Engineering Assessment Report

Proposed Residential Development Site at Knockrabo Phase 2, Mount Anville Road, Goatstown, Dublin

October 2024

Waterman Moylan Consulting Engineers Limited
Block S, EastPoint Business Park, Alfie Byrne Road, Dublin 3
www.watermangroup.com

Client Name: Knockrabo Investments DAC
Document Reference: 20-086r.001 Engineering Assessment Report
Project Number: 20-086

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1	23 May 2024	Lai Shan Lai	Richard Miles	Mark Duignan
2	28 August 2024	Lai Shan Lai	Mark Duignan	DRAFT
3	04 Sept. 2024	Jana Ulicna	Mark Duignan	DRAFT
4	30 October 2024	Jana Ulicna	Mark Duignan	Mark Duignan

Comments

Disclaimer

This report has been prepared by Waterman Moylan, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Terms and Condition of Business and taking account of the resources devoted to us by agreement with the Client.

We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report is confidential to the Client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at its own risk.

Content

Tables

Figures

Appendices

A. JBA (Stage 1) Stormwater Audit

B. Ground Investigations – Soil Infiltration Report

C. Ground Investigations – GII Ground Investigations Report

D. GDSDS Calculations– Chamber Specifications, Drawings and Details

E. Roadplan Consulting - Quality Audit and Road Safety Audit

F. Uisce Eireann Confirmation of Feasibility Letter & Statement of Design Acceptance *(to form part of Stage 3 submission pack)*

G. Flow Model

H. Long Sections

1. Introduction

1.1 Background of Report

This engineering assessment has been prepared by Waterman Moylan as part of the planning application documentation for a proposed development of lands at Knockrabo, Mount Anville Road, Goatstown, Co. Dublin.

This report has been prepared as part of the formal application to Dun Laoghaire Rathdown County Council, for the proposed development of 158 No. residential units, Phase 2 of the overall Knockrabo Lands development. The residential units comprise 12 no. Houses, 119 no. apartments and 27 no. duplexes.

The subject site previously had a grant of planning for the development of 93 No. residential units and childcare facility along with community/leisure facilities and all associated infrastructure. The previous grant of planning DLRCC Register reference is D17A/1124.

This report assesses foul water and surface water drainage, water supply infrastructure and the road and transportation network in the vicinity of the site, and details the criteria used to design the proposed foul water and surface water drainage, water supply and road networks.

1.2 Site Location and Description

The site is in Goatstown, Dublin 14. In this regard, we refer you to the accompanying site location plan 20-086-P100 and Figure 1 below.

The site is bounded to the south-east by Mount Anville Road; to the south by 'Mount Anville Lodge' and by the rear boundaries of 'Thendara' (a Protected Structure – RPS Ref. 812), 'The Garth' (a Protected Structure – RPS Ref. 819), 'Chimes', 'Hollywood House' (a Protected Structure – RPS Ref. 829); to the south-west by existing allotments; to the north by the reservation corridor for the Dublin Eastern By-Pass (DEBP); and to the east by the site of residential development 'Knockrabo' (Phase 1, permitted under DLRCC Reg. Ref. D13A/0689 / An Bord Pleanála (ABP) Ref. PL.06D.243799 and DLRCC Reg. Ref. D16A/0821 (Phase 1); and DLRCC Reg. Ref. D16A/0960 (Phase 1A)). The site includes 'Cedar Mount' (a Protected Structure- RPS Ref. 783), 'Knockrabo Gate Lodge (West)' (a Protected Structure RPS Ref. 796), including Entrance Gates and Piers.

It is noted that an agreed access reservation for the DEBP project is supplied along Knockrabo Way, the entrance road to the development, as indicated in the accompanying Road Hierarchy drawing 20-086-P105A.

The subject site is 2.54 hectares and is predominantly greenfield.

A topographic survey of the area indicated that the site generally slopes from South to North at a steep gradient and naturally drains to the north-eastern corner.

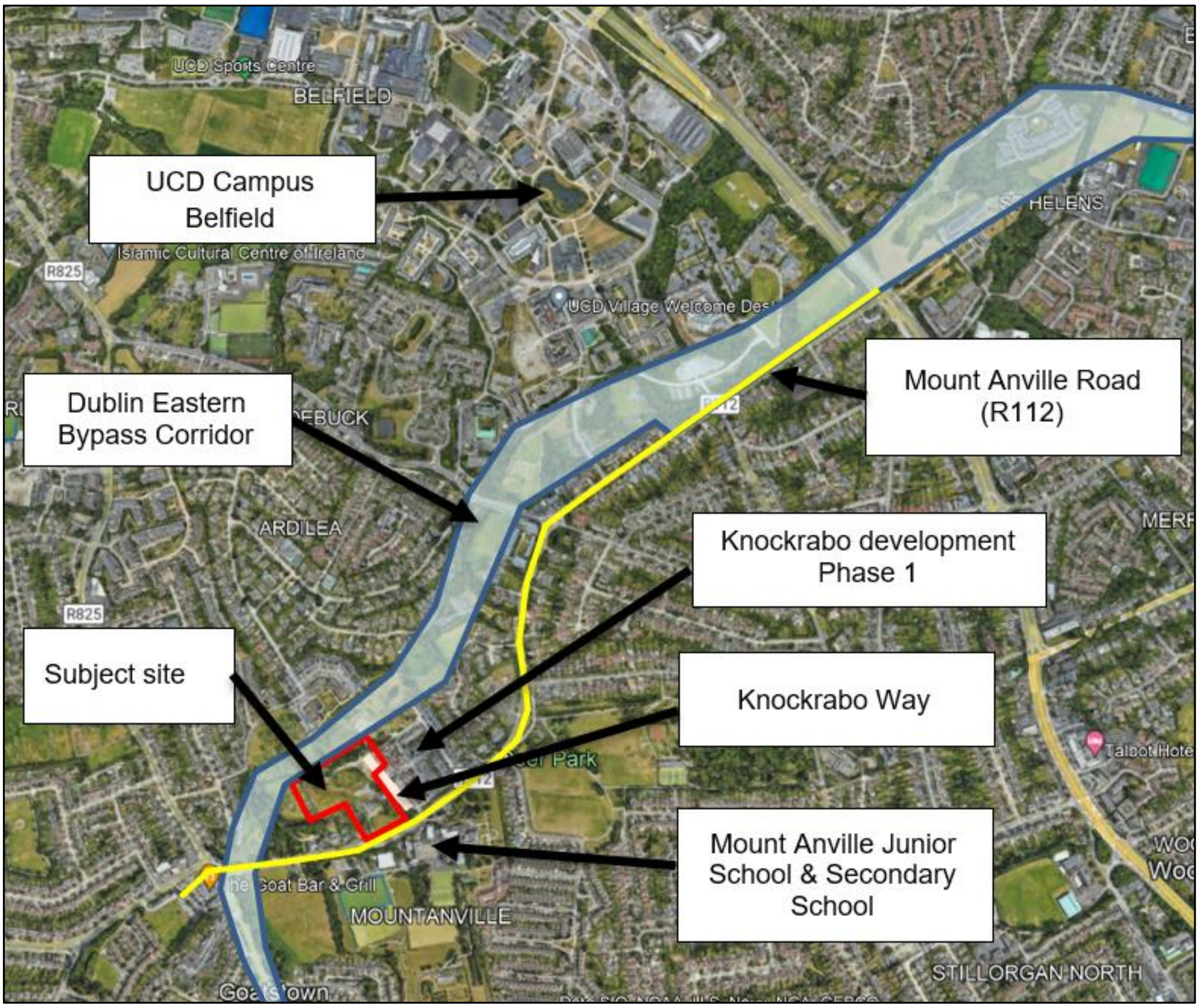


Figure 1 | Site Location (Source: Google Earth)

1.3 Existing Development

The total site area is approximately 2.54 hectares and is predominantly greenfield. The subject site is accessed from a circa 100m section of constructed entrance road, Knockrabo Way, that also facilitates access to the adjacent Phase 1 development to the east. The subject lands include 'Cedar Mount' (a protected structure RPS Ref. 783) and 'Knockrabo Gate Lodge (West) (a protected structure RPS Ref. 796), including entrance gates and piers. There are also several well-established trees and foliage on site.

The site forms part of a broader site on which the construction of Phase 1 has already taken place. Phase 1 to the east of the subject lands comprises a mix of houses and apartments and was granted under Reg. Ref. D13A/0689. The subject lands occupy the western side of this broader Knockrabo site, which had an existing grant of planning (D17A/1124) for the development of 93 No. Residential Units and Childcare Facility along with community/leisure facilities and all associated infrastructure.

1.4 Proposed Development

Knockrabo Investments DAC intend to apply for permission for a Large-scale Residential Development (for a period of 7 years) with a total application site area of c. 2.54 hectares, at Knockrabo, Mount Anville Road, Goatstown, Dublin 14.

The proposed development relates to Phase 2 of the development on the 'Knockrabo' lands. Phase 1 of 'Knockrabo' was granted under Dún Laoghaire-Rathdown County Council (DLRCC) Reg. Ref. D13A/0689/An Bord Pleanála (ABP) Ref. PL06D.243799 and DLRCC Reg. Ref. D16A/0821 (Phase 1) and DLRCC Reg. Ref. D16A/0960 (Phase 1A) and comprises a total of 127 No. units.

The proposed submission does not impact on the reservation corridor for the Dublin Eastern Bypass (DEBP).

The proposed development will consist of the construction of 158 No. residential units (12 No. houses and 146 No. apartments (35 No. 1 beds, 81 No. 2 beds, 3 No. 3 beds and 27 No. 3 bed duplex units), a childcare facility and Community / Leisure Uses.

The development will consist of the use of Knockrabo Gate Lodge (West) (a Protected Structure) as a 3-bed residential dwelling; and the use of Cedar Mount (a Protected Structure) to provide: 1 No. Childcare Facility at Lower Ground Floor level, Community / Leisure Uses at Ground Floor Level, and 2 No. 2 bed apartments at 1st floor level.

The accommodation schedule is set out in the Schedule of Accommodation in *Table 1* below.

Description	1-bed	2-bed	3-bed	4-bed	Total	GWF (sqm)
House	-	1	3	8	12	-
Duplex	-	-	27	-	27	-
Apartment	35	81	3	-	119	-
Childcare Facility	-	-	-	-	-	400
Community/ Leisure Uses	-	-	-	-	-	223
Total	**35**	**82**	**33**	**8**	**158**	**623**

Table 1 | Schedule of Accommodation

The development will also provide 130 No. car parking spaces consisting of 117 No. residential spaces (comprising 54 No. at podium level, 63 No. on-street and on curtilage spaces, 6 No. visitor spaces and 2 No. on-street car sharing spaces); and 5 No. non-residential spaces; provision of 366 No. bicycle parking spaces (consisting of: 288 No. residential spaces, 70 No. (residential) visitor spaces, 6 No. (non-residential) spaces and 2 No. visitor (non-residential) spaces); and 9 No. motorcycle parking spaces.

All other ancillary site development works to facilitate construction, site services, piped infrastructure, 1 No. sub-station, plant, public lighting, bin stores, bike stores, boundary treatments, provision of public, communal and private open space areas comprising hard and soft landscaping, site services all other associated site excavation, infrastructural and site development works above and below ground.

In addition to the repositioned access to Cedar Mount (a Protected Structure) as referenced above, the development will be served by the permitted access road 'Knockrabo Way' (DLRCC Reg. Ref. D13A/0689; ABP Ref. PL.06D.243799, DLRCC Reg. Ref. D16A/0821 and DLRCC Reg. Ref. D16A/0960).

The application does not impact on the future access to the Reservation for the Dublin Eastern Bypass.

1.5 Existing Ground Conditions

A soil infiltration report was commissioned as part of this planning application and is detailed in Appendix B. In total 4 trial holes were excavated, and infiltration tests were undertaken on 2 of these holes in accordance with BRE Special Digest 365. The soakaway tests failed the specification and thus demonstrated the unsuitability of the soils for soakaway design. The descriptions of the materials in the area of the site where soakaway tests were conducted further outlines the unsuitability of the soil for soakaways, i.e. “well compacted clay/silt soils”.

Considering the above Site Investigations and previous site investigations undertaken on the site (included as Appendix C), the soil index used to determine the surface water design has been determined to be Soil Type 4. The site predominantly contains either made ground or cohesive deposits at a shallow level, with weathered bedrock beneath. Given the steep nature of the site, with approximate gradient of 1 in 12, the nature of the soil and underlying ground conditions, it is considered that Type 4 is appropriate for this site and for the necessary calculations associated with the greenfield runoff analysis, further developed in section 4 below.

1.6 Stage 2 LRD Opinion

In August 2024, the Large-Scale Residential Development Opinion (LRD) on the consultation and submission made in June 2024 was issued by Dún Laoghaire-Rathdown County Council (DLRCC). The observations, recommendations and other DLRCC feedback on the key drainage and water supply items are addressed within this Engineering Assessment Report. The key feedback can be summarised as follows:

Opinion 9: *Design of the proposed surface water management system including attenuation features and cross sections of all SuDS features proposed on site in the context of surface water management on the site, discharge rates equal to greenfield sites, integration of appropriate phased works.*

Response:

For details, please refer to Section 3 of this report and drawings; 20-086-P140B Proposed SuDS Strategy Plan and 20-086-P141 SuDS Details Sheet 1 and P142 SuDS Details Sheet 2.

Opinion 12: *A letter from Irish Water (Uisce Eireann) confirming that there is sufficient capacity in the public infrastructure to facilitate a connection for the proposed development obtained no more than 6 months before the date of lodgement of the LRD Application*.

Response:

Confirmation of feasibility has been received on 4 June 2024 and is included in Appendix F of this report. Water and Wastewater connections are feasible without infrastructure upgrade by Uisce Eireann.

Opinion 14: *Information/documentation which address the following concerns/issues of Drainage Planning:*

SOIL value 4 has been justified for this application. The applicant has proposed an overall flow restriction of 13.4l/s for the entire site, with 750m^3 of storage required (771m^3 provided). This has not been supported at this stage by hydraulic analysis.

Response:

A Stage 1 Storm Water Audit (SWA) has been carried out by JBA consulting. After answering all comments raised by the JBA SW Audit a hydraulic analysis with parameters as agreed with JBA has been completed. The parameters are as follows; an overall flow restriction 8.56l/s with 961m^3 of storage is required (985m^3 provided) Soil type 4 classification has been supported by an infiltration test on the subject site, indicating very poor permeability.

Surface Water Drainage

a) As standard, the applicant is requested to ensure that all surface water design proposals are in accordance with the requirements of Appendix 7: Sustainable Drainage System Measures of the County Development Plan 2022-2028.

Response:

A Storm Water Audit (Stage 1) has been completed by JBA, please refer to Appendix A. Appendix 7: Sustainable Drainage System Measures of the County Development Plan 2022-2028 requirements such as climate change, urban creep, assessment of flood risk, utility clash check, wayleaves, private drains, SuDS, infiltration, hardstanding/parking areas, basement, run-off factors, hydrological parameters, discharge rates, attenuation, green roof, interception and treatment, stormwater audit, maintenance, new connections, Irish Water assets, has been applied.

b) As standard, the applicant is requested to ensure that the proposed surface water design is in accordance with County Development Plan 2022-2028 Section 10.2.2.6 Policy Objective EI4: Sustainable Drainage Systems, such that the proposal meets the requirements of the Greater Dublin Strategic Drainage Study (GDSDS) policies in relation to Sustainable Drainage Systems (SuDS). The design must incorporate SuDS measures appropriate to the scale of the proposed development such as green roofs, bioretention areas, permeable paving, rainwater harvesting, swales, etc. that minimise flows to the public drainage system and maximises local infiltration potential.

Response:

The proposed surface water system has been designed in accordance with County Development Plan 2022-2028 Section 10.2.2.6 Policy Objective EI4: Sustainable Drainage Systems, such that the proposal meets the requirements of the Greater Dublin Strategic Drainage Study (GDSDS).

c) The applicant is requested to confirm what the drainage arrangements are for the Gate Lodge West. The applicant should confirm that this area has been removed from the allowable outflow calculation if not included in the positively drained area.

Response:

Gate Lodge West is included in the positively drained area.

d) In the vicinity of Block E, on the "Proposed SuDS Strategy" drawing P140, as well as "Proposed Foul and Storm Water Drainage General Arrangements" Drawing P120, it appears a surface water network (unclear if called up as proposed or existing as drawings conflict) is shown to discharge into a foul network. The foul and surface water should be separate systems.

Response:

Drawings have been updated. The foul and surface water are proposed as separate systems.

e) Further to the above, the surface water coming from Block E appears to discharge into an existing (or permitted) surface water network on the access road, before coming back into the site and discharging into the attenuation system for this proposed scheme. The applicant is requested to clarify what is the catchment of this network and confirm if this has been accounted for in the storage requirements for the site.

Response:

Block E surface water discharges into the permitted surface water pipe within Knockrabo Way, and it is connected to the proposed development. Block E and the portion of Knockrabo Way served by this surface water sewer are included in the proposed development catchment. Drainage and storage have been modelled with this addition contributing area. Refer to 20-086-P121A Drainage Layout.

f) The applicant has indicated in the body of the Engineering Assessment Report that a SAAR of 881 is appropriate for the site. However within the analysis in Appendix D, a figure 774mm has been used. The applicant is requested to use site specific data for analysis and ensure consistency within the documentation.

Response:

SAAR of 836mm - Met Éireann (2024) has been used as recommend by JBA (Stage 1) Stormwater Audit in Appendix A.

g) At full application stage, hydraulic simulation results are required for each standard rainfall return event from the 15 minute to 10800 minute event in order to demonstrate the performance of the proposed surface water drainage network for all rainfall events. Site specific data should be used including SAAR and soil type, as well as M5-60. The applicant is requested to comment on any run-off factors proposed (these should be agreed prior to submission) and the correct CV value, as set out in Appendix 7: Sustainable Drainage System Measures of the County Development Plan 2022-2028 should be used.

Response:

Please refer to the drainage Flow Model in appendix G. Standard Cv values of 0.84 for Winter and 0.75 for Summer has been used.

h) As standard, the applicant is requested to ensure that a penstock is provided in the flow control device chambers and that the flow control device provided does not have a bypass door. The applicant shall also ensure a silt trap is being provided in the flow control device chamber.

Response:

Noted.

i) As standard, the applicant is requested to show the options being proposed for interception and treatment with contributing areas on a drawing together with an accompanying text and tabular submission showing the calculations, to demonstrate that the entire site is in compliance with GDSDS requirements. The applicant should note that over-provision in one location does not compensate for under provision elsewhere. The interception requirements is based on the total positively drained area, rather than the reduced (factored) impermeable area.

Response:

Please refer to this report Section 3.6 drawing 20-086-P140B Proposed SuDS Strategy Plan.

j) As standard, the applicant is requested to ensure that any changes to parking and hardstanding areas shall be constructed in accordance with the recommendations of the Greater Dublin Strategic Drainage Study for sustainable urban drainage systems (SuDS) i.e. permeable surfacing, and in accordance with Section 12.4.8.3 Driveways/Hardstanding Areas of the County Development Plan 2022-2028. Appropriate measures shall be included to prevent runoff from driveways entering onto the public realm as required. Where unbound material is proposed for driveway, parking or hardstanding areas, it shall be contained in such a way to ensure that it does not transfer on to the public road or footpath on road safety grounds.

Response:

Noted. The proposed gravel surface at Gate House slopes away from the adjacent public road (Mount Anville Road). See drawing 20-086-P110B Road Levels & Layout Plan for slopes.

k) As standard, the applicant is requested to submit supporting standard details, including cross-sections and long-sections, and commentary that demonstrates that all proposed SuDS measures have been designed in accordance with the recommendations of CIRIA C753 (The SuDS manual).

Response:

All proposed SuDS measures for the subject site have been designed in accordance with the requirements of Dun-Laoghaire Rathdown County Council and is based on recommendations set out in the Greater Dublin Strategic Drainage Study (GDSDS) and in The SuDS Manual (Ciria C753). Please refer to Section 3 of this report and drawings; 20-086-P140B Proposed SuDS Strategy Plan, 20-086-P141 SuDS Details Sheet 1, 20-086-P142 SuDS Details Sheet 2.

l) As standard, the applicant is requested to submit long-sections of the surface water drainage system, clearly labelling cover levels, invert levels, pipe gradients and pipe diameters, as per this draft submission.

Response:

Please see appendix H.

m) As standard, the applicant is requested to confirm that a utilities clash check has been carried out ensuring all utilities' vertical and horizontal separation distances can be provided throughout the scheme. The applicant should demonstrate this with cross-sections at critical locations such as junctions, site thresholds and connection points to public utilities. Minimum separation distances shall be in accordance with applicable Codes of Practice.

Response:

Clash detection has been undertaken for surface water, foul water and watermain network at critical locations. Utilities coordination will be undertaken at the next stage.

n) As standard the applicant is requested to ensure that a Stage 1 Stormwater Audit is carried out for the development. In accordance with the Stormwater Audit policy, the audit shall be forwarded to DLRCC prior to lodging the planning application. All recommendations shall be complied with, unless agreed in writing otherwise with DLRCC.

Response:

The Stage 1 Stormwater Audit was forwarded via email to Johanne Codd Executive Engineer, Drainage Planning, Municipal Services, DLRCC on 19 September 2024. Please refer to appendix A for Stage 1 Storm Water Audit. All recommendations have been completed with.

2. Foul Water Network

2.1 Existing Foul Water Network

A Pre-Connection Enquiry was submitted to Uisce Eireann (formerly Irish Water) and received a reference number of CDS24002545 in May 2024. The Confirmation of Feasibility Letter (CoF) dated 4 June 2024 is included in appendix F. The letter notes that connection to the 225mm sewer adjacent to the site on Mount Anville Road is feasible without infrastructure upgrades to the foul water network.

Further, an Uisce Eireann Statement of Design Acceptance (SoDA) was received on 18 September 2024. The SoDA confirms Uisce Eireann has no objection to the proposed development foul water drainage connection. The CoF and SoDA are included in Appendix F.

2.2 Proposed Foul Water Network

There is an existing 225mm diameter foul sewer outfall in the northeast of the subject site which was constructed under Phase 1 of the Knockrabo development and was designed and built to drain the Phase 1 and 2 lands.

It is proposed to serve the subject site with a drainage network containing a series of 150mm and 225mm diameter pipes, which will outfall to the existing outfall in the northeast of the site as mentioned above.

The proposed internal foul drainage network has been designed and sized in accordance with the Uisce Eireann Code of Practice for Wastewater Infrastructure and Standard Details. Please refer to drawings 20-086-P121A which shows the proposed foul drainage layout to serve the subject site.

2.3 Foul Water Drainage Calculations

The calculated foul water flows at the subject development are set out in *Table 2* below. Domestic wastewater loads have been calculated based on 2.7 person per unit with a per capita domestic wastewater flow of 150 litres per capita per day along with infiltration rate of 10% unit consumption. A peak flow multiplier of 6 has been used, as per section 2.2.5 of Appendix C of the Code of Practice.

Description	**Total Population**	**Load per Capita**	**Daily Load**	**Total DWF**	**Peak Flow**
	No. People	l/day	l/day	l/s	l/s
12 House	33	150	5,445	0.063	0.378
27 Duplex	73	150	12,045	0.139	0.834
119 Apartment	322	150	53,130	0.615	3.69
Childcare Facility	120	90	11,880	0.137	0.824
Total	**548**	**Varies**	**82,500**	**0.954**	**5.726**

Table 2 | Calculation of Total Foul Water from the Development

The total dry weather flow from the development has been calculated as: 0.954 l/s, with a peak flow of 5.73 l/s.

2.4 Foul Water Drainage - General

Foul water sewer will be constructed strictly in accordance with Uisce Eireann requirements. No private drainage will be located within public areas.

Drains will be laid to comply with the requirements of the latest Building Regulations, and in accordance with the recommendations contained in the Technical Guidance Document H.

3. Surface Water Network

3.1 Existing Surface Water Network

The following section deals with surface water drainage design including details of the SUDS measures proposed as part of the development.

The existing site is greenfield. It is proposed that the development will attenuate the surface water on site before discharging it, at a restricted rate, to an outfall pipe in the north-eastern corner of the development, constructed as part of the adjacent Knockrabo Phase 1 development and installed to facilitate development of the subject lands.

The Surface Water design calculations, reports and drawings had been audited (Stage 1 Audit) by JBA consulting, as required by Dun Laoghaire Rathdown County Council.

This Stormwater Audit required a Flow Model to be provided which now has been completed and informs the surface water design.

For JBA Stormwater Audit please refer to Appendix A and for the associated Flow Model, please refer to Appendix G of this report.

The Stormwater Audit and Flow Model supports and addresses several of the drainage items raised in Dun Laoghaire Rathdown County Council's Pre-Planning Opinion report as follows:

1. Proposed surface water management system including attenuation features and cross sections of all SuDS features proposed on site in the context of surface water management on the site, discharge rates equal to greenfield sites, integration of appropriate phased works.
2. SOIL value 4 has been justified for this application. We now propose an overall flow restriction of 8.56 l/s for contributing site area of 1.441 ha. This has been supported by infiltration test failing on the subject site, indicating very poor permeability.
3. The design now incorporate SuDS measures appropriate to the scale of the proposed development such as green roofs, bioretention areas, permeable paving, rainwater harvesting, swales, etc. that minimise flows to the public drainage system and maximises local infiltration potential for low flows as the soil is not suitable for full infiltration SuDS devices.
4. We now confirm the drainage arrangements for the Gate Lodge West is positively drained via infiltration drains.
5. We have used a SAAR of 836mm as site specific SAAR for analysis and modelling.

3.2 SuDS

Sustainable Drainage System (SuDS) are a collection of water management practices that aim to align modern drainage systems with natural water processes.

By using SuDS techniques, water is either infiltrated or conveyed more slowly to the drainage system and ultimately more slowly to water courses via permeable paving, swales, & detention basins.

The SuDS strategies employed within this development align with the *Dun Laoghaire Rathdown County Council's document titled 12.8.6.2* SuDS (Sustainable Drainage Systems) and the National Guidance

Document '*Nature Based Solutions to the Management of Rainwater, Surface Water Runoff in Urban Areas.* The latter reflects the provisions of the EU Water Framework Directive (2000/60/EC) (WFD).

In the following sections of the surface water chapter, it will be outlined in detail how SuDS devices have been utilised and incorporated to the overall plan for the proposed development, and how their inclusion will mitigate the risk of localised and downstream flooding, while also promoting residential amenity and biodiversity.

3.3 Proposed Surface Water Network and SuDS Strategy

It is proposed to construct a surface water drainage network that will service and attenuate the development internally before discharging at the current greenfield (or allowable) rates to the local natural ditch systems. For surface water drainage layout and attenuation strategy details please see drawings 20-086-P121A and 20-086-P140B. The subject site includes a single catchment.

The following parameters have been used in greenfield run-off rate calculations, which are also provided in the GDSDS Calculations, supplied in Appendix D.

Table 3 | Surface Water Catchment Details

	Catchment
Site Redline Area (Gross) – Ha	2.54
Site Hardstanding and positively drained Area (Net) - Ha	1.441
SAAR - mm*1	836
SOIL Index*2	0.47
Climate Change	20%

*1 – From MetEireann data

*2 – The soil type map of Ireland indicated Soil Type 2 however the SI would suggest this is not correct for this particular site with soil conditions being compacted clay/silt above weathered bedrock in the southern part of the site and shallow bedrock in the northern end of the site, expected for Soil Type 4. Therefore 0.47 is used as the Soil Index for this site. In addition, there is a natural steep slope of c. 1:12 across the site which will increase the rate of run-off from the site, even in its greenfield state.

3.4 Greenfield run-off rates

The Local Authority requirements are that post-development run-off rates are limited to greenfield run-off rates for the site. The greenfield run-off rates for the site have been calculated in accordance with the Institute of Hydrology report No 124 "Flood Estimation for Small Catchments", using the UK SUDS Website. As outlined above, a Soil Index of 0.47 was used in our drainage design calculations. The Greenfield run-off for the site is 8.56 l/s (Qbar). These calculations have been provided in Appendix D of this report. Site investigations have been undertaken to determine the soil infiltration values and to verify the above Soil Index value, and are included as Appendix B. It was determined that it is not viable to use soakaways to infiltrate the surface water at source for this site and that the ground conditions would be typical of Soil Type 4.

3.5 **Proposed Surface Water Strategy**

It is proposed to drain surface water from the development by gravity to the existing public surface water drainage outfall pipe in the north-eastern corner of the development site. Storm water will discharge to the outfall at a controlled rate, limited to the greenfield equivalent runoff. Excess surface water runoff during storm events will be attenuated in new below ground stormwater attenuation tanks within the open space at the northern end of the site, as shown on Waterman Moylan Drainage Layout Drawing No. 20-086-P121A. As noted in section 3.4 above, the suitability of the soil for infiltration soakaways has been explored through site investigation, however the ground conditions are not favourable to this means of surface water design. As such, alternative SuDS measures including attenuation tanks are proposed, as further explained below.

The proposed surface water outfall pipe from the development is a 225mm diameter pipe laid at a gradient of 1:100, giving a capacity of 51.9 l/s. Therefore, the proposed outfall has more than adequate capacity to cater for restricted greenfield rate flows from the development lands.

Furthermore, the adjacent Stage 1 development lands are similarly attenuated. The Stage 1 lands are restricted to 13l/s, which, when combined with phase 2 equates to a combined flow rate of 21.56l/s, still within the capacity limits of permitted combined surface water outfall drainage through the Phase 1 Lands.

Strict separation of surface water and wastewater will be implemented throughout the development. Internal private surface water will consist of uPVC (to IS 123) or concrete socket and spigot pipes (to IS 6). These drains will be laid to comply with the Building Regulations 2010, and in accordance with the recommendations contained in the Technical Guidance Documents, Section H. Surface water sewers will consist of uPVC or concrete socket and spigot pipes (to IS 6) and will be laid strictly in accordance with Dun Laoghaire Rathdown Council requirements for taking in charge.

The proposed development has been designed to incorporate best drainage practice. Section 3.4, above, sets out the methodology used in determining the existing greenfield runoff rate and calculating attenuation storage requirements for the site.

It is proposed to incorporate a Storm Water Management Plan through the use of various SuDS techniques to treat and minimise surface water runoff from the site. The methodology involved in developing a Storm Water Management Plan for the subject site is in accordance with the requirements of Dun-Laoghaire Rathdown County Council and is based on recommendations set out in the Greater Dublin Strategic Drainage Study (GDSDS) and in the SuDS Manual (Ciria C753).

As stated in Section 3.2, the SuDS strategies employed within this development align with the *Dun Laoghaire Rathdown County Council's document titled 12.8.6.2* SuDS (Sustainable Drainage Systems) and the National Guidance Document '*Nature Based Solutions to the Management of Rainwater, Surface Water Runoff in Urban Areas.* The latter reflects the provisions of the EU Water Framework Directive (2000/60/EC) (WFD).

Based on three key elements – Water Quantity, Water Quality and Amenity – the targets of the SuDS train concept have been implemented in the design, providing SuDS devices for each of the following:

- Source Control
- Site Control
- Regional Control

The following drainage hierarchy was used to determine the most suitable and sustainable SUDS strategy. This is in accordance with the GDSDS initiative that all new developments will conform to Best Management Practices for urban storm water drainage:

1. The use of green roofs;
2. Store rainwater for later use;
3. Use infiltration techniques, such as porous surfaces in non-clay areas;
4. Attenuate rainwater in ponds or open water features for gradual release;
5. Attenuate rainwater by storing in tanks or sealed water features for gradual release;
6. Discharge rainwater direct to a watercourse;
7. Discharge rainwater to a surface water sewer/drain;
8. Discharge rainwater to the combined sewer.

A plan of the SuDS measures proposed has been supplied on drawing 20-086-P140B and plans of the SuDS details are supplied on drawings 20-086-P141 and P142, all of which accompany this report.

3.5.1 Source Control

Green Roof:

Green Roofs have been considered and incorporated into the development proposals in accordance with Appendix 16 of DLRCC County Development Plan. The locations of the green roofs are illustrated on the accompanying Waterman Moylan SUDS Drawing 20-086-P140B, and a section of the proposed roof is supplied on details drawing 20-086-P142. The total roof area on site is 2,239m^2 and the area of green roof provided is 1,903m^2 providing 85% coverage in green roof. This is in excess of the minimum requirement of 70% coverage for extensive green roof as outlined in Appendix 7.2 of the DLR Green Roof Policy 2022 document.

As well as providing ecological benefits, green roofs contribute the following positive effects to surface water drainage design:

- The retention of water, through storage in the growing medium and evapotranspiration from the roof's plants and substrate, reducing run-off volumes and the burden on the drainage network.
- Due to the time for water to infiltrate and permeate the substrate, there is also a reduction in peak rates of run-off, helping to reduce the risk of flooding.
- They improve water quality through the filtration of pollutants during the process of water infiltration. This provides treatment in line with CIRIA SUDS Manual management train.

Although green roof space can reduce peak flow rates in the small storm events and aid in reducing the volume of run-off from the site, they operate as conventional roofs in higher storm events. Therefore, green roofs cannot be considered in the surface water drainage run-off calculations for the development. As stated in CIRIA C697 *"although green roofs absorb most of the rainfall that they receive during ordinary events,* *there is still the need to discharge excess water to the building's drainage system. This is because their hydraulic performance during extreme events tends to be fairly similar to standard roofs."*

The green roofs proposed will not be accessed as amenity areas. With respect to maintenance access, we refer you to the accompanying architectural layouts and drawings. Maintenance access to those areas is via level access from internal corridors & stairwells where that is possible, and via external mobile access from hard standing areas where that is not possible. A review of M&E plant space requirements document confirms that PV panels are not proposed for use on the apartment roofs and as such there is no requirement for compatibility between the two.

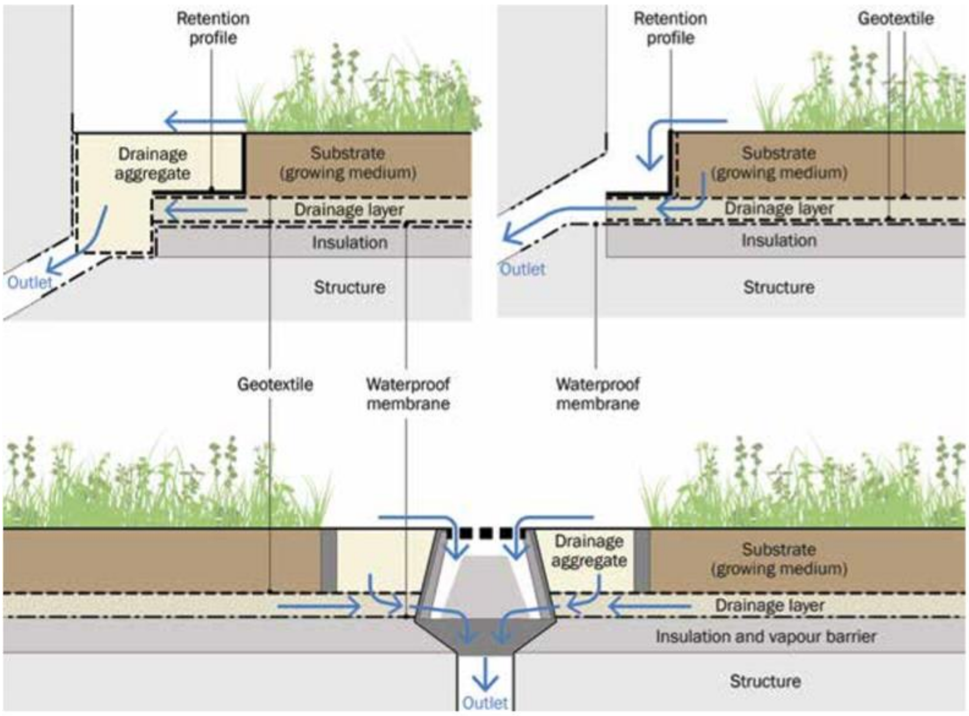


Figure 2 | Example Details of outlets from a green roof – Subsurface outlet (top), and open outlet (bottom) (CIRIA C697).

The substrate and the plant layers in a sedum roof absorb large amounts of rainwater and release it back into the atmosphere by transpiration and evaporation. They also filter water as it passes through the layers, so the run-off, when it is produced, has fewer pollutants. Rainfall not retained by green roofs is detained, effectively increasing the time to peak and reducing peak flows.

A green roof can reduce annual percentage runoff by between 40% and 80% through this retention and evapotranspiration, with the impact dependent on a range of factors including the depth of substrate, the saturation of substrate at the onset of a rain event, the angle of the roof, the range of vegetation growing, intensity of rainfall and the time of year.

Rainwater Storage for Later Use

Rainwater harvesting is often considered the most sustainable solution as it will reduce the total volume of water draining to the outfall as well as reducing the water demand for the proposed buildings. It must be assumed, however, that any water harvesting tanks are full prior to a storm event, and therefore cannot be considered as providing any rainwater attenuation. Rainwater harvesting shall be allowed for in the form of rainwater butts located at the position of rainwater downpipes.

3.5.2 Site Control

As the site investigations have determined, infiltration techniques cannot be utilised on site. However, it is proposed the following site control measures before any discharge to the public surface water sewer.

Permeable paving:

Permeable paving will be utilised at public roadside parking bays providing some treatment volume, with underlying perforated pipes connecting to the storm water sewer network within the roads. Adjacent road gullies will be connected to the underlying filter drains to treat and slow down the runoff rate by means of infiltration. Permeable Paved parking bays have been successfully incorporated in local developments in recent years.

Filter Drains:

Filter Drains are shallow trenches filled with gravel and wrapped in a geotextile membrane to treat and temporarily store surface water run-off. It is proposed to use filter drains on the footpaths and outside communal areas to treat surface water falling on ground level hardstanding areas at source before discharging into the attenuation tanks.

Tree Pits / Bio-retention Areas:

Where possible, surface water runoff from the roads will discharge to tree pits (via kerb inlets) located on the side of the road. Gullies will be positioned downstream of the tree pits to cater for overflow during high rainfall events. Tree pits are suitable for installation alongside carriage ways. The tree pit receives surface water runoff from the road via gully inlet. The surface water drains through the tree pit which is filled with engineered filter material to the underdrain system which discharges the treated surface water to the main surface water sewer in the roadway.

3.5.3 Regional Control

Flow Control:

A Hydrobrake or similar approved flow control device is proposed before the outfall to the public network, with an online attenuation system provided to store excess rainwater during storm events. Flows will be limited to the greenfield equivalent runoff rate. It is proposed to provide a penstock on the inlet to the hydrobrake manhole, which shall be connected to the proposed upstream attenuation tanks. This will facilitate ease of maintenance for the proposed hydrobrake manhole.

Underground Attenuation Storage System:

Private underground attenuation storage tanks are proposed to store excess surface water during storm events before discharging to the public network at the greenfield equivalent runoff rate. The attenuation tanks are to be located in the open space at the north of the proposed site. The attenuation shall incorporate an isolator row that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation. The underground storage tanks are supplied with minimum 900mm of stabilised over material, to facilitate future construction traffic should the need arise for the DEBP construction access way to be utilised above. In this regard, we refer you to attention cross sectional drawing 20-086-P127A. For surface water drainage design and surface water attenuation requirements please refer to Appendix D.

Downstream Defender (or similar approved)

Surface water shall then pass through one final level of treatment before outfall to the existing network, passing through a proposed downstream defender, which is an advanced hydrodynamic vortex separator used to remove fine particles, oils and other floatable debris effectively and reliably from the surface water runoff. It is proposed that the petrol interceptor shall be fitted with an audible high-level silt and oil alarm for maintenance and safety purposes. Regular maintenance and inspection are recommended on these units.

It is also noted that silt and debris removed from the petrol interceptor during maintenance will be classified as contaminated material and should only be handled and transported by a suitably licensed contractor and haulier and disposed of at a suitably licensed landfill only.

3.6 Interception Storage

Interception storage is defined in the SUDS Manual as *"the capture and retention on site of the first 5mm of the majority of rainfall events"*. In accordance with the table 24.6 of the SUDS Manual CIRIA C753 the following guidelines have been used in calculating the area of the site benefiting from interception storage.

Table 4 | Interception Mechanisms (Table 24.6 The SUDS Manual)

Systems	Interception methods assumed compliant for zero runoff from the first 5mm of rainfall for 80% of events during the summer and 50% in winter.
Green Roofs	All surfaces that have green roofs
Permeable Paving	All permeable pavements, whether lined or not, can be assumed to comply, provided there is no extra area drained to the permeable pavement. Where the pavement also drains an adjacent impermeable area, compliance can be assumed for all soil types where the pavement is unlined, as long as the extra paved area is no greater than the permeable pavement area
Swales / Filter Strips	Roads drained by filters strips/swales, where the longitudinal gradient of the vegetated area is less than 1:100, are suitable for Interception delivery for impermeable surface areas up to 5 times the base of the vegetated surface area receiving the runoff. Components steeper than 1 in 100 cannot be deemed to provide interception unless additional effective interception design can be demonstrated.

As described in section 4.3 and 4.4 below, the proposed development will provide, Green Roofs, Permeable Paving/Asphalt & Filter Drains.

3.7 Interception or Treatment Storage and Attenuation Storage

As noted above, the methodology involved in developing the Storm Water Management Plan for the subject site is based on recommendations set out in the Greater Dublin Strategic Drainage Study (GDSDS) and in the SuDS Manual. Appendix E of the Greater Dublin Strategic Drainage Study (GDSDS) sets out criteria for determining the provision of interception or treatment storage, attenuation storage and long-term storage at a development site. These calculations are summarised below:

3.7.1 Criterion 1: River Water Quality Protection

Criterion 1.1: Interception

The Greater Dublin Strategic Drainage Study (GDSDS) states that approximately 30% to 40% of rainfall events are sufficiently small that there is no measurable runoff from greenfield areas into the receiving waters. These events are generally considered as the first 5mm of rainfall. Assuming 75% runoff from paved surfaces and 0% from pervious surfaces for the first 5mm of rainfall yields the following:

The required interception volume is circa 35.74m^3. It is proposed to provide interception mechanisms for the entire site, as described in section 3.6 above.

Paved surfaces connected to drainage system	*14,410m² x 0.62 x 1 =* 8,934m²	*14,410m² development site area* *62% of the site is paved* *100% of the paved area*
Volume of Interception Storage	*8,934m² x 5mm x 0.8 =* **35.74m³**	*Paved area directly drained* *5mm rainfall depth*

Table 5 | Interception Calculation

For this site, interception storage is achieved using green roofs, permeable paving, tree pits and filter drains in various locations throughout the site, however this is assumed to be quite small due to the nature of the sub-soils.

Referring to the soakaway tests conducted throughout the site, as contained in Appendix B, low permeability was observed. Criterion 1.2 will then be assessed to provide the required River Water Quality Protection in accordance with Criterion 1.

Criterion 1.2: Treatment Volume

For events larger than 5mm, and in situations where interception storage cannot be provided, surface water runoff treatment is provided.

Assuming 75% runoff from paved surfaces and 0% from pervious surfaces for the first 15mm of rainfall:

Paved surfaces draining to public drainage network	*14,410m² x 0.62 x 1 =* 8,934m²	*14,410m² development site area* *62% of the site is paved* *100% of the paved area*
Volume of Treatment Storage	*8,934m² x 15mm x 0.75 =* **100.51m³**	*Paved area directly drained* *15mm rainfall depth* *75% runoff from paved surfaces*

Table 6 | Treatment Volume Calculation

The proposed green roofing amounts to a cumulative area of approximately 1,903m^2. The sedum roofing shall consist of 75mm substrate with a sedum blanket. Assuming a 30% water volume retention, this amounts to approximately 43m^3 of treatment storage volume.

The proposed permeable paving provides approximately 0.1m^3 of treatment volume square metre area. This amounts to approximately 302.7m^3 of treatment volume when the external parking areas are considered.

The proposed tree pits 300mm layer of voided stone similarly affords approximately 0.1m^3 of treatment volume square metre area (tree pits vary in size according to site layout). The total area of coverage for all the proposed tree pits is approximately 156 m^2, this amounts to 15.6m^3 of treatment volume.

The proposed filter drains (242m) provision of stone surround similarly affords approximately 0.1m^3 of treatment volume per linear metre. This amounts to approximately 24.2m^3 of treatment volume.

The treatment volume afforded by the above measures is therefore sufficient to meet the required treatment volume for the respective hardstanding areas.

Table 7 | Interception Storage Provided

Area	Total Hard standing Area	Treatment mechanism	Treatment Storage
Block E/F/G Plan Area	2,239 m^2	Green Roof (2,239m^2 @ 85% coverage = 1,903m^2)	43m^3
Road, Path, Roofs and Podium	6,695m^2	Bio Retention Tree Pits 156 m^2	15.6m^3
		Filter Drain – 242m	24.2m^3
		Permeable Paving 3027m^2	302.7m^3
Total	**8,934m^2**		**385.5**m^3

3.7.2 Criterion 2: River Regime Protection

Attenuation storage is provided to limit the discharge rate from the site into receiving waters. As per the GDSDS, the required attenuation volume is calculated assuming 100% runoff from paved areas, and has been calculated for the 1-year, 30-year and 100-year return periods + 20%CC, identifying the critical storm for each – refer to drainage Flow model included in Appendix G.

Based on these calculations, the required attenuation storage volume is 961m^3. This volume is sufficient for the 1-in-100-year storm, accounting for a 20% increase due to climate change. Attenuation tank is proposed in the northern open space, as indicated on drainage layout drawing 20-086-P121A, and it affords 985m^3 in storage volume, 24m^3 more than the modelled storage requirements of the site. Cross section drawings and details of the proposed tanks are provided on drainage drawing 20-086-P127A and chamber specifications and details are supplied under Appendix D.

Surface water runoff shall be restricted via a hydro-brake or similar approved flow control device with design flow 8.56l/s, before the outfall to the existing public surface water network, via a downstream defender as detailed in Section 3.4 above.

3.7.3 Criterion 3: Levels of Service

There are four criteria for levels of service. These are:

Criterion 4.1: No external flooding except where specifically planned (30-year high intensity rainfall event).

Criterion 4.2: No internal flooding (100-year high intensity rainfall event).

Criterion 4.3: No internal flooding (100-year river event and critical duration for site storage).

Criterion 4.4: No flood routing off site except where specifically planned (100-year high intensity rainfall event).

Both internal and external flooding are assessed in the Flood Risk Assessment report which accompanies this submission. The Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009.

The assessment identifies the risk of both internal and external flooding at the site from various sources and sets out mitigation measures against the potential risks of flooding. The sources of possible flooding assessed in the report include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical errors, in order to meet the above referenced criteria.

3.7.4 Criterion 4: River Flood Protection

The long term storage volume is a comparison of pre- and post-development runoff volumes. The objective is to limit the runoff discharged after development to the same as that which occurred prior to development.

Of the three methods described in the GDSDS for establishing River Flood Protection by comparison of the pre- and post-development runoff volumes, (Criteria 4.1, 4.2 and 4.3 respectively), Criteria 4.3 is selected for use as the most practical criteria at this stage in the design.

The Criteria 4.3 approach is for all runoff to be limited to either Q_{BAR} or to 2 l/s/Ha, whichever is the greater. The proposed drainage system includes a flow control device to ensure that the discharge rate is limited to the greenfield equivalent and ample attenuation is provided for the 1-in-100-year storm, accounting for a 20% increase due to climate change.

3.8 Surface Water Drainage – General

Surface water sewers will generally consist of PVC (to IS 123) or concrete socket and spigot pipes (to IS 6) and laid strictly in accordance with Dun Laoghaire Rathdown County Council requirements for taking in charge. It is intended that all sewers within the public domain will be handed over to Dun Laoghaire Rathdown County Council for taking in charge.

All private outfall manholes will be built in accordance with the Greater Dublin Regional Code of Practice for Drainage Works. No private drainage will be located within public areas. Drains will be laid in accordance with the requirements of the Building Regulations, Technical Guidance Document H.

3.9 Surface Water Audit

As outlined in Section 3.1, the surface water design had been subjected to a Stage 1 Surface Water Audit by JBA consulting, and is included in Appendix A.

4. SUDs Maintenance

For the SUDS strategy to work as designed it is important that the entire drainage system is well maintained. It will be the responsibility of the site management team to ensure the drainage system is maintained. Maintenance and cleaning of gullies, drain manholes (including catch pits) and attenuation tanks will ensure adequate performance. The recommended program is outlined in the tables below.

Table 8 | Stormtech (or similar approved) Attenuation Tank Maintenance Schedule

SUDS Element	Maintenance		
Attenuation Tanks	Maintenance Issues	Failure of components, blockage from debris	
	Maintenance Period	Maintenance Task	Frequency
	Regular	Inspect and identify any elements that are not operating correctly. If required, take remedial action.	Monthly for three months, then annually
		Remove sediment/debris from catchment surface that may lead to blockage of structures.	Monthly or as required
		Remove sediment/debris from catch pits/ gullies and control structures.	Annually, after severe storms or as required
	Remedial Work	Repair inlets, outlets, vents, overflows and control structures.	As required
	Monitoring	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are in good condition and operating as designed.	Annually or after severe storms
		Survey inside of tank for sediment build-up and remove if necessary	Every five years or as required

Table 9 | Permeable Paving/Pavements Maintenance Schedule

SUDS Element	Maintenance		
Permeable Paving	Maintenance period	Maintenance Task	Frequency
	Regular	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or as required, based on site specific observations of clogging or manufacturer's recommendations.
	Occasional	Removal of weeds or management using glyophosphate applied directly into the weeds by an applicator rather than spraying	As required
	Remedial work	Remediation work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users	As required
	Monitoring	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually

		Monitor inspection chambers	Annually

Table 10 | Green Roof Maintenance Schedule

SUDS Element	Maintenance		
Green Roof	Maintenance Issues	Vegetation becoming either overgrown or dying	
	Maintenance Period	Maintenance Task	Frequency
	Regular	Inspect all components including soil substrate, vegetation, drains, membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
		Inspect soil substrate for evidence of erosion channels and identify any sediment source	Annually and after severe storms
		Inspect drain inlets to ensure unrestricted run-off from the drainage layer to conveyance or roof drain system.	Annually and after severe storms
		Inspect underside of roof for evidence of leakage.	Annually and after severe storms
		Remove debris and litter to prevent clogging of inlet drains and interference with plant growth.	Six monthly and annually or as required
		During establishment (i.e. year one), replace dead plants as required.	Monthly
		Post-establishment, replace dead plants as required (where >5% of coverage)	Annually (in autumn)
		Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
		Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
		Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate.	Six monthly or as required
	Remedial Work	If erosion channels are evident, these should be established with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
		If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

5. Water Supply

5.1 Existing Water Supply

There is an existing 150mm diameter watermain installed along the entrance road to the development site and Mount Anville Road. This main was installed as part of Phase 1 of the Knockrabo development and a spur left out to facilitate connection to the subject Phase 2 lands.

A Pre-Connection Enquiry was submitted to Uisce Eireann (formerly Irish Water) and received a reference number of CDS24002545 in May 2024.

The Confirmation of Feasibility Letter, dated 4 June 2024 is included in Appendix F. The letter notes that connection to the water supply network is feasible without infrastructure upgrades. The letter further notes that the proposed connection is via Knockrabo Estate, which has not yet been taken in charge by Uisce Éireann. At connection application stage, the developer will be required to provide evidence that the main is connected to Uisce Éireann network and in operation.

Further, a Statement of Design Acceptance (SoDA) No. CDS24002545 was received on 18 September 2024. The SoDA confirms Uisce Eireann has no objection to the proposed development watermain connection. The CoF and SoDA are included in Appendix F.

5.2 Proposed Water Supply

It is proposed to connect the development to the existing 150mm diameter watermain in the access road and Mount Anville Road. The proposed network will consist of a 160mm diameter PE100-SRD17 watermain to service the development.

The proposed watermain layout and the existing watermain network in the adjacent roads can be seen on Waterman Moylan drawing 20-086-P130A.

5.3 Water Supply Calculations

The calculated water demand at the subject development is set out in the table below. The average domestic demand has been established based on an average occupancy ratio of 2.7 persons per dwelling with a daily domestic per capita consumption of 150 litres per head per day and with a 10% allowance factor. The average day/peak week demand has been taken as 1.25 times the average daily domestic demand, while the peak demand has been taken as 5 times the average day/peak week demand, as per Section 3.7.2 of the Uisce Éireann Code of Practice for Water Infrastructure.

Description	Total Population	Water Demand	Average Demand	Average Peak Demand	Peak Demand
	No. People	*l/day*	*l/s*	*l/s*	*l/s*
12 House	33	5,445	0.063	0.079	0.395
27 Duplex	73	12,045	0.139	0.174	0.87
119 Apartment	322	53,130	0.615	0.769	3.845
120 Childcare Facility	120	11,880	0.137	0.171	0.855
Total	**548**	**82,500**	**0.954**	**1.193**	**5.965**

Table 11 | *Calculation of Water Demand for the Development*

The average demand for the development is 1.193 l/s, with a peak demand of 5.965 l/s.

5.4 Water Supply – General

All watermains will be laid strictly in accordance with Uisce Éireann requirements for taking in charge.

Valves, hydrants, scour and sluice valves and water meters will be provided in accordance with the requirements of Uisce Éireann and DLRCC Water Services Department.

6. Roads

6.1 Introduction

A site-specific Transport and Traffic Assessment (TTA) has been carried out by Waterman Moylan. This is included under separate cover as part of this application.

In addition, a Travel Plan together with a Construction Management Plan, have been prepared and are provided under a separate cover. It is noted that the Construction Management Plan includes a section on the proposed development control measures recommended as part of the Dublin Eastern Bypass Corridor Protection Study.

The following section provides a summary on site access, the internal road layout and parking.

6.2 Site Access

The site will be accessed via extension of the existing Knockrabo Way, off Mt Anville Road, which currently provides vehicular and pedestrian access via a 7m wide access road and adjacent 2m wide footpath. The site access from Mount Anville Road is located in a 50 km/h zone. A 2.4m x 49m sightline, which is in compliance with the requirements of the Department of Transport 'Design Manual for Urban Roads and Streets' recommendation for a road of design speed of 50 km/h, is currently provided at the access road junction onto Mount Anville Road. No development works will infringe upon this existing sightline provision.

6.3 Internal Road Layout, Hierarchy and Pedestrian Facilities

The proposed internal road layout connects to the Knockrabo Way entrance road, discussed in above section 6.2. An element of off-street parking spaces and drop off areas are supplied for residents, visitors, and delivery drivers. The road network is proposed and designed to be a low-speed environment, a "slow zone" environment with a maximum speed limit of 20kph.

Refuse and fire tender vehicular movements have been tracked and a demonstration of the largest regular vehicle (refuse vehicle) movements at turning points is provided on planning drawing 20-086-P111A. Safe vehicle movement is achievable in each instance. For fire tender access and movements, vehicle tracking has similarly been undertaken and movements are also accommodated.

The subject site will be serviced by an internal road network with dimensions 5.5m in width, with minimum 2.0m wide pedestrian areas afforded adjacent, as demonstrated on the cross-sectional drawings supplied on drawing 20-086-P116A. A road width of 5.5m is afforded along the main thoroughfare at the northern end of the site, which connects to the 7.0m previously permitted Knockrabo Way entrance road.

Dedicated Staff parking is afforded for the childcare facility off the shared surface road network, as identified on road hierarchy drawing 20-086-P105A.

To ensure drivers are aware that they are entering a shared surface area, the materials and finishes used will indicate that the carriageway is an extension of the pedestrian domain.

The natural topography of the site is very steep at circa 1 in 12 and as such, the road vertical alignments are dictated by this constraint. The maximum road grade (north to south) is 1 in 12.5. East-west routes are at much flatter grades, as indicated on road layout drawing 20-086-P110B.

6.4 Car Parking including Electrically Operated Vehicles

Parking, including loading bays, disabled spaces and set-down drop/off will be provided in on street spaces. A breakdown of the parking provision and the justification for the quantum has been supplied under Section 11 of the accompanying Traffic and Transport Report.

In summary, it is proposed that a total of 130 No. car parking spaces be provided, with 117 No. spaces allocated for residents of the development, 11 No. spaces for non-residents, visitors and drop-off parking, and 2 No. spaces for Go-Car Station.

The proposal includes the following parking spaces:

> **Motorcycle Parking:** 9 no. motorcycle parking are proposed: 1 no. within Block E, 6 within Block F and 2 within Block G.
>
> **Disabled Parking:** 6 no. disabled parking are proposed.

6.5 Cycle Parking

Secure bicycle parking will be provided within the development, and the provision for this development has been supplied under Section 10.0 of the accompanying Traffic and Transport Report.

In summary, it is proposed that a total of 366 no. cycle park spaces will be provided. A total of 358 bicycle parking spaces will be allocated for the residential units, with 288 spaces designated for long-term use and 70 spaces for short-term use. Furthermore, it is proposed that 8 no. cycle parking spaces will be provided for non-resident units, with 6 no. spaces allocated for long-stay and 2 no. spaces for short-stay.

6.6 Quality Audit and Road Safety Audit

A Quality Audit (QA) has been carried out by Roadplan Consulting Engineers and forms part of this submission package. The Quality Audit was developed using a series of discrete but linked assessments and ensures that the broad objectives of place, functionality, maintenance and safety are achieved.

The results of the audit were reviewed and incorporated into the final design.

The Quality Audit and their feedback form can be seen in Appendix E.

6.7 DMURS

6.7.1 Background

The stated objective of DMURS is to achieve better street design in urban areas. This will encourage more people to choose to walk, cycle or use public transport by making the experience safer and more pleasant. It will lower traffic speeds, reduce unnecessary car use, and create a built environment that promotes healthy lifestyles and responds more sympathetically to the distinctive nature of individual communities and places. The implementation of DMURS is intended to enhance how we go about our business, how we interact with each other, and have a positive impact on our enjoyment of the places to and through which we travel.

