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CIVIL & STRUCTURAL



CONSTRUCTION & ENVIRONMENTAL MANAGEMENT PLAN

**RESIDENTIAL DEVELOPMENT AT COOKSTOWN ROAD, ENNISKERRY,
CO. WICKLOW**

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ENNISKERRY**

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**CONSTRUCTION & ENVIRONMENTAL MANAGEMENT PLAN
FOR THE
COOKSTOWN ROAD RESIDENTIAL DEVELOPMENT, ENNISKERRY**

barrett mahony

TABLE OF CONTENTS

1.0 INTRODUCTION	3
1.1 PROJECT DESCRIPTION	3
1.2 PURPOSE OF THE REPORT	4
1.3 KEY INTERFACES	5
2.0 SITE TOPOGRAPHY.....	6
3.0 GROUND CONDITIONS.....	7
3.1 GROUND CONDITIONS:.....	7
3.2 CONSTRUCTION CONSIDERATIONS:.....	7
4.0 DEMOLITION	7
5.0 EARTHWORKS.....	7
6.0 NEW CONSTRUCTION	8
7.0 CONSTRUCTION MANAGEMENT.....	8
7.1 CONSTRUCTION PROGRAMME & PHASING	8
7.2 HOARDING & SITE SECURITY	8
7.3 CRANES.....	9
7.4 SITE ACCOMMODATION & SITE PARKING	9
7.5 HOURS OF WORKING / DELIVERY TIMES	9
7.6 TRAFFIC MANAGEMENT.....	10
7.6.1 <i>General</i>	10
7.6.2 <i>Contractor's Traffic Management Plan</i>	11
7.6.3 <i>Public Traffic</i>	11
7.6.4 <i>Construction Traffic</i>	11
7.6.5 <i>Measures to Minimise Construction Vehicle Movements</i>	12
7.7 SITE SECURITY.....	12
7.8 COVID-19	13
7.9 WATER SUPPLY.....	13
7.10 GROUNDWATER CONTROL/DE-WATERING.....	13
7.11 PUBLIC RELATIONS/COMMUNITY LIAISON	13
8.0 ENVIRONMENTAL CONSIDERATIONS.....	14
8.1 ENVIRONMENTAL IMPACT ASSESSMENT REPORT	14
8.2 NOISE	14
8.2.1 <i>Noise Mitigation Measures</i>	14
8.2.2 <i>Construction Phase Noise Control & Mitigation</i>	15
8.2.3 <i>Construction Phase Vibration Control & Mitigation</i>	17
8.3 DUST & AIR QUALITY.....	17
8.4 PROTECTION TO WILDLIFE	18
8.5 POLLUTION CONTROL.....	19
8.5.1 <i>General</i>	19
8.5.2 <i>Surface Water Drainage & Ground Water Control</i>	19
8.5.3 <i>Soil</i>	20
8.5.4 <i>Harmful Materials</i>	20
8.6 REINSTATEMENT / ROAD CLEANING.....	20
8.6.1 <i>Construction Stage</i>	20
8.6.2 <i>On Completion</i>	20
9.0 MONITORING & PROTECTION OF NEIGHBOURING PROPERTIES	21
9.1 MONITORING WORKS SPECIALIST.....	21
9.2 CONDITION SCHEDULES	21
9.3 MOVEMENT & VIBRATION MONITORING.....	21
9.4 NOISE & DUST MONITORING / CONTROL:	21
9.5 RECORDING:.....	21
APPENDIX 1 - SITE LAYOUT PLAN	
APPENDIX 2 - EXTRACT FROM THE GEOTECHNICAL REPORT	

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

Cairn Homes Properties Ltd., intend to apply to An Bord Pleanála for permission for a strategic housing development on lands within the townland of Cookstown, Enniskerry, Co. Wicklow relating to lands with an overall area of c. 6.6 hectares, including a strip to facilitate footpath and lighting upgrades on the Cookstown Road. Barrett Mahony Consulting Engineers (BMCE) have been commissioned by Cairn Homes Properties Ltd. to prepare a Construction & Environmental Management Plan Report for a proposed residential development.

This report will form part of the strategic housing development (SHD) submitted to An Bord Pleanála.

The development will consist of the construction of 165 no. dwellings and associated ancillary infrastructure as follows:

- a) 105 no. 2 storey houses (49 no. 3 bedroom houses [House Types B, B1, & B2], 56 no. 4 bedroom houses [House Types A, D, E & E1])
- b) 56 no. apartments/duplex apartments in 6 no. 3 storey buildings – (28 no. 2 bedroom apartments and 28 no. 3 bedroom duplex apartments) all with terrace
- c) 4 no. 1 bedroom Maisonette dwellings in a 2-storey building
- d) Part 2-storey and single storey creche (c. 510 sq. m - including storage)
- e) Open space along southern boundary of c. 0.93 hectares [with pedestrian connections to boundary to 'Lover's Leap Lane' to the south and to boundary to the east and west], hard and soft landscaping (including public lighting) and open space (including boundary treatment), communal open space for duplex apartments; regrading/re-profiling of site where required [including import/export of soil as required] along with single storey bicycle/bin stores and ESB substation
- f) Vehicular access (including construction access) from the Cookstown Road from a new junction as well as 313 no. car parking spaces and 150 no. cycle spaces
- g) Surface water attenuation measures and underground attenuation systems as well as connection to water supply, and provision of foul drainage infrastructure (along the Cookstown Road to existing connection at junction with R760) and provision of underground local pumping station to Irish Water specifications
- h) 3 no. temporary (for 3 years) marketing signage structures [2 no. at the proposed entrance and 1 no. at the junction of the R760 and the Cookstown Road] and a single storey marketing suite (c. 81 sq.m) within site
- i) All ancillary site development/construction/landscaping works, along with provision of footpath/public lighting to Powerscourt National School pedestrian entrance and lighting from Powerscourt National School entrance to the junction of the R760 along southern side of Cookstown Road and pedestrian crossing across Cookstown Road.



Photo 1A. – Aerial view of the site

Construction of the development involves the following principal elements:

- Site strip. Earthworks associated with the construction of the houses and roads in the development.
- Construction of new buildings - houses, duplex units & creche.
- Construction of roads, footpaths & hard/soft landscaping.
- Buried site services installation. New foul pumping station. Connection to public services.
- Works to the Cookstown Road along the site boundary, and a new footpath along the southside of the road as far as the existing school crossing. Installation of public lighting on the road.

1.2 PURPOSE OF THE REPORT

This report has been prepared as part of the Planning Application for the Cookstown Road development. The purpose of this report is to ensure that best construction management practices are applied to the site by the main contractor and that measures are in place during construction to reduce as much as possible the impact of the works on people, property and the environment. The contractor will be asked to develop this outline report further in line with his/her detailed requirements.

There is also a Construction Waste & By Product Management Plan and Operational Waste Management Plan accompanying this planning application, they should be read in conjunction with this report.



Photo 1B. View of the site through the entrance gate off the Cookstown Road

1.3 KEY INTERFACES

This site is currently a grass pasture field for the grazing of livestock. The site boundaries and adjacent land uses are as follows:

- Northside: The site is bounded by the Cookstown Road L1020. The field is separate from the road by a hedgerow just inside the site. This hedgerow includes a number of mature trees. There is a field gate in the hedge accessing onto the road (Photo 1B), which is close to the entrance to the Enniskerry Demense housing estate on the other side of the road.
- Eastside: Mature hedge along the boundary. Single private residence behind with access off the Cookstown Road
- Southside: Hedge along the boundary. Public footpath behind.
- Westside: Hedge along most of this boundary. Adjoining field, currently pasture but with planning for a housing development by others. The north corner of this field, abutting the primary school site alongside the Cookstown Road, is part of the subject site.

