ringsend WWTP apart from a minor contribution from foul sewage.

As explained in Section 1.4 above, the peak flow calculated for the proposed development is 1.56l/s. The 225mm diameter sewer pipe has a capacity of 34 l/s and is sufficient for all foul pipework.

2.2 Aquifer Description & Superficial Deposits

Mapping from the Geological Society of Ireland (GSI, 2024 http://www.gsi.ie, accessed on 15-04-2024) indicates the bedrock underlying the site is part of the Lucan Formation (Code: CDLUCN) and made up of dark limestone and shale (Calp). The lithological description comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones, sometimes graded, and interbedded dark-grey calcar. The beds are predominantly fine-grained distal turbidites in the north Dublin Basin. The formation is intermittently exposed on the coast between Rush and Drumanagh Head. The formation ranges from 300m to 800m in thickness. The GSI also classifies the principal aquifer types in Ireland as:

- Lk - Locally Important Aquifer - Karstified
- Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Pu - Poor Aquifer - Bedrock which is Generally Unproductive
- Rkd - Regionally Important Aquifer (karstified diffuse)

Presently, from the GSI (2024) National Bedrock Aquifer Map, the GSI classifies the bedrock aquifer beneath the subject site as a '*Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones*'. The proposed development is within the '*Dublin*' groundwater body (Ground Waterbody Code: IE_EA_G_008) and is classified under the WFD Status 2016-2021 (EPA, 2024) as having '*Good'* status. The WFD Risk Score system for this GWB is under review.

Aquifer vulnerability is a term used to represent the intrinsic geological and hydrological characteristics that determine the ease with which groundwater may be contaminated generally by human activities. The GSI (2024) guidance presently classifies the bedrock aquifer in the region of the proposed development site as having a '*Low*' vulnerability, which indicates a general overburden depth potential >10m, indicating that the aquifer is naturally protected by low permeability glacial clays. During the site investigation carried out by Ground Investigations Ireland (GII) in 2020, all boreholes were terminated at refusal between depths of 2m and 3m BGL after encountering very stiff clay. The aquifer vulnerability class in the region of the site is presented in Figure 2.1 below.

Figure 2.1 *Aquifer Vulnerability (GSI, 2024)*

The GSI/ Teagasc (2024) mapping database of the quaternary sediments in the area of the subject site indicates the principal subsoil type in the residential area comprises Limestone till (Carboniferous) i.e. Till derived from limestones and Made Ground. This is consistent with the subsoils described in the site investigation report (GII, 2020).

3.0 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is developed based on a good understanding of the hydrological and hydrogeological environment, plausible sources of impact and knowledge of receptor requirements. This in turn allows possible Source Pathway Receptor (S-P-R) linkages to be identified. If no S-P-R linkages are identified, then there is no risk to identified receptors.

3.1 Assessment of Plausible Sources

Potential sources during both the construction and operational phases are considered. For the purposes of undertaking the potential of any hydrological/ hydrogeological S-P-R linkages, all potential sources of contamination are considered *without taking account of* any measures intended to avoid or reduce harmful effects of the proposed project (mitigation measures) i.e., a worst-case scenario. Construction sources (short-term) and operational sources (long-term) are considered below.

<u>Construction Phase</u>

The following potential sources are considered plausible risk scenarios for the proposed construction site:

(i) Hydrocarbons or any hazardous chemicals will be stored in specific bunded areas. Refuelling of plant and machinery will also be carried out in bunded areas to minimise risk of any potential being discharged from the site. As a worst-case

scenario, a rupture of a 1,000-litre tank to ground is considered in this analysis which disregards the effect of bunding. This would be a single short-term event.

(ii) Leakage may occur from construction site equipment. As a worst-case scenario an unmitigated leak of 300 litres is considered. This would be a single short-term event.

(iii) Use of wet cement is a requirement during construction. Run-off water from recent cemented areas will result in highly alkaline water with high pH. As this would only occur during particular phases of work this is again considered as a single short-term event rather than an ongoing event.