6.7.2 DMURS: Statement of Design Consistency

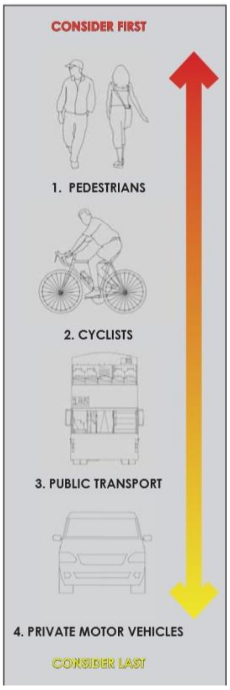
Waterman Moylan Consulting Engineers considers that the proposed road and street design is consistent with the principles and guidance outlined in the Design Manual for Urban Roads and Streets (DMURS). Outlined below are some of the specific design features that have been incorporated within the proposed scheme with the objective of delivering a design that is in compliance with DMURS.

6.7.3 Creating a Sense of Place

Four characteristics represent the basic measures that should be established in order to create people friendly streets that facilitate more sustainable neighbourhoods. These characteristics are connectivity, enclosure, active edges, and pedestrian activities/facilities.

<u>Connectivity:</u>

"The creation of vibrant and active places requires pedestrian activity. This in turn requires walkable street networks that can be easily navigated and are well connected."



In order of importance, DMURS prioritises pedestrians, cyclists, public transport and private cars. This is illustrated in the adjacent image extracted from DMURS.

The proposed development has been designed with pedestrians and cyclists taking precedence over other modes of transport. In this regard, footpaths are provided throughout the development with suitable connections through the open spaces and pedestrian crossings along anticipated desire lines. Footpaths within the development will generally by 2m wide, which is wide enough to allow 2 wheelchairs to pass each other without inconvenience.

Pedestrian crossings have been designed to allow pedestrians to cross the street at grade. Shared surface areas proposed, which provide a safe space for residents, pedestrians, and cyclists with the dominance of cars reduced. These can be viewed on the Road Hierarchy drawing, 20-086-P105A and the accompanying Landscape Architecture drawings submitted under separate cover. This drawing indicates the proposed shared surface areas and identifies the location of pedestrian crossings. The crossings will utilise tactile paving and drop kerbing to facilitate safe crossings at grade and have also been located on elevated road surfaces where possible, such as raised tables. These elevated road surfaces can only be accessed by car via a ramp, which is one of many safety measures implemented throughout the development, and in line with the recommendations of DMURS, to reduce the speed of vehicles. The shared road surfaces will be of a different colour, and potentially texture, the exact composition of which is to be agreed with DLRCC, to further make motorists aware of the change of user priority, this being a change from a vehicle priority road to a pedestrian priority surface. A visual example of the above design strategy as implemented has been extracted from the Proposed Road Hierarchy drawing and is shown in *Figure 3* below. This extract shows the road surface, with a different surface composition to that of the entrance road which will be a clear transition into a low traffic environment.

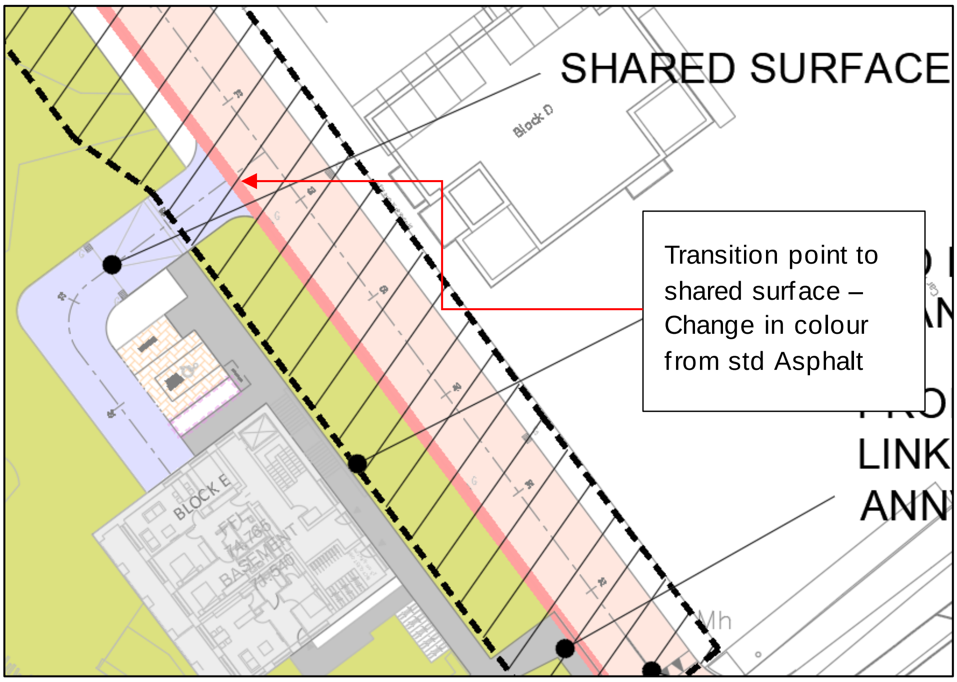


Figure 3 | Extract from Drawing number: 20-086-P105A

Enclosure:

"A sense of enclosure spatially defines streets and creates a more intimate and supervised environment. A sense of enclosure is achieved by orientating buildings towards the street and placing them along its edge. The use of street trees can also enhance the feeling of enclosure."

The proposed development has been designed with residential units overlooking streets and pedestrian routes throughout. High quality landscaping and tree planting are proposed throughout the scheme which creates a definitive sense of place. Road widths are generally 5.5m throughout the development and ensure that a strong sense of enclosure is achieved on residential roads.

Active Edge:

"An active frontage enlivens the edge of the street creating a more interesting and engaging environment. An active frontage is achieved with frequent entrances and openings that ensure the street is overlooked and generate pedestrian activity as people come and go from buildings."

As stated in Section 2.2.1 of DMURS, an active frontage enlivens the edge of the street, creating a more interesting and engaging environment. An active frontage is achieved with frequent entrances and openings. Section 3.4.1 of DMURS further notes that designers should avoid the creation of Dendritic networks, which place heavy restrictions on movement.

There are a number of advantages to more permeable networks in regard to the management of traffic and vehicle speeds. Drivers are more likely to maintain lower speeds over shorter distances than over longer ones. Since drivers are able to access the underground car parks more directly from the main Access

Knockrabo Way (where speeds are more moderate), they are more likely to comply with lower speed limits on the shared Local streets, as stated in Section 3.4.1 of DMURS.

Section 4.4.7 of DMURS recommends the use of horizontal and vertical deflections on straights where there is more than 70m between junctions. The internal road network of the proposed development has been designed by the Civil Engineers in conjunction with the Architects so as to ensure that this distance of 70m has generally not been exceeded through the development, and that in cases where a reduction in straight length was not possible, that appropriate traffic calming measures such as raised tables (vertical deflections) or build-outs (horizontal deflections – Refer *Figure 4* below) have been incorporated to the design.

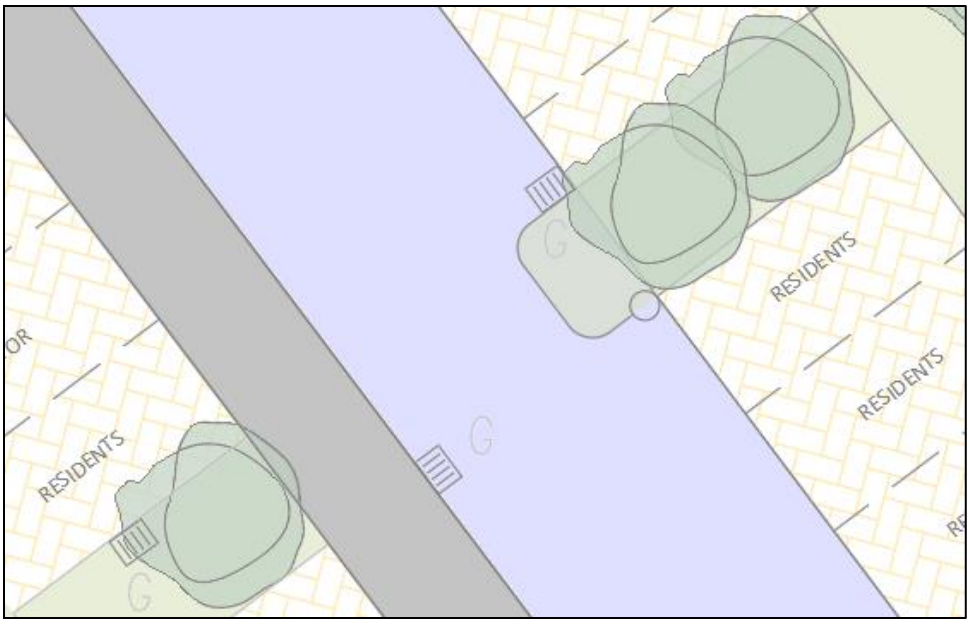


Figure 4 | *Extract from Drawing number: 21-011-P105A Road Hierarchy – Kerb Build Out*

On-street parking separates pedestrians from the vehicle carriageway and, as per DMURS Section 4.4.9, can calm traffic by increasing driver caution, contribute to pedestrian comfort by providing a buffer between the vehicular carriageway and footpath and provide good levels of passive security. On-street parking has been designed at selected locations throughout to implement the DMURS recommendation.

Suitable sightlines have been provided throughout the development, ensuring that localised planting does not obscure visibility as cars make turning manoeuvres, improving the pedestrian safety at crossing points. Turning radii have been minimised within reason to induce lower vehicle speeds, with cognisance to the necessary movements required by Fire Tender and refuse vehicles.

<u>Pedestrian Activities/Facilities:</u>

"The sense of intimacy, interest and overlooking that is created by a street that is enclosed and lined with active frontages enhances a pedestrian's feeling of security and well-being. Good pedestrian facilities (such as wide footpaths and well-designed crossings) also make walking a more convenient and pleasurable experience that will further encourage pedestrian activity."

As outlined in the items above, the proposed development has been designed to provide excellent pedestrian connectivity, with footpaths providing permeability throughout the site.

Throughout the site, pedestrian routes are generally 2m wide or greater which, as mentioned previously, provides adequate space for two wheelchairs to pass one another. DMURS identifies a 1.8m wide footpath as being suitable for areas of low pedestrian activity and a 2.5m footpath as being suitable for low to moderate pedestrian activity. An array of formal and informal routes through the open spaces have been supplied as identified on the Landscape Architect layouts and co-ordinated on the engineering layout drawings, provide links to the development, accounting for anticipated desire lines.

6.7.4 Key Design Principles

DMURS sets out four core design principles which designers must have regard to when designing roads and streets. These four core principles are set out below together with a commentary establishing how these design principles have been incorporated into the design of the proposed development.

Design Principle 1: Pedestrian Activity/Facilities:

"To support the creation of integrated street networks which promote higher levels of permeability and legibility for all users and in particular more sustainable forms of transport."

Streets have been designed in accordance with the alignment and curvature recommendations set out in DMURS Section 4.4.6. The road layout is generally orthogonal, with suitable pedestrian desire line connections adjacent and through the open spaces, refer to drawing 20-086-P105A in this regard. Section 3.3.1 of DMURS notes that street networks that are generally orthogonal in nature are the most effective in terms of permeability (and legibility). Road crossing provision for pedestrians will encourage reduced driving speeds, and wide footpaths will encourage safe and integrated pedestrian facility. We refer you to road construction details drawing 20-086-P116A which provides dimension for the footways adjacent the road network.

Design Principle 2: Multi-Functional Streets:

"The promotion of multi-functional, place-based streets that balance the needs of all users within a self-regulating environment."

The proposed shared surface zones are streets designed primarily to meet the needs of pedestrians, cyclists, children and residents, where the speeds and dominance of cars is reduced. They are shared surface streets, comprising of a shared-surface carriageway allowing for pedestrian focused areas. These zones help to create and to inform a clear hierarchy within the public realm.

It is proposed to utilise a buff-coloured chipping / macadam or similar approved surfacing in the shared surface zone, subject to Dun Laoghaire Rathdown County Council Roads and Transportation approval. Use of a shared-surface buff coloured chipping/macadam indicates to both drivers and pedestrians/cyclists that the road is a shared space. As stated in Section 4.4.2 of DMURS, paving materials can encourage a low vehicle speed shared environment.

It is stated in Section 4.3.4 of DMURS that shared surface streets and junctions are highly desirable where movement priorities are low and there is a high place value in promoting more liveable streets (i.e. home-zones), such as on Local streets within Neighbourhood and Suburbs.

Design Principle 3: Pedestrian Focus:

"The quality of the street is measured by the quality of the pedestrian environment."

The design of the scheme has placed a particular focus on the pedestrian. Connectivity throughout the scheme is weighted towards the pedestrian. There are pedestrian links to Mount Anville Road fronting the site, adjacent to the proposed streets and various formal and informal routes through the high quality public open spaces, all demonstrated on the accompanying road hierarchy drawing 20-086-P105A.

Design Principle 4: Multi-Disciplinary Approach:

"Greater communication and co-operation between design professionals through promotion plan led multidisciplinary approach to design."

The design of the proposed scheme has been developed through the design team working closely together. The proposed development design is led by OMP Architects working together with Waterman Moylan Consulting Engineers, Tom Phillips & Associates Planning Consultants and Dermot Foley Landscape Architects.

Public areas fronting and within the proposed development have been designed by a multidisciplinary design team to accommodate pedestrians and cyclists in accordance with the appropriate principles and guidelines set out in DMURS. In particular, the vehicular access and public footways within the remit of the development will incorporate the relevant DMURS requirements and guidelines as set out above.

APPENDICES

A. JBA (Stage 1) Stormwater Audit

STORMWATER AUDIT (STAGE 1)

JBA Project Code	2024s0599
Contract	Knockrabo Development - Stage 1 Stormwater Audit
Client	Regency, 19 Fitzwilliam Square, Dublin 2, Co Dublin
Prepared by	Dania Thomas & Michael O'Donoghue
Subject	Stage 1 Stormwater Audit Report

Revision History

Issue	Date	Status	Issued to
S3-P01	22/07/2024	First Issue	Waterman Moylan
S3-P02	17/09/2024	Final Issue	Waterman Moylan
S3-P03	19/09/2024	Issued for planning	Waterman Moylan

1 Introduction

JBA Consulting have been contracted by Knockrabo Investments DAC to undertake a Stage 1 SW Audit of the surface water drainage design for the proposed development at Mt. Anville Road, Dublin 14. Waterman Moylan (WM) are the Design Engineers for the project.

The subject of this Stage 1 stormwater audit is to review the proposed surface water drainage design and sustainable urban drainage system (SuDS) proposals for the proposed development.

This audit has been carried out in accordance with the Dún Laoghaire-Rathdown County Council's (DLRCC) Stormwater Audit Procedure as set out in Appendix 7 of the Development Plan 2022-28, where applicable as set out below.

Stage 1 – Pre-Planning Stage*: A Stage 1 Audit shall be carried out of the applicant's proposed Stormwater drainage proposals based on the drawings submitted for planning approval.*

The Stage 1 Audit report must be submitted to Municipal Services for approval prior to lodging the planning application. All recommendations shall be complied with, unless otherwise agreed in writing with DLRCC.

1.1 Report Structure

The Feedback Form in Appendix A identifies queries raised in this report which are to be answered by the Design Engineers. Once an 'Acceptable' status is achieved for each query the audit is deemed to be completed and requires sign off from both Auditor and Designer, prior to submission to the council for approval.

The Audit is not considered complete until the council have been given an opportunity to review and approve the Audit report.

The results of the audit are set out hereunder, where items raised in the feedback form are shown in bold within this report.

1.2 Relevant Studies and Documents

The following guidance documents were considered as part of this surface water audit, or equivalent current at the time of the Stage 1 audit:

- Greater Dublin Strategic Drainage Strategy (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works;
- The SUDs Manual (CIRIA C753).
- DLRCC Development Plan 2022-2028 (where applicable)
- DLRCC Stormwater Management Policy
- BRE Digest 365

The documentation provided by WM on 09/07/2024 is listed below:

- 20-086r.001 Engineering Assessment Report
- 20-086r.002 Flood Risk Assessment
- KNB-WMC-PH2-ZZ-DR-C-P120 Proposed Foul & Storm Water Drainage GA
- KNB-WMC-PH2-ZZ-DR-C-P121 Drainage Layout Sheet 1 of 2
- KNB-WMC-PH2-ZZ-DR-C-P122 Drainage Layout Sheet 2 of 2
- KNB-WMC-PH2-ZZ-DR-C-P126 Storm Water Drainage Construction Details
- KNB-WMC-PH2-ZZ-DR-C-P127 Attenuation Tank Details
- KNB-WMC-PH2-ZZ-DR-C-P130 Proposed Watermains
- KNB-WMC-PH2-ZZ-DR-C-P140 Proposed SuDS Strategy Plan
- KNB-WMC-PH2-ZZ-DR-C-P141 SuDS Details Sheet 1 of 2
- KNB-WMC-PH2-ZZ-DR-C-P142 SuDS Details Sheet 2 of 2
- KNB-WMC-PH2-ZZ-DR-C-P150 Overland Flood Routing

1.3 Key Considerations and Benefits of SuDS

The key benefits and objectives of SuDS considered as part of this audit and listed below include:

- Water Quantity
- Water Quality
- Amenity
- Biodiversity

Which can be achieved by;

- Storing runoff and releasing it slowly (attenuation)
- Harvesting and using the rain close to where it falls
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- Filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

1.3.1 Recommendations from GDSDS

Table 6.3 of the GDSDS recommends the following criteria for Development Drainage;

Criterion		Design Objective
Criterion 1 River water quality protection	1.1 1.2	Interception storage of 5mm Treatment storage if 1.1 not provided
Criterion 2 River regime protection	2.1 2.2	Discharge rate equal 1-year greenfield run-off Discharge rate equal 100-year greenfield run-off
Criterion 3 Level of Service	3.1 3.2 3.3 3.4	No site flooding for 30-year storm No internal property flooding for 100-year storm Floor levels +500mm above 100-year TWL in river or tanks No flooding in 100-year storm of adjacent urban areas
Criterion 4 River Flood Protection	4.1 4.2 4.3	Long term flooding provided by 4.1 & 4.2 for the 100-year 6-hour storm in excess of greenfield runoff. Alternatively, if long term flooding not provided discharge rate Qbar or 2 l/s/ha for ALL storage.

1.3.2 SuDS Management Train

A SuDS Management Train is a robust pollutant removal strategy. The treatment train can comprise four stages:

1. *Prevention*
2. *Source Control*
3. *Site Control*
4. *Regional control*

2 Proposed Development

The site is located at Knockrabo, Mount Anville Road, Goatstown, Dublin 14. It is bounded to the south by Mount Anville Road, to the east by Phase 1 of the overall Knockrabo development, and to the north by the reservation corridor for the Dublin Eastern By-Pass (DEBP). The site is accessed from a circa 100m section of constructed entrance road, Knockrabo Way, that also facilitates access to the adjacent Phase 1 development to the east.

The proposed development, phase 2 of the overall Knockrabo Lands Development, consists of 158 no. residential units, comprising of 12 no. Houses, 119 no. apartments and 27 no. duplexes. The development includes all associated site works, undergoing of overhead lines, boundary treatments, drainage, and service connections.

The site location and proposed site layout are shown below.

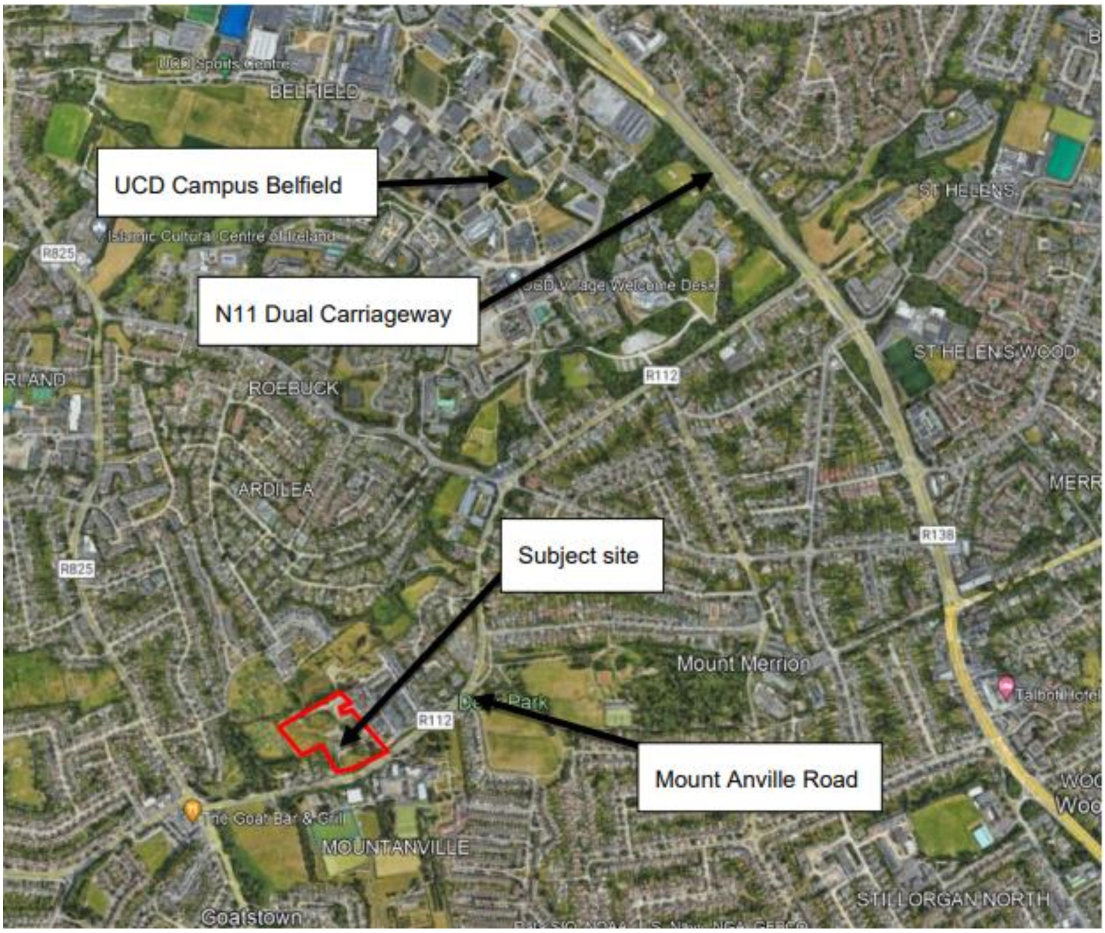


Figure 1 | Site Location (Source: Google Earth)

2.1 Review of SW Drainage Proposals

2.1.1 Site Characteristics

The subject site is 2.48 hectares and is predominantly greenfield. A topographic survey of the area indicated that the site generally slopes from South to North at a steep gradient and naturally drains to the north-eastern corner.

The development is Phase 2 of a larger multi-phase development. Phase 1 located to the east of the site has already been constructed. Some of the drainage works required for Phase 2 were installed in advance with the Phase 1 scope of works.

The subject site already has an existing grant of planning, (D17A/1124). The Knockrabo Way entrance road will remain as granted on the initial application and does not form part of this revised application.

The 2.48ha referenced above is the total area within the planning site boundaries. Site investigations were undertaken by Ground Investigations Ireland in February 2019, and it has been concluded that a Soil Index of 0.47 is appropriate for the site. The development will consist of 1.53ha of positively drained hardstanding area. This area, combined with the site Soil Index, results in a subsequent QBar value of 13.43 l/s.

The storm network will drain to the north-eastern corner of the site, where sub-surface attenuation will contain stormwater run-off. This will drain, via a flow control device, to a previously installed outlet to the east of the development. This outlet was designed to cater for both Phase 1 & 2 and was installed as part of Phase 1.

The soil at the site has been indicated as being Soil Type 4 (SPR 0.47) in accordance with HR Wallingford procedures. A site investigation was carried out by GII Ltd. in February 2019, consisting of mechanically excavated trial pits and dynamic probes. In-situ infiltration tests were undertaken in three of the trial pits to investigate subsoil soakage characteristics. The following exploratory works were carried out:

- 19 no. mechanically excavated trial pits to a depth of 3.3m;
- 26 no. dynamic probes;
- 3 no. in-situ infiltration tests in trial pits;
- 2 No. Rotary Core Boreholes to a maximum depth of 8.30m;

A further 4 No. soakaway tests were undertaken by Site Investigations Ltd. in January 2021.

The strata encountered were deemed to be consistent across the site, with topsoil/made ground underlain with cohesive deposits which were further underlain with a granite bedrock.

The cohesive deposits are described as brown sandy gravelly clay. This is consistent with Soil Type 4.

In both the 2019 and 2021 infiltration tests, no successful infiltration test was achieved. No sufficient water drop was observed, and groundwater ingress was evident in two of the trial holes.

Any proposed underground attenuation units should be lined in instances where the groundwater levels are within 1m of the invert levels of the proposed systems.

Given the lack of infiltration observed during the testing, the QBAR calculation based on Soil Type 4 seems prudent.

2.1.2 Design Parameters

Rainfall parameters	Designer values	JBA Comment
M5_60	19.6mm	17.2mm – Met Éireann (2023 DDF values)
Ratio R	0.279	0.278 – Met Éireann (2023 DDF values)
SAAR	774 (in appendix D) or 881mm	836 mm - Met Éireann (2024)
Soil Index	0.47	OK - representative for the CLAY encountered on site
Limiting discharge	QBAR or to 2 l/s/Ha, whichever is greater	OK
Qbar (l/s)	13.43 l/s	OK -14.74 l/s from UK_SuDS for soil type 4
Climate Change	20% applied to rainfall	OK – DLRCC's County Development Plan 2022-2028
Urban Creep	Not included	DLRCC's County Development Plan 2022-2028 requires 10%

The following queries are required to be addressed by Waterman Moylan (WM).

WM to provide rationale for using whole site area in determination of QBar.

WM to review SAAR value used.

WM to confirm whether Urban Creep has been included in the calculations.

Clarity on use of impermeable liner is required.

2.2 Surface Water Drainage Strategy

2.2.1 Site Drainage Strategy

A 20% climate change factor have been included in the design of the surface water network in accordance with the requirements DLRCC's County Development Plan 2022-2028. However, there is no mention of accounting for 10% urban creep factor in the design.

The proposed surface water drainage network will collect surface water runoff from the site via SuDS measures, a piped network and routed through an attenuation system and petrol interceptor. The runoff will outfall via a flow control device to an existing 225mm storm connection, constructed as part of Phase 1.

2.2.2 SuDS Measures Considered

SuDS Technology	Comments
Green/Blue Roofs	Green roof is proposed in accordance with Appendix 16 of DLRCC County Development Plan. The total roof area on site is 2,239m2 and the area of green roof provided is 1,903m2 providing 85% coverage in green roof. Maintenance access to green roof areas is via level access from internal corridors & stairwells where that is possible, and via external mobile access from hard standing areas where that is not possible. The drawings indicating the locations and sectional detail of green roofs are provided. **Depth of green roof build-up is not included.** **No run-off coefficients have been provided for green roofs.**
Swale, Filter Drain, Infiltration Trench	It is proposed to use filter drains on the footpaths and outside communal areas to treat surface water falling on ground level hardstanding areas at source before discharging into the attenuation tanks. Adjacent road gullies will be connected to the underlying filter drains to treat and slow down the runoff rate by means of infiltration. **A permeable geo-textile liner is indicated in the detail drawing where gullies convey to filter drains under public open spaces. However, other suds measures include impermeable lining. Clarity on use of impermeable liner is required.**
Tree Pits, Bioretention Areas, Rain Gardens	Tree pits are proposed and where possible, surface water runoff from the roads will discharge to tree pits (via kerb inlets) located on the side of the road. Gullies will be positioned downstream of the tree pits to cater for overflow during high rainfall events. Tree pits are suitable for installation alongside carriage ways. The tree pit receives surface water runoff from the road via gully inlet. The surface water drains through the tree pit which is filled with engineered filter material to the underdrain system which discharges the treated surface water to the main surface water sewer in the roadway. Section drawing through bio-retention tree pits is provided. **No impermeable lining is shown on tree pit detail, and depth and plan area varies, with no correlation provided to volumes assumed in treatment calculation.**
Permeable Surfacing	Permeable paving is proposed in private parking space and driveways to provide some treatment volume, with underlying perforated pipes connecting to the storm water sewer network within the roads. The detail drawing indicates an impermeable membrane beneath some the paving. **Extent of liner to be clarified.**

Soakaways	Gate Lodge West appears to have a soakaway, but no details are provided. **WM to clarify.**
Detention Basins, Retention Ponds, Stormwater Wetlands	None proposed
Rainwater Harvesting	Rainwater harvesting shall be allowed for in the form of rainwater butts located at the position of rainwater downpipes.
Petrol Interceptor	Downstream defender is proposed as the one final level of treatment for the surface water to pass before outfall to the existing network. It is proposed that the petrol interceptor shall be fitted with an audible high-level silt and oil alarm for maintenance and safety purposes. Regular maintenance and inspection are recommended on these units.
Attenuation	The attenuation tanks are proposed in the open space located at the north of the proposed site and can afford 771m3 in storage volume, which is 21m3 more than the modelled storage requirements of 750m3. The attenuation shall incorporate an isolator row that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The underground storage tanks are supplied with minimum 900mm of stabilised over material; to facilitate future construction traffic should the need arise for the DEBP construction access way to be utilised above. Section detail drawing for the attenuation tank is provided. **No head/discharge relationship is provided for the hydrobrake.**

2.2.3 Review of drainage design and drawings

Drawing C-P140 shows the proposed SuDS strategy throughout the site including permeable parking spaces, green roofs in Block E, F, G roofs, filter drain and below ground attenuation area.

Drawing C-P120 shows the proposed Foul and Storm water drainage general arrangement, the existing stormwater spur to the new downstream defender is marked and the flow control device and penstock located in the outfall manhole is specified. The drawing shows the existing along with previously approved stormwater and foul water sewer networks.

Drawing C-P121 and 122 show the drainage layouts, also indicated in C-120 drawing.

Drawing C-P126 shows the stormwater drainage construction details. The manhole detail section view is provided.

Drawing C-P127 shows the attenuation tank details, noting geosynthetics woven geotextile between foundation stone and chambers. The outlet manhole with the flow control device is marked. However, the drawing does not indicate the design head for the flow control hydrobrake device, or the diameter.

Drawing C-P130 illustrates the proposed watermains along with existing watermains

Drawing C-P141 shows SuDS details for permeable paving along private parking and driveways, planter box section details, bio-retention pit section and gully to filter drain detail.

Impermeable membrane is indicated beneath part of the permeable paving, with the filter drain shown enclosed with permeable geo-textile layer. Application of liners is inconsistent across SuDS

measures.

Drawing C-P142 shows typical section through green roof and outlet on podium details. **No depths are provided on green roof build up.**

The overland flood routing along with High point and low point of the subject site are indicated in drawing C -P150.

The SAAR parameter of 881mm is specified in the Engineering report for the greenfield run-off calculation. And the GDSDS calculation in Appendix D uses SAAR of 774mm.

2.2.4 Review of Drainage Design Calculations

No network calculations have been provided, with only a volumetric calculation for the attenuation included.

A factor of 20% Climate Change to rainfall was applied.

As per the GDSDS, the required attenuation volume is calculated assuming 100% runoff from paved areas, and has been calculated for the 1-year, 30-year and 100-year return periods, identifying the critical storm for each period. **No runoff coefficients have been indicated, though only 1.53Ha is identified as being drained to the network.**

Based on the calculations, the required attenuation storage volume is 750m3 (critical storm 6hr -100-year storm). This volume is sufficient for the 1-in-100-year storm, accounting for a 20% increase due to climate change. Attenuation tanks proposed in the northern open space can afford 771m3 in storage volume, 21m3 more than the modelled storage requirements of the site.

The attenuation calculations do not evaluate the full range of storm durations, with the maximum storm being capped at 2880mins (48 hours). They do not indicate the storm event the system is capable of conveying without surcharging and don't include any information on individual nodes and associated risk of flooding.

WM to provide full network calculations.

2.2.5 Interception/treatment of Flow

Interception of runoff is intended to prevent any runoff for small rainfall events which are less than 5mm (and up to 10mm if possible). Treatment of 15mm is required if interception is not provided.

Table 24.6 of the CIRIA manual provides indication of deemed to satisfy criteria and it is considered that this should be complied with. All sources of runoff should also be intercepted where possible. Compliance is required for the entire site, or at least for road/paved areas, for it to be considered effective. Interception mechanisms are based on runoff retention. This can be achieved using rainwater harvesting or using soil storage and evaporation. Either infiltration or transpiration rates can dispose of the runoff from minor events to enable the next event to be captured.

Overcompensation in one area cannot be considered acceptable for lack of interception in another area. However, SuDS measures appear to be proposed throughout.

Interception of stormwater is proposed through permeable parking, filter drains, bio-retention tree pits, and green roofs in various locations throughout the site.

The volume of interception storage and volume of treatment storage is calculated, assuming 75% runoff from paved surfaces and 0% from pervious surfaces for the 5mm and 15mm of rainfall respectively. The required volume of interception storage is circa 61.01m3 and volume of treatment storage is 172.5m3. Interception storage volume provided for the total hardstanding area considering the various SuDS treatment measures is 185m3 and is therefore sufficient to meet the required treatment volume for the respective hardstanding areas. For treatment to be deemed acceptable a permanent retention volume is to be provided. It is not clear from the calculations and drawings provided how this will be permanently retained. Only the total site volume for potential interception and treatment has been provided, but individual contributing areas vs. associated suds measure has not been provided.

Table showing breakdown of all applicable SuDS features and corresponding interception areas utilising the guidance from CIRIA C753 Table 24.6 is not provided. WM to assess interception on an area by area basis as per DLRCC procedure.

2.2.6 Exceedance Flows

The attenuation tank has been provided with additional capacity 771m3 to the required design capacity 750m3 to allow for exceedance flows and ensure that it does not overflow. This is deemed satisfactory but full network calculations are required to confirm this.

2.3 Health & Safety and Maintenance Issues

The proposed drainage system comprises SuDS devices, traditional road gullies, manholes, filter drain, attenuation system, permeable parking, tree pits, rainwater harvesting. These elements are considered acceptable from a Health & Safety perspective once supplier/manufacturers guides are followed and complied with during the detailed design, construction, and operation.

Optimum performance of the SuDS treatment train is subject to the frequency of maintenance provided. It is recommended that a maintenance regime be adopted.

It is recommended that the petrol interceptor be fitted with an audible high-level silt and oil alarm for maintenance and safety purposes. Regular inspection and maintenance are recommended for the petrol interceptor.

Please note that silt and debris removed from the petrol interceptor during maintenance will be classified as contaminated material and should only be handled and transported by a suitably licensed contractor and haulier and disposed of at a suitably licensed landfill only.

The maintenance plan has been provided for attenuation tanks, permeable paving and green roofs.

2.4 Audit Conclusions

This report outlines the review of the initial submission by the designer. JBA comments are also included in the Audit Feedback Form in Appendix A. This feedback form shows the audit trail and the responses from the designer. The audit will be deemed closed out once an "Acceptable" status has been achieved for each query. Some queries may be considered acceptable subject to Local Authority agreement.

The following has resulted from the audit process:

- Inclusion of green roof run-off co-efficient in Flow Model.
- Confirmation of minimum separation distance of 1.0m between permeable liners and the highest recorded winter groundwater level.
- Gate Lodge West has now been positively drained to the SW network
- Contributing catchment areas have been revised and appropriate run-off co-efficients applied, resulting in an area of 1.441Ha contributing to the network and an allowable discharge of 8.56l/s.
- Run-off factor for green areas has been increased from 0.20 to 0.47 in line with the SPR used for Qbar.

Audit Report Prepared by: ______________________

Dania Thomas BEng MEng (Hons)
Assistant Engineer

Approved by: ______________________

Michael O'Donoghue BEng CEng MIEI
Associate Director

<u>Audit Report Findings are accepted by the Design Engineer</u>

Representative:	
Name of Company:	
Date:	

Note:

JBA Consulting Engineers & Scientists Ltd. role on this project is as an independent reviewer/auditor. JBA Consulting Engineers & Scientists hold no design responsibility on this project. All issues raised and comments made by JBA are for the consideration of the Design Engineer. Final design, construction supervision, with sign-off and/or commissioning of the surface water system so that the final product is fit for purpose with a suitable design, capacity and lifespan, remains the responsibility of the Design Engineers.

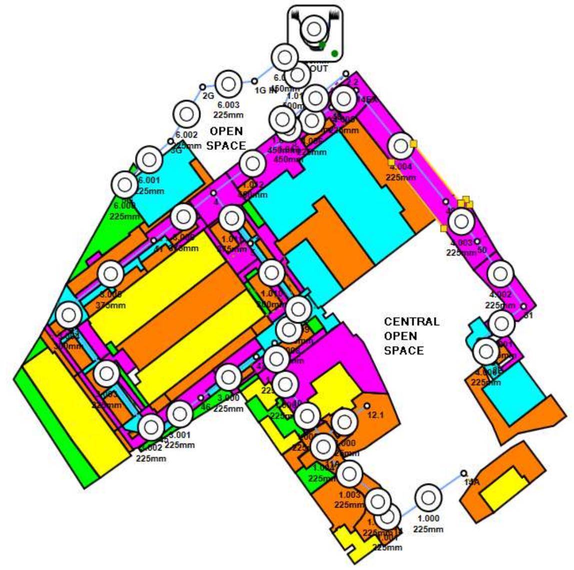
Appendix A – Audit Feedback Form

JBA Consulting Stormwater Audit - Stage 1 Feedback Form	
Project:	Development at Knockrabo, Dublin 14 - Stage 1 SWA
Date:	06/09/2024
JBA Reviev	Dania Thomas & Michael O'Donoghue
Project Nu	2024s0599

Item No.	JBA Review Comment	Comment/Clarification Request/Suggested Mitigation	Response from Client/Client Representative	Acceptable / Not Acceptable
	22/07/2024	22/07/2024		
	Reference Documents **•20-086r.001 Engineering Assessment Report** **•20-086r.002 Flood Risk Assessment** **•KNB-WMC-PH2-ZZ-DR-C-P120 Proposed Foul & Storm Water Drainage GA** **•KNB-WMC-PH2-ZZ-DR-C-P121 Drainage Layout Sheet 1 of 2** **•KNB-WMC-PH2-ZZ-DR-C-P122 Drainage Layout Sheet 2 of 2** **•KNB-WMC-PH2-ZZ-DR-C-P126 Storm Water Drainage Construction Details** **•KNB-WMC-PH2-ZZ-DR-C-P127 Attenuation Tank Details** **•KNB-WMC-PH2-ZZ-DR-C-P130 Proposed Watermains** **•KNB-WMC-PH2-ZZ-DR-C-P140 Proposed SuDS Strategy Plan** **•KNB-WMC-PH2-ZZ-DR-C-P141 SuDS Details Sheet 1 of 2** **•KNB-WMC-PH2-ZZ-DR-C-P142 SuDS Details Sheet 2 of 2** **•KNB-WMC-PH2-ZZ-DR-C-P150 Overland Flood Routing**			
1	A green roof is proposed in accordance with Appendix 16 of DLRCC County Development Plan. The section detail of green roof build up does not, however, indicate any depths.	WM to provide depth of green roof build-up. WM to provide run-off coefficients for green roofs.	We have since carried out a Flow Model which includes run-off coefficients 0.8 for green roofs. The depth of green roof build-up is 75mm.	Acceptable
2	In drwg C-P141, a permeable geo-textile liner is indicated where a gully discharges to a filter drain under the public open spaces. However, other suds measures include impermeable lining. In addition details for permeable paving along private parking and driveways show an impermeable liner only extending part way across the footprint of the paving.	WM to clarify intentions with regard to impermeable liners.	The impermeable liner is used to keep infiltration away from foundations.	See note 15
4	The tree pit detail doesn't have any outfall connectivity. It is also not clear on whether these will be lined or not. Also, there is one treatment volume assigned to the tree pits in the Engineering Report but the tree pits vary in size.	WM to clarify	We do not propose outlet pipes from our tree pits to our positive drainage network. We simply allow our tree pits to take low rainfall runoff from the surrounding hard standing and to overflow to the next down stream gully during heavy rainfall events. We have provided a standard, conservative treatment volume for all tree pits for simplicity.	See note 16
5	Gate Lodge West appears to have a soakaway, but no details are provided.	WM to clarify	Gate Lodge West has now been positively drained to the SW network as per updated drainage drawing 20-086-P121 Drainage Layout, as all infiltration test on this site failed.	See Note 17
6	The head/discharge relationship for the hydrobrake isn't provided.	WM to provide	We have since carried out a Flow Model which has resulted in an outflow rate of 14.7 l/s and a head of 1.2m for the hydrobrake.	See Note 17
7	SAAR value as per engineering report is 881mm. However, Appendix D calculations use SAAR value 774mm.	WM to clarify SAAR value used	Please refer to updated 20-086 Engineering Assessment Report, which now has a SAAR of 836mm - Met Éireann (2024) in the body of the report and Appendix D calculations.	See Note 17
8	20% Climate change factor considered in calculations by WM. 10% Urban Creep factor is required as per DLRCC's County Development Plan 2022-2028.	WM to confirm whether urban creep has been accounted for.	Urban creep 10% has been accounted in the drainage design for private houses an duplexes.	See Note 20
9	The Qbar calculation uses total site area of 2.48ha. As per the engineering report the development consist of 1.53ha of positively drained hardstanding area. Therefore, the area of contributing catchment appears to be overestimated in Qbar calculation. It is also not clear if the network elements residing outside the planning boundary (On Knockrabo Way) are included in the network calculations. Related to this is the inclusion of the rear gardens for units 1-8, where no drainage is proposed.	WM to clarify contributing areas and revise Qbar accordingly.	We have since carried out a Flow Model and can confirm the following: - Total Site Area = 2.573 ha - Positively Drained Area = 1.404 ha Portion of Knockrabo Way (outside of the planning boundary) is included in the network calculations. Rear gardens for units 1-8 are included in the catchment. Public open space is excluded from positively drained area. Please refer to drawing 20-086-P121 Drainage Layout and Flow Model in the Engineering	See note 17
10	Appendix D of the engineering report provides long term storage calculations, but it is not clear whether this is being considered or not.	WM to provide network design calculations	Please refer to Flow Model in Appendix G of the Engineering Assessment Report.	Acceptable

11	No longsections of the network have been provided.	WM to provide	Pease refer to drawing C-P123 for Storm Water long sections of the network.	See Note 18
12	Interception is assessed on a volumetric basis. DLRCC's stormwater audit procedure requires this to be assessed against Table 24.6 of CIRIA C753. In addition, treatment volumes are indicated to be provided. GDSDS defines this volume as a permanently retained volume. It is not clear how this volume will sit within the suds features.	WM to provide areal interception comparison as per DLRCC stormwater audit procedure.	The provided interception volumes are based on the voids under the following: - Green Roofs - Permeable Pavings - Tree Pits - Swales / Filter Strips Please refer to Section 3.6 of the Engineering Assessment Report. Interception storage has been assessed against the table 24.6 of the SUDS Manual CIRIA C753.	Acceptable
13	Drwg C-P140 has a number of hatched areas that aren't included in the legend. The same drawing also indicates a filter drain to the north, but the leader identifies it in a different location.	Drawing to be updated.	Please refer to updated drawing 20-086-P140A for Proposed SuDS Strategy Plan.	Acceptable
14	No runoff coefficients have been included in the report.	WM to advise on what runoff factors have been considered.	Following runoff factors have been considered:- Roofs 100% Roads and Footpaths 95% Permeable Paving 70% Green Roof 80% Front and rear house gardens 70% Green areas 20%	See Note 19
	09/09/2024	**09/09/2024**		
	Reference Documents **20-086-P121 Drainage Layout.pdf** **20-086-P140A Proposed SuDS Strategy Plan.pdf** **Response MXT-JBAI-XX-XX-AU-C-0002-S3-P01-Feedback_Form.xlsx** **20-086r.001 Engineering Assessment Report**			
15	Permeable liner proposed beneath perforated filter drain. It is important that 1.0m separation distance is maintained between any permeable liners and the highest winter groundwater level.	WM to confirm 1.0m separation between permeable liner and groundwater level.	During the ground investigation carried out by Ground Investigations Ireland Ltd. in November 2018 (winter groundwater table), groundwater was encountered in TP03 at 2.80m, TP04 at 2.70m, TP05 at 3.10m, TP07 at 1.7m, TP09 at 2.8m, TP10 at 2.0m , TP16 at 1.2m BGL out of 22 no. trail pits. And at soakaway SA01 at 1.8m. No groundwater was encountered above 64.500m OD Malin site level contour. All trail pits where groundwater was encountered are located at low ground at the northern portion of the site. Proposed filter drains are not constructed deeper than 0.5m and therefore there is a min. separation of 1.0m between permeable liner and a groundwater level. No filter drains are proposed where higher groundwater level was encountered i.e. TP16 at 1.2m (north of the apartment Block F) , TP07 at 1.7m (open space at apartment Block G) and SA01 at 1.8m (Public open space). See sketch showing groundwater levels submitted with this response.	Acceptable
16	No detail on lining of tree pits. The EAR Section 3.5.2 describes "The surface water drains through the tree pit which is filled with engineered filter material to the underdrain system which discharges the treated surface water to the main surface water sewer in the roadway."	If permeable membrane is proposed it is important a 1.0m separation be maintained between the highest winter groundwater level. WM to confirm the use of permeable liners and their separation distance to groundwater levels. Has groundwater monitoring been undertaken?	See also response above. A typical tree pit depth ranges from 0.725m - 0.875m. No tree pits are proposed where higher groundwater table was encountered during the ground investigation in November 2018 and therefore there is a min. separation of 1.0m between permeable liner and a groundwater level.	Acceptable

<table>
<tr>
<td>17</td>
<td>a)Total Site Area = 2.573 ha
Positively Drained Area = 1.404 ha
Total area used in the Qbar calcs is 2.48 ha. This overestimates the Qbar value if it isn't equal to the positively drained area. It also isn't clear if this positively drained area included the Gate Lodge catchment in the latest design.
b)A reduced CV has been applied to the simulation settings. This can be considered double counting when used in combination with runoff reduction factors, and can result in an undersized system.</td>
<td>a)WM to provide area breakdown indicating total unfactored area for each surface, runoff reduction factors applied to each surface and equivalent impermeable area for each surface. If some areas are deemed not to contribute these should be indicated and removed from the Qbar calculation as they are not to be included in the "positively drained area".
b)WM to clarify their use of reduced CV factors alongside surface reduction factors.</td>
<td>
<table>
<tr><th></th><th>Green Space</th><th>Sedum Green Roofs</th><th>Permeable paving</th><th>Roofs</th><th>Roads Footpaths</th><th>Total</th><th></th></tr>
<tr><td></td><td>0.2554</td><td>0.2239</td><td>0.3988</td><td>0.1353</td><td>0.4276</td><td>1.441</td><td>ha</td></tr>
<tr><td>Cv factor</td><td>0.47</td><td>0.8</td><td>0.7</td><td>1</td><td>0.95</td><td></td><td></td></tr>
<tr><td>Equivalent impermeable area</td><td>0.1200</td><td>0.1791</td><td>0.2792</td><td>0.1353</td><td>0.4062</td><td>1.120</td><td>ha</td></tr>
</table>
Please note. The red line area of the subject site has been revised to 2.54ha after the completion of the SW Audit report. This red line revision has no impact on the proposed development's Positively Drained Area of 1.441ha.

a) Total Site Area (Red Line) = 2.48 ha, Area in SW catchment outside the red line = 0.0886 ha.
Positively Drained Area = 1.441 ha.
Total area used in the Qbar calcs is 1.441 ha resulting in allowable discharge of 8.56l/s. Qbar has been calculated only considering the contributing area of 1.441 ha. b) WM has revised Flow model default Cv values of 0.84 for winter and 0.75 for Summer to Cv =1 for both. Please refer to Flow model submitted with this response.</td>
<td>

Acceptable</td>
</tr>
<tr>
<td>18</td>
<td>These have not been provided.</td>
<td>Please provide reference drawing</td>
<td>See SW long sections are submitted with this response.</td>
<td>Acceptable</td>
</tr>
<tr>
<td>19</td>
<td>A runoff factor of 20% has been considered for green areas. This factor should match the SPR used in the Qbar calculations 0.47.</td>
<td>WM to provide rationale for using 20% for green areas as opposed to the SPR value for the site.</td>
<td>WM has revised Flow calculations to include a runoff factor of 0.47 for green areas.</td>
<td>Acceptable</td>
</tr>
<tr>
<td>20</td>
<td>It isn't clear in the calculations as to where this has been allowed for.</td>
<td>WM to clarify</td>
<td>Urban Creep has been allowed for in 10% increase of roof areas for private houses and duplex units.</td>
<td>Acceptable</td>
</tr>
</table>

B. Ground Investigations – Soil Infiltration Report

S.I. Ltd Contract No: 5802

Client:	Knockrabo Investments DAC
Engineer:	Waterman Moylan
Contractor:	Site Investigations Ltd

Knockrabo,
Mount Anville Road, Goatstown, Dublin 14
Soakaway Investigation

Prepared by:

....

Stephen Letch

Issue Date:	08/01/2021
Status	Final
Revision	1

Contents: Page No.

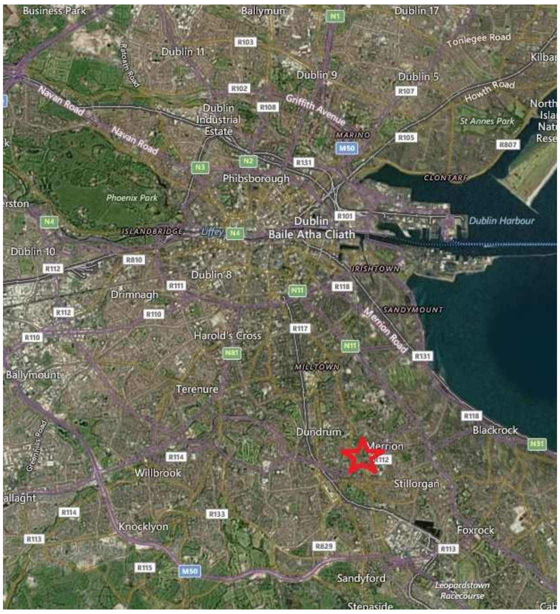
Appendices:

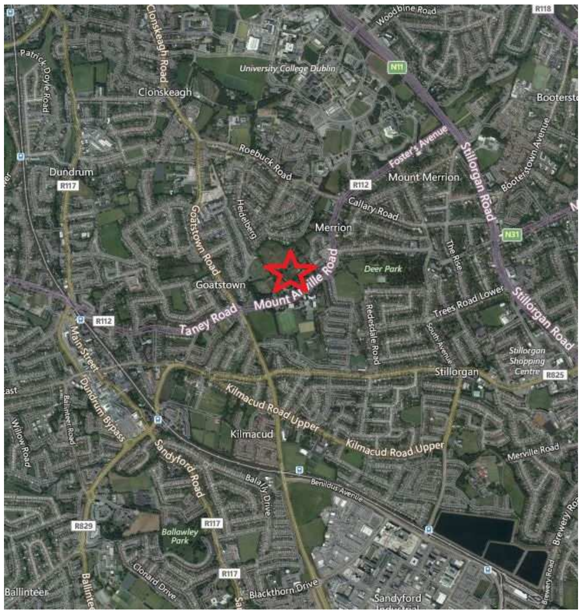
1. Introduction

On the instructions of Waterman Moylan, Site Investigations Ltd (SIL) were appointed to complete a site investigation at Knockrabo, Mount Anville Road, Goatstown, Dublin 14. The investigation was completed in January 2021 on behalf of the client, Knockrabo Investments DAC.

2. Site Location

The site is located on the Mount Anville Road, Goatstown, Dublin 14. The map on the left shows the location of Goatstown in south Dublin and the second map shows the site location in the local area.





3. Fieldwork

4 No. soakaway tests were completed and carried out in accordance with BRE Special Digest 365. The soakaway tests were completed using a tracked excavator and was logged by a 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. The time taken for the water level to fall from 75% volume to 25% volume is required to calculate the rate of infiltration.

The soakaway results and photographs are presented in Appendix 1.

4. 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.

The soakaway tests at SA01 and SA02 recorded no infiltration and therefore, failed the specification. The BRE Digest stipulates that the pit should half empty within 24hrs, and extrapolation indicates this condition would not be satisfied. The test was terminated at the end of the first (of a possible three) fill/empty cycle since further testing would give even slower fall rates due to increased soil saturation. The unsuitability of the soils for soakaways is further suggested by the soil descriptions of the materials in this area of the site where the soakaway was completed, i.e., well compacted clay/silt soils.

The pits excavated at SA03 and SA04 recorded ingresses of groundwater into the pits and therefore the soils are already saturated and unsuitable for soakaway design.

Appendix 1

Soakaway Test Results and Photographs

SOAKAWAY TEST

Project Reference:	5802
Contract name:	Knockrabo
Location:	Goatstown, Dublin 16
Test No:	SA01
Date:	06/01/2021

Ground Conditions

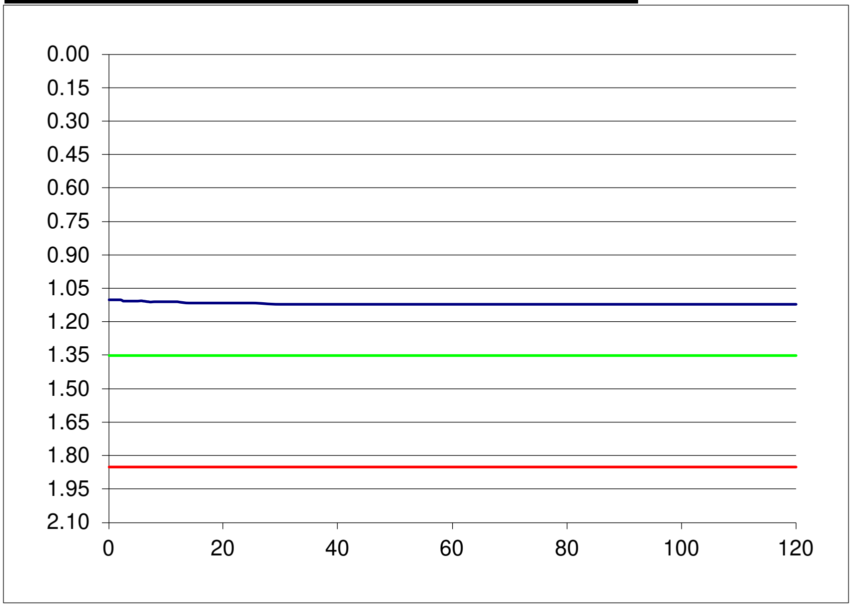
From	To	
0.00	0.40	MADE GROUND: brown slightly sandy slightly gravelly silty clay with low cobble content and some red brick and timber fragments.
0.40	2.10	Firm becoming stiff brown slightly sandy slightly gravelly silty CLAY with medium cobble content.

Remarks:

-

Elapsed Time (mins)	Fall of Water (m)
0	1.10
0.5	1.10
1	1.10
1.5	1.10
2	1.10
2.5	1.11
3	1.11
3.5	1.11
4	1.11
4.5	1.11
5	1.11
6	1.11
7	1.11
8	1.11
9	1.11
10	1.11
12	1.11
14	1.12
16	1.12
18	1.12
20	1.12
25	1.12
30	1.12
40	1.12
50	1.12
60	1.12
75	1.12
90	1.12
120	1.12

Pit Dimensions (m)		
Length (m)	2.90	m
Width (m)	0.70	m
Depth	2.10	m
Water		
Start Depth of Water	1.10	m
Depth of Water	1.00	m
75% Full	1.35	m
25% Full	1.85	m
75%-25%	0.50	m
Volume of water (75%-25%)	**1.02**	m3
Area of Drainage	**15.12**	m2
Area of Drainage (75%-25%)	**5.63**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = **Fail** m/min or **Fail** m/s

SOAKAWAY TEST

Project Reference:	5802
Contract name:	Knockrabo
Location:	Goatstown, Dublin 16
Test No:	SA02
Date:	06/01/2021

Ground Conditions

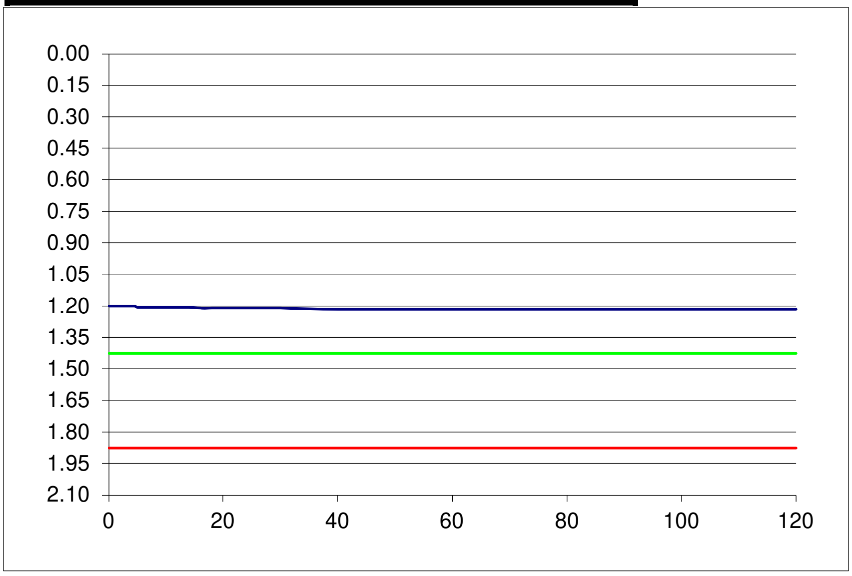
From	To	
0.00	0.10	MADE GROUND: grey silty sandy gravel.
0.10	1.20	MADE GROUND: brown sandy slightly gravelly silty clay with high cobble content and some red brick fragments.
1.20	1.70	Firm becoming stiff grey brown slightly sandy slightly gravelly silty CLAY with medium cobble content.

Remarks:

Obstruction at 1.70mbgl - possible boulders or weathered bedrock.

