Apartment Development at Prussia Street

Basement Impact Assessment (BIA)

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Contents

1 Introduction

1.1 Scope of the Report

Ayesa has been requested by Randalswood Construction LTD. to complete a Basement Impact Assessment (BIA) for the proposed residential apartment development at No. 23-28 Prussia Street in Dublin City.

In accordance with Dublin City Council's (DCC) Dublin City Development Plan 2022-2028, a BIA must accompany all planning applications, where the proposed development involves the construction of any form of basement or substructure. This report complies with the basement impact requirements of DCC. It provides information on the ground and groundwater conditions at the site to assess the impact of the proposed basement / substructure on the groundwater regime and neighbouring structures.

The purpose of this BIA is to identify potential damage to adjacent buildings arising from the development works, inform as to whether the proposed basement / substructure is acceptable and identify appropriate mitigating measures that can be integrated into the development.

1.2 Site Location and Description

The development site is located near the intersection of Prussia Street and St. Joseph's Road in the suburb of Stoneybatter near Dublin City Centre. The eastern boundary of the site adjoins the Grangegorman Campus of the Technological University Dublin and St. Brendan's GAA Club of Grangegorman playing fields. Several rows of domestic back gardens border the site to the south. A detached 3no. storey house, which has been converted into apartments is located at the northwest corner of the site facing onto Prussia Street. The remaining area directly north of the site is used as a vehicle recovery and breakdown services commercial premises.

The present-day development site occupies an area of 3,822m^2 (0.4 hectares) and primarily consists of a car repair and maintenance depot. A small roadside parking area and derelict building directly face onto Prussia Street. The site also contains several prefabricated modular units and storage containers. The remaining area is paved with tarmacadam and concrete and dotted with patches of wild vegetation overgrowth and detritus.

The undulating topography of the site varies from +23.7 / +23.0m OD.

The site location maps, existing topographical survey and aerial view are detailed in Figures 1.1-1.4 on the following pages.

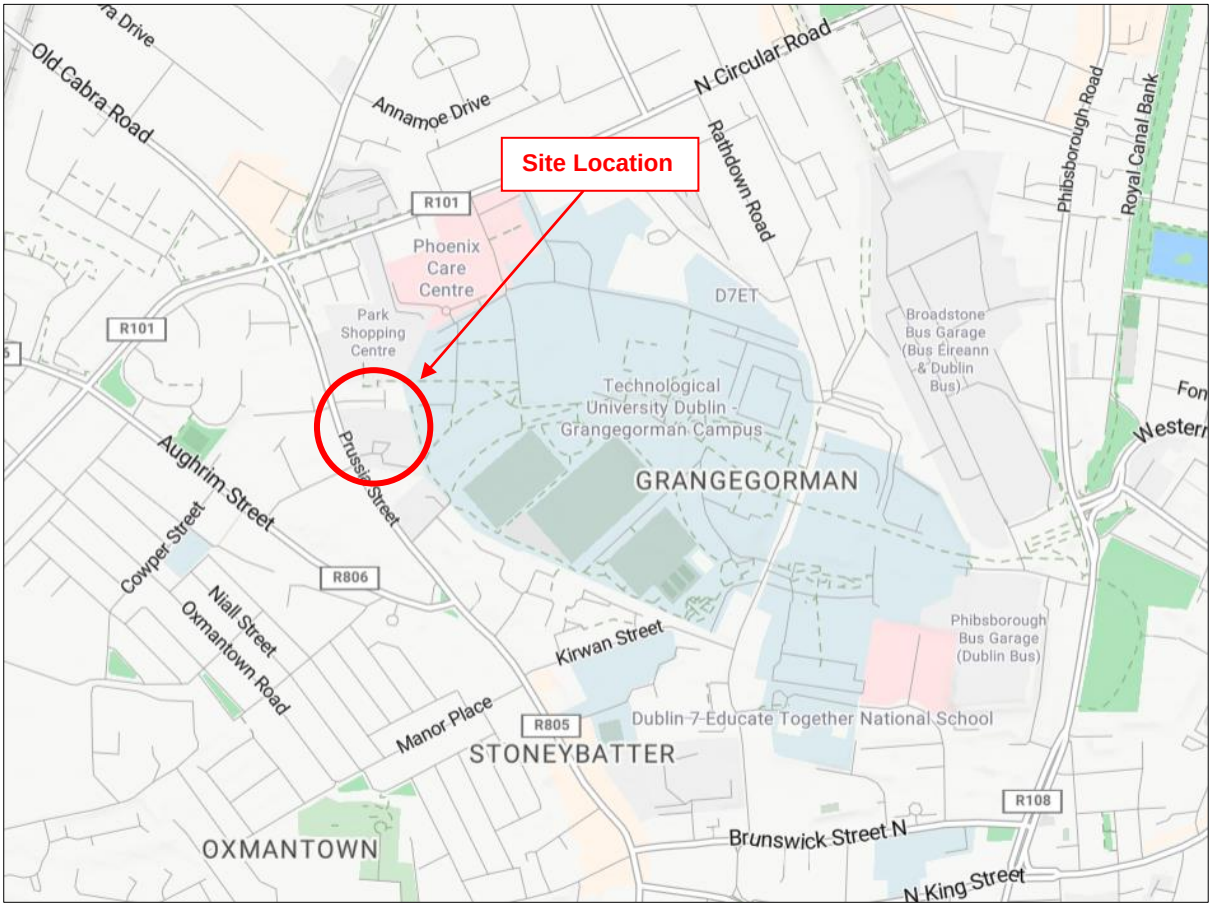

Figure 1.1: Site Location (ref. Bing Maps)

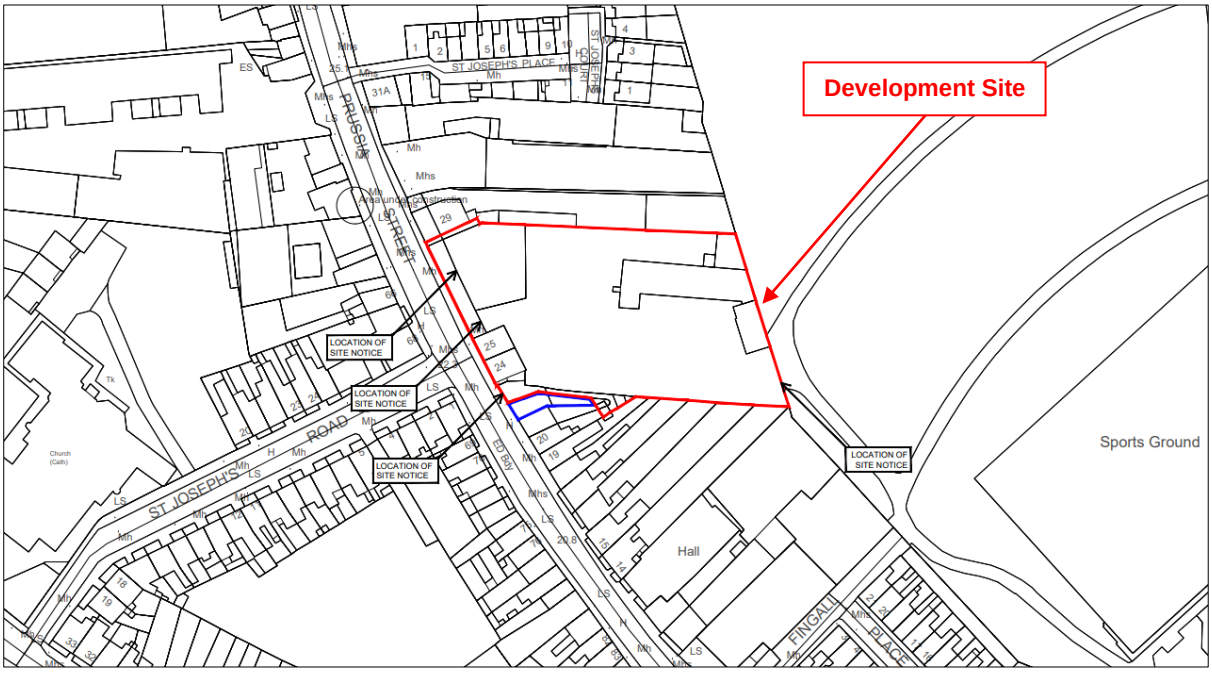

Figure 1.2: Ordnance Survey Site Location Map (ref. Downey - Drawing No. PL-001)

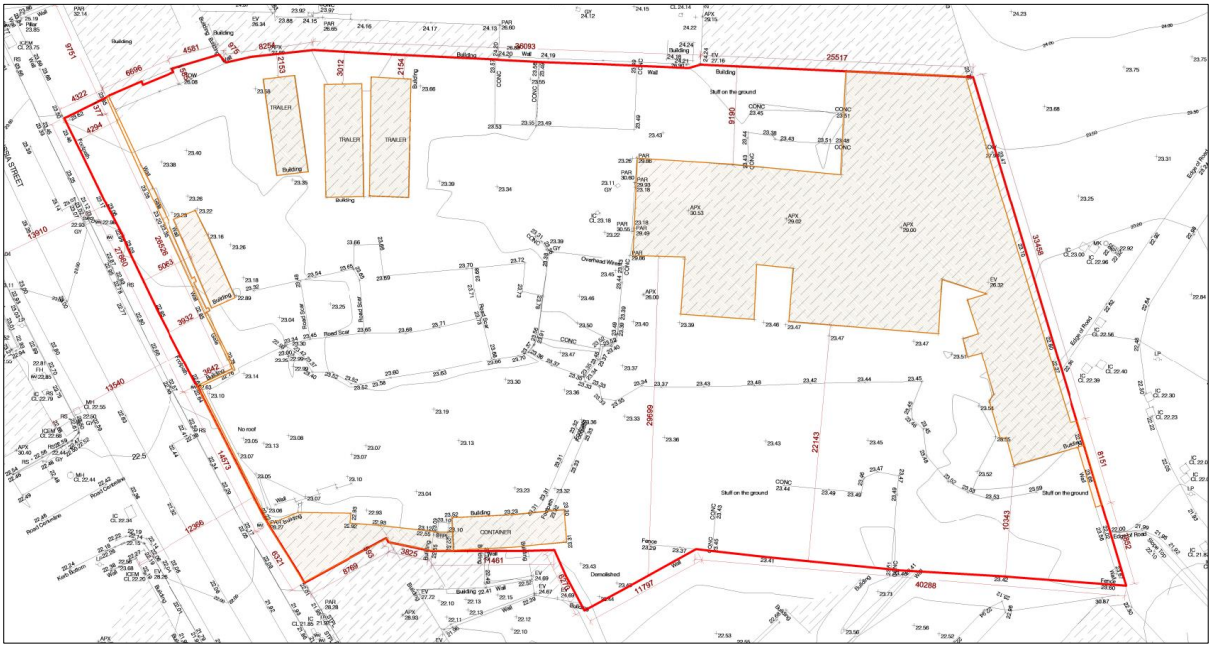

Figure 1.3: Existing Topographical Survey (ref. Downey - Drawing No. PL-002)

Figure 1.4: Aerial Photograph (ref. Google Maps)

1.3 Proposed Development

The proposed development will consist of 3no. apartment blocks and associated works. This will incorporate a total of 102no. apartment units, café / retail area (98.6m^2), communal open space (803m^2), ESB substation, 2no undercroft bike storage areas, bike racks, bin store and a pedestrian / cycle route, which forms part of the public realm / Grangegorman campus gateway (778m^2). Apartment Block B will have a small basement area, which will contain a stair well, utility room, lift shaft and water tanks room. The basement is located in the centre of the site and away from the site boundary.