(iv) Construction requires soil excavation and removal. Unmitigated run-off could contain a high concentration of suspended solids and contaminants such as hydrocarbons during earthworks, given the presence of contamination beneath the site according to site investigations. These could be considered intermittent temporary events, i.e., on the basis that adequate mitigation measures which are already incorporated in the Construction Environmental Management Plan (CEMP) fail.

(v) No significant dewatering is expected during the excavations for foundations given the low permeability glacial clays underlying the site. During the 2020 site investigation carried out by GII, perched groundwater was encountered during percussion boring through soil at depths of 1.80m BGL in WS01, 1.80m BGL in WS02 and 1.90m BGL in WS03. Therefore, there may be localised pumping of perched groundwater within the subsoils and surface run-off from the excavations during and after heavy rainfall events to ensure that the excavation is kept relatively dry. No significant bedrock will occur given the expected depths of bedrock.

Operational Phase

The following sources are considered plausible post construction:

(i) The proposed development does not require any bulk chemical or fuel storage and therefore the potential for water quality impact is negligible.

(ii) Leakage of petrol/ diesel fuel may occur from individual cars in parking areas; run-off may contain a worst-case scenario of 70 litres for example. Any corresponding risk here will be mitigated by the proposed oil/ petrol interceptor at the site. Within the basement carpark area, any rainwater entering the sealed system as a result of snow melt or raindrops from cars will pass through a petrol interceptor providing treatment before discharging to the foul sewer.

(iii) The stormwater drainage system follows SuDS measures that comprises intensive biodiverse and extensive green roofing, intensive paved green roofing, permeable paving, rainwater harvesting and an underground attenuation system (concrete or lined stormtech system). The storage system will discharge following the characteristics of a greenfield run-off into the existing public surface water pipe running along the Goatstown road. No additional treatment measures were considered due to the expected loading and provision of the mentioned interception system. This system has been designed in order to discharge following the characteristics of a greenfield run-off into the public sewer. As such the potential for silt laden runoff is low. It should be noted that the worst-case scenario (70 litres) under consideration here disregards the effect of SuDS and petrol interceptors.

(iv) The development will be fully serviced with separate foul and stormwater sewers which will have adequate capacity for the facility and discharge limits as required by Irish Water licencing requirements. Discharge from the site to the public foul sewer will be sewage and grey water only due to the residential nature of the proposed development. The foul discharge from the site will join the public sewer and will be treated at the Uisce Éireann Ringsend WWTP prior to subsequent discharge to Dublin Bay. This WWTP is required to operate under an EPA licence (D0034-01) and meet environmental legislative requirements as set out in such licence. It is noted that a planning permission for a new upgrade to this facility was received in 2019 and is currently in the process of construction/ implementation.

(v) This plant at Ringsend operates under an EPA licence (D0034-01) and is currently in the process of being upgraded to a PE of 2.4 million to meet the increased demand of the wider Dublin area. The most recent Annual Environmental Report (AER 2022) shows it is currently operating for a PE peak loading of 2.21 million while originally designed for 1.64 million. However, the current maximum hydraulic load (864,774 m^3/day) is less than the peak hydraulic capacity as constructed (959,040 m^3/day) i.e., prior to any upgrade works.

(vi) Uisce Éireann is working to provide infrastructure to achieve compliance with the Urban Wastewater Treatment Directive for a population equivalent of 2.1 million in the second half of 2023. When all the proposed works are complete in 2025, the Ringsend Wastewater Treatment Plant will be able to treat wastewater for up to 2.4 million population equivalent.

(vii) These upgrade works (described in section 3.4 below) have commenced and comprise a number of phases, are ongoing and are expected to be fully completed by 2025.

3.2 Assessment of Pathways

The following pathways have been considered within this assessment with impact assessment presented in Section 3.4:

The potential for offsite migration due to any construction discharges is low as there is no significant pathway in the aquifer or through land ditches or streams.

(i) Vertical migration to the underlying Limestone is minimised due to the recorded '*Low*' vulnerability present at the proposed development site resulting in good aquifer protection from any localised diesel/ fuel oil spills during either construction or operational phases. The site is underlain by Calp limestone which is a 'Locally Important Aquifer'. This aquifer is characterised by discrete local fracturing with little connectivity rather than large and connected fractures which are more indicative of Regional Aquifers. As such, flow paths are generally local.

