7 LAND, SOIL & GEOLOGY

7.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report (EIAR) provides an assessment of the impact on the surrounding soil and geology in the vicinity of the Proposed Development. The Proposed Development which is the subject of these 3no. concurrent planning applications consists of Site 3, Site 4 and Site 5. Dublin Central is underpinned by a Masterplan (refer to Figure 7.5 below indicating the Dublin Central Masterplan area) which will be assessed also. It also sets out mitigation and remedial measures and methods of monitoring once the development is operational.

A full description of the development can be found in Chapter 3: Description of Proposed Development of this EIAR.

This chapter was completed by Stephen Dent-Neville and Joe Gibbons of Waterman Moylan Consulting Engineers. Stephen is a Chartered Engineer with 8 years' experience and Joe is a Chartered Engineer with 35 years' experience.

7.2 ASSESSMENT METHODOLOGY

A desktop study to classify the geological features related to the site was undertaken. Data from the Geological Survey of Ireland (GSI) was reviewed, including the following maps: -

- Bedrock Geology Map.
- Bedrock Aquifer Map.
- Ground Water Vulnerability Map.

This information was supplemented by a review of geotechnical Site Investigations carried out within the Dublin Central site by IGSL in 2008. This comprehensive ground investigation assessed the soil, rock and groundwater conditions across the site and included boreholes, rotary coreholes, piezometers, geophysical surveys, permeability testing and laboratory testing of selected soil and rock samples.

7.3 RECEIVING ENVIRONMENT

The subject development is located in Dublin City Centre. The overall Dublin Central Masterplan site is bounded by Henry Street to the south, O'Connell Street Upper to the east, Parnell Street and O'Rahilly Parade to the north-east and north-west respectively, and Moore Street to the west. Topographic survey data shows that the subject site and the surrounding roads are generally flat, at a level of between 4.85m OD Malin and 5.40m OD Malin.

The site is a brownfield site, comprising of numerous buildings including various retail units, restaurants, offices, and derelict buildings. The subject development will involve a complete redevelopment of the site, though several protected buildings and façades are to be retained, rejuvenated and incorporated into the scheme.

The baseline conditions associated with the Dublin Central Masterplan area are considered to be the same for the individual sites which are subject to this planning application (i.e. Site 3, Site 4 and Site 5).

7.3.1 Desktop Study

Geological Survey Ireland (GSI) produces a wide range of datasets, including bedrock geology mapping, extracted in the Figure below.

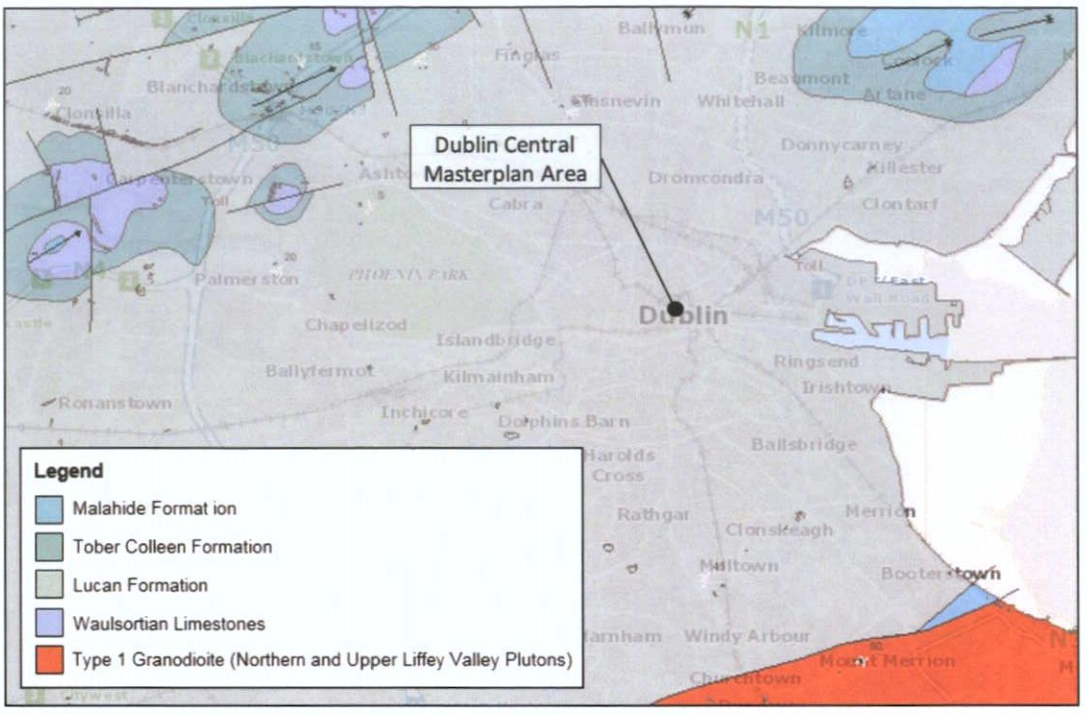

Figure 7.1: Extract from GSI Bedrock Geology Map.

The bedrock geology map indicates that most of Dublin City Centre, including the subject site, lies within the Lucan Formation. This formation 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 National Aquifer Bedrock Map prepared by the Geological Survey of Ireland was consulted and is extracted below. From this map, it was established that the entirety of the site is within the designation LI, which represents locally important moderately productive aquifer.

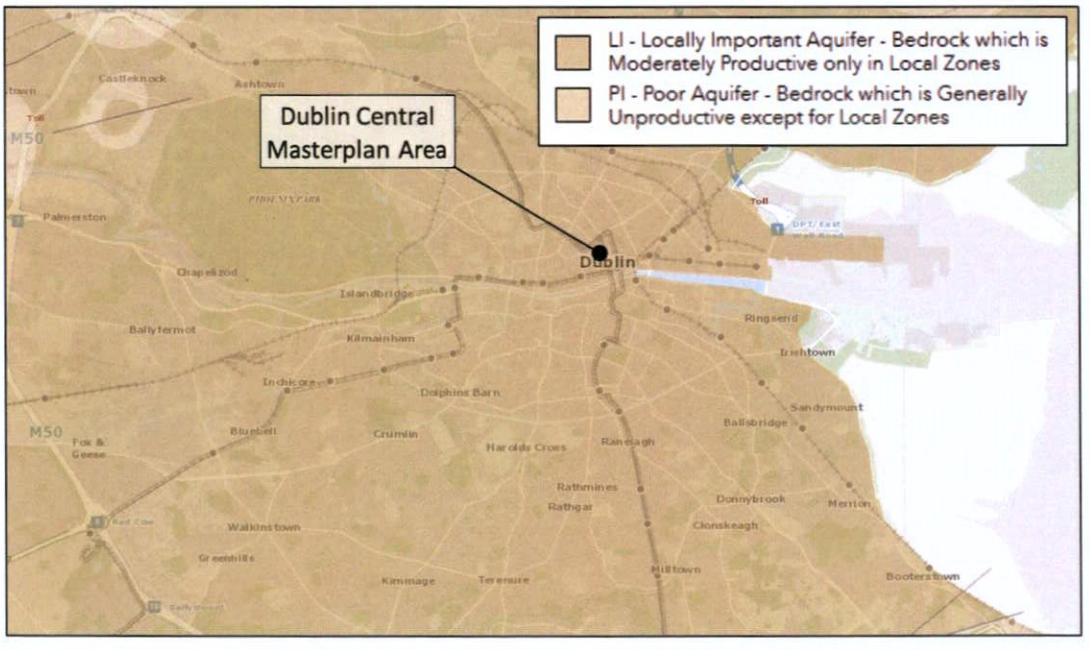

Figure 7.2: Extract from GSI Groundwater Aquifer Map.

The vulnerability of the groundwater in the vicinity of the subject site was also examined by referencing the Geological Survey of Ireland, and it was established that the vulnerability of the aquifer is low.

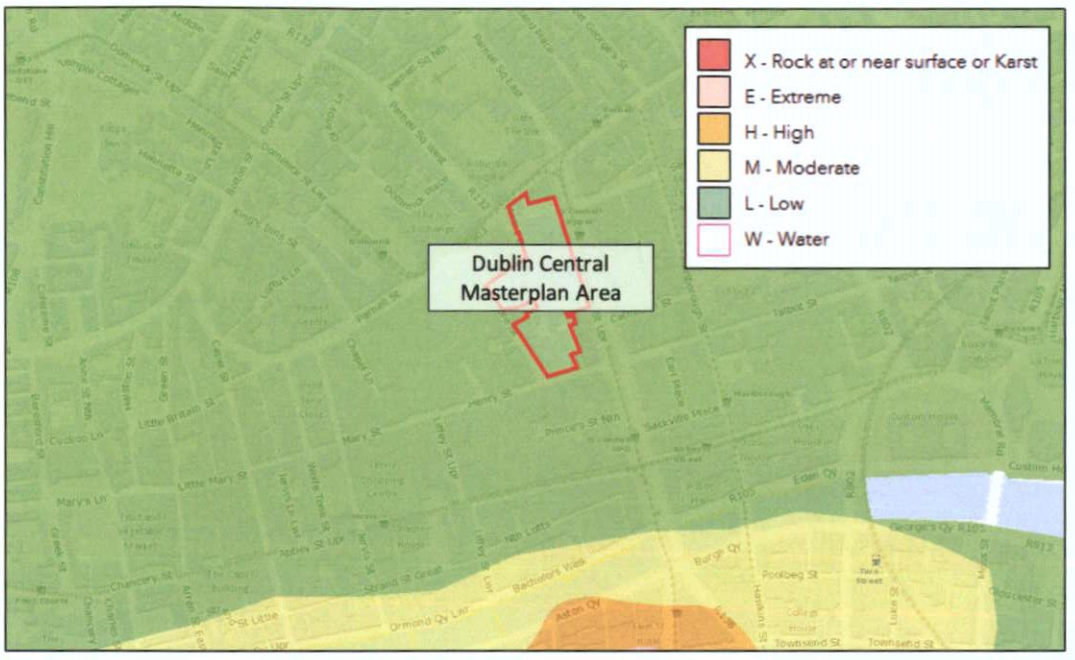

Figure 7.3: Extract from GSI Groundwater Vulnerability Map.

7.3.2 Ground Investigations

Intrusive ground investigations carried out at the site in 2008 by IGSL (See Appendix 7.1). The scope of the site investigation works carried out at the site comprised the following:

- 10no. shell and auger boreholes on an approximately 50m grid spacing across the site. The boreholes were taken to refusal in dense gravel or very stiff to hard boulder clay over rock.
- 13no. rotary coreholes on taken a minimum of 10m into rock to depths of 30-37m using a special triple-tube coring system with a polymer gel drilling fluid to maximise core recovery in very stiff to hard boulder clay and weathered rock.
- Sealed piezometers in soil and rock to observe groundwater levels across the site and any variations in water level between the gravel aquifer and the bedrock. A total 20no. piezometers were installed in 11no. locations (with multiple piezometers in some boreholes).
- 2no. wells and 2no. observation wells for pump tests were installed in the centre of the site for the purpose of measuring the mass permeability of the gravel and the bedrock.
- In-situ SPT tests and variable head permeability testing in boreholes.
- In-situ packer testing in rotary coreholes to assess the permeability of the rock.
- Downhole optical and acoustic imaging of rock coreholes to determine the in situ characteristics of the rock discontinuities such as joints and fractures to assess the stability of rock slopes and the variability in rock quality and type with depth.
- 2-D geophysical profiles around the perimeter of the excavation to obtain a continuous profile of soil and rock along the line of retaining walls and to obtain advanced parameters for numerical modelling of excavation support systems. This consisted of 2-D seismic refraction surveys and shear velocity (MASW) surveys carried out to an effective depth of 30m. A 2-D Resistivity survey was also carried out through the centre of the site.

