HAYES HIGGINS PARTNERSHIP
CHARTERED ENGINEERS • PROJECT MANAGERS

Civil Engineering Services Report

For

10 Units at Old Nangor Road

Clondalkin, Co. Dublin

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DOCUMENT CONTROL SHEET

	Client	Dublin Simon Community							
	Project Title	10 Units at Old Nangor Road Clondalkin, Co. Dublin							
	Project Ref.	17D070							
	Document Title	Planning Report							
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Revision	Status	Author	Reviewed By	Approved By	Issue Dates
P	Planning	LM	DH	DH	Oct 22

1. Introduction

Hayes Higgins Partnership has been commissioned to prepare a Civil Engineering Services Report for the proposed development at Old Nangor Road, Clondalkin, Co. Dublin.

This report was compiled after reviewing the available information on drainage and water supply, reviewing the OPW flood maps and other available information from public bodies. It contains information on the design of the surface water and foul drainage systems to be constructed for the proposed development.

The design of both the surface water and foul drainage systems has been carried out in accordance with the following:

- The Greater Dublin Regional Code of Practice for Drainage Works
- South Dublin County Council Sustainable Drainage Explanatory Design & Evaluation Guide 2022
- Technical Guidance Document H of the Building Regulations
- The Greater Dublin Strategic Drainage Study (GDSDS)
- DOE Recommendations for Site Development Works for Housing Areas
- BS 8301:1985, Code of practice for Building Drainage
- BS EN 752 External building drainage
- OPW The Planning System and Flood Risk Management
- Irish Water Code of Practice and Standard Details (Water & Wastewater)

The proposed surface water drainage system is a combination of SuDs measures including permeable surfaces and gravity feed drainage system discharging to a modular storage attenuation system on site. The surface water system is designed to take the runoff generated by a 1 in 100 year storm event (+20%). The site drainage will be connected to the existing surface water system (on Nangor Road north of the site on site), with a hydrobrake to limit discharge to 2 l/s/ha.

The foul drainage system for the proposed development is a gravity feed system within the site falling to the existing foul drainage system on Nangor Road north of the site.

2. Proposed Site

The site in question is a greenfield site located at Old Nangor Road, Clondalkin, Co. Dublin. The existing surface & foul drainage and watermain lines on the site will be dealt with via diversions. The proposed site measures approximately 0.103ha.

The site is generally bound on all sides by local amenities and car parking for same. The northern boundary of the site where access to the site is located is bound by Nangor Road, with houses on the opposite side of the road. The topography of the site shows a decrease in level from the southern end of the site to the northern end of the site at the access road. The site is relatively overgrown.

Proposed on the site is a single apartment block with 10 units. A copy of the site survey drawing is included in Appendix B.

3. Surface Water Drainage

The surface water drainage systems have been designed in accordance with IS EN 752, Code of Practice for Drainage Outside Buildings and current Building Regulations. Local Authorities require that all developments must include a sustainable urban drainage system, SUDS. A combination of permeable surfacing and modular storage system will be provided. All possible SuDs measures have been explored, refer to the justification matrix for SuDs in Appendix G. Given the nature of the site with the building layout it is not feasible to utilize swales, ponds etc.

To alleviate any possible risk of flood the on-site surface water storage is designed for a 1 in 100-year storm (+20%). A 20% increase in runoff due to global warming is included as per "Greater Dublin Regional Code of Practice for Drainage Works" and the "GDSDS". Site specific MET Eireann Rainfall data has been used in the surface water drainage and attenuation design. The surface water will be dealt with and stored on site and a connection to the existing surface water drainage system will be used to dispose of the surface water from the developed site. A connection to the public surface water system on Nangor Road will be provided via a hydrobrake limiting discharge to 1 L/s. Refer to calculations in Appendix C for surface water design.

There is an existing surface water stone sewer culvert traversing the site east to west. IE consulting were engaged to carry out an analysis of the culvert and propose new design. The culvert will be replaced with 3No. 900mm pipes in lieu of the existing culvert. Refer to drainage layout and report by IE Consulting in Appendix G.

There will be a complete separation of the foul and surface water drainage systems within the site, both in respect of installation and use. The surface water drains are designed in accordance with BS EN 752, Code of Practice for Drainage Outside Buildings.

4. Foul Water Drainage

The foul drainage system has been designed in accordance with Irish Water Code of Practice and Standard Details for Wastewater, BS 8301:1985, Code of Practice for Building Drainage and the current Building Regulations and Irish Water Code of Practice.

The foul drainage system for the development is a gravity feed system falling to the public foul drainage system (225mm dia. foul water pipe) on the Nangor Road north of the site on site. The development will not result in a significant increase in foul discharge from the site on the public sewer and we do not anticipate any capacity problems. The main foul sewers in the proposed development are to consist of 225mm diameter uPVC pipes with fall a minimum 1/170 chosen throughout to minimise the risk of blockages and to aid maintenance. Based on the 225mm diameter pipes with a 1:170 fall, the design flow is calculated as 34.94 l/s. A roughness coefficient (ks) of 1.5mm is applied to the design of all pipes.

There is an existing foul sewer and septic tank traversing the site. The foul line will be diverted around the building and septic tank removed.

A connection application for the development has been submitted to Irish Water. As per previous planning application for the development Irish Water have confirmed the development is feasible without upgrade by Irish Water. The drawings included with the planning application show the proposed foul drainage

layout. Details of the proposed foul sewer are shown in Hayes Higgins Partnership drawing within Appendix A. Calculations are provided within Appendix D.

5. Water Supply System

There is an existing 100mm diameter cast iron water main traversing the site. A connection will to this line will be made and it will be diverted around the building as required. The existing connection from this line to the main on Nangor Road will be maintained. A 100mm diameter HDPE watermain will be installed on site to form the diversion.

In accordance with requirements air valves and scour valves will be provided around the site as necessary. Hydrants will be provided as directed by the Fire Safety Certificate and Technical Guidance Document B of the Building Regulations 2006. Water saving devices including aerated taps and low water usage appliances will be used in the proposed development in accordance with best practice. The water supply system has been designed and will be installed in accordance with Irish Water Code of Practice and Standard Details for Water. A connection application for the development has been submitted to Irish Water. As per previous planning application for the development Irish Water have confirmed the development is feasible without upgrade by Irish Water.

The proposed watermain layout and details are shown on Hayes Higgins Partnership drawing within Appendix A.

6. Flood Risk Assessment

A flood risk assessment was undertaken by Awn Consulting. Refer to Appendix E.

7. Planning Authority's Opinion on Proposed Development

Vehicular and pedestrian access to the site will be provided from Nangor Road to the north. At all pedestrian crossing points tactile paving and dropped kerbs will be provided. Sufficient corner radii bends, site distances at junctions, road and footpath widths and parking will be provided as per the Architectural Layout Drawings. The road layout complies with Design Manual for Urban Roads.

8. Services Design Summary

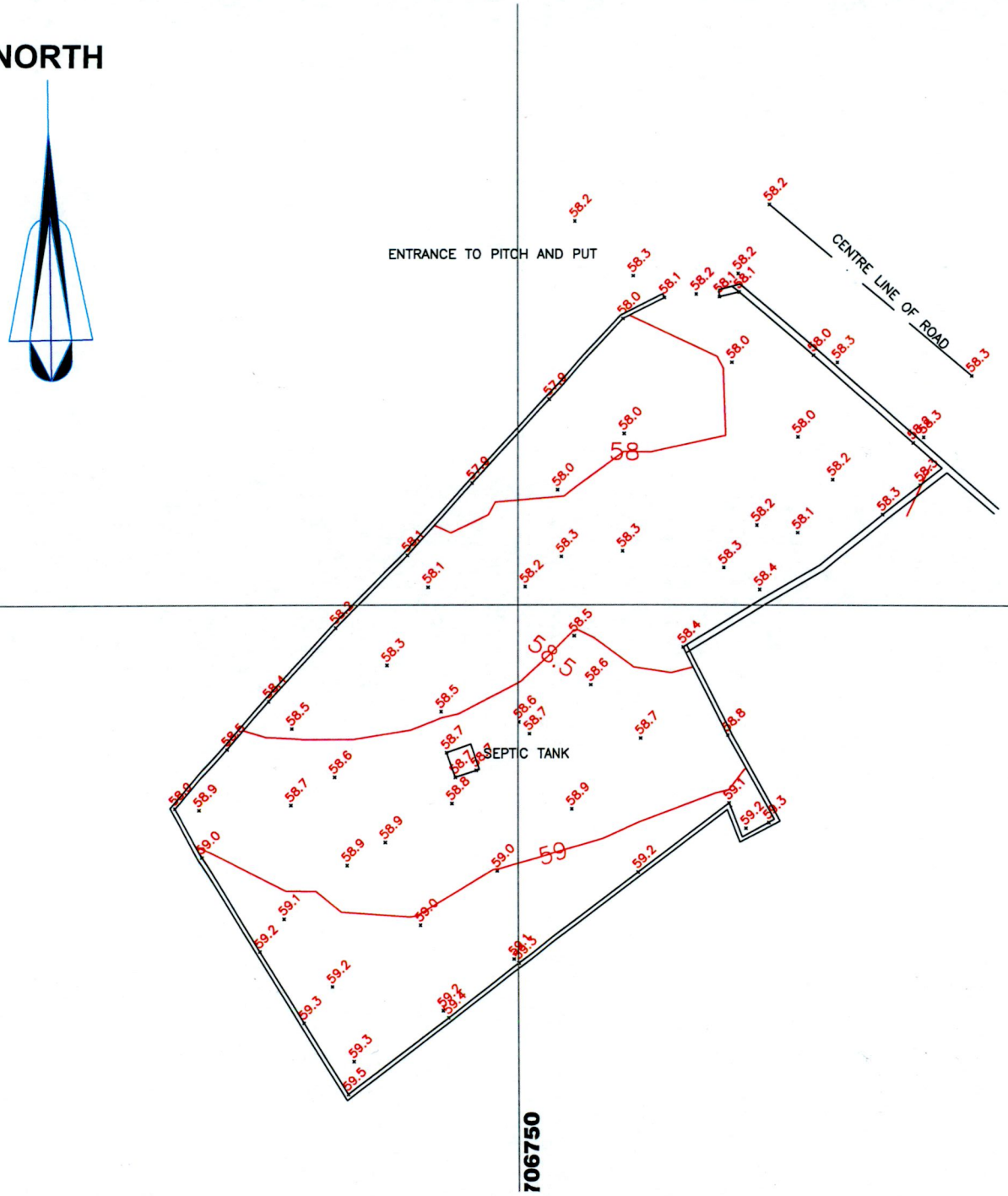
The proposed Surface water drainage system has been set up to ensure that adequate self-cleansing velocities are obtained, in accordance with the Building Regulations, and to comply fully with the Greater Dublin Regional Code of Practice for Drainage Works. Similarly, the proposed Foul drainage system has been set up to ensure that adequate self-cleansing velocities are obtained for partial flows under design loading, in accordance with the Building Regulations and Irish Water Code of Practice and Standard Details for Water & Wastewater.