1.4 Basement Area Excavation

The proposed finished floor levels of the apartment blocks and ground levels in the communal open space areas vary from +23.0 / +22.5m OD. Block B basement finished floor level is +19.7m OD.

It is envisaged that this basement area will be formed by battered excavation on the basis of its size relative to the apartment building footprint. Therefore, a larger secant piled wall installation will not be required.

The layout plan of the Block B basement area relative to the proposed building envelope is detailed in Figures 1.5 and 1.6 below.

Figure 1.5: Block B Basement Location & Building Envelopes

(ref. Downey - Drawing No. 243-046-PL-100)

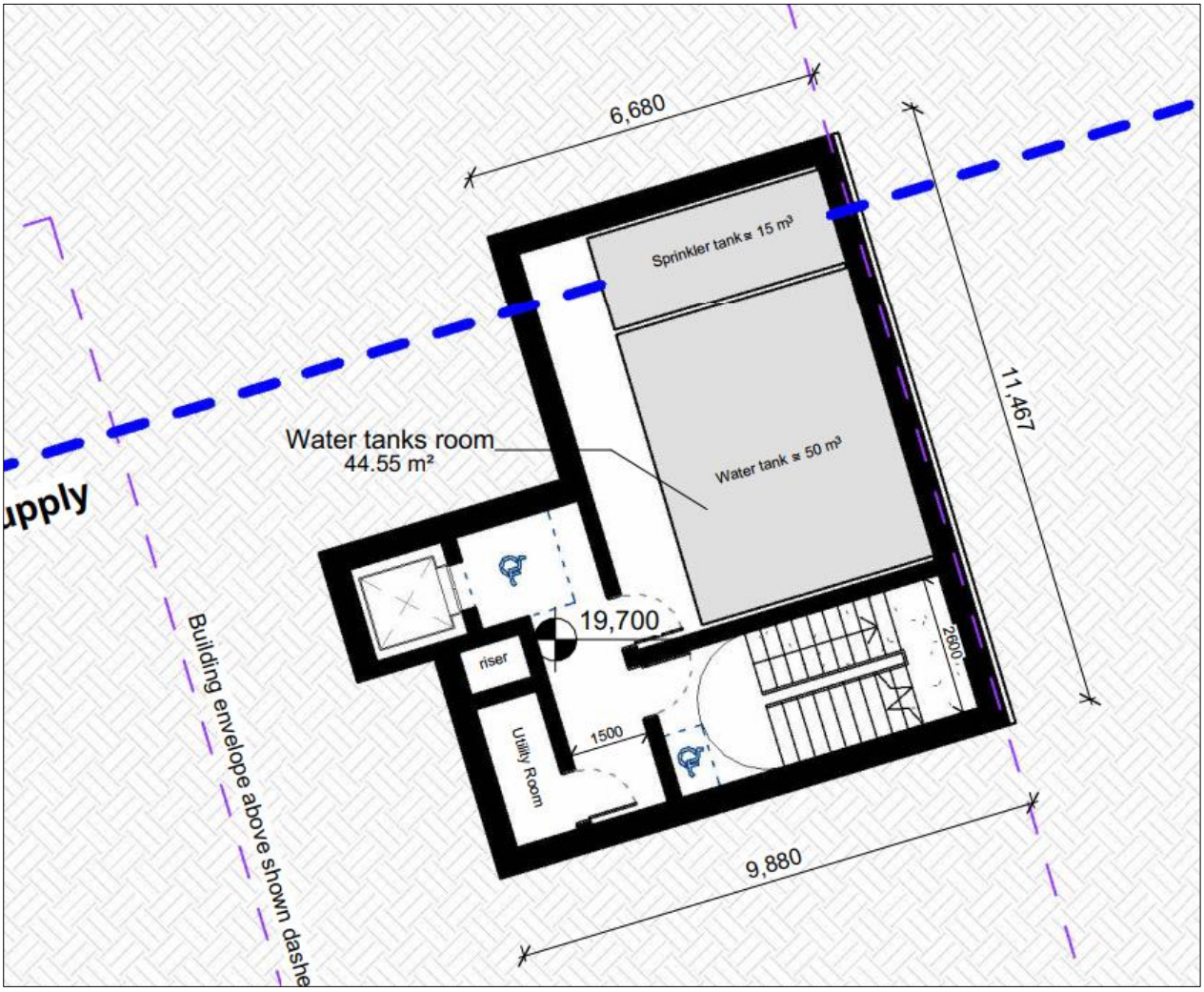

Figure 1.6: Apartment Block B Basement Floor Plan

(ref. Downey - Drawing No. 243-046-PL-100)

1.5 Report Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the ground investigations and surveys completed to date. The results of this work should be viewed in the context of the determinate range of data sources consulted. No liability can be accepted for information relating to other data sources or conditions not revealed during the course of the study.

The ground movement assessment and hydrogeological findings presented in this report are considered predictions. They should be verified and confirmed at detailed design stage following the final selection of construction methodologies and details.

No site-specific ground investigation was completed as part of the project works. A previous BIA was completed by AGL Consulting Geotechnical Engineers. However, this pertained to a different development proposal for the site. The details are as follows:

- Document Title: Development at 23-28 Prussia Street

  Document Number & Revision: 20-129-R01 Rev.1

  Issue Date: 24/07/2020

The investigative scope of this report similarly provides information on the historical land use and functions of the site, geotechnical profile and attributes, groundwater conditions and an assessment of the proposed basement on the local groundwater regime and adjacent structures. Furthermore, the findings of this report are derived from a comprehensive desk study and earlier site investigations completed in the locality.

2 Desktop Survey

2.1 Desktop Survey

Ayesa has consulted a comprehensive range of online information resources to complete the desk study of the development site. Among these include the Geological Survey Ireland (GSI) spatial resources, Ordnance Survey Ireland (OSI), National Monuments Service and National Planning Application Database.

2.1.1 Bedrock Geology

The bedrock geology of site is that of the Lucan Formation (LU), which is described as dark grey argillaceous and cherty limestone and shale. This formation is comprised of dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones, sometimes graded, and interbedded dark grey calcar. The beds are predominantly fine-grained distal turbidites in the north Dublin Basin. This formation is intermittently exposed on the coast between Rush and Drumanagh Head. It ranges from 300-800m in thickness.

The bedrock geology relative to the development site is detailed in Figure 2.1 below.

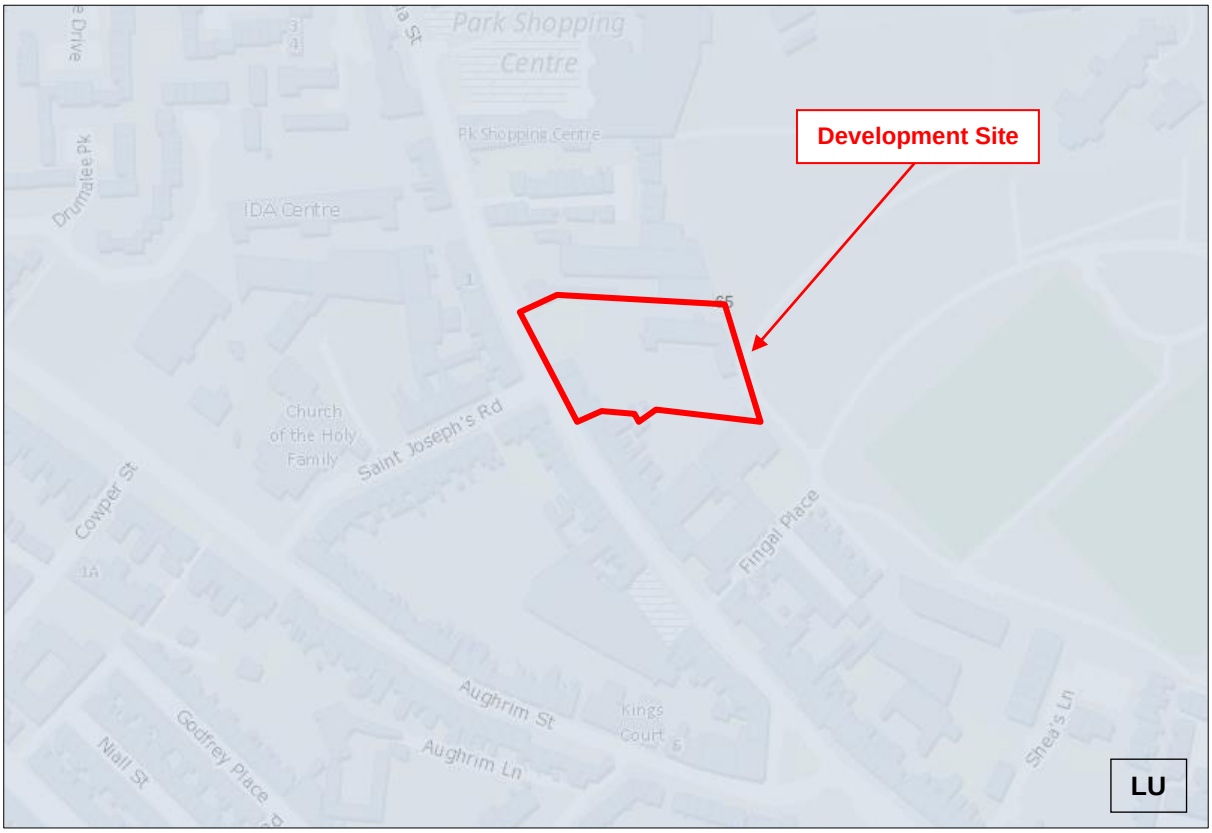

Figure 2.1: Bedrock Geology (ref. GSI)

2.1.2 Quaternary Sediments

The lithological description of the quaternary sediments is that of Till derived from limestones (TLs).

