

## 5.8 Soils & Geology (Including 'Land')

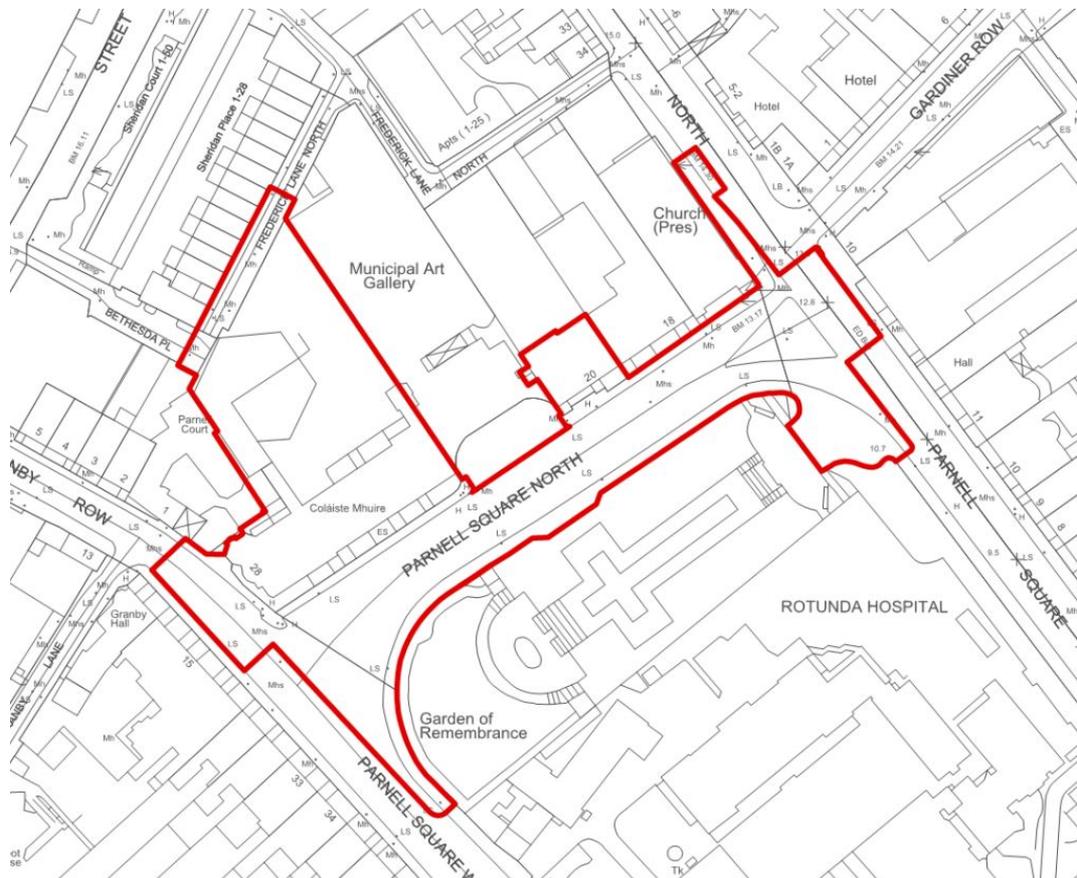
### 5.8.1 Introduction

This chapter presents the soil and geology assessment for the demolition, construction and operational phases of the proposed New City Library and Public Realm Works. The proposed development is described in detail in Chapter 3: Description of Proposed Development, of this EIAR.

The project includes extensive groundworks within and to the rear of 23 – 28 Parnell Square North.

It also includes the reordering of Parnell Square North extending into the northern ends of Parnell Square East and Parnell Square West respectively.

The extent of this area is illustrated under Figure 5.8.1 below.



**Figure 5.8.1:** Site Location Map

## **5.8.2 Methodology**

This section of the Environmental Impact Assessment Report (EIAR) was prepared by Waterman Moylan using the following methodology:

1. Desktop review of the planning stage documentation provided by the project design team
2. Identification of the existing soil and geology environment from the site investigation reports and planning drawings received from the project design team
3. Assessment of the impacts of the proposed development on the soil and geology environment.

This chapter has been prepared having regard to the Guidelines on Information to be contained in Environmental Impact Statements, EPA, 2002.

## **5.8.3 Receiving Environment (Baseline Situation)**

### **5.8.3.1 Background**

Parnell Square is located in Dublin 1 at the northern end of O'Connell Street.