2.0 SITE TOPOGRAPHY

A detailed topographical survey of the existing site has been prepared. There is considerable variation in ground levels across the site. In broad terms the site slopes down from south to north from +110 m O.D maximum approx. at the south boundary to +101 m O.D. approx. at the north east corner adjacent to the Cookstown Road, a distance of 325m metres approx.. There is a lesser slope down from west to east across the site of 4 metres approx. Fig 1 shows typical spot levels across the site.

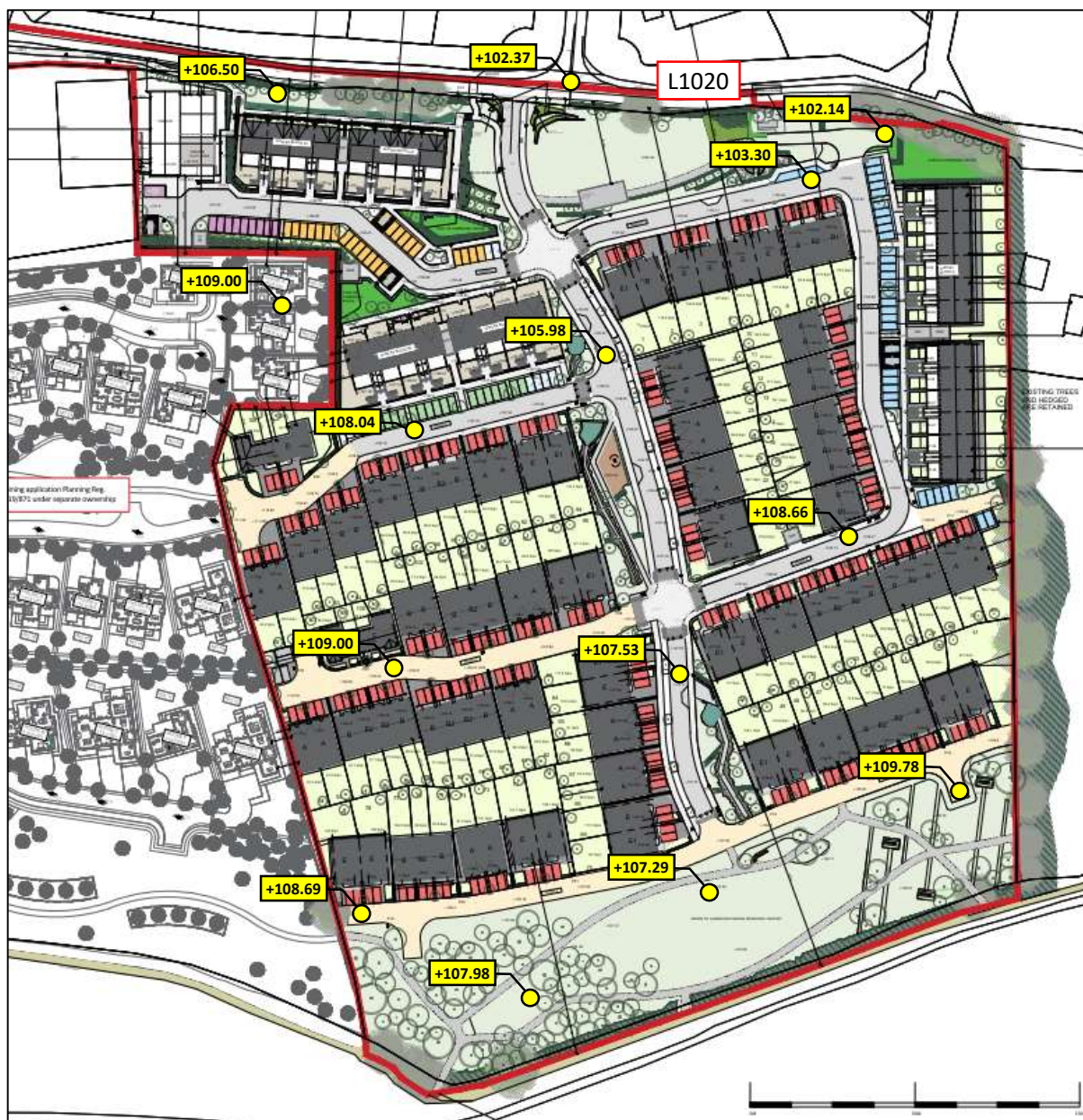


Fig 1. Summary of the Proposed Site Topography superimposed on the proposed project layout (Ordnance Datum Levels).

3.0 GROUND CONDITIONS

A detailed geotechnical and contamination site investigation has been carried out by Site Investigations Ltd under the direction of BMCE. An extract is contained in Appendix 2.

3.1 Ground Conditions:

The typical sequence of stratigraphy is given below. Rock was not encountered in the trial pits or boreholes.

1. Stratigraphy: Topsoil overlying mixed soils – sands, gravels, silts overlying typically sandy gravel at depth. Glacial till (boulder clay) encountered also in a number of locations. No rock encountered in the 18 no. trial pits (circa 2m deep typically) or the 3 no. boreholes (7.5m deep).
2. Bearing capacities: The allowable bearing pressure ABP at 1m below ground level is estimated to be in the range 130 to 180 kPa and the at 2m is in the range 160 to 280 kPa which will allow traditional strip foundations under the buildings. Ground bearing ground floor slabs 150mm thick.
3. Groundwater: None encountered in the trial pits or boreholes.
4. Soakaways: The soakaway test results indicate good infiltration values for soakaway & permeable pavement design.
5. Contamination: Contamination testing of 7 no. samples indicates that the material on site is Non-Hazardous Inert material.
6. Sulphates & Ph values for concrete: Results are in the acceptable range where no special measures need to be taken in the concrete mix design.

3.2 Construction Considerations:

- Excavations: The trial pits indicate that excavations should be stable for short periods. However, when granular soils are encountered then the stability of vertical excavations is reduced compared to cohesive soils and therefore regular inspection of temporary excavations should be completed during construction to ensure that all slopes are stable. Temporary support should be used on any excavation that will be left open for an extended period. Trenches to install services within Glacial Till will be stable at steep angles in the short term. This will avoid the requirement for shoring where man entry is not required.
- Ground Water & Dewatering:
De-watering in excavations due to groundwater is unlikely to be required on this site.
- Contaminated Material:
Rilta test results from the SI indicate Non-Hazardous Inert Material. The advice of an Environmental Engineer should be sought before disposal of material off site.

4.0 DEMOLITION

No demolition work required on this site.

5.0 EARTHWORKS

The draft bulk earthworks are associated with the site strip and with some levelling & re-grading of the site to accommodate road/footpath gradients as necessary. The site has been modelled in the Civils 3d software package. Excavated subsoil will be used as fill on the site. The fill volume exceeds the cut volume and so material will need to be imported onto site. Estimated earthworks quantities are set out in Table 1 below.

Table 1: Estimated Excavation Quantities

Item	Topsoil (m ³)	Soil (m ³)
*Site Strip	7720	-
Fill above site strip level	-	13,793
Bulk Excavation below site strip level	-	20,894
Allowance for the excavation for buried services	-	1,200
Total excavation less fill		14,821

* Includes assumed topsoil strip 300mm deep of the development area, which is assumed to be re-used on site.

Using a 30.0 tonne capacity (16m³) articulated truck, the net fill into the site equates to approximately 926 no. truck movements.

Soil stripping, earthworks and stockpiling of soil will be carried out during the works. Stockpiles have the potential to cause negative impacts on air and water quality. The effects of soil stripping and stockpiling will be mitigated through the implementation of an appropriate earthworks handling protocol during construction. It is anticipated that any stockpiles will be formed within the boundary of the excavation and there will be no direct link or pathway from this area to any surface water body. It is anticipated that only local/low level of stockpiling will occur as the bulk of the material will be excavated either straight into trucks for transport off site or will be reused in other areas of the site as fill. Any excavated material to be disposed off-site will go to a licensed facility.