The quaternary sediments relative to the development site is detailed in Figure 2.2 below.

Figure 2.2: Quaternary Sediments (ref. GSI)

2.1.3 Groundwater

The subsoil is described as Made Ground of low permeability (L). The area is designated as low vulnerability (L).

The bedrock aquifer is a locally important aquifer (LI) in which the bedrock is moderately productive only in local zones. It has a recharge coefficient of 20%, an average recharge rate of 70mm/year, a maximum recharge capacity of 200mm/year and an average recharge range of 51-100mm/year.

The groundwater resources relative to the development site is detailed in Figure 2.3 on the following page.

Figure 2.3: Groundwater Resources (ref. GSI)

2.1.4 Historical Ground Investigations

There are a number of historical geotechnical sites in the locality, which are of relevance to the development site. The details of these site investigations are as follows:

- *St. Brendan's Hospital (Report ID: 15):* This site investigation report was for the St. Brendan's Hospital development project at North Circular Road, which is located approximately 250m northeast from the present site. The report contains an introductory statement, a description of subsurface conditions, recommendations, in-situ and laboratory test results and boring records. The investigative fieldworks were completed by IGSL Ltd. during the months of January and February 1985. The overburden was described as predominantly boulder clay overlying cobbles and boulders or presumed bedrock.

- *Sports Hall (Report ID: 819):* This brief site investigation report dates back to August 1986. It was completed by IGSL Ltd. at the request of Dublin Corporation for a sports hall development project at Aughrim Street. This was located approximately 150m west of the present development site. The report consists of an introductory statement, fieldworks and testing procedure descriptions and findings summary. The appendices contain a site plan, boring records and laboratory test data.

Similar ground conditions were described in which the overburden was initially composed of brown boulder clay overlying black boulder clay. Cobbles and boulders were encountered at the base of all 4no. boreholes.

- *(Report ID: 4120):* A historical geotechnical site directly opposite the development site was identified. This had a total of 5no. boreholes. However, no site investigation report could be accessed for this particular site.

The location of the geotechnical sites relative to the present development site is demarcated in Figure 2.4 below.

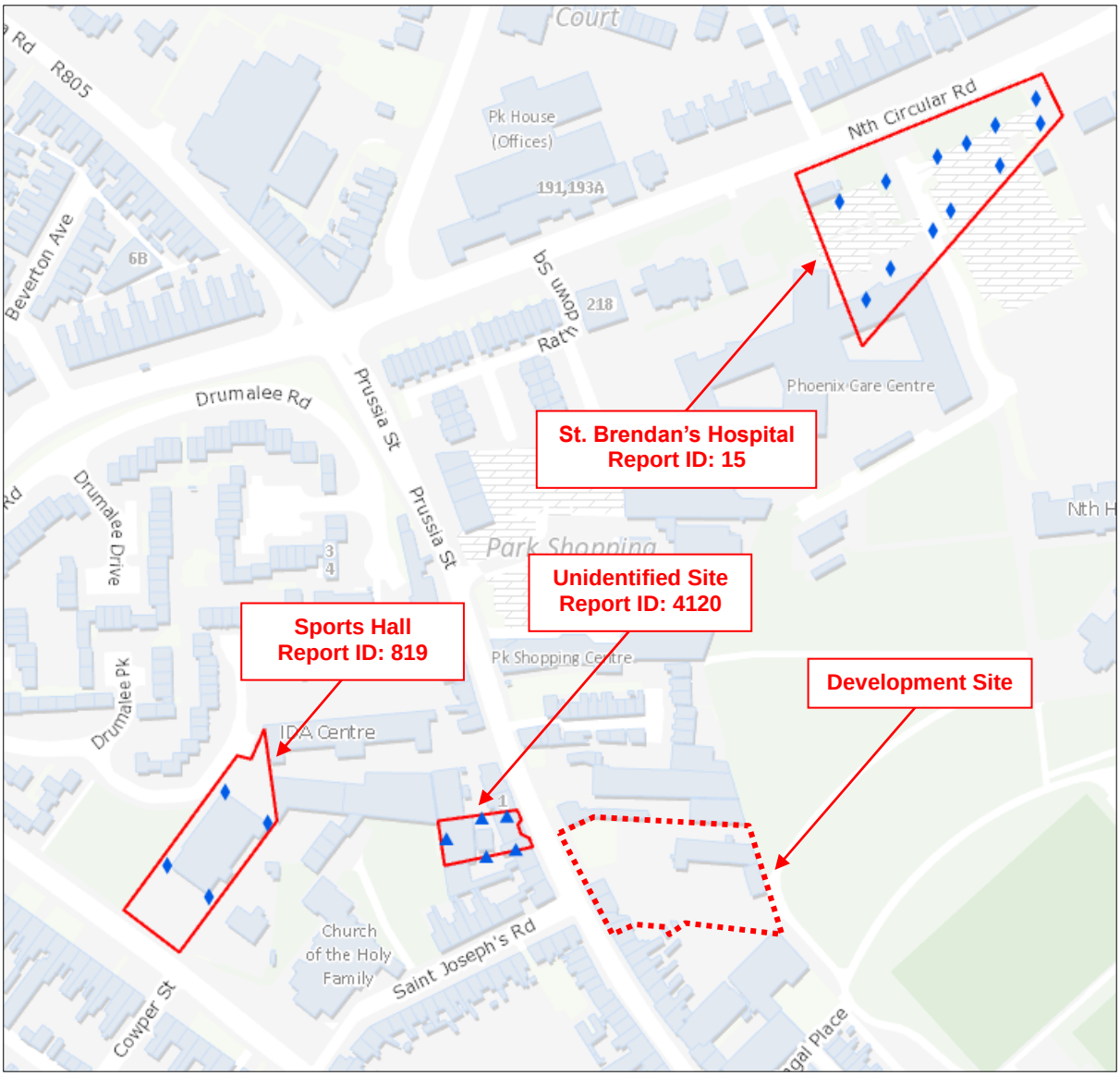

Figure 2.4: Historic Geotechnical Boreholes & Sites (ref. GSI)

2.2 Adjacent Structures

The land use and building functionality of the area are a mixture of low-density commercial units and terraced housing. The descriptions of the adjacent structures are as follows:

- *No. 29 Prussia Street:* This is a detached 3no. storey former house built around 1780 and has been converted into apartments.
- *No. 31 Prussia Street:* The area to the immediate north of the development site consists of single-storey, modular commercial units, which are used for the maintenance and repair of vehicles.
- *No. 14-22 Prussia Street:* A row of 2no. storey terraced houses built around 1820 was located to the south of the development site. These houses have a single storey return to the back overlooking walled garden areas.
- *Fingal Place:* A cluster of unidentified buildings was located further south and at the southeastern corner of the site.

A 3-dimensional view of the buildings in the vicinity of the site is depicted in Figure 2.5 below.

Figure 2.5: 3-Dimensional South-Facing Aerial View (ref. Google Maps)

2.3 Protected Structures

The Historical Environment Viewer of the Department of Housing, Heritage, Local Government and Heritage was accessed to review the datasets of the National Monuments Service (NMS). This facilitated protected structures in the vicinity of the site to be identified as follows:

- *Apartment (Converted) (Reg. No. 50070061):* This detached 3no. storey former house was built c. 1780 and has been converted to apartments in recent times. It has a pitched artificial slate roof, square-headed window openings, rendered walls, cut granite sills and a round-headed door opening. It has a small garden to the front with a modern gate and railings.

- *House (Reg. No. 50070056):* This 3no. storey Georgian era house was built c. 1750 and has 2no. storey return to the rear elevation. It has an M-profile hipped artificial slate roof, red brick walls laid in Flemish bond to the front, cut granite sills, round-headed door opening and replacement railings on a carved granite plinth wall enclosing the area to the front. The building retains its original function as a dwelling house.

- *House (Reg. No. 50070064):* This terraced 2no. storey Georgian era house was built c. 1820 and has a single storey return to the rear elevation. It has an M-profile pitched slate roof, yellow brick walls laid in Flemish bond to the front, square-headed window openings, cut granite sills, a round-headed door opening and granite platform and steps flanked by wrought-iron railings on a cut granite plinth.

- *Apartment (Converted) (Reg. No. 50070066):* This 3no. storey Georgian era house was built in 1761 and has a 3no. storey return to the rear. It has been converted to apartments in recent times. The building possesses a hipped tiled roof with a rendered chimney stack, square-headed window openings, painted concrete sills, round-headed door openings and cast-iron railings on a painted concrete plinth, which encloses the area to the front.

- *Apartment (Converted) (Reg. No. 50070067):* This 3no. storey Georgian era house was built in 1761 and has a 3no. storey return to the rear. It has been converted to apartments in recent times. The building possesses a hipped slate roof with a rendered chimney stack, square-headed window openings, painted cut granite sills, round-headed door openings and wrought-iron railings on rendered plinth, which enclose the area to the front.

Prussia Street was formerly known as Cabra Lane and formed an ancient route away from Dublin City. Many of the houses on this street retain their early Georgian character, although their external facades have undergone various alterations over time.

The locations of these protected structure are detailed in Figure 2.6 on the following page.