- 9no. trial pits carried out at the Nos. 40 – 41 O'Connell Street site to investigate the foundations of existing buildings for underpinning design.
- Laboratory classification and strength testing. This included: -
  - Moisture content and Atterburg limit tests.
  - Particle size distribution tests – wet sieve and hydrometer.
  - Consolidated Undrained Triaxial tests.
  - Bender Element Tests carried out by a specialist laboratory to obtain the small strain stiffness of the boulder clay.
  - pH, sulphate and chloride tests.
  - Uniaxial compressive strength and point load index tests on rock.

Borehole locations are indicated on the Figure below: -

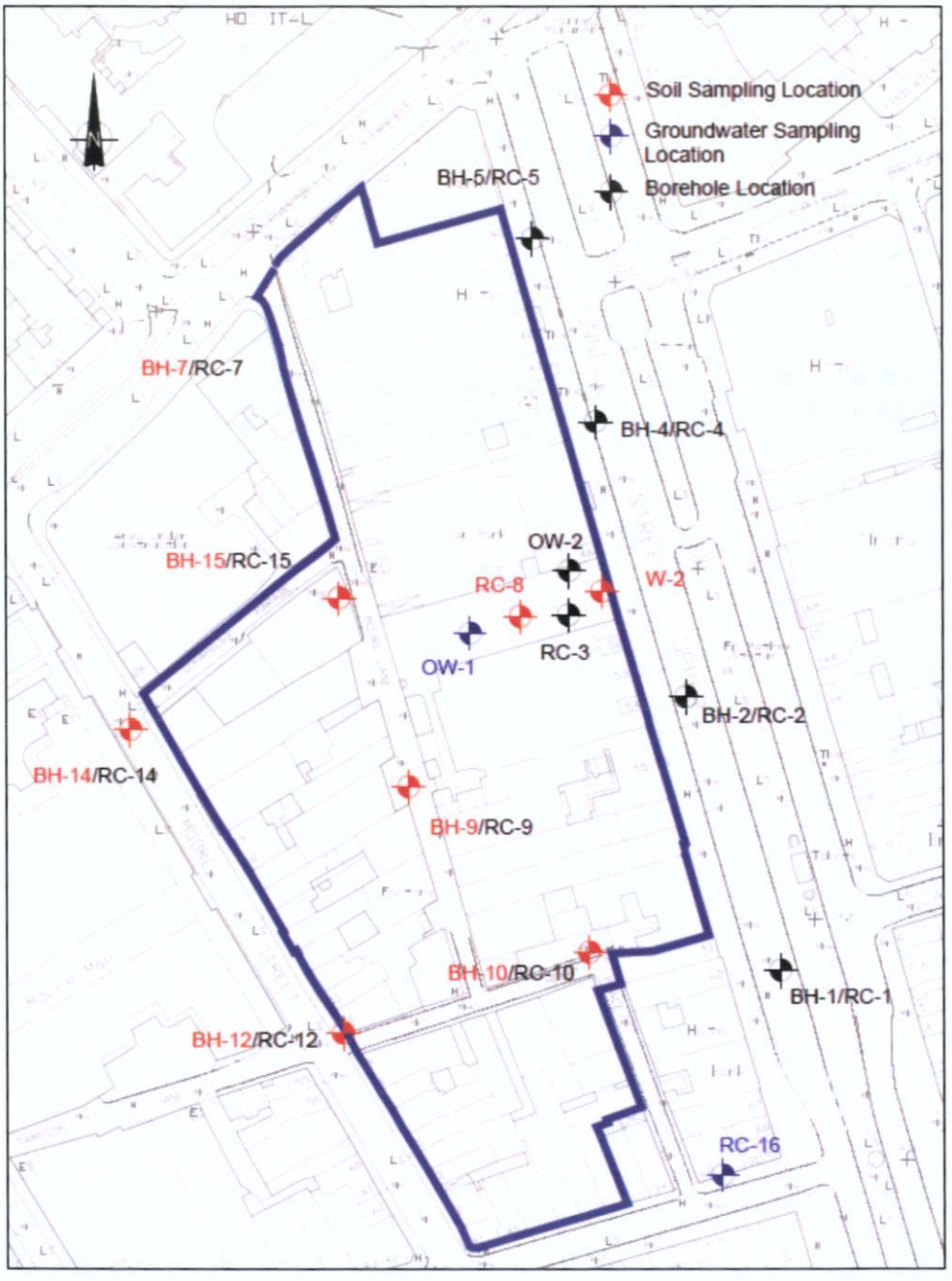

Figure 7.4: Site Investigation Locations.

The ground conditions encountered during the site investigations included made ground immediately below the ground surface between 2m to 5m deep. It was found to be predominantly a gravel with varying proportions of silt, sand and clay. It was also found to be highly variable in strength and stiffness.

Gravel was generally encountered below the fill material, with a high degree of variability in thickness, ranging from about 6m to 21m but thinning out to less than 1m at the corner of Moore Street and Henry Place. The gravel is a medium dense to dense sandy gravel with cobbles and boulders and occasional layers of sand and silt.

The gravel is underlain by Boulder Clay at a depth of 13m to 16m below ground level. The boulder clay is typically a stiff, very stiff or hard stony fine-grained soil which contains varying amounts of gravel, cobbles and boulders However, some seams of boulder clay were encountered in the gravel at higher levels, and locally at Nos. 40 – 41 O'Connell St. the depth to the top of the Boulder Clay drops to 23.5m. The gravel and boulder clay deposits are water bearing, although the gravel deposits would have a significantly higher permeability.

Bedrock was encountered at depths that varied between 17 and 27m below ground level and comprised interbedded Limestone and Shale with strengths in the range of moderately weak to strong. A thin layer of weathered rock up to 1m thick was occasionally encountered at the upper surface of the bedrock. Weathered seams were also encountered with the Limestone and the Shale.

Waste Acceptance Criteria (WAC) testing was carried out on soil samples. In RC-8 and W-2, the levels of sulphate, total dissolved solids, TPH and PAHs exceeded the inert waste WAC. However all of the levels were less than the non-hazardous WAC. In BH-12, which was located on the southeast perimeter of the site TPH and mercury were detected above the inert waste WAC in the upper fill sample; however the levels of these parameters in the underlying fill and natural ground were less than the inert WAC.

There was no evidence of significant contamination in any of the other samples and the tested parameters, where detected, are at levels generally below the inert WAC.

The groundwater table was found to be between +0.1 and +0.5m OD Malin, within the overburden and the bedrock. Groundwater samples were collected from four groundwater monitoring wells (OW-1 Subsoils, OW-1 Bedrock, RC-16 Subsoils and RC-16 Bedrock) and sent to the STL laboratory in Santry for analysis.

The range of parameters tested included dissolved metals (arsenic, antimony, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, tin and zinc), sodium, chloride, potassium, magnesium, sulphate, sulphide, total hardness, bicarbonate, TPH, BTEX and PAH.

Elevated PAH levels were detected in the groundwater wells immediately to the south but not within the portion of the site where deep excavation will occur.

7.4 CHARACTERISTICS OF PROPOSED DEVELOPMENT

7.4.1 Dublin Central Masterplan

The Dublin Central Masterplan is divided into six sites. The overall development site is bounded by Henry Street to the south, O'Connell Street Upper to the east, Parnell Street and O'Rahilly Parade to the north-east and north-west respectively, and Moore Street to the west. The development is a mixed use development, and includes office, hotel, residential, café / restaurant and retail spaces. There is also provision made in Site 2AB and Site 2C for a proposed Metrolink station, to be implemented separately by Transport Infrastructure Ireland (TII). A breakdown of the schedule of accommodation is shown in the Table below: -

	Site 1	Site 2AB	Site 2C	Site 3	Site 4	Site 5	Total
Use	**sq. m**	**sq. m**	**sq. m**	**sq. m**	**sq. m**	**sq. m**	**sq. m**
Office	3,610	17,484	17,029	-	295	5,799	**44,217**
Hotel	8,094	-	-	7,175	-	-	**15,270**
Residential	-	-	-	6,452	1,454	-	**7,906**
Retail	-	1,876	1,255	1,954	617	-	**5,672**
Café / Restaurant	-	625	150	138	864	679	**2,456**
Cultural / Gallery / Cafe	-	-	-	123	-	-	**123**
Extension to National Monument for ancillary use to National Monument – a cultural facility	-	-	-	-	60	-	**60**
Metro Enabling Works	-	555	831	-	-	-	**1,386**
Total	**11,704**	**20,541**	**19,235**	**15,842**	**3,290**	**6,478**	**77,090**

Table 7.1: Schedule of Accommodation by Site.

The blocks which form the six sites of the Dublin Central Masterplan are highly interconnected, and as such a holistic approach has been taken in preparing this EIAR.

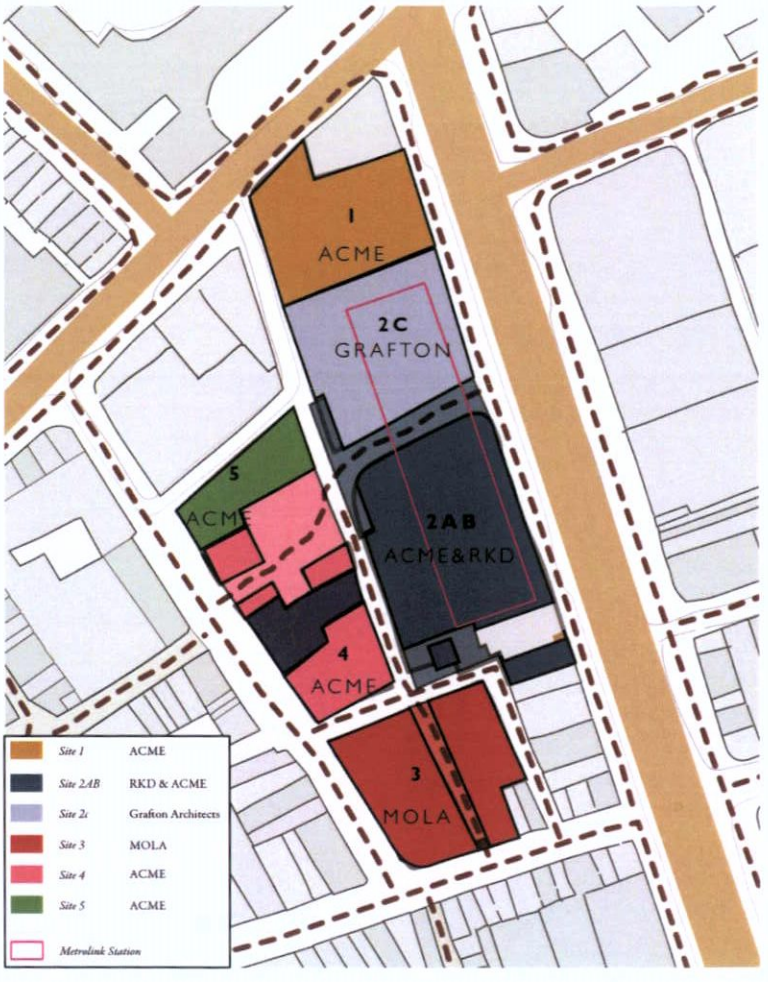

Figure 7.5: Dublin Central Masterplan with each Site identified.

7.4.2 Proposed Development – Site 3, 4 & 5

7.4.2.1 Site 3

The Proposed Development comprises a mixed-use scheme accommodating a hotel, residential units and associated amenities, cultural, retail and café / restaurant uses (c. 15,842 sq. m gross floor area) in 2no. blocks ranging in height from 1 – 9 storeys over 2no. new independent single storey basements. Provision of a new street/laneway linking Henry Street with Henry Place/Moore Lane.