Elapsed Time (mins)	Fall of Water (m)
0	1.20
0.5	1.20
1	1.20
1.5	1.20
2	1.20
2.5	1.20
3	1.20
3.5	1.20
4	1.20
4.5	1.20
5	1.21
6	1.21
7	1.21
8	1.21
9	1.21
10	1.21
12	1.21
14	1.21
16	1.21
18	1.21
20	1.21
25	1.21
30	1.21
40	1.22
50	1.22
60	1.22
75	1.22
90	1.22
120	1.22

Pit Dimensions (m)		
Length (m)	3.10	m
Width (m)	0.70	m
Depth	2.10	m
Water		
Start Depth of Water	1.20	m
Depth of Water	0.90	m
75% Full	1.43	m
25% Full	1.88	m
75%-25%	0.45	m
Volume of water (75%-25%)	**0.98**	m3
Area of Drainage	**15.96**	m2
Area of Drainage (75%-25%)	**5.59**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = Fail or **Fail**

m/min **m/s**

SOAKAWAY TEST

Project Reference:	5802
Contract name:	Knockrabo
Location:	Goatstown, Dublin 16
Test No:	SA03
Date:	06/01/2021

Ground Conditions

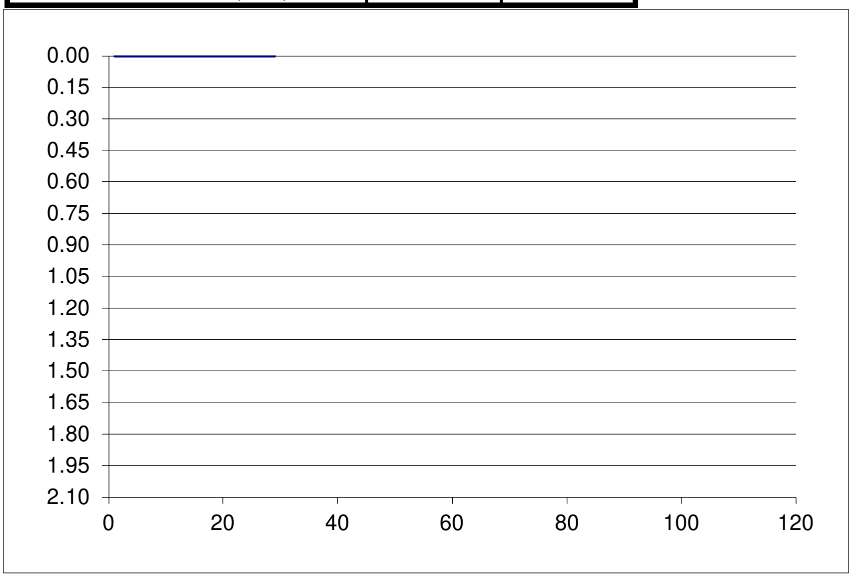
From	**To**	
0.00	0.10	TOPSOIL.
0.10	0.90	Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content.
0.90	2.00	Light brown sandy GRAVELwith high cobble content. (Possible weathered granite).

Remarks:

Obstruction at 2.00mbgl - possible boulders or weathered bedrock.
Medium water ingress at 1.10mbgl - area unsuitable for soakaway design.

Elapsed Time (mins)	Fall of Water (m)
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-

Pit Dimensions (m)		
Length (m)	2.80	m
Width (m)	0.70	m
Depth	2.10	m
Water		
Start Depth of Water	-	m
Depth of Water	-	m
75% Full	-	m
25% Full	-	m
75%-25%	-	m
Volume of water (75%-25%)	**-**	m3
Area of Drainage	**-**	m2
Area of Drainage (75%-25%)	**-**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = **Fail** **m/min** or **Fail** **m/s**

SOAKAWAY TEST

Project Reference:	5802
Contract name:	Knockrabo
Location:	Goatstown, Dublin 16
Test No:	SA04
Date:	06/01/2021

Ground Conditions

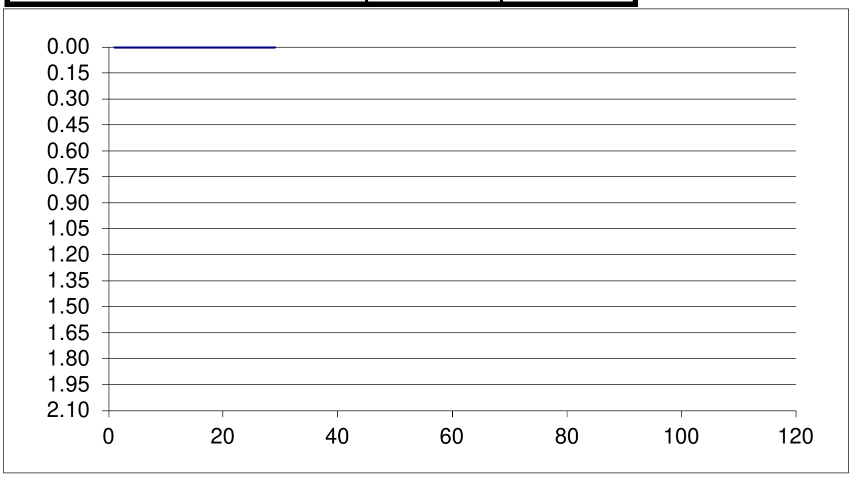
From	To	
0.00	0.10	MADE GROUND: grey silty sandy gravel.
0.10	0.30	MADE GROUND: grey brown sandy slightly gravelly silty clay with medium cobble content and some red brick fragments.
0.30	0.60	Firm brown slightly sandy slightly gravelly silty CLAY with medium cobble content.
0.60	1.55	Firm grey brown slightly sandy slightly gravelly silty CLAY with medium cobble and low boulder content.

Remarks:

Obstruction at 1.55mbgl - possible boulders or weathered bedrock.
Medium water ingress at 1.50mbgl - area unsuitable for soakaway design.

Elapsed Time (mins)	Fall of Water (m)
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-

Pit Dimensions (m)		
Length (m)	2.90	m
Width (m)	0.70	m
Depth	2.10	m
Water		
Start Depth of Water	-	m
Depth of Water	-	m
75% Full	-	m
25% Full	-	m
75%-25%	-	m
Volume of water (75%-25%)	-	m3
Area of Drainage	-	m2
Area of Drainage (75%-25%)	-	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f =	**Fail**	or	**Fail**
	m/min		**m/s**

SA01 Sidewall

SA01 Spoil

SA02 Sidewall

SA02 Spoil

SA03 Sidewall

SA03 Spoil

SA04 Sidewall

SA04 Spoil

Appendix 2

Survey Data

Survey Data

Location	Irish Transverse Mercator		Elevation	Irish National Grid	
	Easting	Northing		Easting	Northing
Soakaway Tests					
SA01	718242.859	728541.905	63.92	318317.806	228514.430
SA02	718344.916	728655.091	63.05	318419.884	228627.641
SA03	718318.367	728591.943	64.13	318393.330	228564.479
SA04	718404.057	728559.783	71.43	318479.039	228532.312

Legend Key

Locations By Type - IP

Contract No:	5802
Contract Name:	Knockrabo
Location:	Goatstown, Dublin 16
Client:	Knockrabo Investments DAC
Engineer:	Waterman Moylan
Title:	Site Plan
Scale:	1:1000
Drawn By:	SL

Site Investigations Ltd
The Grange
12th Lock Road
Lucan
Co. Dublin
T: 01 6108768
e: info@siteinvestigations.ie

C. Ground Investigations – GII Ground Investigations Report

Ground Investigations Ireland Ltd.,
Catherinestown House,
Hazelhatch Road,
Newcastle, Co Dublin.
Tel: 01 601 5175 / 5176 | Fax: 01 601 5173
Email: info@gii.ie | Web: gii.ie

Ground Investigations Ireland

Knockrabo, Mount Anville Road

Ground Investigation Report

DOCUMENT CONTROL SHEET

Project Title	Knockrabo, Mount Anville Road
Engineer	DBFL
Project No	8188-10-18
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
B	Final	S. Connolly	C. Finnerty	C. Finnerty	Dublin	06 February 2019

Ground Investigations Ireland Ltd.,
Catherinestown House,
Hazelhatch Road,
Newcastle, Co Dublin.
Tel: 01 601 5175 / 5176 | Fax: 01 601 5173
Email: info@gii.ie | Web: gii.ie

CONTENTS

APPENDICES

1.0 Preamble

On the instructions of DBFL Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., in November 2018 at the site of the proposed residential development in Knockrabo, Mount Anville, Dublin 14.

2.0 Overview

2.1. Background

It is proposed to construct a new residential development with associated services, access roads and car parking at the proposed site. The site is currently occupied by a disused residential building and gardens and is situated on Mount Anville Road, Dublin 14. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 19 No. Trial Pits to a maximum depth of 3.30m BGL
- Carry out 1 No. Foundation Inspection Pits to determine existing foundation details
- Carry out 3 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Carry out 26 No. Dynamic Probes to determine soil strength/density characteristics
- Carry out 2 No. Rotary Core Boreholes to a maximum depth of 8.30m BGL
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.

The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Trial Pits

The trial pits were excavated using a JCB 3CX excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Foundation Pits

The foundation inspection pit was excavated at the location shown in the exploratory hole location plan in Appendix 1. The exposed foundation was logged and sketched prior to backfilling and reinstatement. The log and sketch are provided in Appendix 3 of this Report.

3.4. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 4 of this Report.

3.5. Dynamic Probing

The dynamic probe tests (DPH) were carried out at the locations shown in the location plan in Appendix 1 in accordance with B.S. 1377: Part 9 1990. The test consists of mechanically driving a cone with a 50kg weight in 100mm intervals and monitoring the number of blows required. An equivalent Standard Penetration Test (SPT) 'N' value may be calculated by dividing the total number of blows over a 300mm drive length by 1.5. The dynamic probe logs are provided in Appendix 5 of this Report.

3.6. Rotary Boreholes

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown on the location plan in Appendix 1. The rotary boreholes were completed from the ground surface or alternatively, where noted on the individual borehole log, from the base of the cable percussion borehole where a temporary liner was installed to facilitate follow-on rotary coring.

The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the "overshoot" recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit, and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids. It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 6 of this Report.

3.7. Surveying

The exploratory hole locations have been recorded using a Trimble R10 GNSS System which records the coordinates and elevation of the locations to ITM or Irish National Grid as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.8. Insitu Plate Bearing Test

The plate bearing tests were carried out by Testall Ltd. The results of which are provided on the test reports in Appendix 7 of this Report.

3.9. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.

Environmental testing, including Waste Acceptance Criteria (WAC) and pH and sulphate testing was carried out by Jones Environmental Laboratory in the UK.

Geotechnical testing consisting of moisture content, Atterberg limits and Particle Size Distribution (PSD) tests were carried out in NMTL's Geotechnical Laboratory in Carlow.

Rock strength testing including Point Load (Is_{50}) and Unconfined Compressive Strength (UCS) testing was carried out in Trinity College Dublin's Geotechnical Laboratory

The results of the laboratory testing are included in Appendix 8 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and are generally comprised;

- Topsoil
- Made Ground
- Cohesive Deposits
- Weathered Rock
- Bedrock

TOPSOIL: Topsoil was encountered in the majority of the exploratory holes and was present to a maximum depth of 0.50m BGL.

MADE GROUND: Made Ground deposits were encountered beneath the Topsoil in TP08, TP10, TP13, TP16, TP17 and TP19, and was present to a maximum depth of 2.50m BGL. These deposits were described generally as *brown slightly sandy gravelly Clay with many fragments of red brick, glass and plastic.*

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Made Ground and were described typically as *brown sandy gravelly CLAY with occasional cobbles*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm or firm to stiff below 1.00m BGL in the majority of the exploratory holes. These deposits had occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

WEATHERED BEDROCK: In the majority of exploratory holes weathered rock was encountered which was digable with the large excavator to a depth of up to 1.20m below the top of the stratum. The trial pits were terminated upon encountering the more competent bedrock, in which further excavation became more difficult. This material was recovered typically as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite however there was some variability in the fracture spacing and the ease at which the excavator could progress.

BEDROCK: The rotary core boreholes recovered Weak to medium strong brown/white coarse grained Granite.

The depth to rock is at 2.30m BGL in both boreholes. The total core recovery is typically poor, with some of the uppermost runs dropping to 25% or 67%. The SCR and RQD both are poor, often recovered as non-intact, however both indices show an increase with depth in each of the boreholes.

4.2. Insitu Strength Testing

The correlated DPH blow counts indicate that the overburden deposits are firm or firm to stiff to depths of between 0.20m to 1.70m BGL and become stiff with depth.

4.3. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors.

4.4. Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to intermediate plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 17% and 46% generally with fines contents of 17 to 38%.

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

The results of the Waste Acceptance Criterial Test Suite are presented with the individual parameter limits for “Inert” “Non Hazardous” and “Hazardous” as outlined within European Council Directive 1999 131/EC Article 16 Annex II, “Criteria and procedures for the acceptance of waste at landfills”. The intended disposal site should be consulted to ensure compliance with their specific requirements.

The results indicate that the total organic carbon content is above the inert limits at 1.50m BGL in TP17 (4.02% vs 3%). Asbestos was detected at 0.50m BGL in TP10, <0.001% as Chrysotile fibre bundles, which was quantified by the lab. Consultation is advised with a specialist environmental consultant or local landfill operators regarding the disposal of this material.

The results from the completed laboratory testing is included in Appendix 7 of this report.

5.0 Recommendations & Conclusions

5.1. General

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 exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

5.2. Foundations

An allowable bearing capacity of 125 kN/m^2 is recommended for conventional strip or pad foundations on the firm to stiff cohesive deposits at a depth of between 0.50m to 1.70m BGL in the majority of the exploration holes, please see Table below. Where the cohesive deposits are deeper, such as at the location of DP15, lean mix trench fill to a depth of 2.50m BGL is recommended to achieve the recommended allowable bearing capacity. An allowable bearing capacity in excess of 250 kN/m^2 is recommended on the bedrock deposits, where present at shallow depths. If a higher allowable bearing capacity is required, 500 kN/m^2 is available on the competent intact granite bedrock as indicated in the rotary core borehole records where total core recovery is greater than 90%.

Allowable Bearing Capacities (ABC) - Dynamic Probe Locations					
Probe No.	ABC kN/m2	Depth m BGL	Probe No.	ABC kN/m2	Depth m BGL
DP01	125	1.40	DP10A	125	0.80
DP02	125	2.20	DP11	125	0.80
DP03	125	2.20	DP12	125	0.80
DP04	100	1.40	DP13	125	0.50
DP05	125	1.40	DP13A	125	0.50
DP06	125	1.20	DP14	125	0.50
DP07	125	2.50	DP14A	125	0.50
DP07A	125	2.50	DP15	200	2.50
DP08	125	1.00	DP16	125	1.00
DP08A	125	1.20	DP18	200	1.70
DP09	125	0.80	DP19	125	0.50
DP09A	125	0.80	DP19A	125	0.50
DP10	125	0.80	DP21A	125	1.50

The possibility for variation in the depth of the made ground or soft cohesive deposits in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete. In any part of the site, should part of the foundation be on rock we would recommend that all the foundations of the unit in question be lowered to the competent rock stratum to avoid differential settlement.

A ground bearing floor slab is recommended to be based on the firm to stiff cohesive deposits with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:2014+A1:2016 and/or NRA SRW CL808 Type E granular stone fill.

The pH and sulphate testing completed on samples recovered from the trial pits indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are required for concrete foundations to prevent sulphate attack.

5.3. External Pavements

The proposed pavements are recommended to be designed in accordance with the CBR test results included in the Appendixes of this Report. The low CBR test results indicate that a capping layer or a sufficient depth of crushed stone fill may be required. Plate bearing tests are recommended at the time of construction to verify the design assumptions for the proposed pavement make up and to verify adequate compaction has been achieved.

5.4. Excavations

Excavations in the Made Ground Deposits will require to be appropriately battered or the sides supported due to the low strength of these deposits.

Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25m BGL or is required to permit man entry.

Any excavations which penetrate the granular deposits will require to be appropriately battered or the sides supported and are likely to require dewatering due to the groundwater seepages noted in the exploratory hole logs in the Appendices of this Report.

The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations. Generally, where significant excavations are required in water bearing granular deposits a cut-off wall may be more cost effective than extensive dewatering. An assessment by a specialist dewatering contractor is recommended to determine the most cost effective approach to the proposed excavation.

Excavations in the upper cohesive and weathered rock deposits are expected to be excavatable with conventional excavation equipment, with zones of more intact bedrock below this depth requiring rock breaking techniques. The JCB 3CX excavator was generally able to excavate to depths of up to 1.20m below the top of the weathered rock, and became difficult to excavate within the confines of the trial pit on encountering the more competent rock.

Any material to be removed off site should be disposed of to a suitably licenced landfill.

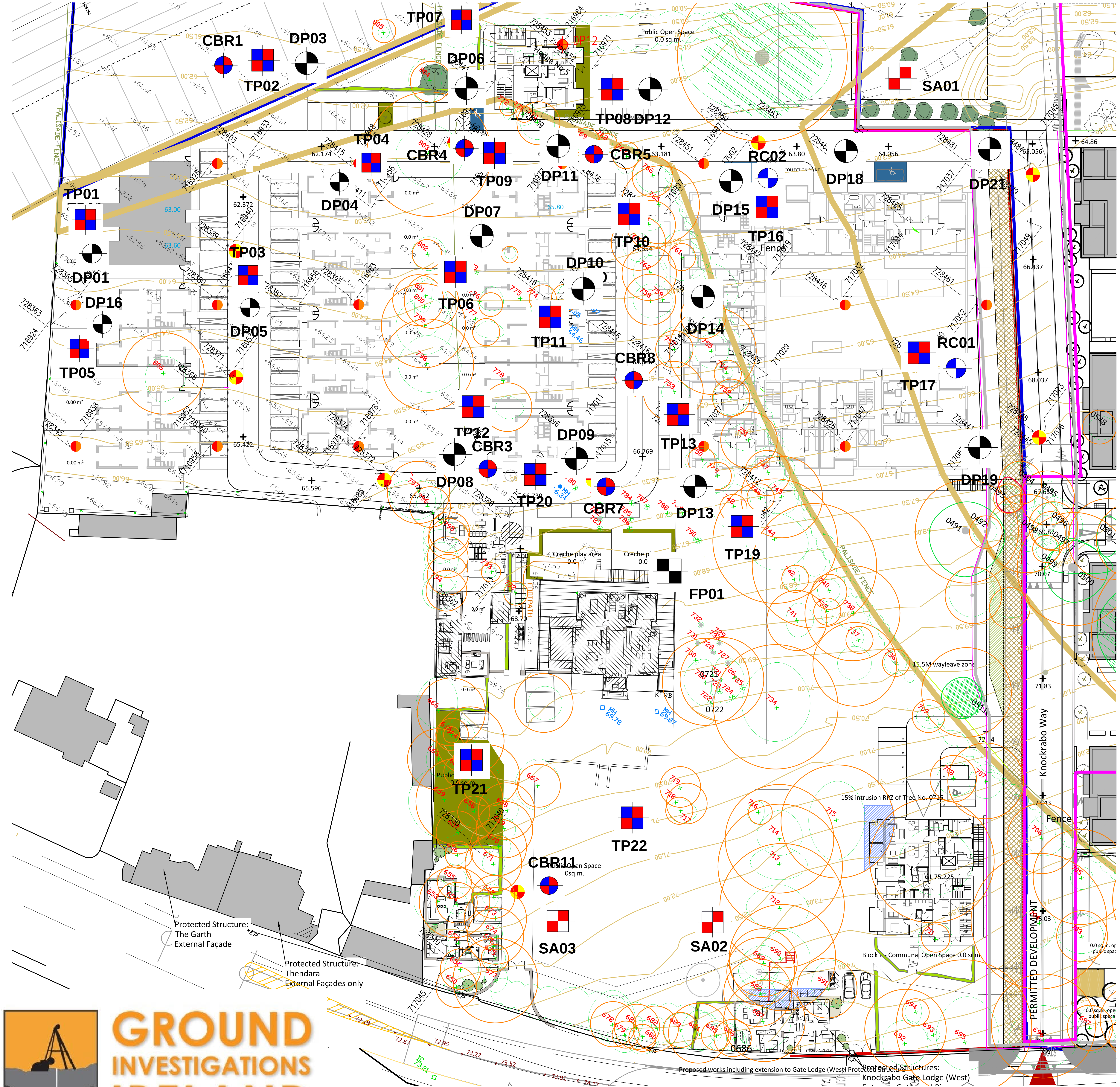
5.5. Soakaway Design

At the locations of SA01, SA02 and SA03, the water level dropped too slowly to allow calculation of ‘f’ the soil infiltration rate. These locations are therefore not recommended as suitable for soakaway design and construction.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

APPENDIX 1 - Site Location Plan

KNOCKRABO, MOUNT ANVILLE - SITE LOCATION PLAN



Dynamic Probe Locations

Trial Pit Locations

Soakaway Locations

Rotary Core Borehole Locations

Foundation Pit Locations

Plate Test Locations

GROUND INVESTIGATIONS IRELAND

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd www.gii.ie			Site Knockrabo, Mount Anville	Trial Pit Number **TP01**
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 18/12/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL with roots		
					0.30	MADE GROUND: Brown slightly sandy slightly gravelly Clay with fragments of plastic, brick and cloth		
1.00	B				(0.90)			
					1.20	Firm brown sandy gravelly CLAY with occasional sub-rounded cobbles		
					(1.80)			
3.00	B				3.00	GRANITE		
					(0.10)			
					3.10	Complete at 3.10m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion
Black wavin pipe at 1.20mBGL

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	

Ground Investigations Ireland Ltd
www.gii.ie

Site	Trial Pit Number
Knockrabo, Mount Anville	TP02

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD) 60.83	Client	Job Number 8188-10-18
	Location 718232.8 E 728604.8 N	Dates 07/11/2018	Engineer DBFL	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	TOPSOIL with roots and many fragments of red brick		
				60.33	0.50 (1.20)	Firm to stiff brown sandy gravelly CLAY with occasional sub-rounded cobbles		
				59.13	1.70 (0.60)	Firm brown sandy gravelly CLAY with occasional sub-rounded cobbles		
2.00	B							
				58.53	2.30 (0.10)	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		
				58.43	2.40 (0.20)	GRANITE		
				58.23	2.60	Complete at 2.60m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion
Old drainage pipe at 0.50mBGL - broken

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP02

Ground Investigations Ireland Ltd
www.gii.ie

Site Knockrabo, Mount Anville				**Trial Pit Number** TP03
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 18/12/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20) 0.20	TOPSOIL with roots		
0.50	B				(0.40) 0.60	Soft to firm light brown sandy gravelly Clay with rare sub-rounded cobbles		
					(2.10) 2.70	Firm brown/grey sandy gravelly CLAY with occasional sub-rounded cobbles		
					(0.10) 2.80	GRANITE		∇1
			Slow flow(1) at 2.80m.			Complete at 2.80m		

Plan

Remarks

Trial pit stable
Groundwater encountered at 2.80mBGL as slow flow
Trial pit backfilled upon completion
Shallow depth due to bedrock

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP03

Ground Investigations Ireland Ltd
www.gii.ie

Machine : JCB 3CX **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 18/12/2018	**Engineer** DBFL	**Sheet** 1/1

Site: Knockrabo, Mount Anville

Trial Pit Number: TP04

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30) 0.30	TOPSOIL with roots		
					(1.00) 1.30	Soft to firm brown/grey sandy gravelly CLAY with rare sub-rounded cobbles		
1.50	B				(1.40) 2.70	Firm becoming firm to stiff below 2.10mBGL brown/grey sandy gravelly CLAY with rare sub-rounded cobbles		∇1
			Slow flow(1) at 2.70m.		(0.50) 3.20	WEATHERED GRANITE: Recovered as white/brown gravelly fine to coarse SAND with occasional sub-rounded cobbles of Granite		
					(0.10) 3.30	GRANITE		
						Complete at 3.30m		

Plan

Remarks

Trial pit collapse below 0.50mBGL
Groundwater encountered at 2.70mBGL as a slow flow
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP04

Ground Investigations Ireland Ltd www.gii.ie	Site: Knockrabo, Mount Anville	Trial Pit Number: TP05

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD)	Client	Job Number 8188-10-18
	Location	Dates 18/12/2018	Engineer DBFL	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL with roots		
					0.30 (0.40)	MADE GROUND: Brown sandy gravelly Clay with occasional sub-rounded cobbles		
					0.70 (2.40)	Firm becoming firm to stiff below 1.50mBGL brown/grey sandy gravelly CLAY with occasional sub-rounded cobbles		
2.50	B							
			Slow flow(1) at 3.10m.		3.10 (0.10)	GRANITE		∇1
					3.20	Complete at 3.20m		

Plan

Remarks

Trial pit stable
Groundwater encountered at 3.10mBGL as a slow flow
Trial pit backfilled upon completion
Black wavin pipe at 0.70mBGL - broken

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP05

Ground Investigations Ireland Ltd www.gii.ie	Site: Knockrabo, Mount Anville	Trial Pit Number: TP06

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD): 63.61	Client	Job Number: 8188-10-18
	Location: 718295.8 E 728582.5 N	Dates: 07/11/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	TOPSOIL		
				63.21	0.40 (0.50)	Firm brown slightly sandy gravelly CLAY with occasioal sub-rounded cobbles		
				62.71	0.90 (0.70)	Stiff brown slightly sandy gravelly CLAY with occasioal sub-rounded cobbles		
				62.01	1.60 (1.70)	Firm to stiff brown slightly sandy gravelly CLAY with occasioal sub-rounded cobbles		
				60.31	3.30	Complete at 3.30m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP06

Ground Investigations Ireland Ltd www.gii.ie			Site: Knockrabo, Mount Anville	Trial Pit Number: TP07
Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD)	Client	Job Number: 8188-10-18
	Location	Dates: 18/12/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	MADE GROUND: Grey angular Gravel FILL		
					(0.40) 0.50	TOPSOIL with roots		
1.00	B				(1.20) 1.70	Soft to firm brown sandy gravelly CLAY with occasional sub-rounded cobbles		
			Rapid flow(1) at 1.70m.		(0.80) 2.50	WEATHERED GRANITE: Recovered as clayey very gravelly fine to coarse SAND with occasional cobbles of Granite		∇1
						Complete at 2.50m		

Plan

Remarks

Trial pit collapse below 0.50mBGL
Groundwater encountered at 1.70mBGL as a rapid flow
Shallow depth due to collapse
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP07

Ground Investigations Ireland Ltd www.gii.ie			Site Knockrabo, Mount Anville	Trial Pit Number **TP08**
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 61.93	**Client**	**Job Number** 8188-10-18
	Location 718291.5 E 728621.4 N	**Dates** 07/11/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	TOPSOIL with roots and many fragments of plastic		
				61.53	0.40	MADE GROUND: Light brown slightly sandy slightly gravelly Clay with roots and occasional fragments of plastic. Occasional sub-rounded cobbles		
					(1.00)			
				60.53	1.40	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		
					(1.20)			
				59.33	2.60	Complete at 2.60m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP08

Ground Investigations Ireland Ltd www.gii.ie	Site: Knockrabo, Mount Anville	Trial Pit Number: TP09

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD): 62.54	Client	Job Number: 8188-10-18
	Location: 718286.9 E 728601.4 N	Dates: 06/11/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				62.34	0.20	Firm brown sandy gravelly CLAY		
					(0.50)			
				61.84	0.70	Firm to stiff brown sandy gravelly CLAY		
					(1.40)			
				60.44	2.10	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		
					(0.90)			
			Slow trickle(1) at 2.80m.					∇1
3.00	B			59.54	3.00	Complete at 3.00m		

Plan

Remarks

Trial pit stable
Groundwater encountered at 2.80mBGL as slow trickle
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP09

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Trial Pit Number **TP10**

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD) 63.33	Client	Job Number 8188-10-18
	Location 718308.3 E 728604.3 N	Dates 06/11/2018	Engineer DBFL	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL with roots		
0.50	B			63.03	0.30 (0.70)	MADE GROUND: Brown slightly sandy gravelly Clay with many fragments of glass, plastic and red brick		
				62.33	1.00 (1.00)	Firm to stiff brown sandy gravelly CLAY with occasional sub-rounded cobbles		
			Slow trickle(1) at 2.00m.	61.33	2.00 (0.10)	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		∇1
				61.23	2.10 (0.10)	GRANITE		
				61.13	2.20	Complete at 2.20m		

Plan

Remarks

Trial pit stable
Groundwater encountered at 2.00mBGL as slow trickle
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP10

Ground Investigations Ireland Ltd www.gii.ie	Site: Knockrabo, Mount Anville	Trial Pit Number: TP11

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD): 64.56	Client	Job Number: 8188-10-18
	Location: 718317.6 E 728586.6 N	Dates: 06/11/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				64.36	0.20	Firm brown slightly sandy slightly gravelly CLAY with rare sub-angular cobbles		
					(0.70)			
				63.66	0.90	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		
					(0.60)			
				63.06	1.50	GRANITE		
					(0.10)			
				62.96	1.60	Complete at 1.60m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP11

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Trial Pit Number TP12

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD) 65.25	Client	Job Number 8188-10-18
	Location 718314.2 E 728565.7 N	Dates 06/11/2018	Engineer DBFL	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL with roots		
				65.05	0.20 (0.80)	Firm to stiff brown slightly sandy gravelly CLAY with roots		
1.00	B			64.25	1.00 (0.20)	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		
				64.05	1.20 (0.10)	GRANITE		
				63.95	1.30	Complete at 1.30m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP12

Ground Investigations Ireland Ltd www.gii.ie	Site: Knockrabo, Mount Anville	Trial Pit Number: TP13
Machine : JCB 3CX Method : Trial Pit		
Dimensions:	Ground Level (mOD): 65.27	Client:
Location: 718330.5 E 728582.8 N	Dates: 06/11/2018	Engineer: DBFL
Job Number: 8188-10-18	Sheet: 1/1	

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				65.07	0.20	MADE GROUND: Brown slightly sandy gravelly Clay with occasional fragments of red brick		
					(0.50)			
				64.57	0.70	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		
1.00	B				(0.80)			
				63.77	1.50	GRANITE		
					(0.10)			
				63.67	1.60	Complete at 1.60m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion
Disused sewer pipe at 0.40mBGL - broken

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP13

Ground Investigations Ireland Ltd www.gii.ie	Site: Knockrabo, Mount Anville	Trial Pit Number: TP16
Machine : JCB 3CX Method : Trial Pit	Dimensions:	Ground Level (mOD): 63.85	Client:	Job Number: 8188-10-18
	Location: 718320.3 E 728621.7 N	Dates: 07/11/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.20)	MADE GROUND: Brown sandy angular cobble FILL with many fragments of plastic and wood		
			Slow trickle(1) at 1.20m.	62.65	1.20 (0.10)	MADE GROUND: Dark brown slightly sandy gravelly Clay with occasional fragments of red brick		∇1
				62.55	1.30	MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional fragments of red brick		
1.50	B				(1.20)			
			Rapid flow(2) at 2.50m.	61.35	2.50 (0.50)	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		∇2
				60.85	3.00	Complete at 3.00m		

Plan

Remarks

Trial pit spalling below 1.30mBGL
Groundwater encountered at 1.20mBGL as a slow trickle and at 2.50mBGL as a rapid flow
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP16

Ground Investigations Ireland Ltd www.gii.ie			Site: Knockrabo, Mount Anville	Trial Pit Number: TP17
Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD) 66.74	Client	Job Number 8188-10-18
	Location 718363.6 E 728614.8 N	Dates 07/11/2018	Engineer DBFL	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				66.54	(0.20) 0.20	MADE GROUND: Grey/blue angular Gravel FILL		
				65.54	(1.00) 1.20	MADE GROUND: Brown slightly sandy gravelly Clay with occasional fragments of plastic,and red brick. Occasional sub-rounded cobbles		
1.50	B			65.04	(0.50) 1.70	MADE GROUND: Brown/grey sandy gravelly Clay with occasional fragments of red brick, wood and plastic		
				64.94	(0.10) 1.80	Firm to stiff light brown slightly sandy slightly gravelly CLAY		
				64.04	(0.90) 2.70	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		
						Complete at 2.70m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP17

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Trial Pit Number **TP19**

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD) 67.89	Client	Job Number 8188-10-18
	Location 718361.3 E 728569.9 N	Dates 06/11/2018	Engineer DBFL	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL with roots		
				67.59	0.30	MADE GROUND: Brown/grey slightly sandy gravelly Clay with roots and occasional fragments of red brick. Many angular cobbles of Granite		
					(0.55)			
0.70	B							
				67.04	0.85 (0.15)	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		
				66.89	1.00 (0.10)	GRANITE		
				66.79	1.10	Complete at 1.10m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion
Disused sewer pipe at 0.60mBGL - broken

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP09

Ground Investigations Ireland Ltd
www.gii.ie

Machine : JCB 3CX **Method :** Trial Pit	**Dimensions**	**Ground Level (mOD)** 66.24	**Client**	**Job Number** 8188-10-18
	Location 718329.8 E 728564.9 N	**Dates** 06/11/2018	**Engineer** DBFL	**Sheet** 1/1

Site: Knockrabo, Mount Anville

Trial Pit Number: TP20

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				66.04	0.20	Firm to stiff brown slightly sandy gravelly CLAY with rare sub-rounded cobbles		
					(0.50)			
				65.54	0.70	WEATHERED GRANITE: Recovered as sandy fine to coarse angular GRAVEL with occasional cobbles of Granite		
					(0.50)			
				65.04	1.20	GRANITE		
					(0.10)			
				64.94	1.30	Complete at 1.30m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion

Scale (approx)	**Logged By**	**Figure No.**
1:25	S. Connolly	8188-10-18.TP20

Ground Investigations Ireland Ltd www.gii.ie	Site: Knockrabo, Mount Anville	Trial Pit Number: TP21

Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD): 69.58	Client	Job Number: 8188-10-18
	Location: 718345.9 E 728516.8 N	Dates: 06/11/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				69.38	0.20	Stiff to very stiff brown sandy gravelly CLAY		
					(1.80)			
				67.58	2.00	Complete at 2.00m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion
Shallow depth due to confines of trial pit

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP21

Ground Investigations Ireland Ltd www.gii.ie			Site: Knockrabo, Mount Anville	Trial Pit Number: TP22
Machine : JCB 3CX Method : Trial Pit	Dimensions	Ground Level (mOD): 70.93	Client	Job Number: 8188-10-18
	Location: 718374 E 728520.9 N	Dates: 07/11/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				70.73	0.20	Firm to stiff brown slightly sandy gravelly CLAY with occasional sub-rounded cobbles		
					(1.75)			
				68.98	1.95	GRANITE		
				68.93	2.00	Complete at 2.20m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.TP22

Knockrabo, Mount Anville – Trial Pit Photos

TP01

TP01


TP01


TP01

TP01

TP02


TP02


TP02

TP02

TP03


TP03


TP03

TP03

TP04

TP04

TP04

TP04

TP05

TP05

TP05

TP05

TP06

TP06

TP06


TP06


TP07


TP07


TP07

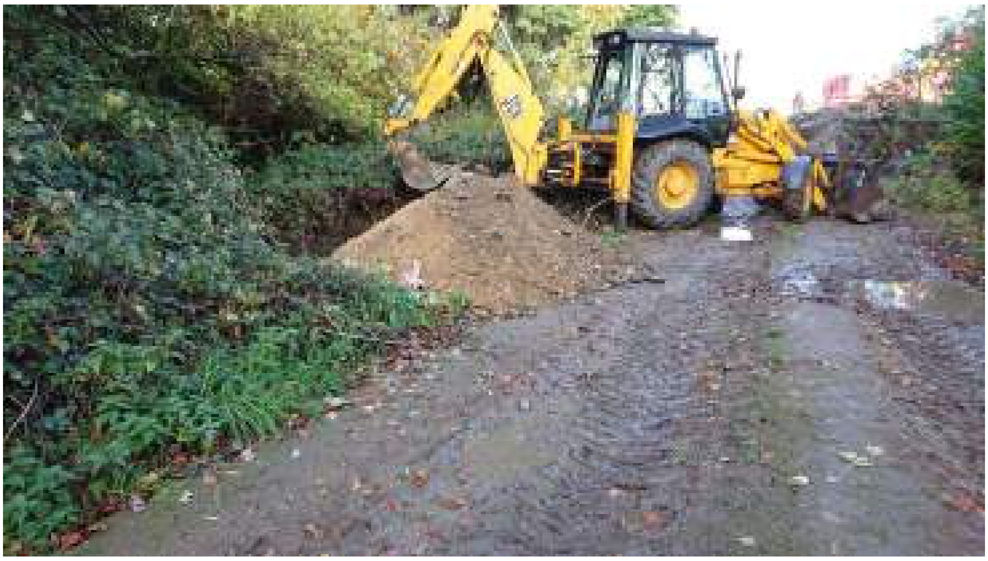
TP07

TP07


TP08


TP08

TP08



TP08


TP09


TP09

TP09

TP09


TP10


TP10


TP10


TP10

TP11

TP11

TP11

TP11

TP12

TP12

TP12

TP12

TP13

TP13


TP13


TP13

TP16

TP16

TP16


TP16

TP17

TP17

TP17

TP17

TP17

TP19


TP19


TP19


TP19


TP20


TP20


TP20

TP20

TP21

TP21

TP21

TP21


TP22

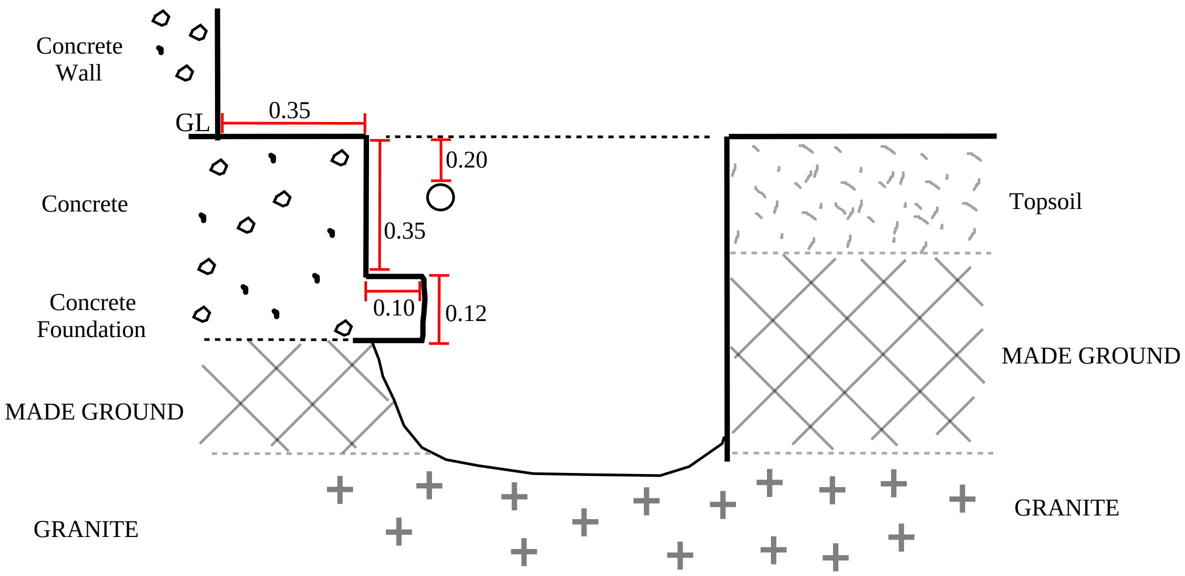

TP22


TP22

TP22

APPENDIX 3 – Foundation Pit Records

Foundation Pit



Note: Disused white 60mm wavin pipe at 0.20mBGL - broken

Ground Conditions	
0.00-0.20	Topsoil
0.20-0.70	MADE GROUND: Brown sandy gravelly Clay
0.70-0.75	GRANITE

Project:	Knockrabo	FP01	
Client:	DBFL		
Contractor:	Ground Investigations Ireland	Date	18/12/2018

Knockrabo, Mount Anville – Foundation Pit Photos

FP01

FP01


FP01


FP01


FP01


FP01

APPENDIX 4 – Soakaway Records

Ground Investigations Ireland Ltd www.gii.ie			Site: Knockrabo, Mount Anville	Trial Pit Number: SA01
Machine : JCB 3CX Method : Trial Pit	Dimensions L x W x D 2.10 x 0.50 x 2.40m	Ground Level (mOD)	Client	Job Number: 8188-10-18
	Location	Dates: 18/12/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL with roots		
					0.30	Soft to firm brown slightly sandy slightly gravelly CLAY with rare sub-rounded cobbles		
					(1.50)			
			Slow flow(1) at 1.80m.		1.80	WEATHERED GRANITE: Recovered as brown clayey sandy fine to coarse Gravel with cobbles of Granite		∇1
					(0.60)			
					2.40	Complete at 2.40m		

Plan

Remarks

Trial pit stable
Groundwater encountered at 1.80mBGL as a slow flow
Trial pit backfilled upon completion
Soakaway completed in trial pit

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.SA01

Ground Investigations Ireland Ltd www.gii.ie		Site: Knockrabo, Mount Anville	Trial Pit Number: SA02
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** L x W x D 2.40 x 060 x 1.40m	**Ground Level (mOD)** 72.58	**Client**	**Job Number** 8188-10-18
	Location 718393.1 E 728509.3 N	**Dates** 07/11/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL with roots		
				72.38	0.20	Firm brown slightly sandy slightly gravelly CLAY with occasional sub-rounded cobbles		
					(1.10)			
				71.28	1.30 (0.10)	GRANITE		
				71.18	1.40	Complete at 1.40m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion
Soakaway completed in trial pit

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.SA03

Ground Investigations Ireland Ltd www.gii.ie		Site: Knockrabo, Mount Anville	Trial Pit Number: SA03
Machine : JCB 3CX Method : Trial Pit	Dimensions L x W x D: 2.70 x 0.60 x 2.20m	Ground Level (mOD): 71.91	Client:	Job Number: 8188-10-18
	Location: 718375.4 E 728496.3 N	Dates: 07/11/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				71.71	0.20	Firm to stiff brown slightly sandy slightly gravelly CLAY with occasional sub-rounded cobbles		
0.80	B							
					(2.00)			
				69.71	2.20	Complete at 2.20m		

Plan

Remarks

Trial pit stable
No groundwater encountered
Trial pit backfilled upon completion
Soakaway completed in trial pit

Scale (approx)	Logged By	Figure No.
1:25	S. Connolly	8188-10-18.SA03

Knockrabo, Mount Anville – Soakaway Pit Photos

SA01

SA01


SA01


SA01

SA02

SA02


SA02

SA02

SA03

SA03

SA03

SA03

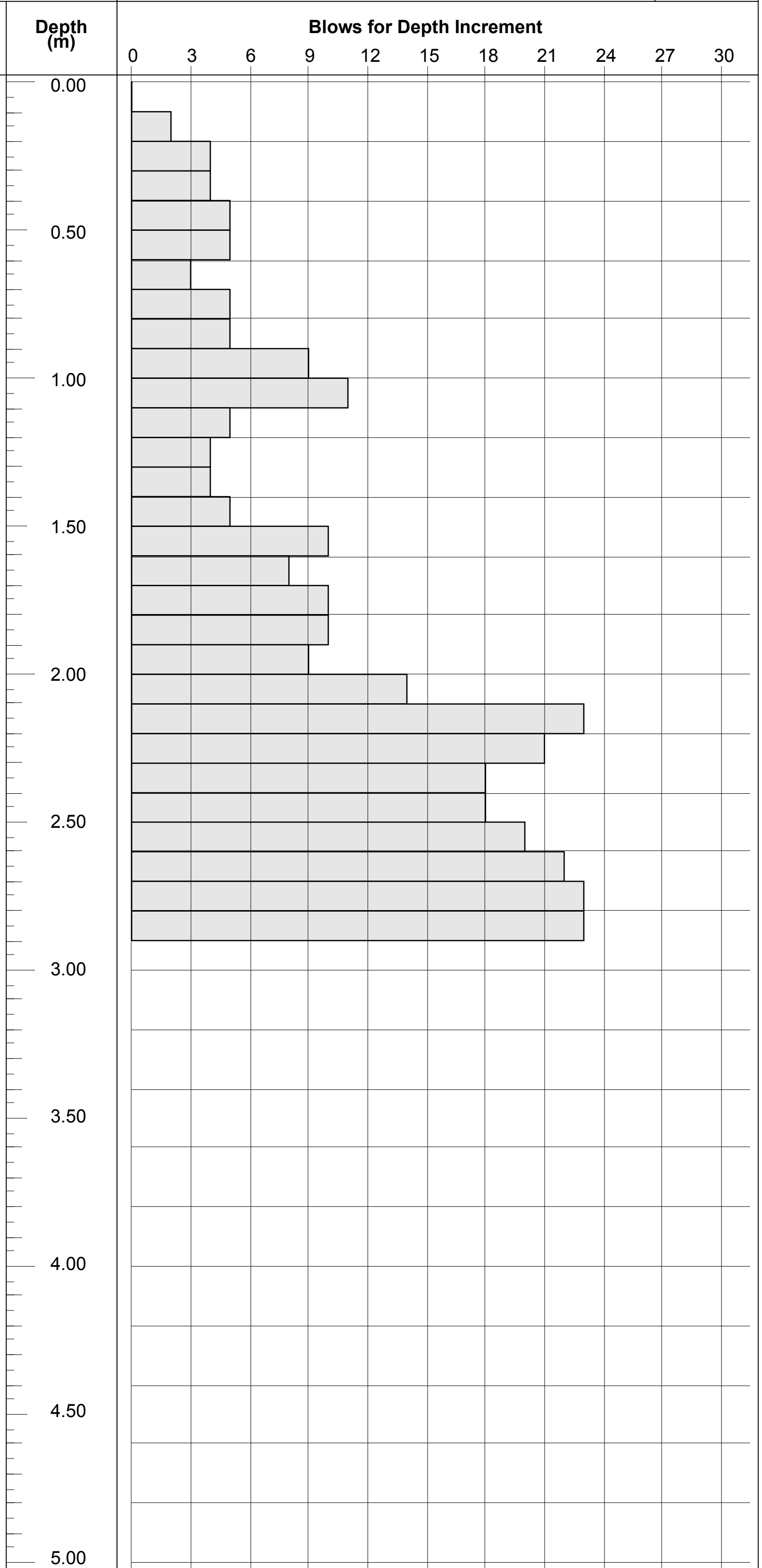
APPENDIX 5 – Dynamic Probe Records

Ground Investigations Ireland Ltd
www.gii.ie

Site	Probe Number
Knockrabo, Mount Anville	DP01

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe DPH, Fall Height 500mm, Hammer Wt. 50kg				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		20/12/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	0		
0.10-0.20	2		
0.20-0.30	4		
0.30-0.40	4		
0.40-0.50	5		
0.50-0.60	5		
0.60-0.70	3		
0.70-0.80	5		
0.80-0.90	5		
0.90-1.00	9		
1.00-1.10	11		
1.10-1.20	5		
1.20-1.30	4		
1.30-1.40	4		
1.40-1.50	5		
1.50-1.60	10		
1.60-1.70	8		
1.70-1.80	10		
1.80-1.90	10		
1.90-2.00	9		
2.00-2.10	14		
2.10-2.20	23		
2.20-2.30	21		
2.30-2.40	18		
2.40-2.50	18		
2.50-2.60	20		
2.60-2.70	22		
2.70-2.80	23		
2.80-2.90	23		



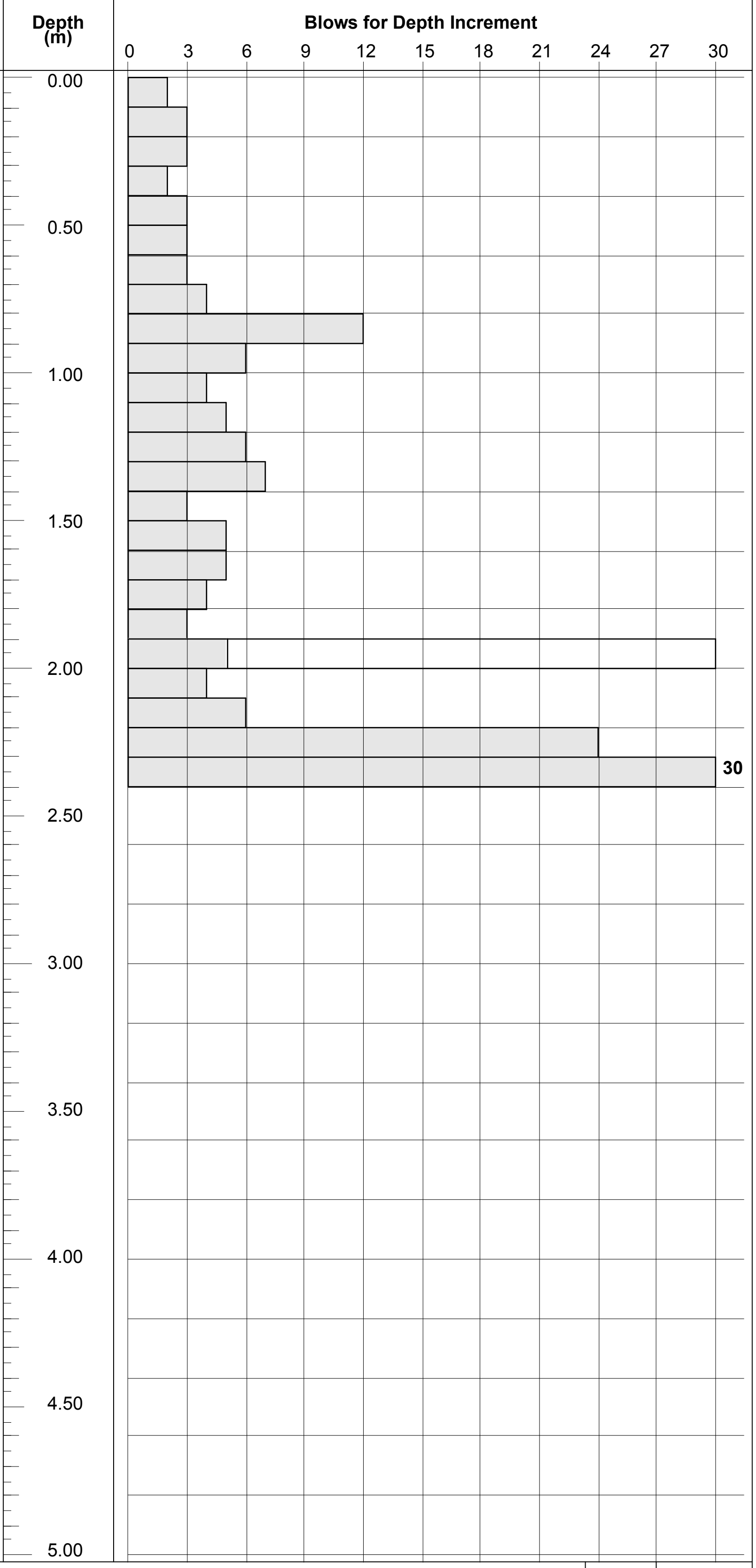
Remarks
Refusal at 2.90mBGL
Completed adjacent to TP01

Scale (approx)	Logged By
1:25	

Figure No. 8188-10-18.DPH01

Ground Investigations Ireland Ltd www.gii.ie			Site Knockrabo, Mount Anville	Probe Number **DP02**
Method Dynamic Probe DPH, Fall Height 500mm, Hammer Wt. 50kg	**Cone Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 20/12/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	3		
0.20-0.30	3		
0.30-0.40	2		
0.40-0.50	3		
0.50-0.60	3		
0.60-0.70	3		
0.70-0.80	4		
0.80-0.90	12		
0.90-1.00	6		
1.00-1.10	4		
1.10-1.20	5		
1.20-1.30	6		
1.30-1.40	7		
1.40-1.50	3		
1.50-1.60	5		
1.60-1.70	5		
1.70-1.80	4		
1.80-1.90	3		
1.90-2.00	5		
2.00-2.10	4		
2.10-2.20	6		
2.20-2.30	24		
2.30-2.40	30		



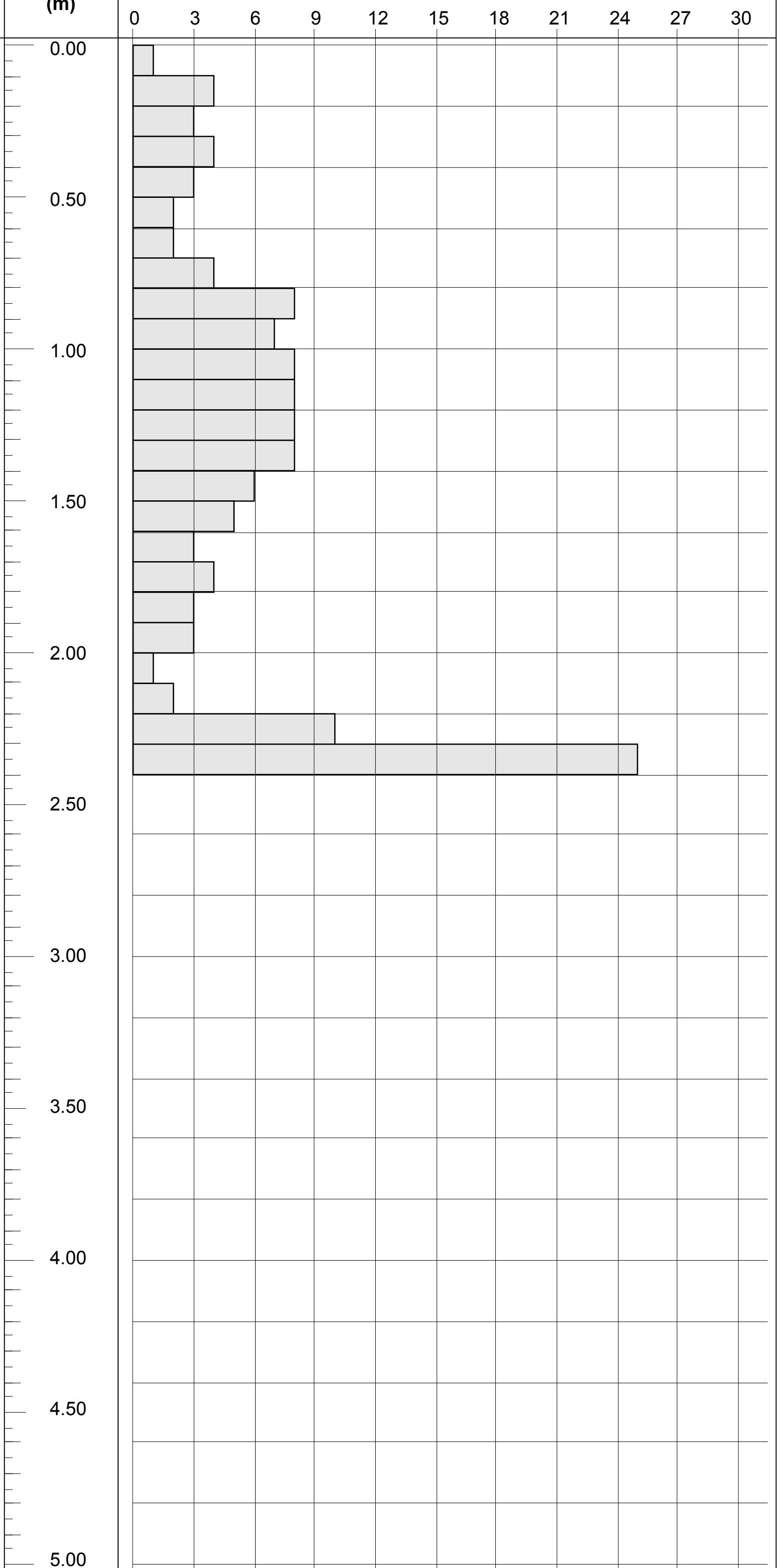
Remarks
Refusal at 2.40mBGL with 30 blows for 50mm
Completed adjacent to TP02

Scale (approx)	Logged By
1:25	
Figure No.	
8188-10-18.DPH02	

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Probe Number DP03

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		08/11/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	4		
0.20-0.30	3		
0.30-0.40	4		
0.40-0.50	3		
0.50-0.60	2		
0.60-0.70	2		
0.70-0.80	4		
0.80-0.90	8		
0.90-1.00	7		
1.00-1.10	8		
1.10-1.20	8		
1.20-1.30	8		
1.30-1.40	8		
1.40-1.50	6		
1.50-1.60	5		
1.60-1.70	3		
1.70-1.80	4		
1.80-1.90	3		
1.90-2.00	3		
2.00-2.10	1		
2.10-2.20	2		
2.20-2.30	10		
2.30-2.40	25		