(ii) There is no direct hydrological linkage for construction and operation run-off or any small hydrocarbon leaks from the site to the River Slang (and River Dodder), Elm Park Stream or Dublin Bay. However, an indirect pathway exists through the public stormwater sewers.

(iii) There is no direct pathway for foul sewage to any receiving water body (as identified above). There is however an 'indirect pathway' through the public sewer which ultimately discharges to the Irish Water's Ringsend WWTP prior to final discharge to Dublin Bay post treatment.

3.3 Assessment of Receptors

The receptors considered in this assessment include the following:

(i) Underlying limestone bedrock aquifer;
(ii) River Slang c. 0.9 km west of the site;
(iii) Elm Park Stream c. 0.6 km north of the site;
(iv) Liffey Estuary Lower transitional waterbody and Dublin Bay coastal waterbody;
(v) South Dublin Bay SAC (Site Code: 000210) – c. 2.7 km north-east of the site; and
(vi) South Dublin Bay and River Tolka Estuary SPA (Site Code: 004024) – c. 2.7 km north-east of the site.

Other Natura 2000 Sites within Dublin Bay that may be hydrologically connected to the proposed development site, but are located further away are North Dublin Bay SAC [Site Code: 000206], North Bull Island SPA [Site Code: 004006], North-West Irish Sea SPA [Site Code: 004236], Dalkey Islands SPA [Site Code: 004172], Rockabill to Dalkey Island SAC [Site Code: 003000], Howth Head SAC [Site Code: 000202] and Howth Head Coast SPA [004113].

These Natura 2000 sites were excluded from the assessment due to their distance from the proposed development site, the potential loading of contaminant from the site (risk scenarios presented in Section 3.1) and significant dilution through its pathway.

3.4 Assessment of Source Pathway Receptor Linkages

Table 3.1 below summarises the plausible pollutant linkages (S-P-R) considered as part of the assessment and a review of the assessed risk is also summarised below.

Construction Phase

The potential for impact on the aquifer is *Low* based on the absence of any bulk chemical storage on site. The overburden thickness, low permeability nature of till and a lack of fracture connectivity within the limestone will minimise the rate of off-site migration for any indirect discharges to ground at the site. As such there is no potential for a change in the groundwater body status or significant source pathway linkage through the aquifer to any Natura 2000 site.

During construction phase, there is no direct open-water pathway between the site and Dublin Bay. However, there is an indirect pathway through the existing 225mm diameter foul sewer running along the western boundary of the site which eventually discharges into the Irish Water's Ringsend WWTP and the stormwater sewer which drains to the existing public sewer under the Goatstown Road to the west of the site. Should any silt-laden stormwater from construction or hydrocarbon-contaminated water from a construction vehicle leak/tank leak manage to enter into the surface water sewer, the suspended solids will naturally settle within the sewer; however, in the event of a worst case hydrocarbon leak of 1,000 litres this would be diluted to background levels (water quality objectives as outlined in S.I. No. 272 of 2009, S.I. No. 386 of 2015 and S.I. No. 77 of 2019) by the time the stormwater reaches the nearest Natura 2000 Sites (South Dublin Bay, c. 2.83 km downgradient).

Operational Phase

During operation, the potential for a release is low as there is no bulk fuel/chemical storage and no silt laden run-off. The stormwater drainage system follows SuDS measures which include an interception storage system (permeable paving, intense biodiverse and extensive green roofing, intensive paved green roofing, rainwater harvesting and an underground stormtech attenuation system).

In addition, the potential for hydrocarbon discharge is quite minimal based on an individual vehicle (70 litres) leak being the only source for hydrocarbon release. However, even if the operation of the proposed SuDS and interceptor systems are excluded from consideration, there is no likely impact above water quality objectives as outlined in S.I. No. 272 of 2009, S.I. No. 386 of 2015 and S.I. No. 77 of 2019) in the worst-case scenarios described above at section 3.2 and there will be no significant effect on any European site. The volume of contaminant release is low and combined with the significant attenuation within the stormwater drainage network, hydrocarbons will dilute to background levels with no likely impact above water quality objectives as outlined in S.I. No. 272 of 2009, S.I. No. 386 of 2015 and S.I. No. 77 of 2019 at any Natura 2000 sites.