7.4.2.2 Site 4

The Proposed Development comprises a mixed-use scheme accommodating residential units and associated amenities, retail and café / restaurant uses (c. 3,290 sq. m gross floor area) in 2no. parts located north and south of the Nos. 14 – 17 Moore Street (a National Monument/Protected Structures) ranging in height from 1 – 3 storeys including retained independent single storey basements. Provision of a part of the new public plaza and archway onto new public square.

7.4.2.3 Site 5

The Proposed Development comprises a mixed-use scheme accommodating office and café / restaurant uses (c. 6,478 sq. m gross floor area) in a single building ranging in height from 2 – 6 storeys (top floor set back) over new single storey localised basement. Provision of a part of the new public plaza.

The Proposed Development, with respect to soils and geology, includes the following characteristics: -

- Excavation of basements and foundations.
- Excavation of drainage sewers and utilities.
- Minor regrading and landscaping.
- Disposal of any surplus excavated soils including any contaminated material.

7.5 POTENTIAL IMPACTS

7.5.1 Dublin Central Masterplan

7.5.1.1 Construction Stage

The removal of topsoil during earthworks and the construction of roads, services and buildings, in particular basements and foundations, will expose subsoil to weathering and may result in the erosion of soils during adverse weather conditions. Surface water runoff from the surface of the excavated areas may result in silt discharges to the River Liffey.

Excavations for foundations, remaining roadworks and services will result in a surplus of subsoil. Surplus subsoil will be used in fill areas where applicable.

Dust from the site and from soil spillages on the existing road network around the site may be problematic, especially during dry conditions.

Accidental oil or diesel spillages from construction plant and equipment, in particular at refuelling areas, may result in oil contamination of the soils and underlying geological structures.

7.5.1.2 Operational Stage

During the operational stage of the development it is not envisaged that there will be any ongoing impacts on the underlying soil as a result of the Proposed Development. Any hydro-geological impacts are temporary and associated with the construction of the Proposed Development.

7.5.1.3 Do-Nothing Impact

There is no impact on the soils and geology in the do-nothing scenario.

7.5.2 Proposed Development – Site 3, 4 & 5

7.5.2.1 Construction Stage

The potential impacts of the Proposed Development are the same as the potential impacts of the Dublin Central Masterplan described in Section 7.5.1.1.

7.5.2.2 Operational Stage

The potential impacts of the Proposed Development are the same as the potential impacts of the Dublin Central Masterplan described in Section 7.5.1.2.

7.5.2.3 Do-Nothing Impact

The do-noting impact of the Proposed Development is the same as the do noting impact of the Dublin Central Masterplan described in Section 7.5.1.3.

7.6 MITIGATION MEASURES (AMELIORATIVE, REMEDIAL OR REDUCTIVE MEASURES)

7.6.1 Dublin Central Masterplan

7.6.1.1 Construction Stage

To reduce the quantity of soil to be removed from or imported into the site, the floor levels of the proposed buildings and roads are designed to match existing levels and minimise the cut and fill balance. The number of vehicle movements offsite will be minimised by this optimisation. However, given that there are significant basement areas proposed, including the proposed underground Metrolink station, it is anticipated that there will be a significant surplus of soil to be removed from the site.

Surplus subsoil and rock that may be required to be removed from site will be deposited in approved fill areas or to an approved waste disposal facility. Surplus subsoil will be stockpiled on site, in such a manner as to avoid contamination with builders' waste materials, etc., and so as to preserve the materials for future use as clean fill. A Construction Management Plan will need to include protocols for soil removal and should be implemented by the development's main contractor during the construction stage.

Where contaminated soils are encountered during the works, they will be excavated and disposed of off-site in accordance with the Waste Management Acts, 1998-2006, and associated regulations and guidance provided in Guidelines for the Management of Waste from National Road Construction Projects published by the National Roads Authority in 2008.

The provision of wheel wash facilities at the construction entrances to the development will minimise the amount of soils deposited on the surrounding road network. The adjoining road network will be cleaned on a regular basis, as required, to prevent the build-up of soils from the development site on the existing public roads.

Measures will be implemented throughout the construction stage to prevent contamination of the soil and adjacent watercourses from oil and petrol leakages. Suitable bunded areas will be installed for oil and petrol storage tanks. Designated fuel filling points will be put in place with appropriate oil and petrol interceptors to provide protection from accidental spills. Refuelling will be restricted to these allocated re-fuelling areas. This area is to be an impermeable bunded area designed to contain 110% of the volume of fuel stored.

During excavation works, temporary sumps will be used to collect any surface water run-off thereby avoiding of standing water within the basement and other excavations.

Silt traps, silt fences and tailing ponds will need to be provided by the contractor where necessary to prevent silts and soils being washed away by heavy rains during the course of the construction stage. Surface water runoff and water pumped from the excavation works will be discharged via a silt trap / settlement pond to the existing combined drainage system which discharges to the Dublin Wastewater Treatment Plant at Ringsend. Straw bales will be used at the outfall to filter surface water to remove contaminants.

Dampening down measures with water sprays will be implemented during periods of dry weather to reduce dust levels arising from the development works.

After implementation of the above measures, the Proposed Development will not give rise to any significant long term adverse impact. Moderate negative impacts during the construction stage will be short term only in duration.

A Construction Management Plan, Traffic Management Plan and Waste Management Plan will be implemented by the contractor during the construction stage to control the above remedial measures.

7.6.1.2 Operational Stage

No mitigation measures for soils or geology will required during the operational stage.

7.6.2 Proposed Development – Site 3, 4 & 5

7.6.2.1 Construction Stage

The mitigation measures for the Proposed Development are the same as the mitigation measures set out for the Dublin Central Masterplan described in Section 7.6.1.1.

7.6.2.2 Operational Stage

No mitigation measures for soils or geology will required during the operational stage.

7.7 RESIDUAL IMPACT

7.7.1 Dublin Central Masterplan

7.7.1.1 Construction Stage

With the protective measures noted above in place during excavation works, any potential impacts on soils and geology in the area will be minimised.

The Proposed Development will result in a surplus of excavated material, which may contain contaminants. Any contaminated material will be exported to an approved licensed waste facility.

No significant adverse impacts on the soils and geology of the subject lands are envisaged.

7.7.1.2 Operational Stage

During the operational stage, the buildings and public realm will be an urban environment, largely covered in roof and hard standing. Some areas with permeable paving, tree pits and green planting will allow for some surface water to permeate the soil. These SuDS devices treat and improve water quality by trapping suspended solids and filtering pollutants before they enter the soil.

No likely significant adverse impacts are predicted on soils or geology.

7.7.1.3 Worst Case Impact

The worst case scenario would be for contaminated soils to be encountered during the works. As noted above, any contaminated soils encountered will be excavated and disposed of off-site in accordance with the Waste Management Acts, 1998 – 2006, and associated regulations and guidance provided in Guidelines for the Management of Waste from National Road Construction Projects published by the National Roads Authority in 2008.

In the worst case scenario, subsoil may be exposed to inclement weather during construction and may result in the erosion of soils. However, with the proposed mitigation measures the quantity of soils exposed and the duration of that exposure will be minimised.

7.7.2 Proposed Development – Site 3, 4 & 5

7.7.2.1 Construction Stage

The residual impacts for the Proposed Development are the same as the residual impacts described for the Dublin Central Masterplan described in Section 7.7.1.1.

7.7.2.2 Operational Stage

The residual impacts for the Proposed Development are the same as the residual impacts described for the Dublin Central Masterplan described in Section 7.7.1.2.

7.7.2.3 Worst Case Impact

The worst case impact for the Proposed Development are the same as the worst case impact described for the Dublin Central Masterplan described in Section 7.7.1.3.

7.8 MONITORING

7.8.1 Dublin Central Masterplan

7.8.1.1 Construction Stage

Monitoring during the construction stage is recommended, in particular in relation to the following: -

- Adequate protection from contamination of soils for removal.
- Monitoring of surface water discharging to the existing drainage network.
- Monitoring cleanliness of the adjoining road network.
- Monitoring measures for prevention of oil and petrol spillages.
- Dust control by dampening down measures close to the boundaries of the site, when required due to unusually dry weather conditions.

During the operational stage, the surface water network (drains, gullies, manholes, AJs, SuDS devices, attenuation system) will need to be regularly maintained and where required cleaned out. A suitable

maintenance regime of inspecting and cleaning should be incorporated into the safety file / maintenance manual for the development.

7.8.1.2 Operational Stage

Not applicable.

7.8.2 Proposed Development – Site 3, 4 & 5

7.8.2.1 Construction Stage

The monitoring for the Proposed Development is the same as the monitoring for the Dublin Central Masterplan described in Section 7.8.1.1.

7.8.2.2 Operational Stage

Not applicable.

7.9 REINSTATEMENT

7.9.1 Dublin Central Masterplan

Trenches opened during construction will be backfilled with subsoil to reinstate existing ground levels. Upon completion no impact is foreseen.

7.9.2 Proposed Development Site 3, 4 & 5

The reinstatement for the Proposed Development is the same as the reinstatement for the Dublin Central Masterplan described in Section 7.9.1.

7.10 DIFFICULTIES ENCOUNTERED

There were no difficulties encountered when undertaking this assessment.

8 WATER

8.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report (EIAR) provides an assessment of the impact on the network of water (water supply, foul drainage, surface water) in the vicinity of the Proposed Development. The Proposed Development which is the subject of these 3no. concurrent planning applications consists of Site 3, Site 4 and Site 5. Dublin Central is underpinned by a Masterplan (refer to Figure 8.1 below indicating the Dublin Central Masterplan area) which will be assessed also. The chapter also sets out mitigation and remedial measures and methods of monitoring while the development is operational.

A full description of the development can be found in Chapter 3: Description of Proposed Development of this EIAR.

This chapter was completed by Stephen Dent-Neville and Joe Gibbons of Waterman Moylan Consulting Engineers. Stephen is a Chartered Engineer with 8 years' experience and Joe is a Chartered Engineer with 35 years' experience.

8.2 ASSESSMENT METHODOLOGY

8.2.1 Water Supply

Research for this section included a review of the existing watermain layout from Irish Water / Dublin City Council records for the area.

8.2.2 Foul Water Drainage

Research for this section included a review of the existing foul water layout from Irish Water / Dublin City Council records for the area.

8.2.3 Surface Water Drainage

Research for this section included a review of Ordnance Survey and Topographical surveys of the subject site and surrounding area and a review of the existing surface water layout from Irish Water / Dublin City Council records for the area.

8.3 RECEIVING ENVIRONMENT

8.3.1 Water Supply

There are a number of existing interconnected water supply mains in the vicinity of the Dublin Central Masterplan site, including: -

- A 200mm ductile iron main in Moore Street, constructed in 1986.
- A 350mm ductile iron main in Parnell Street, constructed in 1986.
- A 250mm ductile iron main on the western side of O'Connell Street Upper, constructed in 2006.
- A 12-inch (c. 300mm) cast iron main on the northern side of Henry Street, constructed in 1900.
- A 6-inch (c. 150mm) cast iron main on the southern side of Henry Street, constructed in 1900.
- A 125mm HDPE main in Henry Place, constructed in 2019.
- A 4-inch (c. 100mm) cast iron main in Moore Lane, constructed in 1900.
- A 110mm HPPE main in O'Rahilly Parade, constructed in 2007.

Existing buildings at the subject site are currently fed water by various connections to this existing network.