6.0 NEW CONSTRUCTION

In summary the construction of the development will involve the following:

- Site strip. Earthworks associated with the construction of the houses, duplex units, creche and roads in the development.
- Construction of new buildings - houses, duplex units & creche, including ancillary buildings such as bike stores, bins stores and an ESB substation.
- Construction of roads, footpaths & hard/soft landscaping.
- Buried site services installation. New foul pumping station. Connection to public services.
- Works to the Cookstown Road along the site boundary, and construction/installation of a new footpath and public lighting along the southern side of Cookstown Road towards Enniskerry. Installation of public lighting on the road.

7.0 CONSTRUCTION MANAGEMENT

7.1 Construction Programme & Phasing

The project may be constructed and handed over in a number of phases for commercial reasons. The exact number of phases and the make-up of each will be subject to market conditions and commercial considerations at the time. However, at present it is envisaged that the development will be constructed in 1 phase.

7.2 Hoarding & Site Security

The new works will be hoarded off or fenced off from the public at all times. A 2.4m minimum high plywood painted timber hoarding will be provided along the Cookstown Road boundary after tree/hedge removal here and at any other areas around the site where the perimeter fence/hedge is not deemed sufficient for safety and security reasons. Heras type fencing will be used on short term site boundaries where appropriate to suit the works. The hoarding alignment and specification are to be confirmed by the Contractor prior to commencement.

Controlled access points to the site, in the form of gates or doors/turnstiles, will be kept locked for any time that these areas are not monitored (e.g. outside working hours).

During working hours, a gateman will control traffic movements and deliveries at any active site access to ensure safe access and egress to & from site onto the public roads. All personnel working on site must have a valid Safe Pass card and be inducted by the Main Contractor with regard to site specific information.



Photo 2 – Typical Site Hoarding Arrangement

7.3 Cranes

Tower cranes will not be required on site. Mobile cranes may be used for some activities. All materials being lifted by crane will be controlled by guide ropes and will only be carried out under the strict supervision of appropriately qualified and experienced banksmen.

Any works outside of the site boundary will be subject to a method statement to be agreed with Wicklow County Council.

7.4 Site Accommodation & Site Parking

On site accommodation will consist of:

- Staff welfare facilities (toilets, canteen, offices/meeting rooms,)
- Materials storage areas and drop off.

Temporary water supply, electricity supply and foul drainage will be required for the new facilities. Connections to electricity & water are available close to the site boundary. Foul drainage will need to be taken to a vented holding tank for regular removal by suction tanker.

Limited parking for construction personnel will be provided within the site for the period of construction. The site is within walking distance of Enniskerry Village which is served by a number of Dublin Bus routes. The contractor parking areas are to be confirmed by the Contractor prior to commencement.

7.5 Hours of Working / Delivery Times

Unless required otherwise by Wicklow County Council, it is proposed that standard construction working hours should apply, i.e.:

- 7am to 6pm Monday to Friday
- 8am to 2pm on Saturdays.

Any works proposed outside of these periods shall be strictly by agreement with the Local Authority in advance.

7.6 Traffic Management

7.6.1 General

The works associated with the new development will result in additional traffic on the road network with the vehicles for the importation of earthworks fill material and the delivery of new materials for construction – concrete, concrete blocks, pipes, timber, roof tiles, glazing, road surfacing materials etc.

Construction traffic access to the site will be via an entrance off the Cookstown Road at or close to the existing field gate.

It is proposed that unloading bays should be provided for deliveries to the site within the hoarding perimeter. Appropriately demarcated storage zones will be used to separate and segregate materials.

All deliveries to site will be scheduled to ensure their timely arrival and avoid the need for storing large quantities of materials on site. The storage area is to be located at least 50m from the site access to allow for the possibility of traffic queuing inside the site without any interference with the public road. Deliveries and site traffic to and from the site should avoid, when possible, busy school traffic periods for the adjacent national school.



Photo 3 – View along the Cookstown Road looking eastwards. Entrance to Enniskerry Demense housing estate on the left and existing field gate entrance to the subject site on the right (Photo 1B).

Going eastwards, the Cookstown Road becomes narrower beyond the site & unsuitable for lorries & flatbed trucks. Larger vehicular traffic should access the site from the Enniskerry Village direction.

7.6.2 Contractor's Traffic Management Plan

A Traffic Management Plan will be prepared by the contractor and agreed with Wicklow County Council's Transportation Department & An Garda Síochána, to mitigate any impact of construction on the surrounding road network. The contractor should also liaise with the local Powerscourt National School while preparing the traffic management plan to ensure a coordinated and safe strategy for construction traffic during busy school commuting hours. The Traffic Management Plan will provide for the following where required:

1. The contractor shall be responsible for and make good any damage to existing roads or footpaths caused by his own contractor's or suppliers transport to and from the site.
2. The contractor shall at all times keep all public and private roads, footpaths entirely free of excavated materials, debris, rubbish, provide vehicle wheel wash and thoroughly clean all wheels and arches of all vehicles as they leave the site.
3. The contractor shall confine his activities to the area of the site occupied by the works and the builders' compound, as far as practicably possible, during any particular phase of the development.
4. Haul routes to and from the site will be defined and agreed with the Local Authority.
5. Properly designed and designated entrance and egress points to the construction site for construction traffic will be used to minimize impact on external traffic.
6. Flagmen shall be used to control the exit of construction vehicles from the site onto the public road, if required.
7. Existing fire hydrants are to remain accessible as required.

Suggested headings for the Contractor's Traffic Management Plan (not exhaustive)

- Construction Traffic Management – General Requirements
- Traffic Safety and Control
- Temporary Traffic Diversions & one-way systems
- Emergency Contact Numbers and Personnel
- Emergency Plan
- Access Arrangements
- Compound and Staff Parking

7.6.3 Public Traffic

For safety & convenience, the management of public traffic, both pedestrian & vehicular, is a key part of the construction management process.

7.6.4 Construction Traffic

The vehicles associated with the construction activities are as follows: -

- Excavators
- Dump trucks
- Concrete delivery trucks
- Concrete pumps
- Delivery trucks – flatbed & containers
- Mobile cranes
- Mobile hoists

Construction traffic access from the N11 will be limited to using the R117 and R760. Local road L1020, between the site entrance and the N11 is not suitable for construction traffic.