Remarks
Refusal at 2.40mBGL with 25 blows for 50mm

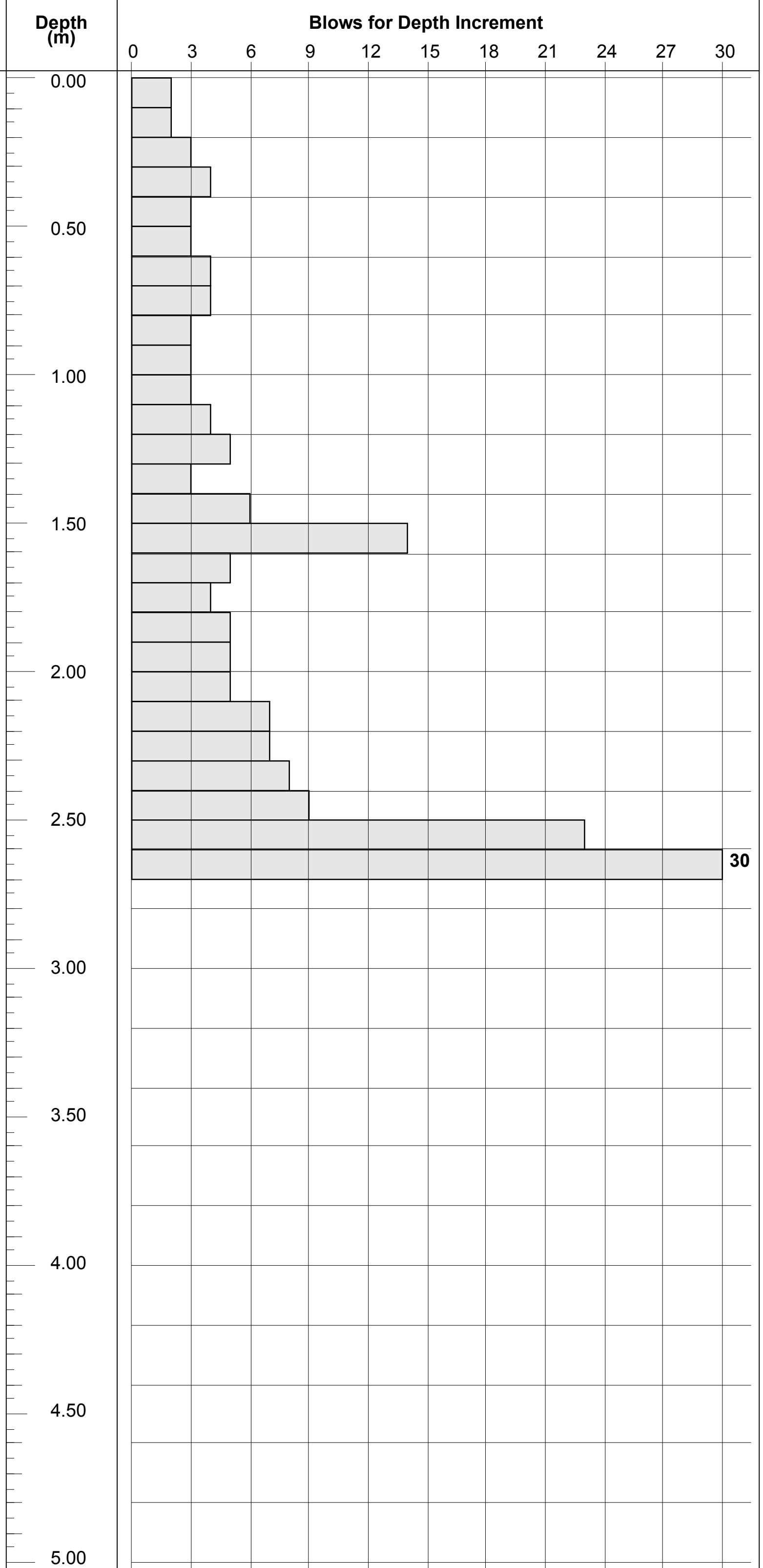
Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP03

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Probe Number **DP04**

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe DPH, Fall Height 500mm, Hammer Wt. 50kg				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		20/12/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	2		
0.20-0.30	3		
0.30-0.40	4		
0.40-0.50	3		
0.50-0.60	3		
0.60-0.70	4		
0.70-0.80	4		
0.80-0.90	3		
0.90-1.00	3		
1.00-1.10	3		
1.10-1.20	4		
1.20-1.30	5		
1.30-1.40	3		
1.40-1.50	6		
1.50-1.60	14		
1.60-1.70	5		
1.70-1.80	4		
1.80-1.90	5		
1.90-2.00	5		
2.00-2.10	5		
2.10-2.20	7		
2.20-2.30	7		
2.30-2.40	8		
2.40-2.50	9		
2.50-2.60	23		
2.60-2.70	30		



Remarks
Refusal at 2.70mBGL with 30 blows for 50mm
Completed adjacent to TP04

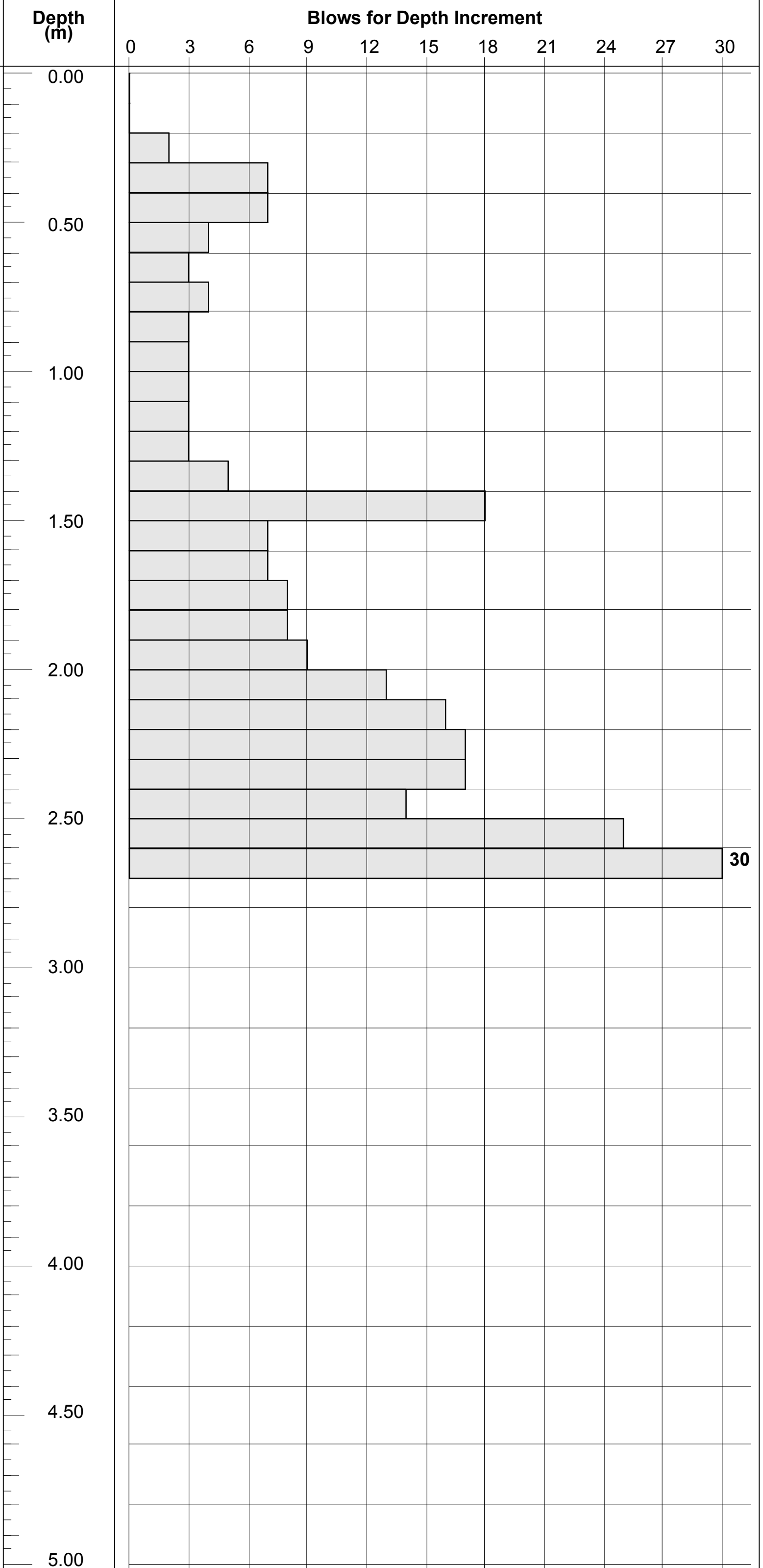
Scale (approx)	Logged By
1:25	

Figure No.
8188-10-18.DPH04

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Probe Number **DP05**

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe DPH, Fall Height 500mm, Hammer Wt. 50kg				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		20/12/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	0		
0.10-0.20	0		
0.20-0.30	2		
0.30-0.40	7		
0.40-0.50	7		
0.50-0.60	4		
0.60-0.70	3		
0.70-0.80	4		
0.80-0.90	3		
0.90-1.00	3		
1.00-1.10	3		
1.10-1.20	3		
1.20-1.30	3		
1.30-1.40	5		
1.40-1.50	18		
1.50-1.60	7		
1.60-1.70	7		
1.70-1.80	8		
1.80-1.90	8		
1.90-2.00	9		
2.00-2.10	13		
2.10-2.20	16		
2.20-2.30	17		
2.30-2.40	17		
2.40-2.50	14		
2.50-2.60	25		
2.60-2.70	30		

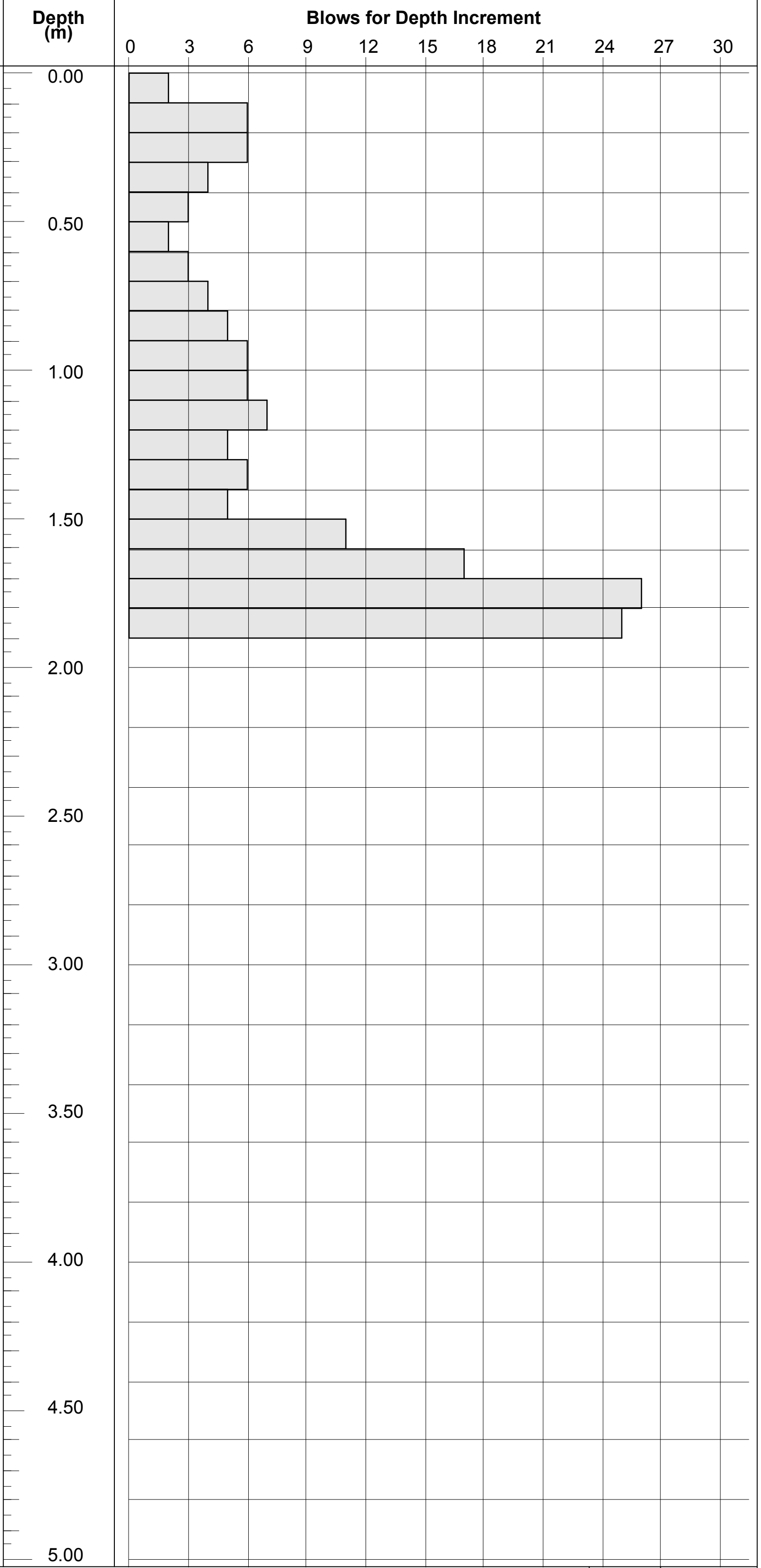


Remarks
Refusal at 2.70mBGL with 30 blows for 50mm
Completed adjacent to TP03

Scale (approx)	Logged By
1:25	
Figure No.	
8188-10-18.DPH05	

Ground Investigations Ireland Ltd www.gii.ie			Site Knockrabo, Mount Anville	Probe Number **DP06**
Method Dynamic Probing	**Cone Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 08/11/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	6		
0.20-0.30	6		
0.30-0.40	4		
0.40-0.50	3		
0.50-0.60	2		
0.60-0.70	3		
0.70-0.80	4		
0.80-0.90	5		
0.90-1.00	6		
1.00-1.10	6		
1.10-1.20	7		
1.20-1.30	5		
1.30-1.40	6		
1.40-1.50	5		
1.50-1.60	11		
1.60-1.70	17		
1.70-1.80	26		
1.80-1.90	25		



Remarks
Refusal at 1.90mBGL with 25 blows for 25mm

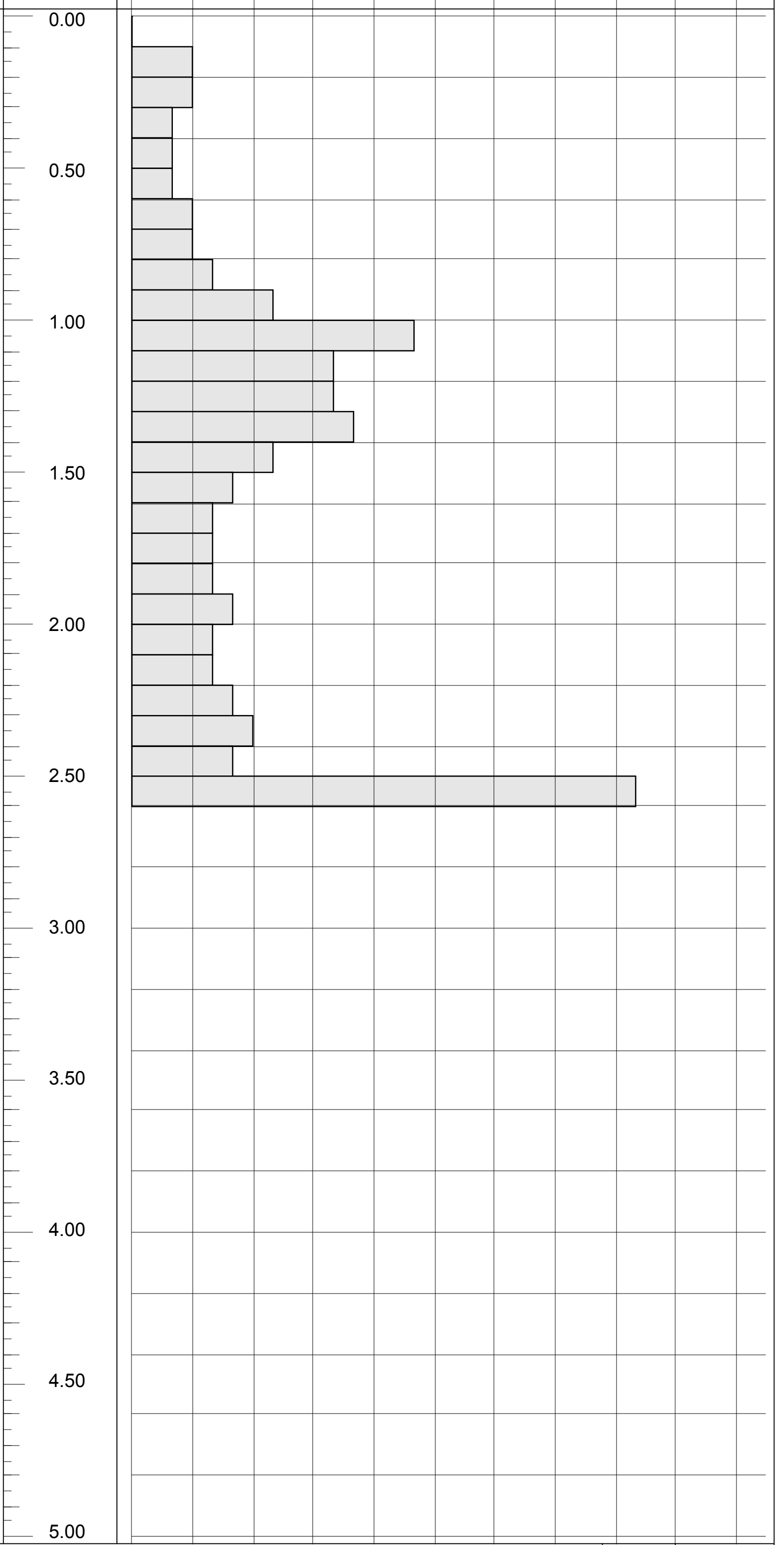
Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP06

Ground Investigations Ireland Ltd www.gii.ie			Site Knockrabo, Mount Anville	Probe Number DP07
Method Dynamic Probing	Cone Dimensions	Ground Level (mOD)	Client	Job Number 8188-10-18
	Location	Dates 08/11/2018	Engineer DBFL	Sheet 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	0		
0.10-0.20	3		
0.20-0.30	3		
0.30-0.40	2		
0.40-0.50	2		
0.50-0.60	2		
0.60-0.70	3		
0.70-0.80	3		
0.80-0.90	4		
0.90-1.00	7		
1.00-1.10	14		
1.10-1.20	10		
1.20-1.30	10		
1.30-1.40	11		
1.40-1.50	7		
1.50-1.60	5		
1.60-1.70	4		
1.70-1.80	4		
1.80-1.90	4		
1.90-2.00	5		
2.00-2.10	4		
2.10-2.20	4		
2.20-2.30	5		
2.30-2.40	6		
2.40-2.50	5		
2.50-2.60	25		

Depth (m) / Blows for Depth Increment



Remarks
Refusal at 2.60mBGL with 25 blows for 25mm

Scale (approx)	Logged By
1:25	S. Kelly

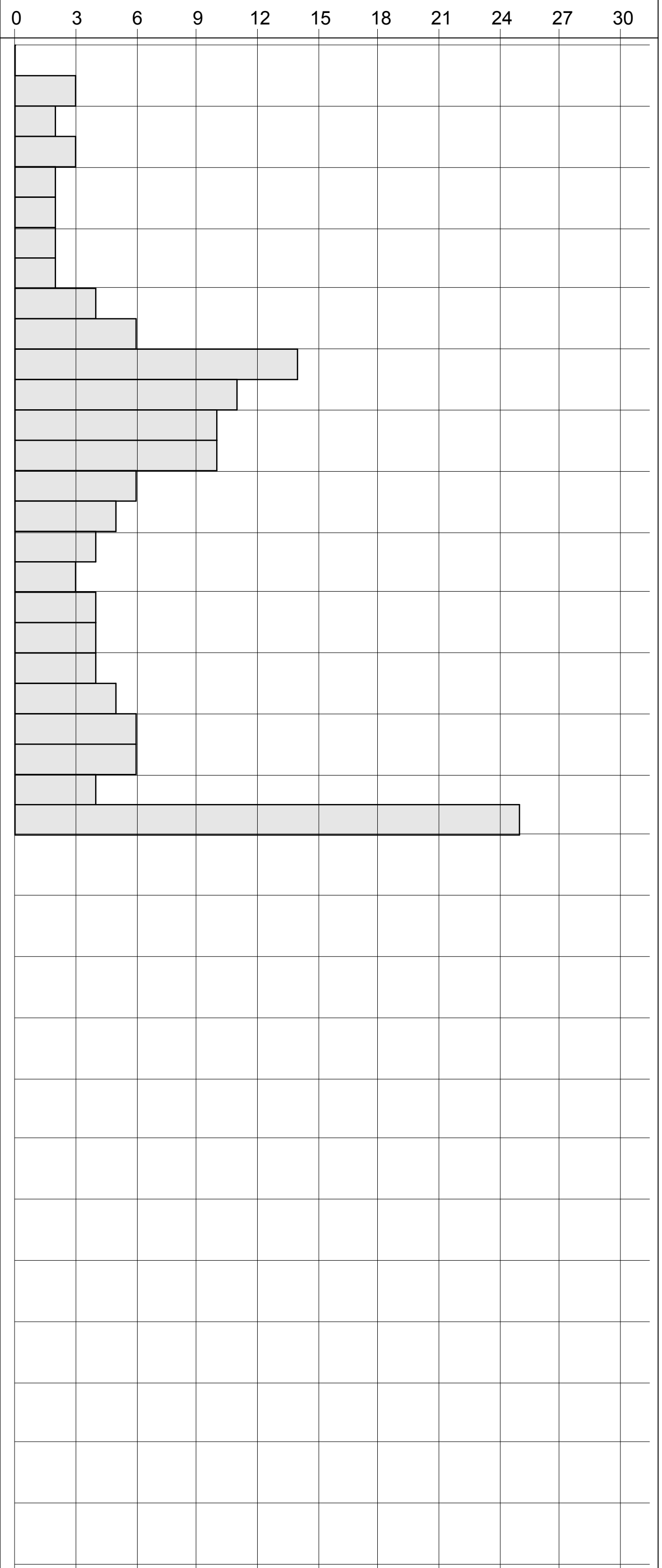
Figure No.
8188-10-18.DP07

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Probe Number **DP07A**

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		08/11/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0			0.00
0.10-0.20	3			
0.20-0.30	2			
0.30-0.40	3			
0.40-0.50	2			
0.50-0.60	2			0.50
0.60-0.70	2			
0.70-0.80	2			
0.80-0.90	4			
0.90-1.00	6			
1.00-1.10	14			1.00
1.10-1.20	11			
1.20-1.30	10			
1.30-1.40	10			
1.40-1.50	6			
1.50-1.60	5			1.50
1.60-1.70	4			
1.70-1.80	3			
1.80-1.90	4			
1.90-2.00	4			
2.00-2.10	4			2.00
2.10-2.20	5			
2.20-2.30	6			
2.30-2.40	6			
2.40-2.50	4			
2.50-2.60	25			2.50
				3.00
				3.50
				4.00
				4.50
				5.00

Blows for Depth Increment



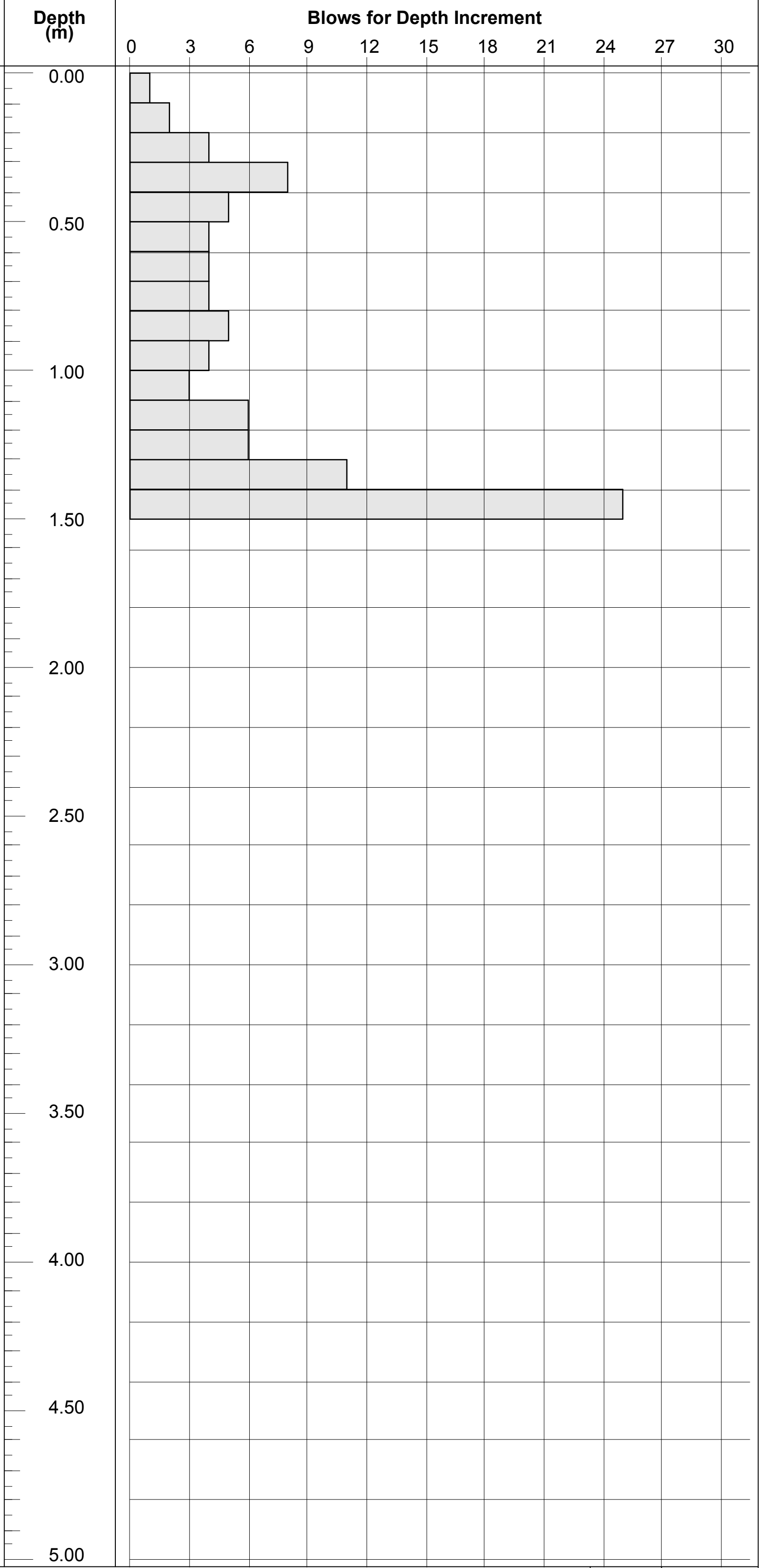
Remarks
Refusal at 2.60mBGL with 25 blows for 25mm

Scale (approx)	Logged By
1:25	S. Kelly
Figure No.	
8188-10-18.DP07	

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Probe Number DP08

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		08/11/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	2		
0.20-0.30	4		
0.30-0.40	8		
0.40-0.50	5		
0.50-0.60	4		
0.60-0.70	4		
0.70-0.80	4		
0.80-0.90	5		
0.90-1.00	4		
1.00-1.10	3		
1.10-1.20	6		
1.20-1.30	6		
1.30-1.40	11		
1.40-1.50	25		



Remarks
Refusal at 1.50mBGL with 25 blows for 50mm

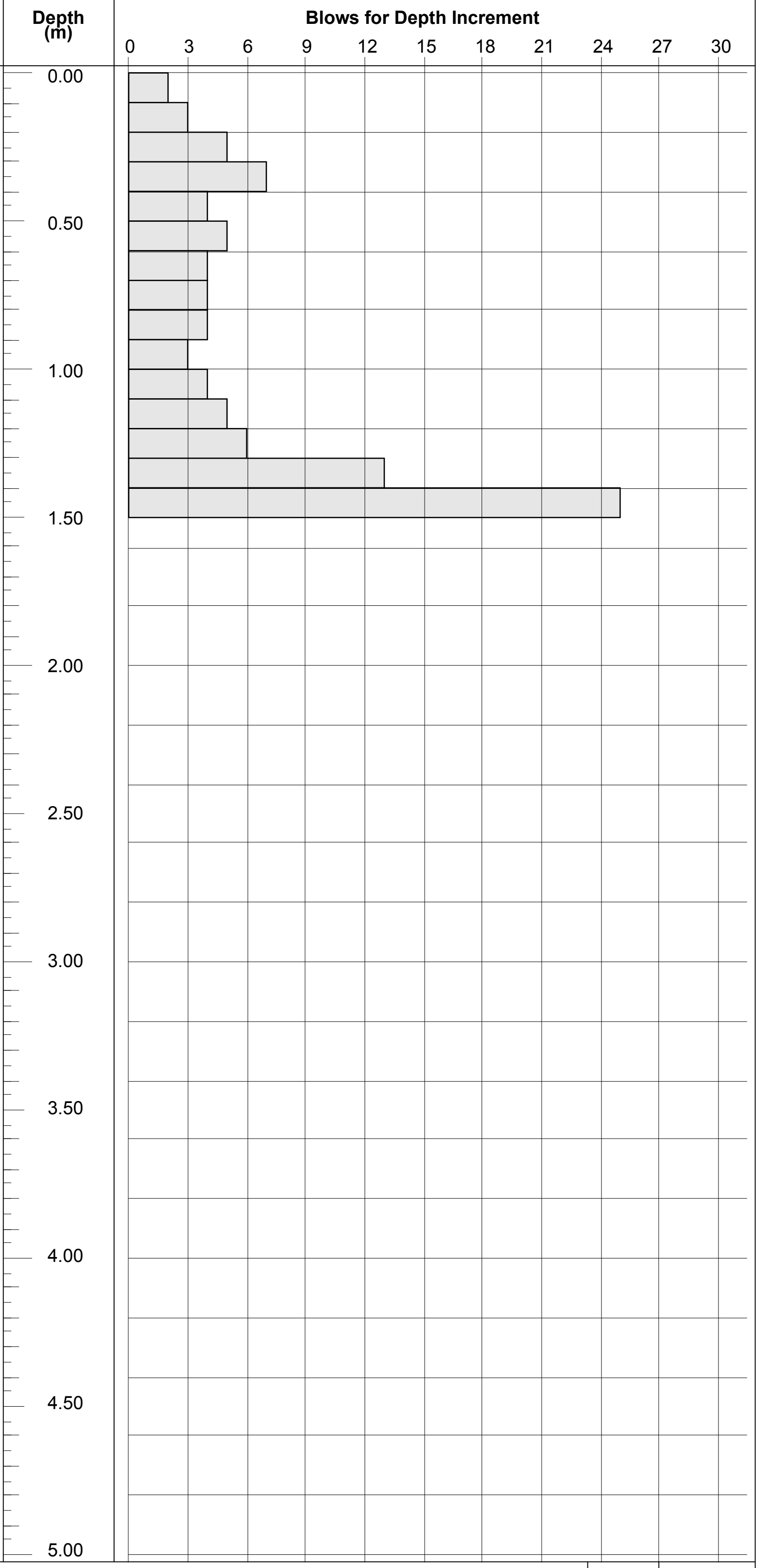
Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP08

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Probe Number DP08A

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		08/11/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	3		
0.20-0.30	5		
0.30-0.40	7		
0.40-0.50	4		
0.50-0.60	5		
0.60-0.70	4		
0.70-0.80	4		
0.80-0.90	4		
0.90-1.00	3		
1.00-1.10	4		
1.10-1.20	5		
1.20-1.30	6		
1.30-1.40	13		
1.40-1.50	25		



Remarks
Refusal at 1.50mBGL with 25 blows for 50mm

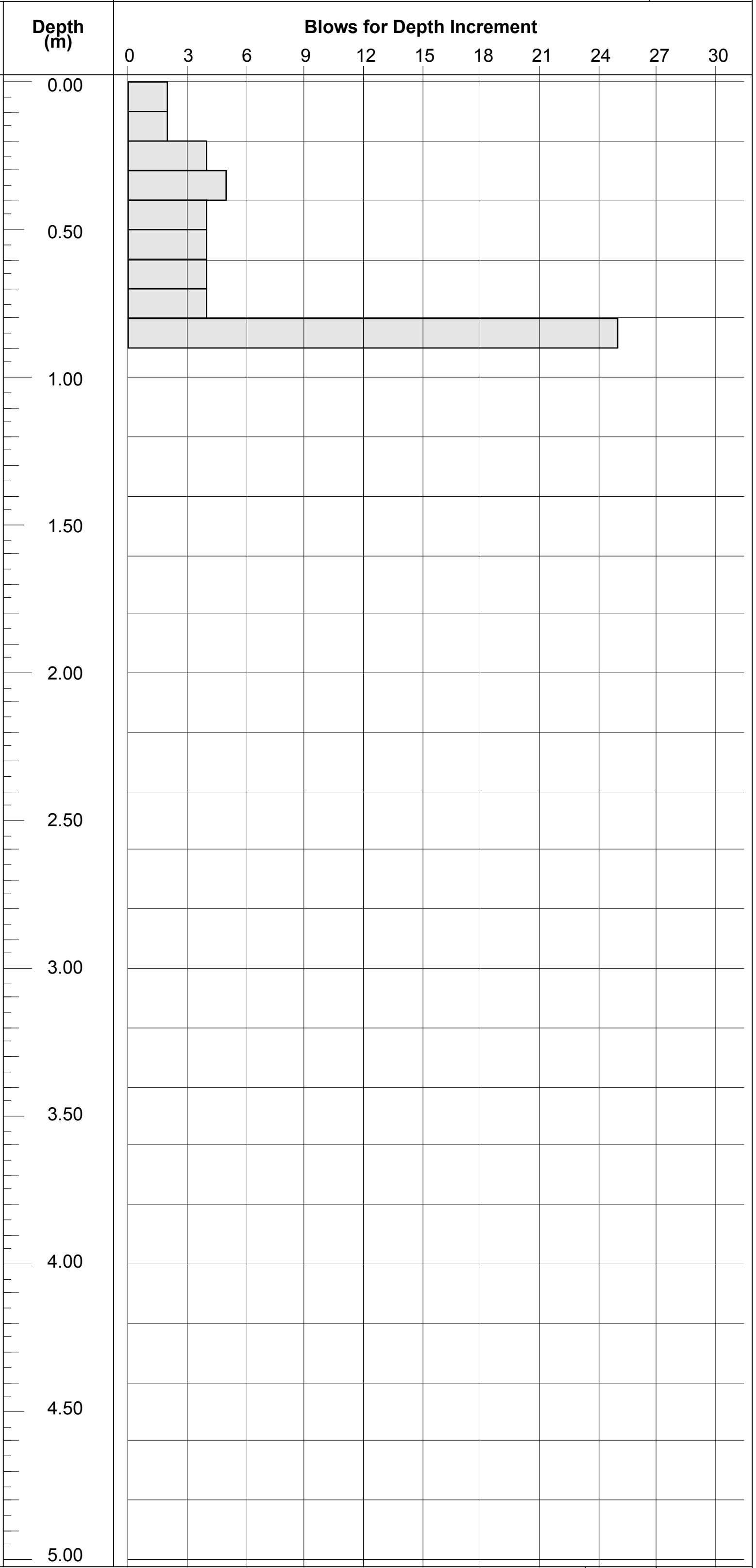
Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP08

Ground Investigations Ireland Ltd
www.gii.ie

Site	Knockrabo, Mount Anville		**Probe Number**	DP09
Method	Dynamic Probing			
Cone Dimensions				
Ground Level (mOD)				
Client			**Job Number**	8188-10-18
Location				
Dates	08/11/2018			
Engineer	DBFL		**Sheet**	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	2		
0.20-0.30	4		
0.30-0.40	5		
0.40-0.50	4		
0.50-0.60	4		
0.60-0.70	4		
0.70-0.80	4		
0.80-0.90	25		



Remarks
Refusal at 0.90mBGL with 25 blows for 25mm

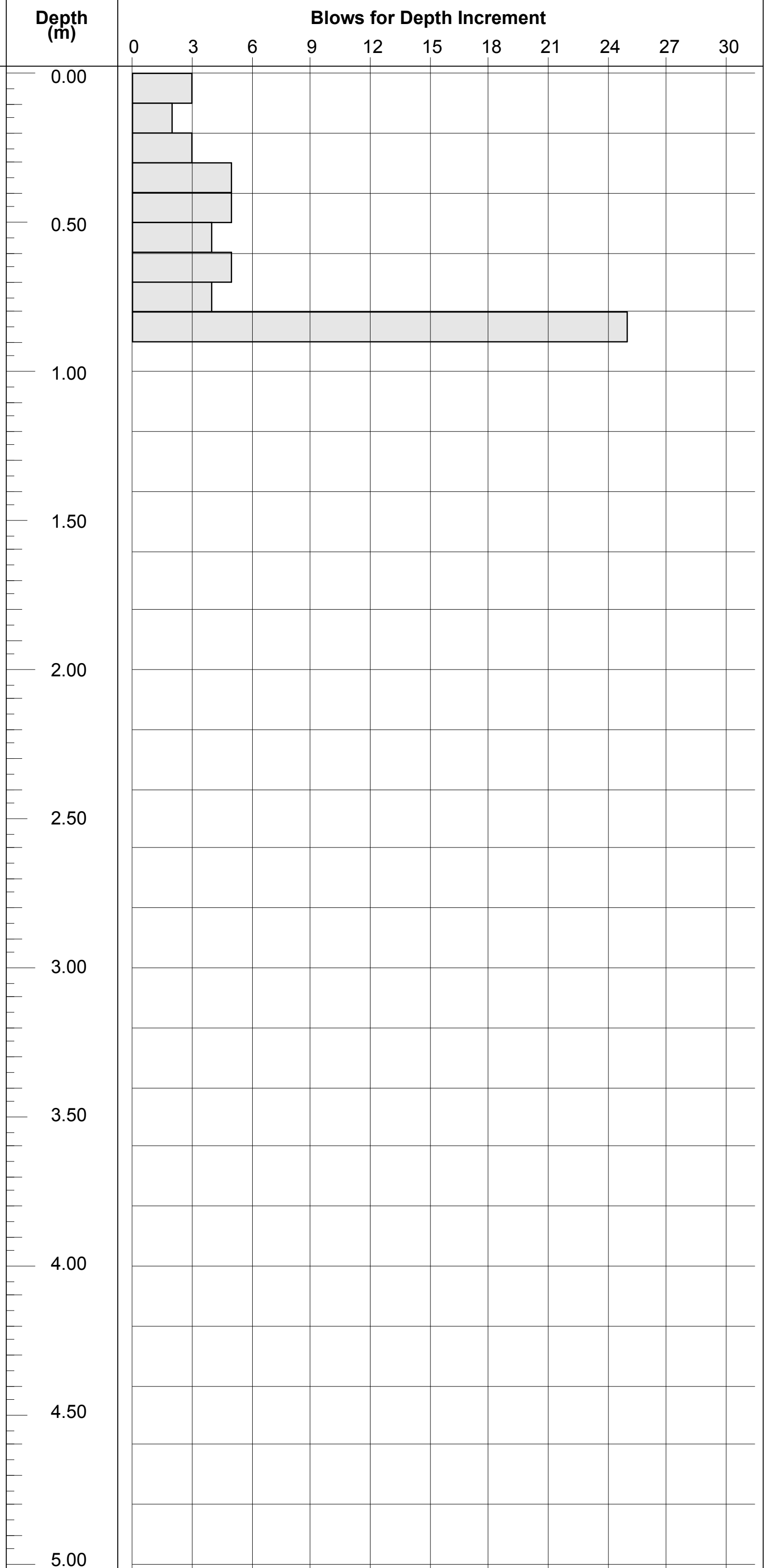
Scale (approx)	1:25
Logged By	S. Kelly
Figure No.	8188-10-18.DP09

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Probe Number **DP09A**

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		08/11/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	3		
0.10-0.20	2		
0.20-0.30	3		
0.30-0.40	5		
0.40-0.50	5		
0.50-0.60	4		
0.60-0.70	5		
0.70-0.80	4		
0.80-0.90	25		

Depth (m)



Remarks
Refusal at 0.90mBGL with 25 blows for 25mm

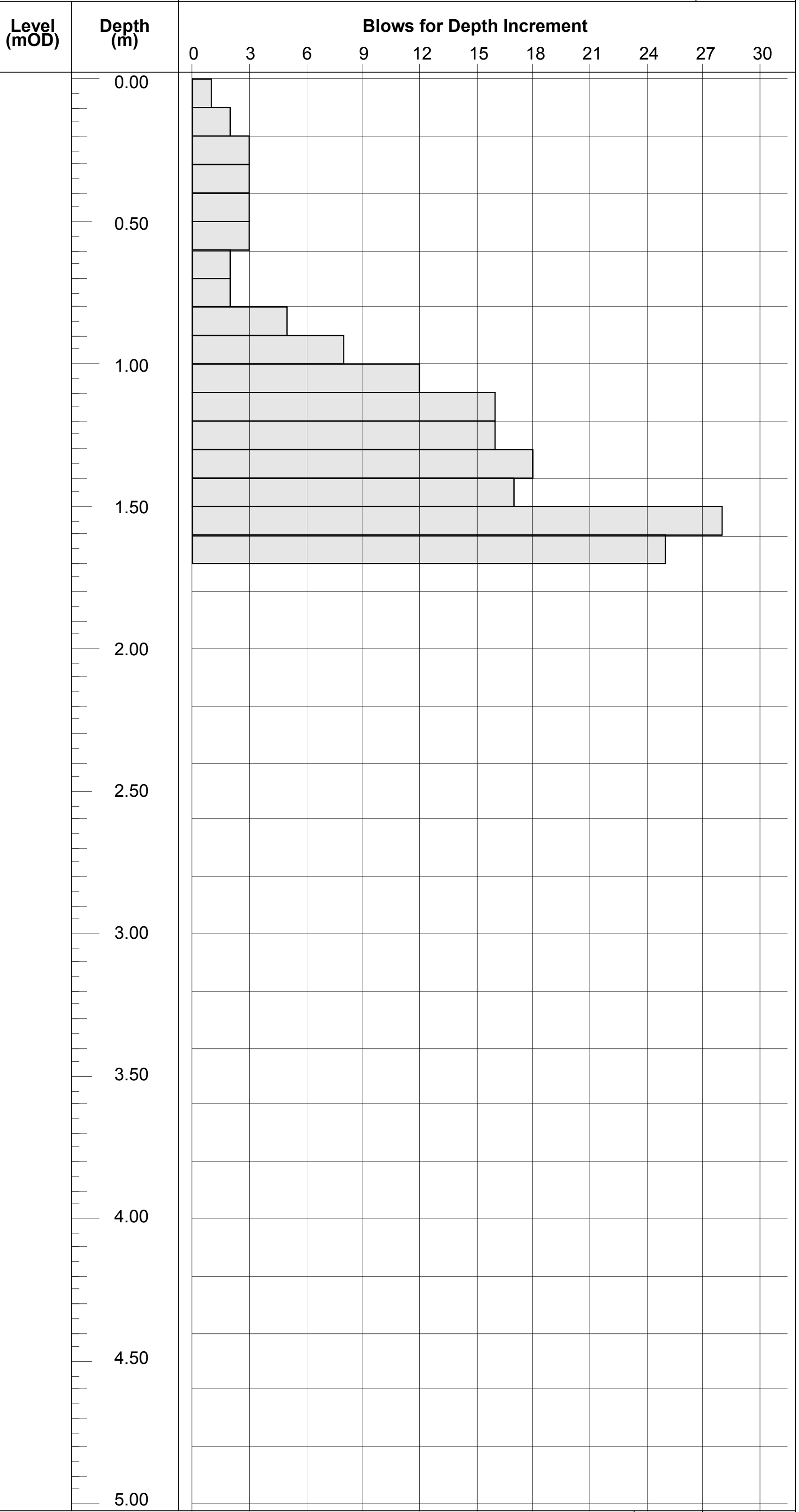
Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP09

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Probe Number DP10

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		08/11/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	2		
0.20-0.30	3		
0.30-0.40	3		
0.40-0.50	3		
0.50-0.60	3		
0.60-0.70	2		
0.70-0.80	2		
0.80-0.90	5		
0.90-1.00	8		
1.00-1.10	12		
1.10-1.20	16		
1.20-1.30	16		
1.30-1.40	18		
1.40-1.50	17		
1.50-1.60	28		
1.60-1.70	25		



Remarks
Refusal at 1.70mBGL with 25 blows for 25mm

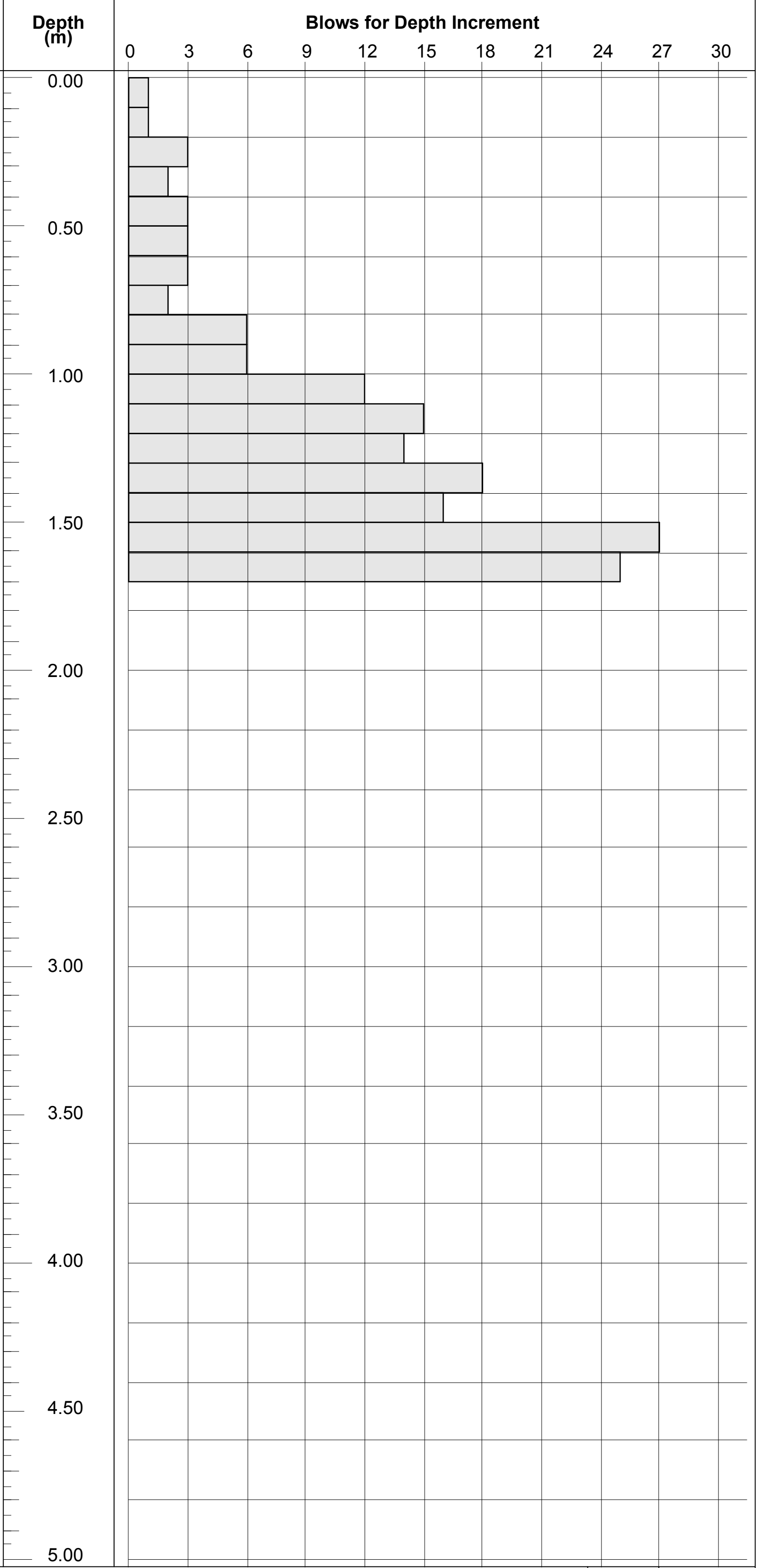
Scale (approx)	Logged By
1:25	S. Kelly
Figure No.	
8188-10-18.DP10	

Ground Investigations Ireland Ltd
www.gii.ie

Site	Probe Number
Knockrabo, Mount Anville	DP10A

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		08/11/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	1		
0.20-0.30	3		
0.30-0.40	2		
0.40-0.50	3		
0.50-0.60	3		
0.60-0.70	3		
0.70-0.80	2		
0.80-0.90	6		
0.90-1.00	6		
1.00-1.10	12		
1.10-1.20	15		
1.20-1.30	14		
1.30-1.40	18		
1.40-1.50	16		
1.50-1.60	27		
1.60-1.70	25		



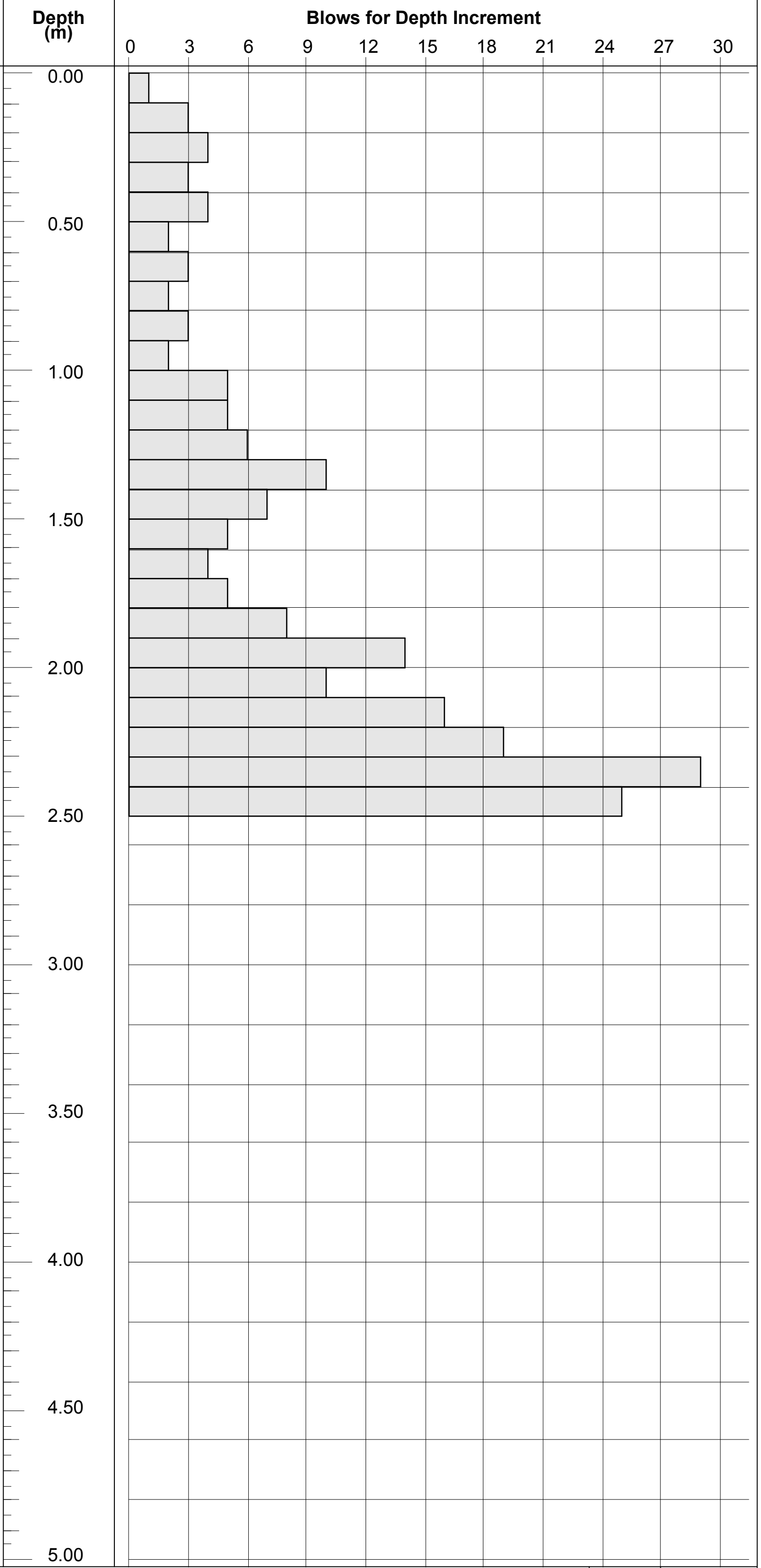
Remarks
Refusal at 1.70mBGL with 25 blows for 25mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP10

Ground Investigations Ireland Ltd www.gii.ie		Site Knockrabo, Mount Anville	Probe Number **DP11**
Method Dynamic Probing	Cone Dimensions	Ground Level (mOD)	Client	Job Number 8188-10-18
	Location	Dates 08/11/2018	Engineer DBFL	Sheet 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	1		
0.10-0.20	3		
0.20-0.30	4		
0.30-0.40	3		
0.40-0.50	4		
0.50-0.60	2		
0.60-0.70	3		
0.70-0.80	2		
0.80-0.90	3		
0.90-1.00	2		
1.00-1.10	5		
1.10-1.20	5		
1.20-1.30	6		
1.30-1.40	10		
1.40-1.50	7		
1.50-1.60	5		
1.60-1.70	4		
1.70-1.80	5		
1.80-1.90	8		
1.90-2.00	14		
2.00-2.10	10		
2.10-2.20	16		
2.20-2.30	19		
2.30-2.40	29		
2.40-2.50	25		



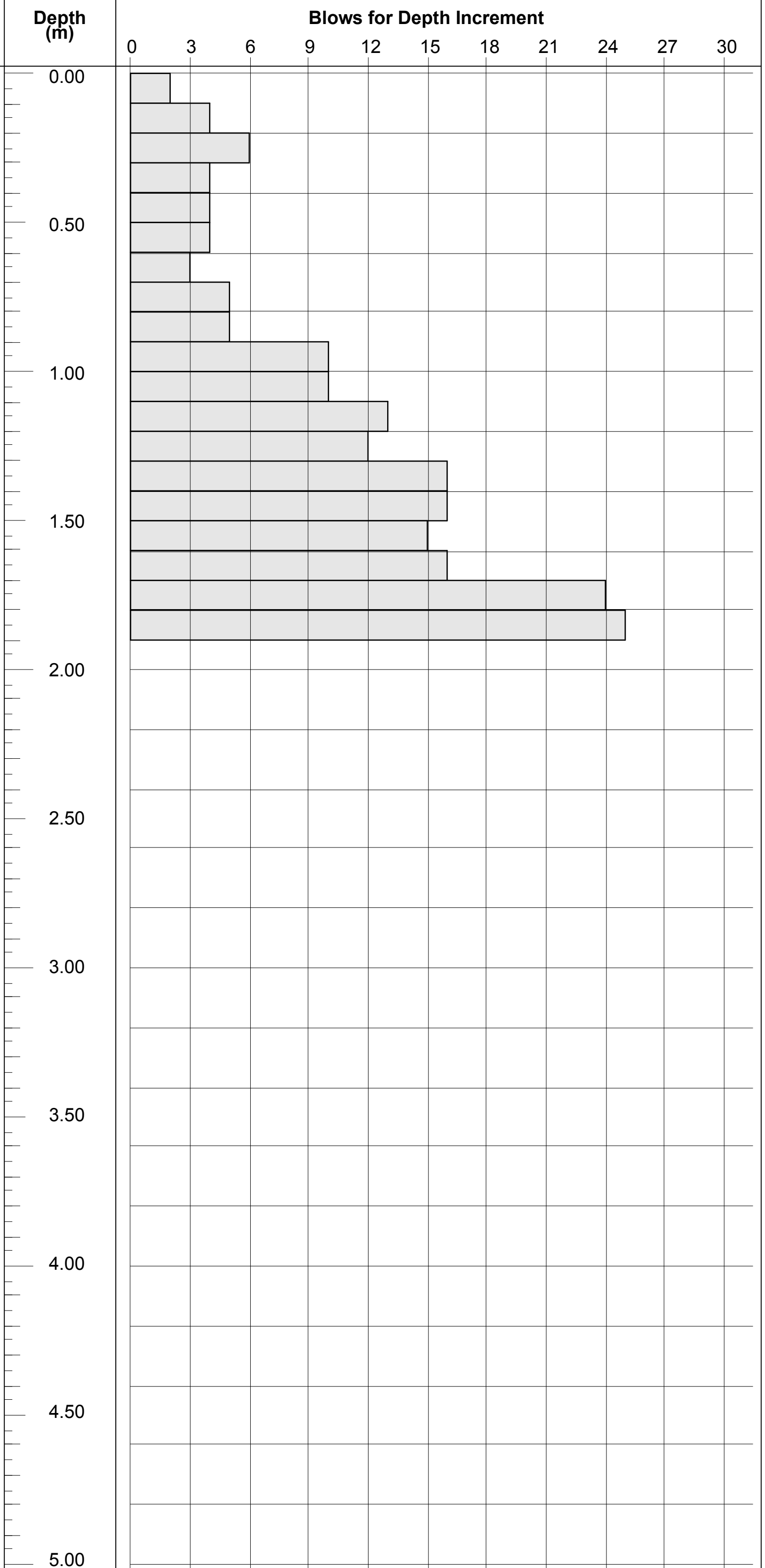
Remarks
Refusal at 2.50mBGL with 25 blows for 25mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP11

Ground Investigations Ireland Ltd www.gii.ie			Site Knockrabo, Mount Anville	Probe Number **DP12**
Method Dynamic Probing	**Cone Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 08/11/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	4		
0.20-0.30	6		
0.30-0.40	4		
0.40-0.50	4		
0.50-0.60	4		
0.60-0.70	3		
0.70-0.80	5		
0.80-0.90	5		
0.90-1.00	10		
1.00-1.10	10		
1.10-1.20	13		
1.20-1.30	12		
1.30-1.40	16		
1.40-1.50	16		
1.50-1.60	15		
1.60-1.70	16		
1.70-1.80	24		
1.80-1.90	25		



Remarks
Refusal at 1.90mBGL with 25 blows for 50mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP12