The buildings at Colaiste Mhuire (Nos 23 – 28) and 20 – 21 Parnell Square were developed over 200 years ago in the Georgian style. All of the buildings include basements and lightwells on Parnell Square North excepting No 21 which does not have a lightwell.

### **5.8.3.2 Ground Levels - Existing**

A topographical survey carried out as part of the Proposed Development recorded that the existing ground levels at the subject site varied from +13.5 mOD to +15.5 mOD.

The floor of the existing basement is located at +10.4 mOD and it is proposed to reduce this level to +10.0 mOD.

### **5.8.3.3 Soil - Existing**

#### **5.8.3.3.1 Geotechnical Investigation 2014**

As part of the proposed development, a geotechnical site investigation was carried out by Site Investigations Ltd in February 2014 at the rear of Nos 23 – 28 Parnell Square North.

The investigation comprised 4 x boreholes, 2 x trial pits and 6 x slit trenches.

Groundwater was encountered at 12.7 – 13.0 m below ground level.

The investigation did not include identification of the underlying bedrock. The strata encountered during the investigation are summarised in Table 5.8.1.

Environmental testing on soil samples comprised a simple landfill acceptability test (WAC) to determine if the material would be accepted as 'inert material by an Irish landfill.

The results of the tests showed that the subsoil was mildly selenium- toxic at a relatively low concentration.

No site investigation was carried out at 20 – 21 Parnell Square North or in the area of the proposed plaza on Parnell Square North as there are no groundworks in these areas that could potentially affect the existing soil and geology environment.

**Table 5.8.1:** Existing Soil under Colaiste Mhuire

<b>Strata</b>	<b>Depth Below Ground (m)</b>	<b>Thickness (m)</b>	<b>Elevation (mOD)</b>
Made Ground	0 – 1.9	1.0 – 1.9	13.35 – 11.46
Brown Boulder Clay	1.0 – 9.5	1.6 – 8.5	12.35 – 3.85
Black Boulder Clay	3.5 – 13.0	0.2 – 5.5	9.86 – 0.36
Sands and Gravels	12 – 21.0	7.3 – 8.0	5.36 - 7.64

### 5.8.3.3.2 Geotechnical Investigation 2018

A second geotechnical site investigation for the proposed development was carried out by Ground Investigations Ireland at the rear of Nos 23 – 28 Parnell Square North in June 2018.

The investigation comprised 7 x trial pits to depths of up to 3.4 metres below ground level.

The strata encountered comprised made ground to varying depths from 1.4 metres to 4.0 metres below ground level overlying brown and black boulder clay.

The results of the laboratory tests on samples from the trial pits showed that:-

- a) The Total Organic Carbon organic content at 3.1% at 0.5m below ground level in Trial Pit 101 was marginally above the inert limits of 3.0%.

- b) Asbestos was detected in samples from Trial Pits 101, 103 and 105 at depths between 0.5 and 3.0 metres below ground level.

No site investigation was carried out at Nos 20 – 21 Parnell Square North or in the area of the proposed plaza on Parnell Square North.

#### **5.8.3.4 Geology - Existing**

The existing geology in the area of the proposed development was identified from:-

- a) Bedrock Geology 1:100,000 online mapping published by the GSI.
- b) The nearest borehole to the site which identified bedrock. This borehole, which was part of the Metro North ground investigation recorded bedrock at 26.5 m below ground level at an elevation of – 13.5 mOD.

The bedrock under the proposed development is expected to be predominantly Carboniferous Limestone typical of the Lucan Formation or Calp Limestone.

#### **5.8.3.5 Groundwater - Existing**

During drilling by Site Investigations Ltd in December 2013, groundwater was recorded between 12.15 and 13.14 metres below ground level (1.35 – 0.36 mOD) in the fluvio-glacial layers under the subject site.

These strikes were observed during drilling only and may not be representative of equilibrium groundwater levels under the site.

As determined from the permeability and attenuation of the overlying deposits, the groundwater vulnerability of the aquifer below the location of the proposed development is 'Low'.