8.3.2 Foul Water Drainage

The drainage network surrounding the Dublin Central Masterplan site consists of combined foul and surface water sewers. There are a number of existing combined sewers in the vicinity of the subject Dublin Central Masterplan site, including: -

- A brick sewer conveying flows in a southerly direction along Moore Street, varying in size from 2220mm x 1200mm at Parnell Street to the north to 2160mm x 1230mm at Henry Street to the south.
- This brick sewer continues east along Henry Street, where it reduces in size to 1860mm x 730mm.
- A brick sewer conveying flows in a southerly direction along O'Connell Street Upper, varying in size from 1670mm x 970mm near the north-east corner of the site to 2200 x 760 near the south-eastern corner, where it connects with the sewer coming from Henry Street and both continue east away from the site along North Earl Street.
- A 1200mm concrete sewer in Parnell Street flowing west.
- An 810mm x 510mm brick sewer in Henry Place, connected to the Henry Street sewer.
- An 810mm x 510mm brick sewer in Moore Lane flowing south to the sewer in Henry Place.
- A 300mm vitrified clay sewer in Moore Lane, flowing west to the brick sewer in Moore Street.
- A 300mm concrete sewer on the eastern side of O'Rahilly Parade, flowing westwards into a 300mm concrete sewer at the eastern side of O'Rahilly Parade, connected to the Moore Street brick sewer.

Foul and surface water currently run uncontrolled / unattenuated from the Dublin Central Masterplan site, discharging to the existing combined network via several connections.

8.3.3 Surface Water Drainage

The Dublin Central Masterplan site is bounded by Henry Street to the south, O'Connell Street Upper to the east, Parnell Street and O'Rahilly Parade to the north-east and north-west respectively, and Moore Street to the west. The site is generally flat, at a level of approximately 5m OD Malin.

The surrounding drainage network consists of combined foul and surface water sewers, as described in Section 8.3.2 above. Foul and surface water currently run uncontrolled / unattenuated from the subject site, discharging to the existing combined network via several connections.

In addition to this combined network, there are also some separated surface water sewers in the vicinity of the site. There is a 225mm concrete sewer in Parnell Street, increasing to 300mm near the intersection with Dominick Street Lower. There is a 375mm concrete surface water sewer in Henry Street approximately 110m west of the site's southern boundary.

8.4 CHARACTERISTICS OF PROPOSED DEVELOPMENT

8.4.1 Dublin Central Masterplan

The Dublin Central Masterplan site is divided into six separate sites. The overall development site is bounded by Henry Street to the south, O'Connell Street Upper to the east, Parnell Street and O'Rahilly Parade to the north-east and north-west respectively, and Moore Street to the west.

The development is a mixed use development, and includes office, hotel, residential, café / restaurant and retail spaces. There is also provision made in Site 2AB and Site 2C for a proposed Metrolink station, to be implemented separately by Transport Infrastructure Ireland (TII). A breakdown of the schedule of accommodation is shown in the Table below: -

	Site 1	Site 2AB	Site 2C	Site 3	Site 4	Site 5	Total
Use	**sq. m**	**sq. m**	**sq. m**	**sq. m**	**sq. m**	**sq. m**	**sq. m**
Office	3,610	17,484	17,029	-	295	5,799	**44,217**
Hotel	8,094	-	-	7,175	-	-	**15,270**
Residential	-	-	-	6,452	1,454	-	**7,906**
Retail	-	1,876	1,255	1,954	617	-	**5,672**
Café / Restaurant	-	625	150	138	864	679	**2,456**
Cultural / Gallery / Cafe	-	-	-	123	-	-	**123**
Extension to National Monument for ancillary use to National Monument – a cultural facility	-	-	-	-	60	-	**60**
Metro Enabling Works	-	555	831	-	-	-	**1,386**
Total	**11,704**	**20,541**	**19,235**	**15,842**	**3,290**	**6,478**	**77,090**

Table 8.1: Schedule of Accommodation by 'Site' within the Dublin Central Masterplan.

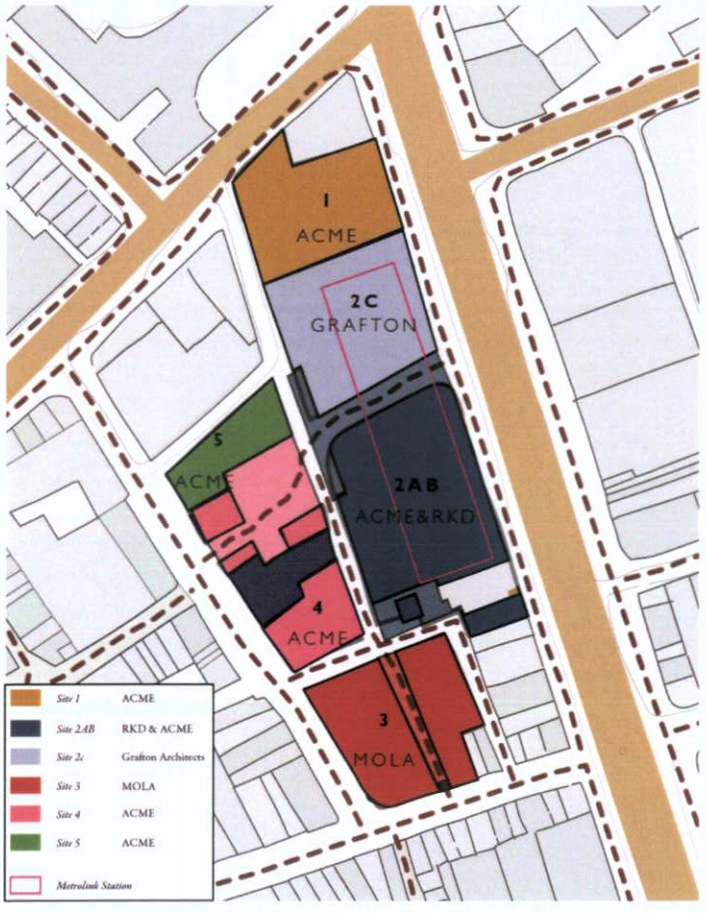

Figure 8.1: Dublin Central Masterplan with each Site identified.

8.4.1.1 Water Supply

It is proposed to supply water to each site within the Dublin Central Masterplan via new metered connections to the existing watermain network.

An estimate of the water demand from the public water supply system for the Dublin Central Masterplan is shown in the Table below. An approximate allocation has been made for the Metrolink project also to provide a more robust assessment of water demand.

The average domestic demand has been established based on an average occupancy ratio of 2.7 persons per dwelling with a daily domestic per capita consumption of 150 litres per head per day and with a 10% allowance factor. Note that the Irish Water Code of Practice assumes 2.7 residents per unit regardless of the unit type. In the case of the subject development, the residential units are studio, 1-bed and 2-bed apartments, so 2.7 persons per unit is considered a very conservative estimate and the actual number of residents will likely be much lower.

The average day / peak week demand has been taken as 1.25 times the average daily domestic demand, while the peak demand has been taken as 5 times the average day / peak week demand, as per Section 3.7.2 of the Irish Water Code of Practice for Water Infrastructure.

Description		Quantity	Total Population	Per Capita Water Demand	Water Demand	Average Demand	Average Peak Demand	Peak Demand
			No. People	*l/hd/day*	*l/day*	*l/s*	*l/s*	*l/s*
Office	**Staff**	1 staff per 10m² GFA	4,422 Staff	90	437,748	5.067	6.333	31.666
Hotel	**Guests**	325 Rooms	650 Customers	250	178,750	2.069	2.586	12.930
	Staff	1 staff per 5 rooms	65 Staff	90	6,435	0.074	0.093	0.465
Residential	**Residents**	100 Apartments	270 Residents	150	44,550	0.516	0.645	3.223
Food & Beverage	**Customers**	1 customer per 3m² GFA	819 Customers	30	27,017	0.313	0.391	1.954
	Staff	1 staff per 15m² GFA	164 Staff	45	8,105	0.094	0.117	0.586
Retail	**Customers**	1 customer per 5m² GFA	1,134 Customers	15	18,718	0.217	0.271	1.354
	Staff	1 staff per 15m² GFA	378 Staff	45	18,718	0.217	0.271	1.354
Metro	**Public Restrooms**	2 Toilet Blocks	250 Uses	10	2,750	0.032	0.040	0.199
	Staff	25 Full Time Staff	25 Staff	90	2,475	0.029	0.036	0.179
Total					**745,267**	**8.626**	**10.782**	**53.911**

Table 8.2: Estimate of the Water Demand for the Dublin Central Masterplan.

Based on these figures, the water demand that will be generated by the Dublin Central Masterplan is approximately 8.626l/s, or 745.29m³ per day.

A pre-connection enquiry was submitted to Irish Water in October 2020 to confirm whether there is adequate capacity in the existing water supply network to cater for the all the sites within the Dublin Central Masterplan. The enquiry is still under assessment by Irish Water.

8.4.1.2 Foul Water Drainage

An estimate of the foul water discharge rate from the Dublin Central Masterplan to the public drainage network is shown in the Table below. An approximate allocation has been made for the Metrolink project also to provide a more robust assessment of water demand.

Domestic wastewater loads have been calculated based on 2.7 persons per unit with a per capita wastewater flow of 150 litres per head per day along with a 10% unit consumption allowance, in line with Section 3.6 of the Irish Water Code of Practice for Wastewater Infrastructure. Note that the Irish Water Code of Practice assumes 2.7 residents per unit regardless of the unit type. In the case of the subject development, the residential units are studio, 1-bed and 2-bed apartments, so 2.7 persons per unit is considered a very conservative estimate and the actual number of residents will likely be much lower.

Per capita wastewater flows for the commercial areas have been based on the flow rates set out in Appendix C of the Code of Practice, and a peak flow multiplier of 6 has been used, as per Section 2.2.5 of Appendix B of the Code of Practice.

Description		Quantity	Total Population	Load per Capita	Daily Load	Total DWF	Peak Flow
			No. People	*l/hd/day*	*l/day*	*l/s*	*l/s*
Office	**Staff**	1 staff per 10m² GFA	4,422 Staff	90	437,748	5.067	30.399
Hotel	**Guests**	325 Rooms	650 Customers	250	178,750	2.069	12.413
	Staff	1 staff per 5 rooms	65 Staff	90	6,435	0.074	0.447
Residential	**Residents**	100 Apartments	270 Residents	150	44,550	0.516	3.094
Food & Beverage	**Customers**	1 customer per 3m² GFA	819 Customers	30	27,017	0.313	1.876
	Staff	1 staff per 15m² GFA	164 Staff	45	8,105	0.094	0.563
Retail	**Customers**	1 customer per 5m² GFA	1,134 Customers	15	18,718	0.217	1.300
	Staff	1 staff per 15m² GFA	378 Staff	45	18,718	0.217	1.300
Metro	**Public Restrooms**	2 Toilet Blocks	250 Uses	10	2,750	0.032	0.191
	Staff	25 Full Time Staff	25 Staff	90	2,475	0.029	0.172
Total					**745,267**	**8.626**	**51.755**

Table 8.3: Foul Discharge Rate for the Dublin Central Masterplan.

Dry Weather Flow (DWF) from the Development = 8.626 l/s

Peak Flow (6 x DWF) = 51.755 l/s

It is proposed to drain wastewater from each site within the Dublin Central Masterplan via new connections to the existing combined drainage network.

A pre-connection enquiry was submitted to Irish Water in October 2020 to confirm whether there is adequate capacity in the existing drainage network to cater for the Proposed Development. The enquiry is still under assessment by Irish Water.

8.4.1.3 Surface Water Drainage

It is proposed to drain surface water from Dublin Central Masterplan site to the existing public surface water sewer at Parnell Street where feasible, and elsewhere to the adjacent combined network.