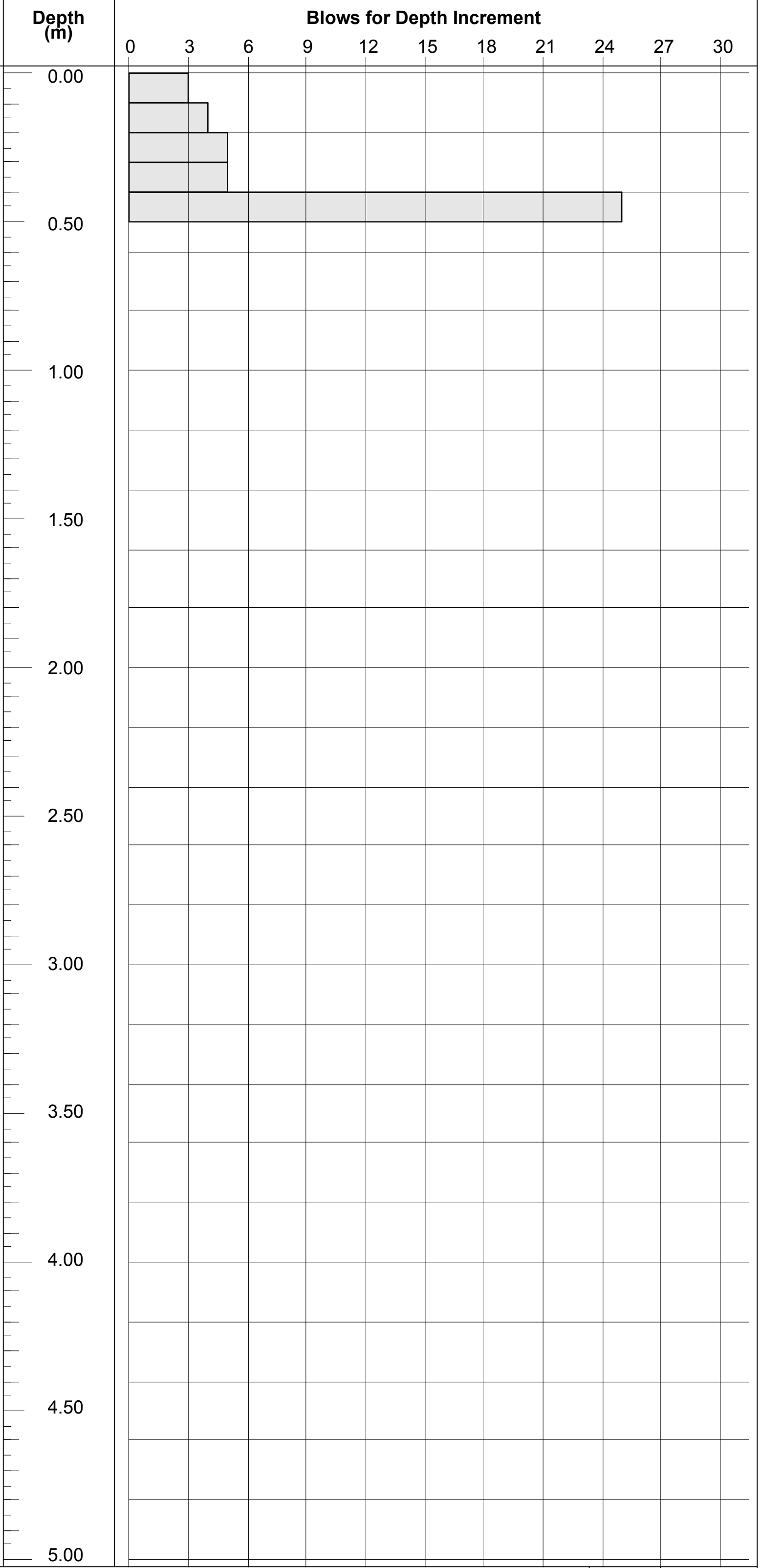
Ground Investigations Ireland Ltd
www.gii.ie

Site	Probe Number
Knockrabo, Mount Anville	DP13

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18

Location	Dates	Engineer	Sheet
	08/11/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	3		
0.10-0.20	4		
0.20-0.30	5		
0.30-0.40	5		
0.40-0.50	25		



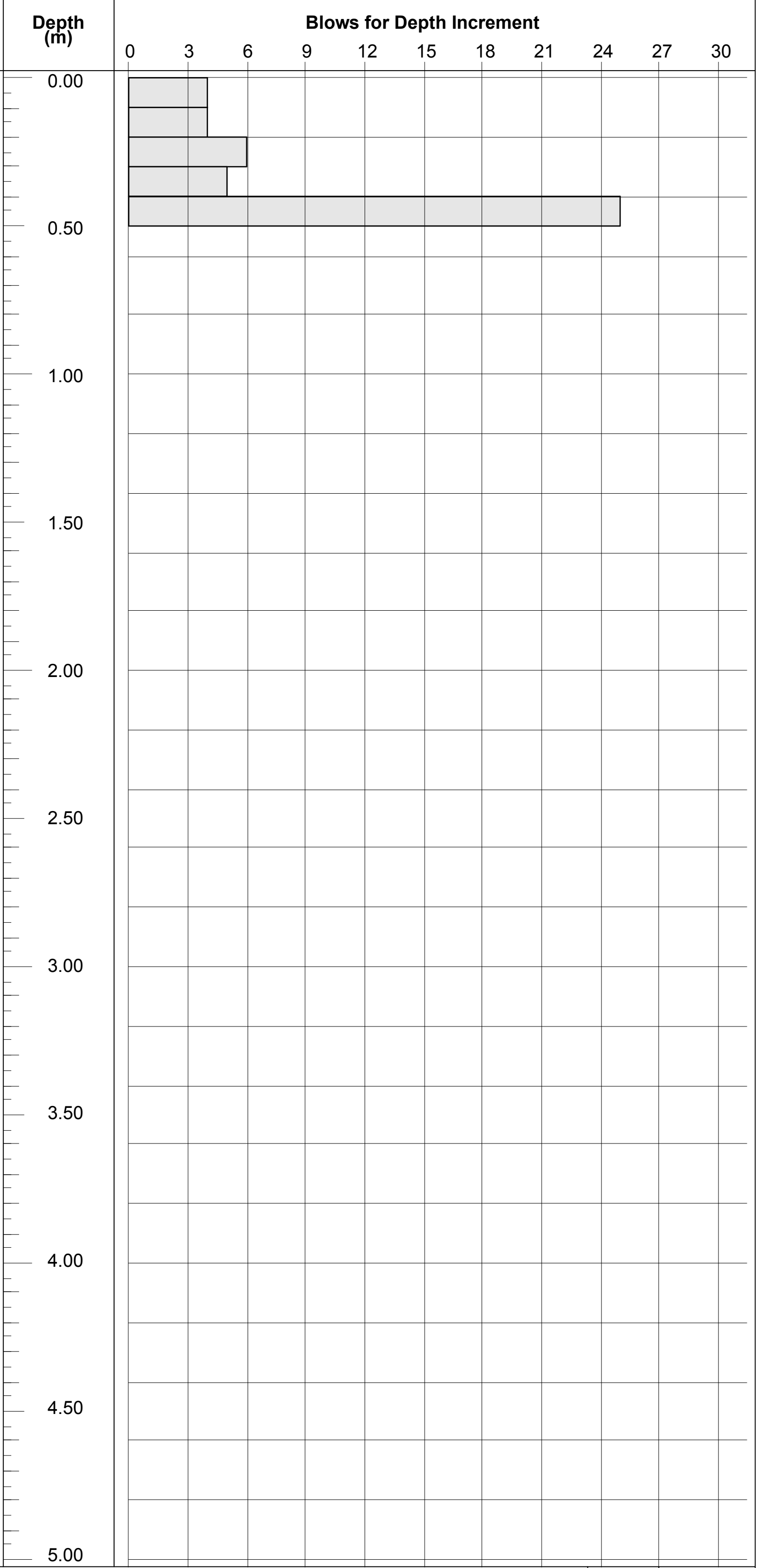
Remarks
Refusal at 0.50mBGL with 25 blows for 25mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP13

Ground Investigations Ireland Ltd www.gii.ie			Site Knockrabo, Mount Anville	Probe Number **DP13A**
Method Dynamic Probing	**Cone Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 08/11/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	4		
0.10-0.20	4		
0.20-0.30	6		
0.30-0.40	5		
0.40-0.50	25		



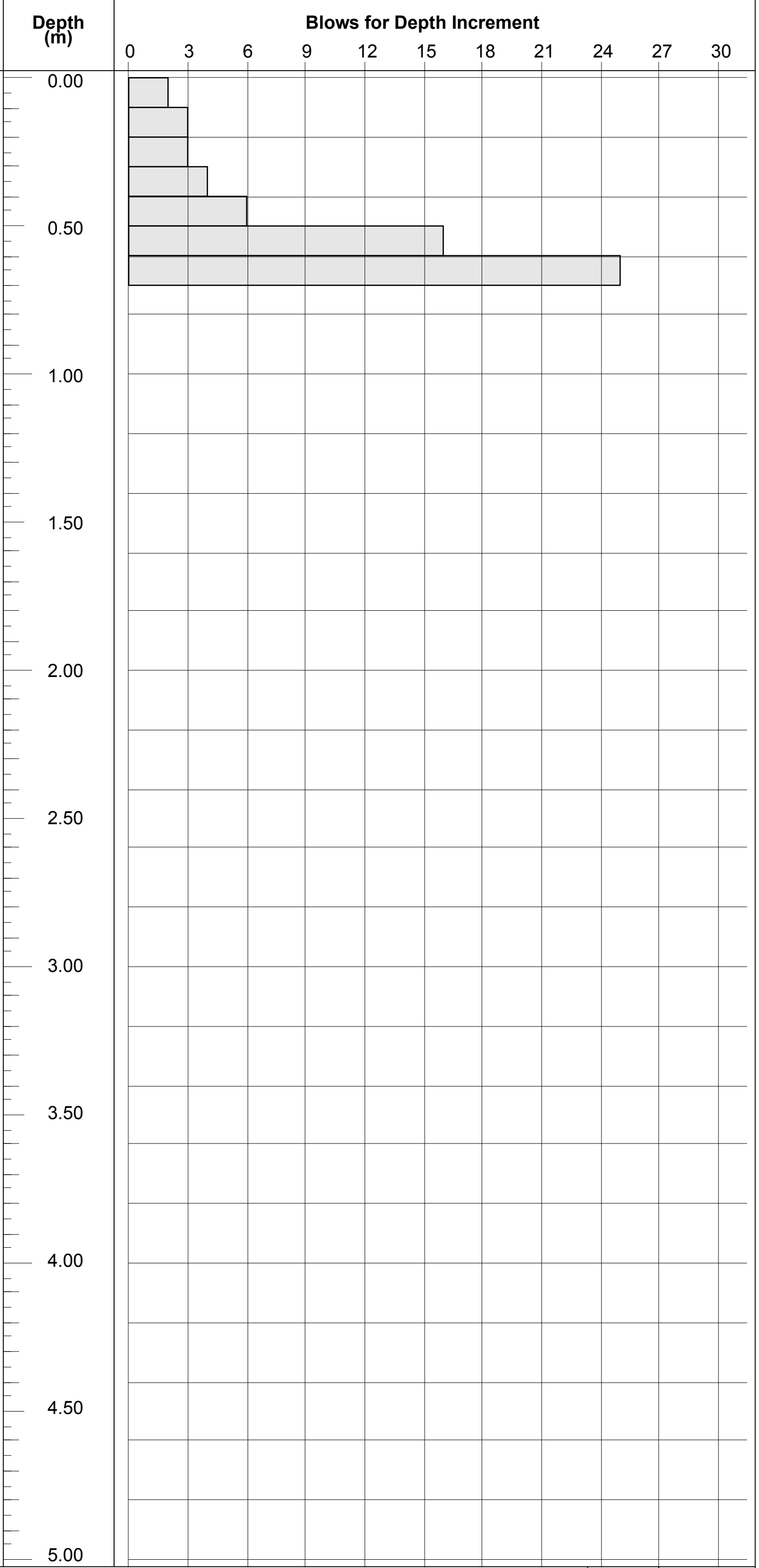
Remarks
Refusal at 0.50mBGL with 25 blows for 25mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP13

Ground Investigations Ireland Ltd www.gii.ie			Site Knockrabo, Mount Anville	Probe Number **DP14**
Method Dynamic Probing	**Cone Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 08/11/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	3		
0.20-0.30	3		
0.30-0.40	4		
0.40-0.50	6		
0.50-0.60	16		
0.60-0.70	25		



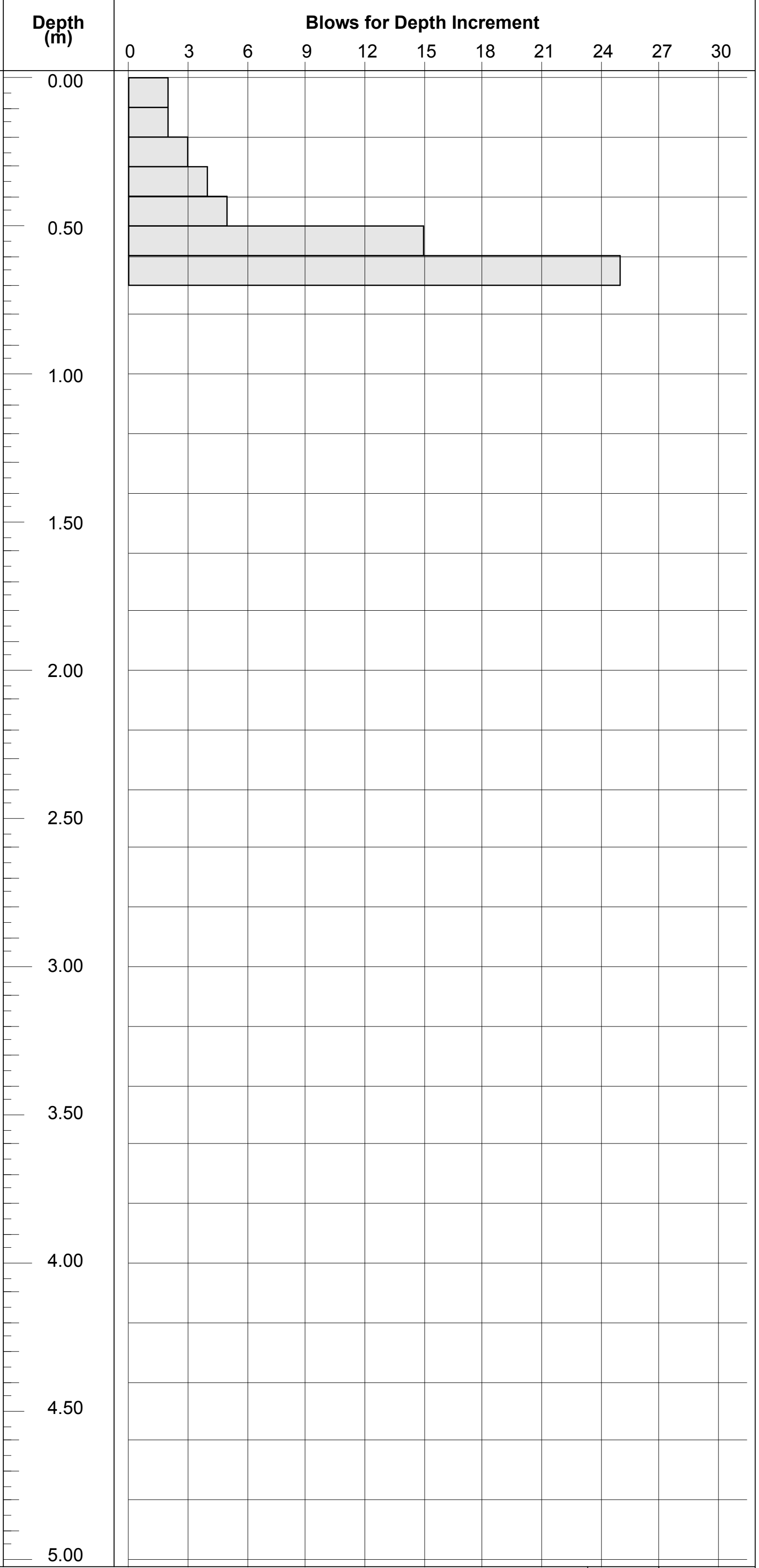
Remarks
Refusal at 0.70mBGL with 25 blows for 50mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP14

Ground Investigations Ireland Ltd www.gii.ie			Site: Knockrabo, Mount Anville	Probe Number: DP14A
Method: Dynamic Probing	Cone Dimensions:	Ground Level (mOD):	Client:	Job Number: 8188-10-18
	Location:	Dates: 08/11/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	2		
0.20-0.30	3		
0.30-0.40	4		
0.40-0.50	5		
0.50-0.60	15		
0.60-0.70	25		



Remarks
Refusal at 0.70mBGL with 25 blows for 50mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No.: 8188-10-18.DP14

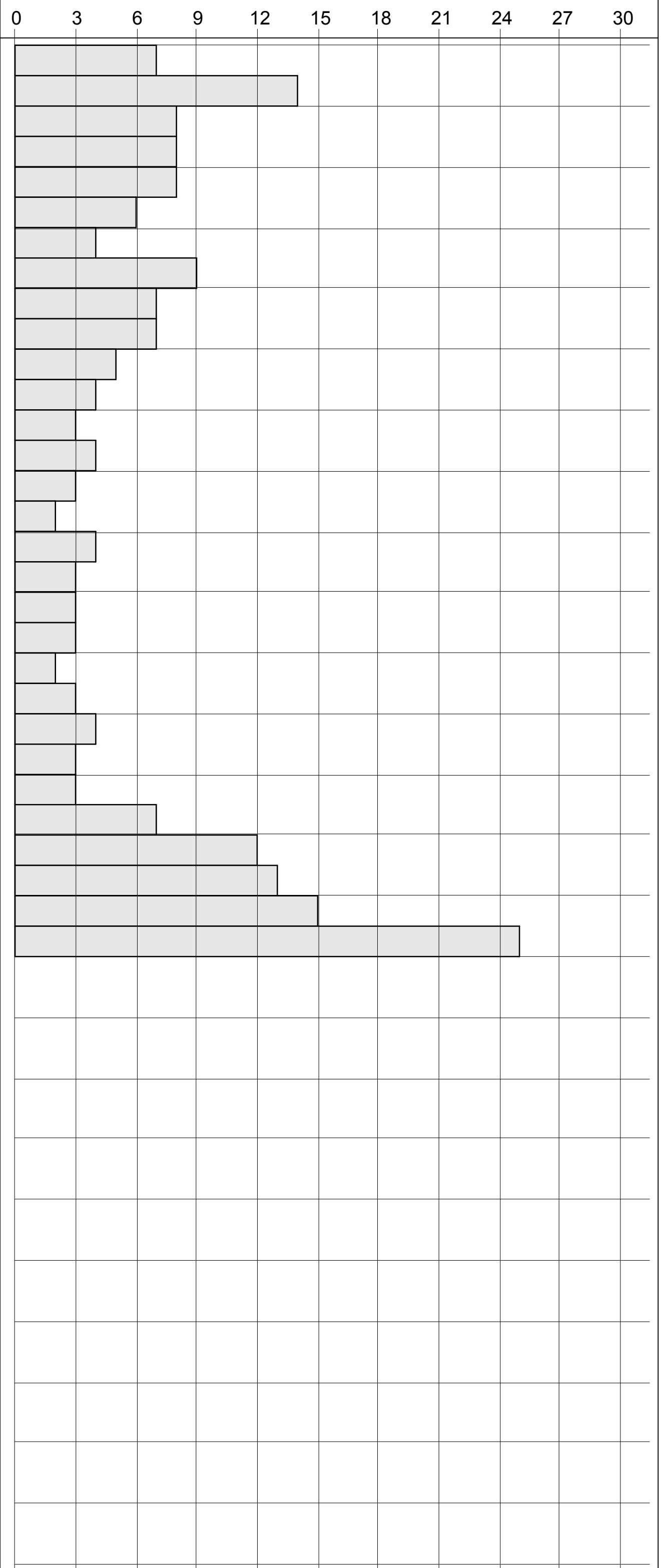
Ground Investigations Ireland Ltd www.gii.ie			Site Knockrabo, Mount Anville	Probe Number **DP15**
Method Dynamic Probing	**Cone Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 08/11/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	7		
0.10-0.20	14		
0.20-0.30	8		
0.30-0.40	8		
0.40-0.50	8		
0.50-0.60	6		
0.60-0.70	4		
0.70-0.80	9		
0.80-0.90	7		
0.90-1.00	7		
1.00-1.10	5		
1.10-1.20	4		
1.20-1.30	3		
1.30-1.40	4		
1.40-1.50	3		
1.50-1.60	2		
1.60-1.70	4		
1.70-1.80	3		
1.80-1.90	3		
1.90-2.00	3		
2.00-2.10	2		
2.10-2.20	3		
2.20-2.30	4		
2.30-2.40	3		
2.40-2.50	3		
2.50-2.60	7		
2.60-2.70	12		
2.70-2.80	13		
2.80-2.90	15		
2.90-3.00	25		

Depth (m)

0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00

Blows for Depth Increment

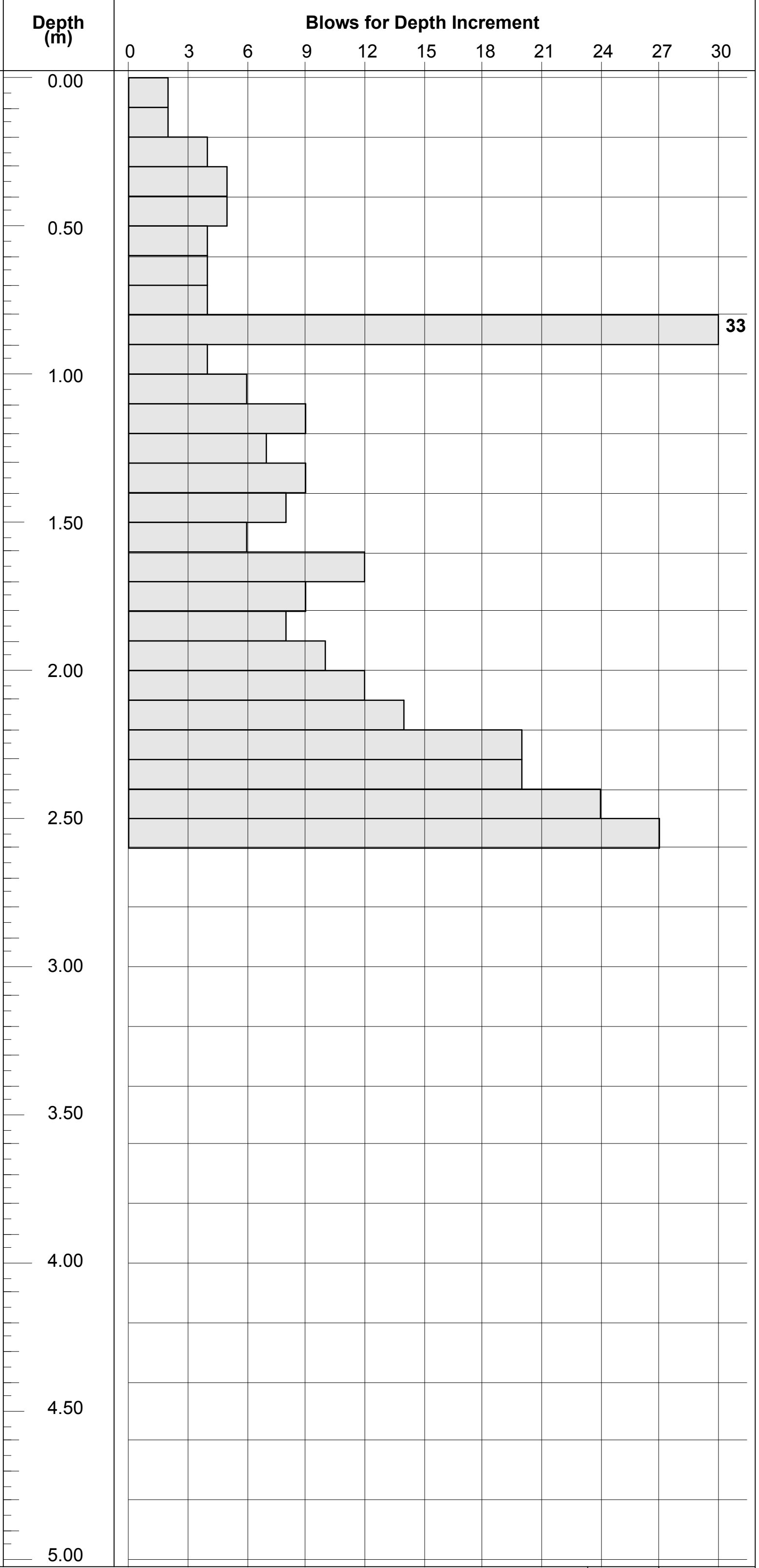


Remarks
Refusal at 3.00mBGL with 25 blows for 50mm

Scale (approx)	Logged By
1:25	S. Kelly
Figure No.	
8188-10-18.DP15	

Ground Investigations Ireland Ltd www.gii.ie			Site: Knockrabo, Mount Anville	Probe Number: DP16
Method: Dynamic Probe DPH, Fall Height 500mm, Hammer Wt. 50kg	Cone Dimensions	Ground Level (mOD)	Client	Job Number: 8188-10-18
	Location	Dates: 20/12/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	2		
0.20-0.30	4		
0.30-0.40	5		
0.40-0.50	5		
0.50-0.60	4		
0.60-0.70	4		
0.70-0.80	4		
0.80-0.90	33		
0.90-1.00	4		
1.00-1.10	6		
1.10-1.20	9		
1.20-1.30	7		
1.30-1.40	9		
1.40-1.50	8		
1.50-1.60	6		
1.60-1.70	12		
1.70-1.80	9		
1.80-1.90	8		
1.90-2.00	10		
2.00-2.10	12		
2.10-2.20	14		
2.20-2.30	20		
2.30-2.40	20		
2.40-2.50	24		
2.50-2.60	27		



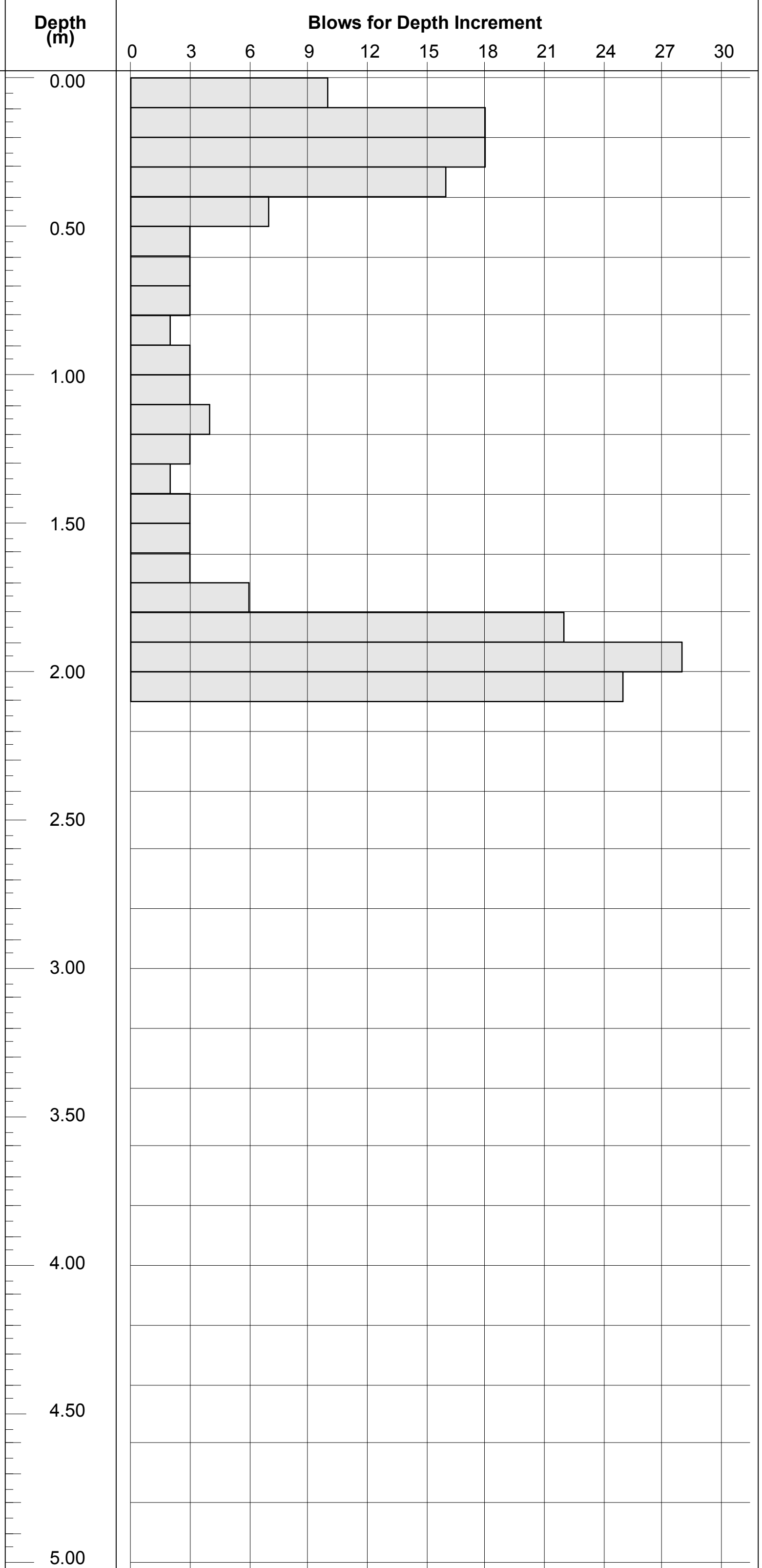
Remarks
Refusal at 2.70mBGL
Completed adjacent to TP05

Scale (approx)	Logged By
1:25	

Figure No. 8188-10-18.DPH16

Ground Investigations Ireland Ltd www.gii.ie			Site: Knockrabo, Mount Anville	Probe Number: DP18
Method: Dynamic Probing	Cone Dimensions:	Ground Level (mOD):	Client:	Job Number: 8188-10-18
	Location:	Dates: 08/11/2018	Engineer: DBFL	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	10		
0.10-0.20	18		
0.20-0.30	18		
0.30-0.40	16		
0.40-0.50	7		
0.50-0.60	3		
0.60-0.70	3		
0.70-0.80	3		
0.80-0.90	2		
0.90-1.00	3		
1.00-1.10	3		
1.10-1.20	4		
1.20-1.30	3		
1.30-1.40	2		
1.40-1.50	3		
1.50-1.60	3		
1.60-1.70	3		
1.70-1.80	6		
1.80-1.90	22		
1.90-2.00	28		
2.00-2.10	25		



Remarks
Refusal at 2.10mBGL with 25 blows for 25mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No.
8188-10-18.DP18

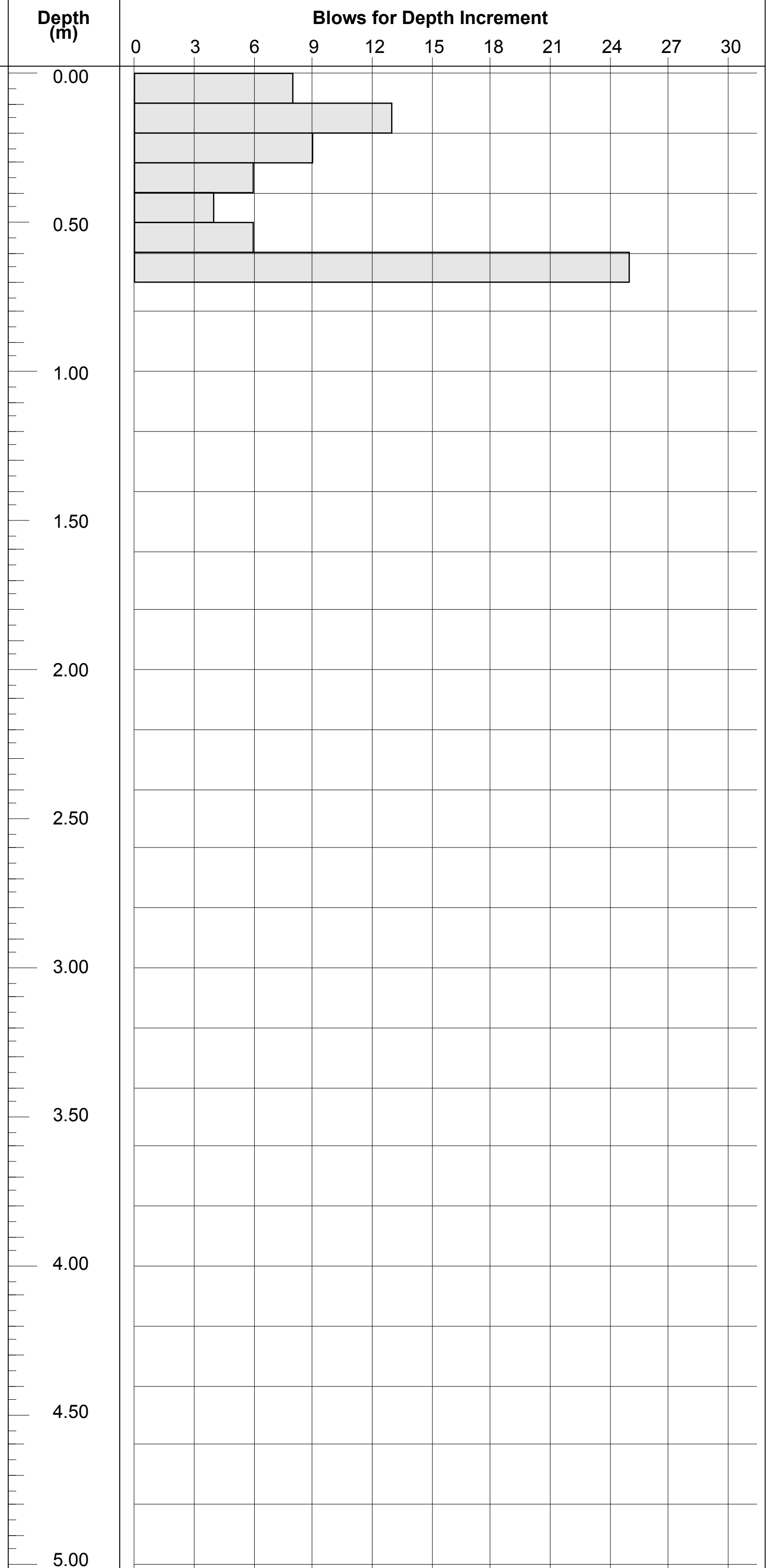
Ground Investigations Ireland Ltd
www.gii.ie

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		08/11/2018	DBFL	1/1

Site: Knockrabo, Mount Anville

Probe Number: DP19

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	8		
0.10-0.20	13		
0.20-0.30	9		
0.30-0.40	6		
0.40-0.50	4		
0.50-0.60	6		
0.60-0.70	25		



Remarks
Refusal at 0.70mBGL with 25 blows for 50mm

Scale (approx)	Logged By
1:25	S. Kelly

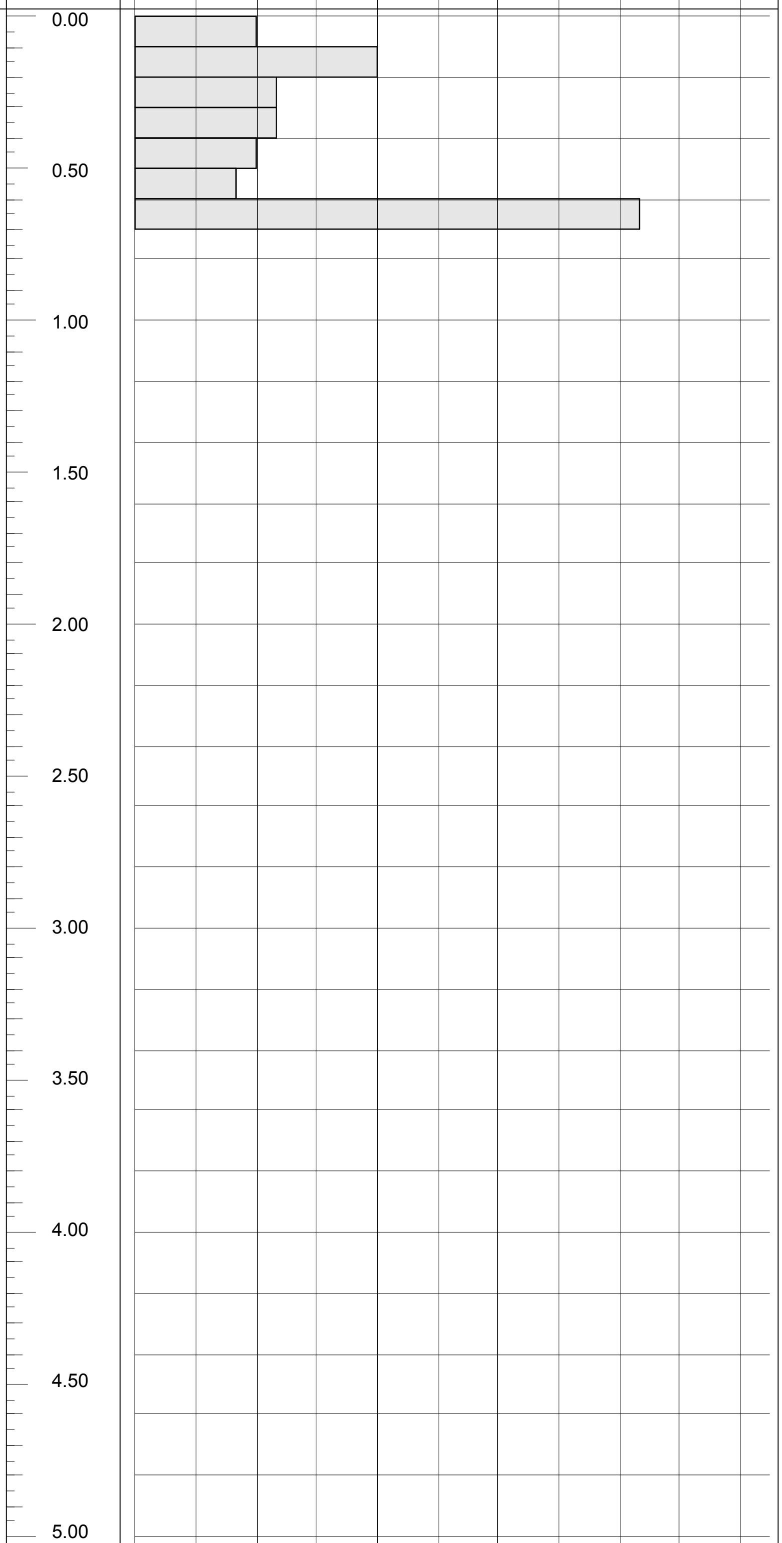
Figure No. 8188-10-18.DP19

Ground Investigations Ireland Ltd www.gii.ie	Site: Knockrabo, Mount Anville	Probe Number: DP19A

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probing				8188-10-18
	Location	**Dates**	**Engineer**	**Sheet**
		08/11/2018	DBFL	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	6		
0.10-0.20	12		
0.20-0.30	7		
0.30-0.40	7		
0.40-0.50	6		
0.50-0.60	5		
0.60-0.70	25		

Blows for Depth Increment



Remarks
Refusal at 0.70mBGL with 25 blows for 50mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No. 8188-10-18.DP19

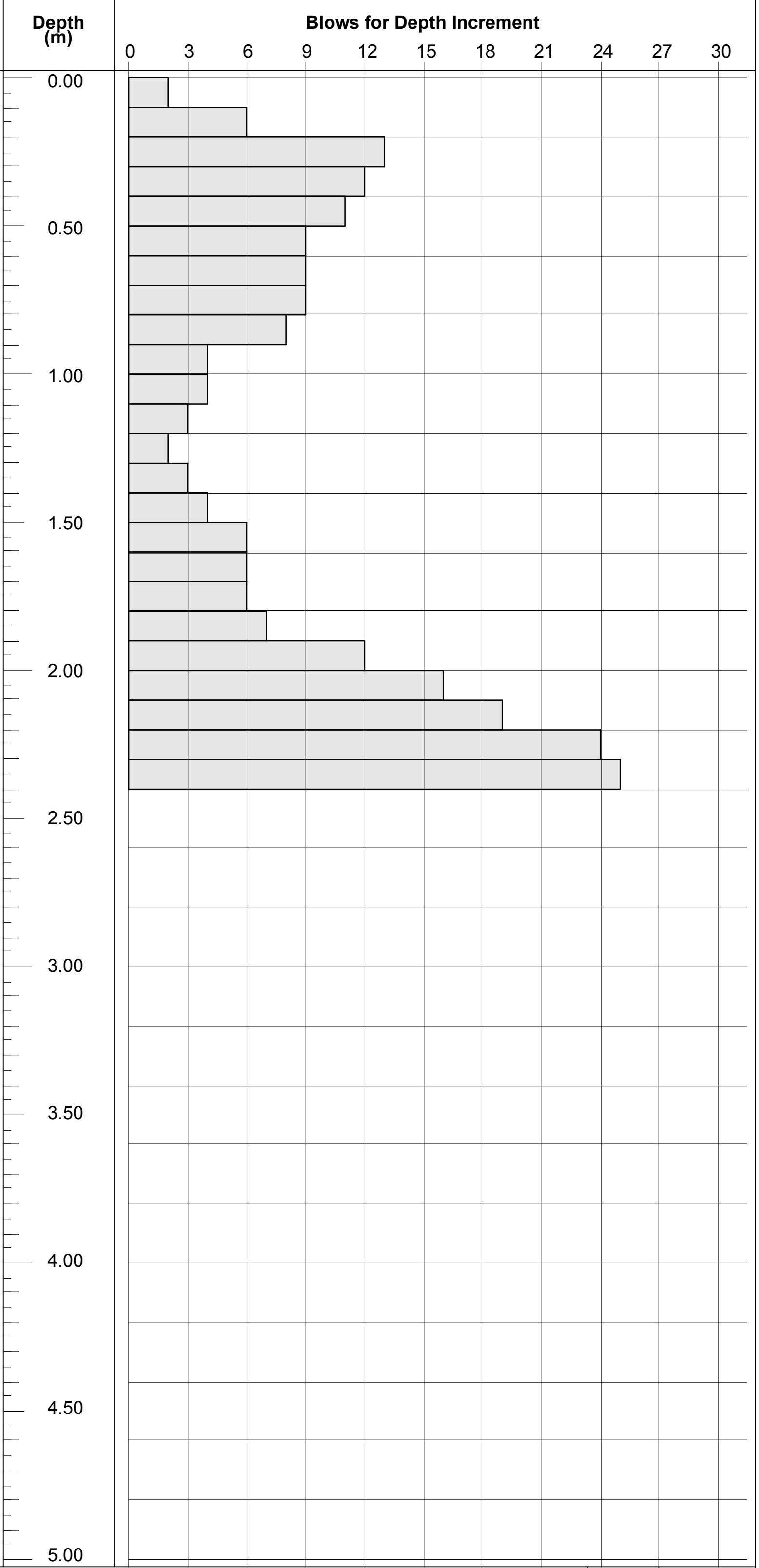
Ground Investigations Ireland Ltd
www.gii.ie

Method Dynamic Probing	**Cone Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number** 8188-10-18
	Location	**Dates** 08/11/2018	**Engineer** DBFL	**Sheet** 1/1

Site: Knockrabo, Mount Anville

Probe Number: DP21

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)
0.00-0.10	2		
0.10-0.20	6		
0.20-0.30	13		
0.30-0.40	12		
0.40-0.50	11		
0.50-0.60	9		
0.60-0.70	9		
0.70-0.80	9		
0.80-0.90	8		
0.90-1.00	4		
1.00-1.10	4		
1.10-1.20	3		
1.20-1.30	2		
1.30-1.40	3		
1.40-1.50	4		
1.50-1.60	6		
1.60-1.70	6		
1.70-1.80	6		
1.80-1.90	7		
1.90-2.00	12		
2.00-2.10	16		
2.10-2.20	19		
2.20-2.30	24		
2.30-2.40	25		



Remarks
Refusal at 2.40mBGL with 25 blows for 50mm

Scale (approx)	Logged By
1:25	S. Kelly

Figure No. 8188-10-18.DP21

APPENDIX 6 – Rotary Borehole Records

Ground Investigations Ireland Ltd www.gii.ie	Site Knockrabo, Mount Anville	Borehole Number **RC01**

Machine : Beretta T44 Flush : Core Dia : mm Method : Rotary Cored	Casing Diameter 180mm cased to 8.30m	Ground Level (mOD) 67.13	Client	Job Number 8188-10-18
	Location 718370.9 E 728615.6 N	Dates 27/12/2018	Engineer DBFL	Sheet 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00	23	-					(2.30)	OVERBURDEN: Poor recovery consisting of brown/grey sandy gravelly CLAY with occasional cobbles of Granite		
2.30	67	19	15			64.83	2.30	Weak brown/white coarse GRANITE. Residual weathering with clay along fractures		
3.80	100	0	0	NI						
5.30	93	25	9				(6.00)	2.30-8.30 - Non intact		
6.80	87	20	14	NI						
8.30						58.83	8.30	Complete at 8.30m		

Remarks Borehole backfilled upon completion	Scale (approx) 1:50	Logged By S. Connolly
	Figure No. 8188-10-18.RC01	

Ground Investigations Ireland Ltd www.gii.ie	Site: Knockrabo, Mount Anville	Borehole Number: RC02

Machine : Beretta T44 **Flush :** **Core Dia :** mm **Method :** Rotary Cored	**Casing Diameter** 180mm cased to 8.30m	**Ground Level (mOD)** 64.02	**Client**	**Job Number** 8188-10-18
	Location 718322.5 E 728625.6 N	**Dates** 28/12/2018	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00	27	-					(2.00)	OVERBURDEN: Poor recovery consisting of brown/white Granite Fill		
						62.02	2.00 (0.30)	OVERBURDEN: Poor recovery consisting of brown/grey sandy gravelly Clay with fragments of roots, wood and plastic		
2.30	25	0	0	NI		61.72	2.30 (1.50)	Weak brown/white coarse GRANITE. Residual weathering 2.30-3.80 - Non intact		
3.80	67	20	8	NI		60.22	3.80	Weak to medium strong brown/white coarse GRANITE. Destructured weathering 3.80-5.95 - Mostly non intact but pattern indicates to sets. F1: Sub-horizontal to 10 degrees, undulating rough. F2: Sub-vertical to 80 degrees, undulating rough		
5.30	78	26	14				(4.50)			
5.95				7				5.95-7.90 - Two fracture sets. F1: Closely to medium spaced sub-horizontal to 45 degrees, undulating rough. F2: Medium spaced, sub-vertical to 70 degrees, undulating rough		
6.80	83	31	27							
7.90				NI				7.90-8.30 - Non intact		
8.30						55.72	8.30	Complete at 8.30m		

Remarks Borehole backfilled upon completion	**Scale (approx)** 1:50	**Logged By** S. Connolly
	Figure No. 8188-10-18.RC02	

Knockrabo – Rotary Core Photos

RC01 Box 1

RC01 Box 2

RC02 Box 1

RC02 Box 2

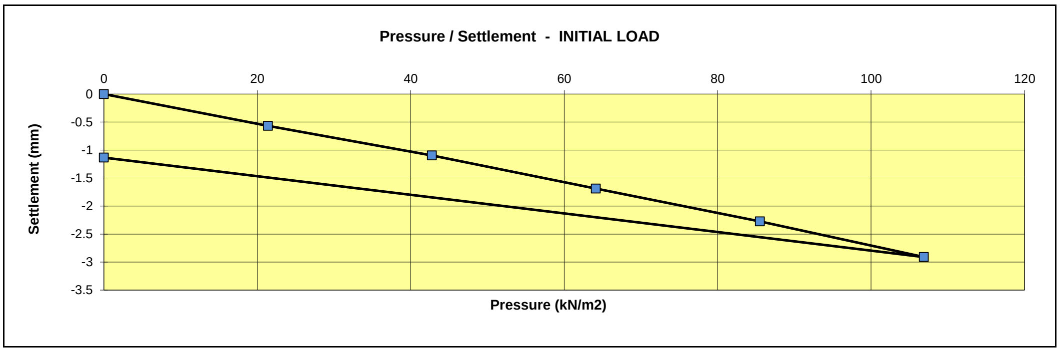
APPENDIX 7 – Plate Test Records

Testall Ltd
295A Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

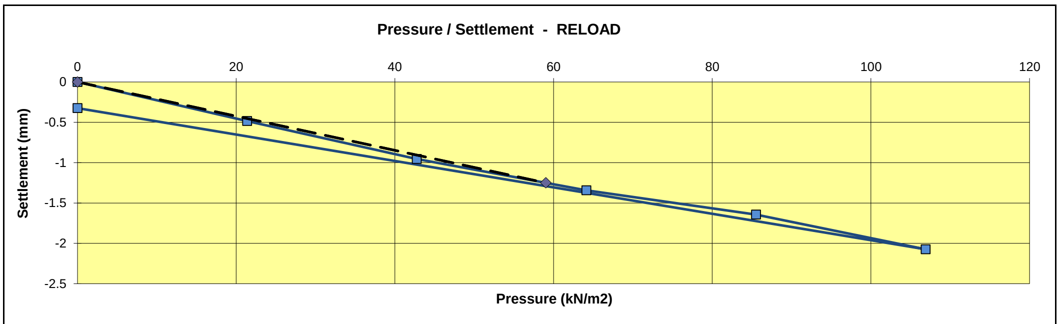
INSITU PLATE LOAD TEST REPORT - BS 1377 - 9 : 1990

Client : Ground Investigations Ireland Ltd (GEM) **Contract :** Knockrabo Apartment Blocks **Job No :** J00669

ERN Sample No.	SA8344	**Site / Client Ref. No.**	DJ/13/11/7 CBR 1A
Supplier	Insitu	**Source**	Insitu
Material Description	Silty brown clay	**Deposition**	Knockrabo Apartment Blocks
Chainage	Back field of existing residence	**Offset**	
Date Tested / Operator	13/11/2018 DJ	**Level**	OGL - 0.8m
Plate Size (mm)	450	**Plate Correction factor**	0.64 (in accordance with HD 25-26/10)
Max Applied Pressure (KN/m^2)	107	**Max Deformation (mm)**	2.9



Initial Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.57
43	-1.10
64	-1.69
86	-2.27
107	-2.91
0	-1.13



Re-Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.48
43	-0.95
64	-1.34
86	-1.64
107	-2.07
0	-0.32

		INITIAL LOAD	RELOAD	
Elastic Modulus (Ev_1 / Ev_2)	=	12	17	MN / m^2
Modulus of subgrade reaction (k)	=	24844	30349	KN / m^2 / m
Compaction Elastic Modulus Ratio (Ev_2 / Ev_1)	=	1.4		
Equivelent CBR % Value	=	**3**	**4**	

in accordance with HD 25-26/10 in Volume 7 Section 2, Part 2A (Pavement Foundation and Design) of the of the TII DMRB (TII Publication No. DN-PAV-03021)

Remarks:

Signed: for Testall Ltd **Date:** 18/11/2018

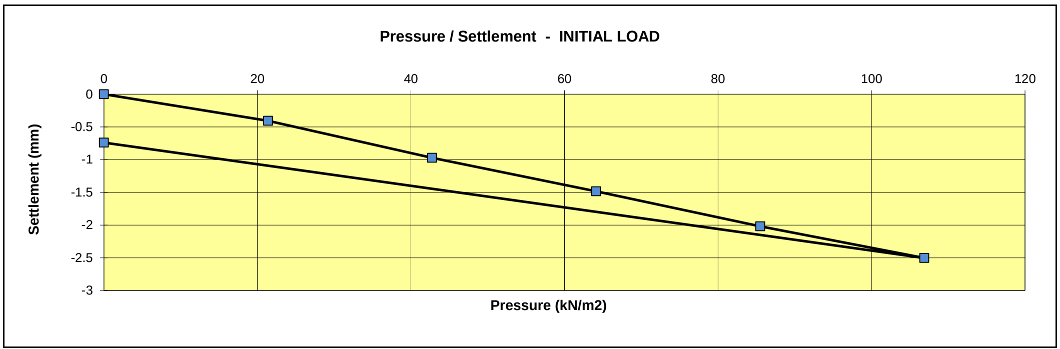
Authorised signatories : ☑ D. Jordan - Laboratory Manager ☐ G.McHugh - Quality Manager

Testall Ltd
295A Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

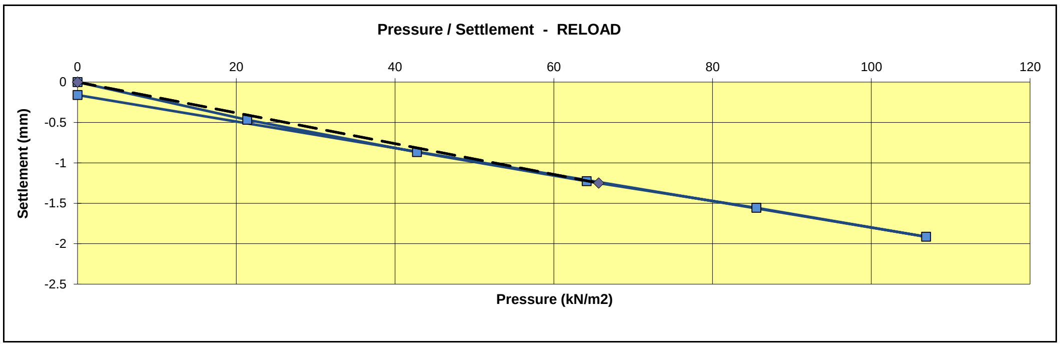
INSITU PLATE LOAD TEST REPORT - BS 1377 - 9 : 1990

Client : Ground Investigations Ireland Ltd (GEM) **Contract :** Knockrabo Apartment Blocks **Job No :** J00669

ERN Sample No.	**SA8341**	**Site / Client Ref. No.**	DJ/13/11/4 CBR 3
Supplier	Insitu	**Source**	Insitu
Material Description	Firm silty clay	**Deposition**	Knockrabo Apartment Blocks
Chainage	Back garden of existing residence	**Offset**	
Date Tested / Operator	13/11/2018 DJ	**Level**	OGL - 0.5m
Plate Size (mm)	450	**Plate Correction factor**	0.64 (in accordance with HD 25-26/10)
Max Applied Pressure (KN/m^2)	107	**Max Deformation (mm)**	2.5



Initial Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.41
43	-0.97
64	-1.48
86	-2.02
107	-2.50
0	-0.74



Re-Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.47
43	-0.87
64	-1.23
86	-1.56
107	-1.91
0	-0.16

		INITIAL LOAD	RELOAD	
Elastic Modulus (Ev$_1$ / Ev$_2$)	=	14	18	MN / m^2
Modulus of subgrade reaction (k)	=	27950	33757	KN / m^2 / m
Compaction Elastic Modulus Ratio (Ev$_2$ / Ev$_1$)	=	1.3		
Equivelent CBR % Value	=	**3**	**4**	

in accordance with HD 25-26/10 in Volume 7 Section 2, Part 2A (Pavement Foundation and Design) of the of the TII DMRB (TII Publication No. DN-PAV-03021)

Remarks:

Signed: **Date:** 18/11/2018

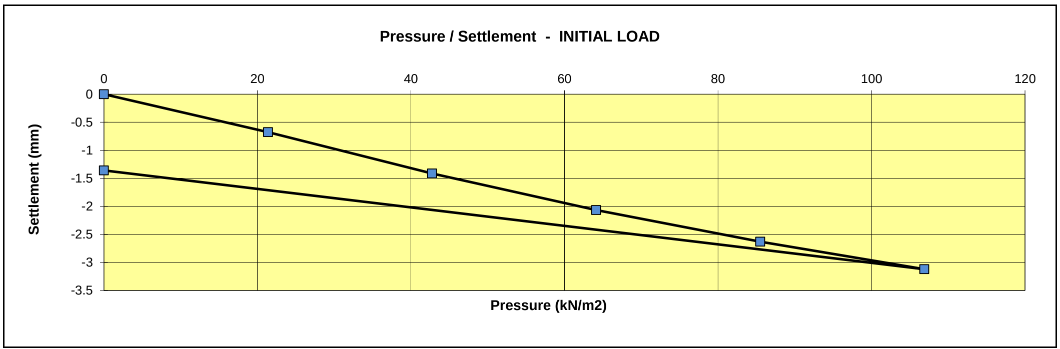
for Testall Ltd **Authorised signatories :** ☑ D. Jordan - Laboratory Manager ☐ G.McHugh - Quality Manager

Testall Ltd
295A Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

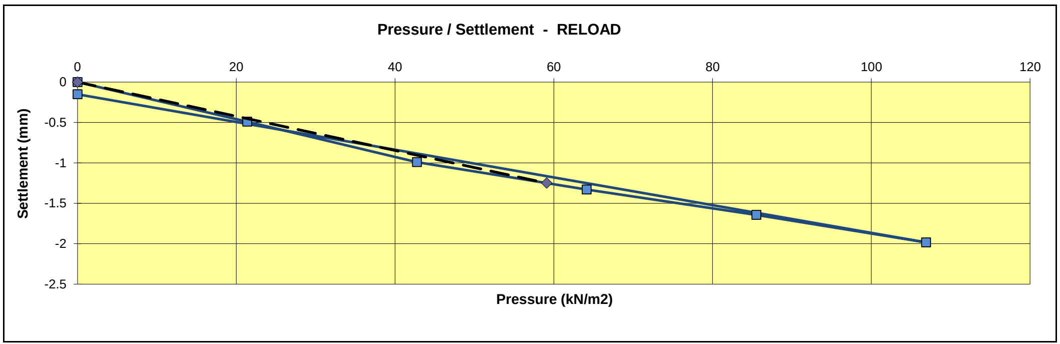
INSITU PLATE LOAD TEST REPORT - BS 1377 - 9 : 1990

Client : Ground Investigations Ireland Ltd (GEM) **Contract :** Knockrabo Apartment Blocks **Job No :** J00669

ERN Sample No.	**SA8342**	**Site / Client Ref. No.**	DJ/13/11/5 CBR 4
Supplier	Insitu	**Source**	Insitu
Material Description	Soft silty clay	**Deposition**	Knockrabo Apartment Blocks
Chainage	Back garden of existing residence	**Offset**	
Date Tested / Operator	13/11/2018 DJ	**Level**	OGL - 0.5m
Plate Size (mm)	450	**Plate Correction factor**	0.64 (in accordance with HD 25-26/10)
Max Applied Pressure (KN/m^2)	107	**Max Deformation (mm)**	3.1



Initial Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.68
43	-1.41
64	-2.07
86	-2.63
107	-3.12
0	-1.36



Re-Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.49
43	-0.99
64	-1.33
86	-1.64
107	-1.98
0	-0.15

		INITIAL LOAD	RELOAD	
Elastic Modulus (Ev$_1$ / Ev$_2$)	=	11	18	MN / m^2
Modulus of subgrade reaction (k)	=	19549	30393	KN / m^2 / m
Compaction Elastic Modulus Ratio (Ev$_2$ / Ev$_1$)	=	1.6		
Equivelent CBR % Value	=	**2**	**4**	

in accordance with HD 25-26/10 in Volume 7 Section 2, Part 2A (Pavement Foundation and Design) of the of the TII DMRB (TII Publication No. DN-PAV-03021)

Remarks:

Signed: **Date:** 18/11/2018

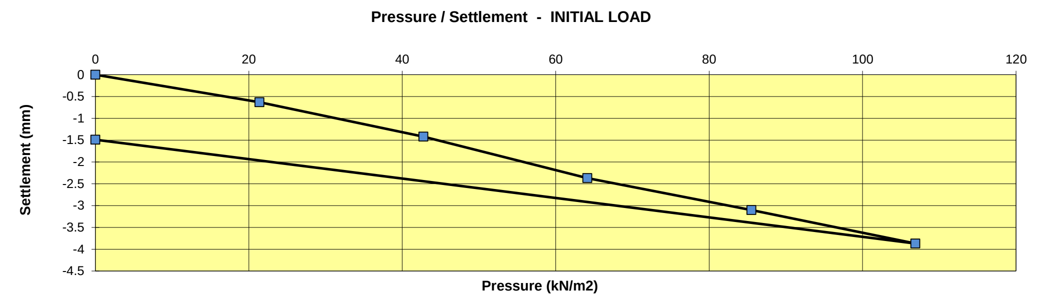
for Testall Ltd **Authorised signatories :** ☑ D. Jordan - Laboratory Manager ☐ G.McHugh - Quality Manager

Testall Ltd
295A Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

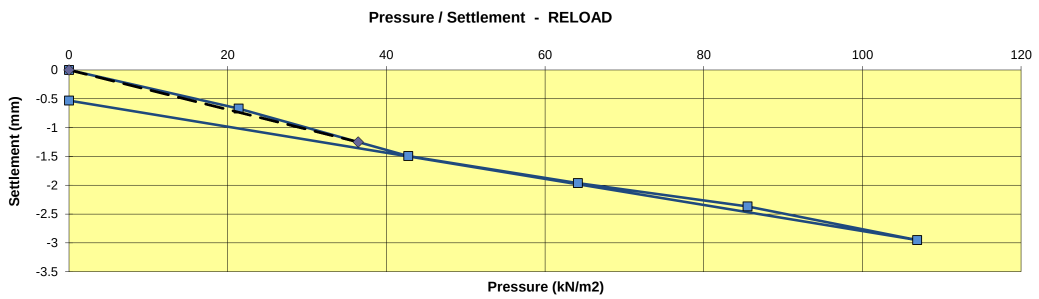
INSITU PLATE LOAD TEST REPORT - BS 1377 - 9 : 1990

Client : Ground Investigations Ireland Ltd (GEM) **Contract :** Knockrabo Apartment Blocks **Job No :** J00669

ERN Sample No.	SA8343	**Site / Client Ref. No.**	DJ/13/11/6 CBR 5
Supplier	Insitu	**Source**	Insitu
Material Description	Soft clay	**Deposition**	Knockrabo Apartment Blocks
Chainage	Back garden of existing residence	**Offset**	
Date Tested / Operator	13/11/2018 DJ	**Level**	OGL - 0.5m
Plate Size (mm)	450	**Plate Correction factor**	0.64 (in accordance with HD 25-26/10)
Max Applied Pressure (KN/m^2)	107	**Max Deformation (mm)**	3.9



Initial Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.63
43	-1.42
64	-2.37
86	-3.10
107	-3.87
0	-1.49



Re-Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.67
43	-1.49
64	-1.96
86	-2.37
107	-2.95
0	-0.53

		INITIAL LOAD	RELOAD	
Elastic Modulus (Ev_1 / Ev_2)	=	9	12	MN / m^2
Modulus of subgrade reaction (k)	=	19621	18738	KN / m^2 / m
Compaction Elastic Modulus Ratio (Ev_2 / Ev_1)	=	1.3		
Equivelent CBR % Value	=	**2**	**2**	

in accordance with HD 25-26/10 in Volume 7 Section 2, Part 2A (Pavement Foundation and Design) of the of the TII DMRB (TII Publication No. DN-PAV-03021)

Remarks:

Signed: for Testall Ltd **Date:** 18/11/2018

Authorised signatories : ☑ D. Jordan - Laboratory Manager ☐ G.McHugh - Quality Manager

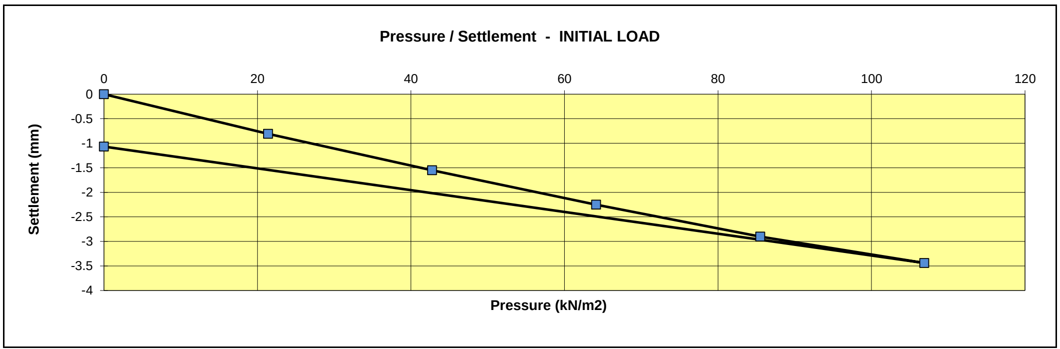
RS 1

Testall Ltd
295A Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

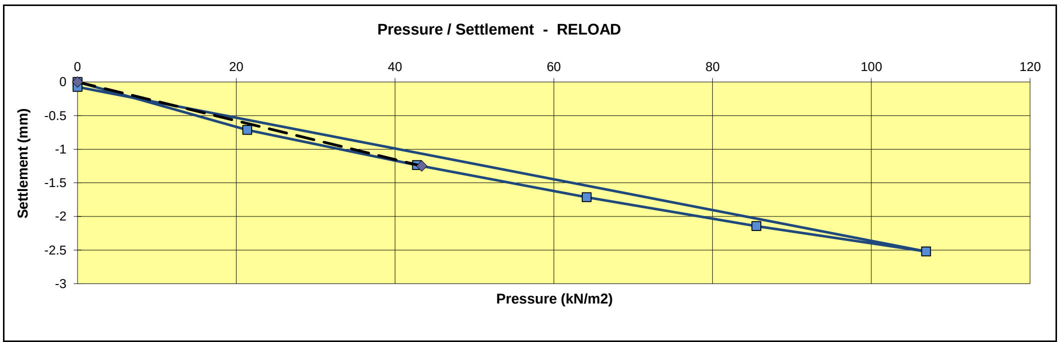
INSITU PLATE LOAD TEST REPORT - BS 1377 - 9 : 1990

Client : Ground Investigations Ireland Ltd (GEM) **Contract :** Knockrabo Apartment Blocks **Job No :** J00669

ERN Sample No.	SA8339	**Site / Client Ref. No.**	DJ/13/11/2 CBR 7B
Supplier	Insitu	**Source**	Insitu
Material Description	Soft brown clay	**Deposition**	Knockrabo Apartment Blocks
Chainage	Back garden of existing residence	**Offset**	
Date Tested / Operator	13/11/2018 DJ	**Level**	OGL - 0.2m
Plate Size (mm)	450	**Plate Correction factor**	0.64 (in accordance with HD 25-26/10)
Max Applied Pressure (KN/m²)	107	**Max Deformation (mm)**	3.4



Initial Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.81
43	-1.55
64	-2.25
86	-2.90
107	-3.44
0	-1.07



Re-Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.71
43	-1.24
64	-1.71
86	-2.14
107	-2.52
0	-0.07

		INITIAL LOAD	RELOAD	
Elastic Modulus (Ev_1 / Ev_2)	=	10	14	MN / m²
Modulus of subgrade reaction (k)	=	17530	22294	KN / m² / m
Compaction Elastic Modulus Ratio (Ev_2 / Ev_1)	=	1.4		
Equivelent CBR % Value	=	**1**	**2**	

in accordance with HD 25-26/10 in Volume 7 Section 2, Part 2A (Pavement Foundation and Design) of the of the TII DMRB (TII Publication No. DN-PAV-03021)

Remarks:

Signed: D. Jordan **Date:** 18/11/2018

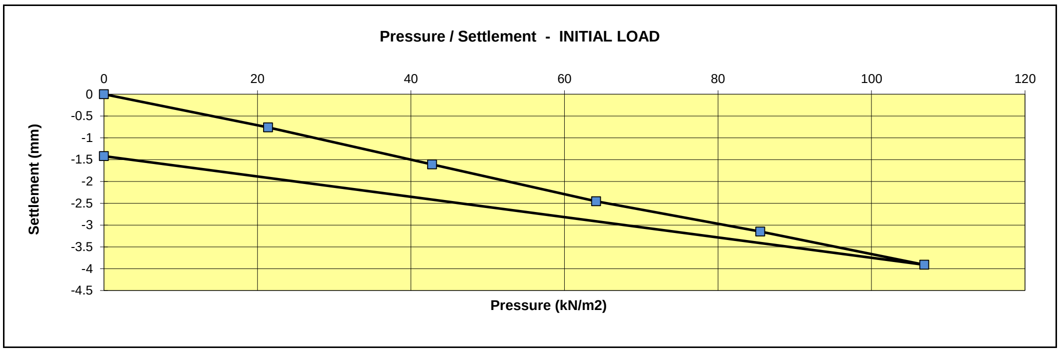
for Testall Ltd **Authorised signatories :** ☑ D. Jordan - Laboratory Manager ☐ G.McHugh - Quality Manager

Testall Ltd
295A Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

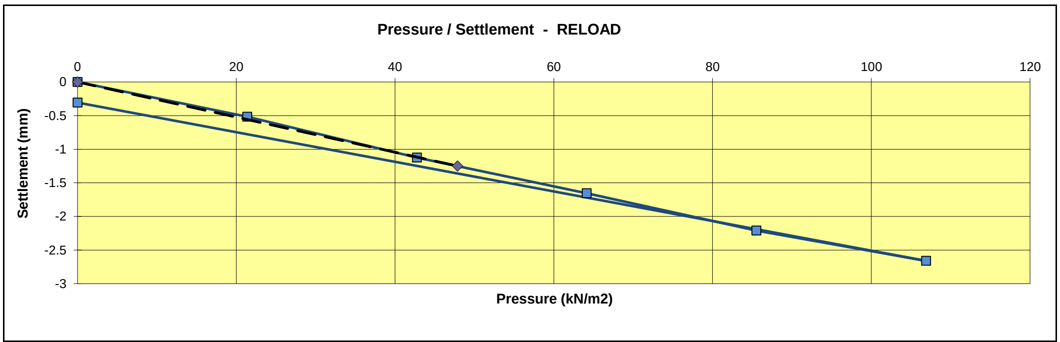
INSITU PLATE LOAD TEST REPORT - BS 1377 - 9 : 1990

Client : Ground Investigations Ireland Ltd (GEM) **Contract :** Knockrabo Apartment Blocks **Job No :** J00669

ERN Sample No.	SA8340	**Site / Client Ref. No.**	DJ/13/11/3 CBR 8
Supplier	Insitu	**Source**	Insitu
Material Description	Soft silty clay	**Deposition**	Knockrabo Apartment Blocks
Chainage	Back garden of existing residence	**Offset**	
Date Tested / Operator	13/11/2018 DJ	**Level**	OGL - 0.2m
Plate Size (mm)	450	**Plate Correction factor**	0.64 (in accordance with HD 25-26/10)
Max Applied Pressure (KN/m^2)	107	**Max Deformation (mm)**	3.9



Initial Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.76
43	-1.61
64	-2.46
86	-3.15
107	-3.91
0	-1.42



Re-Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.52
43	-1.12
64	-1.65
86	-2.21
107	-2.66
0	-0.31

		INITIAL LOAD	RELOAD	
Elastic Modulus (Ev_1 / Ev_2)	=	9	13	MN / m^2
Modulus of subgrade reaction (k)	=	17312	24614	KN / m^2 / m
Compaction Elastic Modulus Ratio (Ev_2 / Ev_1)	=	1.5		
Equivelent CBR % Value	=	**1**	**2**	

in accordance with HD 25-26/10 in Volume 7 Section 2, Part 2A (Pavement Foundation and Design) of the of the TII DMRB (TII Publication No. DN-PAV-03021)

Remarks:

Signed: D. Jordan **Date:** 18/11/2018

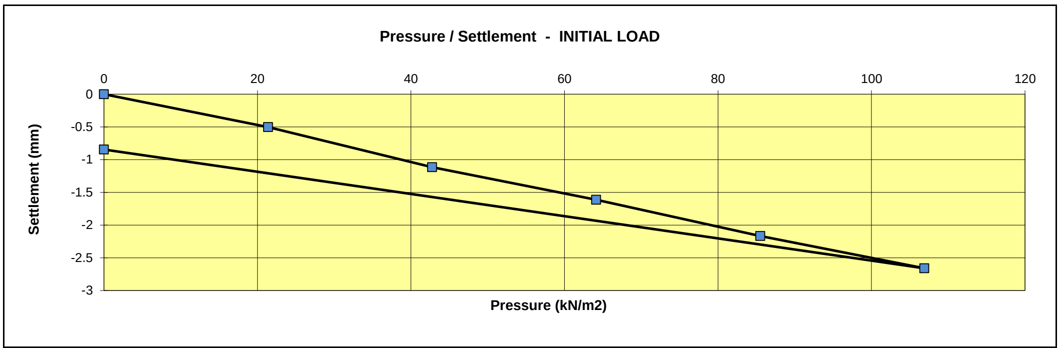
for Testall Ltd **Authorised signatories :** ☑ D. Jordan - Laboratory Manager ☐ G.McHugh - Quality Manager

Testall Ltd
295A Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

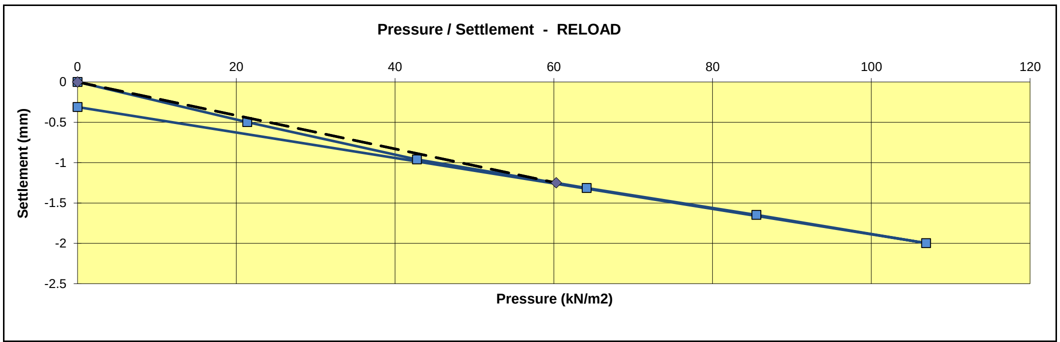
INSITU PLATE LOAD TEST REPORT - BS 1377 - 9 : 1990

Client : Ground Investigations Ireland Ltd (GEM) **Contract :** Knockrabo Apartment Blocks **Job No :** J00669

ERN Sample No.	SA8338	**Site / Client Ref. No.**	DJ/13/11/1 CBR 11
Supplier	Insitu	**Source**	Insitu
Material Description	Brown firm clay	**Deposition**	Knockrabo Apartment Blocks
Chainage	Front garden of existing residence	**Offset**	
Date Tested / Operator	13/11/2018 DJ	**Level**	OGL - 0.2m
Plate Size (mm)	450	**Plate Correction factor**	0.64 (in accordance with HD 25-26/10)
Max Applied Pressure (KN/m^2)	107	**Max Deformation (mm)**	2.7



Initial Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.50
43	-1.12
64	-1.61
86	-2.17
107	-2.66
0	-0.85



Re-Load Cycle	
Applied Pressure (kN/m2)	Average settlement (mm)
0	0
21	-0.50
43	-0.96
64	-1.31
86	-1.65
107	-2.00
0	-0.31

		INITIAL LOAD	RELOAD	
Elastic Modulus (Ev$_1$ / Ev$_2$)	=	13	17	MN / m^2
Modulus of subgrade reaction (k)	=	24938	31010	KN / m^2 / m
Compaction Elastic Modulus Ratio (Ev$_2$ / Ev$_1$)	=	1.3		
Equivelent CBR % Value	=	**3**	**4**	

in accordance with HD 25-26/10 in Volume 7 Section 2, Part 2A (Pavement Foundation and Design) of the of the TII DMRB (TII Publication No. DN-PAV-03021)

Remarks:

Signed: **Date:** 18/11/2018

for Testall Ltd **Authorised signatories :** ☑ D. Jordan - Laboratory Manager ☐ G.McHugh - Quality Manager

RS 1

APPENDIX 8 – Laboratory Test Results

Exova Jones Environmental

Registered Office: Exova Environmental UK Limited, 10 Lower Grosvenor Place, London, SW1W 0EN. Reg No. 11371415

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland

Attention :	Aisling McDonnell
Date :	11th December, 2018
Your reference :	8188-10-189
Our reference :	Test Report 18/18871 Batch 1
Location :	Knockrabo,Mount Anville
Date samples received :	22nd November, 2018
Status :	Final report
Issue :	1

Six samples were received for analysis on 22nd November, 2018 of which six were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Where Waste Acceptance Criteria Suite (EC Decision of 19 December 2002 (2003/33/EC)) has been requested, all analyses have been performed using the relevant EN methods where they exist.

Compiled By:

Phil Sommerton BSc
Project Manager

Exova Jones Environmental

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	8188-10-189		
Location:	Knockrabo,Mount Anville	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Aisling McDonnell		
JE Job No.:	18/18871		

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18							
Sample ID	TP10	TP12	TP16	TP17	TP19	SA03							
Depth	0.50	1.00	1.50	1.50	0.70	0.80							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1					LOD/LOR	Units	Method No.
Date of Receipt	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018							
Antimony	-	2	3	3	2	2					<1	mg/kg	TM30/PM15
Arsenic #	-	15.6	18.1	17.1	13.4	9.8					<0.5	mg/kg	TM30/PM15
Barium #	-	94	115	104	71	54					<1	mg/kg	TM30/PM15
Cadmium #	-	3.1	3.3	2.1	2.1	2.4					<0.1	mg/kg	TM30/PM15
Chromium #	-	42.6	75.3	63.9	55.4	28.7					<0.5	mg/kg	TM30/PM15
Copper #	-	34	47	37	29	29					<1	mg/kg	TM30/PM15
Lead #	-	45	87	102	29	18					<5	mg/kg	TM30/PM15
Mercury #	-	<0.1	<0.1	<0.1	<0.1	<0.1					<0.1	mg/kg	TM30/PM15
Molybdenum #	-	4.7	5.4	4.9	3.9	3.2					<0.1	mg/kg	TM30/PM15
Nickel #	-	56.1	57.5	46.4	49.1	39.5					<0.7	mg/kg	TM30/PM15
Selenium #	-	2	2	2	1	1					<1	mg/kg	TM30/PM15
Zinc #	-	130	163	149	105	91					<5	mg/kg	TM30/PM15
Antimony	4	-	-	-	-	-					<1	mg/kg	TM30/PM62
Arsenic	30.9	-	-	-	-	-					<0.5	mg/kg	TM30/PM62
Barium	472	-	-	-	-	-					<1	mg/kg	TM30/PM62
Cadmium	2.4	-	-	-	-	-					<0.1	mg/kg	TM30/PM62
Chromium	26.8	-	-	-	-	-					<0.5	mg/kg	TM30/PM62
Copper	61	-	-	-	-	-					<1	mg/kg	TM30/PM62
Lead	348	-	-	-	-	-					<5	mg/kg	TM30/PM62
Mercury	<0.1	-	-	-	-	-					<0.1	mg/kg	TM30/PM62
Molybdenum	5.3	-	-	-	-	-					<0.1	mg/kg	TM30/PM62
Nickel	57.1	-	-	-	-	-					<0.7	mg/kg	TM30/PM62
Selenium	2	-	-	-	-	-					<1	mg/kg	TM30/PM62
Zinc	275	-	-	-	-	-					<5	mg/kg	TM30/PM62

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Exova Jones Environmental

Client Name: Ground Investigations Ireland
Reference: 8188-10-189
Location: Knockrabo,Mount Anville
Contact: Aisling McDonnell
JE Job No.: 18/18871

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18			
Sample ID	TP10	TP12	TP16	TP17	TP19	SA03			
Depth	0.50	1.00	1.50	1.50	0.70	0.80			
COC No / misc									
Containers	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018			
PAH MS									
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	0.69	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	0.47	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	4.48	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	0.59	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	3.39	<0.03	0.06	0.11	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	2.77	<0.03	0.06	0.13	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	1.36	<0.06	<0.06	0.10	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	1.63	<0.02	<0.02	0.07	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	2.23	<0.07	0.10	0.16	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	1.23	<0.04	0.06	0.07	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	0.85	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	0.24	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.67	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	0.07	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	8.37	<0.22	0.22	0.34	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	20.67	<0.64	<0.64	0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	1.61	<0.05	0.07	0.12	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.62	<0.02	0.03	0.04	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	100	98	97	97	98	99	<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16
TPH CWG									
Aliphatics									
>C5-C6 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Exova Jones Environmental

Client Name: Ground Investigations Ireland
Reference: 8188-10-189
Location: Knockrabo,Mount Anville
Contact: Aisling McDonnell
JE Job No.: 18/18871

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18							
Sample ID	TP10	TP12	TP16	TP17	TP19	SA03							
Depth	0.50	1.00	1.50	1.50	0.70	0.80							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1							
Date of Receipt	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018					LOD/LOR	Units	Method No.
TPH CWG													
Aromatics													
>C5-EC7 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	<4	<4	<4	<4	<4					<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	<7	<7	<7	20	<7	<7					<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26	<26	<26	<26	<26					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	<52	<52	<52	<52	<52					<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	<10					<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10	<10	18	<10	<10					<10	mg/kg	TM5/PM8/PM16
MTBE #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM31/PM12
Benzene #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM31/PM12
Toluene #	<5	<5	<5	33	<5	<5					<5	ug/kg	TM31/PM12
Ethylbenzene #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM31/PM12
m/p-Xylene #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM31/PM12
o-Xylene #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<35	<35					<35	ug/kg	TM17/PM8
Natural Moisture Content	18.2	35.9	23.8	41.9	19.5	11.7					<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	15.4	26.4	19.2	29.5	16.3	10.5					<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3					<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	-	0.0126	-	-	-	0.0078					<0.0015	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext)	0.0143	-	-	-	-	-					<0.0015	g/l	TM38/PM60
Chromium III	NDP	42.6	75.3	63.9	55.4	28.7					<0.5	mg/kg	NONE/NONE
Chromium III	26.8	-	-	-	-	-					<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	NDP	1.17	1.55	4.02	0.62	0.44					<0.02	%	TM21/PM24
pH #	8.08	7.78	8.34	7.37	8.36	8.55					<0.01	pH units	TM73/PM11

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Exova Jones Environmental

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	8188-10-189		
Location:	Knockrabo,Mount Anville	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Aisling McDonnell		
JE Job No.:	18/18871		

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18							
Sample ID	TP10	TP12	TP16	TP17	TP19	SA03							
Depth	0.50	1.00	1.50	1.50	0.70	0.80							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1					LOD/LOR	Units	Method No.
Date of Receipt	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018							
Mass of raw test portion	0.1076	0.1205	0.1137	0.1261	0.1045	0.1043						kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09						kg	NONE/PM17

Exova Jones Environmental

Client Name: Ground Investigations Ireland
Reference: 8188-10-189
Location: Knockrabo,Mount Anville
Contact: Aisling McDonnell
JE Job No.: 18/18871

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18					LOD/LOR	Units	Method No.
Sample ID	TP10	TP12	TP16	TP17	TP19	SA03							
Depth	0.50	1.00	1.50	1.50	0.70	0.80							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1							
Date of Receipt	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018							
Dissolved Antimony #	<0.002	<0.002	<0.002	0.003	<0.002	0.002					<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	0.03	<0.02	0.02					<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	0.0026	<0.0025	0.0055	0.0085	<0.0025	<0.0025					<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	0.026	<0.025	0.055	0.085	<0.025	<0.025					<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.012	<0.003	<0.003	0.027	<0.003	<0.003					<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.12	<0.03	<0.03	0.27	<0.03	<0.03					<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005					<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005					<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015					<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015					<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007					<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07					<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005					<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05					<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.006	<0.002	0.005	0.007	0.006	0.003					<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.06	<0.02	0.05	0.07	0.06	0.03					<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	0.005	<0.002	<0.002					<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	0.05	<0.02	<0.02					<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003					<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03					<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	0.003	<0.003	<0.003	<0.003	<0.003					<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	0.03	<0.03	<0.03	<0.03	<0.03					<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001					<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					<0.1	mg/kg	TM26/PM0
Fluoride	0.4	<0.3	0.3	<0.3	0.3	<0.3					<0.3	mg/l	TM173/PM0
Fluoride	4	<3	3	<3	<3	<3					<3	mg/kg	TM173/PM0
Sulphate as SO4 #	0.46	0.42	6.05	<0.05	2.80	0.36					<0.05	mg/l	TM38/PM0
Sulphate as SO4 #	4.6	4.2	60.5	<0.5	28.0	3.6					<0.5	mg/kg	TM38/PM0
Chloride #	2.5	0.4	0.6	1.9	0.6	<0.3					<0.3	mg/l	TM38/PM0
Chloride #	25	4	6	19	6	<3					<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	4	2	2	16	<2	<2					<2	mg/l	TM60/PM0
Dissolved Organic Carbon	40	20	20	160	<20	<20					<20	mg/kg	TM60/PM0
pH	7.86	7.93	7.27	7.89	7.98	8.10					<0.01	pH units	TM73/PM0
Total Dissolved Solids #	158	88	55	155	83	125					<35	mg/l	TM20/PM0
Total Dissolved Solids #	1580	880	550	1550	830	1250					<350	mg/kg	TM20/PM0

Client Name: Ground Investigations Ireland
Reference: 8188-10-189
Location: Knockrabo,Mount Anville
Contact: Aisling McDonnell
JE Job No.: 18/18871

Report : EN12457_2

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18						
Sample ID	TP10	TP12	TP16	TP17	TP19	SA03						
Depth	0.50	1.00	1.50	1.50	0.70	0.80						
COC No / misc												
Containers	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018	20/11/2018						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018	22/11/2018						
Solid Waste Analysis												
Total Organic Carbon #	NDP	1.17	1.55	4.02	0.62	0.44	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	0.033	<0.025	<0.025	6	-	-	<0.025	mg/kg	TM31/PM12
Sum of 7 PCBs #	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30	<30	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	8.37	<0.22	0.22	0.34	<0.22	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	20.67	<0.64	<0.64	0.64	<0.64	<0.64	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate												
Arsenic #	0.026	<0.025	0.055	0.085	<0.025	<0.025	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.12	<0.03	<0.03	0.27	<0.03	<0.03	20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.06	<0.02	0.05	0.07	0.06	0.03	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	0.05	<0.02	<0.02	0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02	0.03	<0.02	0.02	0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	1580	880	550	1550	830	1250	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	40	20	20	160	<20	<20	500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1076	0.1205	0.1137	0.1261	0.1045	0.1043	-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	83.3	74.9	78.9	71.3	85.7	86.4	-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.882	0.87	0.876	0.864	0.885	0.886	-	-	-		l	NONE/PM17
Eluate Volume	0.75	0.8	0.82	0.8	0.79	0.85	-	-	-		l	NONE/PM17
pH #	8.08	7.78	8.34	7.37	8.36	8.55	-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	4	<3	3	<3	<3	<3	-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	4.6	4.2	60.5	<0.5	28.0	3.6	1000	20000	50000	<0.5	mg/kg	TM38/PM0
Chloride #	25	4	6	19	6	<3	800	15000	25000	<3	mg/kg	TM38/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland

Reference: 8188-10-189

Location: Knockrabo,Mount Anville

Contact: Aisling McDonnell

Matrix : Solid

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	EPH Interpretation
18/18871	1	TP10	0.50	1-3	No interpretation possible
18/18871	1	TP12	1.00	4-6	No interpretation possible
18/18871	1	TP16	1.50	7-9	No interpretation possible
18/18871	1	TP17	1.50	10-12	No interpretation possible
18/18871	1	TP19	0.70	13-15	No interpretation possible
18/18871	1	SA03	0.80	16-18	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 8188-10-189
Location: Knockrabo,Mount Anville
Contact: Aisling McDonnell

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:

Ryan Butterworth
Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/18871	1	TP10	0.50	2	29/11/2018	**General Description (Bulk Analysis)**	soil-stones
					29/11/2018	**Asbestos Fibres**	Fibre Bundles
					29/11/2018	**Asbestos ACM**	NAD
					29/11/2018	**Asbestos Type**	Chrysotile
					29/11/2018	**Asbestos Level Screen**	less than 0.1%
					11/12/2018	**Total ACM Gravimetric Quantification (% Asb)**	<0.001 (mass %)
					11/12/2018	**Total Detailed Gravimetric Quantification (% Asb)**	<0.001 (mass %)
					11/12/2018	**Total Gravimetric Quantification (ACM + Detailed) (% Asb)**	<0.001 (mass %)
18/18871	1	TP12	1.00	5	29/11/2018	**General Description (Bulk Analysis)**	soil-stones
					29/11/2018	**Asbestos Fibres**	NAD
					29/11/2018	**Asbestos ACM**	NAD
					29/11/2018	**Asbestos Type**	NAD
					29/11/2018	**Asbestos Level Screen**	NAD
18/18871	1	TP16	1.50	8	29/11/2018	**General Description (Bulk Analysis)**	soil-stones
					29/11/2018	**Asbestos Fibres**	NAD
					29/11/2018	**Asbestos ACM**	NAD
					29/11/2018	**Asbestos Type**	NAD
					29/11/2018	**Asbestos Level Screen**	NAD
18/18871	1	TP17	1.50	11	29/11/2018	**General Description (Bulk Analysis)**	soil-stones
					29/11/2018	**Asbestos Fibres**	NAD
					29/11/2018	**Asbestos ACM**	NAD
					29/11/2018	**Asbestos Type**	NAD
					29/11/2018	**Asbestos Level Screen**	NAD
18/18871	1	TP19	0.70	14	29/11/2018	**General Description (Bulk Analysis)**	soil-stones
					29/11/2018	**Asbestos Fibres**	NAD
					29/11/2018	**Asbestos ACM**	NAD
					29/11/2018	**Asbestos Type**	NAD
					29/11/2018	**Asbestos Level Screen**	NAD
18/18871	1	SA03	0.80	17	29/11/2018	**General Description (Bulk Analysis)**	soil-stones
					29/11/2018	**Asbestos Fibres**	NAD
					29/11/2018	**Asbestos ACM**	NAD
					29/11/2018	**Asbestos Type**	NAD
					29/11/2018	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 8188-10-189
Location: Knockrabo,Mount Anville
Contact: Aisling McDonnell

Matrix : Solid

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Method No.	NDP Reason
18/18871	1	TP10	0.50	1-3	NONE/NONE	Asbestos detected in sample
18/18871	1	TP10	0.50	1-3	TM21/PM24	Asbestos detected in sample

Client Name: Ground Investigations Ireland
Reference: 8188-10-189
Location: Knockrabo,Mount Anville
Contact: Aisling McDonnell

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
No deviating sample report results for job 18/18871						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 18/18871

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Exova Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

Appendix - Methods used for WAC (2003/33/EC)

JE Job No.: 18/18871

Leachate tests	
10l/kg; 4mm	I.S. EN 12457-2:2002 Specified particle size; water added to L/S ratio; capped; agitated for 24 ± 0.5 hours; eluate settled and filtered over 0.45 µm membrane filter.
Eluate analysis	
As	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ba	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cd	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cr total	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cu	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Hg	I.S. EN 13370 rec. EN 1483 (CVAAS)
Mo	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ni	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Pb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Sb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Se	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Zn	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Chloride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Fluoride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Sulphate	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Phenol index	I.S. EN 13370 rec. ISO 6439 (4-Aminoantipyrine spectrometic methods after distillation)* (BY HPLC - Jones Env)
DOC	I.S. EN 1484
TDS	I.S. EN 15216
Compositional analysis	
TOC	I.S. EN 13137 Method B: carbonates removed with acid; TOC by combustion.
BTEX	GC-FID
PCB7**	I.S. EN 15308 analysis by GC-ECD.
Mineral oil	I.S. EN 14039 C10 to C40 analysis by GC-FID.
PAH17***	I.S. EN 15527 PAH17 analysis by GC-MS
Metals	I.S. EN 13657 - Aqua regia digestion: EN ISO 11885 (ICP-OES)
Other	
Dry matter	I.S. EN 14346 sample is dried to a constant mass in an oven at 105 ± 3 °C; Method B Water content by direct Karl-Fischer-titration and either volumetric or coulometric detection.
LOI	I.S. EN 15169 Difference in mass after heating in a furnace up to 550 ± 25 °C.
ANC	CEN/TS 15364 Determined by amouns of acid or base needed to cover the pH range

Notes:

*If not suitable due to LOD, precision, etc., any other suitable method can be used, e.g. AFS, ICP-MS
**PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180

***Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)perylene, Benzo(a)pyrene, Chrysene, Coronene, Dibenzo(a,h)anthracene, Fluorene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene and Pyrene.

JE Job No: 18/18871

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3: 1990/USEPA 160.3 Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

JE Job No: 18/18871

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM62	Acid digestion of as received solid samples using Aqua Regia refluxed at 112.5 °C.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM0	No preparation is required.	Yes		AR	Yes

JE Job No: 18/18871

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM60	As received solid samples are extracted with deionised water in a 2:1 ratio of water to solid.			AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060, APHA Standard Methods for Examination of Water and Wastewater 5310B, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Modified US EPA methods 245.7 and 200.7. Determination of Mercury by Cold Vapour Atomic Fluorescence.	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM131	Quantification of Asbestos Fibres and ACM, based on HSG248 and SCA method.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 340.2	PM0	No preparation is required.			AR	Yes

JE Job No: 18/18871

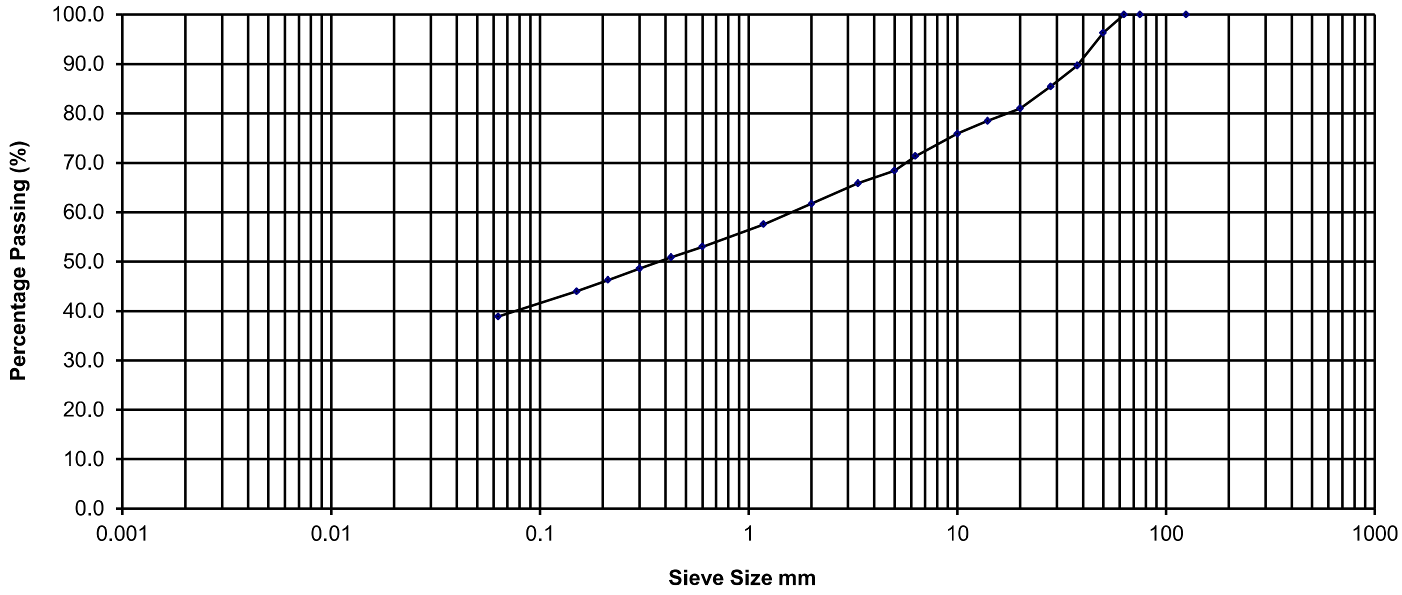
Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
NONE	No Method Code	NONE	No Method Code			AR	Yes
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	96.3
37.500	89.7
28.000	85.5
20.000	81.0
14.000	78.5
10.000	75.9
6.300	71.3
5.000	68.4
3.350	65.8
2.000	61.7
1.180	57.6
0.600	53.0
0.425	50.9
0.300	48.6
0.212	46.3
0.150	44.0
0.063	38.8



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	38.8	22.9	38.3	0.0	0.0

Sample Description	Brown slightly sandy gravelly silty CLAY	Project No.	NMTL 2771
		BH/TP No.	SA03
Project	Knockrobo, Mount Anville	Sample No.	B

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	10/12/2018	Depth	0.80m

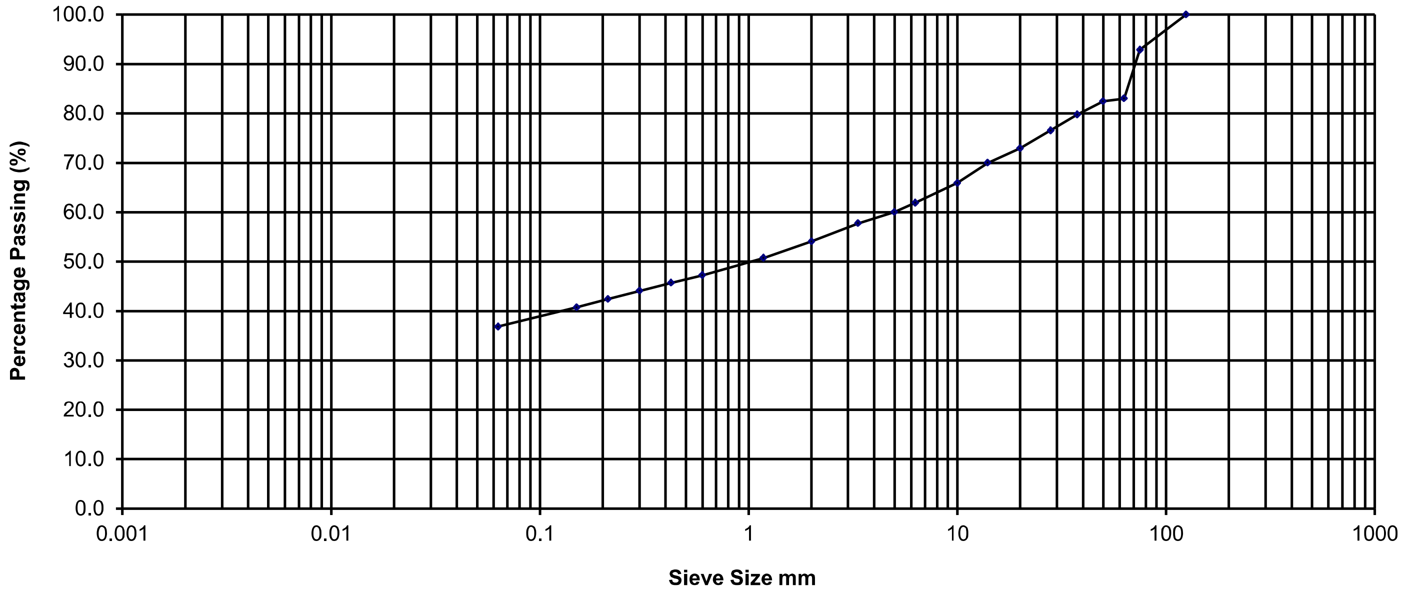
NM
TL
Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	92.8
63.000	83.0
50.000	82.5
37.500	79.7
28.000	76.5
20.000	72.9
14.000	70.0
10.000	65.9
6.300	61.9
5.000	60.0
3.350	57.8
2.000	54.1
1.180	50.7
0.600	47.2
0.425	45.7
0.300	44.1
0.212	42.4
0.150	40.8
0.063	36.8



Percentage Particle Size

Clay	Silt (Fine, Medium, Coarse)	Sand (Fine, Medium, Coarse)	Gravel (Fine, Medium, Coarse)	Cobbles	Boulder
	36.8	17.3	28.9	17.0	0.0

Sample Description: Brown slightly sandy slightly gravelly silty CLAY, with some cobbles.

Project: Knockrobo, Mount Anville

Project No.	NMTL 2771
BH/TP No.	TP02
Sample No.	B
Depth	2.00m

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	10/12/2018

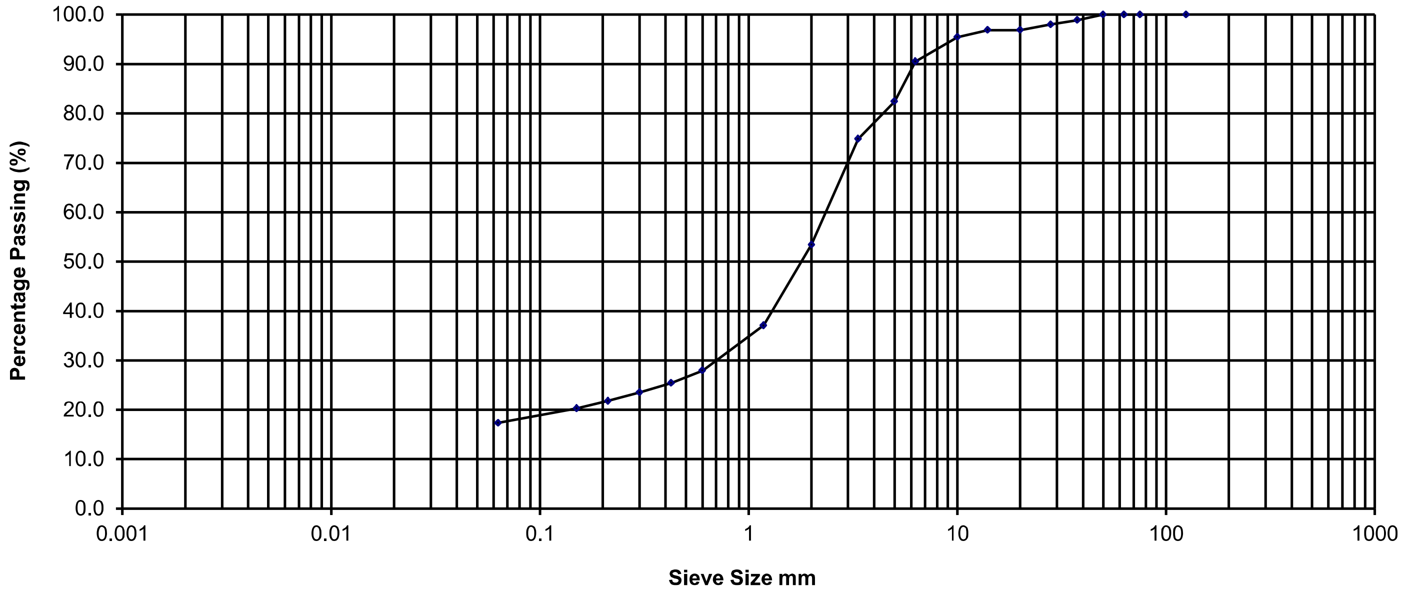
NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	98.9
28.000	98.0
20.000	96.9
14.000	96.9
10.000	95.5
6.300	90.5
5.000	82.4
3.350	74.8
2.000	53.5
1.180	37.1
0.600	28.0
0.425	25.4
0.300	23.5
0.212	21.8
0.150	20.3
0.063	17.3



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
	17.3	36.1	46.5	0.0	0.0

Sample Description	Brown clayey silty very sandy GRAVEL.	Project No.	NMTL 2771
		BH/TP No.	TP09
Project	Knockrobo, Mount Anville	Sample No.	B

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	10/12/2018	Depth	3.00m

NM TL Ltd

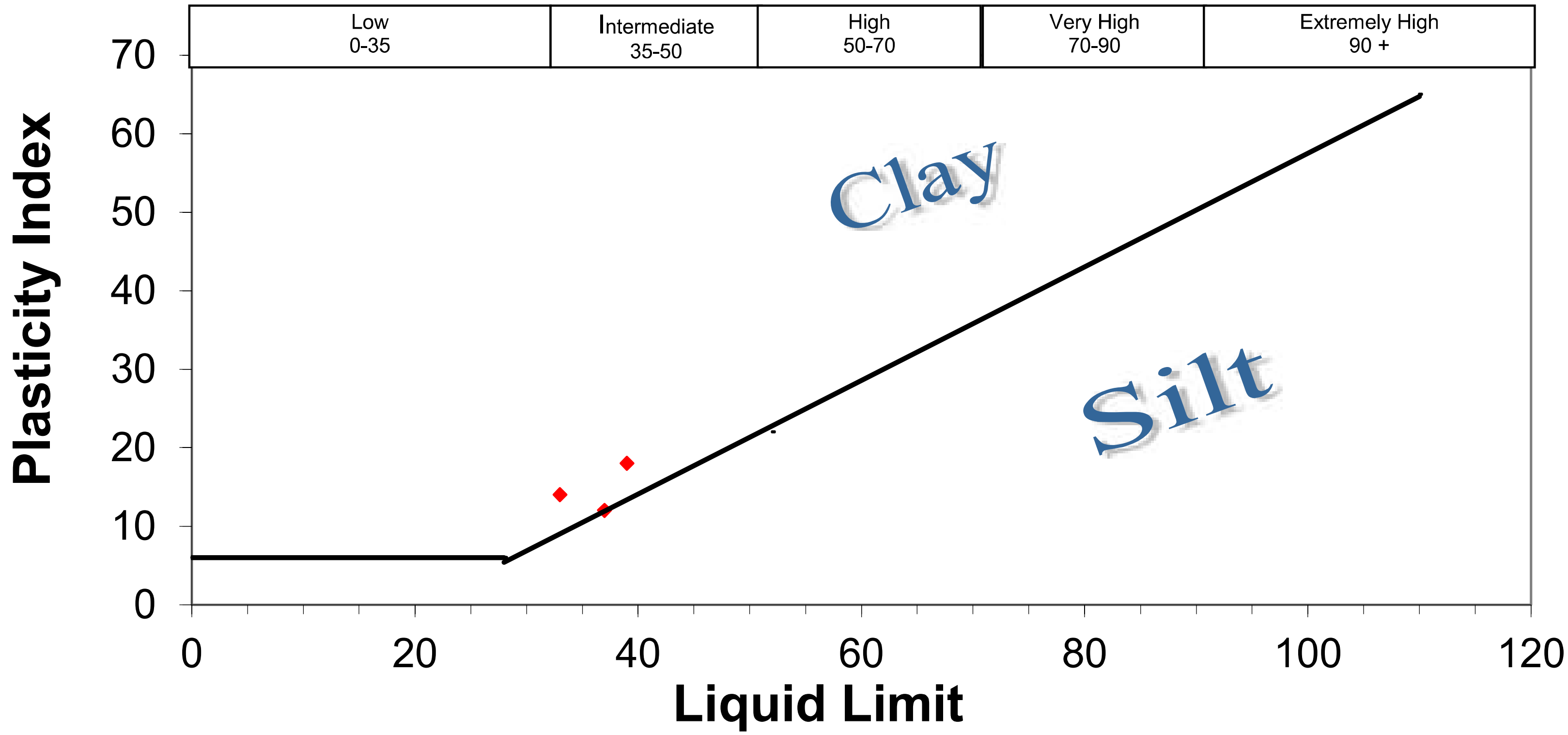
National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
TP02	2.00	B	24.2		45.7	39	21	18						
TP09	3.00	B	13.7		25.4	37	25	12						
SA03	0.80	B	16.5		50.9	33	19	14						

NMTL		Notes :	Job ref No.	NMTL 2771	Table
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Knockrobo, Mount Anville	

NMTL LTD **Unit 18c, Tullow Industrial Estate** **Tullow** **County Carlow** **Tel: 00353 59 9180822** **Mob: 00353 872575508** billachana@eircom.net	**Contract:** Knockrobo, Mount Anville **Client:** Ground Investigations Ireland Ltd **Engineer:** N/A **Date:** 14/12/2018 **Tested By:** Tzr **Checked:** Bc **Job ref No.** NMTL 2771



NATIONAL MATERIALS TESTING LABORATORY LTD.

DETERMINATION OF THE CALIFORNIA BEARING RATIO TEST
BS 1377 : PART 4 : CLAUSE 7 : 1990

Soil Description: Brown slightly sandy slightly gravelly SILT/CLAY.

Date: 21-Jan-19

Test Method: BS 1377: Part 4 : 1990 :7.4

Force Measuring Device: VJT-08211

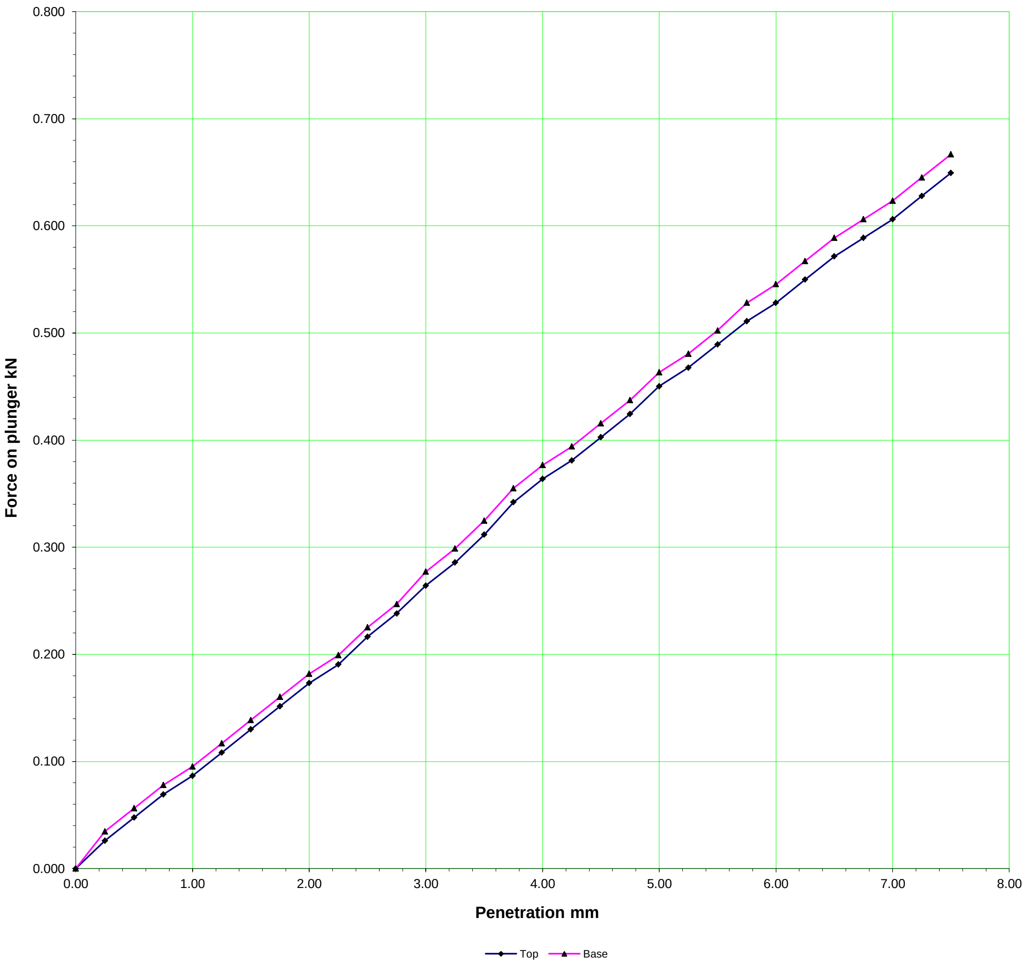
Test 1

Preperatic Remoulded with 2.5 kg rammer at natural moisture content

Surcharge: 10 kPa

Penetration of plunger mm	Force Gauge reading divisions Top	Bottom	Force on plunger kN Top	Bottom	California Bearing Ratio Results % Top	Base
			Mean Calibration		4.33	N/Div
					4.33	N/Div
0.00	0.0	0.0	0.000	0.000		
0.25	6.0	8.0	0.026	0.035		
0.50	11.0	13.0	0.048	0.056		
0.75	16.0	18.0	0.069	0.078		
1.00	20.0	22.0	0.087	0.095		
1.25	25.0	27.0	0.108	0.117		
1.50	30.0	32.0	0.130	0.139		
1.75	35.0	37.0	0.152	0.160		
2.00	40.0	42.0	0.173	0.182		
2.25	44.0	46.0	0.191	0.199		
2.50	**50.0**	**52.0**	**0.217**	**0.225**	**1.64**	**1.71**
2.75	55.0	57.0	0.238	0.247		
3.00	61.0	64.0	0.264	0.277		
3.25	66.0	69.0	0.286	0.299		
3.50	72.0	75.0	0.312	0.325		
3.75	79.0	82.0	0.342	0.355		
4.00	84.0	87.0	0.364	0.377		
4.25	88.0	91.0	0.381	0.394		
4.50	93.0	96.0	0.403	0.416		
4.75	98.0	101.0	0.424	0.437		
5.00	**104.0**	**107.0**	**0.450**	**0.463**	**2.25**	**2.32**
5.25	108.0	111.0	0.468	0.481		
5.50	113.0	116.0	0.489	0.502		
5.75	118.0	122.0	0.511	0.528		
6.00	122.0	126.0	0.528	0.546		
6.25	127.0	131.0	0.550	0.567		
6.50	132.0	136.0	0.572	0.589		
6.75	136.0	140.0	0.589	0.606		
7.00	140.0	144.0	0.606	0.624		
7.25	145.0	149.0	0.628	0.645		
7.50	150.0	154.0	0.650	0.667		

Moisture content after test		Top	Middle	Base		
Container No.		Tray	Tray	Tray	Specimen wt g	5030
					Diameter mm	152
Mass of wet soil + container	g	1731.60	1857.73	1911.50	Length mm	127.0
Mass of dry soil + container	g	1546.77	1658.85	1701.72		
Weight of container	g	185.35	148.00	141.37		
Mass of moisture	g	184.83	198.88	209.78	Average MC %	13.39
Dry weight	g	1361.42	1510.85	1560.35	Density Mg/m3	2.18
Moisture content	%	13.58	13.16	13.44	Dry Density Mg/m3	1.92



NM TL Ltd

Project: Knockrobo.

		Date	Project No.	NMTL2771
Operator	Tch	21-Jan-19	BH/TP	TP05
Checked	Nc		Sample No.	B
Approved	Bc		Depth	2.50m

D. GDSDS Calculations– Chamber Specifications, Drawings and Details

waterman moylan

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	JU
Approved by:	MD

Input Data

Project Name	Knockrabo
Project Number	20-086
Client	Client
Architect	Architect
Status	Planning
Date	04/09/2024

Total Site Area: 24,800m² *… Entire redline area*

Paved Area

Total: 62% *… Total paved area as a percentage of site area*

Drained: 75% *… Proportion of paved area drained*

Soil Area

Drained: 20% *… Proportion of soil area drained*

Runoff Growth Factors:

1-Year: 0.85 *… Typical value for Dublin is 0.85*

30-Year: 2.10 *… Typical value for Dublin is 2.10*

100-Year: 2.60 *… Typical value for Dublin is 2.60*

Soil Type: Type 4 *… From 1 to 5, preferably from Site Investigation report, or else estimate from the adjacent map*

SAAR: 836mm *… Values from the Word Document*

Climate Change Factor: 20% *… 20% is typically used in Ireland*

Rain Data From: Met Éireann Archive

Rainfall return period data: contact enquiries@met.ie (provide Irish Grid coordinates).
Note: https://www.met.ie/climate/services/rainfall-return-periods is down.

Met Éireann Archive Rainfall Data

Duration *(Hours)*	**Return Period** *(Years)* **1**	**5**	**10**	**20**	**30**	**50**	**100**
0.5	7.6	12.7	15.8	19.4	21.7	25.0	30.3
1	9.9	16.3	20.1	24.4	27.2	31.2	37.4
2	12.9	20.8	25.5	30.7	34.1	38.8	46.3
4	16.8	26.6	32.3	38.6	42.7	48.4	57.2
6	19.6	30.7	37.1	44.1	48.7	55.0	64.8
12	25.5	39.2	47.0	55.5	60.9	68.5	80.1
24	33.3	50.2	59.6	69.8	76.3	85.3	99.0
48	40.0	58.5	68.7	79.6	86.5	95.9	110.2

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	JU
Approved by:	MD

Project Data

Project Name	Knockrabo
Project Number	20-086
Client	Client
Architect	Architect
Status	Planning
Date	04/09/2024

Description		%	Area
Total Site Area		-	24,800m²
Paved Area	Total	62%	15,376m²
	Drained	75%	11,532m²
Soil Area	Total	38%	9,424m²
	Drained	20%	1,885m²

Soil Type:	Type 4
SPR Index (from FSR):	0.47
SAAR:	836mm
Rain Data:	Met Éireann
Climate Change Factor:	20%

Greenfield Runoff:

$Q_{BARrural}$ = 0.00108 x Area$^{0.89}$ x SAAR$^{1.17}$ x Soil$^{2.17}$

Area	=	0.0248km²	*… Total site area in km²*
SAAR	=	836mm	*… Standard Average Annual Rainfall in mm*
SOIL	=	0.47	*… The "SPR" index from FSR*

Note: Where a site is <0.5km², the Q $_{BARrural}$ formula should be applied for 0.5km² and the result factored based on the ratio of the actual site area and the applied area.