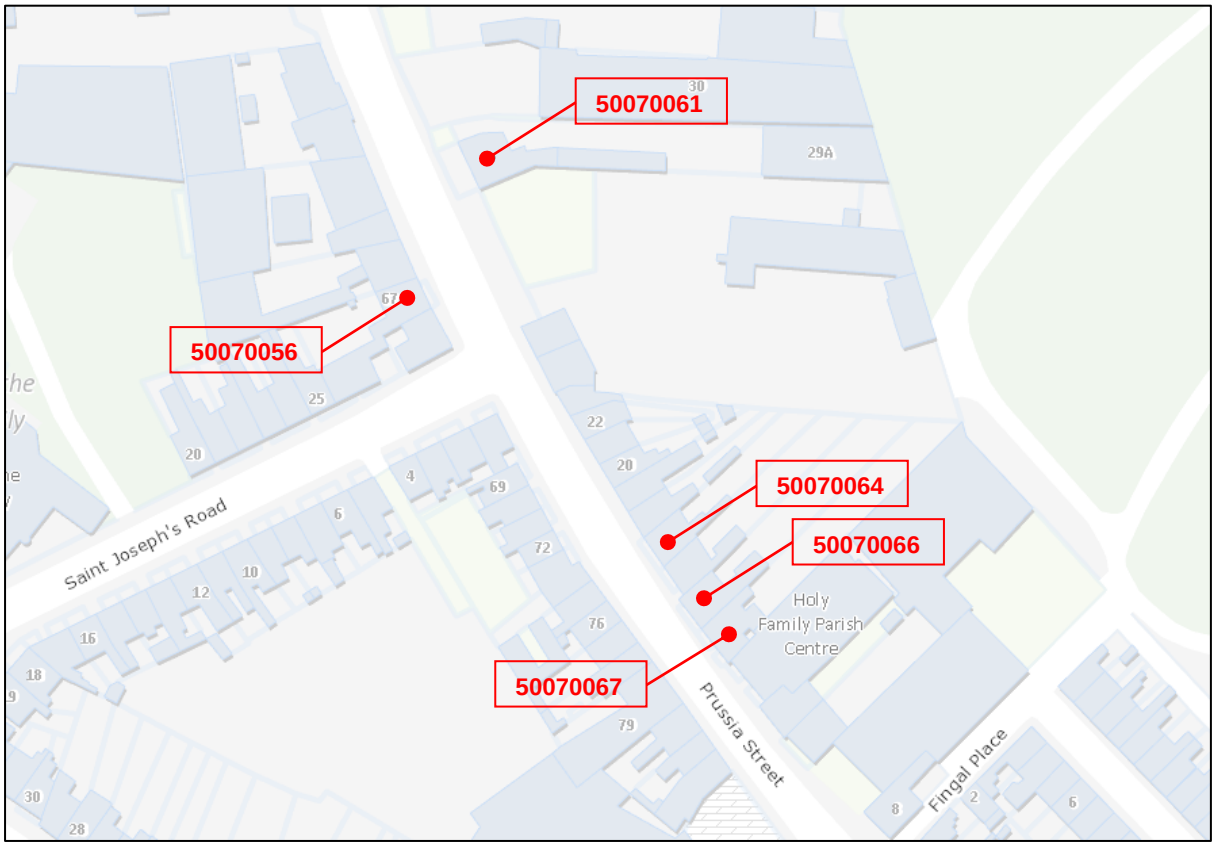

Figure 2.6: Protected Structures (ref. NMS)

2.4 Nearby Basements

As required by DCC's basement guidance, Ayesa has investigated the presence of existing nearby basements. The National Planning Application Database (NPAD) was accessed to identify permitted developments with basements, which might interact with the proposed basements. The planning applications in the area relative to the development site from 2010 onwards are shown in Figure 2.7 on the following page.

- *Planning Application Reference 2683/19:* This c. 0.5ha planning application site is based at 84-97 Prussia Street, which is approximately 50m to the southwest of the proposed development site. Permission has been granted for amendments to the original permission (ref. 4035/16), which was for multiple student accommodation apartment blocks and associated works. This development incorporates a basement substructure. A later planning application (ref. 4219/22) was granted for this same site. This involved amendments that included changes to the internal layout of the basement.

- *Planning Application Reference GSDZ4861/23:* This more recent c. 5.7ha planning application site is within the Grangegorman Strategic Development Zone (SDZ) and an area of several protected structures. It is situated approximately 50m northeast of the development site.

The development relates to an education facility, which will comprise of a 2-6no. storey building over a partial basement. The description of the proposed development mentions that the basement area will accommodate 404no. bicycle parking spaces.

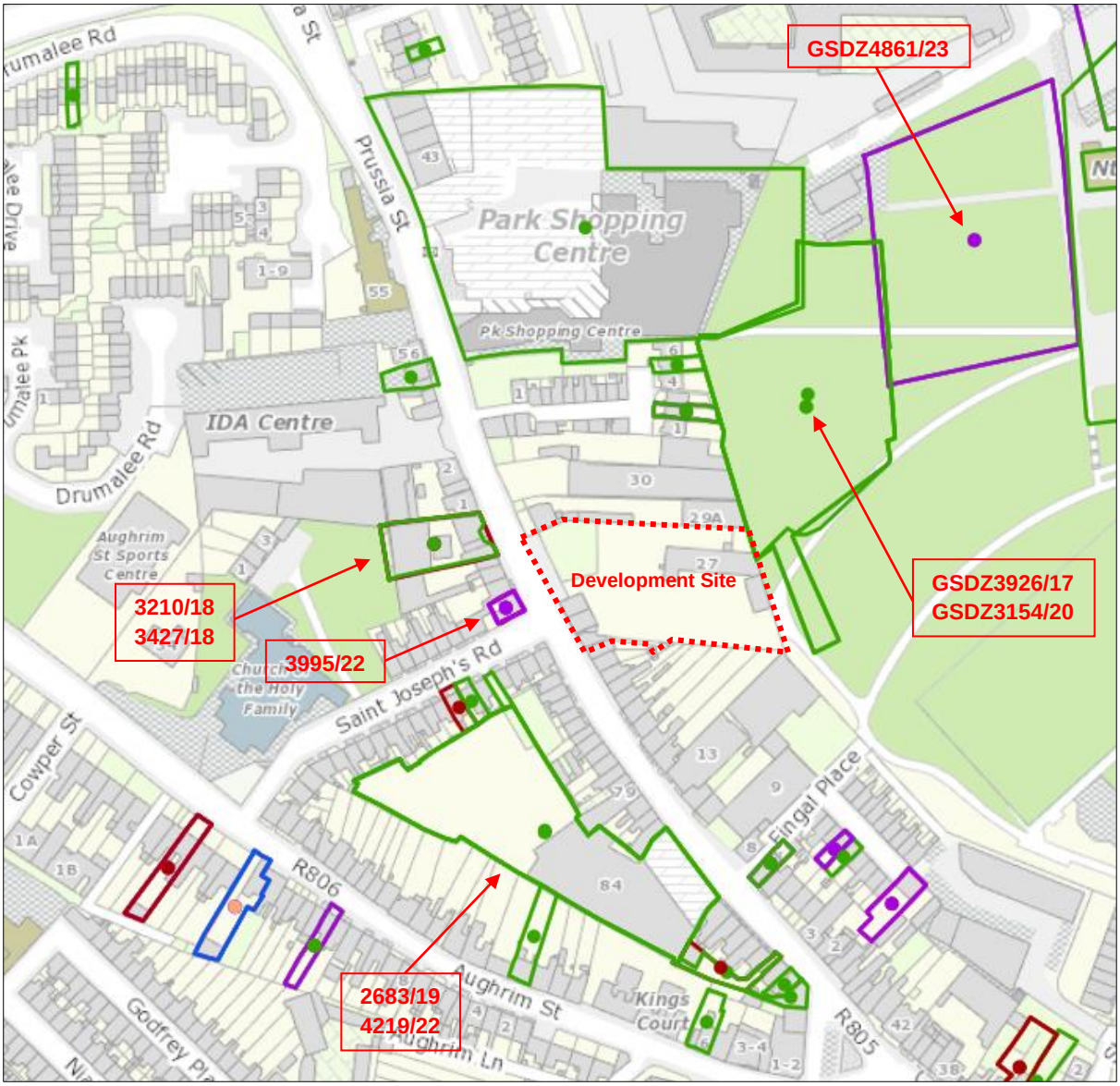

Figure 2.7: Planning Applications Incorporating Basement Substructure (ref. NPAD)

The planning applications (ref. GSDZ3926/17 & GSDZ3154/20) adjoining the development site to the east are sites in the Grangegorman Strategic Development Zone and relate to the development of a 1 and 2no. storey energy centre and educational building and associated works. The later retention permission application is for modifications to the permitted design. There are other nearby planning application sites directly opposite the development site. Planning applications 3210/18 and 3427/18 pertain to amendments to the existing commercial premises, while 3995/22 was for a new 4 no. storey apartment building, which was refused.

3 Ground Conditions

3.1 Ground Investigations

No site-specific ground investigation was completed at the development site. Therefore, the ground model and soil parameters are derived on the basis of the interpretation of the desk study and historical ground investigations in the area.

3.2 Ground Profile

The assumed ground profile is as follows:

- ***MADE GROUND:*** The surficial layer initially consists of tarmacadam paving and concrete hardstanding in certain areas of the site. This overlies a layer of Fill material, which contains fragments of construction debris.
- ***BOULDER CLAY:*** A layer of initially firm to stiff, brown, silty, sandy, gravelly CLAY with a variable cobble content underlies the MADE GROUND layer. This progresses with depth to stiff to hard, black, silty, sandy, gravelly CLAY material, which both contains cobbles and boulders.
- ***LIMESTONE:*** The bedrock material was presumed to be LIMESTONE bedrock.

3.3 Ground Model

The following ground model has been adopted for the assessment:

Table 3.1: Stratum Type & Depth

Stratum	Depth (m BGL)	Thickness (m)
MADE GROUND	0.0	0.3 - 0.6
Firm / Stiff CLAY	0.3 - 0.6	1.6 - 3.0
Hard CLAY	2.2 - 3.3	2.7 - 5.8
Presumed LIMESTONE Bedrock	6.0 - 8.0	-

3.4 Characteristic Geotechnical Parameters

As no site-specific investigation has been completed to date, the assumed geotechnical design parameters adopted for the assessment are based on the desk study, information from historical site investigations at nearby sites and typical soil parameters used in Dublin City Centre. These are detailed in Table 3.2 below.

Table 3.2: Characteristic Geotechnical Parameters

STRATUM	γ (kN/m^3)	ϕ' (°)	C_u (kPa)	E' (MPa)	E_u (MPa)
MADE GROUND	19	30	60	20	30
Firm / Stiff CLAY	18	34	150	60	90
Hard CLAY	18	36	300	120	180
Presumed LIMESTONE bedrock	22	38	c' = 100	250	-

3.5 Groundwater

No groundwater monitoring has been completed at the development site to date. It is recommended that groundwater monitoring measures should be implemented on-site. The data obtained could then be used at the detailed design phase of the basement substructure and any associated temporary works.

A groundwater level of 2m BGL has been adopted in the assessment. This is based on conservative engineering judgement and previous project experience in this area.