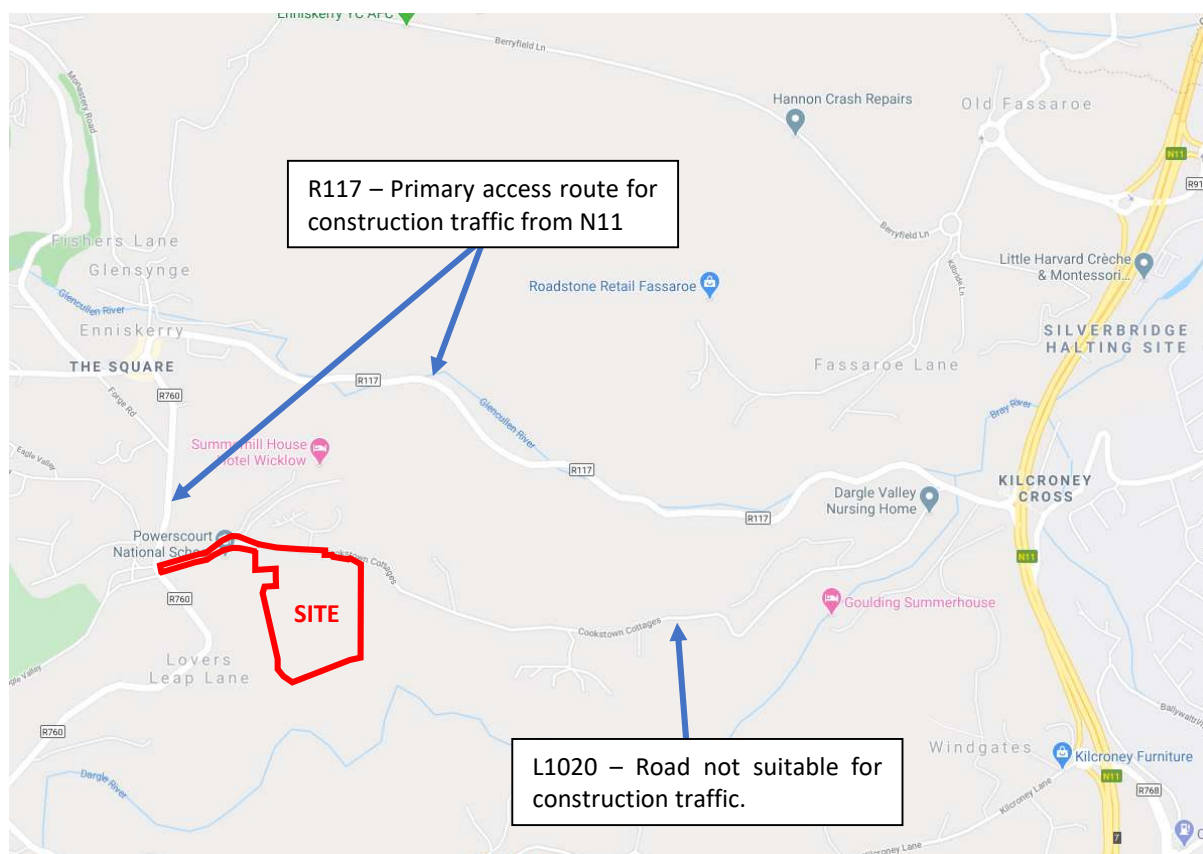


Fig 2. Construction traffic access route from the N11.

7.6.5 Measures to Minimise Construction Vehicle Movements

Construction vehicle movements will be minimised through:

- Consolidation of delivery loads to/from the site and scheduling of large deliveries to site to occur outside of peak periods;
- Use of precast/prefabricated materials where possible;
- 'Cut' material generated by the construction works will be re-used on site where possible, through various accommodation works.
- Adequate storage space on site will be provided;
- Construction staff vehicle movements will also be minimised by promoting the use of public transport.
- Car sharing among the construction staff following Covid-19 safety guidelines may be used to reduce traffic numbers.
- Public Transport: An information leaflet to all staff as part of their induction on site highlighting the location of the public transport services in the vicinity of the construction site.

7.7 Site Security

The Contractor will be responsible for the security of the site. The Contractor will be required to:

- Operate a site induction process for all site staff.
- Ensure all site staff shall have current 'safe pass' cards.
- Install adequate site hoarding to the site boundary.
- Maintain site security staff at all times.
- Separate pedestrian access from construction at the main site entrance off the Cookstown Road and provide a safe walkway for pedestrians along the main access road into the site.
- Ensure restricted access is maintained to the works.

7.8 COVID-19

The Contractor is to follow the latest CIF safety protocols for COVID-19 in relations to all activities on site, in relation to travel to & from home to site for all staff, in relation to site visitors and in relation to any other relevant activities connected with the construction of the development.

7.9 Water Supply

A water supply will be required for various activities on site.

The main contractor will require a water source for the duration of the works. Water will be required for:

- Main contractor's welfare facilities.
- Wheel wash and vehicle wash-down (use recycled water where feasible).
- Dust suppression (as applicable).
- Curing of concrete in warm weather.
- General construction cleaning materials/equipment etc.

There are existing public water mains on the Cookstown Road, which could be used during the construction subject to Irish Water approval.

7.10 Groundwater Control/De-Watering

The ground conditions and likely groundwater flow rates are discussed in Section 3 of this report. It is not anticipated that there will be any significant de-watering required on site.

7.11 Public Relations/Community Liaison

The site is located in a rural area on the edge of Enniskerry Village. The Main Contractor will be required to ensure that all agents, sub-contractors and suppliers act in a manner to minimise disruption to the locality. Construction staff will be encouraged to remove all Personal Protective Equipment (PPE) and use wash down facilities before leaving the site.

A senior site staff member should be appointed as a Liaison Manager and should be responsible for the following:

- Participation and distribution of a local information leaflet on site activities.
- Briefing as necessary with neighbours on progress and issues.
- Liaison with the Local Council and emergency services as appropriate.
- Liaison with An Garda Síochána, particularly in relation to traffic movements and permits.
- Preparation of reports for the site meetings on neighbourhood issues if they arise.

Efficient signage, maintenance and cleanliness of services and temporary facilities will be given high priority.

Due to the nature of construction works, it is essential to operate Good Neighbour Policies wherever possible. The key aspects of the Projects Team's good neighbour policy include:

- Early implementation
- Good client, staff and neighbourhood liaison.
- Reduction of nuisance factors.
- Clear access for neighbouring premises.
- Clear and concise information.
- Designated liaison officer.
- Working within the prescribed hours

It is essential that the Good Neighbour Policy and any necessary procedures be in place before any works are commenced on site.

8.0 ENVIRONMENTAL CONSIDERATIONS

The main contractor will be required to be accredited with ISO14001 Environmental Management Systems. The main contractor will be required to mitigate the impact of the construction works on the environment. Proposed measures in relation to a number of items are set out below.

8.1 Environmental Impact Assessment Report

An Environmental Impact Assessment Report (EIAR) has been prepared as part of the planning application package. In addition to the various measures noted in this report, a series of impact mitigation measures have been set out in the EIAR. The contractor shall implement these measures. These measures are summarised in a specific mitigation measures Chapter of the EIAR.

8.2 Noise

Some impact of noise is likely to occur as a result of the construction activity. Construction work is of a temporary nature and the resulting noise levels are usually acceptable, subject to typical management and time control procedures which are common to most development projects.

Construction plant used on site will comply with the relevant Irish regulations in relation to noise and vibration requirements.

Noise will be minimized as far as possible, by limiting the use of compressors and other plant to stated hours and by fitting and use of silencing devices wherever practicable. Attention should be paid to the recommendations given in the latest version of BS 5228. 'Noise Control on construction & Open Sites' & BS 6187 Code of Practice for Demolition.

8.2.1 Noise Mitigation Measures

The following noise management measures shall be implemented at the site from the outset of site activities to control and manage noise levels during the construction phase of the proposed development:

- An independent acoustic consultant shall be engaged by the contractor prior to the commencement of site activities to ensure that all noise mitigation measures as specified in this Section of the EIAR are implemented and to prepare a site-specific *Construction Phase Noise Management Plan*. The Plan shall include all relevant noise and vibration control measures as specified in this Chapter of the EIAR. The Plan shall be submitted to Wicklow County Council for approval as required.
- The nominated contractor shall appoint a designated person to manage all environmental complaints including noise and vibration.
- A noise complaint procedure shall be implemented in which the details of any noise related complaint are logged, investigated and where required, measures are taken to ameliorate the source of the noise complaint.
- Appropriate signage shall be erected on all access roads in the vicinity of the site to inform HGV drivers that engines shall not be left idling for prolonged periods and that the use of horns shall be banned at all times.
- HGV's queuing on any local or public road shall not be permitted and it shall be the responsibility of site management to ensure this policy is enforced.
- All onsite generator units (if required) used to supply electricity to the site shall be silenced models or enclosed and located away from any receptor.
- The site compound shall be located at a point on site furthest away from any existing residential development.
- Mains power shall be used to supply electricity to all site offices and site lighting at the earliest instance.
- The use of generators during the night-time shall be avoided.