Dublin Central Masterplan incorporates a Storm Water Management Plan within each Site through the use of various SuDS techniques. Treatment and storage of surface water at source will intercept and slow down the rate of runoff from the site to the existing surface water sewer system.

Based on three key elements, Water Quantity, Water Quality and Amenity, the targets of the SuDS train concept have been implemented in the design. The SuDS devices proposed within and around the individual sites include green and blue roofing, permeable paving, tree pits and planted areas, underground attenuation and flow control devices.

Attenuation storage is provided to limit the discharge rate from the site into the public network. As per the GDSDS, the required attenuation volume is calculated assuming 100% runoff from paved areas, and has been calculated for the 1-year, 30-year and 100-year return periods, identifying the critical storm for each. Surface water runoff will be restricted via a hydro-brake or similar approved flow control device, limited to 2 l/s for each Site.

8.4.2 Proposed Development – Site 3, 4 & 5

A full description of the development can be found in Chapter 3: Description of Proposed Development of this EIAR. The following is a broad outline of the development of each site: -

- Site 3: The Proposed Development comprises a mixed-use scheme accommodating a hotel, residential units and associated amenities, cultural, retail and café / restaurant uses (c. 15,842 sq. m gross floor area) in 2no. blocks ranging in height from 1 – 9 storeys over 2no. new independent single storey basements. Provision of a new street/laneway linking Henry Street with Henry Place / Moore Lane.
- Site 4: The Proposed Development comprises a mixed-use scheme accommodating residential units and associated amenities, retail and café / restaurant uses (c. 3,290 sq. m gross floor area) in 2no. parts located north and south of the Nos. 14 – 17 Moore Street (a National Monument/Protected Structures) ranging in height from 1 – 3 storeys including retained independent single storey basements. Provision of a part of the new public plaza and archway onto new public square.
- Site 5: The Proposed Development comprises a mixed-use scheme accommodating office and café / restaurant uses (c. 6,478 sq. m gross floor area) in a single building ranging in height from 2 – 6 storeys (top floor set back) over new single storey localised basement. Provision of a part of the new public plaza.

8.4.2.1 Water Supply

It is proposed to supply water to the subject blocks via new metered connections to the existing watermain network, as indicated on the watermain layout drawings which accompany this submission. Water supply will be provided for each site as follows: -

- Site 3: It is proposed to provide two new metered water supply connections to serve the development, one for Block A and one for Block B. The Block A connection will be made to the existing 12" main in Henry Street, to the south of the site. To serve Block B, it is proposed to construct a new loop in Henry Place connected to the existing 200mm main in Moore Street.
- Site 4: It is proposed to provide two new metered water supply connections to serve the development, one for the northern portion of the site and another for the southern portion. The southern block will connect to the new loop in Henry Place, which is proposed as part of the Site 3 development. The northern portion of the site will be connected directly to the existing 200mm ductile iron main in Moore Street.
- Site 5: It is proposed to provide one new metered water supply connection to serve the development, at the location of the existing connection to the 110mm main in O'Rahilly Parade.

8.4.2.2 Foul Water Drainage

It is proposed to drain wastewater from the subject development to the existing combined network. Any existing drainage connections at the sites are to be decommissioned, with the existing drain capped from within the site to decommission the pipe. Although the existing drainage infrastructure comprises of combined foul and surface water sewers, private foul and surface water will be drained on completely separate systems throughout the development (refer also to Section 8.4.2.3 below). Foul water will be drained from each site as follows: -

- Site 3: It is proposed to provide two new 225mm connections to the existing public network, one for Block A and one for Block B. The Block A connection will be made to the existing sewer in Henry Street, to the south of the site, while the Block B connection will be to the 300mm sewer to the north. A new manhole will be constructed at each of the two connection points.
- Site 4: It is proposed to provide two new 225mm connections to the existing public network, one for the northern portion of the site and one for the southern portion. The southern block will connect to the existing 300mm vitrified clay sewer to the south of the site. The northern portion of the site will discharge wastewater to the existing brick sewer on Moore Street via a new connection. A new manhole will be constructed at each of the two connection points.
- Site 5: It is proposed to provide one new 225mm connection to the existing public network in O'Rahilly Parade. A new manhole will be constructed at the connection point.

8.4.2.3 Surface Water Drainage

The option to discharge surface water from each site to the public surface water sewers in Henry Street and in Parnell Street were examined. However, given the depths of these existing sewers and given the flat gradients of the surrounding road network, it was determined only to be feasible for Site 5 to discharge to the surface water network. Sites 3 and 4 will discharge surface water to the existing combined network.

Under the proposed scheme, surface water discharges will be restricted through the use of flow control devices, and each site will incorporate suitable attenuation for the 1-in-100 year storm. Appropriate Sustainable Drainage System (SuDS) measures are proposed, including the use of green roofs, blue roofs and tree pits. These surface water proposals will significantly reduce the rate of surface water runoff to the existing combined network compared to the current scenario.

Surface water will be drained from each site as follows: -

- Site 3: It is proposed to drain surface water to the existing public combined water sewer adjacent to the site in Moore Lane. Surface water will discharge from Site at a controlled rate limited to the practical minimum rate of 2l/s. Attenuation storage is to be provided at blue roofs and in an underground tank.
- Site 4: It is proposed to drain surface water to the existing public combined water sewer adjacent to the site in Moore Street. Two surface water connections are proposed to the existing combined sewer; one for the portion of the site south of the National Monument at 14-17 Moore Street and another for the portion of the site to the north of the National Monument. Surface water will discharge from each of these catchments a controlled rate limited to the practical minimum rate of 2l/s. Attenuation storage is to be provided at blue roofs and in two underground tanks, one for the northern portion of the site and another for the southern portion.
- Site 5: New surface water drains will be laid along O'Rahilly Parade towards Moore Street, continuing north along Moore Street to the existing sewer in Parnell Street. Surface water will discharge from the Site at a controlled rate limited to the practical minimum rate of 2l/s. Attenuation storage is to be provided at blue roofs and in an underground tank.

8.5 POTENTIAL IMPACTS

8.5.1 Dublin Central Masterplan

8.5.1.1 Water Supply

8.5.1.1.1 Construction Stage

Many of the existing buildings within the Dublin Central Masterplan site are currently occupied and in use. Although there will be some water demand for site offices, commencement of construction will result in a net decrease in the water demand for the site.

There is a risk of contamination to the existing water supply during connection of the individual sites watermains within the Dublin Central Masterplan to the public water supply.

8.5.1.1.2 Operational Stage

During the operational stage of the Dublin Central Masterplan, there will be an increase in demand for water from the public water supply.

8.5.1.2 Foul Water Drainage

8.5.1.2.1 Construction Stage

During the construction of the new foul sewers there is the potential for surface water to be discharged to the existing public foul sewer system due to pipes and manholes being left open.

There is a risk of pollution of groundwater and water courses by accidental spillage of foul effluent during connections being made to live sewers.

8.5.1.2.2 Operational Stage

There will be a net peak foul water flow of 52l/s discharging to the foul water system serving the Dublin Central Masterplan site. Foul and surface water currently flow uncontrolled / unattenuated from the Dublin Central Masterplan site to the existing combined network. The proposal will result in a net reduction in flows to the network.

There is a possibility of some surface water ingress into the foul water drainage system due to poor workmanship. There is also a possibility of leakage from sewers and drains within the Dublin Central Masterplan site and along the route to the outfall sewer. Any foul water leakage would result in local contamination of soil and ground waters in the area.

8.5.1.3 Surface Water Drainage

8.5.1.3.1 Construction Stage

Foul and surface water currently flow uncontrolled / unattenuated from Dublin Central Masterplan site to the existing combined network. The proposal will result in a net reduction in flows to the combined network.

There is a possibility of some surface water ingress into the combined drainage system due to poor workmanship. There is also a possibility of leakage from sewers and drains within the Dublin Central Masterplan site and along the route to the outfall sewer. Any leakage would result in local contamination of soil and ground waters in the area.

8.5.1.3.2 Operational Stage

The development of the Dublin Central Masterplan will result in a net reduction in the runoff volume through the introduction of SuDS devices and in a reduction in the runoff rate through the introduction of flow control devices and attenuation storage. However, the Dublin Central Masterplan site currently discharges surface water to the existing combined network, whereas the Dublin Central Masterplan will discharge from Site 5 to the existing separated surface water network. The increase in the runoff to the surface water network could therefore result in downstream flooding.

The runoff from the roads and hardstanding areas will discharge contaminants, including oils and silts, to the surface water system which might result in polluting of the surface water network.

8.5.1.4 Do-Nothing Impact

In the do-nothing scenario, surface water will continue to flow from the site uncontrolled and unrestricted to the existing combined network.

8.5.2 Proposed Development – Site 3, 4 & 5

8.5.2.1 Water Supply

The potential impacts on water supply of the Proposed Development (Sites 3, 4 and 5) are the same as the potential impacts of the Dublin Central Masterplan described in Section 8.5.1.1.

8.5.2.2 Foul Water Drainage

The potential impacts on foul water drainage of the Proposed Development (Sites 3, 4 and 5) are the same as the potential impacts of the Dublin Central Masterplan described in Section 8.5.1.2.

8.5.2.3 Surface Water Drainage

The potential impacts on surface water drainage of the Proposed Development (Sites 3, 4 and 5) are the same as the potential impacts of the Dublin Central Masterplan described in Section 8.5.1.3.

8.5.2.4 Do-Nothing Impact

The do-noting impact of the Proposed Development (Sites 3, 4 and 5) is the same as the do noting impact of the Dublin Central Masterplan described in Section 8.5.1.4.

8.6 MITIGATION MEASURES (AMELIORATIVE, REMEDIAL OR REDUCTIVE MEASURES)

8.6.1 Dublin Central Masterplan

Mitigation measures will be implemented on a site by site basis in line with best practice standards. The relevant mitigation measures for Site 3, 4 & 5 are set out in Section 8.6.2 below. The same standards will be implemented as part of the development of the remaining sites within the Dublin Central Masterplan area.

8.6.2 Proposed Development – Site 3, 4 & 5

8.6.2.1 Water Supply

8.6.2.1.1 Construction Stage

A method statement setting out in detail the procedures to be used when working in the vicinity of existing watermains will be produced by the contractor for any construction works within the vicinity of watermains and for roads or services crossing watermains.

All watermains will be cleaned and tested in accordance with Irish Water guidelines prior to connection to the public watermain.

All connections to the public watermain will be carried out by, or under the supervision of, Irish Water

Potential negative impacts during construction stage will be short term only.

8.6.2.1.2 Operational Stage

Water meters will be installed at connection points, with locations to be agreed and approved by Irish Water, and these meters will be linked to Irish Water's monitoring system by telemetry. These meters will facilitate the early detection of unusual water usage in the network and identify potential leaks in the system.

All plumbing fixtures and fittings and sanitary wear to be installed within the development should be to the current best practice for water consumption to minimise future water usage.

It is not envisaged that any further remedial or reductive measures will be necessary on completion.

8.6.2.2 Foul Water Drainage

8.6.2.2.1 Construction Stage

In order to reduce the risk of defective or leaking foul sewers, the following remedial measures will be implemented: -

- All new foul sewers will be tested by means of an approved air test during the construction stage in accordance with Irish Waters Code of Practice and Standard Details.
- All private drainage will be inspected and signed off by the design Engineer in accordance with the Building Regulations Part H and BCAR requirements.
- Foul sewers will be surveyed by CCTV to identify possible physical defects.
- The connection of the new foul sewers to the public sewer will be carried out under the supervision of Irish Water and will be checked prior to commissioning.
- Prior to commencement of excavations in public areas, all utilities and public services will be identified and checked, to ensure that adequate protection measures are implemented during the construction stage.