Appendix A – Proposed Drainage & Watermain Layout

Appendix B – Site Survey

SURVEY
DRAWING IN ITM COORDINATES

NORTH



AIDAN KENT CIVIL ENGINEER
EDWARDSTOWN DUNCORMICK CO WEXFORD PHONE 086-2471074 FAX 053-9164986

SITE SURVEY AT CLONDALKIN

SCALE: 1:250 | DRAWING NO. 17-1204A | REVISION

DATE: DEC 17

CLONDALKIN
DUBLIN

MERRION CONTRACTING

Appendix C – Surface Design

17D070 - Surface Water Attenutation Calculation 1-100 + 20%

1	2	3	4	5	6
Storm Frequency & Duration	*Rainfall* (mm)	*Rainfall Intensity* (mm/hr)	*Potential Run-off From Developed Site* (l/s)	*Allowable Run-off From Developed Site* (l/s)	*Storage Requirement* (m3)
M100-5 min	20.88	250.56	52.20	1.0	15.4
M100-10 min	29.16	174.96	36.45	1.0	21.3
M100-15 min	34.32	137.28	28.60	1.0	24.8
M100-30 min	42.48	84.96	17.70	1.0	30.1
M100-60 min	52.68	52.68	10.98	1.0	35.9
M100-2 hr	65.28	32.64	6.80	1.0	41.8
M100-3 hr	74.04	24.68	5.14	1.0	44.7
M100 - 4hr	81.00	20.25	4.22	1.0	46.4
M100-6 hr	**91.80**	**15.30**	**3.19**	**1.0**	**47.3**
M100-9 hr	104.16	11.57	2.41	1.0	45.7
M100-12 hr	113.88	9.49	1.98	1.0	42.2
M100-18 hr	129.12	7.17	1.49	1.0	32.0
M100-24 hr	141.24	5.89	1.23	1.0	19.5
M100-2day	155.04	3.23	0.67	1.0	-56.5

SUDS/Green Infrastructure feasibility checklist – 17D070 – October 2022

SuDS Measures	Measures to be used on this site	Rationale for selecting/not selecting measure
Source Control		
Swales	N	There is limited space within the site for same.
Tree Pits	N	Tree pits maybe included in landscape design – to be reviewed. Not included in the SuDs calculations, but they will contribute.
Rainwater Butts	N	Not a viable option given the apartment nature of the development, could be explored in detailed design to examine feasibility.
Rainwater harvesting	N	This can be reviewed with the architect and client to see if it is a viable option – currently not allowed for.
Soakaways	N	There is limited space on site given the size that would be required.
Infiltration trenches	N	There is limited space on site
Permeable pavement	Y	Permeable surfacing will be provided to allow some infiltration directly to the ground will be allowed.
Green Roofs	N	Not viable due to nature of development
Filter strips	N	Filter strips maybe included in landscape design – to be reviewed. Not included in the SuDs calculations, but they will contribute.
Bio-retention systems/Raingardens	N	Raingardens maybe included in landscape design – to be reviewed. Not included in the SuDs calculations, but they will contribute. Site space is limited.
Blue Roofs	N	Not cost effective over the lifespan due to maintenance.
Filter Drain	N	Not currently proposed.
Site Control		
Detention Basins	N	No available room on site for large bodies of water and poses a potential drowning hazard.
Retentions basins	N	No available room on site for large bodies of water and poses a potential drowning hazard.
Regional Control		
Ponds	N	No available room on site for large bodies of water and poses a potential drowning hazard
Wetlands	N	No available room on site for large bodies of water and poses a potential drowning hazard.
Other		
Petrol/Oil interceptor	Y	Included in overall drainage design.
Attenuation tank – only as a last resort where other measures are not feasible	Y	Provided on site. Site storage for 1/100 storm + 20% climate change with hydrobrake connection to mains

Appendix D – Foul Water Calculations

Job Title:	Nangor Rd	**Job Number:**	17D070
Calculation by:	LM	**Date:**	Oct-22
Checked by:	DH		

Proposed Foul Drainage: BS 8301 1985

RESIDENTIAL

SITE COMPRISES

No. of Apartments/houses = 10

DETERMINE AVERAGE DAILY FLOW

Assume foul discharge for each dwelling = 650 litres/day

Average Residential Daily Flow = **0.075** **l/s**

DESIGN FOR PEAK FOUL FLOW

Assume 26 Discharge Units/Apartment/house - Table 4 BS 8301

Therefore, No. of Discharge Units = 260

PEAK FLOW = **4.9928** **l/s** - Fig.2 BS 8301

COLEBROOK - WHITE FORMULA

Q = 4.99 **l/s**

ks = 1.5 **mm**

Kinematic viscosity @ 15 degrees Celsius = 1.141×10^{-6} m^2/s

Self Cleansing Velocity= 0.75 m/s

Use	225	**mm Pipe**
@ 1 in	170	**Gradient**
Q =	34.94	**l/s** -
v =	0.879	**m/s** -

Appendix E – Flood Risk Assessment

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FLOOD RISK ASSESSMENT, OLD NANGOR ROAD, CLONDALKIN, CO. DUBLIN

Technical Report Prepared For

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Technical Report Prepared By

Colm Driver
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Teri Hayes
Director

Our Reference

TH/17/9530

Date Of Issue

05 May 2017

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Document History

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TH/17/9530		08 May 2017	
Revision Level	Revision Date	Description	Sections Affected

Record of Approval

Details	Written by	Approved by
Signature		
Name	Colm Driver	Teri Hayes
Title	Hydrogeologist	Director
Date	08 May 2017	08 May 2017

EXECUTIVE SUMMARY

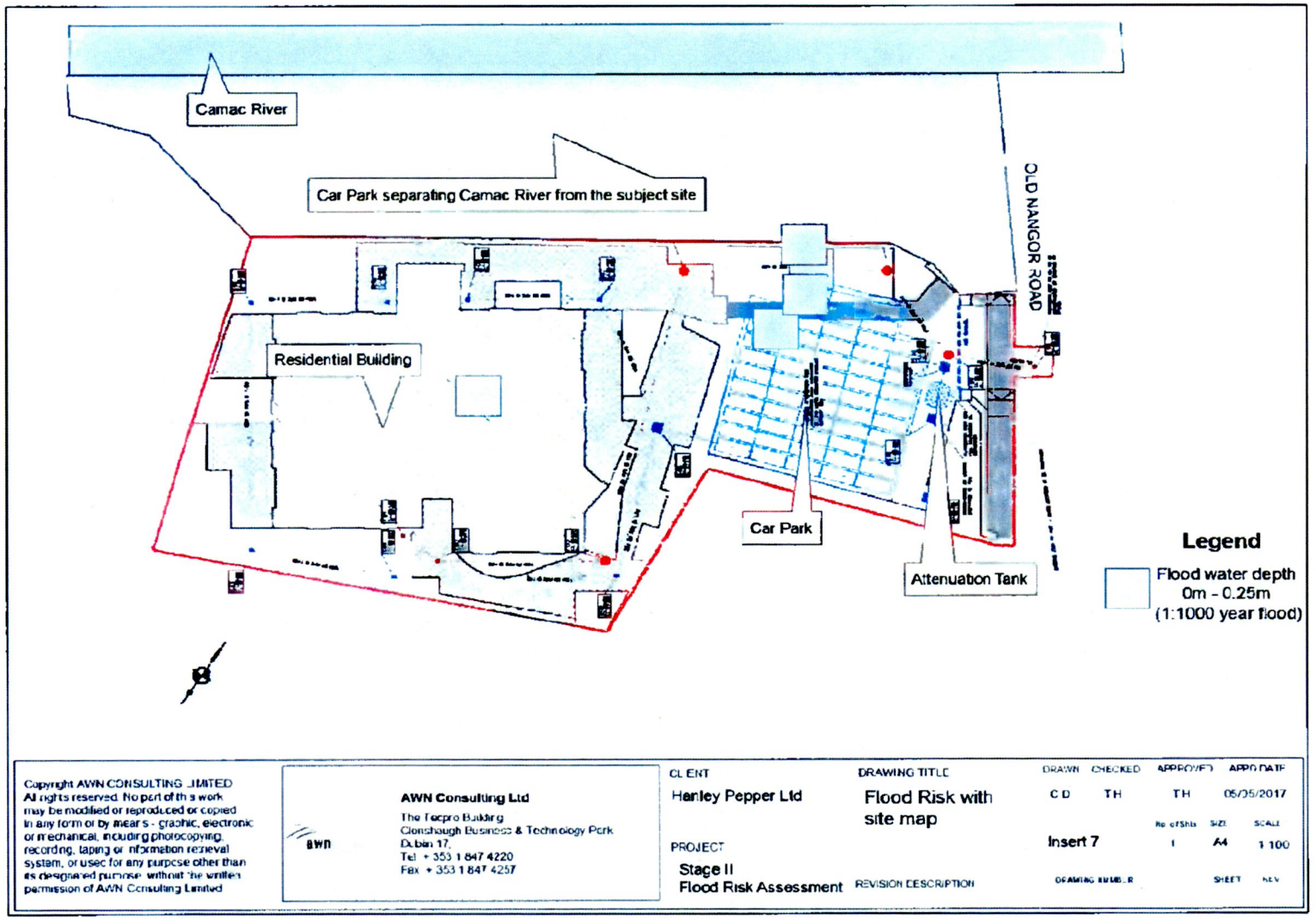
AWN Consulting Ltd (AWN) was directed by Hanley Pepper Ltd to undertake a Flood Risk Assessment ("FRA") within and surrounding a proposed site for the development of a 3-storey apartment complex. This study is based on the site walkover conducted on the 28th of April and the assessment of CFRAM flood risk maps. The CFRAM maps are based on flood models of the Camac River.

The apartment complex consists of 10 one bedroom apartments with a car park on the lands at Old Nangor Road, Clondalkin, Co. Dublin ("the proposed development site"). The total site area is 0.1087 hectares with a hardstanding area of 0.07 hectares.

There is no history of fluvial flooding within the proposed development site however flooding does occur in the surrounding area due to the Camac River after storm events. The OPW FRA map indicates that the proposed development may be affected by the 1:1000 year flood event with a water level of up to 25 mm in very localised areas of the site (see Insert 7 below). As such, this site is located within Flood Zone B (where the probability of flooding is low, less than 0.1% AEP or 1 in 1000 for both river and coastal flooding). The proposed development site is not at risk of flooding during a 1:100 flood event.

The potential flooding indicated on the CFRAM maps (1:1000 year flood event) will not adversely impact on the safety of the proposed development for residential purposes as the proposed finished floor level is designed for 58.57 m AOD which is above the existing ground level of 58.07 MAOD and localised 1: 1000 year flood level of 0.25m. The localised flood level is also located primarily in the car park area, see insert below.

Adequate stormwater attenuation has been provided for within the proposed design based on twice the required 1:100 storm event. As such the proposed development will not impact on flood levels in surrounding lands. This doubling of the 1:100 storm event meets with the requirements of SDCC.



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CLIENT: Hanley Pepper Ltd

DRAWING TITLE: Flood Risk with site map

PROJECT: Stage II Flood Risk Assessment

REVISION DESCRIPTION:

DRAWN	CHECKED	APPROVED	APP DATE
C D	TH	TH	05/05/2017

Insert 7

No of Shts	SIZE	SCALE
1	A4	1:100

DRAWING NUMBER SHEET REV

Contents

1.0 INTRODUCTION

AWN Consulting Ltd (AWN) has been appointed by Hanley Pepper Ltd to undertake a Flood Risk Assessment ("FRA") within and surrounding a proposed site for the development of a 3-storey apartment complex. The apartment complex consists of 10 one bedroom apartments with a car park on the lands at Old Nangor Road, Clondalkin, Co. Dublin ("the proposed site"). The total site area is 0.1087 hectares with a proposed hardstanding area of 0.07 hectares. Dublin Simon Community, as part of their discussions with South Dublin County Council, are aware of a pressing need to provide residential units for single users in the Local Authority area

This report and assessment has been prepared by AWN Consulting Ltd.'s Water Team. Teri Hayes BSc MSc PGeo is a Hydrogeologist with >22 years' experience in environmental impact assessment. She is a former president of The International Association of Hydrogeologists (IAH Irish Group) and is a professional member of the Institute of Geologists of Ireland (IGI) and European Federation of Geologists (EurGeol). Colm Driver BSc MSc is an Hydrogeologist with AWN with project experience in environmental and flood risk assessment.

1.1 Scope

This assessment is undertaken in accordance with the guidelines produced by the Department of the Environment, Heritage and Local Government (DoEHLG) - The Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009, hereafter referred to as the FRM Guidelines.

As per the FRM Guidelines a tiered approach has been taken. This usually commences with a Stage 1 Assessment which aims to quantify the risk posed to the development and to the surrounding environment.

From initial investigation, it was deemed necessary to complete a stage 2 flood risk assessment for this site due the close proximity to the Camac River.

This hierarchy of assessment ensures that flood risk is taken into account at all levels of the planning system but also that the right level of detail is considered. This avoids the need for detailed and costly assessments prior to making strategic decisions.

In terms of the Flood Risk Assessment and Management Study the scope of this work incorporates three stages:

- ***Stage 1: Flood Risk Identification*** - to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation.

- ***Stage 2: Initial Flood Risk Assessment*** - to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. The extent of the risk of flooding should be assessed which may involve preparing indicative flood zone maps. Where existing river or coastal models exist, these should be used broadly to assess the extent of the risk of flooding and potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures; and

- ***Stage 3: Detailed Flood Risk Assessment*** - to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve use of an existing or construction of a hydraulic model of the river or coastal cell across a wide enough area to appreciate the catchment wide impacts and hydrological processes involved.

As described in the FRM guidelines flood risk is a combination of the likelihood of flooding and the potential consequences arising. This is normally expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

Likelihood of flooding is normally expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% probability indicates the flood level that is expected to be reached on average once in 100 years, i.e. it has a 1% chance of occurring in any one year. Therefore:

- 100-year flood = 1% Annual Exceedance Probability (AEP);
- 1000-year flood = 0.1% AEP.