## **5.8.4 Characteristics of the Proposed Development**

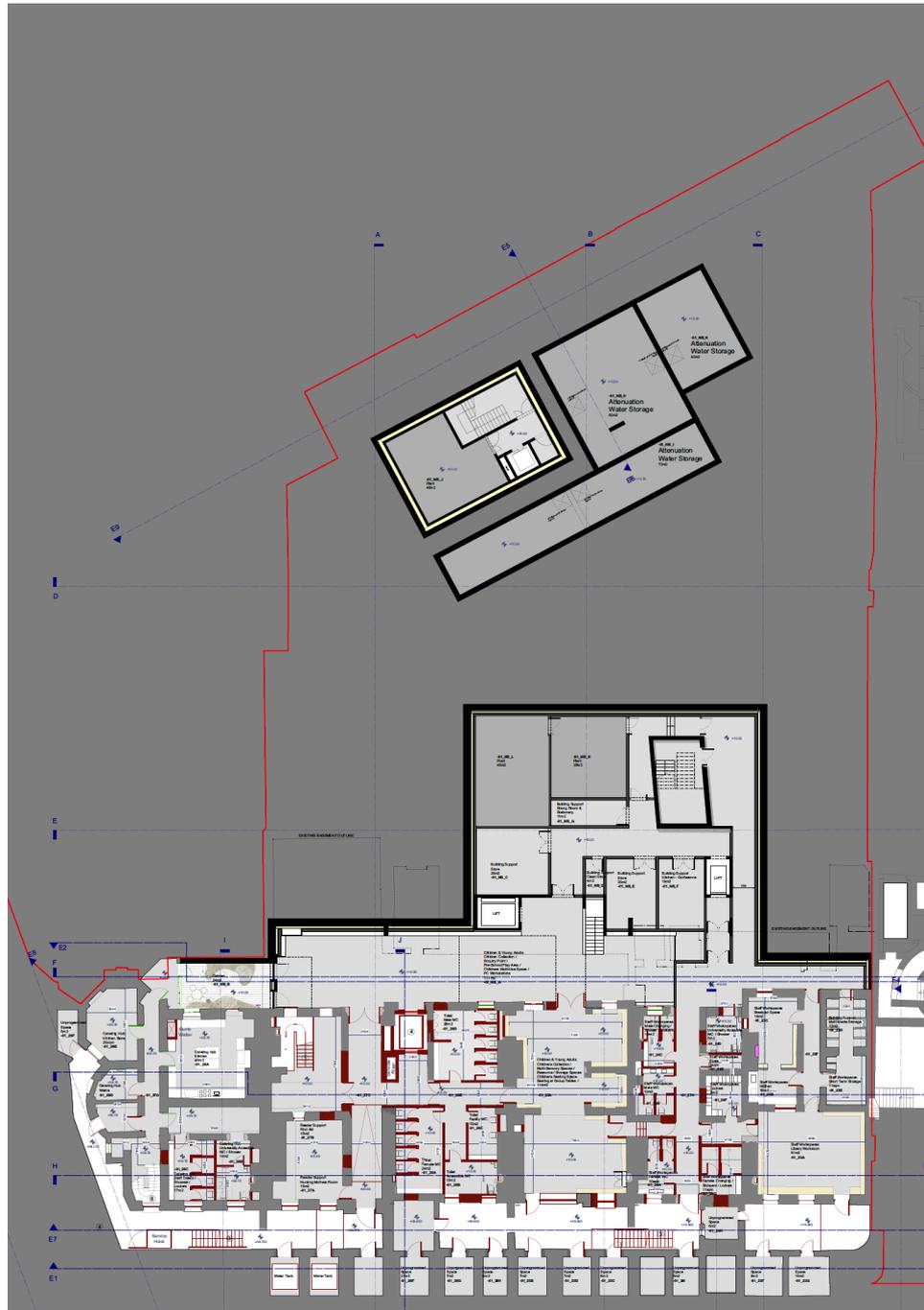
### **5.8.4.1 Proposed Development – New City Library**

The subject proposal comprises the redevelopment of the former Colaiste Mhuire premises at Nos 23 – 28, and 20 – 21 Parnell Square into New City Library.

The facilities at the POSCQ will extend to some 11,198 sqm and provide facilities for

- Lending and Reference Library
- Storey House Literature Centre
- Conference and Exhibition facilities
- Learning Suite
- Music and Innovation Hubs

The New City Library will include a basement under most of the ground floor and an underground attenuation / water storage tank(s) under the loading bay on Frederick Lane North. See Figure 5.8.2.