It can be concluded that the in-combination effects of surface water arising from the proposed development taken together with that of other permitted developments will not be significant based on the in-combination low potential chemical and sediment expected loading. Therefore, based on the loading of any hazardous material considered in the worst-case scenarios mentioned in Section 3.1 above during construction and operation phases, there is subsequently no potential for impact on downgradient Natura 2000 habitats (Dublin Bay, which is located 2.83 km north-east And downgradient of the proposed development site).

The peak wastewater discharge is calculated at 1.56 l/s (Barrett Mahony Consulting Engineers, April 2024). The sewage discharge will be licensed by Uisce Éireann, collected in the public sewer and treated ultimately at Irish Water's WWTP at Ringsend prior to discharge to Dublin Bay. As outlined in section 3.1 (iv), upgrade works commenced in 2018 and are expected to be fully completed by 2025. The upgrade works will result in treatment of sewage to a higher quality than current, thereby ensuring effluent discharge to Dublin Bay will comply with the Urban Wastewater Treatment Directive.

Note: The following additional information is provided with regard to the Uisce Éireann WWTP at Ringsend, Dublin and in the context of the proposed development sites calculated discharges:

The [WWTP upgrade] project is being progressed in stages to ensure that the plant continues to treat wastewater to the current treatment levels throughout the delivery of the upgrade. The project comprises three key elements and underpinning these is a substantial programme of ancillary works:

- *Provision of additional secondary treatment capacity with nutrient reduction (400,000 population equivalent);*
- *Upgrade of the 24 existing secondary treatment tanks to provide additional capacity and nutrient reduction, which is essential to protect the nutrient-sensitive Dublin Bay area; and*
- *Provision of a new phosphorous recovery process.*

In February 2018, the work commenced on the first element, the construction of a new 400,000 population equivalent extension at the Ringsend Wastewater Treatment

Plant. After commissioning stages, the Capacity Upgrade facility began accepting flows for treatment in November 2021). This facility will enable current treatment levels to be maintained during the remainder of the upgrade of the existing secondary treatment tanks.

The 2019 planning permission facilitated upgrading works to meet nitrogen and phosphorus standards set out in the licence, which are temporarily exceeded currently. Works on the first of four contracts to retrofit the existing treatment tanks with aerobic granular sludge technology commenced in November 2020 and was completed in December 2021. In September 2021, the second contract was awarded, and its construction works commenced in November 2021 and is expected to take approximately 2 years to complete. In November 2021, the third contract was awarded, and its Construction works are anticipated to commence in late 2022 (this has not yet been confirmed by Uisce Éireann). The fourth contract was scheduled to commence in mid-2023, which has also not been confirmed by Uisce Éireann to date.

The application for the upgrade of the WWTP in 2012 and the revised upgrade in 2018 was supported by a detailed EIAR. As outlined in the EIAR, modelling of water quality in Dublin Bay has shown that the upgrades (which are now currently underway) will result in improved water quality within Dublin Bay. The 2018 EIAR predicts that the improvement in effluent quality achieved by the upgrade will compensate for the increase in flow through the plant. The ABP inspector's report summarises the positive findings of the modelling for the post WWTP upgrade scenario on Dublin Bay water quality in sections 12.3.5 and 12.3.12 of his report and the overall positive impact for human health and the environment in his conclusions in section 12.9.1.

In addition, the EIAR report acknowledges that under the do-nothing scenario "the areas in the Tolka Estuary and North Bull Island channel will continue to be affected by the cumulative nutrient loads from the river Liffey and Tolka and the effluent from the Ringsend WWTP", which could result in a deterioration of the biological status of Dublin Bay (Irish Water, 2018). Nevertheless, these negative impacts of nutrient over-enrichment are considered "unlikely" (Uisce Éireann, 2018). This is because historical data suggests that pollution in Dublin Bay has had little or no effect on the composition and richness of the benthic macroinvertebrate fauna. Therefore, the do-nothing scenario predicts that nutrient and suspended solid loads from the WWTP will "continue at the same levels and the impact of these loadings should maintain the same level of effects on marine biodiversity". Therefore, it can be concluded that significant effects on the current status of the European sites within Dublin Bay from the current operation of Ringsend WWTP are unlikely. This conclusion is not dependent upon any future works to be undertaken at Ringsend.