In the FRM Guidelines, the likelihood of a flood occurring is established through the identification of Flood Zones which indicate a high, moderate or low risk of flooding from fluvial or tidal sources, as defined as follows:

- *Flood Zone A* - Where the probability of flooding is highest (greater than 1% AEP or 1 in 100 for river flooding and 0.5% AEP or 1 in 200 for coastal flooding) and where a wide range of receptors would be vulnerable;

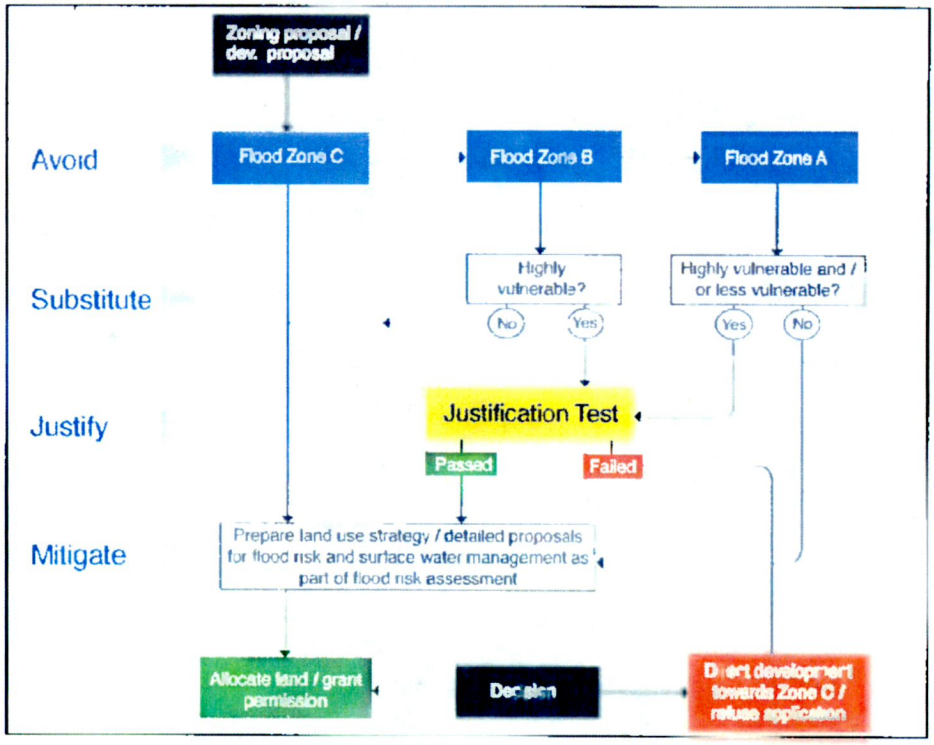
- *Flood Zone B* - Where the probability of flooding is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP or 1 in 200 for coastal flooding); and

- *Flood Zone C* - Where the probability of flooding is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding).

This report contains the second stage of the flood risk assessment, where a Justification Test is required.

Stage 2 – Initial Flood Risk Assessment, in accordance with the guidelines produced by the Department of the Environment, Heritage and Local Government (DoEHLG) - *The Planning System and Flood Risk Management Guidelines for Planning Authorities*, November 2009.

Potential impacts of the proposed development were considered within the study area. This is defined as the area within the planning the proposed development site boundary (i.e. the proposed site); and the wider hydrological setting of the area. A sequential approach was undertaken for this risk assessment under guidance from the local planning authorities (2009). Specifically, a sequential approach is first and foremost directed towards land that is at low risk of flooding. The underpinning philosophy of the sequential approach is highlighted in the illustration below. (NOTE: Based on the PRFA maps, the proposed development resides within Flood Zone B, therefore it is classifies as a highly vulnerable development and as such a justification test is required under a stage 2 assessment).



Insert 1: Sequential approach mechanism in the planning process

1.2 Methodology

This assessment follows the FRM Guidelines for Stage I and II assessment; the methodology involves researching the following data sources:

- Base maps- Ordnance Survey of Ireland
- Flood Hazard Maps and flooding information for Ireland, www.floodmaps.ie Office of Public Works (OPW)
- Geological Survey of Ireland (GSI) maps on superficial deposits
- EPA hydrology maps
- Eastern CFRAMS (Catchment Flood Risk Assessment & Management Study)
- Strategic Flood Risk Assessment for South Dublin County Development Plan (2015)
- Site walkover (conducted 28th April 2017)

Under the sequential approach and within section 3.5 under the OPW/DoEHLG guidelines (2009) any building that is used for: residential, dwelling houses, student halls and hostels can be treated as a "Highly Vulnerable Development" (see **Insert 2** below). Given the nature of the Development i.e. primarily residential type development it is therefore regarded as being a 'Highly Vulnerable Development' that resides in Flood Zone B (corresponding to 1 in 1000-year flood event) is deemed to may need a justification test (see **Insert 3** below). Therefore a 'Justification Test' may be required (as set out in Table 3.2 of the guidelines for Flood Risk Management (DoEHLG/OPW, 2009).

Vulnerability class	Land uses and types of development which include*
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding;
	Hospitals;
	Emergency access and egress points;
	Schools;
	Dwelling houses, student halls of residence and hostels;
	Residential institutions such as residential care homes, children's homes and social services homes;
	Caravans and mobile home parks;
	Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and
	Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions;
	Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;
	Land and buildings used for agriculture and forestry;
	Waste treatment (except landfill and hazardous waste);
	Mineral working and processing; and
	Local transport infrastructure.
Water-compatible development	Flood control infrastructure;
	Docks, marinas and wharves;
	Navigation facilities;
	Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location;
	Water-based recreation and tourism (excluding sleeping accommodation);
	Lifeguard and coastguard stations;
	Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and
	Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan)

*Uses not listed here should be considered on their own merits

Insert 2: Classification of vulnerability of different types of developments.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Insert 3: Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test.

2 DEVELOPMENT PLANS & POLICIES

There are a number of plans associated with this development which were consulted. These are as follows;

- Dublin City Development Plan 2016 -2022
- The National Development Plan 2007-2013

2.1 The National Development Plan 2007-2013

For details of the flooding policies outlined in the National Development Plan, see Appendix A.

2.2 Dublin City Development Plan 2016-2022

For details of the flood policy outlined in the Dublin City Development Plan, see Appendix A.

3 EXISTING HYDROLOGCAL ENVIRONMENT

3.1 Site Location

The site is located within the Eastern River Basin District (ERBD) in Hydrometric Area no. 9 (Liffey and Dublin Bay) of the Irish River Network. The site is located within the Cammock Water Management Unit (WMU).

It is situated within an existing residential area with other residential developments located immediately north of the site. "Open space" zoned lands are located immediately west and south west of the development. The site can be accessed via the Old Nangor Road immediately north of the development.

The Camac River is located 25m east of the proposed site. It is separated from the Camac River by a car park intended for the pitch and putt course adjacent to the development. The Camac River flows in a north easterly direction. The Liffey and Dublin Bay River catchment encompasses an area of approximately 1185km^2 and includes Dublin, Wicklow and Kildare.

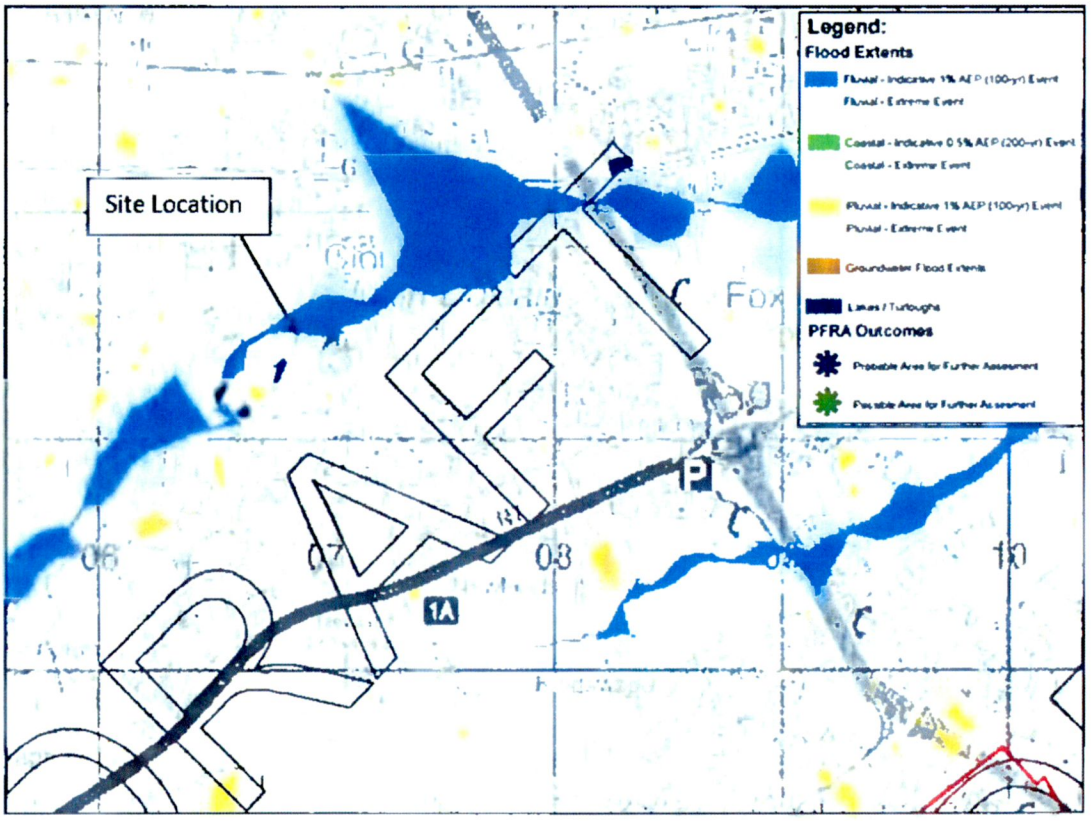
3.2 Existing Flood Records

Historically flood data was reviewed for the area. Existing photographs, reports and any other previous assessment including any assessments carried out by the OPW. A summary of the flood events within 2.5km of the proposed development provided online (OPW National Flood Hazard Mapping, floodmaps.ie) are as follows:

- Flooding at Diageo, Nangar Road, Dublin (2011)
- Flooding at junction of Watery Lane and Riversdale Road, Clondalkin, Dublin 22 (2011)
- Camac (2009)
- Camac Cherrywood (1993)
- Camac Clondalkin (1993) **Closest flood event to the site**
- Camac Cherrywood (1962)
- Camac Watery Lane, Clondalkin (Recurring flood event)

- Flooding at Robinhood Industrial Estate (2011)
- Flooding at Yellow Meadow Apartments, off Nangor/Yellow Meadows Road (2011)
- Flooding at Riverview Business Centre, New Nangor Road, Dublin (2011)
- Camac Cherrywood (1994)
- Beech Row Ronanstown (Recurring)
- Cappaghmore Ronanstown (Recurring)

From reviewing floodmaps.ie it is evident that there are number of flood events within the immediate vicinity of the site area. The last known flood event at the site last occurred on the 11th June 2011 at Leinster Terrace - Camac and Old Nangor Road where the Camac River enters the former site of the Clondalkin Paper Mills. Details of the flood reports including historic flood events in the area are provided by OPW website.



Insert 4 CFRAM PFRA (Draft)

3.3 Existing Drainage

The surface water drainage system will tie into the SDCC pre-existing surface water drainage infrastructure. Foul water sewer will be constructed to serve the apartment complex and will tie into the SDCC foul sewer water infrastructure. Within this proposed development, the northern region of the site will comprise a car park with a storm water attenuation tank. This tank will have a capacity of 48m³ to facilitate twice 1:100 year storm event and minimise flooding with the increase in surface runoff. The

capacity of the attenuation tank was based on climate change, rainfall (storm event) and runoff rates based on an increase in hardstand due to development of 0.07 hectares.

The current state of the site is occupied by both natural and hardstanding areas. Site drainage infrastructure to the west of the site is limited to natural water run-off. Here, rainfall will infiltrate naturally to the ground and discharge will likely be towards the Camac River and nearby surface water drains. It is intended that the proposed development will construct new drainage infrastructure and tie into the pre-existing SDCC infrastructure. Visual inspection from the site walkover shows that the topography gently dips towards the north east of the site towards Old Nangor Road. However, the topography throughout the whole site was difficult to establish due to the heavy vegetated conditions. Further towards the west, the topography generally decreases towards the Camac River.

A site walkover which was conducted on the 28th April 2017 confirmed the location of the Camac River (i.e. following the western boundary of the proposed development site) and running through the local pitch and putt course and likely floodplain. It was noted that the general embankment of approximately 1-2m exists on the western and eastern banks of the river. The water level was noted at 0.3 m (Photograph 1). The embankments of the Camac River are heavily vegetated.

Photograph 1: *Carmac River- view looking south. The proposed development is to the east.*

Photograph 2: *CPM Pitch and Putt course car park separating the proposed development (right of this picture) from the Camac River (left of this picture)– view is facing north.*

Photograph 2 presents the relative location of the river in relation to the proposed development site. The Carmac River becomes culverted at this location along the river adjacent to the Mill Shopping Centre, see photograph below.

Photograph 3: *Camac River culverted at the bridge- view is facing north-west.*

The proposed development site is heavily vegetated and there was no sign of any ponded water within the site at this time, see photo below. A slight decrease in elevation was noted to the north of the site.

Photograph 4: *The proposed site for development heavily vegetated-view facing south.*

3.4 Existing Site Geology and Hydrogeology

The Geological Survey of Ireland (GSI) website provides information on its public online mapping service at www.gsi.ie on bedrock aquifers and vulnerability. Reference to the GSI Bedrock Geology Map for the area indicates that the site is underlain by dark-grey argillaceous & cherty limestone & shale as part of the Lucan formation.