8.2.2 Construction Phase Noise Control & Mitigation

The following shall be implemented to mitigate construction noise impacts in order to ensure that the construction phase of the development does not have an unacceptable impact on sensitive receptors:

- A strictly enforced noise management programme shall be implemented at the site from the outset of construction activities.
- The Developer shall appoint an acoustic consultant independent of the Contractor to conduct routine noise audit surveys which shall be conducted at the baseline noise monitoring locations throughout the construction phase of the development to assess compliance with the construction noise limit criteria detailed in the relevant chapter of the EIAR, and to assess the effectiveness and implementation of the specific Construction Phase noise mitigation measures detailed in this document.
- The principal of controlling noise at source shall be implemented at the site. Best practice mitigation techniques as specified in *BS 5228:2009+A1 2014 – Noise and Vibration Control on Construction and Open Sites* shall be implemented during the construction phase and are detailed in this Section.
- Noisy stationary equipment shall be sited away from sensitive site boundaries as far as practicable.
- Where reasonable, practicable, noisy plant or activities shall be replaced by less noisy alternatives if noise breaches and/or complaints occur.
- Proper use of plant with respect to minimising noise emissions and regular maintenance will be required.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and will be maintained in good efficient order
- Where noisy plant is required to operate in work areas next to residential houses low noise plant options will be used wherever practicable.
- Dumpers and any plant used for moving materials around the site will have high performance exhaust silencers.
- Selected use of rubber-tyred equipment over steel track equipment where practicable.
- The use of inherently quiet plant is required where appropriate – all compressors and generators will be “sound reduced” or “super silent” models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers.
- All compressors, generators and pumps shall be silenced models fitted with properly lined and sealed acoustic covers or enclosures, which will be kept closed whenever the machines are in use.
- All pneumatic percussive tools such as pneumatic hammers shall be fitted with dampers, mufflers or silencers of the type recommended by the manufacturer.
- Fixed items of plant shall be electrically powered in preference to being diesel or petrol driven.
- Vehicles and mechanical plant utilised on site for any activity associated with the works shall be fitted with effective exhaust silencers and shall be maintained in good working order and operated in a manner such that noise emissions are controlled and limited as far as reasonably practicable.
- Any plant, equipment or items fitted with noise control equipment found to be defective in shall not be operated until repaired / replaced.
- Machines in intermittent use shall be shut down in the intervening periods between works or throttled down to a minimum during periods when not in use.
- Static noise emitting equipment operating continuously shall be housed within suitable acoustic enclosure, where appropriate.
- All excavator mounted pneumatic breakers used for demolition and ground breaking activities shall be fitted with effective dampeners and /or enclosed within a noise adsorbing blanket structure to minimise noise emissions.
- Site activities shall be staggered when working in proximity to any receptor, that is concrete cutting and rock breaking should where possible. This proposed method of working will provide effective noise management of site activities to ensure that any receptor is not exposed to unacceptably high levels of noise over extended periods.
- Excessive revving of all vehicles shall be avoided.
- Unnecessary dropping of heavy items onto ground surfaces shall be banned.
- The use of an excavator bucket to break up slabs of concrete or tarmacadam shall not be permitted.

- The dragging of materials such as steel covers, plant or excavated materials along ground surfaces shall not be permitted.
- The use of acoustic screens to attenuate noise at source shall be implemented as deemed necessary.
- Plant Reversing Alarms: Where reasonably practicable and deemed safe by risk assessment, taking into account onsite hazards and working environment, the tonal reversing alarms of mobile plant shall be replaced with broadband alarms.
- A nominated person from the Project Management team will be appointed to liaise with local residents and businesses regarding noise nuisance events.
- In the event of the requirement for out of hours work to occur which will involve the generation of noise levels that are predicted to exceed out of hours noise limit criteria, Wicklow County Council shall be immediately notified prior to the works commencing.
- A nominated person from the Project Management team will be appointed to liaise with and inform local residents and Wicklow County Council regarding out of hours works.
- An independent acoustic consultant shall review the implementation of the recommended mitigation measures on a monthly basis.
- The images below describe the use of localised noise screens that shall be used during construction activities.



Double height acoustic blanket enclosure



Acoustic blankets screening excavations



3 sided Acoustic enclosure for surrounding breaking, cutting works

8.2.3 Construction Phase Vibration Control & Mitigation

The following specific vibration mitigation and control measures shall be implemented during the construction phase:

- Breaking out concrete elements using low vibration tools
- Choosing alternative, lower-impact equipment or methods wherever possible
- Scheduling the use of vibration-causing equipment, such as jackhammers, at the least sensitive time of day
- Routing, operating or locating high vibration sources as far away from sensitive areas as possible
- Sequencing operations so that vibration causing activities do not occur simultaneously
- Isolating the equipment causing the vibration on resilient mounts
- Keeping equipment well maintained.
- Confining vibration-generating operations to the least vibration-sensitive part of the day which could be when the background disturbance is highest
- A nominated person from the Project Management team will be appointed to liaise with local residents and businesses regarding vibrational nuisance events.
- An independent acoustic consultant shall review the implementation of the recommended mitigation measures on a monthly basis.
- In order to ensure that site construction activities are conducted to minimise the vibration impacts on the receiving environment, structural vibration monitoring shall be conducted during the course of the project works.
- As detailed in the relevant chapter of the EIAR, the transient vibration guide values for cosmetic damage as specified in British Standard BS 7385: Evaluation and measurement for vibration in buildings, Part 2 1993 Guide to damage levels arising from ground borne vibration is 15 mm/sec Peak Component Particle Velocity at 4 Hz increasing to 20 mm/sec at 15 Hz. This limit value rises to 50 mm/sec at frequencies of 40 Hz and greater. The applied conservative limit of 12.5 mm/sec PPV (peak particle velocity) applied for this assessment is significantly lower than these levels.

Further information on noise and vibration control during the construction stage are contained in the Noise Assessment & Management Report in Appendix 3 of this report.

8.3 Dust & Air Quality

The Contractor's proposals are to include dust control measures in accordance with best practice and with reference to the following:

- Air Pollution Act 1987
- BS 6187: Code of Practice for Demolition

In order to ensure that adverse air quality impacts are minimised during the construction phase and that the potential for soiling of property and amenity and local public roads is minimised, the following mitigation measures shall be implemented during the course of all construction activities:

- Avoid unnecessary vehicle movements and manoeuvring, and limit speeds on site so as to minimise the generation of airborne dust.
- Use of rubble chutes and receptor skips during construction activities.
- During dry periods, dust emissions from heavily trafficked locations (on and off site) will be controlled by spraying surfaces with water and wetting agents.
- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic only.
- Re-suspension in the air of spillages material from trucks entering or leaving the site will be prevented by limiting the speed of vehicles within the site to 10kmh and by use of a mechanical road sweeper.
- The overloading of tipper trucks exiting the site shall not be permitted.
- Aggregates will be transported to and from the site in covered trucks.
- Where the likelihood of windblown fugitive dust emissions is high and during dry weather conditions, dusty site surfaces will be sprayed by a mobile tanker bowser.