Even without treatment at the Ringsend WWTP, the peak effluent discharge, calculated for the proposed development as 1.56 l/s (which would equate to 0.0014% of the licensed discharge at Ringsend WWTP [peak hydraulic capacity]), would not have a measurable impact on the overall water quality within Dublin Bay and therefore would not have an impact on the current Water Body Status (as defined within the Water Framework Directive). This assessment is supported by hydrodynamic and chemical modelling within Dublin Bay which has shown that there is significant dilution for contaminants of concern (DIN and MRP) available quite close to the outfall for the treatment plant (Ringsend WWTP 2012 EIS, Ringsend WWTP 2018 EIAR; refer to Section 12.4.22, ABP-301798-18 Inspector's report). The most recent water quality assessment of Dublin Bay WFD Waterbody undertaken by the EPA (Water Quality in 2022: An Indicators Report, 2023) also shows that Dublin Bay on the whole, currently has an '*Unpolluted*' water quality status (refer to www.catchments.ie).

It should be noted that the Ringsend WWTP has experienced capacity issues during rainfall events and therefore overflows can occur following periods of heavy rainfall. These overflows occur as a result of the impact on treatment capacity during heavy rainfall events due to surges primarily caused by the historical combined drainage system in Dublin. As the proposed development will not contribute any additional stormwater drainage to the WWTP over the natural greenfield rate, the development will therefore have no measurable impact on the water quality in any overflow situation.

The assessment has also considered the effect of cumulative events, such as release of sediment laden water combined with a hydrocarbon leak on site (1,000 litres as a worst-case scenario during the construction phase). As there is adequate assimilation and dilution between the site and the Natura 2000 sites (Dublin Bay, which is c. 2.83 km north-east the site), it is concluded that no perceptible impact on water quality would occur at the Natura 2000 sites as a result of the construction or operation of the proposed development. It can also be concluded that the cumulative or in-combination effects of effluent arising from the proposed development with that of other permitted proposed developments, or with development planned pursuant to statutory plans in the greater Dublin, Meath and Kildare areas, which will be discharged into Ringsend WWTP will not be significant having regard to the size of the calculated discharge from the proposed development and having regard to the following:

- Recent water quality assessment for Dublin Bay shows that they currently continue to meet the criteria for ‘Unpolluted’ water quality status.
- The Ringsend WWTP upgrade which is currently being constructed will result in improved water quality by 2025 to ensure compliance with Water Framework Directive requirements.
- All new developments are required to comply with SuDS which ensures management of run-off rate within the catchment of Ringsend WWTP.
- The natural characteristics of Dublin Bay result in enriched water rapidly mixing and degrading such that the plume has no appreciable effect on water quality at Natura 2000 sites.

As the proposed development will have no additional stormwater run-off during a stormwater event over and above the current level, surface water run-off from the development in the operational phase will therefore have no impact on the current In addition, there is no long term discharge planned which could have an impact on the status of the water body. In the scenario of an accidental release (unmitigated leaks mentioned above) there is potential for a temporary impact only which would not be of a sufficient magnitude to effect a change in the current water body status.

Finally, in a worst-case scenario of an unmitigated leak and not considering the operation of the SuDS measures included in the design, no perceptible risk to any Natura 2000 Sites is anticipated given the distance from source South Dublin Bays protected areas (c. 2.83 km). Potential contaminant loading will be attenuated, diluted and dispersed near source area.

Table 3.1 below presents a summary of the risk assessment undertaken.