The aquifer vulnerability determines the limitations of the drainage available, i.e. whether the use of infiltration drainage methods will be appropriate. The GSI vulnerability classification for the site is predominantly "High" to "Extreme". This indicates that the overburden material ranges from 0m to 10m following GSI guidance (insert 4).

According to borehole data at Mill Lane, adjacent to the proposed development site, the bedrock depth is quite shallow. The boreholes encountered bedrock at a depth of 3m to 3.5m. This is consistent with the aquifer vulnerability of "High" to "Extreme".

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A – not applicable.
(2) Precise permeability values cannot be given at present
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

Insert 4 GSI Aquifer Vulnerability Table

4 FLOOD RISK IDENTIFCATION

A desk study is undertaken as part of a Stage II Flood Risk assessment. This information is detailed as seen below.

4.1 Fluvial Flooding

Review of historical records such as the OPW Flood maps and the GSI Subsoil maps classification was undertaken as part of the FRA process. The nearest potential source of fluvial flooding within proximity to the proposed development site is the Camac River. The OPW floodmaps indicate that the proposed development site is not affected by the 1:100 flood event. However, parts of the proposed site are affected by the 1:1000 flood event modelled by the OPW, see ***Insert 3 & 5***. The area of the proposed site affected by the flood is the car park. As outlined in section 3.2 above, there have been historic flooding events which have occurred in immediate vicinity of the proposed development site. The previous historical flooding events represent the potential risks to the proposed development. It also demonstrates a potential risk to the surrounding lands as result of the proposed development. There is no historic flooding directly relating to the proposed development site.

The GSI Subsoil maps indicate the presence of glacial tills derived chiefly from limestone. There is a presence of made ground surrounding the area of the proposed development site, the glacial tills follow the Carmac River. Made ground covers the Camac River which indicates a culverted river environment (**see *Photograph* 3**) and an area dependent on surface water drainage systems to transfer water during rainfall events.

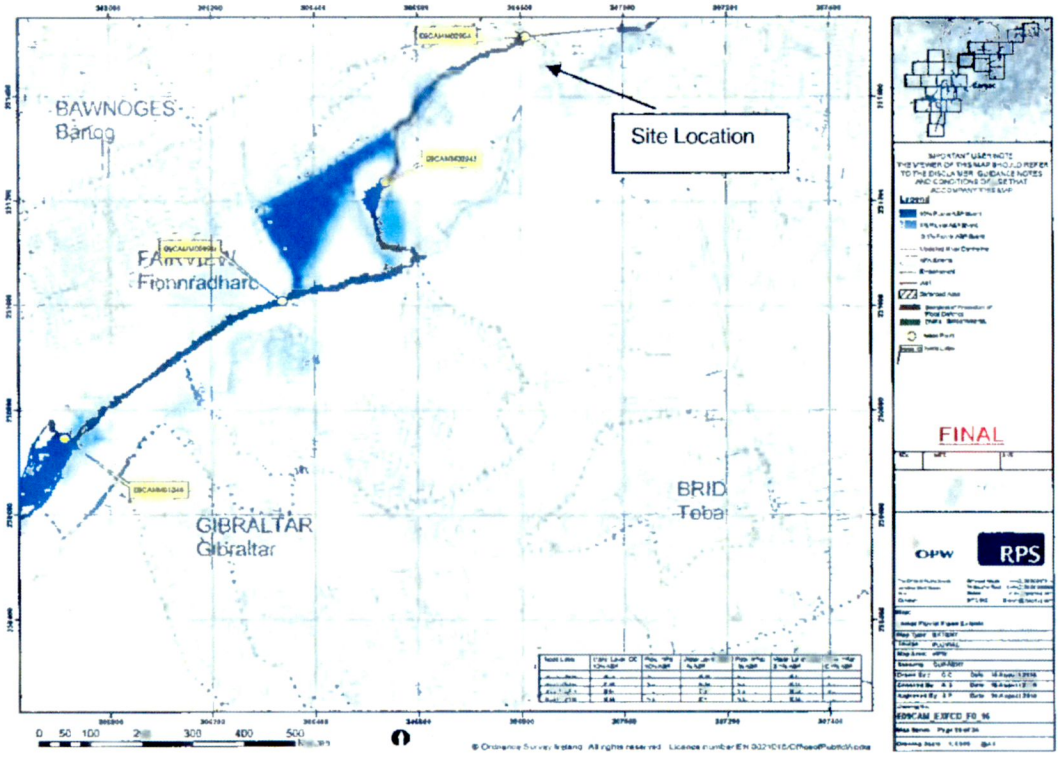
4.1.1 CFRAM Preliminary Flood Risk Assessment ("PFRA")

The EU Floods Directive (2007/60/EC) requires Member States to undertake a national preliminary flood risk assessment by 2011 to identify areas where significant flood risk exists or might be considered likely to occur. Members States are also required to prepare catchment-based Flood Risk Management Plans by 2015 that will set out flood risk management objectives, actions and measures.

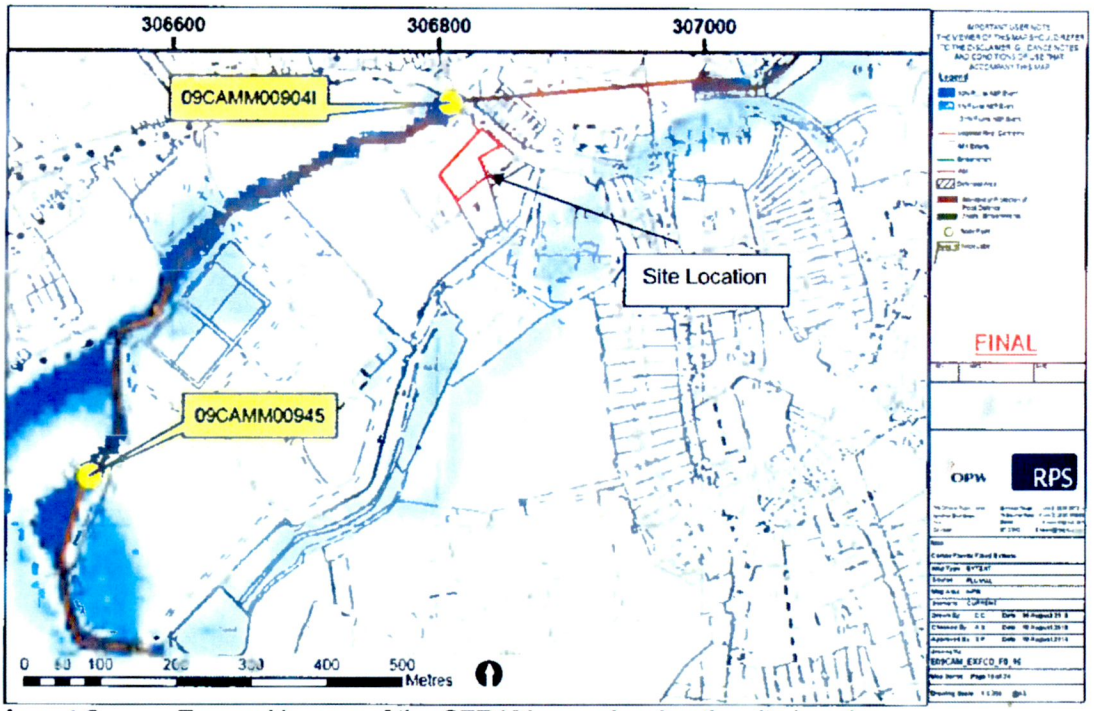
As a result, the OPW, in co-operation with various Local Authorities have produced Catchment Flood Risk Assessment and Management studies ("CFRAMS").

CFRAMS aim to map out current and possible future flood risk areas and develop risk assessment plans, and will also identify possible structural and non-structural measures to improve the flood risk of the area. Final CFRAM mapping is not currently available for this area. As part of the CFRAM programme, provisional floodmaps were produced by the OPW with cooperation with the local authorities.

The PFRA floodmaps (below) indicate potential fluvial flooding (1% AEP, 1000-year event) at the western boundary of the site and within the site, along the Camac River. Insert 1: CFRAM FRA Floodmap present the floodmap for the region. Insert 2: CFRAM map updated as the Camac River was recently remodelled by OPW. It is important to note that the location of the proposed development site and boundary as presented in **Insert 5 & 6** is indicative only due to the quality/resolution of the FRA map. However, applying a conservative approach indicates potential flooding along the river boundary of the site.



Insert 5 CFRAM PRFA map with recent modelling results for the Camac River.



Insert 6 Zoomed in area of the CFRAM map showing the site location.

Insert 5 demonstrates that the proposed development is partially affected by the 1 in 1000 flood event (1% AEP) and as such is considered to be in Flood Zone B.

The site walkover confirmed the location of the Camac River (i.e. 25m west of the proposed development site). It was noted that an embankment of approximately 1-2m exists on the western and eastern banks of the river, however there are small areas/sections along the river (upstream) where the water level is relatively close to the ground level (<1m). The river becomes culverted at 09CAMM00904I (see insert no. 6 above). This location will have a specific capacity and can be a factor in the occurrence of flooding after a storm event. There was no evidence of an extensive flood line noted during the site visit.

Insert 6 indicates an area of potential flood water located to the north-west of the proposed development site near where the proposed development with the associated car park will be situated. However, during the site visit it was noted that the site is a heavily vegetated area, see **Photograph 4**.

The depth of the pluvial flood water on site expected for 1: 1000 event based on the CFRAM study is 0m to 0.25m. The flood map does not show connectivity between the flood cells within the proposed development site. This is due to the removal of cells under 0.25m of flood water depth.

4.2 Pluvial Flooding

Pluvial flooding is commonly caused by intense rainfall that may only last a few hours. The resulting water follows natural valley lines, creating flow paths along roads. These flow paths have the potential to flow through and around developments and ponding in topographic lows. This often coincides with fluvial floodplains in low

lying areas. Any areas at risk from fluvial flooding will almost certainly be at risk from pluvial flooding.

4.3 Groundwater Flooding

As part of the EU Floods Directive and the development of the PFRA maps, the OPW included an indication of vulnerability to groundwater flooding. The purpose of this mapping was to highlight areas where a more detailed assessment of the risk of groundwater may be required. It was determined from the initial stages of this project that a model-based approach to the determination of groundwater flooding extent was not possible due to a lack of data. The assessment was evidence-based relying primarily on historic flood records, existing maps, site observations etc. Evidence from the preliminary assessment of groundwater flooding indicates that the clear majority of extensive, recurring groundwater floods originate at turloughs, and so this was the focus of the groundwater-mapping project.

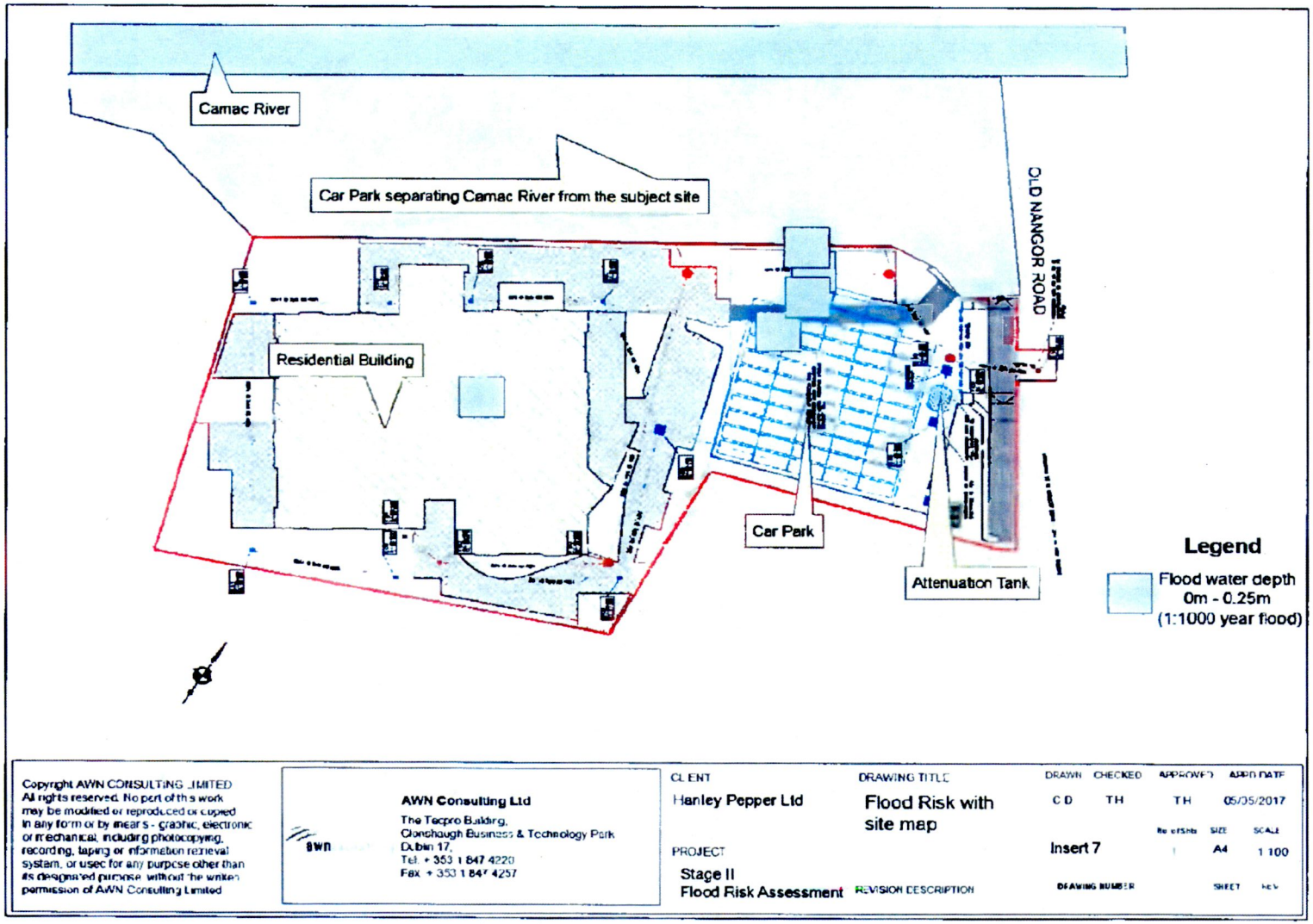
CFRAM PFRA Map Extract (see **Insert 4, 5 & 6: CFRAM PFRA Floodmap** above) does not indicate the occurrence of groundwater flooding at or adjacent to the site.