4 Hydrogeology

4.1 Geology and Hydrogeology of Dublin

Limestone bedrock from the Carboniferous age (365-325 million years ago) underlies c. 65% of the island of Ireland. This part of Dublin City is underlain by the Lucan Formation (LU), which is classified by the GSI as a Locally Important (LI) aquifer and moderately productive in local zones only as shown in Figure 4.1 below. In general, permeability in the Lucan Formation is low (1m/day). The flow of groundwater in rock aquifers is dependent on the network of fractures and its properties such as density of fracture, direction, length, width and the connectivity between the network of fractures. Fracture length can vary accordingly from a few metres to hundreds of metres (Comte et al., 2012). When fractures are present in rocks, it will change the flow pattern of groundwater because the water is trapped inside the fractures and moves along the direction of the fracture. Fractured rock aquifer characteristics such as transmissivity and storage will also greatly differ depending on the length and width of the fracture.

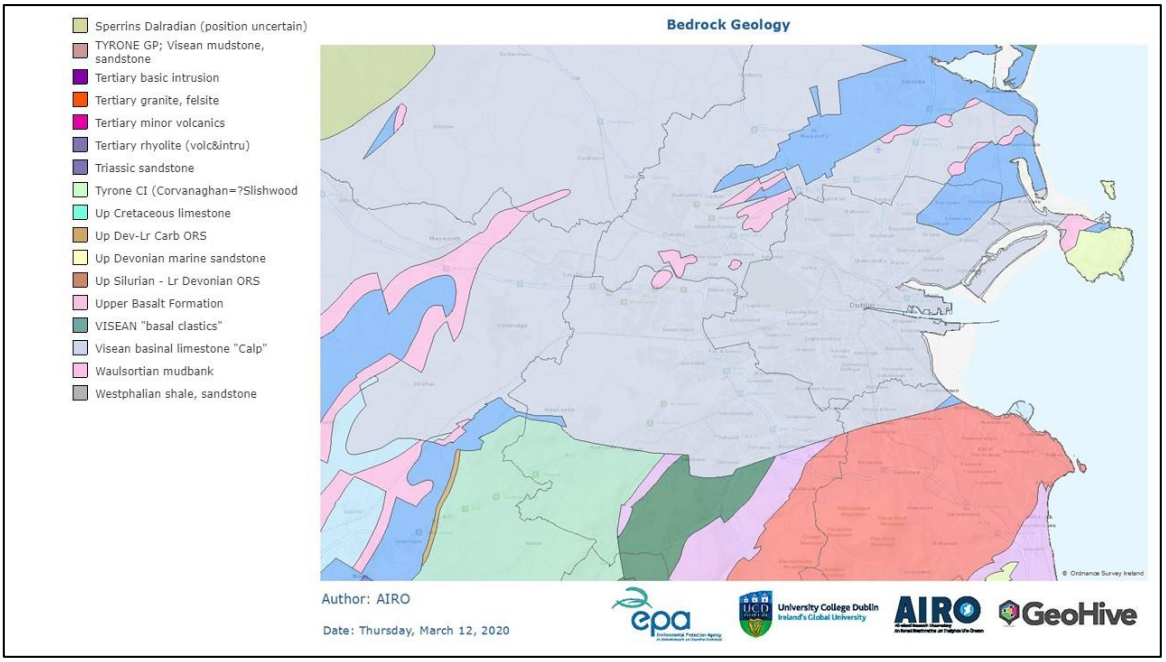

Figure 4.1: Bedrock Geology (ref: GSI)

Some 10,000 years ago, when a layer of ice of 1km thickness covered the majority of the Leinster region, a low permeability lodgement till was formed at the base of this ice sheet due to the abrasive action of the ice sheet on the bedrock. This layer of low permeability, sandy, gravelly clay (Dublin Boulder Clay) is present almost everywhere in the Dublin region and ranges in thickness from 20m in some parts to being absent near the Heuston Station and Smithfield area. A layer of glacial-fluvial sand and gravel can be found in Dublin City along the channels / floodplains of the River Liffey, Dodder and Camac. In addition, some unconnected sand and gravel lenses can be found within the Boulder Clay and their lateral and vertical extents are also limited.

Groundwater flow in the bedrock is confined (artesian to semi-artesian) by the layer of low permeability clay present above it in the Dublin region. The Boulder Clay hence acts as a protective layer to the bedrock from surface activities such as contamination and oil spills. It also limits the amount of rainfall that can end up recharging the groundwater in the bedrock (Misstear, Brown & Daly, 2009).

4.2 Findings from the Detailed Assessment of Former Metro North Station Boxes on Groundwater Levels

The impact of deep basement construction within Dublin City Centre has not been studied or investigated thoroughly. However, a small number of major developments such as the former Metro North (also known as MetroLink today) were requested by An Bord Pleanála (ABP) to appoint a hydrogeologist to carry out a study on the potential impact of its proposed underground station boxes on surrounding groundwater flow and / or levels. The former alignment of Metro North traverses areas, which had low permeability geology (Made Ground overlying Dublin Boulder Clay and Limestone bedrock). It also crosses areas where there are layers of alluvial deposits above the Dublin Boulder Clay such as in the Parnell Square area. The proposed underground station boxes for the Metro North project had average dimensions of 165m length, 30m width, and 25m depth. Professor William Powrie from the University of Southampton in the UK was appointed to carry out the study and his conclusions were as follows:

- Where basements are founded in low permeability tills such as sandy, gravelly, clay (Dublin Boulder Clay), there are no impacts on the groundwater regime since it is evident that there is very little water flow in these low permeability horizons regardless of their porosity.

4.3 Impact of the Proposed Development on the Groundwater Regime

The proposed development works involve the construction of a single basement area. The basement floor level will be +19.7m OD with an excavation depth of approximately 4.0m BGL. It will be constructed in the firm / stiff CLAY and hard CLAY strata. These cohesive soil materials have very limited ability to transmit groundwater on the basis of their low permeability. Hence, they are deemed to be aquitards / aquicludes. The proposed basement is not likely to impede or block groundwater flow across the majority of the site.

4.4 Bedrock Aquifers

Given the low permeability of the majority of the overburden, the underlying joints and crevices in the bedrock can become critical pathways for groundwater flow. Disturbing these can therefore influence the groundwater regime.

The GeoUrban map viewer in the GSI online spatial resources was accessed to investigate the depth to bedrock level for the development site. A depth to bedrock range of 15-20m was obtained. This is detailed in Figure 4.2 below.

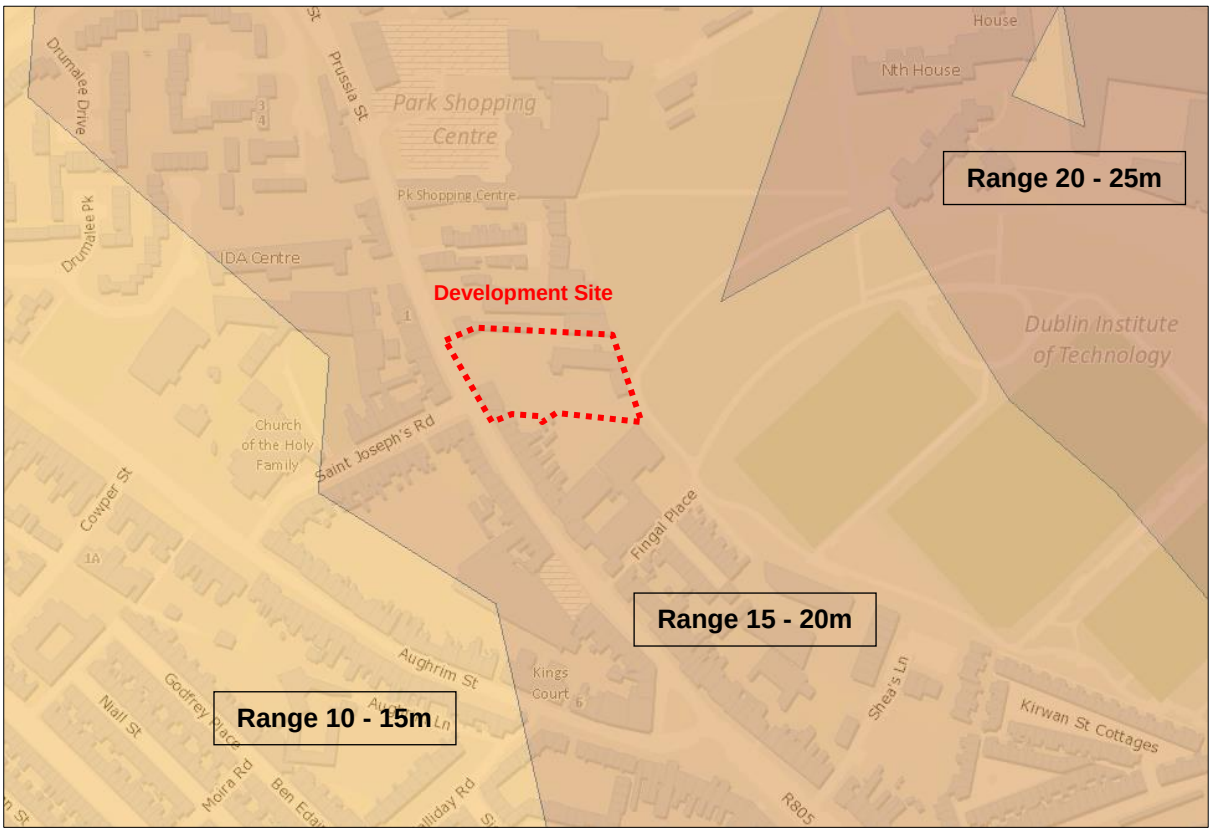

Figure 4.2: Depth to Bedrock - Dublin County (ref: GSI)

The depth to bedrock range of 15-20m contrasts with the lower range of 6-8m derived from the nearby historical ground investigations. Although there is much variation in stated rockhead depths, it is not expected that the proposed basement will encroach on the existing bedrock levels and subsequently disturb the bedrock aquifer regime.

4.5 Groundwater Extractions and Well Data

Several groundwater extraction areas are believed to exist in central Dublin. Groundwater wells and springs records for the area were obtained from the GSI online spatial resources and demarcated in Figure 4.3 on the following page.

There is one borehole well type at North Brunswick Street, approximately 500m from the development site. It was drilled to a depth of 30.4m on the 29th of December 1899. It is for industrial use with a yield class designated as good and yield volume of 393m^3.