Table 3.1 *Pollutant Linkage Assessment (without mitigation)*

Source	Pathways	Receptors considered	Risk of Impact
Construction Impacts (Summary)			
Unmitigated leak from an oil tank to ground/ unmitigated leak from construction vehicle (1,000 litres worst case scenario). Discharge to ground of runoff water with High pH from cement process/ hydrocarbons from construction vehicles/run-off containing a high concentration of suspended solids.	Bedrock protected by >10m low permeability overburden. Migration within weathered/ less competent limestone is low (limestone has discrete local fracturing rather than large and connected fractures). Indirect pathway through stormwater drainage to Dublin Bay waterbody (distance source-receptor: c. 2.83 km).	Limestone bedrock aquifer (Locally Important aquifer). River Slang and Elm Park Stream. Liffey Estuary Lower transitional waterbody Dublin Bay South Dublin Bay SAC/SPA/pNHA.	Low risk of vertical migration through thick glacial till and migration through poorly connected fracturing within the limestone (Locally Important Aquifer) rock mass. No likely impact on the status of the aquifer/off site migration due to low potential loading, natural attenuation within overburden and discrete nature of fracturing reducing off site migration. Potential for local temporary exceedances of statutory water quality standards at outfall. However, no perceptible risk to water requirements for the Natura 2000 sites in Dublin Bay based on loading and high level of dilution in the surface water sewer over a distance of c. 2.83 km between the source and Dublin Bay.
Operational Impacts (Summary)			
Foul effluent discharge to sewer. Discharge to ground of hydrocarbons from carpark leak.	Indirect pathway to Dublin Bay through public sewer Indirect pathway through stormwater drainage to River Slang and Elm Park Stream and subsequently Dublin Bay coastal waterbody (distance source-receptor c. 2.83 km)	River Slang and Elm Park Stream. Liffey Estuary Lower transitional waterbody Dublin Bay South Dublin Bay SAC/SPA/pNHA.	No perceptible risk – Even without treatment at Ringsend WWTP, the peak effluent discharge (1.56 l/s which would equate to 0.0014% of the licensed discharge at Ringsend WWTP); would not impact on the overall water quality within Dublin Bay and therefore would not have an impact on the current Water Body Status (as defined within the Water Framework Directive). No perceptible risk – taking into account the extent of loading of contaminant, distance between the source and Dublin Bay is c. 2.83 km and significant dilution in the surface water sewer will ensure any released hydrocarbons are at background levels (i.e., with no likely impact above water quality objectives as outlined in S.I. No. 272 of 2009, S.I. No. 386 of 2015 and S.I. No. 77 of 2019).

4.0 CONCLUSIONS

A conceptual site model (CSM) has been prepared following a desk top review of the site and surrounding environs. Based on this CSM, plausible Source-Pathway-Receptor linkages have been assessed assuming an absence of any measures intended to avoid or reduce harmful effects of the proposed project (i.e., mitigation measures) in place at the proposed development site.

During construction and operation phases there is no direct source pathway linkage between the proposed development site and open waters. There is no direct source pathway linkage between the proposed development site and any Natura 2000 sites (i.e., South Dublin Bay SAC/SPA/pNHA). There is an indirect source pathway linkage from the proposed development to Dublin Bay coastal waterbody through the stormwater network, River Slang and Elm Park Stream. There will also be an indirect source pathway linkage through the foul water drainage network, which eventually discharges to Irish Water's Ringsend WWTP.

Even disregarding the operation of design measures including SuDS features i.e. permeable paving, intense biodiverse and extensive green roofing, intensive paved green roofing, rainwater harvesting and an underground stormtech attenuation system, it is concluded there will be imperceptible impacts from the proposed development to the discussed water bodies due to emissions from the site stormwater drainage infrastructure to the wider drainage network. It should be noted that the proposed SuDS features will provide additional filtration from the site to the drainage network.

It is concluded that there are no pollutant linkages as a result of the construction or operation of the proposed development which could result in a water quality impact which could alter the habitat requirements of the Natura 2000 sites within Dublin Bay coastal waterbody.

Finally, and in line with good practice, appropriate and effective mitigation measures will be included in the construction design, management of construction programme and during the operational phase of the proposed development. With regard the construction phase, adequate mitigation measures will be incorporated in the Construction Environmental Management Plan (CEMP). These specific measures will provide further protection to the receiving soil and water environments. However, the protection of downstream European sites is in no way reliant on these measures and they have not been taken into account in this assessment.

5.0 REFERENCES

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