A review of the GSI Groundwater Vulnerability maps show that the area is of 'High' to 'Extreme' which indicates a depth of overburden at the site ranging from 0m to 10m. Therefore, indicating that this site is at low risk from groundwater flooding.

4.4 Assessment of proposed development in relation to 1: 1000 flood event

It is proposed that the car park will be placed along the Old Nangor Road with a greenfield terrace. This terrace will act as a garden for residents, separating the 10-bedroom apartment complex from the car park. Observations made during the site investigation noted that the area of the proposed apartment complex is not at risk to flooding based on topography. There is a rise in topography to the south of the site where the construction of the residential building is proposed. The topography gently dips from the south to the north east.

The finished residential floor level is 58.57 m AOD and the ground level is 58.07 m AOD. Therefore, this indicates a 0.5m in the difference. This raised floor level will ensure that a 1:1000 year flood will have negligible risk for the residential development. Some minimal flooding may occur in the car park based on the CFRAM model (Insert 6 & 7).



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PROJECT: Stage II Flood Risk Assessment

REVISION DESCRIPTION

DRAWING TITLE: Flood Risk with site map

DRAWN	CHECKED	APPROVED	APPR DATE
C D	TH	TH	05/05/2017

DRAWING NUMBER	REVISION	SIZE	SCALE
Insert 7		A4	1:100

SHEET REV

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Findings

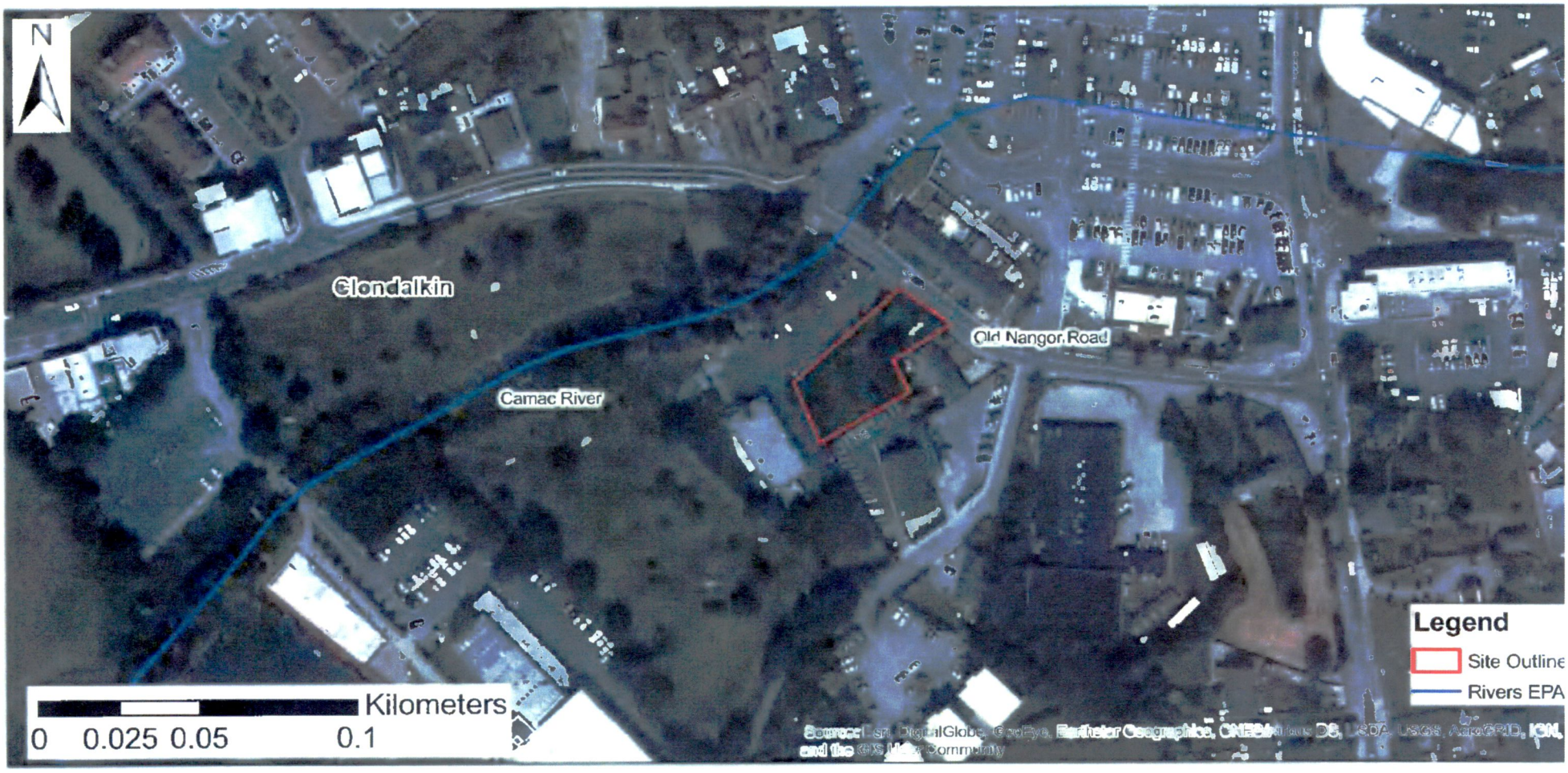
Following a site inspection and review of the proposed design in relation to the CFRAM Modelling the following conclusions have been made.

The proposed development has a risk of localised fluvial flooding in a 1: 1000 event in the area of the site proposed for car park and part of the footprint of the apartments.

The finished floor level for the proposed development site is 58.57m AOD This is higher in elevation than the depth of flood water (0m to 0.25m) presented in the flood risk map for a 1:1000 year flood event. As a result of this raised floor, the risk of flooding impact is mitigated.

Run-off from increase in hardstand on this site is mitigated by providing an attenuation tank that consists of a capacity twice the 1:100 storm event rainfall. This doubling of the 1:100 storm event was recommended by the SDCC.

Figures



Note: Drawing is for illustrative purposes only; Do not scale
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CLIENT: Hanley Pepper	**PROJECT:** Clondalkin Stage II Flood Risk Assessment	DRAWN: J.Mg	CHECKED: T.H	APPROVED: T.H	APP'D DA 05/05/2(
DRAWING TITLE: Hydrological Environment		Figure 1	No. of Sheets 1	SIZE A4	SCA 1:1(
	PROJECT Ref: 15/8695	REVISION DESCRIPTION		SHEET	RI

APPENDIX A

Development Plans and Policies

There are a number of development plans associated with this site which were consulted. These are as follows

- The National Development Plan 2007-2013
- South County Dublin Development Plan 2016-2020

National Development Plan 2007 - 2013

The National Development Plan 2007 – 2013 sets out the priorities of the State in terms of economic, social and infrastructural investment over the course of the plan. In relation to flood risk assessment the focus of Plan investment under this heading is on

a) Relief from flooding where such occurs
b) Preventing the creation of new problem areas and
c) The maintenance of existing defences.

This will be achieved through structural works involving the construction of Flood Relief Schemes in a number of locations throughout the country. This programme of structural works is being designed and implemented in many areas at flood risk throughout the country. The spending in this area in the coming years will benefit, in many cases, older, less developed areas of towns which have had less development for the very reason that they are at risk from flooding. All these schemes will be implemented in an environmentally friendly fashion as far as possible, taking account of the principles of the Government's National Biodiversity Plan, which requires that:

- Damage to biodiversity is kept to a minimum and where possible, mitigation measures are implemented;
- Significant damage to biodiversity is avoided; and
- Where possible biodiversity is enhanced.

In addition, a range of non-structural measures will be funded. These include the Flood Hazard Mapping Programme which is already well under way. This programme will map areas which, based on historical data, are known to be at risk of flooding countrywide, and make this information available to the planning and development process in a timely manner. Early Flood Warning Systems are also being developed for those areas most at risk and where flood protection depends on the erection of defences when flooding is predicted.

OPW is also using its resources to highlight the dangers of flooding and remedial action which can be taken, and is promoting a Public Awareness Campaign, which endeavours to help people to take the appropriate action when flooding is forecasted.

South County Dublin Development Plan 2016-2020

CC5 Policy to address flood risk at strategic level through the process of strategic flood risk assessment, and through improvements to the city's flood defences.

SI8 Policy to mitigate the effects of floods and droughts.

SI9 Policy to develop catchment based Flood Risk Management Plans for rivers, coastlines and estuaries

SI10 Policy to have regard to the Flood Risk Management Guidelines

SI11 Policy to protect integrity of Flood Defence Infrastructure

SI12 Policy to comply with the Strategic Flood Risk Assessment

SI13 Policy regarding Basements and Flooding

SI14 Policy to protect coastline from flooding

SI15 Policy to minimise the risk of pluvial flooding

SI16 Policy to minimise flood risk from all other sources

SI17 Policy to require an environmental assessment of al proposed flood protection or flood alleviation works

SI18 Policy regarding use of SUDS

GI2 Policy requiring AA screening for plans/projects

GI4 Policy regarding GI and flooding

GI9 Policy regarding multifunctional role of GI including Urban drainage and flood management Objectives

Appendix F – Site Investigation

IGSL Limited

Hayes Higgins
Consulting Engineers

Old Nangor Road
Clondalkin
Dublin Simon Community

Ground Investigation Report

Report No. 21322

October 2018

Report

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Project: Old Nangor Road, Clondalkin

Project No. 21322

Revision	Date	Title		
Revision 0	October 2018	Draft Geotechnical Report		
		Prepared By	Document Format	Copies
		Joe Clancy	PDF	
	To	Hayes Higgins		
Revision	**Date**	**Title**		
Revision 0	16/11/2018	Geotechnical Report		
		Prepared By	Document Format	Copies
		Joe Clancy	PDF	
	To	Hayes Higgins		
Revision	**Date**	**Title**		
		Prepared By	Document Format	Copies
	Name			
	To			
Revision	**Date**	**Title**		
		Prepared By	Document Format	Copies
	Name			
	To			

TABLE OF CONTENTS

FOREWORD

The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards

The ground investigation works for this project (Old Nangor Road, Clondalkin) have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (1999), BS 1377 (Parts 1 to 9) and Engineers Ireland Specification & Related Documents for Ground Investigation in Ireland (2006). The following Irish (IS) and European Standards or Norms are referenced:

- IS EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- IS EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- IS EN ISO 14688-1:2002 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- IS EN ISO 14688-2:2004 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Classification Principles
- IS EN ISO 14689-1:2004 Geotechnical Investigation and Testing - Identification & Classification of Rock, Part 1: Identification & Description

Reporting

Recommendations made and opinions expressed in this report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations. The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

This report has been prepared for Hayes Higgins and the information should not be used by third parties without prior written permission. The recommendations developed in this report specifically relate to the proposed development. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

1.0 Introduction

A new residential development is proposed for a site at Nangor Road in Dublin. Apartment units are to be constructed for The Dublin Simon Community.

An investigation of sub soil conditions in the site area has been ordered by Hayes Higgins, Consulting Engineers, on behalf of their client.

The programme of the investigation included the construction of five Boreholes and five Trial Pits, to establish geotechnical criteria on which to base foundation design. Work was carried out in accordance with BS 5930, Code of Practice for Site Investigations (1999) and Eurocode 7.