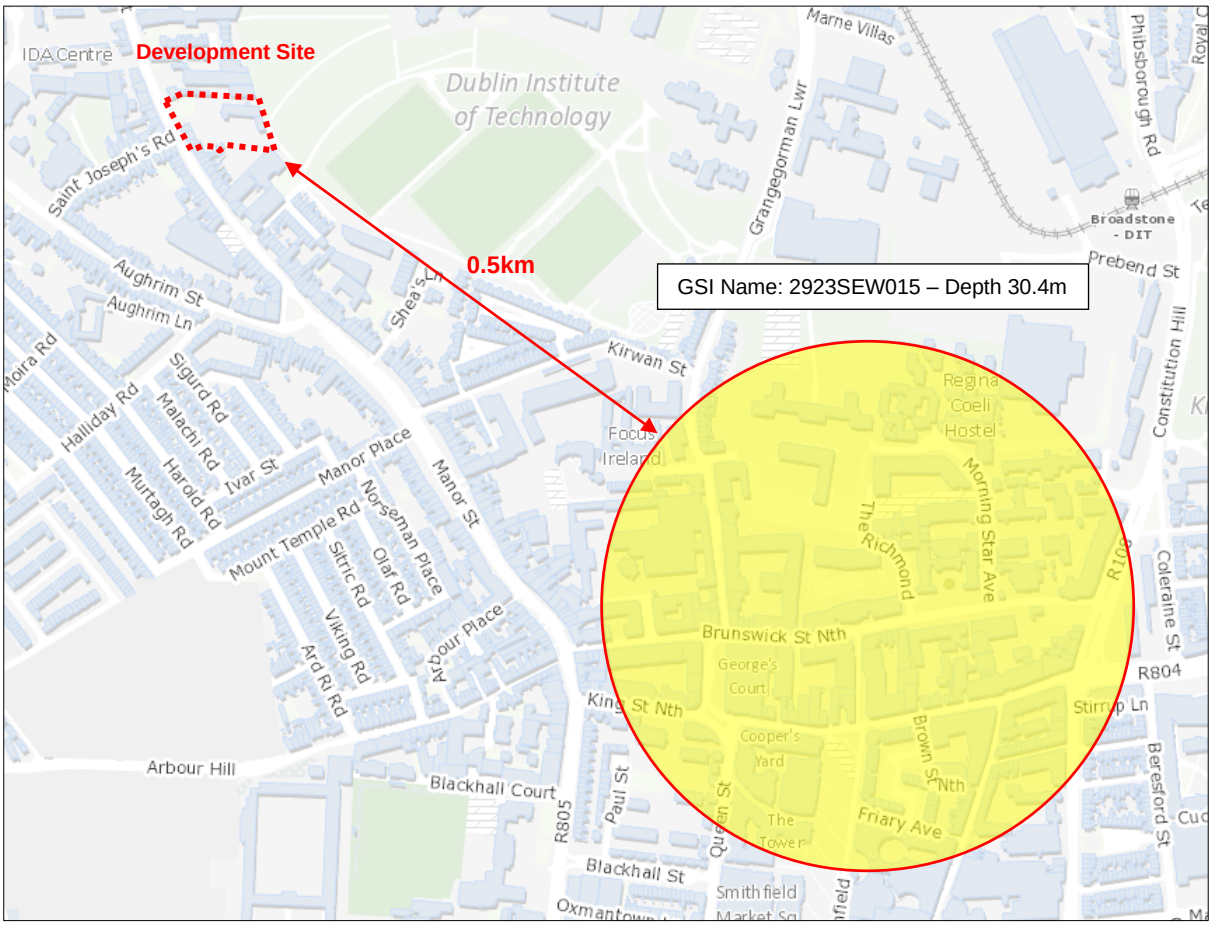

Figure 4.3: Groundwater Extraction and Well Data (Ref. GSI)

4.6 Groundwater Flow

Groundwater within the Dublin City area is reported to flow in a generally eastward direction and either contributes to the various rivers flowing within the area or discharges directly into the sea at Dublin Bay.

Figure 4.4 on the following page depicts the general direction of groundwater flow, which moves from a west-to-east direction and replicates the direction of the flow of the River Liffey. This does not extend sufficiently far east to encapsulate the site but indicates that groundwater level is likely to be fairly shallow.

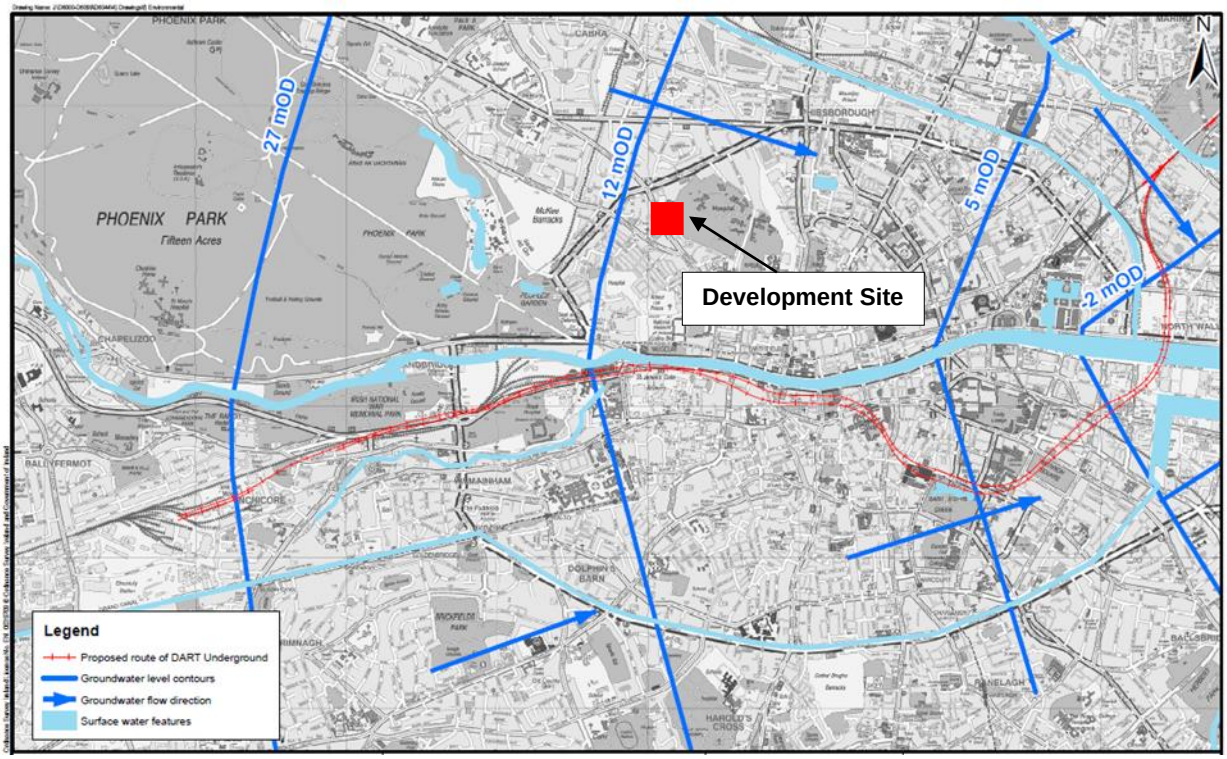

Figure 4.4: Groundwater Level Contours & Flow Lines in Dublin Area

(excerpt from Environmental Impact Statement for DART underground)

4.7 Cumulative Impact of Nearby Basements

As outlined previously, it is considered unlikely that a number of basements exist in the vicinity of the proposed development site. Scenarios A1 and B1 are applicable to this site. The increased impact of this proposed development is considered nominal. This is based on the extents of existing basements relative to the site, bedrock depth, and low permeability ground conditions.

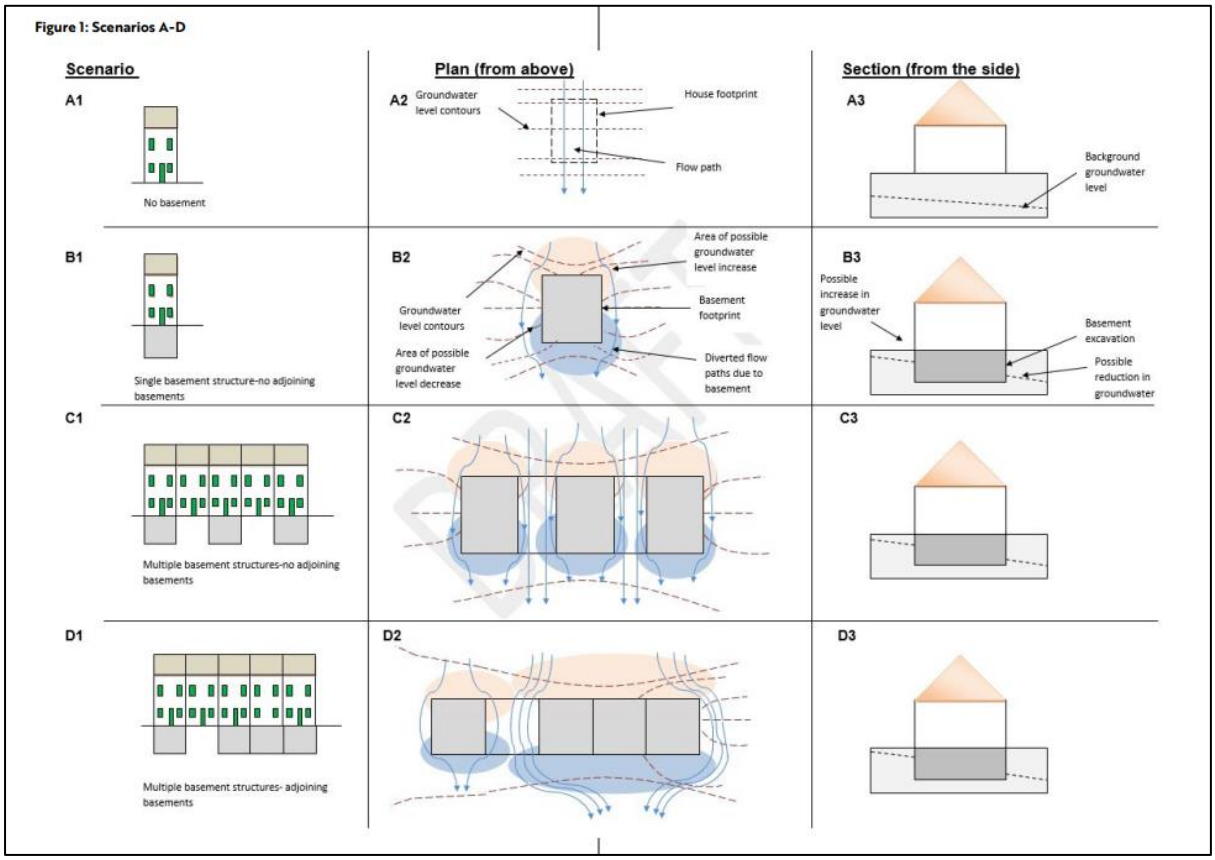

Figure 4.5: Cumulative Effects of Basement Construction on Groundwater

(ref. Dublin City Development Plan Appendix 9 – Figure 1)

4.8 Temporary Groundwater Control

During the basement excavation works, water pumps may be required to keep the excavation area dry. The source of this water ingress will most likely be surface water run-off, which will accumulate within the excavation footprint. A minimal pumping arrangement will be sufficient.