8.6.2.2.2 Operational Stage

All foul drains will be tested and surveyed prior to connection to the public sewers to minimise the risk of uncontrolled ground water penetration or leakage of the foul water to ground water on the site.

Otherwise, no remedial or reductive measures are deemed to be necessary after completion of the development of the Dublin Central Masterplan, other than normal maintenance of the foul sewer system.

8.6.2.3 Surface Water Drainage

8.6.2.3.1 Construction Stage

The contractor will prepare and implement a Construction Management Plan which will outline the requirements for the storage and handling of fuel, including the refuelling of vehicles in designated refuelling zones to minimise the risk of spillages, and the impact of spillages should they occur.

The Construction Management Plan will also utilise sedimentation controls, including silt traps, tailings ponds and silt fences during the construction period.

All private drainage will be inspected and signed off by the design Engineer in accordance with the Building Regulations Part H and Building Control (Amendment) Regulations (BCAR) requirements. This will reduce the possibility of any cross connections being constructed.

8.6.2.3.2 Operational Stage

Surface water will be attenuated privately within each site of the Dublin Central Masterplan, and will discharge to the public network at a controlled rate limited to 2l/s from each site.

In addition, the SuDS devices outlined in Section 8.4.1.3 will reduce and slow down the rate of surface water runoff from each site within the Dublin Central Masterplan. This will minimise peak flows in the downstream system during major storm events. Gullies and the flow control devices shall be regularly maintained to avoid blockages.

The SuDS treatment train will also treat the surface water discharging to the public network, removing pollutants form the surface water runoff. Maintenance of these SuDS devices will be required to ensure that they continue to treat the surface water as designed.

8.7 RESIDUAL IMPACT

8.7.1 Dublin Central Masterplan

8.7.1.1 Water Supply

8.7.1.1.1 Construction Stage

Due to the proposed remedial measures outlined above no significant adverse impacts are expected to arise during the construction stage of the implementation of the Dublin Central Masterplan on the water supply network.

8.7.1.1.2 Operational Stage

There will be a water demand for the implementation of the Dublin Central Masterplan of approximately 800m^3 per day. Irish Water will confirm whether the existing network has sufficient capacity, or alternatively will outline any upgrades required to facilitate the development.

8.7.1.2 Foul Water Drainage

8.7.1.2.1 Construction Stage

During the construction stage of implementation of the Dublin Central Masterplan some short term negative impacts as identified above may result. However, if the proposed remedial and reductive measures are implemented, the impact of the implementation of the Dublin Central Masterplan during the construction stage will be minimised and **no significant long term impacts** will result from the construction works.

8.7.1.2.2 Operational Stage

By removing surface water flows from the combined network, the implementation of the Dublin Central Masterplan will result in a net decrease in the wastewater flows discharging to the existing combined drainage system.

8.7.1.3 Surface Water Drainage

8.7.1.3.1 Construction Stage

During the construction stage of implementation of the Dublin Central Masterplan some short term negative impacts as identified above may result. However, if the proposed remedial and reductive measures are implemented, the impact of the implementation of the Dublin Central Masterplan during the construction stage will be minimised and **no significant long term impacts** will result from the construction works.

8.7.1.3.2 Operational Stage

With the implementation of the SuDS treatment train, attenuation and flow control, there will be a net improvement in the quality and a net reduction in the quantity of surface water discharging from the individual site within the Dublin Central Masterplan. The proposal to discharge Site 5 to the existing surface water network, rather than the combined network, will result in a significant decrease in flows to the combined network and a net increase in flows to the surface water network.

No significant adverse impacts are envisaged.

8.7.1.4 Worst Case Impact

In the worst case scenario, there could be some surface water ingress into the foul water drainage system due to poor workmanship. Leakage from sewers and drains could result in local contamination of soil and ground waters in the area. The runoff from the roads and hardstanding areas will discharge contaminants, including oils and silts, to the surface water system which might result in polluting of the surface water network. However, with the mitigation measures set out above, the likelihood of these impacts will be minimised, and **no significant long term impacts** will result from the development.

8.7.2 Proposed Development – Site 3, 4 & 5

8.7.2.1 Water Supply

The potential impacts on water supply of the Proposed Development (Sites 3, 4 and 5) are the same as the potential impacts of the Dublin Central Masterplan described in Section 8.7.1.1.

8.7.2.2 Foul Water Drainage

The potential impacts on foul water drainage of the Proposed Development (Sites 3, 4 and 5) are the same as the potential impacts of the Dublin Central Masterplan described in Section 8.7.1.2.

8.7.2.3 Surface Water Drainage

The potential impacts on surface water drainage of the Proposed Development (Sites 3, 4 and 5) are the same as the potential impacts of the Dublin Central Masterplan described in Section 8.7.1.3.

8.7.2.4 Worst Case Impact

The worst case impact of the Proposed Development (Sites 3, 4 and 5) is the same as the do noting impact of the Dublin Central Masterplan described in Section 8.5.1.4.

8.8 MONITORING

8.8.1 Dublin Central Masterplan

Monitoring will be implemented on a site by site basis in line with best practice standards. The relevant mitigation measures for Site 3, 4 & 5 are set out in Section 8.8.2 below. The same standards will be implemented as part of the development of the remaining sites within the Dublin Central Masterplan area.

8.8.2 Proposed Development – Site 3, 4 & 5

8.8.2.1 Water Supply

Water usage and potential leakage will be monitored by Irish Water using the water meters which will be installed on the supply pipes so that the development can be monitored in sections. The location of these meters will be agreed with Irish Water and the meters will be linked to Irish Water's monitoring system via telemetry.

8.8.2.2 Foul Water Drainage

Following completion of construction of the Dublin Central Masterplan there are no monitoring requirements envisaged other than normal monitoring and maintenance of the wastewater system by Irish Water.

8.8.2.3 Surface Water Drainage

The surface water network (drains, gullies, manholes, AJs, SuDS devices, attenuation systems) will need to be regularly maintained and where required cleaned out. A suitable maintenance regime of inspecting and cleaning shall be incorporated into the safety file/maintenance manual for the Dublin Central Masterplan.

8.9 REINSTATEMENT

8.9.1 Dublin Central Masterplan

Any existing roads and footpaths that are opened to facilitate water supply, foul water drainage and surface water drainage connections will be reinstated.

8.9.2 Proposed Development – Site 3, 4 & 5

The reinstatement for the Proposed Development (Sites 3, 4 and 5) is the same as the reinstatement for the Dublin Central Masterplan described in Section 7.9.1.

8.10 DIFFICULTIES ENCOUNTERED

There were no difficulties encountered when undertaking this assessment.

9 CLIMATE (AIR QUALITY & CLIMATE CHANGE)

9.1 INTRODUCTION

This chapter assesses the likely air quality and climate impacts associated with the Proposed Development at O'Connell Street, Dublin 1. The Proposed Development which is the subject of these 3no. concurrent planning applications consists of Site 3, Site 4 and Site 5. Dublin Central is underpinned by a Masterplan which will be assessed also. A full description of the development is available in Chapter 3: Description of Proposed Development.

This chapter was completed by Ciara Nolan, an environmental consultant in the air quality section of AWN Consulting Ltd. She holds an MSc. (First Class) in Environmental Science from University College Dublin and has also completed a BSc. in Energy Systems Engineering. She is an Associate Member of both the Institute of Air Quality Management (AMIAQM) and the Institution of Environmental Science (AMIEnvSc). She has been active in the field of air quality for 4 years, with a primary focus on consultancy.

9.2 ASSESSMENT METHODOLOGY

9.2.1 Criteria for Rating of Impacts

9.2.1.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 9.1 and Appendix 9.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011 (S.I. no. 180 of 2011), which incorporate EU Directive 2008/50/EC, which has set limit values for a number of pollutants. The limit values for NO_2, PM_{10} and $PM_{2.5}$ are relevant to this assessment (see Table 9.1). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Appendix 9.1).

Pollutant	Regulation Note 1	Limit Type	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health – not to be exceeded more than 18 times / year.	200 µg/m³
		Annual limit for protection of human health.	40 µg/m³
		Critical level for protection of vegetation.	30 µg/m³ $NO + NO_2$
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health – not to be exceeded more than 35 times / year.	50 µg/m³
		Annual limit for protection of human health.	40 µg/m³
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health.	25 µg/m³

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC.

Table 9.1: Air Quality Standards Regulations.

9.2.1.2 Dust Deposition Guidelines

The concern from a health perspective is focussed on particles of dust which are less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) and the EU ambient air quality standards outlined in Table 9.1 have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regards to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been stipulated for nuisance dust in respect of this development.

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/(m^2*day) averaged over a one year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Heritage & Local Government (DEHLG, 2004) apply the Bergerhoff limit of 350 mg/(m^2*day) to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction of the Proposed Development.

9.2.1.3 Climate Agreements

Ireland is party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The Paris Agreement, which entered into force in 2016, is an important milestone in terms of international climate change agreements and includes an aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made in the Paris Agreement on elevating adaption onto the same level as action to cut and curb emissions.

In order to meet the commitments under the Paris Agreement, the EU enacted *Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013* (the Regulation). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030 compared to 2005. Ireland's obligation under the Regulation is a 30% reduction in non-ETS greenhouse gas emissions by 2030 relative to its 2005 levels.

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the Act). The purpose of the Act was to enable Ireland '*to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050*' (3.(1) of No. 46 of 2015). This is referred to in the Act as the '*national transition objective*'. The Act made provision for a national mitigation plan, and a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The *Climate Action Plan* (CAP) (Government of Ireland, 2019), published in June 2019, outlines the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlines the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The CAP also details the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The CAP has set a built environment sector reduction target of 40 – 45% relative to 2030 pre-NDP (National Development Plan) projections.

Following on from Ireland declaring a climate and biodiversity emergency in May 2019 and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme for the Climate Action (Amendment) Bill 2019 in December 2019 (Government of Ireland, 2019) followed by the publication of the Climate Action and Low Carbon Development (Amendment) Bill 2021 (hereafter referred to as the 2021 Climate Bill) in March 2021 (Government of Ireland, 2021). The 2021 Climate Bill was prepared for the purposes of giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Bill is to provide for the approval of plans *'for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050'*. The 2021 Climate Bill will also *'provide for carbon budgets and a decarbonisation target range for certain sectors of the economy'*. The 2021 Climate Bill defines the carbon budget as *'the total amount of greenhouse gas emissions that are permitted during the budget period'*.

The 2021 Climate Bill removes any reference to a national mitigation plan and instead refers to both the Climate Action Plan, as published in 2019, and a series of National Long Term Climate Action Strategies. In addition, the Environment Minister shall request each local authority to make a 'local authority climate action plan' lasting five years and to specify the mitigation measures and the adaptation measures to be adopted by the local authority.

The Dublin City Council Climate Change Action Plan published in 2019 (Dublin City Council and Codema, 2019) outlines a number of goals and plans to prepare for and adapt to climate change. There are five key action areas within the plan: energy and buildings, transport, flood resilience, nature-based solutions and resource management. Some of the measures promoted within the Action Plan under the 5 key areas involve building retrofits, energy master-planning, development of segregated cycle routes, the promotion of bike share schemes, development of flood resilient designs, promotion of the use of green infrastructure and water conservation initiatives. The implementation of these measures will enable the Dublin City Council area to adapt to climate change and will assist in bringing Ireland closer to achieving its climate related targets in future years. New developments need to be cognisant of the Action Plan and incorporate climate friendly designs and measures where possible.