**Figure 5.8.2** Proposed Basement Floor Plan

## 5.8.4.2 Levels - Proposed

### 5.8.4.2.1 Ground Floor

A topographical survey carried out as part of the proposed development recorded that the existing ground levels at the subject site varied from +13.5 mOD to +15.5mOD.

The proposed ground floor level at the proposed development will be +13.3mOD.

The proposed excavation level for the new ground floor slab will be +13.0 mOD.

#### **5.8.4.2.2 Basement**

The floor of the existing basement is located at a level of +10.4 mOD and it is proposed to reduce this level to +10.0 mOD.

The proposed excavation level for the new build basement will be +9.5 mOD.

#### **5.8.4.3 Groundworks - Proposed**

##### **5.8.4.3.1 Structure - Proposed**

The redevelopment of Colaiste Mhuire will require the following ground works at basement and ground level: -

- Underpinning of the walls of the existing Georgian buildings at basement level.
- Underpinning of the party walls to Parnell Court and Hugh Lane.
- Excavation to depth of 900mm to facilitate lowering the floor level in the existing basements by 400 mm.
- Excavation for service trenches.
- Excavation for lift pits.
- Installation of piles to – 7.0 mOD under cores and to 0.00 mOD elsewhere.
- Excavation for pile caps.
- Excavation for new basement at the rear of the Georgian buildings
- Excavation for surface water attenuation and water storage tanks.
- Storage of excavated material in temporary stockpiles.
- Local pumping if any groundwater is encountered during excavation works.

These works will create a surplus of excavated material, some contaminated, which will need to be disposed off-site.

##### **5.8.4.3.2 Public Realm - Proposed**

Within the public realm, the redevelopment of Parnell Square North will require the following ground works:-

- Excavation of the existing paving.

- Excavation of trenches for new / relocated services including pipes and cables.
- Excavation works for landscaping.

These works will also create a surplus of excavated material which will need to be disposed off-site.

#### 5.8.4.4 Disposal of Excavated Material

Some of the subsoil at the New City Libray has been found to contain marginally elevated levels of Selenium, asbestos and Total Organic Carbon organic content.

Prior to removal from site, these materials will be tested to determine the most appropriate means of disposal off-site, all described in Chapter 5.14: Material Assets - Waste Management, of this EIAR.

#### 5.8.4.5 Groundwater

The lowest excavation proposed for the proposed development will be to +8.6 mOD for the pile cap under the surface water attenuation tank.

The existing groundwater level is some 9.0 metres below this excavation level and will not be affected by any of the excavation works.

However, piling for the proposed development is expected to extend to – 7.0 mOD under cores and 0.00 mOD elsewhere. These levels will be reviewed following a post planning site investigation to prove rock level.

The details of the excavation and groundwater levels are presented in Table 5.8.2.

**Table 5.8.2:** Excavation and Groundwater Levels

Element	OS Malin	Depth below Ground Level
Ground Floor Level	+13.3 mOD	(1.1m)
Ground Level	+12.2 mOD	0.0m
Existing Basement Level	+10.4 mOD	1.8m

Proposed Basement Level	+10.0 mOD	2.2m
Pilecaps under Attenuation Tank	+8.6 mOD	3.6m
Groundwater Level	- 0.3 mOD	12.5m
Toe of pile level	- 7.0 mOD	19.2m

## **5.8.5 Potential Impacts of the Proposed Development**

### **5.8.5.1 Demolition and Construction Phase**

The potential impacts which could arise from the demolition and construction phase of the proposed redevelopment of Colaiste Mhuire and 20 – 21 Parnell Square North are set out below.

During adverse weather conditions, surface water runoff across the exposed sub-soil could result in increased levels of standing water within the excavated basement area. Temporary sumps will be used to gather the ground water which will then be pumped into the main drainage system.

During the construction phase, there is a risk for construction traffic to damage the structure of some of the adjoining road network and to increase the amount of mud and dust on the public roads which provide access to the site. There will also be a temporary increase in traffic levels due to deliveries of materials, construction workers and removal of spoil/waste off site.

During construction, there is a risk to workers due to the presence of contaminated ground.

Excavation of foundations and/or removal of contaminated material adjacent to the existing basement may cause instability in the existing basement and/or secant wall.

During construction of the drainage and/or paving, there is a risk for an increase in traffic due to some works being carried out on the live road network. There is also a risk of damage to or disruption of existing services.