5 Ground Movement Assessment

5.1 Introduction

The basement of the proposed development will be formed by battered excavations. A secant-piled wall is not required due to the relatively small footprint of the excavation area. Furthermore, the clearance between the proposed basement location and any sensitive structures is considered adequate, thereby the requirement for excavation support measures will be omitted. The excavation will be formed within the firm / stiff CLAY and hard CLAY layers to an approximate elevation of +19.2m OD (~ depth of 4.0m BGL).

The proposed section of Block B is displayed in Figure 5.1 below.

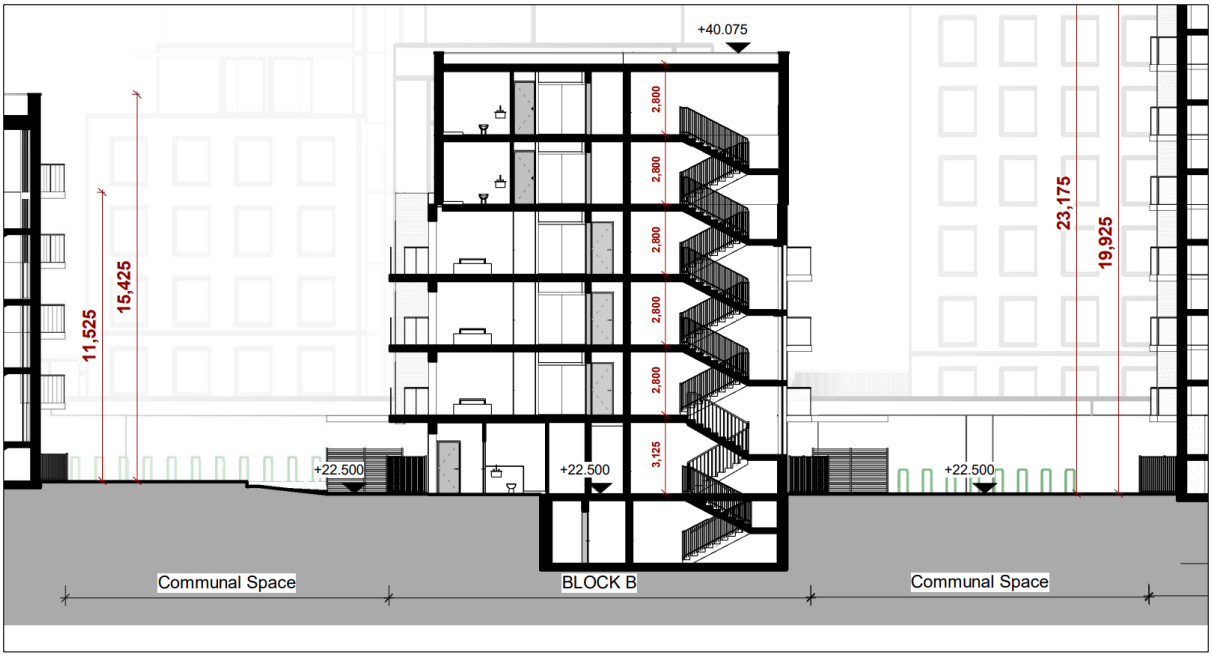

Figure 5.1: Proposed Sections (ref. Downey - Drawing No. PL-301)

5.2 Ground Movements surrounding the New Basement

5.2.1 Software Used

The assessment of ground movements within and surrounding the excavation area has been estimated using empirical correlations found in CIRIA C760. These correlations are reasonably conservative and deemed appropriate to be used at this stage of the development.

The OASYS XDisp software application has been used to assess the impact of the ground movement predictions on the adjacent buildings and structures.

5.2.2 Ground Movement Assessment

The surface ground movements from the proposed basements excavations were analysed by the XDisp model, which was based on an unsupported excavation in front of a low stiffness wall in stiff clay (CIRIA C760 Fig. 6.15(a)). The category of damage to the surrounding buildings from settlement was determined from the XDisp analyses and using the Burland Scale for the structures. It was conservatively assumed that the existing adjacent strutures were on raft foundations at ground level.

The layout of the adjacent structures is detailed in Figure 5.2 below.

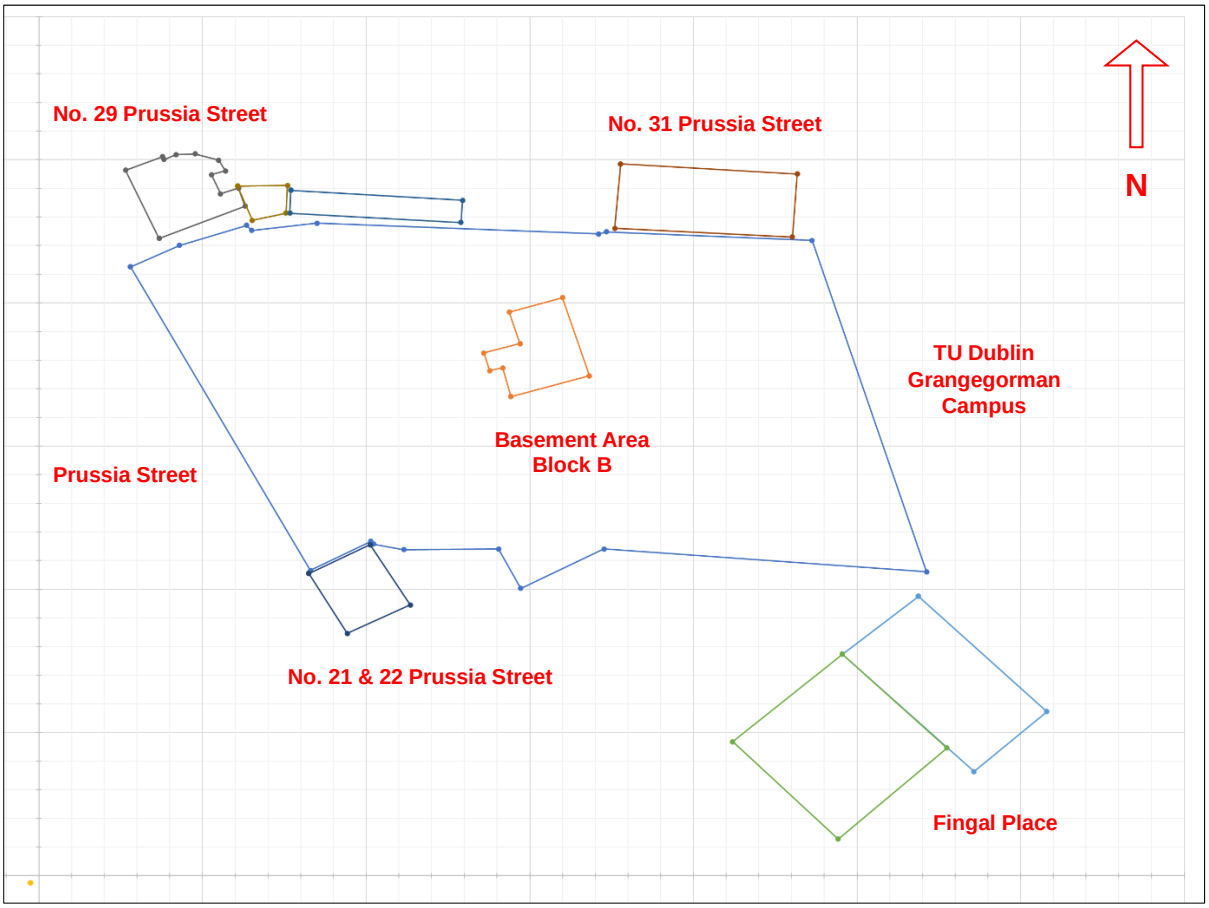

Figure 5.2: Adjacent Buildings & Site Boundary

The selected adjacent buildings will incur neglible damage (Category 0) from the basement development works. The results are deemed conservative based on the chosen assumptions and ground movement curves used in the analysis.

5.3 Damage Impact Assessment

These classifications have been extracted and presented in Table 5.1 below. They are based on method of damage assessment outlined by Burland et al. (1977), Boscardin and Cording (1989) and Burland (2001).

Table 5.1: Table 6.4 of CIRIA C760: Classification of visible damage to walls

(Burland et al. 1977, Boscardin and Cording 1989 and Burland 2001)

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain, ε_{lim} (%)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible	<0.1	0.0 to 0.05
1 Very slight	**Fine cracks that can easily be treated during normal decoration.** Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection	<1	0.05 to 0.075
2 Slight	**Cracks easily filled. Redecoration probably required.** Several slight fractures showing inside of building. Cracks are visible externally and **some repointing may be required externally** to ensure weathertightness. Doors and windows may stick slightly.	<5	0.075 to 0.15
3 Moderate	**The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable lining. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.** Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5 to 15 or a number of cracks >3	0.15 to 0.3
4 Severe	**Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.** Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Services pipes disrupted.	15 to 25, but also depends on number of cracks	>0.3
5 Very severe	**This requires a major repair, involving partial or complete rebuilding.** Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	Usually >25, but depends on numbers of cracks	

The results of the analyses are summarised in Table 5.2 below. These are based on the ground movements at the foundation level for each structure.