In addition, an infiltration test was carried out in accordance with BRE Digest 365 and in-situ CBR values were established by plate bearing test.

A programme of laboratory testing to confirm geotechnical and environmental soil parameters followed site operations.

This report includes all factual data pertaining to the project and comments on the geotechnical findings relative to foundation design.

2.0 Fieldwork

The site is located on the Old Nangor Road, Clondalkin, Dublin. A site location map is enclosed in Appendix 6 to this report. This indicates the positions of boreholes and trial pits.

Prior to commencement of work in each borehole location, a shallow trial pit was opened to ensure that underground services were not damaged. All locations were electronically scanned to confirm absence of underground services.

The scope of work comprised the following:

* Conventional Cable Percussion Boreholes	5 Nr.
* Trial Pits	5 Nr.
* BRE Digest 365 Percolation Test	1 Nr.
* CBR by Plate Bearing Test	2 Nr.
* Geotechnical Soil Tests	
* Environmental Soil Tests	

a. Boreholes

The five exploratory holes were bored with conventional 200mm cable tool methods using a Dando Exploratory Rig. Boreholes were located at each corner and in the centre of the proposed apartment block.

Detailed geotechnical records are contained in Appendix 1 to this report. The records give details of stratification, sampling, in-situ testing and groundwater. Note is also taken of any obstructions to normal boring requiring the use of the heavy chisel for advancement. It was not possible to recover undisturbed samples because of the high stone/cobble content of the strata encountered.

The boreholes confirm the presence of MADE GROUND extending from ground level at each location. The thickness of fill varies from 0.40 metres at BH01 to 2.10 metres at BH05. The fill is generally of gravelly clay composition, containing traces of brick, roots, plastic and organics.

Below the fill is a thin stratum of firn to stiff grey black gravelly CLAY (boulder clay). The boulder clay continues to depths ranging from 1.60 to 4.00 metres, where refusal was recorded following a period of abortive chiselling at each location.

It is probable that the final refusal depths are indicative of the weathered shaley limestone bedrock horizon. However limestone boulders may also have resulted in borehole refusal. Proof core drilling to confirm bedrock parameters was not scheduled for this investigation.

No groundwater was noted during the course of the borehole investigation. A standpipe was installed at BH01 to facilitate future groundwater observations.

b. Trial Pits

Trial Pits were opened at five locations using a 14 tonne excavator under engineering supervision. Excavations were carefully logged and photographed and samples were recovered for laboratory analysis. Detailed records are presented in Appendix 2.

The trial pit records confirm the presence of MADE GROUND over the site area. The thickness of fill ranged from 0.80 to 1.80 metres.

At TP01 the made ground extends to 1.70 with refusal recorded at this point.

The remaining trial pits encountered a thin stratum of stiff dark grey gravelly CLAY (black boulder clay) below the fill. Excavator refusal generally on black shale / limestone was noted at depths between 1.80 and 2.10 metres.

Slight water seepage was noted at the base of TP04 and TP05. The remaining excavations were dry.

c. BRE Digest 3 65 Soakaway

A soakaway tests was carried at one excavated trial pit where made ground extended to 1.90 metres with shale fragments at the base of the excavation.

The test was performed in accordance with BRE Digest 365, over two stages following initial soakage. Test data is presented in Appendix 3.

The infiltration rate calculated from the final phase of test are as follows:

SA1 Infiltration Rate (f) = 0.00184 metres/minute

d. CBR by Plate Test

Plate bearing tests were carried out at two specified locations and equivalent CBR values were calculated. Tests were carried out 0.30 metres BGL in made ground.

Results are presented in Appendix 4 and are summarised in the following table.

Test No.	CBR at Load Cycle (%)	CBR at Reload (%)
CBR01	6.9	7.8
CBR02	11.4	10.8

3.0 Testing

a. In-Situ:

Standard penetration tests were carried out at approximate 1.00 metre intervals in the geotechnical boreholes to measure relative in-situ soil strength. N values are noted in the right hand column of the boring records, representing the blow count required to drive the standard sampler 300mm into the soil, following initial seating blows. Where full test penetration was not achieved the blow count for a specific penetration is recorded, or refusal is indicated where appropriate.

The results of the tests are summarised as follows:

STRATUM	N VALUE RANGE	COMMENT
MADE GROUND	3 to 15	Loose to Medium Dense
Grey Boulder CLAY	13 to 48	Firm to very Stiff

Some limited penetration SPT tests with refusals were recorded at the base of the respective boreholes.

b. Laboratory:

All geotechnical samples from the boreholes have been returned to the IGSL INAB Accredited laboratory for initial visual inspection. A schedule of testing was prepared and tests as appropriate carried out. Chemical and environmental analysis was carried out by Chemtest Ltd. in their UKAS facility. All laboratory data is presented in Appendix 5.

Testing included the following elements:
a. Moisture Content and Classification (Liquid and Plastic Limits)
b. Grading Analysis
c. MCV
d. RILTA Environmental

Classification / MC
Liquid and Plastic Limits were established for samples of the grey gravelly clay (Boulder Clay) underlying the made ground.

The results classified the cohesive soils as clay of low to intermediate plasticity (CL and CI) with moisture contents in the range 13 to 25%. At BH02, the basal deposits were coarser, classifying as a gravel soil with a lower moisture content of 9%.

Grading:

Wet sieve and hydrometer analysis was carried out to establish particle size distribution.

The results showed that the samples of cohesive soil ("boulder clay") were generally well graded with fines (silt/clay) contents in the range 40 to 62%. The aforementioned sample from the base of BH02 was considerably coarser, classifying as a clayey sandy gravel with a fines content of 12%.

MCV:

Two samples had moisture condition values established.

It is noted that the MCV test specimen contains only those particles that pass through the 20 mm diameter sieve. Therefore, when testing the sample from borehole BH02 (classified as a clayey sandy gravel), the specimen comprised a small proportion of the sample. The specimen was also observed to be in a water-softened condition, most likely due to the addition of water during the drilling process. The MCV value of 2.1 is lower than would be typically expected of a coarse granular soil and would be considered unrepresentative of the sample as a whole.

The sample of "boulder clay" from BH03 yielded an MCV of 8.0, thus indicating that this material has the potential to be reused as engineering fill, subject to proper handling and control of moisture content.

RILTA Environmental Suite:

Five samples were submitted for Waste Acceptance Criteria (WAC) analysis.

Samples were tested in accordance with the RILTA Suite, which is used to determine the suitability of soils for disposal to a landfill. The RILTA suite includes Heavy Metals, Polycyclic Aromatic Hydrocarbons (PAH), TPH-CWG, BTEX, PCB and Total Organic Carbon (TOC) carried out on dry soil samples. Also included are leachate analyses, whereby leachate is generated in accordance with CEN 10:1 specification and this is tested for the presence of recognised contaminants including Heavy Metals, Dissolved Organic Carbon (DOC) and Total Dissolved Solids (TDS). An Asbestos Screen is also included in the RILTA Suite.

The results of the RILTA Suite are typically compared with the European limits for inert landfills as set out in the European Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.

The results showed that all samples were safely below the limits for inert landfills.

4.0 Discussion

A site at Nangor Road is to be developed for Dublin Simon Community and an Apartment Complex is to be constructed.

A detailed site investigation has been carried out under the direction of Hayes Higgins Consulting Engineers.

The borehole findings reflect the typical stratification of the Nangor Road / Clondalkin area with FILL deposits overlying generally stiff grey black gravelly clay. These soils represent glacial till deposition, locally referred to as black BOULDER CLAY.

A pattern of shallow refusal of both boreholes and trial pits is evident, with black shale / limestone fragments recovered at the base of the trial pits. This would be consistent with other ground investigations in the area. However proof core drilling was not scheduled for this project to confirm rock horizon and rock integrity.

The findings and characteristics of each stratum can be summarised as follows:

MADE GROUND:
This surface FILL layer is variable in composition and strength, ranging in thickness from about 0.50 to 2.10 metres and is considered unsuitable as a founding medium for either structural or floor loading.

Environmental test results for this stratum show that the samples tested satisfied the limits for inert waste.

Where the results of the RILTA Suite fall below the inert landfill limits for all substances, the sample would be expected to be accepted at an inert landfill, providing it is classified as non-hazardous. Classification of samples as hazardous or non-hazardous does not form part of this report, but this process can be carried out by an environmental specialist using the results of the RILTA Suite.

It should be noted that the chosen landfill should be furnished with the RILTA Suite results in advance of any soils being removed from site. Depending on the extent and depth of excavation, the landfill may require additional testing to achieve the frequency of analysis (i.e. number of samples per unit volume of excavation) that meets their license requirements.

GREY GRAVELLY CLAY
This represents the regional glacial till or black boulder clay. The stratum on this site is noted below the FILL and ranges from about 0.50 to 1.70 metres in thickness in the area of the proposed building. SPT values are generally in excess of N=20 with an allowable bearing pressure of 200 KPa available for reinforced conventional strip or pad foundations.

PRESUMED ROCK
Borehole and Trial Pit refusals were recorded between 1.60 and 2.30 BGL generally. At BH05 (located in the centre of the proposed structure) this increased to 4.00 metres. Assuming the refusal depths represent weathered upper limestone, an allowable bearing pressure in excess of 350 KPa can be assumed if foundations are taken into the rock.

Appendix 1

Borehole Records

GEOTECHNICAL BORING RECORD

REPORT NUMBER 21322

CONTRACT	Nangor Road , Clondalkin,Dublin 24	**BOREHOLE NO.**	**BH01**
		SHEET	Sheet 1 of 1
CO-ORDINATES	**RIG TYPE** DANDO 2000	**DATE COMMENCED**	18/10/2018
GROUND LEVEL (m AOD)	**BOREHOLE DIAMETER (mm)** 200	**DATE COMPLETED**	18/10/2018
	BOREHOLE DEPTH (m) 1.60		
CLIENT Dublin Simon Community	**SPT HAMMER REF. NO.**	**BORED BY**	J.O'TOOLE
ENGINEER Hayes Higgins	**ENERGY RATIO (%)**	**PROCESSED BY**	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	MADE GROUND (Comprised of brown clay fill with some brick fragments)			0.40						
	Firm grey/brown SILT/CLAY									
1					AA91693	B	1.00		N = 13 (1, 2, 2, 3, 4, 4)	
				1.50						
	Dense angular COBBLES and BOULDERS			1.60	AA91694	B	1.50		N = 10/10 mm (25, 9, 10)	
	End of Borehole at 1.60 m									
2										
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.4	1.6	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
18-10-18	1.60	0.50	1.60	50mm SP

REMARKS CAT scanned location and hand dug inspection.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 21322.GPJ IGSL.GDT 16/11/18

GEOTECHNICAL BORING RECORD

REPORT NUMBER 21322

CONTRACT	Nangor Road , Clondalkin,Dublin 24	**BOREHOLE NO.**	**BH02**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**RIG TYPE**	DANDO 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (m AOD)		**BOREHOLE DEPTH (m)**	2.20
		DATE COMMENCED	18/10/2018
		DATE COMPLETED	18/10/2018
CLIENT	Dublin Simon Community	**SPT HAMMER REF. NO.**	
ENGINEER	Hayes Higgins	**ENERGY RATIO (%)**	
		BORED BY	J.O'TOOLE
		PROCESSED BY	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	MADE GROUND (Comprised of brown clay fill with masonry and rubble)									
1					AA91691	B	1.00		N = 12 (2, 2, 2, 3, 3, 4)	
				1.80						
2	Very stiff grey/brown gravelly CLAY			2.20	AA91692	B	2.00		N = 23 (4, 4, 5, 6, 4, 8)	
	Obstruction End of Borehole at 2.20 m									
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.6	1.8	0.75	
2.1	2.1	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
1.10	1.10	No	No	20	Seepage

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 21322.GPJ IGSL.GDT 16/11/18

GEOTECHNICAL BORING RECORD

REPORT NUMBER 21322

CONTRACT	Nangor Road , Clondalkin,Dublin 24	**BOREHOLE NO.**	**BH03**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**RIG TYPE**	DANDO 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (m AOD)		**BOREHOLE DEPTH (m)**	2.50
		DATE COMMENCED	16/10/2018
		DATE COMPLETED	16/10/2018
CLIENT	Dublin Simon Community	**SPT HAMMER REF. NO.**	
ENGINEER	Hayes Higgins	**ENERGY RATIO (%)**	
		BORED BY	J.O'TOOLE
		PROCESSED BY	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	MADE GROUND (Comprised of brown clay fill with masonry and rubble)									
1				1.30	AA91685	B	1.00		N = 15 (2, 3, 4, 3, 4, 4)	
	Stiff black sandy gravelly CLAY with occasional cobbles									
2				2.10	AA91686	B	2.00		N = 48 (4, 11, 10, 10, 15, 13)	
	Dense angular COBBLES and BOULDERS			2.30						
	Obstruction End of Borehole at 2.50 m									
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.3	2.5	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 21322.GPJ IGSL.GDT 16/11/18