- Wetting agents shall be utilised to provide a more effective surface wetting procedure.
- Exhaust emissions from vehicles operating within the construction site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor by ensuring that emissions from vehicles are minimised by routine servicing of vehicles and plant, rather than just following breakdowns; the positioning of exhausts at a height to ensure adequate local dispersal of emissions, the avoidance of engines running unnecessarily and the use of low emission fuels.
- All plant not in operation shall be turned off and idling engines shall not be permitted for excessive periods.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- Material stockpiles containing fine or dusty elements including top soils shall be covered with tarpaulins.
- Where drilling or pavement cutting, grinding or similar types of stone finishing operations are taking place, measures to control dust emissions will be used to prevent unnecessary dust emissions by the erection of wind breaks or barriers. All concrete cutting equipment shall be fitted with a water dampening system.
- A programme of air quality monitoring shall be implemented at the site boundaries for the duration of construction phase activities to ensure that the air quality standards relating to dust deposition and PM₁₀ are not exceeded. Where levels exceed specified air quality limit values, dust generating activities shall immediately cease and alternative working methods shall be implemented.
- A complaints log shall be maintained by the construction site manager and in the event of a complaint relating to dust nuisance, an investigation shall be initiated.
- Dust netting and site hoarding shall be installed along the north, south, east and western site boundaries to minimise fugitive windblown dust emissions falling on third party lands and existing residential areas.

A dust minimisation plan will be formulated for the construction phase of the project. The Contractor will put in place a regime for monitoring dust levels in the vicinity of the site during the works using the Bergerhoff Method. Then minimum criteria to be maintained shall be the limit specified by the Environmental Protection Agency (EPA) for licensed facilities in Ireland which is 350mg/m²/day as a 30-day average.

8.4 Protection to wildlife

In order to reduce the levels of disturbance to wildlife during the construction phase of the project, from noise, vibration, dust, air quality and traffic effects, the following mitigation measures should be implemented:

- Noise screens should be used during construction,
- Turn off machinery when not in use,
- Ensure staff are aware of parking area,
- Provide staff with alternative transport such as bicycles and to ensure deliveries are not queuing outside the site,
- Avoid unnecessary vehicle movements and manoeuvring, and limit speeds on site so as to minimise the generation of airborne dust,
- Use of rubble chutes and receptor skips during construction activities,
- During dry periods, dust emissions from heavily trafficked locations (on and off site) will be controlled by spraying surfaces with water and wetting agents,
- Aggregates will be transported to and from the site in covered trucks,
- Lighting: Lighting design and intensity should be controlled to protect bats in the evening & at night. Use down-lighting and low intensity lights (sodium lamps). Construction equipment such as cranes should be sensitively lit to allow birds to see them at night.

The advice of an ecologist should be obtained in relation to the above. Refer to the Bio-diversity Chapter of the EIAR for further information.

8.5 Pollution Control

Prior to the commencement of construction, the appointed contractor will be required to obtain formal agreement from the Local Authority on pollution prevention measures as well as the overall approach and emergency procedures for all construction stages.

Contractors will have regard to the following best practice guidelines to ensure that water bodies are adequately protected from construction work:

- Construction Industry Research and Information Association (CIRIA) C649: *Control of water pollution from linear construction projects: Technical guidance* (Murnane et al. 2006)
- CIRIA C649: *Control of water pollution from linear construction projects: Site guide* (Murnane et al. 2006)

This plan will provide precise details on methods to prevent sediment or pollutants from leaving the construction site in line with the notes below:

8.5.1 General

- Construction methods used should be tailored to reduce, as much as possible, dust and noise pollution.
- In order to prevent the accidental release of hazardous materials (fuels, paints, cleaning agents, etc.) during site activity, all hazardous materials should be stored within secondary containment designed to retain at least 110% of the storage contents. Temporary bunds for oil/diesel storage tanks should be used on the site during the construction phase of the project. Safe materials handling of all potentially hazardous materials should be emphasised to all construction personnel employed during this phase of the project.
- Prior to the commencement of demolition and construction, details will be provided for locations and safe-guards for refuelling of machinery, machine servicing, concrete-mixing, etc.
- Comprehensive traffic management procedures, including the provision of access to all roads, and access/egress points should be prepared and agreed with the Local Authority. These traffic management measures should be implemented at times when traffic disruption may be experienced.
- Road sweeping and/or wheel wash facilities should be provided, as required.
- All oils/diesel stored on site for construction equipment are to be located in appropriately bunded areas.
- The location and size of stockpile areas for sands and gravel will be specified and identified on the maps.
- Sediment runoff will be minimised by standard engineering measures including sediment skirts around soil stockpiles, sediment retention barriers in surface water drains and the use of adequate construction roads.

8.5.2 Surface Water Drainage & Ground Water Control

Ground conditions on site (sandy gravelly soils) mean that any run-off on the site should be very limited. Notwithstanding this, a method statement is to be prepared by the contractor and if necessary agreed with Wicklow County Council prior to commencement of the works, detailing the measures to be taken to ensure that no water run-off from the site occurs during the construction period. It is noted that the site falls towards the Cookstown Road which already has localised winter flooding issues in the vicinity of the site. Any run-off should be intercepted on site. This will be achieved with open drains or French drains and collected to a soakaway. Run-off control measures to include the following:

- Dewatering measures should only be employed where necessary.
- For groundwater encountered during construction phase, mitigation measures will include;
 - Dewatering by pumping to a soakaway.
 - Excluding contaminating materials such as fuels and hydrocarbons from sensitive parts of the site i.e. highly vulnerable groundwater areas.
- If concrete mixing is carried out on site, the mixing plant should be sited in a designated area with an impervious surface.
- Existing surface drainage channels within the site that serve adjacent lands should be retained where possible to prevent causing increased flooding impacts.

- Any surface water sewer connections should be made under the supervision of the Local Authority/Irish Water and checked prior to commissioning.
- New onsite surface water drains should be tested and surveyed prior to commissioning to prevent any possibility of ingress of ground water.
- All surface water manholes and drains will be inspected and where necessary sealed to ensure that uncontrolled ground water inflow does not occur.
- Filters and silt traps will be used to prevent rain washing silts and other materials into the surface water network and creating blockages.
- Areas surrounding the site are to be protected as necessary from sedimentation and erosion due to direct surface water runoff generated onsite during construction phase. To prevent this from occurring surface water discharge from the site will be managed and controlled for the duration of the construction works, as noted in the points above, until the permanently surface water drainage system of the proposed site is complete.
- Regular inspections of de-watering settlement tanks, if used, are to be carried out and additional treatment used if settlement is not adequate.
- Bunded areas will be created for the storage or use of any fuels, oils, greases, cement, etc.
- Emergency spill kits will be kept close to the works.

8.5.3 Soil

- If un-contaminated, any existing topsoil will be retained on site to be used for the proposed development. Topsoil should be stored in an appropriate manner on site for the duration of the construction works and protected for re-use on completion of the main site works.
- During the demolition and construction phase, all excavations and exposed sub-soils in open cuts will be blinded and protected with clean broken stone as soon as possible after exposing the subsoil in order to prevent erosion.

8.5.4 Harmful Materials

Harmful materials shall be stored on site for use in connection with the construction works only. These materials shall be stored in a controlled manner. Where on site fuelling facilities are used there shall be bunded filling area using a double bunded steel tank at a minimum.

8.6 Reinstatement / Road Cleaning

8.6.1 Construction Stage

Prior to the works commencing, detailed photographic surveys (condition schedules) of adjoining walls, roads, footpaths, fences etc. is to be prepared. Copies of the relevant parts are to be made available to adjoining owners and WCC. This record will form the basis of assessing repairs to adjoining areas in the future should a dispute arise as to their cause. Roadways are to be kept clean of muck and other debris. A road sweeping truck is to be provided if necessary to ensure that this is so.

8.6.2 On Completion

Reinstatement at completion of the works will involve:

- Testing and cleaning of all watermains in the development to the requirements of the IW / WCC prior to connection to the public watermain. This will reduce the risk of contamination to the public water supply when the new network is connected to the system.
- Repair of any damage to any adjacent public roadways, kerbs, grass verges etc. in accordance with WCC requirements.
- Reinstatement of all excavations to the requirements of WCC.
- Leaving the area in a neat and clean condition, removing all deleterious materials that may have been deposited during construction works.