9.2.2 Construction Phase

9.2.2.1 Air Quality

The Institute of Air Quality Management in the UK (IAQM) guidance document *'Guidance on the Assessment of Dust from Demolition and Construction'* (2014) outlines an assessment method for predicting the impact of dust emissions from demolition, earthworks, construction and haulage activities based on the scale and nature of the works and the sensitivity of the area to dust impacts. The IAQM methodology has been applied to the construction phase of this development in order to predict the likely risk of dust impacts in the absence of mitigation measures and to determine the level of site specific mitigation required. The use of UK guidance is considered best practice in the absence of applicable Irish guidance.

The major dust generating activities are divided into four types within the IAQM guidance (2014) to reflect their different potential impacts. These are: -

- Demolition.
- Earthworks.
- Construction.
- Trackout (movement of heavy vehicles).

The magnitude of each of the four categories is divided into Large, Medium or Small scale depending on the nature of the activities involved. These are described below for each category as per the IAQM guidance (2014).

Demolition

Demolition will primarily involve the removal of buildings or structures currently on the site in a potentially dusty manner. This may also involve dust generation at heights. Dust emission magnitude from demolition can be classified as small, medium and large and are described below: -

- **Large**: Total building volume >50,000m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20m above ground level.
- **Medium**: Total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10 – 20m above ground level.
- **Small**: Total building volume less than 20,000m^3.

Earthworks

Earthworks typically involve excavating material, loading and unloading of materials, tipping and stockpiling activities. Activities such as levelling the site and landscaping works are also considered under this category. Dust emission magnitude from earthworks can be classified as small, medium and large and are described below: -

- **Large:** Total site area > 10,000m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000 tonnes.
- **Medium:** Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (e.g. silt), 5 – 10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8 m in height, total material moved 20,000 – 100,000 tonnes.
- **Small:** Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds < 4m in height, total material moved <20,000 tonnes, earthworks during wetter months.

Construction

Dust emission magnitude from construction can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below: -

- **Large:** Total building volume >100,000 m^3, on-site concrete batching, sandblasting.
- **Medium:** Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching.
- **Small:** Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout

Factors which determine the dust emission magnitude associated with trackout are vehicle size, vehicle speed, number of vehicles, road surface material and duration of movement. Dust emission magnitude from trackout can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below: -

- **Large:** >50 HGV (>3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m.
- **Medium:** 10 – 50 HGV (>3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 – 100 m.
- **Small:** <10 HGV (>3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

The magnitude of each activity is combined with the overall sensitivity of the area to determine the risk of dust impacts from site activities. This allows the level of site specific mitigation to be determined.

Construction phase traffic also has the potential to impact air quality and climate. The UK Highways Agency Design Manual for Roads and Bridges (DMRB) guidance (UK Highways Agency, 2019a), states that road links meeting one or more of the following criteria can be defined as being 'affected' by a Proposed Development and should be included in the local air quality assessment. The use of the UK guidance is recommended by the TII (2011) in the absence of specific Irish guidance, this approach is considered best practice and can be applied to any development that causes a change in traffic.

- Annual average daily traffic (AADT) changes by 1,000 or more.
- Heavy duty vehicle (HDV) AADT changes by 200 or more.
- A change in speed band.
- A change in carriageway alignment by 5m or greater.

In addition, the impact of construction activities on vehicle movements shall be assessed where construction activities are programmed to last for more than 2 years (UK Highways Agency, 2019a). The construction phase of the Proposed Development will last for over 2 years, in addition, the traffic associated with the overall Dublin Central Masterplan will increase the construction phase HDV AADT by over 200 on certain roads.

As a result, the impact of construction phase traffic emissions on local air quality was investigated using the UK Highways Agency DMRB screening model (2007). Air dispersion modelling of NO_2 emissions was undertaken for the worst case construction year of 2025. Only modelling of NO_2 was undertaken in detail as per the UK Highways Agency guidance (2019a). The traffic data used in the modelling assessment was obtained from Waterman Moylan, the consulting engineers on this project and is detailed in Table 9.2 below. Modelling was undertaken at 2 worst-case sensitive receptors within 200m of the impacted road links as per the DMRB guidance (UK Highways Agency, 2019a). These receptors are the Rotunda Hospital (R1) and an apartment building on the corner of Moore Street and Parnell Street (R2).

Road Name	Speed (kph)	% HGV	Do Nothing AADT	Do Something AADT
			Construction Year 2025	
Link 7 (Parnell St, east of Moore St)	30	2%	13,309	13,552
Link 9 (Parnell St, west of Moore St)	30	2%	13,309	13,552

Table 9.2: Construction Phase Traffic Data used in Air Quality Assessment

9.2.2.2 Climate

The impact of the construction phase of the development on climate was determined by a qualitative assessment of the nature and scale of greenhouse gas generating construction activities associated with the Proposed Development.

9.2.3 Operational Phase

9.2.3.1 Air Quality

Operational phase traffic has the potential to impact local air quality as a result of increased vehicle movements associated with the Proposed Development. The UK Highways Agency DMRB scoping criteria detailed in Section 9.2.2.1 was used to determine if any road links are affected by the Proposed Development and require inclusion in a detailed air dispersion modelling assessment. As there is minimal car parking associated with the Proposed Development it is not predicted to significantly change the existing traffic on the nearby road links. Therefore, according to the DMRB scoping criteria in section 9.2.2.1 none of the local road links can be classed as 'affected' and detailed air dispersion modelling of operational phase traffic emissions is not required as there is no potential for significant impacts to air quality.

9.2.3.2 Climate

Ireland has annual GHG targets which are set at an EU level and need to be complied with in order to reduce the impact of climate change. Impacts to climate as a result of GHG emissions are assessed against the targets set out by the EU under *Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013*. Which has set a target of a 30% reduction in non-ETS sector emissions by 2030 relative to 2005 levels.

As per the EU guidance document *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Commission, 2013) the climate baseline is first established by reference to EPA data on annual GHG emissions (see Section 9.3.3). Thereafter the impact of the Proposed Development on climate is determined. Emissions from road traffic associated with the Proposed Development have the potential to emit carbon dioxide (CO_2) which will impact climate.

The UK Highways Agency has published an updated DMRB guidance document in relation to climate impact assessments *LA 114 Climate*. The following scoping criteria are used to determine whether a detailed climate assessment is required for a proposed project during the operational stage. During the operational phase, if any of the road links impacted by the Proposed Development meet the below criteria then further assessment is required.

- A change of more than 10% in AADT.
- A change of more than 10% to the number of heavy duty vehicles.
- A change in daily average speed of more than 20 km/hr.

The Proposed Development will not increase traffic by more than 10% AADT on any nearby road links, therefore, none of the above scoping criteria are met and a detailed climate assessment is not required as there is no potential for significant impacts to climate as a result of traffic emissions.

The EU guidance (2013) also states indirect GHG emissions as a result of a development must be considered, this includes emissions associated with energy usage. The Energy & Sustainability Statement, prepared by BDP in relation to the Proposed Development has been reviewed and used to inform the operational phase climate assessment. This report outlines a number of measures in relation to energy usage from the Proposed Development primarily in relation to heat and electricity. A number of measures have been incorporated into the overall design of the development to reduce the impact to climate where possible.

9.3 RECEIVING ENVIRONMENT

The receiving environment in terms of air quality and climate is the same for the Dublin Central Masterplan and each individual site of the development. Therefore, the following sections detail the existing air quality and climate environment and do not differentiate between the Dublin Central Masterplan or the individual sites of the Proposed Development being assessed within this EIAR chapter.

9.3.1 Meteorological Conditions

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (World Health Organisation, 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds.

However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Dublin Airport, which is located approximately 8 km north of the site. Dublin Airport met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 9.1). For data collated during five representative years (2016 – 2020), the predominant wind direction is westerly to south-westerly with a mean wind speed of 5.5 m/s over the period 1981 - 2010 (Met Eireann, 2021).

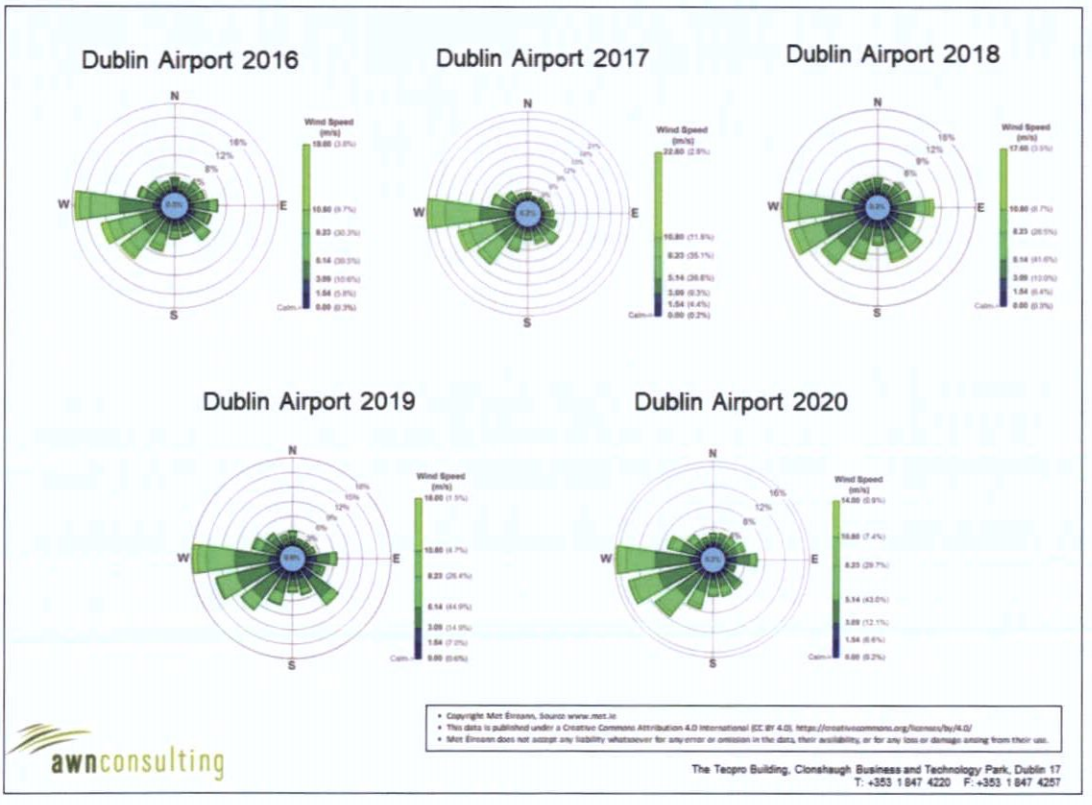

Figure 9.1: Dublin Airport Windrose 2016 – 2020.

9.3.2 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2019*" (EPA, 2020a). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments (EPA, 2021).

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2020a). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, the Proposed Development site is within Zone A (EPA, 2020a). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the Proposed Development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

Long-term NO_2 monitoring was carried out at the Zone A suburban locations of Rathmines, Ballyfermot, Dun Laoghaire and Swords and the urban location of Winetavern Street for the period 2015 - 2019 (EPA, 2020a). Long term average concentrations are significantly below the annual average limit of 40 $\mu g/m^3$ for both the urban and suburban locations. Average results range from 13 – 22 $\mu g/m^3$ for the suburban background locations and from 27 – 37 $\mu g/m^3$ for the urban location of Winetavern Street. The NO_2 annual average for this five year period suggests an upper average limit of no more than 22 $\mu g/m^3$ (Table 9.3) as a background concentration for the suburban locations. Based on the above information and having regard to the Proposed Developments location within Dublin City Centre, a conservative estimate of the current background NO_2 concentration for the region of the Proposed Development is 25 $\mu g/m^3$.