GEOTECHNICAL BORING RECORD

REPORT NUMBER 21322

CONTRACT	Nangor Road , Clondalkin,Dublin 24	**BOREHOLE NO.**	**BH04**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**RIG TYPE**	DANDO 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (m AOD)		**BOREHOLE DEPTH (m)**	1.60
		DATE COMMENCED	19/10/2018
		DATE COMPLETED	19/10/2018
CLIENT	Dublin Simon Community	**SPT HAMMER REF. NO.**	
ENGINEER	Hayes Higgins	**ENERGY RATIO (%)**	
		BORED BY	J.O'TOOLE
		PROCESSED BY	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	MADE GROUND (Comprised of brown gravelly clay fill with cobbles)									
1				1.10	AA91695	B	1.00		N = 31 (2, 3, 4, 5, 10, 12)	
	Stiff grey/brown gravelly CLAY with cobbles			1.50	AA91696	B	1.40		N = 25/75 mm (25, 25)	
	Dense angular COBBLES and BOULDERS			1.60						
2	End of Borehole at 1.60 m									
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.4	1.6	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
10-10-18	1.60	0.50	1.60	50mm SP

REMARKS CAT scanned location and hand dug inspection.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 21322.GPJ IGSL.GDT 16/11/18

GEOTECHNICAL BORING RECORD

REPORT NUMBER 21322

CONTRACT	Nangor Road , Clondalkin,Dublin 24	**BOREHOLE NO.**	**BH05**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**RIG TYPE**	DANDO 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (m AOD)		**BOREHOLE DEPTH (m)**	4.00
		DATE COMMENCED	11/10/2018
		DATE COMPLETED	11/10/2018
CLIENT	Dublin Simon Community	**SPT HAMMER REF. NO.**	
ENGINEER	Hayes Higgins	**ENERGY RATIO (%)**	
		BORED BY	J.O'TOOLE
		PROCESSED BY	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	MADE GROUND (Comprised of brown clay fill with masonry and rubble)									
				1.10	AA91687	B	1.00		N = 3 (0, 0, 1, 0, 1, 1)	
1	MADE GROUND (Comprised of brown silty granular fill)									
				2.10	AA91688	B	2.00		N = 23 (2, 4, 7, 5, 5, 6)	
2	Stiff black gravelly CLAY with frequent angular cobbles									
					AA91689	B	3.00		N = 26 (2, 3, 7, 5, 6, 8)	
3				3.80						
	Dense angular COBBLES and BOULDERS			4.00	AA91690	B	3.80		N = 35/85 mm (10, 15, 25, 10)	
4	Obstruction End of Borehole at 4.00 m									
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.8	4	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.30	2.30	2.70	2.00	20	Seepage
3.10	3.10	3.60	2.80	0	Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17-10-18	4.00	Nil	2.00	End of BH

REMARKS CAT scanned location and hand dug inspection.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 21322.GPJ IGSL.GDT 16/11/18

Appendix 2

Trial Pit Records

TRIAL PIT RECORD

REPORT NUMBER 21322

CONTRACT	Old Nangor Road , Clondalkin, Dublin 24	**TRIAL PIT NO.**	**TP1**
		SHEET	Sheet 1 of 1
LOGGED BY	SH	**CO-ORDINATES**	
		DATE STARTED	18/10/2018
		DATE COMPLETED	18/10/2018
CLIENT	Dublin Simon Community	**GROUND LEVEL (m)**	
ENGINEER	Hayes Higgins	**EXCAVATION METHOD**	14T Excavator

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (Comprised of brown gravelly sandy SILT with rootlets and organic material throughout and scattered fragments of red brick).									
		0.80			103521	B	0.80-0.80		
1.0 MADE GROUND (Comprised of grey brown sandy gravelly CLAY with scattered red brick and black shale fragments of coarse gravel size throughout. Gravel is subrounded to angular. Sand is medium to coarse).									
		1.70			103522	B	1.70-1.70		
End of Trial Pit at 1.90m									
2.0									
3.0									
4.0									

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG UUUU.GPJ IGSL.GDT 26/10/18

TRIAL PIT RECORD

REPORT NUMBER 21322

CONTRACT	Old Nangor Road , Clondalkin, Dublin 24	**TRIAL PIT NO.**	**TP2**
		SHEET	Sheet 1 of 1
LOGGED BY	SH	**CO-ORDINATES**	
		DATE STARTED	18/10/2018
		DATE COMPLETED	18/10/2018
CLIENT	Dublin Simon Community	**GROUND LEVEL (m)**	
ENGINEER	Hayes Higgins	**EXCAVATION METHOD**	14T Excavator

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (Comprised of brown gravelly sandy SILT with rootlets, organic material and scattered fragments of red brick throughout).									
		0.90							
1.0 MADE GROUND (Comprised of grey brown sandy gravelly silty CLAY. Contains scattered red brick fragments and angular cobbles of black shale with low sphericity).					103518	B	0.90-0.90		
					103519	B	1.40-1.40		
		1.60							
2.0 Firm to stiff grey sandy gravelly CLAY with medium cobble content. Cobbles are of black shale and are angular with low sphericity.					103520	B	2.00-2.00		
		2.10							
End of Trial Pit at 2.10m									
3.0									
4.0									

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG UUUU.GPJ IGSL.GDT 26/10/18

TRIAL PIT RECORD

REPORT NUMBER 21322

CONTRACT	Old Nangor Road , Clondalkin, Dublin 24	**TRIAL PIT NO.**	**TP3**
		SHEET	Sheet 1 of 1
LOGGED BY	SH	**CO-ORDINATES**	
		DATE STARTED	18/10/2018
		DATE COMPLETED	18/10/2018
CLIENT	Dublin Simon Community	**GROUND LEVEL (m)**	
ENGINEER	Hayes Higgins	**EXCAVATION METHOD**	14T Excavator

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (Comprised of dark brown sandy silty CLAY with low cobble content. Cobbles are subrounded to subangular of limestone. Contains rare red brick fragments).					103516	B	0.60-0.60		
		0.80							
1.0 Firm to stiff light grey brown gravelly sandy CLAY with rare boulders. Gravel is fine to medium and subrounded to subangular. Sand is fine to medium.					103517	B	1.50-1.50		
End of Trial Pit at 1.80m		1.80							
2.0									
3.0									
4.0									

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG UUUU.GPJ IGSL.GDT 26/10/18

TRIAL PIT RECORD

REPORT NUMBER 21322

CONTRACT	Old Nangor Road , Clondalkin, Dublin 24	**TRIAL PIT NO.**	**TP4**
		SHEET	Sheet 1 of 1
LOGGED BY	SH	**CO-ORDINATES**	
		DATE STARTED	18/10/2018
		DATE COMPLETED	18/10/2018
CLIENT	Dublin Simon Community	**GROUND LEVEL (m)**	
ENGINEER	Hayes Higgins	**EXCAVATION METHOD**	14T Excavator

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (Comprised of brown gravelly sandy SILT. Rootlets and organic material throughout. Contains scattered fragments of red brick).					103513	B	0.40-0.40		
MADE GROUND (Comprised of grey brown sandy gravelly CLAY. Contains scattered red brick and black shale fragments of coarse gravel size. Gravel is subrounded to angular. Sand is medium to coarse).		0.60			103514	B	1.10-1.10		
Firm to stiff black sandy silty CLAY with boulders and medium cobble content. Cobbles are of black shale and are angular with low sphericity.		1.60							
End of Trial Pit at 1.80m		1.80		1 (Seepage)	103515	B	1.80-1.80		

1.0 2.0 3.0 4.0

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG UUUU.GPJ IGSL.GDT 26/10/18

TRIAL PIT RECORD

REPORT NUMBER 21322

CONTRACT	Old Nangor Road , Clondalkin, Dublin 24	**TRIAL PIT NO.**	**TP5**
		SHEET	Sheet 1 of 1
LOGGED BY	SH	**CO-ORDINATES**	
		DATE STARTED	18/10/2018
		DATE COMPLETED	18/10/2018
CLIENT	Dublin Simon Community	**GROUND LEVEL (m)**	
ENGINEER	Hayes Higgins	**EXCAVATION METHOD**	14T Excavator

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (Comprised of dark brown gravelly sandy SILT. Rootlets and organic material throughout. Contains scattered fragments of red brick and plastic. Rare medium to coarse angular gravel of black shale).					103510	B	0.60-0.60		
1.0 MADE GROUND (Comprised of light grey brown gravelly sandy CLAY with cobble sized red brick fragments, shale fragments and concrete. Gravel is fine to coarse and subangular to angular).		1.10			103511	B	1.30-1.30		
Grey clayey sandy GRAVEL with cobbles of fragmented black shale. Gravel is medium to coarse and subangular to angular. Sand is medium to coarse.		1.60		(Seepage)	103512	B	1.80-1.80		
2.0 End of Trial Pit at 2.10m		2.10							
3.0									
4.0									

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG UUUU.GPJ IGSL.GDT 26/10/18

Report No: 21322
Old Nangor Road

TP1 1 of 2

TP1 2 of 2

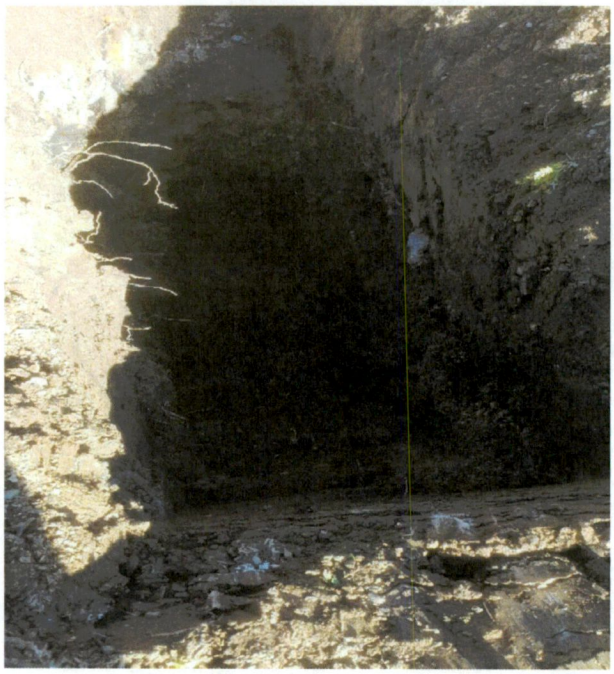
TP2 1 of 2

TP2 2 of 2

TP3 1 of 2

TP3 2 of 2

TP4 1 of 2



TP4 2 of 2

TP5 1 of 2

TP5 2 of 2

Appendix 3

BRE Digest 365 Test

Soakaway Design f -value from field tests (F2C) IGSL

Contract: Old Nangor Road, Clondalkin, Dublin 24 Contract No. 21322
Test No. Soakaway 1
Client Dublin Simon Community
Date: 18/10/18

Summary of ground conditions

from	to	Description	Ground water
0.00	1.90	Soft to firm gravelly sandy SILT. Scattered fragments of red brick and plastic throughout. Cobble sized fragments of black shale at bottom of pit. (MADE GROUND)	

Notes:

Field Data

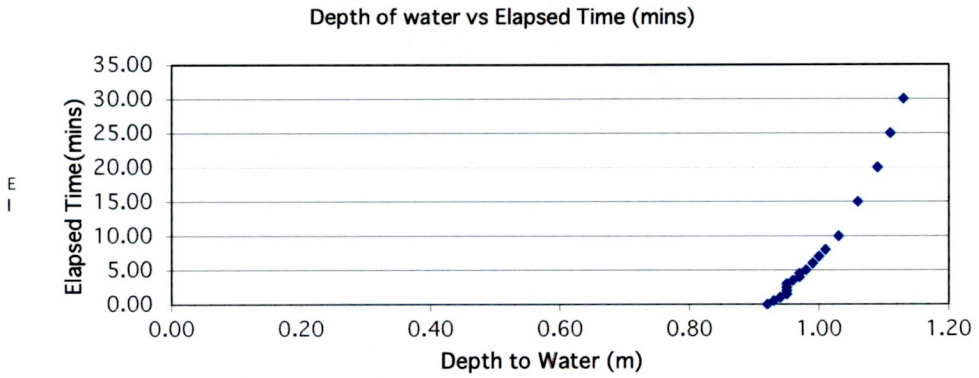
Depth to Water (m)	Elapsed Time (min)
0.92	0.00
0.93	0.50
0.94	1.00
0.95	1.50
0.95	2.00
0.95	2.50
0.95	3.00
0.96	3.50
0.97	4.00
0.97	4.50
0.98	5.00
0.99	6.00
1.00	7.00
1.01	8.00
1.03	10.00
1.06	15.00
1.09	20.00
1.11	25.00
1.13	30.00