9.0 MONITORING & PROTECTION OF NEIGHBOURING PROPERTIES

A monitoring regime will be put in place to protect neighbours & neighbouring properties with a full and detailed vibration, noise, dust and groundwater monitoring regime put in place for the duration of the works.



Fig 3. Flowchart for the Instrumentation and Monitoring Subcontractor (MSC)

9.1 Monitoring Works Specialist

The Contractor will appoint a competent person to be referred to as the Surveying, Instrumentation and Monitoring Subcontractor (**MSC**) and together with them will prepare and maintain the vibration, noise, dust and groundwater monitoring plan, for the agreement/approval of the Client, Employers Representative and the Technical Advisors.

9.2 Condition Schedules

The MSC will be responsible for preparing or organising the preparation of condition surveys of surrounding buildings, walls, hardstanding area etc. prior to the carrying out of any works on site. Extent of surveys to be agreed.

The condition surveys shall be carried out to a level of detail, suitable to the nature and extent of conditions encountered in order to obtain an understanding of the general structural condition of the property/structure and/or external environments.

9.3 Movement & Vibration Monitoring

Movement & vibration monitoring of adjoining areas are not deemed to be required given the nature of the works and the site location.

9.4 Noise & Dust Monitoring / Control:

Refer to Section 8.2 & 8.3 of this report, and the EIAR for details.

9.5 Recording:

The MSC will monitor, collate and report on noise & dust in report format, on a monthly basis, increased to weekly during critical activities.

APPENDIX

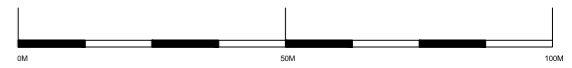
1

SITE LAYOUT





TYPE A STANDARD 4 BED 26 NO. 140.53 SQM	PUBLIC OPEN SPACE 0.4 Ha on Residential zoned lands (7.7 % of 5.18 Ha development area) (0.3885 7.5% required as per AAP) 0.92 Ha on OS1 zoned lands (Linear Park)
TYPE B (SEMI END TERRACE) STANDARD 3 BED 32 NO. 118.87 SQM	DUPLEX COMMUNAL SPACE (COMBINED 0.108 Ha)
TYPE B1 (SIDE ENTRY) STANDARD 3 BED 2 NO. 118.89 SQM	PRIVATE GARDENS
TYPE B2 (MID TERRACE) STANDARD 3 BED 15 NO. 119.84 SQM	ROAD
TYPE D 4 BED 2 NO. 143.80 SQM	HOME ZONE
TYPE E (SEMI D) LARGE 4 BED 20 NO. 180.24 SQM	LIGHTING LAYOUT (REFER TO SABRE PUBLIC LIGHTING LAYOUT)
TYPE E1 (SIDE ENTRY) LARGE 4 BED 8 NO. 181.78 SQM	PRIVATE CAR PARK SPACE (2 no. per house unit)
TYPE F/F1 1 BED MANSCHETTE 4 NO. 56.84 / 64.56	CRECHE CAR PARK SPACE (11 no.)
DUPLEX Block A1, A2, B1, B2, C, D 66 NO. UNITS 3 Storey 9496 SQM	DUPLEX A CAR PARK SPACE (24 no.)
	DUPLEX B CAR PARK SPACE (18 no.)
	DUPLEX C & D CAR PARK SPACE (36 no.)
	UNITS F CAR PARK SPACE (4 no.)
	E CHARGING CAR PARK SPACE (10 no.)



APPENDIX

2

EXTRACT FROM THE
GEOTECHNICAL
REPORT



S.I. Ltd Contract No: 5638

Client: Cairn Homes Ltd
Engineer: Barrett Mahony
Contractor: Site Investigations Ltd

Cookstown Lane,
Enniskerry, Co. Dublin
Site Investigation Report

Prepared by:

.....
Stephen Letch

Issue Date:	08/10/2019
Status	Final
Revision	1

<u>Contents:</u>	Page No.
1. Introduction	1
2. Fieldwork	1
3. Laboratory Testing	3
4. Ground Conditions	3
5. Recommendations and Conclusions	4

Appendices:

1. Cable Percussion Borehole Logs
 2. Trial Pit Logs and Photographs
 3. Soakaway Test Results and Photographs
 4. Geotechnical Laboratory Test Results
 5. Environmental Laboratory Test Results
 6. Survey Data
-

1. Introduction

On the instructions of Barrett Mahony, Site Investigations Ltd (SIL) were appointed to complete a ground investigation at Cookstown Lane, Enniskerry, Co. Dublin. The investigation was for a new residential development of the site and was completed on behalf of the Client, Cairn Homes Ltd.

The fieldworks comprised a programme of cable percussion boreholes, trial pits, soakaway tests and California Bearing Ratio tests. All fieldwork was carried out in accordance with BS 5930:2015, Engineers Ireland GI Specification and Related Document 2nd Edition 2016 and Eurocode 7: Geotechnical Design. Geotechnical and environmental laboratory testing was completed on representative soil samples recovered from the boreholes and trial pits and these are in accordance with the relevant specification.

This report presents the factual geotechnical data obtained from the field and laboratory testing with interpretation of the ground conditions discussed.

2. Fieldwork

The geotechnical fieldworks were started and completed in September 2019 and comprised the following:

- 3 No. cable percussive boreholes
- 18 No. trial pits
- 1 No. soakaway test
- 9 No. California Bearing Ratio tests

2.1. Cable Percussive Boreholes

Cable percussion boring was undertaken at 3 No. locations using a Dando 150 rig and constructed 200mm diameter boreholes. The boreholes terminated at the scheduled depth of 7.50mbgl. It was not possible to collect undisturbed samples due to the gravel and cobble content in the cohesive soils and the lack of cohesion in the granular soils so bulk disturbed samples were recovered at regular intervals where possible.

To test the strength of the stratum, Standard Penetration Tests (SPT's) were performed at 1.00m intervals in accordance with BS 1377 (1990). In soils with high gravel and cobble content it is appropriate to use a solid cone (60°) (CPT) instead of the split spoon and this was used throughout the testing. The test is completed over 450mm and the cone is driven 150mm into the stratum to ensure that the test is conducted over an undisturbed zone. The cone is then driven the remaining 300mm and the blows recorded to report the N-Value. The report shows the N-Value with the 75mm incremental blows listed in brackets (e.g. BH01 at

1.00mbgl where $N=14-(3,4/3,3,4,4)$). Where refusal of 50 blows across the test zone was encountered was achieved during testing, the penetration depth is also reported (e.g. BH02 at 6.00mbgl where $N=50-(7,8/50$ for 50mm)).

At BH01 and BH03, groundwater standpipes were installed to allow for long term monitoring. These were formed of a slotted standpipe with a gravel pack surround to allow for the groundwater to ingress into the pipe and stabilise. Bentonite seals were placed above the pipe to ensure that water does not migrate into the hole from the surface.

The logs are presented in Appendix 1.

2.2. Trial Pits

18 No. trial pits were excavated using a tracked excavator to the scheduled depth of 3.00mbgl. They were logged by a SIL geotechnical engineer and this included the soil strata, any groundwater ingresses and the pit wall stability. Representative disturbed bulk samples were also recovered as the pits were excavated and they were also returned to the laboratory for testing. Finally, before backfilling the trial pits with the arisings, photographs of the pit, sidewall and spoil heap were taken for the record.

The trial pit logs and photographs are presented in Appendix 2.

2.3. Soakaway Test

1 No. soakaway test was completed using a tracked excavator and they were logged by SIL geotechnical engineer. The soakaway test is used to identify possible areas for storm water drainage. The pit was filled with water and the level of the groundwater was recorded over time. As stipulated by BRE Special Digest 365, the pit should be filled three times and that the final cycle is used to provide the infiltration rate. The time taken for the water level to fall from 75% volume to 25% volume is required to calculate the rate of infiltration. However, if the water level does not fall at a steady rate then the test is deemed to have failed and the area is unsuitable for storm water drainage.