$Q_{BARrural}$ = 0.015m³/s
$Q_{BARrural}$ = 14.737 l/s
$Q_{BARrural}$ = 5.943 l/s/Ha

Return Period	1-year	30-year	100-year
Growth Factor	0.85	2.10	2.60
Q_{BAR} (l/s)	12.53	30.95	38.32
Q_{BAR} (l/s/Ha)	5.05	12.48	15.45
Allowable Discharge	14.74	14.74	14.74

Rainfall Data:

Rain Data From: Met Éireann Archive
Climate Change Factor: 20%

Duration	Return Period *(Years)*						
(Hours)	1	5	10	20	30	50	100
0.5	9.1	15.2	19.0	23.3	26.0	30.0	36.4
1	11.9	19.6	24.1	29.3	32.6	37.4	44.9
2	15.5	25.0	30.6	36.8	40.9	46.6	55.6
4	20.2	31.9	38.8	46.3	51.2	58.1	68.6
6	23.5	36.8	44.5	52.9	58.4	66.0	77.8
12	30.6	47.0	56.4	66.6	73.1	82.2	96.1
24	40.0	60.2	71.5	83.8	91.6	102.4	118.8
48	48.0	70.2	82.4	95.5	103.8	115.1	132.2

waterman moylan

Block S, EastPoint Business Park,
Alfie Byrne Road, Dublin D03 H3F4
t 01 664 8900 f 01 661 3618 e info@waterman-moylan.ie

Calculation By:	JU
Approved by:	MD

Criterion 1
River Protection Volume

Project Name	Knockrabo
Project Number	20-086
Client	Client
Architect	Architect
Status	Planning
Date	04/09/2024

1.1 Interception

Paved surfaces connected to drainage system	*24800m² x 0.62 x 1 =* 15,376.00m²	*24,800m² site area* *62% of the site is paved* *100% of the paved area*
Volume of Interception Storage	*15376m² x 5mm x 0.8 =* **61.50m³**	*Paved area directly drained* *5mm rainfall depth* *80% paved runoff factor*

1.2 Treatment Volume

Paved surfaces draining to public drainage network	*24800m² x 0.62 x 1 =* 15,376.00m²	*24,800m² site area* *62% of the site is paved* *100% of the paved area*
Volume of Treatment Storage	*15376m² x 15mm x 0.75 =* **172.98m³**	*Paved area directly drained* *15mm rainfall depth* *75% runoff from paved surfaces*

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

KNOCKRABO
DUBLIN, EUROPE

MC-7200 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-7200.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLOURS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-7200 CHAMBER SYSTEM

1. STORMTECH MC-7200 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUB-GRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm).
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS AS TO NOT DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUB-SURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-7200 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILISED OVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

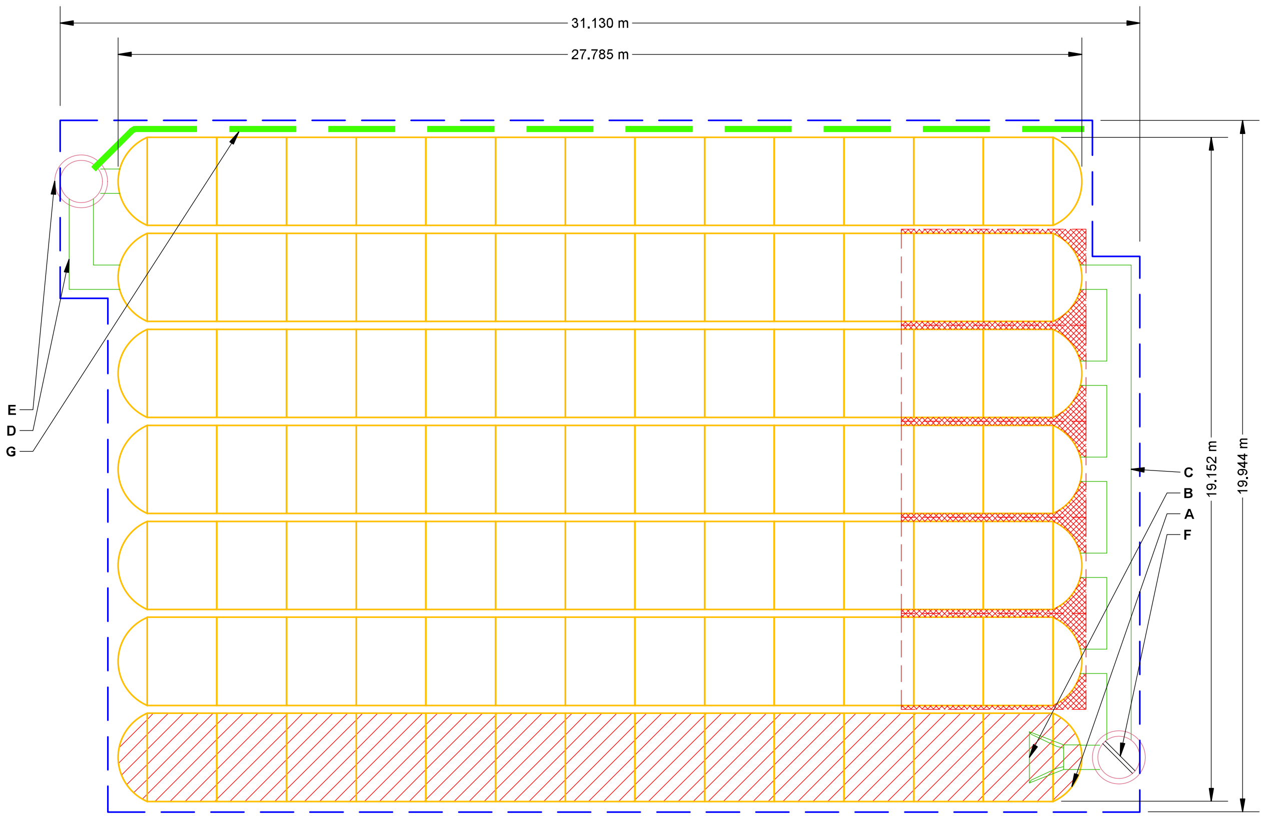
ISOLATOR ROW PLUS COMPONENTS SHOWN ON THIS DESIGN MAY NOT BE AVAILABLE IN THE SPECIFIED PROJECT REGION. PLEASE CONTACT YOUR LOCAL ADS REPRESENTATIVE OR E-MAIL ADSINTERNATIONAL@ADS-PIPE.COM FOR FURTHER INFORMATION

PROPOSED LAYOUT	
91	STORMTECH MC-7200 CHAMBERS
14	STORMTECH MC-7200 END CAPS
305	STONE ABOVE (mm)
229	STONE BELOW (mm)
40	STONE VOID
771.2	INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
595.2	SYSTEM AREA (m²)
102.1	SYSTEM PERIMETER (m)

CONCEPTUAL ELEVATIONS:	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	3.886
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	2.515
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	2.362
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	2.362
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	2.362
TOP OF STONE:	2.057
TOP OF MC-7200 CHAMBER:	1.753
600 mm x 600 mm BOTTOM MANIFOLD INVERT:	0.286
600 mm x 600 mm BOTTOM MANIFOLD INVERT:	0.286
600 mm ISOLATOR ROW PLUS INVERT:	0.286
600 mm BOTTOM CONNECTION INVERT:	0.286
BOTTOM OF MC-7200 CHAMBER:	0.229
UNDERDRAIN INVERT:	0.000
BOTTOM OF STONE:	0.000

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	600 mm BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	57 mm	
FLAMP	B	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	C	600 mm x 600 mm BOTTOM MANIFOLD, ADS N-12	57 mm	
MANIFOLD	D	600 mm x 600 mm BOTTOM MANIFOLD, ADS N-12	57 mm	
CONCRETE STRUCTURE	E	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		396 L/s OUT
CONCRETE STRUCTURE W/WEIR	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		1174 L/s IN
UNDERDRAIN	G	150 mm ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 5.334 m OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

KNOCKRABO
DUBLIN, EUROPE

DATE:
DRAWN: RM
PROJECT #:
CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

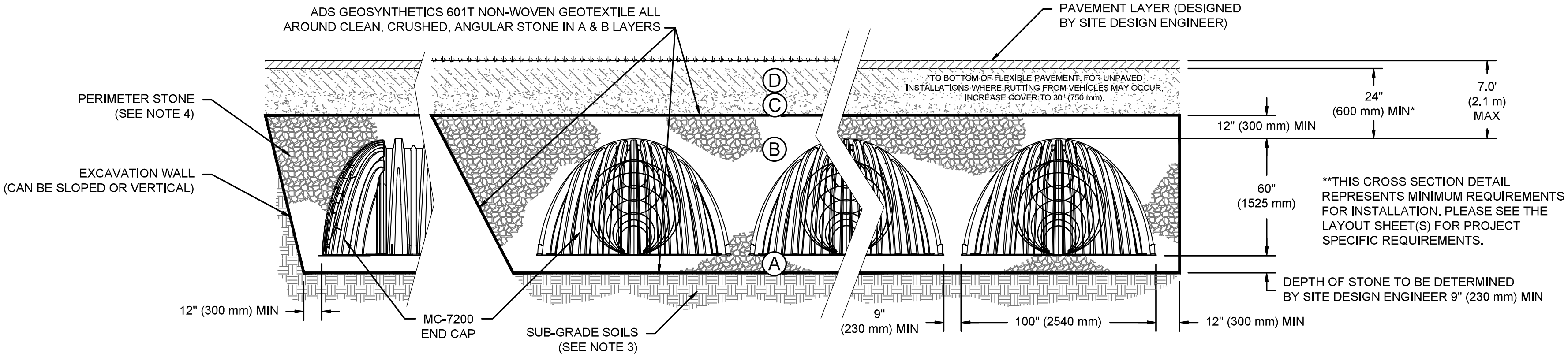
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

SCALE = 1 : 150

ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUB-BASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUB-GRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUB-BASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUB-BASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUB-GRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUB-BASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



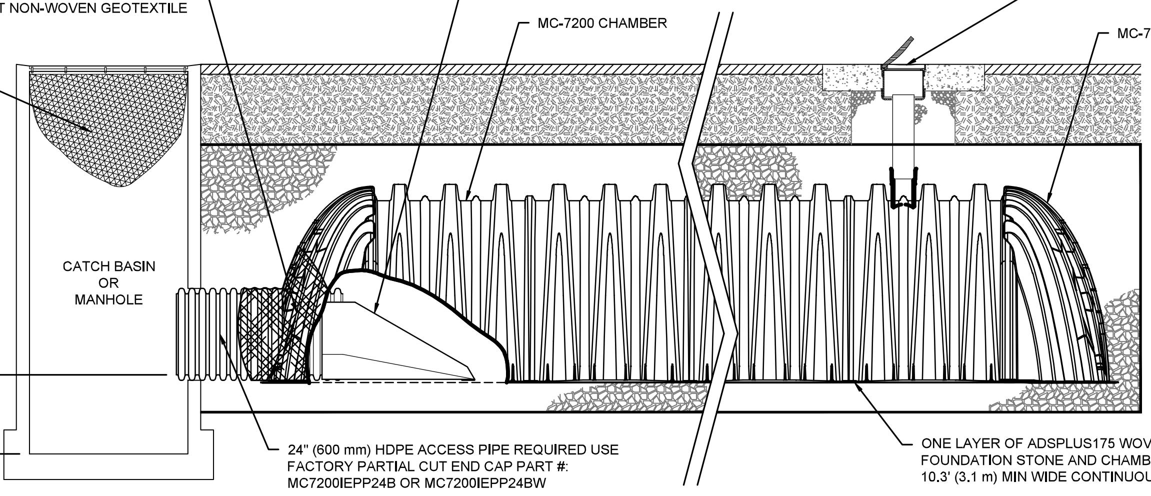
NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-7200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUB-GRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23°, AND C) CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLOURS.

KNOCKRABO
DUBLIN, EUROPE
DATE:
DRAWN: RM
PROJECT #:
CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473



MC-7200 ISOLATOR ROW PLUS DETAIL

NTS

ISOLATOR ROW PLUS COMPONENTS SHOWN ON THIS DESIGN MAY NOT BE AVAILABLE IN THE SPECIFIED PROJECT REGION. PLEASE CONTACT YOUR LOCAL ADS REPRESENTATIVE OR E-MAIL ADSINTERNATIONAL@ADS-PIPE.COM FOR FURTHER INFORMATION

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH-WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

KNOCKRABO
DUBLIN, EUROPE

DATE: | DRAWN: RM
PROJECT #: | CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

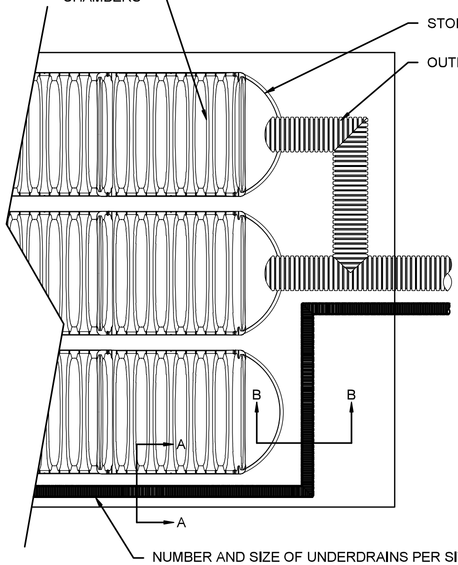
StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

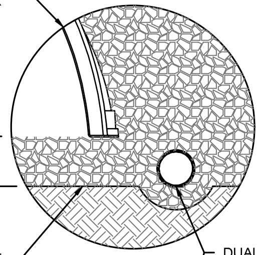
SHEET
4 OF 5

UNDERDRAIN DETAIL

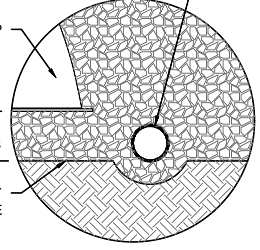
NTS



NUMBER AND SIZE OF UNDERDRAINS PER SITE DESIGN ENGINEER
4" (100 mm) TYP FOR SC-310 & SC-160LP SYSTEMS
6" (150 mm) TYP FOR SC-740, DC-780, MC-3500, MC-4500 & MC-7200 SYSTEMS



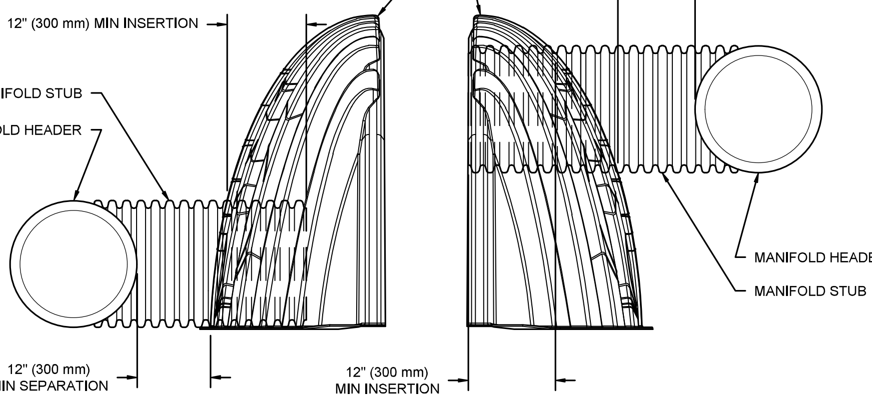
SECTION A-A



SECTION B-B

MC-SERIES END CAP INSERTION DETAIL

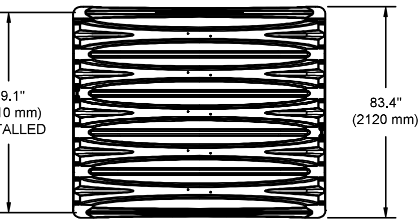
NTS

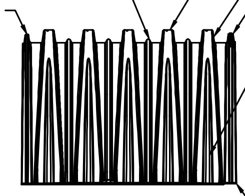


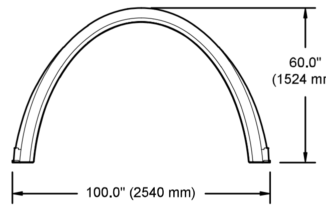
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

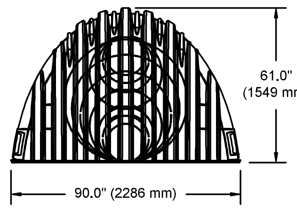
MC-7200 TECHNICAL SPECIFICATION

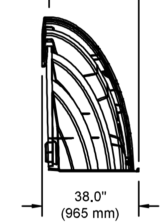
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 79.1"	(2540 mm X 1524 mm X 2010 mm)
CHAMBER STORAGE	175.9 CUBIC FEET	(4.98 m³)
MINIMUM INSTALLED STORAGE*	267.3 CUBIC FEET	(7.56 m³)
WEIGHT (NOMINAL)	205 lbs.	(92.9 kg)

NOMINAL END CAP SPECIFICATIONS

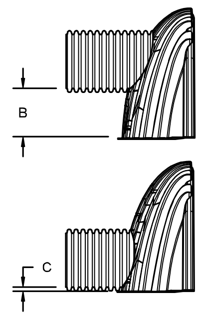
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC7200IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC7200IEPP06B		---	0.86" (22 mm)
MC7200IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC7200IEPP08B		---	1.01" (26 mm)
MC7200IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC7200IEPP10B		---	1.33" (34 mm)
MC7200IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC7200IEPP12B		---	1.55" (39 mm)
MC7200IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC7200IEPP15B		---	1.70" (43 mm)
MC7200IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC7200IEPP18TW			
MC7200IEPP18B		---	1.97" (50 mm)
MC7200IEPP18BW			
MC7200IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC7200IEPP24TW			
MC7200IEPP24B		---	2.26" (57 mm)
MC7200IEPP24BW			
MC7200IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC7200IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC7200IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-7200 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

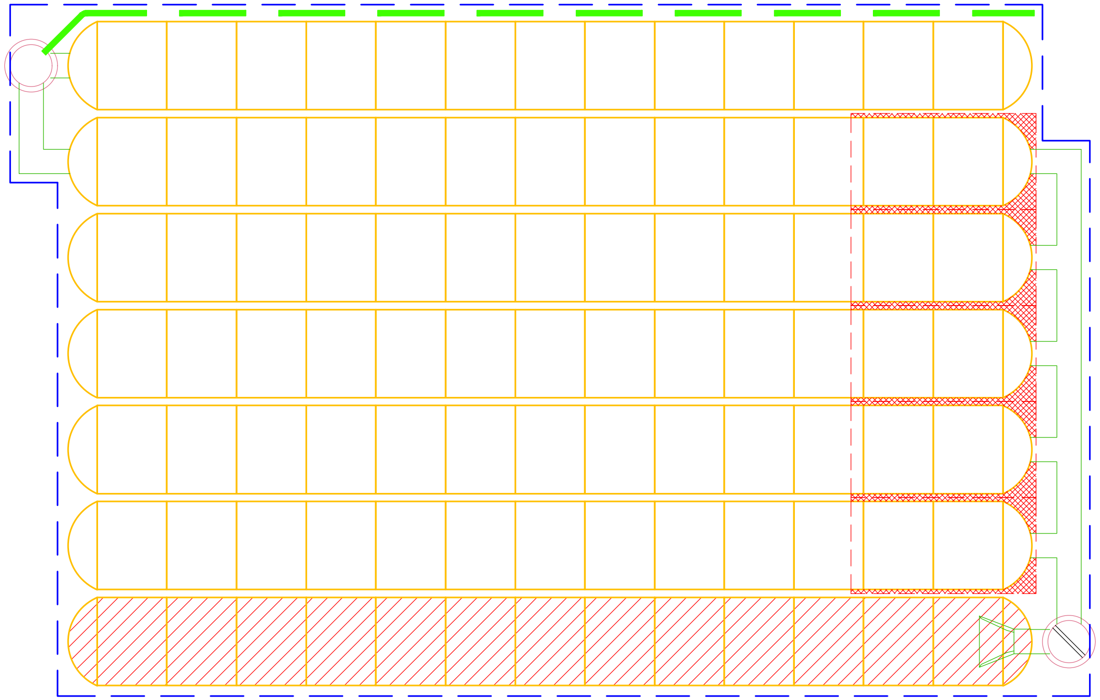
KNOCKRABO
DUBLIN, EUROPE

DRAWN: RM
CHECKED: N/A
DATE:
PROJECT #:

DATE	DRW	CHK	DESCRIPTION

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM



E. Roadplan Consulting - Quality Audit and Road Safety Audit

24134-01-001

PROPOSED HOUSING DEVELOPMENT
AT KNOCKRABO, MOUNT ANVILLE ROAD, DUBLIN 14

Stage 1 Quality Audit

(Incorporating a DMURS Street Design Audit, and Audits of Accessibility, Cycling, Walking and Road Safety)

for

Waterman Moylan

AUGUST 2024

ROADPLAN
CONSULTING

7, Ormonde Road
Kilkenny.
R95 N4FE

Tel: 056 7795800
info@roadplan.ie
www.roadplan.ie

DOCUMENT CONTROL SHEET

Project Title	Proposed Housing Development, Knockrabo, Mt Anville Rd, Dublin 14
Project No.	24134-01
Client	Waterman Moylan
Document Title	Stage 1 Quality Audit
Document No.	24134-01-001

Status	Author(s)	Reviewed By	Approved By	Issue Date
Draft 1	GH/GF	GF/GH	GF	19/8/2024
Final	GH/GF	GF/GH	GF	4/9/2024

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Roadplan Consulting has been commissioned by Waterman Moylan to carry out a Quality Audit of a proposed development at Knockrabo, Mount Merrion, Dublin.

1.2 The proposed development comprises the construction of a second phase of residential units to the Knockrabo Site. The development will also include dedicated car parking spaces, bike parking spaces, bicycle stores, bin stores, and allotment gardens.

1.3 The development is situated on Mount Anville Road.

1.4 Figure 1 below is a layout drawing of the development. Mount Anville Road has a speed limit of 50 km/h in the area of the proposed development.

Figure 1.1 – *Site Location Map and Site Layout for the development*

2. QUALITY AUDIT

2.1 Quality Audit is a defined process, independent of, but involving, the design team that, through planning, design, construction and management stages of a project provides a check that high quality places are delivered and maintained by all relevant parties, for the benefit of all end users. Quality Audit is a process, applied to urban roads, traffic management or development schemes, which systematically reviews projects using a series of discrete but linked evaluations and ensures that the broad objectives of place, functionality, maintenance and safety are achieved.

2.2 Quality Audit was introduced in the publication Design Manual for Urban Roads and Streets following concerns that in the design of new streets provisions made for motor vehicles frequently led to a poorly designed public realm. In an urban area there is a high level of competing demand from different classes of road users. A well-balanced street will have minimal visual clutter and obstacles; it will use durable materials and most importantly, will encourage a degree of negotiation between road users as they make their way through it.

2.3 Quality Audit involves various assessments of the impacts of a street scheme in terms of road safety, visual quality and the use of streets by the community. Access for disabled people, pedestrians, cyclists and drivers of motor vehicles is considered.

2.4 In the context of a Quality Audit, road safety assessment is considered to be an appropriate method of examining road safety issues as it incorporates both the hazard identification techniques used in road safety audit and formal risk assessment techniques. This allows the opportunity at an early stage for road safety issues to be considered in a more dynamic way within the design process, and to ensure that safety issues are considered as part of the design rather than after design work is completed.

2.5 The Quality Audit Team reports findings with suggestions for future action. It should be noted that, in a Quality Audit, it is not the intention that suggestions would be binding on the design team; they are offered for detailed consideration in the design process.

2.6 DMURS states that Quality Audits should consist of the following parts:

- DMURS Street Design Audit
- Individual Design Audits
- Quality Audit Report

In the case of this report the individual design audits comprise an RSA, an Accessibility audit, a Walking audit and a Cycle audit.

3. METHODOLOGY

3.1 The Audit Team was as follows:

- George Frisby, Chartered Engineer MIEI
- Glenn Hingerty, Chartered Engineer MIEI

3.2 Road safety, non-motorised users, visual quality, access for disabled and functionality were considered in the Quality Audit. This exercise focused on issues such as:

- the design rationale as it related to vehicle, cycle and pedestrian movements;
- pedestrian desire lines both to and through the site;
- access requirements for all modes of transport;
- access requirements for disabled people and other vulnerable users;
- any road safety concerns associated with the scheme;
- how the scheme is experienced by those entering it and moving around within the street, including how this affects road user behavior; and
- any other issues considered relevant to each constituent element of the Quality Audit process.

3.3 The site visit for this quality audit was carried out on 20th July 2024.

The documents provided for the audit were:

Drawing Number	Rev	Drawing Title
1307G-OMP-00-00-DR-A-1010	C1	Proposed Site Layout
KNB-WMC-PH2-ZZ-DR-C-P100	-	Site Location Plan

Copies of these audited drawings are contained in Appendix A.

Details of drainage or road lighting are not provided. It is assumed that adequate layouts will be provided for each.

In accordance with DMURS Advice Note No. 4 May 2019 (contained on https://www.dmurs.ie/supplementary-material) a Quality Audit should always contain a DMURS Street Design Audit and Other Design Audits (as required). Section 4 of this report contains the Street Design Audit and Section 5 contains the Other Design Audits (Road Safety, Walking, Cycling, Accessibility). The Street Design Audit is in the format provided as a template on the DMURS website.

4. STREET DESIGN AUDIT

CONNECTIVITY			
Key Issues	**Key DMURS Reference**	**Audit Suggestion**	**Design Team Response**
Strategic routes/major desire lines been identified and are clearly incorporated into the design.	3.1 – Integrated Street Network 3.2.1 – Movement Function 3.3.1 – Street layouts 3.3.4 - Wayfinding	3.2.1 – Not all pedestrian desire lines are met and in some cases the infrastructure is lacking, substandard or has topographical constraints that are unclear. 3.2.1 – No clear cycle desire lines. It is unclear how cyclists will tie into any future GDA cycle network.	3.2.1 - The road layout is generally orthogonal, with suitable pedestrian desire line connections adjacent and through the open spaces and along the Knockrabo Way. 3.2.1 - The proposed development is a home zone with 20km/h vehicle speed limit with no through traffic and with traffic calming measures proposed. National cycle design manual allows for mixed traffic in such circumstances and no segregated cycleways are proposed.
Multiple points of access are provided to the site/place, in particular for sustainable modes.	3.3.1 – Street Layouts 3.3.3 – Retrofitting [1]	3.3.1 – Enhanced permeability through the site and to/from key trip generators and adjacent bus stops should be considered.	3.3.1 –. The street layout is generally orthogonal, with suitable pedestrian desired line connection to bus stop. The connection is adjacent and through the open spaces. Drawings has been updated to reflect. Section 3.3.1 of DMURS notes that street networks that are generally orthogonal in nature are the most effective in terms of permeability (and legibility).

[1] *When connecting with existing communities a detailed analysis and extensive community consultation should be carried out to identify the optimal location for connections (refer also to the NTA Permeability in Existing Urban Areas: Best Practice Guide).*

CONNECTIVITY			
Key Issues	**Key DMURS Reference**	**Audit Suggestion**	**Design Team Response**
Accessibility throughout the site is maximised for pedestrians and cyclists, ensuring route choice.	3.3.1 – Street Layouts 3.3.2 – Block Sizes 3.4.1 – Vehicle Permeability	3.3.1 – Pedestrian and cyclist desire lines are not exhaustive.	3.3.1- Pedestrian crossings interconnect main pedestrian links ensuring permeability. A continuous segregated footpaths has been provided including along the Knockrabo Way. The proposed development is a home zone with 20km/h vehicle speed limit with no through traffic and with traffic calming measures proposed. National cycle design manual allows for mixed traffic in such circumstances and no segregated cycleways are proposed. Drawings has been updated to reflect.
Through movements by private vehicles on local streets are discouraged by an appropriate level of traffic calming measures.	3.2.1 – Movement Function 3.2.2 – Place Context 3.4.1 – Vehicle Permeability	No Comment	

SELF-REGULATING STREET ENVIRONMENT			
Key Issues	**Key DMURS Reference**	**Audit Suggestion**	**Design Team Response**
A suitable range of design speeds have been applied with regard to context and function.	3.2.1 – Movement Function 3.2.2 – Place Context 4.1.1 – A Balanced Approach to Speed [2]	4.1.1 – There is no evidence of grade changes or speed ramps within the residential areas; these could be used at all crossings and junctions. This would support accessibility and traffic calming.	4.1.1 - Speed ramps are provided and drawings has been updated to reflect.
The street environment will facilitate the creation of a traffic calmed environment via the use of 'softer' or passive measures.	4.2.1 – Building Height and Street Width 4.2.2 – Street Trees 4.2.3 – Active Street Edges 4.2.4 – Signage and Line Marking 4.2.7 – Planting 4.4.2 – Carriageway Surfaces 4.4.9 – On-Street Parking Advice Note 1 – Transitions and Gateways	4.2.1 – No information on building heights is provided within the drawings. 4.2.4 – Adequate signage and road markings should be provided according to the TSM and DMURS at all junctions and elsewhere as required.	4.2.1 – Building height are standard and proportional to street withs to create sense of enclosure. 4.2.4 – Adequate signage has now been provided and drawings have been updated.
A suitable range of design standards/ measures have been applied that are consistent with the applied design speeds.	4.4.1 – Carriageway Widths 4.4.4 – Forward Visibility 4.4.5 – Visibility Splays 4.4.6 – Alignment and curvature 4.4.7 – Horizontal and Vertical Deflections Advice Note 1 – Transitions and Gateways	4.4.4 – Forward visibility at all bends should be kept clear of all obstructions including parked vehicles, and vegetation/landscaping. 4.4.5 – Visibility Splays at all junctions should be kept clear of all obstructions including parked vehicles, walls, and vegetation/landscaping. This includes future maintenance of tree growth in proximity to junction visibility splays.	4.4.4 - DMURS recommended Stopping sight distance for 20km/h is 14m. Parking, landscaping and street furniture is designed as not to have impact on the overall bends intervisibility. 4.4.5 - Visibility Splays at all junctions have been examined and drawings updated.

[2] *Refer also to the National Speed Limit Guidelines*

SELF-REGULATING STREET ENVIRONMENT			
Key Issues	**Key DMURS Reference**	**Audit Suggestion**	**Design Team Response**
PEDESTRIAN AND CYCLING ENVIRONMENT			
Key Issues	Key DMURS Reference	Audit Suggestion	Design Team Response
The built environment contributes to the creation of a safe and comfortable pedestrian environment.	4.2.1 – Building Height and Street Width 4.2.3 – Active Street Edges 4.2.5 – Street Furniture 4.4.9 – On-Street parking	4.2.5 – Information on streetlights throughout the scheme is not provided within the drawings. It is assumed that adequate lighting will be provided. Its effectiveness should not be impacted by trees or parked vehicles on streets.	4.2.5 – Adequate lighting will be provided.
Footpaths are continuous and wide enough to cater for the anticipated number of pedestrian movements.	3.2.1 – Movement Function 3.2.2 – Place Context 4.2.5 – Street Furniture 4.3.1 - Footways, Verges and Strips 4.3.2 - Pedestrian Crossings	4.2.5 – Segregated footways have been provided and appear to be clear of obstructions which may reduce their effective width. 4.2.5 – Sheffield stands should be in designated area separated by kerbs and recessed away from footways. 4.2.5 – Benches may be a useful addition to the landscaped area. This will allow pedestrian with a mobility impairment to rest.	4.2.5 - Pedestrian routes are generally 2m wide. 4.2.5 – Drawings have been updated to reflect. 4.2.5 – This item will be considered at detail design stage.
Cycling facilities will cater for cyclists of all ages and abilities.	3.2.1 – Movement Function 3.2.2 – Place Context 4.3.5 - Cycle facilities	3.2.1 – Cyclists will be expected to mix amongst general vehicular traffic at the tie-ins to certain edged of the scheme. There is limited proposed tie-in provision for future cycle schemes in the GDA Cycle network strategy. 4.3.5 – There does not appear to be adequate secured cycle facilities, for	3.2.1 - The proposed development is a home zone with 20km/h vehicle speed limit with no through traffic and with traffic calming measures proposed. National cycle design manual allows for mixed traffic in such circumstances and no segregated cycleways are proposed.

SELF-REGULATING STREET ENVIRONMENT			
Key Issues	**Key DMURS Reference**	**Audit Suggestion**	**Design Team Response**
		cargo cycles, provided. These will be particularly important with an increased cycle usage in the area.	4.3.5 - Secured cycle facilities, for cargo cycles are provided within apartment blocks.
The particular needs of visually and mobility impaired users been identified and incorporated in the design.	4.2.5 - Street Furniture 4.3.1 - Footways, Verges and Strips 4.2.5 - Street Furniture 4.3.2 - Pedestrian Crossings 4.3.4 - Pedestrianised and Shared Surfaces	4.3.1 – No Tactile Paving has been proposed within the development. This will compromise navigation abilities of those with vision impairments and should be rectified. 4.3.1 – The existing topography may result in challenging gradients for pedestrians with mobility impairments. No Tactile Paving has been proposed in the development.	4.3.1 – Tactile paving is provided at all crossings and drawings updated to reflect. 4.3.1 – Tactile paving is provided at all crossings and drawings updated to reflect.

VISUAL QUALITY			
Key Issues	**Key DMURS Reference**	**Audit Suggestion**	**Design Team Response**
The landscape plan responds to the street hierarchy and the value of the place.	3.2.1 – Movement Function 3.2.2 – Place Context 4.2.2 – Street Trees 4.2.7 – Planting Advice Note 1 – Transitions and Gateways	4.2.7 – Limited planting is proposed. This may be improved by integrating planting with SuDS measures, especially given the gradients.	4.2.7 – Planting has been integrated where possible.
Street furniture is orderly placed.	3.2.1 – Movement Function 3.2.2 – Place Context 4.2.5 - Street Furniture 4.3.1 - Footways, Verges and Strips	4.3.1 – Footways largely appear clear of proposed obstacles that may reduce their effective width; however, it is not clear where bins will be stored on collection day. This may pose a hazard for those with visual and mobility impairments.	4.3.1 - Bins will be stored in designated areas on collection day.
The use of signage and line marking has been minimised.	3.2.1 – Movement Function. 3.2.2 – Place Context. 4.2.4 - Signage and Line Marking.	No comment	
Materials and finishes used throughout the scheme have been selected from a limited palette and respond to the value of the place?	3.2.1 – Movement Function 3.2.2 – Place Context 4.2.6 – Materials and Finishes 4.2.8 – Historic Contexts 4.3.2 – Pedestrian Crossings 4.4.2 – Carriageway Surfaces Advice Note 2 – Materials and Specifications	4.2.6 – It is not clear if there is clarity between footways and roadways for pedestrians with visual impairments.	4.2.6 – Tactile paving is provided at all crossings.

ADDITIONAL COMMENTS

5. ROAD SAFETY

5.1 Issue

It is unclear if the required sightlines are achievable at the junctions in Figure 5.1 due to the presence of proposed parking. This may lead to vehicular collisions.

Figure 5.1 – *Poor Visibility Splays*

Suggestion

Ensure adequate visibility splays at all junctions.

5.2 Issue

A number of low radius bends are proposed within the development along the access roads. Two vehicles may have difficulty in passing one another on these bends which may lead to side swipe collisions. Stopping sight distance may also be restricted by boundaries and/or parked vehicles on the inside of these bends.

Figure 5.2 – *Low Radius Bends*

Suggestion

Revise the layout at the bends if necessary to ensure that two vehicles can safely pass one another on these bends and that appropriate stopping sight distances is provided throughout the bends.

5.3 **Issue**

There is limited traffic calming provided on the access roads which will be quite steep due to the topography. This may induce excessive speeds on a residential street with an increased risk of vehicle collisions and injuries to vulnerable road users.

Suggestion

Ensure adequate provision of traffic calming measures.

5.4 **Issue**

The proposed development will have three vehicle entrances in close proximity to one another onto Mount Anville Road. Additional vehicular accesses onto Mount Anville Road may lead to increased collision risk particularly for pedestrians and cyclists. In additional, turning areas for vehicles within the smaller sites appear to be restricted which may lead to vehicles reversing out onto Mount Anville Road or parking on the carriageway/footpath on Mount Anville Road in the case of refuse and delivery vehicles. It is also noted that some of the vehicle access points may not cater for opposing vehicles simultaneously entering and exiting the access.

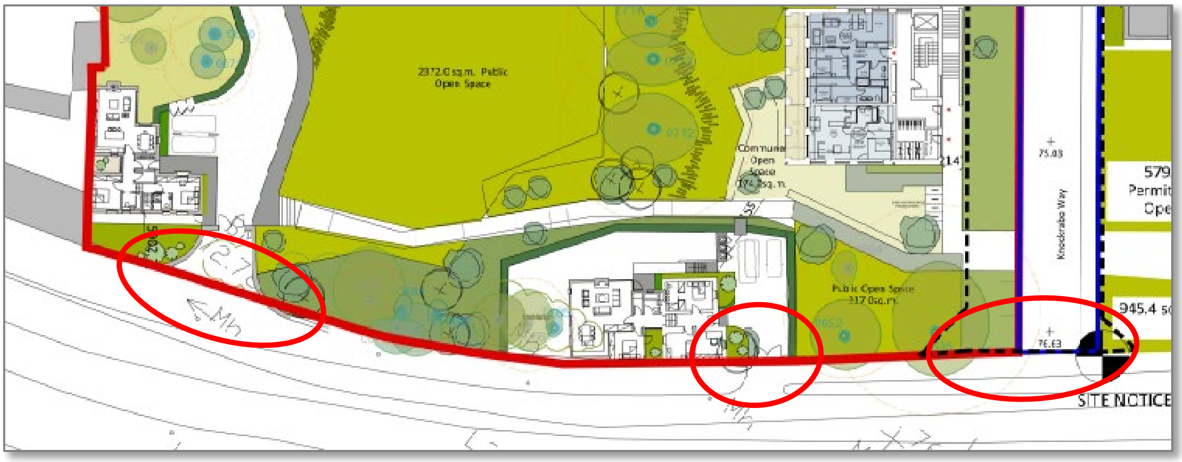


Figure 5.3 – *Three adjacent vehicular entrances*

Suggestion

Rationalise the vehicular access points and ensure that they are adequately designed to cater for opposing vehicles simultaneously entering and exiting. In addition, ensure adequate turning facilities within all areas of the proposed development to cater for all vehicle types.

5.5 **Issue**

No Swept Path analyses have been carried out for the scheme for any vehicle type. It is unclear if all vehicles can make required manoeuvres, including turning into/out of streets at junctions and entering/exiting proposed parking spaces. If manoeuvrability is not achievable this may result in vehicles colliding with each other or overrunning footways and injuring pedestrians.

Suggestion

Ensure adequate manoeuvrability is achievable within the proposed streetscape.

5.6 **Issue**

No signage or road markings are shown to be provided at junctions within the proposed development, at the proposed accesses with Mount Anville Road or at the existing access of Knockabro Avenue with Mount Anville Road.

Suggestion

Ensure adequate signs and road markings are provided at all junctions.

5.7 **Issue**

Priority between pedestrians and motorists at the proposed two new accesses onto Mount Anville Road is unclear. This may lead to collision between pedestrians and motorists at this location

Suggestion

Provide an adequate layout at these locations to reduce the risk of pedestrian collisions.

6. WALKING

6. 1 Issue

Inter-visibility between pedestrians and motorists at pedestrian crossings within the proposed development may be compromised by landscaping and parking locations. This may increase the risk of collisions and pedestrian injuries at these locations including, but not limited to, that circled in Figure 6.1.

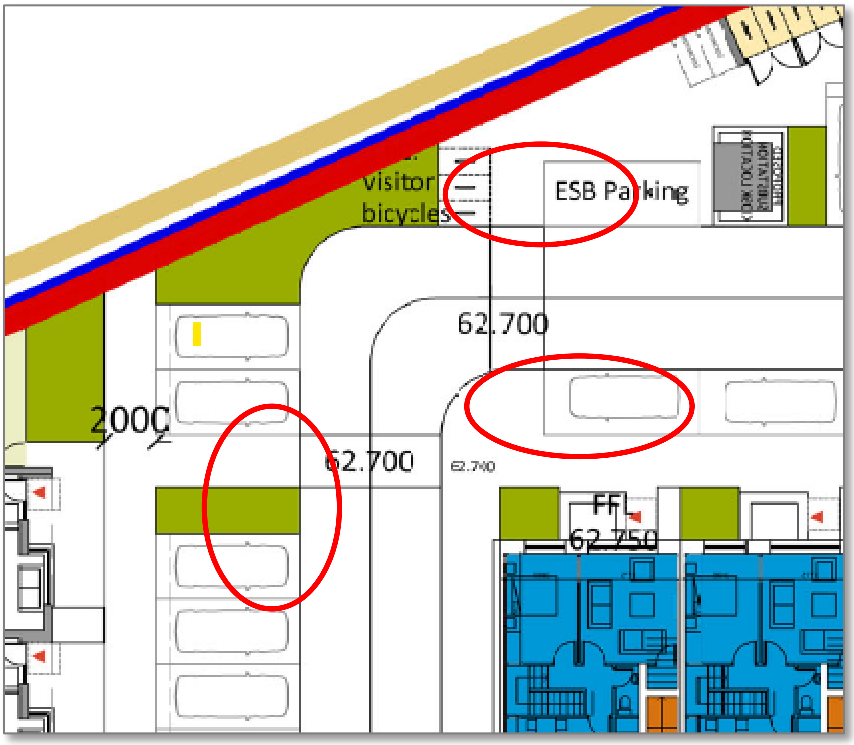


Figure 6.1 – *Compromised Pedestrian / Motorist Invisibility*

Suggestion

Revise the layout if necessary to ensure that adequate intervisibility is provided between pedestrians and motorists at all pedestrian crossing locations.

6. 2 Issue

Some pedestrian desire lines, on an east-west orientation, are compromised by continuous car parking (e.g. Figure 6.2). This will increase the length of walking required for certain journeys and thereby make walking more unattractive.

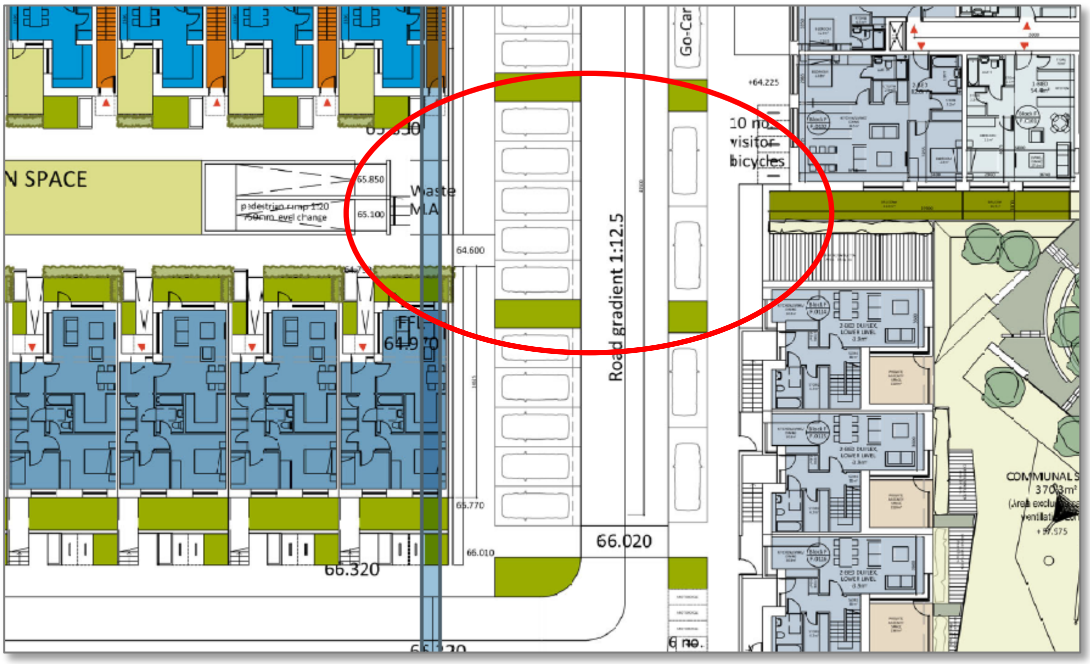


Figure 6.2 – *Compromised Pedestrian / Motorist Invisibility*

Suggestion

Create pedestrian infrastructure, including road crossings, to ensure adequate pedestrian permeability.

6.3 **Issue**

There is no existing footpath along the west side of Knockabro Avenue. A lack of an adequate footpath along the west side of Knockabro Avenue may result in pedestrians walking along the carriageway when travelling to and from the proposed development where they would be at an increased risk of being struck by a passing vehicle.

Suggestion

Provide a continuous footpath along the west side of Knockabro Avenue.

6.4 **Issue**

The pedestrian desire lines shown in Figure 6.3 will not be met by infrastructure and pedestrians will either walk along the roadway or have to cross the roadway twice in some locations.

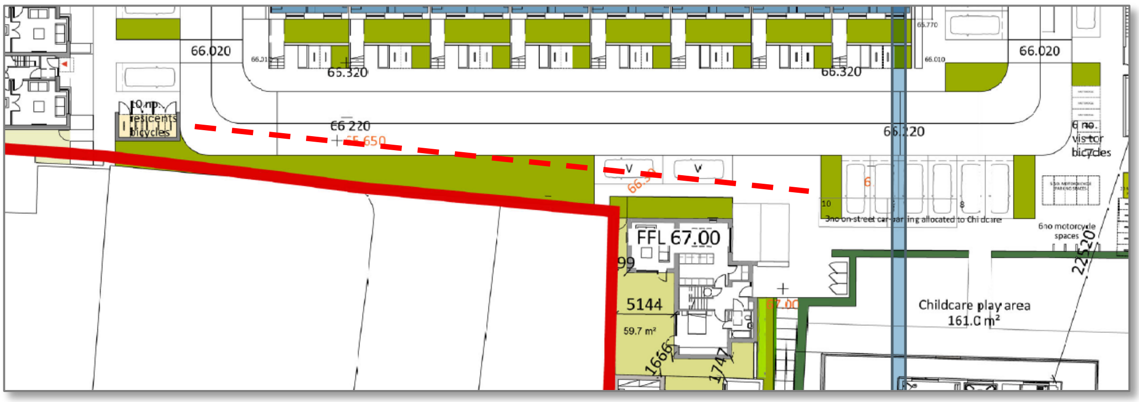


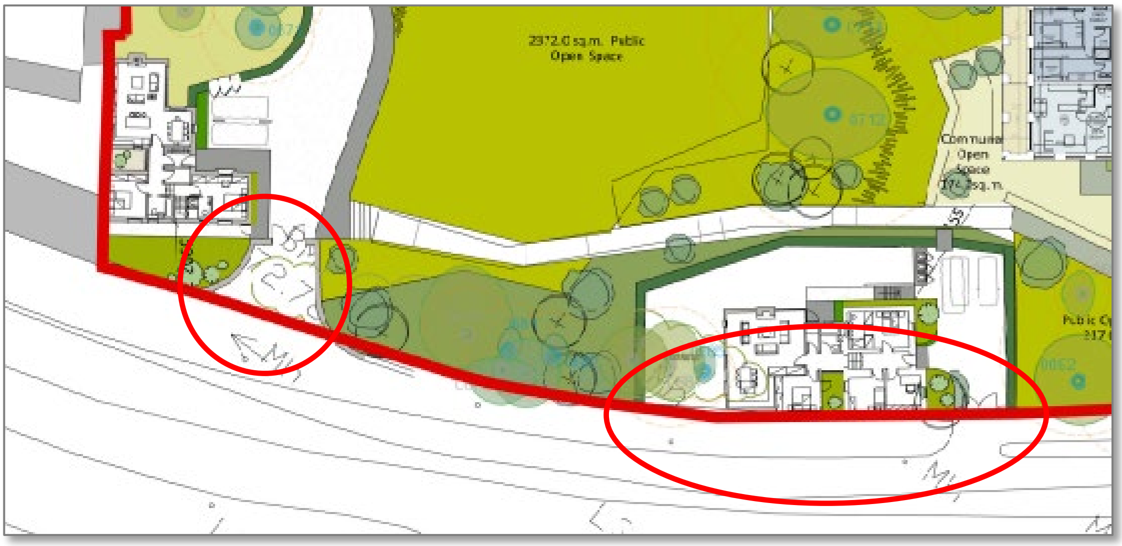
***Figure 6.3 –** Compromised Pedestrian / Motorist Invisibility*

Suggestion

Create pedestrian infrastructure and footways to ensure pedestrian desire lines are met.

6. 5 **Issue**

It is unclear if adequate pedestrian access will be provided to all sections of the proposed development from the existing footpath on Mount Anville Road. A lack of appropriate pedestrian access may force pedestrian to use vehicle access points when accessing the proposed development.



Suggestion

Provide adequate pedestrian access to all sections of the proposed development from the existing footpath on Mount Anville Road.

7. CYCLING

7. 1 **Issue**

It is unclear if proposed cycle storage will be adequate for cargo cycles. This may cause cyclists to lock cycles to other street furniture, creating a navigation risk and reducing the effective widths of footways, especially for cargo cycle users. Bolted Sheffield Stands may increase risk of cycle theft as they can be easily removed. It is also unclear if there is adequate storage for all cycle types for residents in mid-terrace housing.

Suggestion

Provide adequate volumes secure storage for all cycle types. Sheffield Stands should be concreted into the ground to negate theft.

7. 2 **Issue**

As there is no proposed cycle infrastructure in the development, it is not clear how the development will tie into the proposed 'Primary Orbital' Route (Maroon in Figure 7.1) or 'Secondary' (Blue in Figure 7.1) adjacent or within the development. A lack of coordination may reduce the effectiveness of these schemes and undermine potential to achieve cyclist desire lines.

Figure 7.1 – *GDA Cycle Network (www.nationaltransport.ie/wp-content/uploads/2023/01/2022-GDA-Cycle-Network.pdf)*

Suggestion

Consider wider network impacts of future schemes to support Provide a network of segregated cycleways through the development. Consult with Dublin City Council and National Transport Authority to ensure the development is futureproofed.

7. 3 **Issue**

It is noted that there will be steep inclines in the development due to the existing topography. It is unclear what impact this will have on cycling within the development.

Suggestion

Proposed gradients should be reviewed to ensure none are too excessive for cycle usage within the development.

8. ACCESSIBILITY

8. 1 **Issue**

Disabled parking spaces are provided within the development. However, no dropped kerbs are shown to be provided to allow a mobility impaired pedestrian to access the footpath adjacent to the disabled parking spaces.

Suggestion

Provide dropped kerbs to ensure mobility impaired pedestrians can directly access the adjacent footpath at all disabled parking spaces.

8. 2 **Issue**

Pedestrian crossing facilities including dropped kerbs and tactile paving are not shown to be provided at pedestrian crossing locations within the development including either side of the existing and proposed junctions with Mount Anville Road. A lack of or inappropriate pedestrian facilities may increase the risk of pedestrian collisions with other road users. Pedestrians and in particular mobility impaired pedestrians may have difficulty in crossing the access road.

Suggestion

Adequate pedestrian facilities to ensure safe connectivity into and around the development should be provided.

8. 3 **Issue**

Pedestrian crossing facilities including dropped kerbs and tactile paving are not shown to be provided at pedestrian crossing locations between the proposed development and the existing development on the east side of Knockabro Avenue. A lack of or inappropriate pedestrian facilities may increase the risk of pedestrian collisions with other road users. Pedestrians and in particular mobility impaired pedestrians may have difficulty in crossing Knockabro Avenue.

Suggestion

Adequate pedestrian facilities to ensure safe connectivity between the proposed development and the existing development on the east side of Knockabro Avenue should be provided.

8. 4 **Issue**

There are a number of steps proposed within the development. These do not appear to feature railings or relevant tactile paving. This may prove challenging for pedestrians with vision or mobility impairments. In addition, it is unclear if alternative access routes are provided for wheelchair users where steps are located along the access route.

Suggestion

Ensure adequate provision of tactile paving and railings as appropriate. Provide alternative ramped access for wheelchair users.

8. 5 **Issue**

Due to the location of vehicular parking (between footway and carriageway – separated from housing) relative to housing units, it is not clear how electric car users will charge their vehicle without running electrical leads across the footways between parking and housing. This may post a tripping hazard for pedestrians, especially those with a vision impairment.

Suggestion

Ensure ample opportunity for motorists to charge electric vehicles without trailing cables. Provide communal electric car chargers. Rearrange parking as required.

8. 6 **Issue**

The proposed disabled bays do not include dimensions. It is unclear if they will be adequate for accessibility requirements.

Suggestion

Ensure adequate accessibility of disabled bays.

8. 7 **Issue**

It is unclear what the refuse collection strategy is for this development. Most road edges in the development feature parking in designated bays. This creates a risk that refuse bins will be left on the roadway and block sightlines or left on the segregated footways and thereby reduce the effective width thereof resulting in navigation challenges, particularly for those with vision or mobility impairments.

Suggestion

Revise refuse collection strategies in conjunction with infrastructure provision. Install singular/centralised bin storage areas.

9. QUALITY AUDIT FEEDBACK FORM

Scheme: Proposed Housing Development at Knockrabo, Mount Anville

Document Number: 24134-01-001

Date Audit Completed: 16th August 2024

Paragraph No. in Safety Audit Report	To Be Completed By Designer			To Be Completed by Audit Team Leader
	Problem accepted (yes/no)	Recommended measure Accepted (yes/no)	Describe alternative measure(s). Give reasons for not accepting recommended measure. Only complete if recommended measure is not accepted.	Alternative measures or reasons accepted by auditors (yes/no)
5.1	yes	yes	--	--------------
5.2	no	no	DMURS recommended Stopping sight distance for 20km/h is 14m. Parking, landscaping and street furniture is designed as not have impact on the overall bends intervisibility. See WM drawing P111 for bends autotrack and SSD.	Yes
5.3	yes	yes	--	---------------
5.4	yes	In part	All three vehicular accesses onto Mount Anville Road are existing entrances and include protected structures. Where simultaneous entering and exiting is not possible a priority will be given to the incoming vehicle from public road. According to the TTA only 9no. trips are expected to be generated during AM peak hour. Service and delivery vehicles will use Knockrabo Way access. See WM drawing P112 for autotrack turning movements. For refuse collection strategy please see Chapter 02 of the OMP Architect's Design Statement and the AWN Operational Waste Management Plan.	Noted
5.5	yes	yes	--	--------------
5.6	yes	yes	--	--------------
5.7	yes	In part	All three vehicular accesses onto Mount Anville Road are existing entrances and include protected structures. A 2m wide footpath has	Noted

			been provided west of Knockrabo Way to tie into the existing footpath on Mount Anville Road.	
6.1	yes	no	The proposed development as designed is a low speed (20km/h), low flow environment. The proposed 90 degree bends have traffic calming effect and DMURS compliant corner radii. Parking, landscaping and street furniture is designed as not have impact on the overall bends intervisibility between pedestrians and vehicles. See WM drawing P111.	Yes
6.2	no	no	Pedestrian crossings are provided 20m north and south of the indicated area. These crossings interconnect main pedestrian links ensuring permeability.	Yes
6.3	yes	yes	---------------------------------------	-------------
6.4	yes	no	The proposed development as designed is a low speed, low flow environment and an area of higher pedestrian activity.	Noted
6.5	yes	no	Both existing access gates on Mount Anville Road are protected structures. Provision of a pedestrian access at the Gate House will be examined. The Gate Lodge West is a private property entrance.	Noted
7.1	yes	yes	--	-------------
7.2	no	no	The proposed development is a home zone with 20km/h vehicle speed limit with no through traffic and with traffic calming measures proposed. National cycle design manual allows for mixed traffic in such circumstances and no segregated cycleways are proposed.	Yes
7.3	yes	no	There are some steep gradients but only for a limited length of the road where unavoidable due to site topography. All road gradients are DMURS compliant.	Noted
8.1	yes	yes	--	--------------
8.2	yes	yes	--	--------------
8.3	yes	In part	Within the proposed development red line.	Noted
8.4	yes	yes	--	------------
8.5	yes	yes	--	--------------

8.6	yes	yes	--	------------
8.7	yes	yes	--	------------

Safety Audit
Signed off ……………………………… Design Team Leader

Print Name ……. .Jana Ulicna MSc.……….…………... Date 02/09/2024

Safety Audit

Signed off ……… ……..…… Audit Team Leader

Print Name ……George Frisby ……………………. Date ……3/9/2024…………

Please complete and return to: Roadplan Consulting,
7, Ormonde Road,
Kilkenny.
E-mail: info@roadplan.ie

APPENDIX A – DRAWINGS

Proposed Site Layout

PLEASE REFER TO ENGINEERS DRAWINGS FOR PROPOSED ROAD LEVELS & SITE SERVICES LAYOUT AND TO LANDSCAPE ARCHITECTS'S DRAWINGS FOR LANDSCAPING PROPOSALS & PROPOSED BOUNDARY TREATMENTS. ALL DIMENSIONS IN MILLIMETERS. ALL LEVELS (IN METRES) RELATE TO THE MALIN HEAD DATUM.

- APPLICATION SITE OUTLINES IN RED
- LANDS WHICH ABUT SUBJECT SITE AND ARE UNDER CONTROL OF THE APPLICANT
- RESERVATION FOR PROPOSED DUBLIN EASTERN BYPASS CORRIDOR
- OUTLINE OF RESERVATION TO PROVIDE POSSIBLE POTENTIAL FUTURE ACCESS TO DEBP CORRIDOR, AS PERMITTED UNDER D17A/1124
- SITE NOTICE LOCATION

OS MAP REF:

ORDNANCE SURVEY IRELAND LICENCE CYAL50378517
COPYRIGHT ORDNANCE SURVEY IRELAND AND GOVERNMENT OF IRELAND 2024

HISTORIC 6" LATEST EDITION

ORDNANCE SURVEY IRELAND (OSI) DATA SOURCE / REFERENCE: PRIME2

MAP SHEETS:
3392-04 3392-03
3392-09 3392-08

CENTRE POINT COORDINATES: X,Y=718425.68295,728718.0075
DATA EXTRACTION DATE: 19-AUG-2024

Revision Description	Date	Rev. No.	Issued by
Suitable for Information	30-07-2024	P11	SK
Suitable for Information	21-08-2024	P12	SK
Suitable for Information	22-08-2024	P13	SK
Suitable for Review & Acceptance	23-08-2024	P14	SK
Suitable for Information	29-08-2024	P15	SK
Suitable for Review & Acceptance	04-09-2024	P16	SK
Suitable for Information	05-09-2024	P17	SK
Suitable for Information	27-09-2024	P18	SK
Suitable for Review & Acceptance	11-10-2024	P19	SK
Suitable for Coordination	15-10-2024	P20	SK

Any reference to fire safety design or performance is presented for coordination purposes only. Refer only to the granted Fire Safety Certificate, and fire consultant's information for fire safety design, specification and performance.