Station	Station Classification	Averaging Period Note 1	Year				
			2015	2016	2017	2018	2019
Rathmines	Suburban Background	Annual Mean NO_2 ($\mu g/m^3$)	18	20	17	20	22
		99.8th%ile 1-hr NO_2 ($\mu g/m^3$)	105	88	86	87	102
Ballyfermot	Suburban Background	Annual Mean NO_2 ($\mu g/m^3$)	16	17	17	17	20
		99.8th%ile 1-hr NO_2 ($\mu g/m^3$)	127	90	112	101	101
Dun Laoghaire	Suburban Background	Annual Mean NO_2 ($\mu g/m^3$)	16	19	17	19	15
		99.8th%ile 1-hr NO_2 ($\mu g/m^3$)	91	105	101	91	91
Swords	Suburban Background	Annual Mean NO_2 ($\mu g/m^3$)	13	16	14	16	15
		99.8th%ile 1-hr NO_2 ($\mu g/m^3$)	93	96	79	85	80
Winetavern Street	Urban Traffic	Annual Mean NO_2 ($\mu g/m^3$)	31	37	27	29	28
		99.8th%ile 1-hr NO_2 ($\mu g/m^3$)	128	120	110	115	115

Note 1 Annual average limit value of 40 $\mu g/m^3$ and hourly limit value of 200 $\mu g/m^3$ (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Table 9.3: Trends in Zone A Air Quality – NO_2

Continuous PM_{10} monitoring was carried out at the Zone A locations of Winetavern Street, Rathmines, Dun Laoghaire, Ballyfermot and Phoenix Park from 2015 – 2019. These showed an upper average limit of no more than 15 $\mu g/m^3$ (Table 9.4). Levels range from 9 – 16 $\mu g/m^3$ over the five year period with at most 9 exceedances of the 24-hour limit value of 50 $\mu g/m^3$ in Rathmines and Winetavern Street in 2019 (35 exceedances are permitted per year) (EPA, 2020a). Sufficient data is available for the urban background location in the Phoenix Park to observe long-term trends in the data. Data from 2015 – 2019 suggests an upper average annual mean value of at most 12 $\mu g/m^3$ as a background concentration at the Phoenix Park location. Based on the EPA data, a conservative estimate of the current background PM_{10} concentration in the region of the Proposed Development is 15 $\mu g/m^3$.

Station	Station Classification	Averaging Period	Year				
			2015	2016	2017	2018	2019
Ballyfermot	Suburban Background	Annual Mean PM_{10} ($\mu g/m^3$)	12	11	12	16	14
		24-hr Mean > 50 $\mu g/m^3$ (days)	3	0	1	0	7
Dún Laoghaire	Suburban Background	Annual Mean PM_{10} ($\mu g/m^3$)	13	13	12	13	12
		24-hr Mean > 50 $\mu g/m^3$ (days)	3	0	2	0	2
Winetavern Street	Urban Traffic	Annual Mean PM_{10} ($\mu g/m^3$)	14	14	13	14	15
		24-hr Mean > 50 $\mu g/m^3$ (days)	4	2	3	1	9
Rathmines	Suburban Background	Annual Mean PM_{10} ($\mu g/m^3$)	15	15	13	15	15
		24-hr Mean > 50 $\mu g/m^3$ (days)	5	3	5	2	9
Phoenix Park	Urban Background	Annual Mean PM_{10} ($\mu g/m^3$)	12	11	9	11	11
		24-hr Mean > 50 $\mu g/m^3$ (days)	2	0	1	0	2

Note 1 Annual average limit value of 40 $\mu g/m^3$ and 24-hour limit value of 50 $\mu g/m^3$ (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Table 9.4: Trends in Zone A Air Quality – PM_{10}

Monitoring of both PM_{10} and $PM_{2.5}$ takes place at the station in Rathmines which allows for the $PM_{2.5}/PM_{10}$ ratio to be calculated. Average $PM_{2.5}$ levels in Rathmines over the period 2015 – 2019 ranged from 9 – 10 $\mu g/m^3$, with a $PM_{2.5}/PM_{10}$ ratio ranging from 0.60 – 0.68 (EPA, 2020a). Based on this information, a conservative ratio of 0.7 was used to generate an existing $PM_{2.5}$ concentration in the region of the development of 10.5 $\mu g/m^3$.

9.3.3 Climate Baseline

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details provisional emissions up to 2019 (EPA, 2020b). The data published in 2020 states that Ireland will exceed its 2019 annual limit set under the EU's Effort Sharing Decision (ESD), 406/2009/EC1 by an estimated 6.98 Mt. For 2019, total national greenhouse gas emissions are estimated to be 59.90 million tonnes carbon dioxide equivalent (Mt CO_2eq) with 45.71 $MtCO_2eq$ of emissions associated with the ESD sectors for which compliance with the EU targets must be met. Agriculture is the largest contributor in 2019 at 35.3% of the total, with the transport sector accounting for 20.3% of emissions of CO_2.

GHG emissions for 2019 are estimated to be 4.5% lower than those recorded in 2018. Emission reductions have been recorded in 6 of the last 10 years. However, compliance with the annual EU targets has not been met for four years in a row. Emissions from 2016 – 2019 exceeded the annual EU targets by 0.29 $MtCO_2eq$, 2.94 $MtCO_2eq$, 5.57 $MtCO_2eq$ and 6.98 $MtCO_2eq$ respectively. Agriculture is consistently the largest contributor to emissions with emissions from the transport and energy sectors being the second and third largest contributors respectively in recent years.

The EPA 2020 GHG Emissions Projections Report for 2019 – 2040 (EPA 2020c) notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018 and the Climate Action Plan (CAP) published in 2019. Implementation of these are classed as a *"With Additional Measures scenario"* for future scenarios. A change from generating electricity using coal and peat to wind power and diesel vehicle engines to electric vehicle engines are envisaged under this scenario. While emissions are projected to decrease in these areas, emissions from agriculture are projected to grow steadily due to an increase in animal numbers. However, over the period 2013 – 2020 Ireland is projected to cumulatively exceed its compliance obligations with the EU's Effort Sharing Decision (Decision No. 406/2009/EC) 2020 targets by approximately 13.4 Mt CO_2eq under the *"With Existing Measures"* scenario and 12.6 Mt CO_2eq under the "With Additional Measures" scenario (EPA, 2020c).

9.3.4 Sensitivity of the Receiving Environment

In line with the UK Institute of Air Quality Management (IAQM) guidance document *'Guidance on the Assessment of Dust from Demolition and Construction'* (2014) prior to assessing the impact of dust from a Proposed Development, the sensitivity of the area must first be assessed as outlined below. Both receptor sensitivity and proximity to proposed works areas are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time or areas where users would expect a high level of amenity. Commercial properties, parks and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity. Figure 9.2 shows the sensitive receptors within 50m of the Dublin Central Masterplan area.

The surrounding land use in the vicinity of the Proposed Development site is predominantly commercial in nature which would typically be considered of medium sensitivity in terms of dust emissions. However, due to the location of the Proposed Development in the O'Connell Street area and the high level of tourism in the area, users would typically expect a high level of amenity. Therefore, the surrounding area would be considered high sensitivity in terms of dust soiling. It is estimated that there are over 100 receptors within 50m of the site due to the presence of a number of hotels, an apartment block, the Rotunda Hospital, and numerous commercial premises. Based on the IAQM criteria outlined in Table 9.5, the worst case sensitivity of the area to dust soiling is considered to be high.

Receptor Sensitivity	Number Of Receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	**High**	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 9.5: Sensitivity of the Area to Dust Soiling Effects on People and Property

In addition to sensitivity to dust soiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts. The criteria take into consideration the current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors affected within various distance bands from the construction works.

In terms of receptor sensitivity to human health impacts, the IAQM guidance defines high sensitivity receptors as *"locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day)"* (IAQM, 2014). Examples include residential properties, schools and hospitals. Office and shop workers are considered of medium sensitivity. Low sensitivity receptors are areas where exposure is transient such as public footpaths and shopping streets.

There are high, medium and low sensitivity receptors within close proximity to the Proposed Development site. However, for the purposes of this assessment the worst-case sensitivity has been used. It is estimated that there are between 10-100 high sensitivity receptors within 50m of the Proposed Development site, this includes the Rotunda Hospital and an apartment building on Moore Street. A conservative estimate of the current annual mean PM_{10} concentration in the vicinity of the Proposed Development is 15 $\mu g/m^3$ (see Section 9.3.2). Based on the IAQM criteria outlined in Table 9.6, the worst case sensitivity of the area to human health is considered to be low.

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number Of Receptors	Distance from source (m)				
			<20	<50	<100	<200	<350
High	< 24 $\mu g/m^3$	>100	Medium	Low	Low	Low	Low
		10-100	Low	**Low**	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	< 24 $\mu g/m^3$	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	< 24 $\mu g/m^3$	>1	Low	Low	Low	Low	Low

Table 9.6: Sensitivity of the Area to Human Health Impacts.

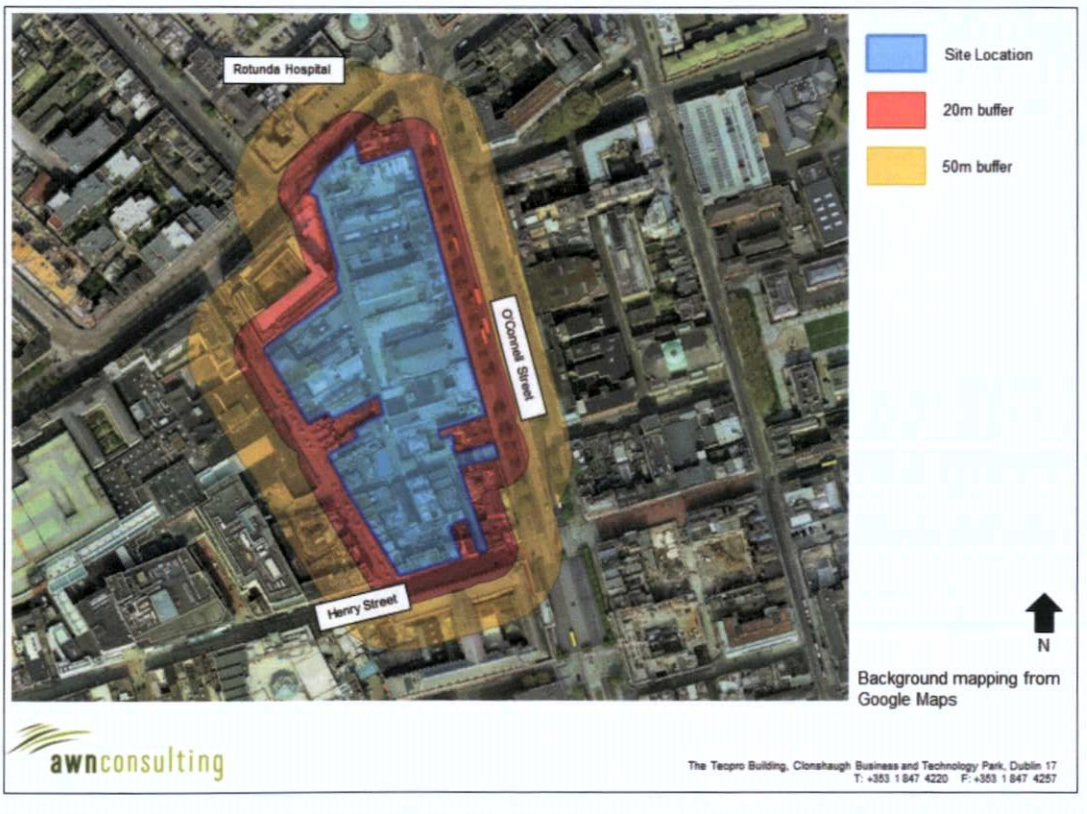

Figure 9.2: Sensitive Receptors within 50m of Dublin Central Masterplan area.