During construction, there is a risk of contamination to the soil from petrol and/or diesel spills which could occur during refueling or storage of fuel.

During dry weather, there is a risk of pollution by dust arising from the excavation works.

Unless the contaminated material in the made ground is removed prior to the commencement of piling, the installation of piles could transfer contaminated subsoil from the upper layers into the groundwater layer.

The proposed mitigation measures and the predicted impact of these potential impacts are addressed below.

### **5.8.5.2 Operational Phase**

On completion of the construction phase, no further impacts on the soil environment are envisaged except for the possibility of contamination of soil from foul water effluent or oil spills.

The worst case scenario for the site is one of effluent and pollutants from the site or main sewer discharging into the ground, contaminating the soil and geological substrate. The likelihood of this scenario is very low however, as all pipe lines will be tested prior to connection to the main sewer and any work in the vicinity of the main sewer will be monitored for breakages in the pipeline. Any oil or petrol storage tanks will be located in suitable bunded areas.

The proposed mitigation measures and the predicted impact of these potential impacts are addressed below.

### **5.8.5.3 Do-Nothing Impact**

Due to the relatively thick layer of impermeable boulder clay, contaminated soil from the made ground layer is highly unlikely to leach down to the underlying groundwater.

There will be no impact on the soils and geology of the area in the "Do Nothing" scenario.

## **5.8.6 Mitigation Measures**

### **5.8.6.1 Demolition and Construction Phase**

The primary mitigation measure during the construction phase will be the implementation of the Construction Management & Waste Management Plan and the procedures described in Chapter 5.14: Material Assets - Waste Management, of this EIAR.

Three options have been considered to avoid the transfer of contaminated subsoil from the upper made ground layers into the groundwater layer during the construction of the substructures. Firstly, the installation of underpinning and temporary retaining walls together with the removal of contaminated subsoil prior to the commencement of piling will ensure piling through uncontaminated ground and avoid contamination of the underlying groundwater. Secondly, casing of piles over the upper 4 – 5 metres will isolate the contaminated ground from the piling operation. Thirdly, if shown to be feasible after the design stage site investigation, the piling option could be replaced by a raft solution which would not affect the underlying groundwater.

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 phase 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.

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.

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 phase will be short term only in duration.

#### Removal and Disposal of Contaminated Materials

Excavated material from the Proposed Development will be disposed of as set out in Chapter 5.14: Material Assets - Waste Management of this EIAR.

Where contaminated soils are encountered during works on the public realm in Parnell Square North, they will be excavated and disposed of-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.

#### **5.8.6.2 Operational Phase**

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

## **5.8.7 Predicted Impact of the Proposed Development**

### **5.8.7.1 Demolition and Construction Phase**

The proposed development will result in a surplus of excavated material which has been identified to contain contaminants. The contaminated material will be exported to an approved licensed waste facility as described in Chapter 5.14: Material Assets - Waste Management, of this EIAR.

The removal of contaminated soil prior to the commencement of piling, will ensure that piling takes place through uncontaminated ground and avoids contamination of the underlying groundwater.

This is likely to be a slight negative, short term impact during the construction phase.

### **5.8.7.2 Operational Phase**

During the operational stage, the buildings and public realm will be an urban environment covered in roof and hard standing.

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

### **5.8.7.3 Worst Case Impact**

During excavation works, site operatives could be adversely exposed to contaminated materials. To prevent this occurrence, site personnel will be issued with appropriate personal protective equipment by the contractor.

During underpinning works at basement level, the soil supporting the adjoining buildings could be destabilised. To prevent such an occurrence, lateral support will be provided through temporary retaining works.

During the installation of piles, contaminated soil could be transferred to groundwater. To prevent this occurrence, contaminated soil will be removed prior to the commencement of piling.

During the groundworks phase including the development of the public realm works, soil spillage could be washed into the public drainage system. To prevent such an occurrence, 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.

During the construction phase, spillage of hydrocarbon fuels could contaminate the subsoil and / or groundwater. To prevent such an

occurrence, any oil or petrol storage tanks will be located in suitable bunded areas.

## **5.8.8 Monitoring / Reinstatement**

### **5.8.8.1 Demolition and Construction Phase**

The operation of the Outline Construction Management & Waste Management Plan and the operation of Chapter 5.14: Material Assets - Waste Management should be monitored by the project team for the proposed development.

Any issues arising addressed by the project team.