Table 5.2: Results of Damage Impact Assessment

Structure Location	Category of Damage
No. 29 Prussia Street	Cat. 0 - Negligible
No. 29A Prussia Street	Cat. 0 - Negligible
No. 21 & 22 Prussia Street	Cat. 0 - Negligible
Fingal Place	Cat. 0 - Negligible

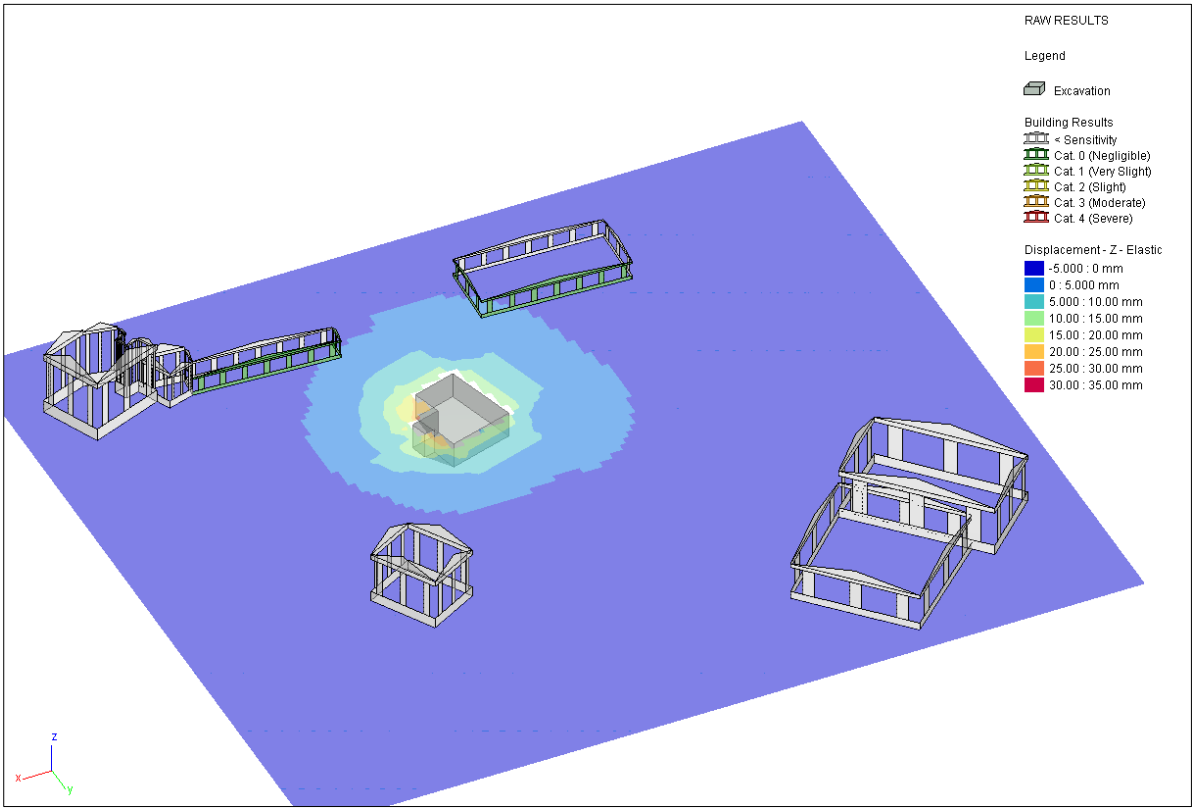

Figure 5.3: Damage Impact Assessment – Isometric View No. 1

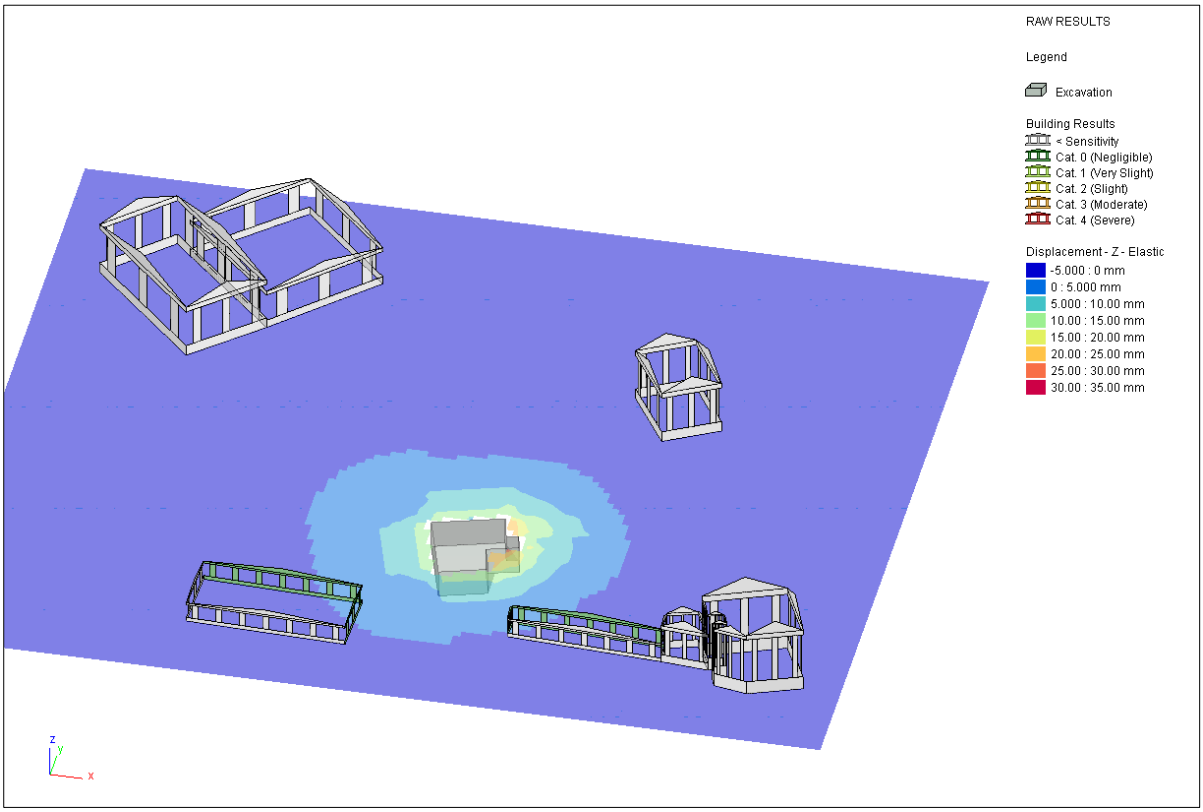

Figure 5.4: Damage Impact Assessment – Isometric View No. 2

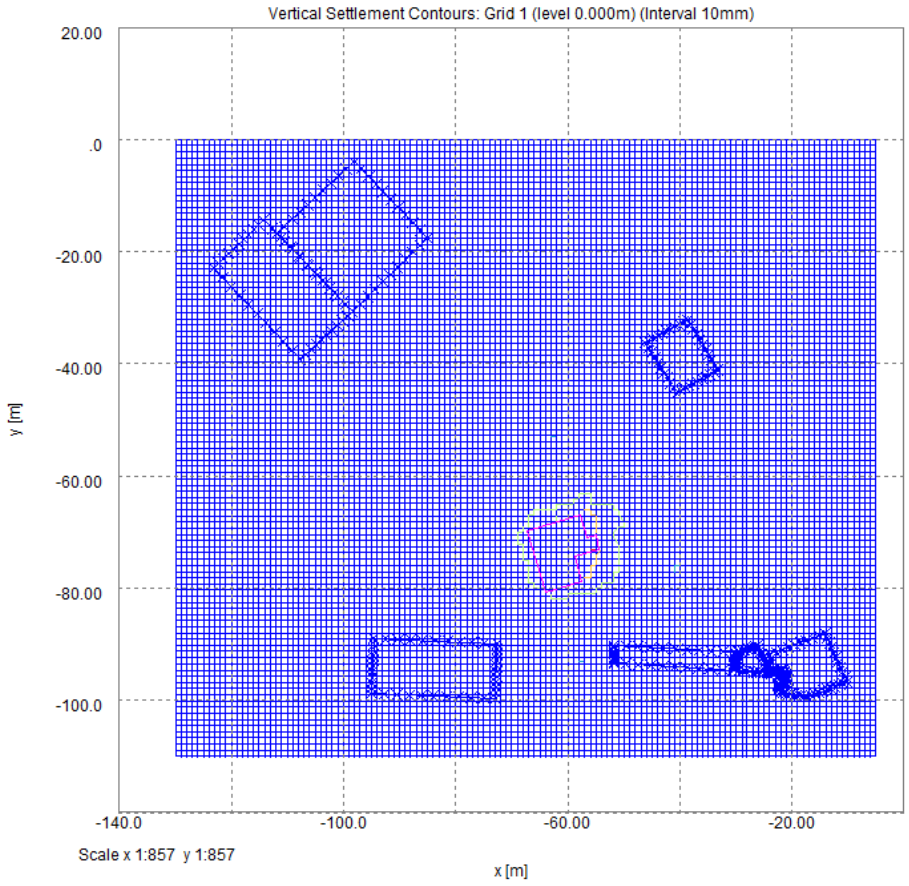

Figure 5.5: Damage Impact Assessment – Plan View

5.4 Monitoring of Ground Movements

The predictions of ground movements given here are considered preliminary and are subject to detailed design solutions implemented at construction stage (i.e. temporary works, quality of construction, installation techniques, groundwater control measures, finalised bearing pressures from permanent works etc.). The predictions given here are however considered appropriate estimations for the purposes of the BIA.

During construction, the predictions of ground movement based on the analysis should be checked by monitoring. It is recommended that condition surveys of adjacent existing structures should be carried out before and after the proposed works. The precise monitoring strategy will be developed at a later stage. It will be subject to discussions and agreements with the owners of the adjacent properties and structures.

Contingency measures will be implemented if movements of the adjacent structures exceed predefined trigger levels as noted above. Both contingency measures and trigger levels will need to be developed within a future monitoring specification for the works.

6 Summary and Recommendations

Ayesa has completed the basement impact assessment (BIA) for the proposed residential apartment development at No. 23-28 Prussia Street in Stoneybatter, Dublin 7. This assesses the potential damage to adjacent structures and effect on groundwater flow. The retrieval of historical ground investigation information in the locality facilitated the derivation of ground conditions and geotechnical parameters for the development site. Conservative assumptions also formed the basis of this BIA.

The damage impact assessment on the nearby buildings was then completed by modelling the basement / substructure through the software package OASYS XDisp. The ground movement analysis has concluded that the predicted damage to the neighbouring existing properties would generally be negligible (Category 0).

The predictions of ground movements given here are considered preliminary and are subject to the more comprehensive ground model, detailed design solutions and excavation plan implemented at construction stage (i.e. temporary support system, quality of construction, groundwater control measures, bearing pressures from permanent works, etc.). In addition, ground movement monitoring should be implemented for the works as described in this report. The battering of the side slopes of the excavation will reduce the ground movements associated with the basement excavation.

A detailed groundwater flow analysis has not been carried out due to the lack of groundwater monitoring information. The implementation of a comprehensive monitoring regime that includes standpipe and piezometer installations across this site is recommended. However, based on the assumed extents of existing basements relative to the site, bedrock depth and low permeability ground conditions across much of the site, the risk to the existing structures due to potential changes in the groundwater flow is considered nominal.