Field Test

Depth of Pit (D)	1.90	m
Width of Pit (B)	0.95	m
Length of Pit (L)	1.80	m
Initial depth to Water =	0.92	m
Final depth to water =	1.13	m
Elapsed time (mins)=	30.00	
Top of permeable soil	0.00	m
Base of permeable soil	1.90	m
Base area=	1.71	m2
*Av. side area of permeable stratum over test period	4.8125	m2
Total Exposed area =	6.5225	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00184 m/min or 3.059E-05 m/sec

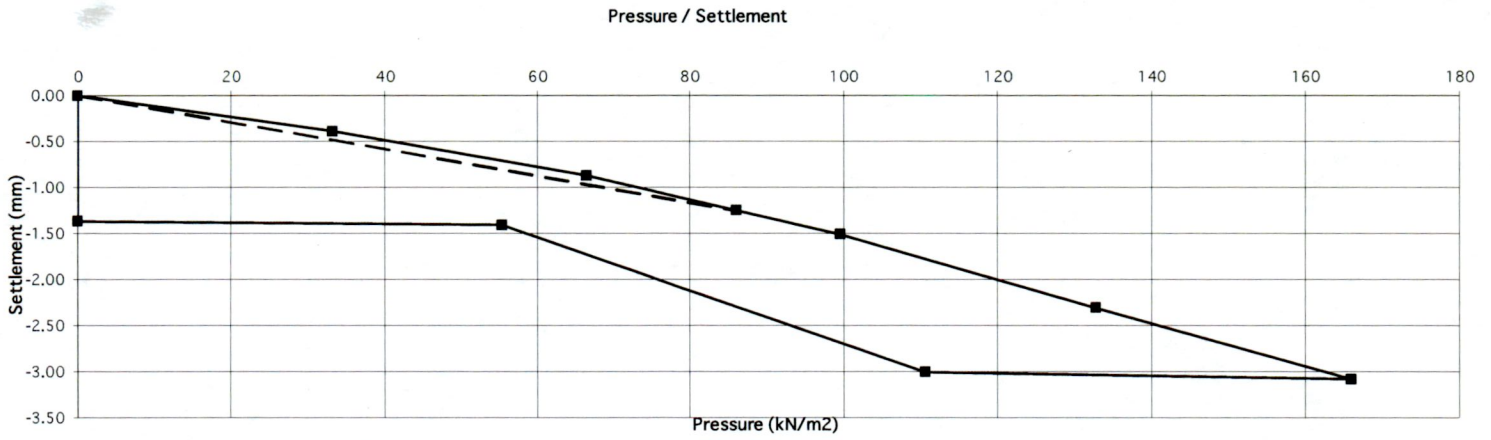


Soakaway 1 of 1

Appendix 4

CBR by Plate Test

PLATE TEST REPORT SHEET (F3.1)		Applied Pressure/Settlement Curve	
Reference No.	R95041		
Contract	Old Nangor Road , Clondalkin	Description of soil under test (natural soil, placed fill, sub-base)	
Test No.	CBR 1 - Load	MADE GROUND	
Location	CBR 1		
Depth	OGL - 0.3m	Easting (m)	
Client	Dublin Simon Community	Northing (m)	
Plate Diameter:	450 mm	Ground Level (mOD)	
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test	Sample Ref No. N/A	
Technician	Shaun Hughes	Depth 0.00 m bgl	
Authorised by			
Date	10/18/2018		



Gradient at 1.25 mm settlement intersection = 69
Modulus of subgrade reaction = 44 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 6.9 %

PLATE TEST REPORT SHEET (F3.1)

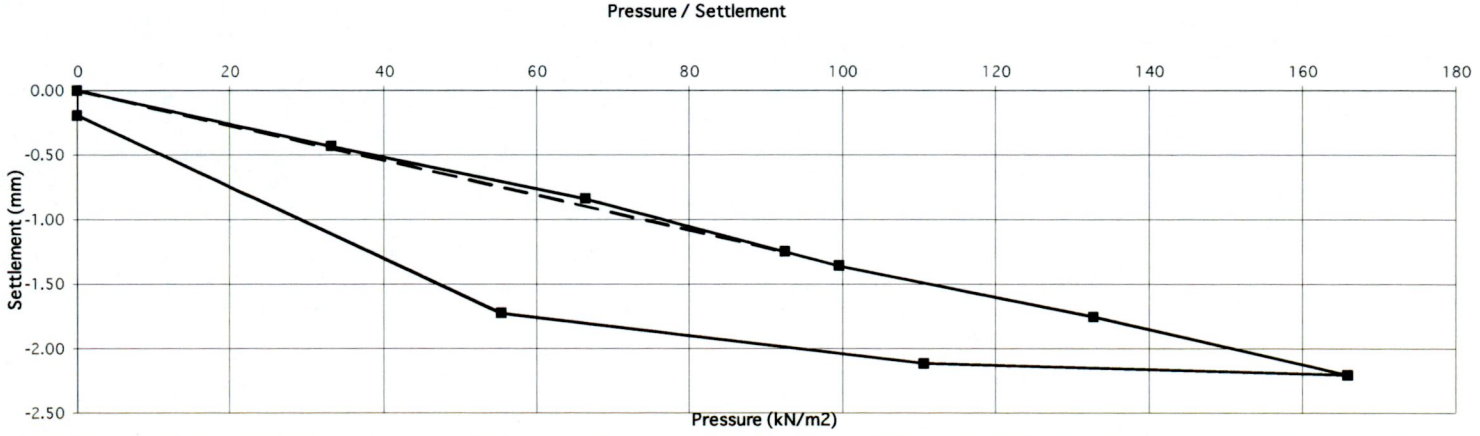
Applied Pressure/Settlement Curve

Reference No.	R95041
Contract	Old Nangor Road , Clondalkin
Test No.	CBR 1 - Reload
Location	CBR 1
Depth	OGL - 0.3m
Client	Dublin Simon Community
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	Shaun Hughes
Authorised by	
Date	10/18/2018

Description of soil under test
(natural soil, placed fill, sub-base)
MADE GROUND

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 74
Modulus of subgrade reaction = 48 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 7.8 %

PLATE TEST REPORT SHEET (F3.1)

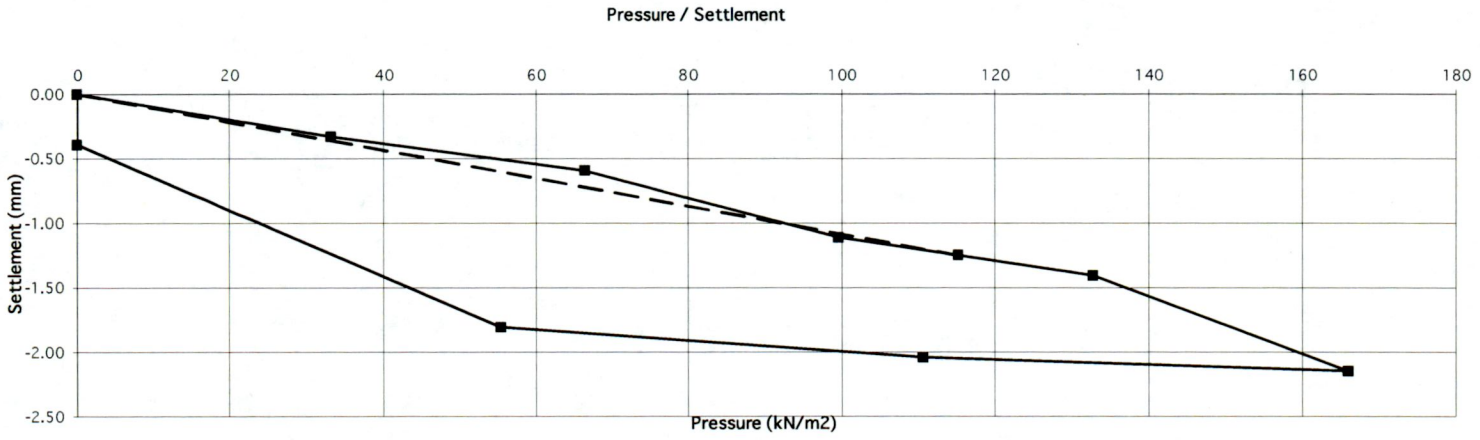
Applied Pressure/Settlement Curve

Reference No.	R95042
Contract	Old Nangor Road , Clondalkin
Test No.	CBR 2 - Load
Location	CBR 2
Depth	OGL - 0.3m
Client	Dublin Simon Community
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	Shaun Hughes
Authorised by	
Date	10/18/2018

Description of soil under test
(natural soil, placed fill, sub-base)
MADE GROUND

Easting (m)
Northing (m)
Ground Level (mOD)

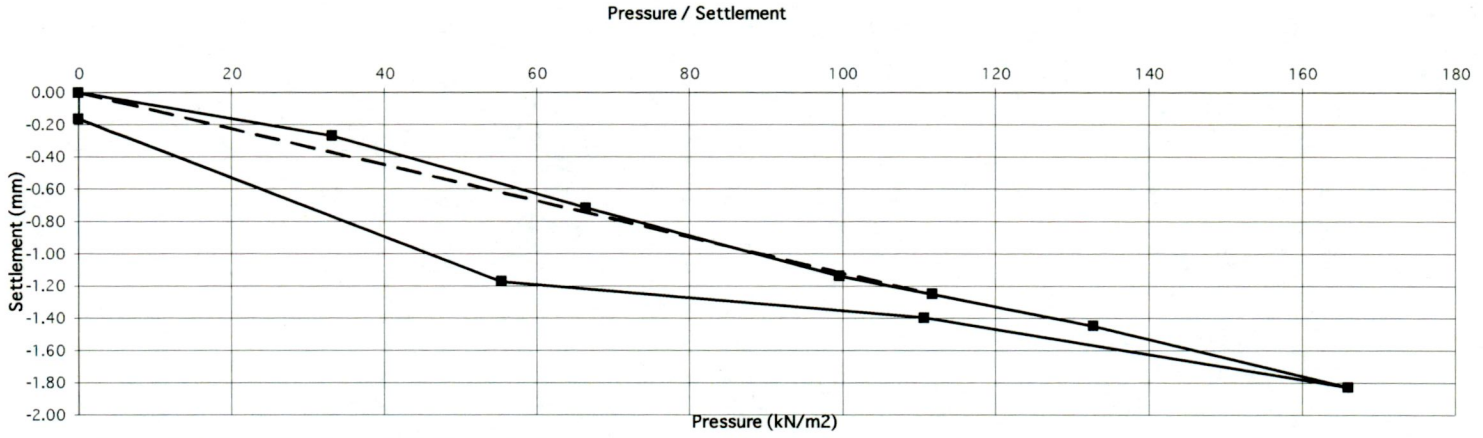
Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 92
Modulus of subgrade reaction = 59 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 11.4 %

PLATE TEST REPORT SHEET (F3.1)		Applied Pressure/Settlement Curve	
Reference No.	R95042		
Contract	Old Nangor Road , Clondalkin	Description of soil under test (natural soil, placed fill, sub-base)	
Test No.	CBR 2 - Reload	MADE GROUND	
Location	CBR 2		
Depth	OGL - 0.3m	Easting (m)	
Client	Dublin Simon Community	Northing (m)	
Plate Diameter:	450 mm	Ground Level (mOD)	
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test	Sample Ref No. N/A	
Technician	Shaun Hughes	Depth 0.00 m bgl	
Authorised by			
Date	10/18/2018		



Gradient at 1.25 mm settlement intersection = 89		
Modulus of subgrade reaction = 57 MPa/m	Equivalent CBR value in accordance with NRA HD25-26/10	10.8 %
Correction factor applied = 0.64 as per HD 25-26/10		

Appendix 5

Laboratory Test Data

IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133I

Report No. **R95608** Contract No. 21322 Contract Name: Nangor Road , Clondalkin , Dublin 22

Customer 2HP

Samples Received: 29/10/18 Date Tested: 29/10/18

BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
BH02	AA91692	2.0	A18/9051	B	9.0	51	23	28	53	WS	4.4	C H	Brown/grey clayey, sandy, GRAVEL with many cobbles
BH03	AA91686	2.0	A18/9052	B	13	32	18	14	85	WS	4.4	C L	Grey/black slightly sandy, gravelly, CLAY
BH04	AA91696	1.4	A18/9053	B	25	38	21	17	89	WS	4.4	C I	Brown slightly sandy, slightly gravelly, CLAY
BH05	AA91689	3.0	A18/9054	B	16	36	16	20	60	WS	4.4	C I	Brown/grey slightly sandy, gravelly, CLAY

Notes: Preparation: WS - Wet sieved; AR - As received; NP - Non plastic
Liquid Limit Clause: 4.3 Cone Penetrometer definitive method; 4.4 Cone Penetrometer one point method
Sample Type: B - Bulk Disturbed; U - Undisturbed

Remarks:

NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of ISO17892-1:2014
Opinions and interpretations are outside the scope of accreditation.
The results relate to the specimens tested. Any remaining material will be retained for one month.

IGSL Ltd Materials Laboratory	Persons authorized to approve reports	Approved by	Date	Page
	H Byrne (Laboratory Manager)	H Byrne	14/11/18	1 of 1