### **5.8.8.2 Operational Phase**

No monitoring of soil or geology is expected to be required during the operational phase of the proposed development.

### **5.8.9 Interactions**

The interactions between Soil & Geology and the other chapters of the EIAR are set out below.

#### **Population and Human Health**

The human health of the population will be safeguarded during the excavation of contaminated subsoil to be undertaken for the construction of groundworks within and at the rear of Nos 23 – 28 Parnell Square North by the implementation of best management construction management measures including implementation of the Construction Management & Waste Management Plan.

#### **Biodiversity**

During the construction phase, the Contractor will implement the Construction Management and Waste Management Plan to contain any areas at risk of contaminated runoff.

As a result, there will be no significant impact on Biodiversity due to the implementation of best management construction management measures.

#### **Water (Drainage, Supply and Flood Risk)**

Excess material excavated during the installation of new water supply and drainage services will be stored, handled and disposed of as per Chapters 5.9 and 5.14 of this EIAR.

#### **Air – Noise and Vibration**

The noise and vibration generated during the construction of the groundworks within and at the rear of 23 – 28 Parnell Square North and during the repaving of the public realm will be controlled and monitored as set out in Chapter 5.10 of this EIAR.

### **5.8.10 Cumulative Impacts**

The proposed development is located in the city centre where development is continually occurring.

No other significant projects have been identified in the area of the proposed development which would result in a significant cumulative impact on Water either during the demolition, construction or operational phases.

### **5.8.11 Difficulties Encountered**

No particular difficulties were encountered during the compilation of this chapter.

### **5.8.12 Consultations**

No pre-planning consultations, discussions or meetings were held by the project design team with the GSI, EPA or DCC in relation to Soils or Geology.

### 5.8.13 Bibliography

The following documents were consulted during the preparation of Chapter 5.8 Soil & Geology

#### Reports

- Ground Investigation Report, Ground Investigations Ireland, 25 July 2018.
- 5.7 Soils, Geology and Hydrogeology, Arup, May 2018.
- Report on a Site Investigation for Development at North Frederick Lane, IGSL, 2004.
- Site Investigation Report for Colaiste Mhuire, Site Investigations Ltd, February 2014.
- Existing Buildings Stage 2b Cost Plan Rev3, Workbook 69, Arup, 23rd May 2018.
- New Build Stage 2b Cost Plan Rev3, Workbook 70, Arup, 18th May 2018.
- Groundworks Overview, Workbook 76, Arup, July 2018.
- Outline Construction Management & Waste Management Plan, Issue 1, Arup, 4th September 2018.
- Guidelines for the Management of Waste from National Road Construction Projects, NRA, 2008.
- Guidelines on Information to be contained in Environmental Impact Statements, EPA, 2002.

#### Figures

- Figure 10.1 Site Location, Arup, 9th May 2018
- Figure 10.2a Historical Mapping, John Roque, Arup, 9th May 2018
- Figure 10.2b Historical Mapping, 6 inch B & W 1837 – 1842, Arup, 9th May 2018
- Figure 10.2c Historical Mapping, 6 inch B & W 1888 – 1913 Arup, 9th May 2018
- Figure 10.3a Aerial Photography 1995, Arup, 9th May 2018
- Figure 10.3b Aerial Photography 2000, Arup, 9th May 2018
- Figure 10.3c Aerial Photography 2005, Arup, 9th May 2018
- Figure 10.3c Aerial Photography Current Imagery, Arup, 9th May 2018
- Figure 10.4 GSI Subsoils, Arup, 9th May 2018

- Figure 10.5 GSI Depth to Bedrock, Arup, 9th May 2018
- Figure 10.6 GSI Bedrock Geology, Arup, 9th May 2018
- Figure 10.7 Granular Aggregate Potential, Historic and Active Quarries, Arup, 9th May 2018
- Figure 10.8 Nearby Waterbodies, Arup 9th May 2018
- Figure 10.9 Ground Recharge and Abstraction Wells, Arup, 9th May 2018
- Figure 10.10 Groundwater Vulnerability, Arup, 9th May 2018
- Figure 10.11 Protected Features, Arup, 9th May 2018.
- Figure 10.12 EPA Licensed Facilities, Arup 9th May 2018.
- Figure 10.13 Ground Investigation Location Plan, Arup, May 2018
- Figure 10.14 Conceptual Site Model (blank), Arup 10th May 2018