The soakaway log and photographs are presented in Appendix 3.

2.4. Surveying

Following completion of all the fieldworks, a survey of the exploratory hole locations was completed using a GeoMax GPS Rover. The data is supplied on each individual log and along with a site plan in Appendix 6.

3. Laboratory Testing

Geotechnical laboratory testing was undertaken on representative soil samples in accordance with BS 1377 (1990). Testing includes:

- 9 No. Moisture content
- 6 No. Atterberg limits
- 9 No. Particle size gradings
- 3 No. Hydrometers
- 3 No. pH, sulphate and chloride content

Environmental testing was completed by ALS Environmental Ltd. and consisted of the following:

- 7 No. Rilta Analysis

The geotechnical laboratory test results are presented in Appendix 4 with the environmental results in Appendix 5.

4. Ground Conditions

4.1. Overburden

The natural overburden deposits vary slightly across the site with the boreholes encountering SAND (BH01), SILT (BH02) and CLAY (BH03) overlying GRAVEL. The trial pits are dominated by granular SAND and GRAVEL soils across the site although some CLAY strata were occasionally recorded.

The laboratory tests of the cohesive soils confirm that both CLAY and SILT soils are present on site with low plasticity indexes of 3 to 15% recorded. The particle size distribution curves were poorly sorted straight-line curves and also confirmed that all soil types are present on site.

4.2. Groundwater

Groundwater details in the boreholes and trial pits during the fieldworks are noted on the logs in Appendices 1 and 2. Groundwater was not recorded in any of the boreholes or trial pits during the fieldworks period.

5.0. Recommendations and Conclusions

Please note the following caveats:

The recommendations given, and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between the exploratory hole locations or below the final level of excavation, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for adjacent unexpected conditions that have not been revealed by the exploratory holes. It is further recommended that all bearing surfaces when excavated should be inspected by a suitably qualified Engineer to verify the information given in this report.

Excavated surfaces in clay strata should be kept dry to avoid softening prior to foundation placement. Foundations should always be taken to a minimum depth of 0.50mBGL to avoid the effects of frost action and possible seasonal shrinkage/swelling.

If it is intended that on-site materials are to be used as fill, then the necessary laboratory testing should be specified by the Client to confirm the suitability. Also, relevant lab testing should be specified where stability of side slopes to excavations is a concern, or where contamination may be an issue.

5.1. Shallow Foundations

Due to the unknown depth of foundation and no longer-term groundwater information, this analysis assumes the groundwater will not influence the construction or performance of these foundations.

Due to the varied nature of the soils across the site, analysis of bearing capacities from the SPT N-values is provided below in the table. In the cohesive soils, Stroud and Butler proposed a correlation between the SPT N-value and undrained shear strength using the Atterberg Limits and using the indices of 10%, a correlation of $C_u=6N$ has been chosen for this site. This can be used to calculate the ultimate bearing capacity (UBC), and finally, a factor of safety is applied and with a factor of 3 chosen to give the allowable bearing capacity (ABC).

In granular soils, the SPT N-value can then be used to calculate the allowable bearing capacity, as per Terzaghi and Peck, using the correlation of $SPT\ N\text{-value} \times 10 = ABC$. All capacities shown below are in kN/m^2

BH No.	1.00m					2.00m				
	Cohesive Soils			Granular Soils		Cohesive Soils			Granular Soils	
	C _u	UBC	ABC	N-Value	ABC	C _u	UBC	ABC	N-Value	ABC
BH01				14	130				16	160
BH02	102	540	180						18	160
BH03	102	540	180						28	280

The following assumptions were made as part of these analyses. If any of these assumptions are not in accordance with detailed design or observations made during construction these recommendations should be re-evaluated.

- The foundation is to be 1m wide.
- Foundations are to be constructed on a level formation of uniform material type (described above).
- All man-made or filled material is to be removed prior to construction.
- The bulk unit weight of the material in this stratum has a minimum density of 19kN/m³.
- Based on groundwater observations this analysis assumes the groundwater will not influence the construction or performance of these foundations.
- All founding strata to be inspected by a suitably qualified Engineer prior to pouring the foundations.

The trial pits indicate that excavations should be stable for a short while at least. However, when granular soils are encountered then the stability of the pit walls are reduced compared to cohesive soils and therefore regular inspection of temporary excavations should be completed during construction to ensure that all slopes are stable. Temporary support should be used on any excavation that will be left open for an extended period.

5.2. Groundwater

The caveats below relating to interpretation of groundwater levels should be noted:

There is always considerable uncertainty as to the likely rates of water ingress into excavations in clayey soil sites due to the possibility of localised unforeseen sand and gravel lenses acting as permeable conduits for unknown volumes of water.

Furthermore, water levels noted on the borehole and trial pit logs do not generally give an accurate indication of the actual groundwater conditions as the borehole or trial pit is rarely left open for sufficient time for the water level to reach equilibrium.

Also, during boring procedures, a permeable stratum may have been sealed off by the borehole casing, or water may have been added to aid drilling. Therefore, an extended period

of groundwater monitoring using any constructed standpipes is required to provide more accurate information regarding groundwater conditions. Finally, groundwater levels vary with time of year, rainfall, nearby construction and tides.

Pumping tests would be required to determine likely seepage rates and persistence into excavations taken below the groundwater level. Deep trial pits also aid estimation of seepage rates.

As discussed previously there were no water strikes in the boreholes or trial pits. The site is dominated by granular soils and this would suggest that the soils are very well drained and the groundwater table is low.

If groundwater is encountered during excavations then mechanical pumps will be required to remove the groundwater from sumps. Sumps should be carefully located and constructed to ensure that groundwater is efficiently removed from excavations and trenches.

5.3. Soakaway Test

The tests show that the test was completed in the granular soils and this passed the test. The f-value was calculated as **3.58 x 10⁻⁵** and this value should be used for the soakaway design.

5.4. Contamination

Environmental testing was carried out on seven samples from the investigation and the results are shown in Appendix 5. For material to be removed from site, Rilta Suite testing was carried out to determine if the material is hazardous or non-hazardous and then the leachate results were compared with the published waste acceptance limits of BS EN 12457-2 to determine whether the material on the site could be accepted as 'inert material' by an Irish landfill.

The Waste Classification report created using HazWasteOnline™ software shows that the material tested can be classified as non-hazardous material. The Total Petroleum Hydrocarbon (TPH) results did record levels above the limit of detection in one of the seven samples (TP04), but the levels recorded are low and not in liquid form so therefore, the sample can be recorded as non-hazardous.

Following this analysis of the solid test results, the leachate disposal suite results indicate that the soils tested would be able to be treated as Inert Waste. The sample from TP01 did exceed the loss on ignition results but the remaining results are low.

Seven samples were tested for analysis but it cannot be discounted that any localised contamination may have been missed. Any MADE GROUND excavated on site should be

stockpiled separately to natural soils to avoid any potential cross contamination of the soils. Additional testing of these soils may be requested by the individual landfill before acceptance and a testing regime designed by an environmental engineer would be recommended to satisfy the landfill.

5.5. Aggressive Ground Conditions

The chemical test results in Appendix 4 indicate a general pH value between 7.80 and 8.15, which is close to neutral and below the level of 9, therefore no special precautions are required.

The maximum value obtained for water soluble sulphate was 126mg/l as SO₃. The BRE Special Digest 1:2005 – '*Concrete in Aggressive Ground*' guidelines require SO₄ values and after conversion ($SO_4 = SO_3 \times 1.2$), the maximum value of 151mg/l shows Class 1 conditions and no special precautions are required.