Figured dimensions only to be used. This drawing is copyright of O'Mahony Pike Architects Ltd. All information is shared as per approved use in accordance with ISO19650-2:2018, Table 5; Standard Codes for Suitability of Models and Documents and the BEP. If the 'Status' field is empty, this information has been shared at S0 - WIP.

o'mahony pike
architecture|urban design
email: info@omahonypike.com
tel: +353 1 202 7400
fax: +353 1 283 0822
www.omahonypike.com

Dublin
The Chapel
Mount St. Anne's
Milltown, Dublin 6
D06 XN52 Ireland

Cork
One South Mall
Cork City
Co. Cork
T12 CCN3 Ireland

Project Code: N/A
Project Lead: SD
Drawn By: SK
Job No.: 1307G
Purpose: Suitable for Coordination
Scale @ A1: 1:500
Date Printed: 15-10-2024
Current Rev.: P20
Status: S1

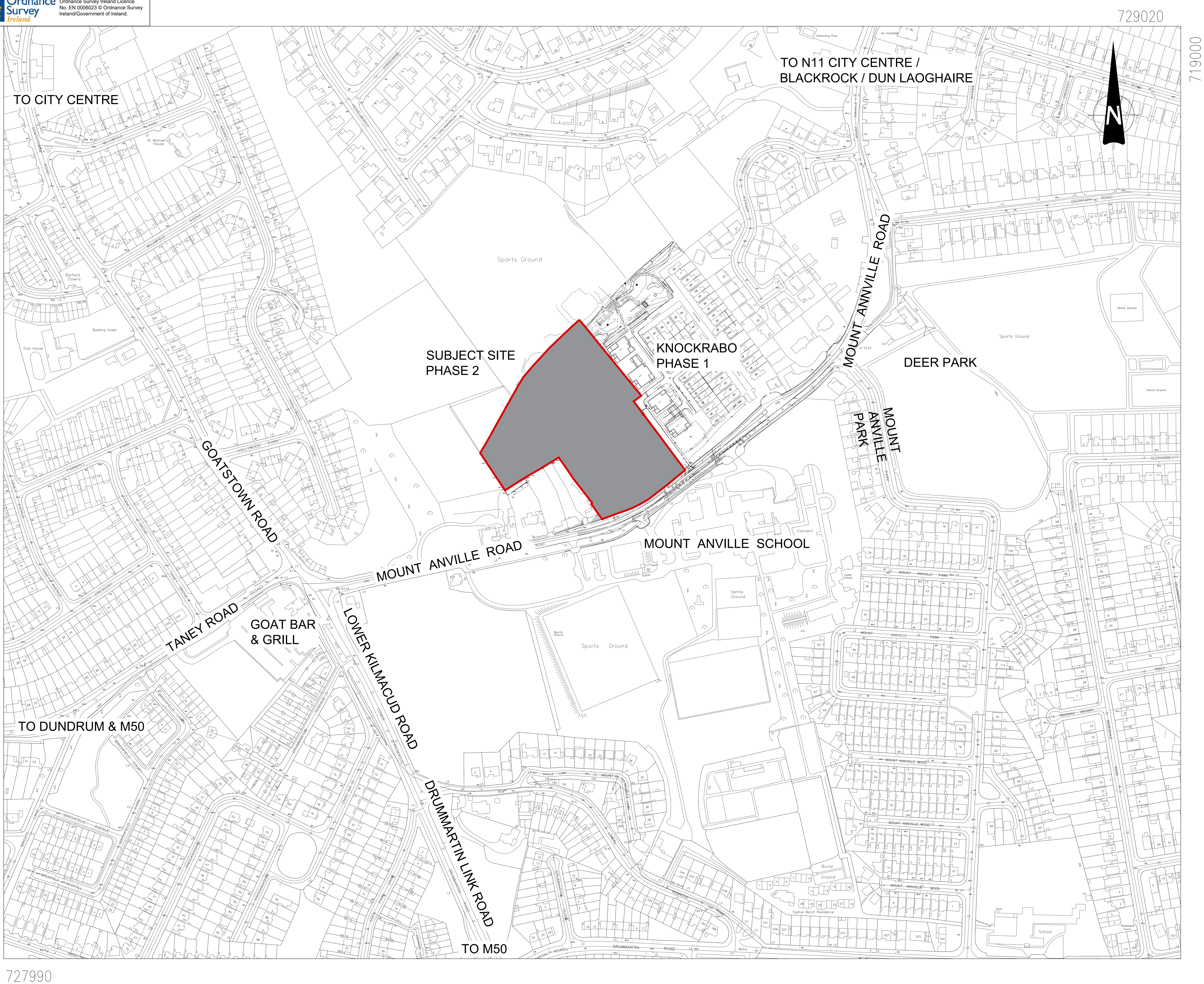
Project: Knockrabo Phase 2
Location: Mt. Anville Road, Dublin 14
Client: KIDAC

Drawing Title: Proposed Site Layout
Drawing No.: 1307G-OMP-00-00-DR-A-1010

Source File: 1307G-OMP-00-00-DR-A-1010.DWG

Ordnance Survey Ireland

Ordnance Survey Ireland Licence No. EN 0066023 © Ordnance Survey Ireland/Government of Ireland.



NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.

SITE COORDINATES
718340,728605

Rev	Date	Description	By	Chk
A	18/10/2024	SUBMISSION OF APPLICATION	MS	JU

Amendments

Project

PHASE 2 RESIDENTIAL DEVELOPMENT AT KNOCKRABO, Mt. ANVILLE ROAD, DUBLIN 14

Title

SITE LOCATION PLAN

Client

KNOCKRABO INVESTMENTS DAC

waterman moylan

BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD, DUBLIN D03 H3F4 IRELAND. Tel: (01) 664 8900
Email: info@waterman-moylan.ie www.waterman-moylan.ie

Status

PLANNING

Designed By	Approved	Waterman Ref
RM	MD	20-086
Drawn By	**Date**	**Scales @ A1**
MS	MAY 2024	1:2000

Project - Originator - Volume - Level - Type - Role - Number	Revision
KNB - WMC - PH2 - ZZ - DR - C - P100	A

Drawing Location: M:\Projects\20\20-086 - Knockrabo\Drawings\Waterman Moylan\Civil\Planning\Autocad Drawings\20-086-P100A Site Location Plan.dwg
Date: Oct 17, 2024 - 3:59pm

F. Uisce Eireann Confirmation of Feasibility Letter & Statement of Design Acceptance

CONFIRMATION OF FEASIBILITY

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Stephen Dent - Neville

Waterman Moylan
EastPoint Business Park, Block S,
Alfie Byrne Road,
Dublin
D03H3F4

4 June 2024

Our Ref: CDS24002545 Pre-Connection Enquiry
Knockrabo, Mount Anville Road, Goatstown, Dublin

Dear Applicant/Agent,

We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 144 unit(s) at Knockrabo, Mount Anville Road, Goatstown, Dublin, (the **Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible without infrastructure upgrade by Uisce Éireann

- Proposed connection is via Knockrabo Estate. As per Uisce Éireann GIS record, the network hasn't been taken i charge including the 150mm main along Mount Annville Road. At a connection application stage, the Developer has to provide evidence that the main is connected to Uisce Éireann network and in operation.

- **Wastewater Connection** - Feasible without infrastructure upgrade by Uisce Éireann subject to:
  - connection to the 225mm sewer adjacent to the site on Mount Anville Rad.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Uisce Éireann's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections**, **email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,

D Phelan

Dermot Phelan
Connections Delivery Manager

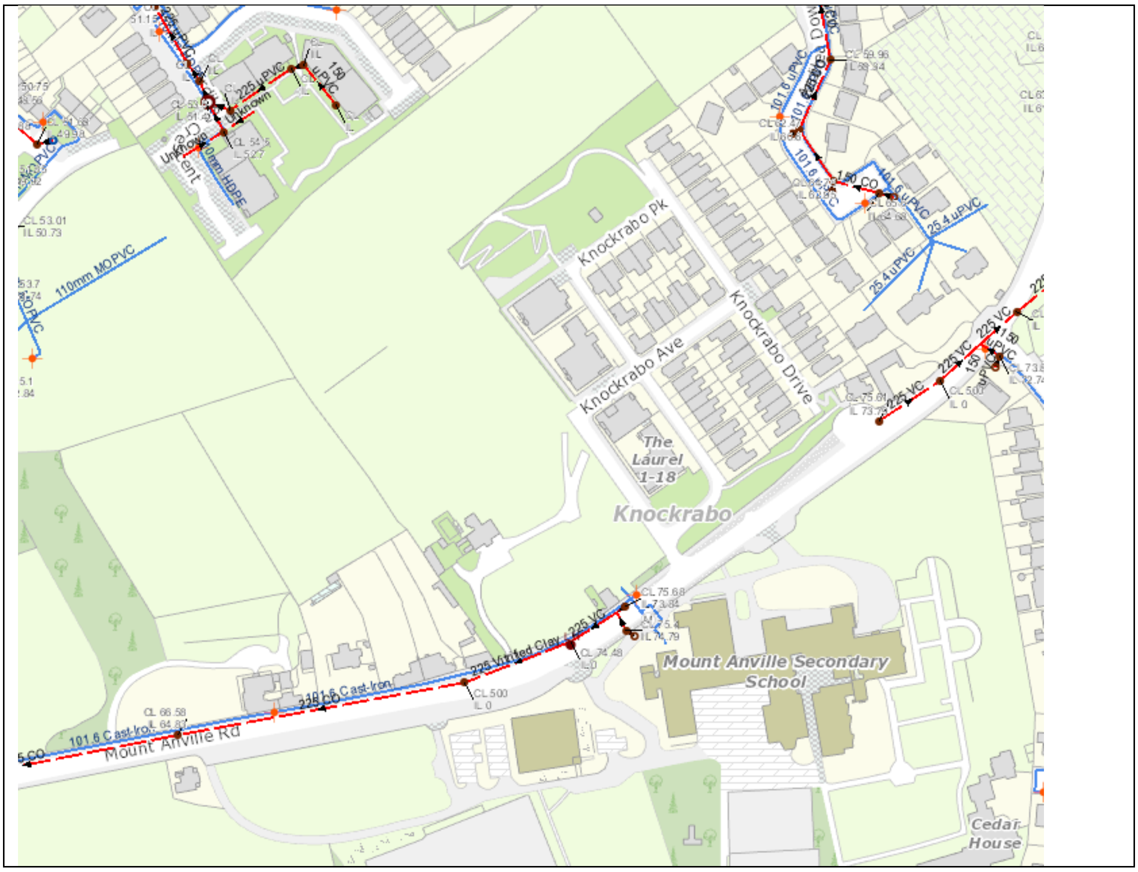
Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application <u>and be granted and sign</u> a connection agreement with Uisce Éireann.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Uisce Éireann connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Uisce Éireann's network(s)?	• Requests for maps showing Uisce Éireann's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

Section B – Details of Uisce Éireann’s Network(s)

The map included below outlines the current Uisce Éireann infrastructure adjacent the Development: To access Uisce Éireann Maps email datarequests@water.ie



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Note: The information provided on the included maps as to the position of Uisce Éireann’s underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Uisce Éireann.

Whilst every care has been taken in respect of the information on Uisce Éireann’s network(s), Uisce Éireann assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Uisce Éireann’s underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Uisce Éireann’s underground network(s) is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Stephen Dent - Neville
Waterman Moylan
EastPoint Business Park, Block S,
Alfie Byrne Road,
Dublin 3,
D03H3F4

18 September 2024

Re: Design Submission for Knockrabo, Mount Anville Road, Goatstown, Dublin (the "Development")
(the "Design Submission") / Connection Reference No: CDS24002545

Dear Stephen Dent - Neville,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Uisce Éireann has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before you can connect to our network you must sign a connection agreement with Uisce Éireann. This can be applied for by completing the connection application form at www.water.ie/connections. Uisce Éireann's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Uisce Éireann's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Uisce Éireann does not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Uisce Éireann representative:
Name: Antonio Garzón Mielgo
Email: antonio.garzonmielgo@water.ie

Yours sincerely,

Dermot Phelan
Connections Delivery Manager

Appendix A

Document Title & Revision

- KNB-WMC-PH2-ZZ-DR-C-P120 Proposed Foul & Storm Water Drainage GA
- KNB-WMC-PH2-ZZ-DR-C-P121 Drainage Layout Sheet 1 of 2
- KNB-WMC-PH2-ZZ-DR-C-P122 Drainage Layout Sheet 2 of 2
- KNB-WMC-PH2-ZZ-DR-C-P130 Proposed Watermains
- 20-086-P124 Waste Water Longitudinal Sections-Layout1

Additional Comments

The design submission will be subject to further technical review at connection application stage.

Uisce Éireann cannot guarantee that its Network in any location will have the capacity to deliver a particular flow rate and associated residual pressure to meet the requirements of the relevant Fire Authority, see Section 1.17 of Water Code of Practice.

For further information, visit ***www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Uisce Éireann will not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

Ordnance Survey Ireland Licence No. EN 0006023 © Ordnance Survey Ireland/Government of Ireland.

This drawing should not be scaled. Dimensions to be verified on site.
Any discrepancies should be referred to the Engineer prior to work being put in hand.
This drawing is the property of Waterman Moylan Consulting Engineers Limited and is issued on the condition that it is not copied, reproduced, retained or disclosed to any unauthorized person, either wholly or in part without the consent in writing of
Waterman Moylan Consulting Engineers Limited
Block S East Point Business Park Dublin D03 H3F4 Ireland
t +353 1 664 8900

NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.

LEGEND:

- EXISTING FOUL SEWER
- EXISTING SURFACE WATER SEWER
- PROPOSED WASTE WATER SEWER
- PROPOSED SURFACE WATER SEWER
- EXTENT OF STORMWATER ATTENUATION STORAGE
- PROPOSED PERMEABLE PAVED PARKING BAY

NOTE:
ALL PROPOSED PUBLIC STORM WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH DUN LAOGHAIRE RATHDOWN REQUIREMENTS FOR TAKING IN CHARGE AND IN ACCORDANCE WITH THE GREATER DUBLIN REGIONAL CODE OF PRACTICE FOR DRAINAGE WORKS.

ALL PROPOSED PUBLIC FOUL WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH IRISH WATER REQUIREMENTS.

ALL PRIVATE DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH THE BUILDING REGULATIONS PART H.

ALL COVER LEVELS ARE INDICATIVE ONLY AND SHOULD BE SET TO SUIT THE FINISHED ROAD OR PAVED LEVEL.

BASEMENTS TO DRAIN VIA GRAVITY TO FOUL NETWORK.
NO PUMPING REQUIRED.
NO STORMWATER CONNECTION TO FOUL PROPOSED.

NOTE:
IT IS THE CONTRACTORS RESPONSIBILITY TO ENSURE THAT ALL WORKS ARE CONSTRUCTED IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE AND STANDARD DETAILS. THE CODE OF PRACTICE AND STANDARD DETAILS ARE AVAILABLE TO DOWNLOAD FROM THE IRISH WATER WEB SITE AT WWW.WATER.IE/CONNECTIONS/DEVELOPER-SERVICES/ WHERE THE DETAILS CONTAINED ON THIS DRAWING DIFFER FROM THE IRISH WATER CODE OF PRACTICE OR STANDARD DETAILS THIS MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY. IRISH WATER STANDARDS WILL TAKE PRECEDENCE.

Rev	Date	Description	By	Chk
Amendments				

Project
PHASE 2 RESIDENTIAL DEVELOPMENT AT KNOCKRABO, Mt. ANVILLE ROAD, DUBLIN 14

Title
PROPOSED FOUL AND STORM WATER DRAINAGE GENERAL ARRANGEMENT

Client
KNOCKRABO INVESTMENTS DAC

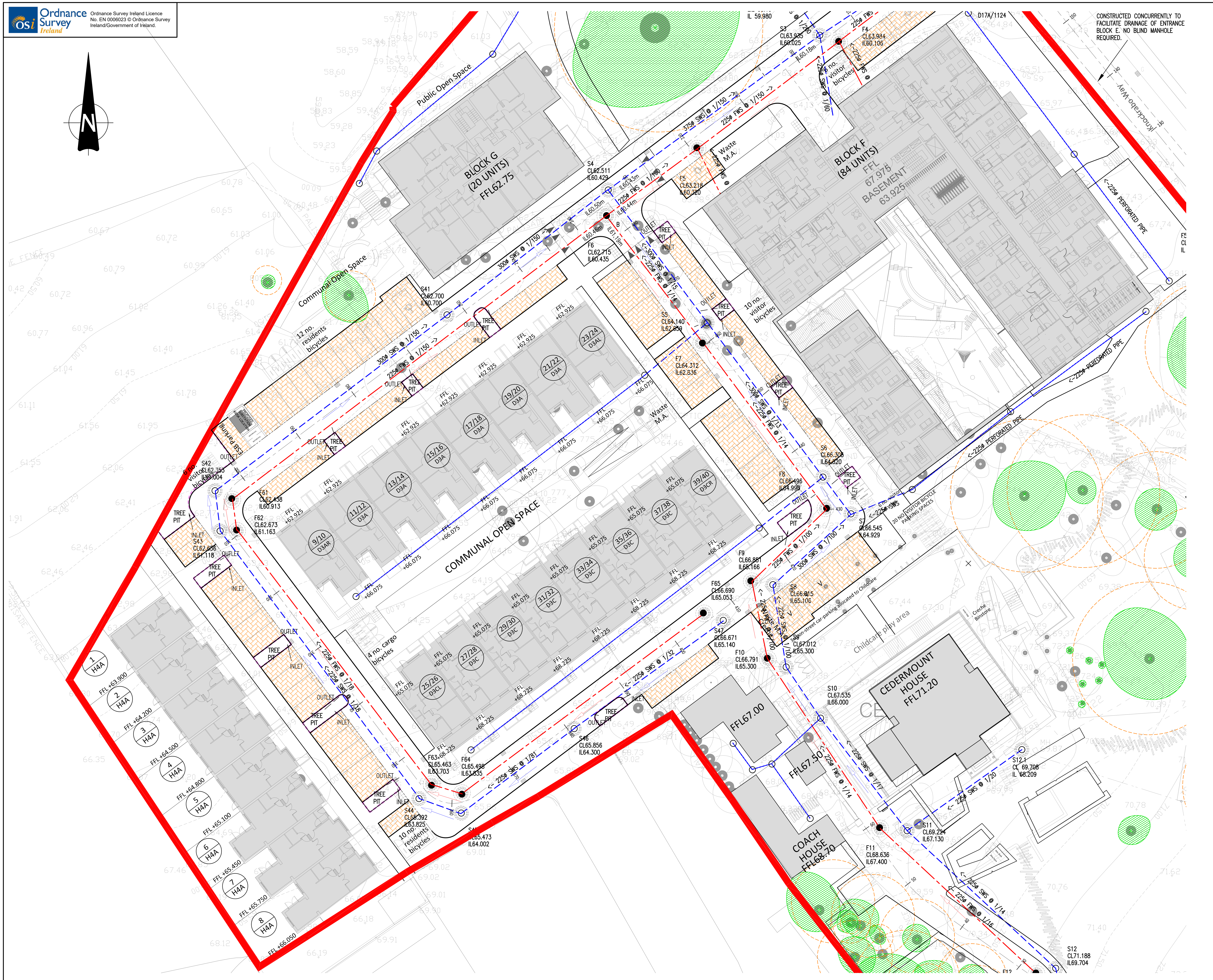
BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD, DUBLIN D03 H3F4 IRELAND. Tel: (01) 664 8900
Email: info@waterman-moylan.ie www.waterman-moylan.ie

Status
PLANNING

Designed By	Approved	Waterman Ref
RM	MD	20-086
Drawn By: MS	Date: MAY 2024	Scales @ A1: 1:500

Project - Originator - Volume - Level - Type - Role - Number	Revision
KNB - WMC - PH2 - ZZ - DR - C - P120	

Drawing Location: M:\Projects\20\20-086 - Knockrabo\Drawings\Waterman Moylan\Civil\Planning\Autocad Drawings\20-086-P120 Proposed Foul & Storm Water Drainage GA.dwg
Date: Jun 07, 2024 - 2:35pm



This drawing should not be scaled. Dimensions to be verified on site.
Any discrepancies should be referred to the Engineer prior to work being put in hand.
This drawing is the property of Waterman Moylan Consulting Engineers Limited and is issued on the condition that it is not copied, reproduced, retained or disclosed to any unauthorized person, either wholly or in part without the consent in writing of
Waterman Moylan Consulting Engineers Limited
Block S East Point Business Park Dublin D03 H3F4 Ireland
t +353 1 664 8900

NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.

LEGEND:

	EXFSMH CL X IL X	EXISTING FOUL SEWER WITH PIPE SIZE, MANHOLE REF. AND INVERT LEVEL
	EXSWMH CL X IL X	EXISTING SURFACE WATER SEWER WITH PIPE SIZE, MANHOLE REF. AND INVERT LEVEL
XXXmmø @ 1/XXX ->	FX CL X IL X	PROPOSED uPVC SN8 FOUL WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL 500mm RING OFFSET INDICATED
XXXmmø @ 1/XXX ->	SX CL X IL X	PROPOSED SURFACE WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
		PROPOSED PERFORATED PIPE
G		PROPOSED GULLY AND CONNECTION
		PROPOSED PERMEABLE PAVED PARKING BAY
		EXISTING TREE TO BE RETAINED WITH ROOT PROTECTION ZONE INDICATED
		EXTENT OF STORMWATER ATTENUATION STORAGE

NOTE:
ALL PROPOSED PUBLIC STORM WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH DUN LAOGHAIRE RATHDOWN REQUIREMENTS FOR TAKING IN CHARGE AND IN ACCORDANCE WITH THE GREATER DUBLIN REGIONAL CODE OF PRACTICE FOR DRAINAGE WORKS.

ALL PROPOSED PUBLIC FOUL WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH IRISH WATER REQUIREMENTS.

ALL PRIVATE DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH THE BUILDING REGULATIONS PART H.

ALL COVER LEVELS ARE INDICATIVE ONLY AND SHOULD BE SET TO SUIT THE FINISHED ROAD OR PAVED LEVEL.

WHERE COVER TO FOUL SEWER IS LESS THAN 1.2m CONCRETE SURROUND TO BE PROVIDED IN ACCORDANCE WITH IRISH WATER STANDARDS SEE SECTION 3.9 OF COP

BASEMENTS TO DRAIN VIA GRAVITY TO FOUL NETWORK. NO PUMPING REQUIRED.
NO STORMWATER CONNECTION TO FOUL PROPOSED.

MANHOLE COVERS LOCATED IN SOFT LANDSCAPED/GRASS AREAS ARE TO BE SURROUNDED BY A CONCRETE PLINTH, 200MM ALL ROUND AND 100MM DEEP FORMED WITH C20/25 CONCRETE, 20MM AGGREGATE SIZE, BEDDED IN CLAUSE 804 MATERIAL.

TREE PITS TO BE SUPPLIED WITH LOW LEVEL OVERFLOW TO PREVENT ROOT SUFFOCATION.

Rev	Date	Description	By	Chk

Amendments

Project
PHASE 2 RESIDENTIAL DEVELOPMENT AT KNOCKRABO, Mt. ANVILLE ROAD, DUBLIN 14

Title
DRAINAGE LAYOUT SHEET 1 OF 2

Client
KNOCKRABO INVESTMENTS DAC

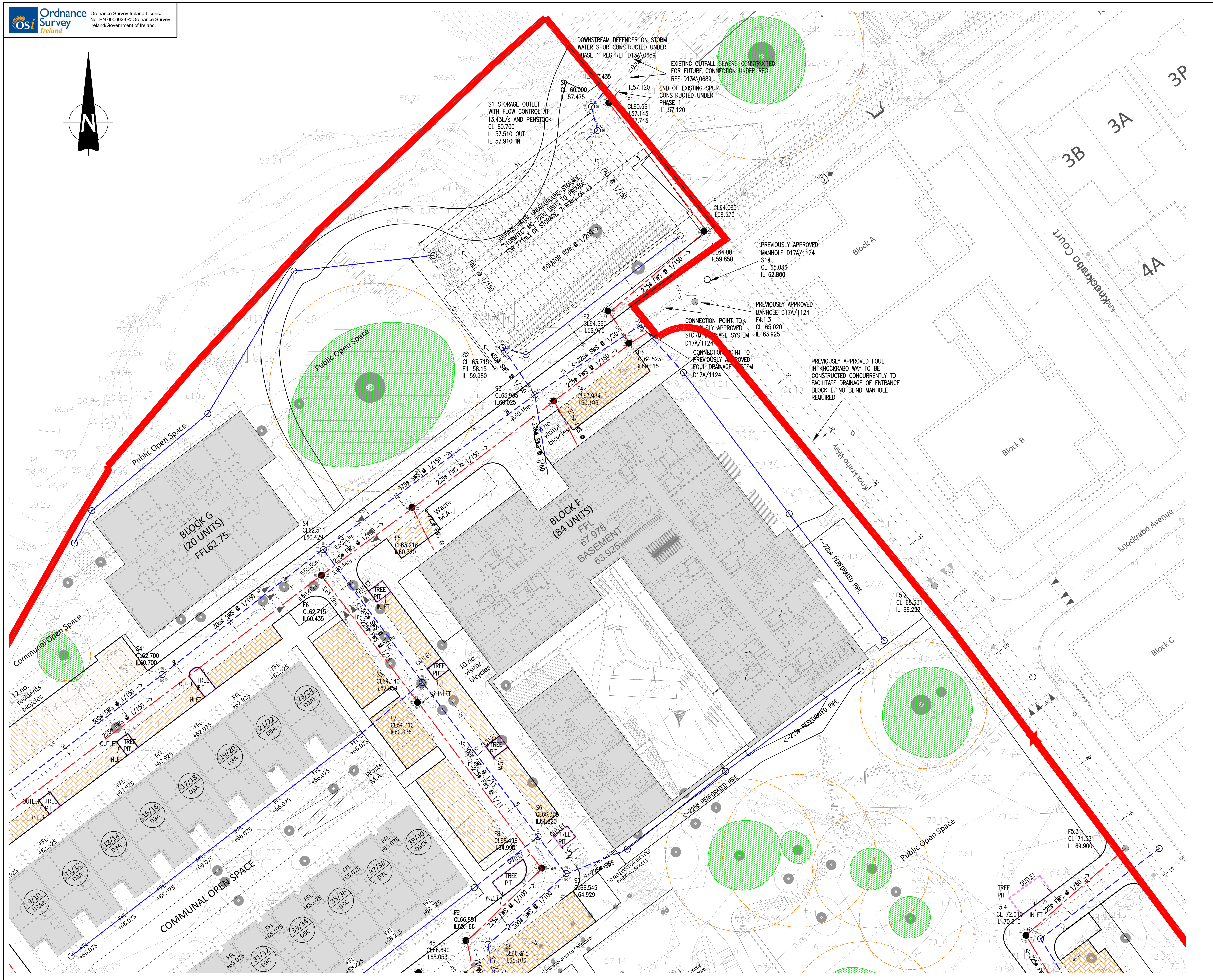
BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD, DUBLIN D03 H3F4 IRELAND. Tel: (01) 664 8900
Email: info@waterman-moylan.ie www.waterman-moylan.ie

Status
PLANNING

Designed By RM	Approved MD	Waterman Ref 20-086
Drawn By MS	Date MAY 2024	Scales @ A1 1:500

Project - Originator - Volume - Level - Type - Role - Number	Revision
KNB - WMC - PH2 - ZZ - DR - C - P121	

Drawing Location: M:\Projects\20\20-086 - Knockrabo\Drawings\Waterman Moylan\Civil\Planning\Autocad Drawings\20-086-P121-P122 Drainage Layout Sheet 1 & 2.dwg
Date: Jun 07, 2024 - 2:37pm



NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.

LEGEND:

EXFSMH CL X IL X	EXISTING FOUL SEWER WITH PIPE SIZE, MANHOLE REF. AND INVERT LEVEL
EXSWMH CL X IL X	EXISTING SURFACE WATER SEWER WITH PIPE SIZE, MANHOLE REF. AND INVERT LEVEL
XXXmmø @ 1/XXX -> FX CL X IL X	PROPOSED uPVC SN8 FOUL WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL 500mm RING OFFSET INDICATED
XXXmmø @ 1/XXX -> SX CL X IL X	PROPOSED SURFACE WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
	PROPOSED PERFORATED PIPE
G	PROPOSED GULLY AND CONNECTION
	PROPOSED PERMEABLE PAVED PARKING BAY
	EXISTING TREE TO BE RETAINED WITH ROOT PROTECTION ZONE INDICATED
	EXTENT OF STORMWATER ATTENUATION STORAGE

NOTE:
ALL PROPOSED PUBLIC STORM WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH DUN LAOGHAIRE RATHDOWN REQUIREMENTS FOR TAKING IN CHARGE AND IN ACCORDANCE WITH THE GREATER DUBLIN REGIONAL CODE OF PRACTICE FOR DRAINAGE WORKS.

ALL PROPOSED PUBLIC FOUL WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH IRISH WATER REQUIREMENTS.

ALL PRIVATE DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH THE BUILDING REGULATIONS PART H.

ALL COVER LEVELS ARE INDICATIVE ONLY AND SHOULD BE SET TO SUIT THE FINISHED ROAD OR PAVED LEVEL.

WHERE COVER TO FOUL SEWER IS LESS THAN 1.2m CONCRETE SURROUND TO BE PROVIDED IN ACCORDANCE WITH IRISH WATER STANDARDS SEE SECTION 3.9 OF COP

BASEMENTS TO DRAIN VIA GRAVITY TO FOUL NETWORK. NO PUMPING REQUIRED.
NO STORMWATER CONNECTION TO FOUL PROPOSED.

MANHOLE COVERS LOCATED IN SOFT LANDSCAPED/GRASS AREAS ARE TO BE SURROUNDED BY A CONCRETE PLINTH, 200MM ALL ROUND AND 100MM DEEP FORMED WITH C20/25 CONCRETE, 20MM AGGREGATE SIZE, BEDDED IN CLAUSE 804 MATERIAL.

TREE PITS TO BE SUPPLIED WITH LOW LEVEL OVERFLOW TO PREVENT ROOT SUFFOCATION.

Rev	Date	Description	By	Chk

Amendments

Project
PHASE 2 RESIDENTIAL DEVELOPMENT AT KNOCKRABO, Mt. ANVILLE ROAD, DUBLIN 14

Title
DRAINAGE LAYOUT SHEET 2 OF 2

Client
KNOCKRABO INVESTMENTS DAC

waterman moylan
BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD, DUBLIN D03 H3F4 IRELAND. Tel: (01) 664 8900
Email: info@waterman-moylan.ie www.waterman-moylan.ie

Status
PLANNING

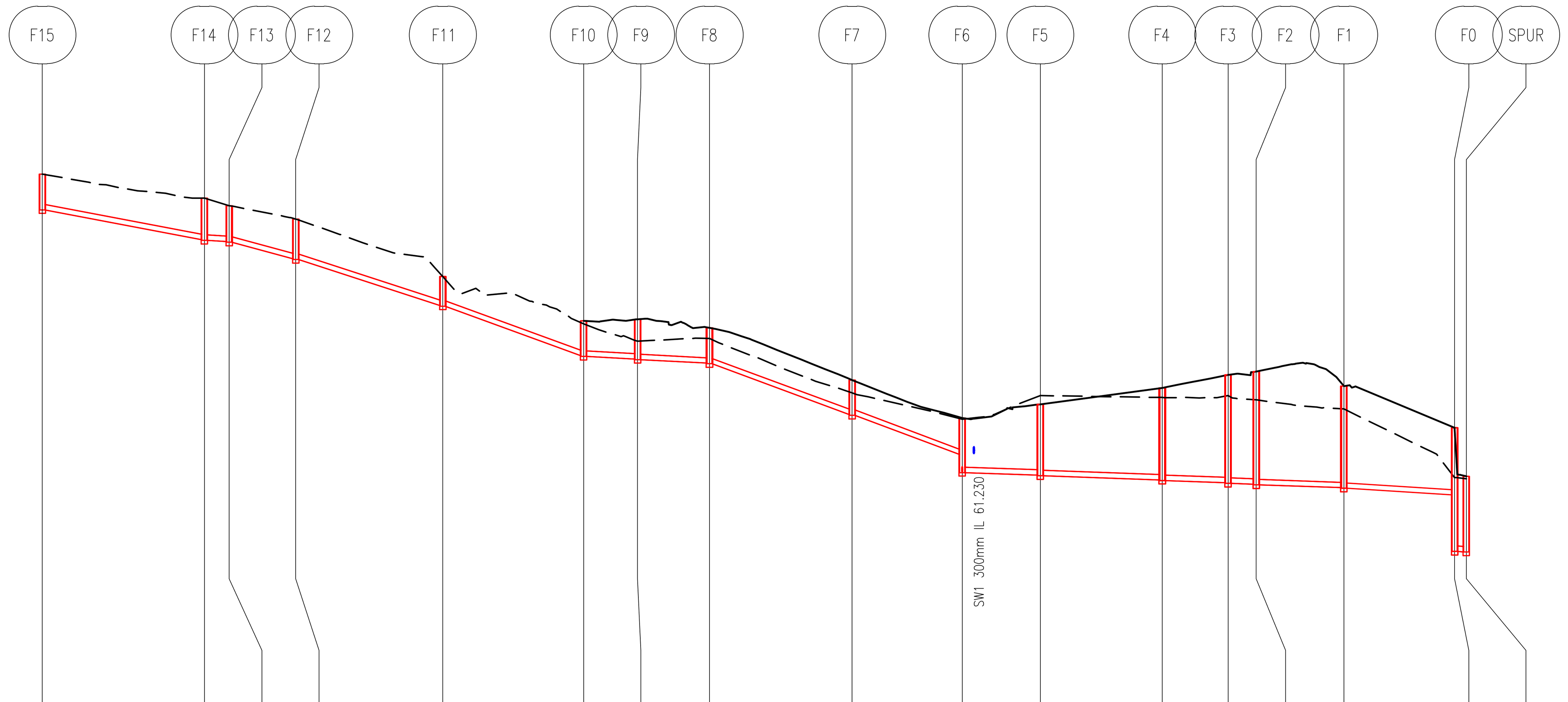
Designed By RM	Approved MD	Waterman Ref 20-086
Drawn By MS	Date MAY 2024	Scales @ A1 1:500

Project - Originator - Volume - Level - Type - Role - Number: KNB - WMC - PH2 - ZZ - DR - C - P122
Revision

Drawing Location: M:\Projects\20\20-086 - Knockrabo\Drawings\Waterman Moylan\Civil\Planning\Autocad Drawings\20-086-P121-P122 Drainage Layout Sheet 1 & 2.dwg
Date: Jun 07, 2024 - 2:38pm

NOTES:

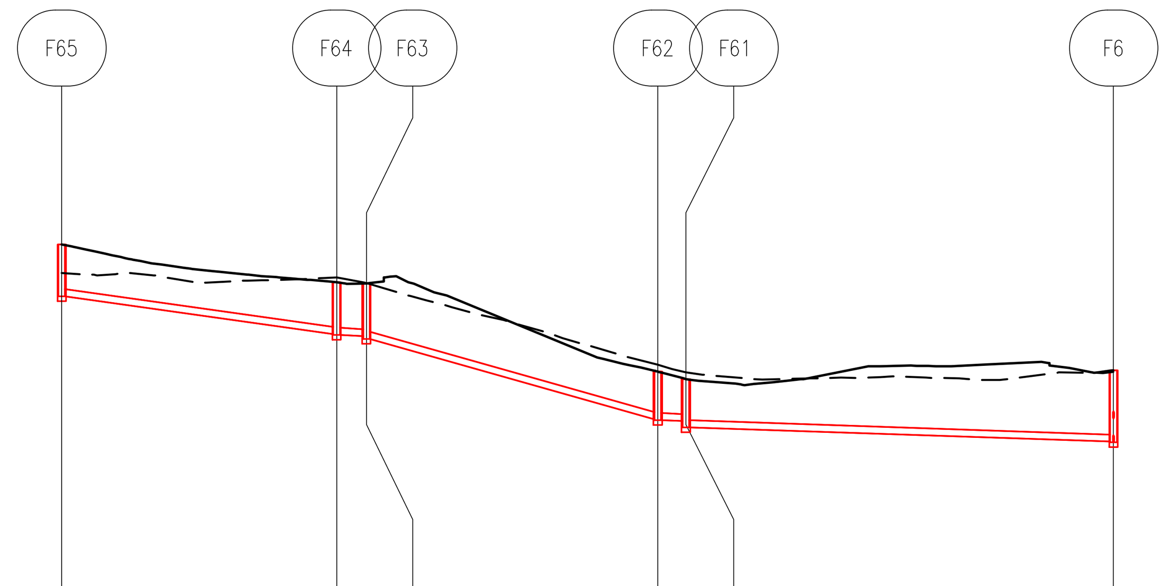
1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.



DATUM R.L. 30.000 (24.000 from F4)

	F15		F14		F13		F12		F11		F10		F9		F8		F7		F6		F5		F4		F3		F2		F1		F0		SPUR
GRADE		1in27		1in104		1in20		1in20		1in20		1in103		1in100		1in20		1in20		1in150		1in150		1in150		1in150		1in150		1in150		1in97	
DIAMETER		225		225		225		225		225		225		225		225		225		225		225		225		225		225		225		225	
DEPTH TO INVERT OF SEWER	1.495		1.734 / 1.759		1.500 / 1.525		1.660 / 2.683		1.815 / 1.840		1.466 / 1.491		1.660 / 1.685		1.480 / 2.565		1.872 / 1.897		1.450 / 2.275		2.964 / 2.989		3.847 / 3.872		4.503 / 4.528		4.710 / 4.735		4.252 / 4.277		2.686 / 5.170		3.167
INVERT LEVEL	71.426		70.175 / 70.150		70.100 / 70.075		69.379 / 68.357		66.821 / 66.796		65.325 / 65.300		65.191 / 65.166		65.015 / 63.931		62.440 / 62.415		61.265 / 60.426 60.440		60.331 / 60.282 60.306		60.136 / 60.111		60.020 / 59.995		59.955 / 59.930		59.808 / 59.783		59.629 / 57.145		57.120
DESIGN SURFACE LEVEL	72.921		71.909		71.600		71.040		68.636		66.791		66.851		66.496		64.312		62.715		63.295		63.984		64.523		64.665		64.060		62.315		60.287
EXISITNG GROUND LEVEL	72.921		71.909		71.600		71.040		68.636		66.652		65.929		66.042		63.769		62.670		63.661		63.580		63.655		63.487		63.096		60.237		60.177
RUNNING CHAINAGE	0.000	33.861	33.861	5.186	39.047	13.918	52.966	30.728	83.693	29.421	113.114	11.294	124.408	15.024	139.432	29.818	169.250	23.006	192.255	16.314	208.569	25.491	234.060	13.756	247.816	5.898	253.714	18.315	272.029	23.146	295.174	2.430	297.605

FW01



DATUM R.L. 55.000

	F65		F64		F63		F62		F61		F6
GRADE		1in36		1in100		1in20		1in150		1in150	
DIAMETER		225		225		225		225		225	
DEPTH TO INVERT OF SEWER	1.638		1.638 / 1.663		1.675 / 1.997		1.510 / 1.535		1.329 / 1.525		2.253 / 2.275
INVERT LEVEL	65.053		63.860 / 63.835		63.788 / 63.466		61.163 / 61.138		61.108 / 60.913		60.462 / 60.440
DESIGN SURFACE LEVEL	66.690		65.498		65.463		62.673		62.438		62.715
EXISITNG GROUND LEVEL	65.783		65.653		65.471		62.895		62.649		62.670
RUNNING CHAINAGE	0.000	43.465	43.465	4.715	48.180	46.053	94.233	4.439	98.672	67.602	166.274

FW02

NOTE:

ALL PROPOSED PUBLIC FOUL WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH IRISH WATER REQUIREMENTS.

ALL PRIVATE DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH THE BUILDING REGULATIONS PART H.

ALL COVER LEVELS ARE INDICATIVE ONLY AND SHOULD BE SET TO SUIT THE FINISHED ROAD OR PAVED LEVEL.

WHERE COVER TO FOUL SEWER IS LESS THAN 1.2m CONCRETE SURROUND TO BE PROVIDED IN ACCORDANCE WITH IRISH WATER STANDARDS SEE SECTION 3.9 OF COP

Rev	Date	Description	By	Chk

Amendments

Project

PHASE 2 RESIDENTIAL DEVELOPMENT AT KNOCKRABO, Mt. ANVILLE ROAD, DUBLIN 14

Title

WASTE WATER LONGITUDINAL SECTIONS

Client

KNOCKRABO INVESTMENTS DAC

waterman moylan

BLOCK 5, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD, DUBLIN D03 H3F4 IRELAND. Tel: (01) 664 8900
Email: info@waterman-moylan.ie www.waterman-moylan.ie

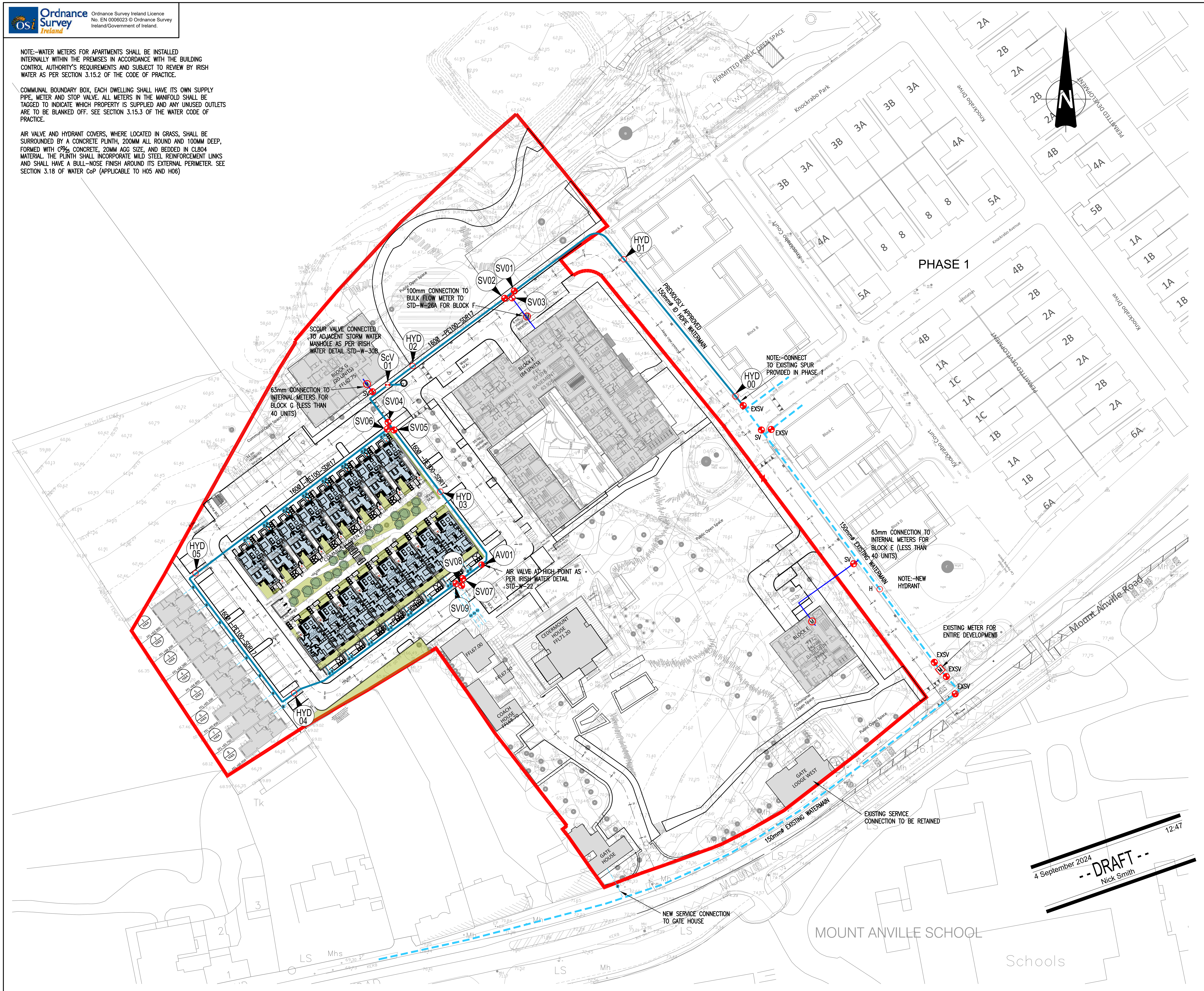
Status

PLANNING

Designed By RM	Approved MD	Waterman Ref 20-086
Drawn By MS	Date MAY 2024	Scales @ A1 AS SHOWN

Project - Originator - Volume - Level - Type - Role - Number | Revision

KNB - WMC - PH2 - ZZ - DR - C - P124



NOTE:-WATER METERS FOR APARTMENTS SHALL BE INSTALLED INTERNALLY WITHIN THE PREMISES IN ACCORDANCE WITH THE BUILDING CONTROL AUTHORITY'S REQUIREMENTS AND SUBJECT TO REVIEW BY IRISH WATER AS PER SECTION 3.15.2 OF THE CODE OF PRACTICE.

COMMUNAL BOUNDARY BOX, EACH DWELLING SHALL HAVE ITS OWN SUPPLY PIPE, METER AND STOP VALVE. ALL METERS IN THE MANIFOLD SHALL BE TAGGED TO INDICATE WHICH PROPERTY IS SUPPLIED AND ANY UNUSED OUTLETS ARE TO BE BLANKED OFF. SEE SECTION 3.15.3 OF THE WATER CODE OF PRACTICE.

AIR VALVE AND HYDRANT COVERS, WHERE LOCATED IN GRASS, SHALL BE SURROUNDED BY A CONCRETE PLINTH, 200MM ALL ROUND AND 100MM DEEP, FORMED WITH C20/25 CONCRETE, 20MM AGG SIZE, AND BEDDED IN CL804 MATERIAL. THE PLINTH SHALL INCORPORATE MILD STEEL REINFORCEMENT LINKS AND SHALL HAVE A BULL-NOSE FINISH AROUND ITS EXTERNAL PERIMETER. SEE SECTION 3.18 OF WATER CoP (APPLICABLE TO H05 AND H06)

NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS.

LEGEND

100mmø ID – HDPE	PROPOSED HDPE WATERMAIN
SV	PROPOSED SLUICE VALVE
H	PROPOSED HYDRANT
AV	PROPOSED AIR VALVE
	PROPOSED BOUNDARY BOX
	PROPOSED METER BOX
150mm ø WATERMAIN	EXISTING WATERMAIN AND PIPE SIZE

NOTES:

1. ALL PIPE MATERIALS TO BE IN ACCORDANCE WITH IRISH WATER STANDARDS AND SPECIFICATIONS.
2. ALL WATERMAINS UNDER ROADS OR AT ROAD CROSSINGS TO BE HDPE OR DUCTILE IRON.
3. HDPE DISTRIBUTION PIPES TO BE PE-100(SDR-17).
4. DUCTILE IRON PIPES TO IS EN 545 WITH C40 POWER RATING.
5. SEPARATION DISTANCES BETWEEN WATERMAINS ASSOCIATED WITH THE WORKS FROM OTHER UTILITY PIPES AND ACCESSORIES SHALL BE IN ACCORDANCE WITH SECTION 3.6 OF THE CODE OF PRACTICE AND STD-W-11.
6. MINIMUM SEPARATION DISTANCES FOR GAS NETWORKS IRELAND INFRASTRUCTURE SHALL BE IN ACCORDANCE WITH IS329 'GAS DISTRIBUTION MAINS' AND IS328 'CODE OF PRACTICE FOR GAS TRANSMISSION MAINS' AS AMENDED UPDATED.

NOTE:

IT IS THE CONTRACTORS RESPONSIBILITY TO ENSURE THAT ALL WORKS ARE CONSTRUCTED IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE AND STANDARD DETAILS. THE CODE OF PRACTICE AND STANDARD DETAILS ARE AVAILABLE TO DOWNLOAD FROM THE IRISH WATER WEB SITE AT WWW.WATER.IE/CONNECTIONS/DEVELOPER-SERVICES/ WHERE THE DETAILS CONTAINED ON THIS DRAWING DIFFER FROM THE IRISH WATER CODE OF PRACTICE OR STANDARD DETAILS THIS MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY. IRISH WATER STANDARDS WILL TAKE PRECEDENCE.

Rev	Date	Description	By	Chk
A	03/09/24	REVISED TO SUIT IRISH WATER COMMENTS	NS	MD

Amendments

Project
PHASE 2 RESIDENTIAL DEVELOPMENT AT KNOCKRABO, Mt. ANVILLE ROAD, DUBLIN 14

Title
PROPOSED WATERMAINS

Client
KNOCKRABO INVESTMENTS DAC

waterman moylan
BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD, DUBLIN D03 H3F4 IRELAND. Tel: (01) 664 8900
Email: info@waterman-moylan.ie www.waterman-moylan.ie

Status
PLANNING

Designed By	RM	Approved	MD	Waterman Ref	20-086
Drawn By	MS	Date	MAY 2024	Scales @ A1	1:500

Project - Originator - Volume - Level - Type - Role - Number	Revision
KNB - WMC - PH2 - ZZ - DR - C - P130	A

Drawing Location: M:\Projects\20\20-086 - Knockrabo\Drawings\Waterman Moylan\Civil\Planning\Autocad Drawings\20-086-P130 Proposed Watermains.dwg
Date: Sep 04, 2024 - 12:47pm

G. Flow Model

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	20	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	17.200	Minimum Backdrop Height (m)	0.200
Ratio-R	0.278	Preferred Cover Depth (m)	1.200
CV	0.800	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
46	0.015	4.00	65.856	1200	718298.952	728541.586	1.556
45	0.002	4.00	65.473	1200	718282.648	728529.348	1.471
44	0.057	4.00	65.392	1350	718276.732	728531.489	1.567
43	0.107	4.00	63.073	1200	718248.030	728570.016	1.955
42	0.028	4.00	62.972	1350	718247.319	728575.816	1.968
41	0.056	4.00	62.700	1350	718280.646	728601.153	2.000
4G	0.041	4.00	60.000	1350	718270.701	728624.739	0.900
8	0.016	4.00	66.815	1200	718327.564	728562.303	1.709
7	0.045	4.00	66.545	1200	718338.800	728572.411	1.616
5	0.122	4.00	64.140	1200	718318.142	728600.039	1.481
14EX			65.036	1200	718359.138	728658.012	2.236
3	0.003	4.00	63.935	1200	718334.320	728641.414	3.910
4	0.064	4.00	62.511	1350	718303.855	728619.131	2.082
3G			61.030	1350	718287.237	728638.693	2.038
2G			61.210	1350	718299.637	728659.246	2.338
1G IN			60.000	1350	718319.760	728661.471	2.090
10	0.023	4.00	67.535		718334.436	728543.089	1.535
11	0.090	4.00	69.224		718346.898	728526.883	2.094
12.1		4.00	69.708		718363.415	728538.552	1.499
12			71.188		718368.289	728507.070	1.484
13	0.045	4.00	71.504		718369.947	728499.374	1.460
14			71.763		718372.499	728492.516	1.442
9	0.071	4.00	67.012		718329.477	728550.452	1.712
47	0.035	4.00	66.671		718320.424	728557.164	1.531
1 OUT			60.700	1500	718343.330	728679.465	3.190
0			60.000		718342.465	728682.918	2.525
2 IN			61.510		718329.584	728648.246	3.360
2.1			63.800		718331.687	728645.675	3.800
2.2	0.037	4.00	64.000		718355.242	728664.312	1.000
6	0.183	4.00	66.305		718334.783	728577.800	1.485
48	0.144	4.00	64.523		718349.723	728651.552	2.104
49	0.058	4.00	68.970		718394.001	728615.854	1.200
50	0.023	4.00	70.570		718406.166	728600.789	1.200
51	0.031	4.00	72.553		718424.209	728576.191	2.190
1E	0.011	4.00	72.009		718407.132	728563.095	1.538
2E	0.051	4.00	71.734		718412.141	728555.118	1.200
5G	0.006	4.00	61.000		718268.180	728619.711	1.000
14A	0.038	4.00	72.900		718400.808	728506.746	1.180

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	14A	14	31.684	0.600	71.720	70.321	1.399	22.6	225	4.19	50.0
1.001	14	13	7.317	0.600	70.321	70.044	0.277	26.4	225	4.24	50.0
1.002	13	12	7.873	0.600	70.044	69.704	0.340	23.2	225	4.29	50.0
1.003	12	11	29.157	0.600	69.704	67.130	2.574	11.3	225	4.41	50.0
2.000	12.1	11	20.223	0.600	68.209	67.130	1.079	18.7	225	4.11	50.0
1.004	11	10	20.443	0.600	67.130	66.000	1.130	18.1	225	4.52	50.0
1.005	10	9	8.877	0.600	66.000	65.300	0.700	12.7	225	4.56	50.0
1.006	9	8	12.004	0.600	65.300	65.106	0.194	61.9	225	4.68	50.0
1.007	8	7	15.114	0.600	65.106	64.929	0.177	85.4	300	4.83	50.0
1.008	7	6	6.721	0.600	64.929	64.820	0.109	61.7	300	4.89	50.0
1.009	6	5	27.776	0.600	64.820	62.659	2.161	12.9	300	4.99	50.0
1.010	5	4	23.846	0.600	62.659	60.429	2.230	10.7	300	5.07	50.0
3.000	47	46	26.533	0.600	65.140	64.300	0.840	31.6	225	4.19	50.0
3.001	46	45	20.386	0.600	64.300	64.002	0.298	68.4	225	4.40	50.0
3.002	45	44	6.291	0.600	64.002	63.825	0.177	35.5	225	4.45	50.0
3.003	44	43	48.043	0.600	63.825	61.118	2.707	17.7	225	4.71	50.0
3.004	43	42	5.843	0.600	61.118	61.004	0.114	51.3	300	4.75	50.0
3.005	42	41	41.865	0.600	61.004	60.700	0.304	137.7	300	5.27	50.0
3.006	41	4	29.360	0.600	60.700	60.429	0.271	108.3	300	5.60	50.0
1.011	4	3	37.745	0.600	60.429	60.025	0.404	93.4	450	5.90	50.0
4.000	2E	1E	9.419	0.600	70.534	70.471	0.063	149.5	225	4.15	50.0
4.001	1E	51	21.520	0.600	70.471	70.363	0.108	199.3	225	4.54	50.0
4.002	51	50	30.506	0.600	70.363	69.370	0.993	30.7	225	4.75	50.0
4.003	50	49	19.363	0.600	69.370	67.770	1.600	12.1	225	4.84	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	2.761	109.8	6.7	0.955	1.217	0.038	0.0
1.001	2.555	101.6	6.7	1.217	1.235	0.038	0.0
1.002	2.730	108.6	14.4	1.235	1.259	0.083	0.0
1.003	3.909	155.4	14.4	1.259	1.869	0.083	0.0
2.000	3.036	120.7	0.0	1.274	1.869	0.000	0.0
1.004	3.091	122.9	30.0	1.869	1.310	0.173	0.0
1.005	3.694	146.9	34.0	1.310	1.487	0.196	0.0
1.006	1.665	66.2	46.4	1.487	1.484	0.267	0.0
1.007	1.702	120.3	49.1	1.409	1.316	0.283	0.0
1.008	2.005	141.7	56.8	1.316	1.185	0.328	0.0
1.009	4.408	311.6	88.5	1.185	1.181	0.510	0.0
1.010	4.834	341.7	109.7	1.181	1.782	0.632	0.0
3.000	2.336	92.9	6.1	1.306	1.331	0.035	0.0
3.001	1.583	62.9	8.8	1.331	1.246	0.051	0.0
3.002	2.201	87.5	9.2	1.246	1.342	0.053	0.0
3.003	3.120	124.1	19.2	1.342	1.730	0.110	0.0
3.004	2.201	155.6	37.8	1.655	1.668	0.218	0.0
3.005	1.338	94.6	42.6	1.668	1.700	0.246	0.0
3.006	1.510	106.7	52.4	1.700	1.782	0.302	0.0
1.011	2.103	334.5	173.0	1.632	3.460	0.998	0.0
4.000	1.067	42.4	8.8	0.975	1.313	0.051	0.0
4.001	0.922	36.7	10.7	1.313	1.965	0.062	0.0
4.002	2.369	94.2	16.1	1.965	0.975	0.093	0.0
4.003	3.782	150.4	20.1	0.975	0.975	0.116	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.004	49	14EX	54.706	0.600	67.770	62.800	4.970	11.0	225	5.07	50.0
4.005	14EX	48	11.418	0.600	62.800	62.419	0.381	30.0	225	5.15	50.0
4.006	48	3	18.440	0.600	62.419	61.804	0.615	30.0	225	5.27	50.0
1.012	3	2.1	5.009	0.600	60.025	60.000	0.025	200.4	450	5.96	50.0
5.000	2.2	2.1	30.036	0.600	63.000	62.500	0.500	60.1	225	4.30	50.0
1.013	2.1	2 IN	3.322	0.600	60.000	59.983	0.017	195.4	450	5.99	50.0
1.014	2 IN	1 OUT	34.111	0.600	58.150	57.923	0.227	150.3	450	6.34	50.0
6.000	5G	4G	5.627	0.600	60.000	59.100	0.900	6.3	225	4.02	50.0
6.001	4G	3G	21.637	0.600	59.100	58.992	0.108	200.3	225	4.41	50.0
6.002	3G	2G	24.004	0.600	58.992	58.872	0.120	200.0	225	4.84	50.0
6.003	2G	1G IN	20.246	0.600	58.872	58.771	0.101	200.5	225	5.21	50.0
6.004	1G IN	1 OUT	29.653	0.600	57.910	57.510	0.400	74.1	450	5.42	50.0
1.015	1 OUT	0	3.560	0.600	57.510	57.475	0.035	101.7	225	6.38	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
4.004	3.966	157.7	30.2	0.975	2.011	0.174	0.0
4.005	2.398	95.4	30.2	2.011	1.879	0.174	0.0
4.006	2.398	95.3	55.2	1.879	1.906	0.318	0.0
1.012	1.432	227.8	228.9	3.460	3.350	1.319	0.0
5.000	1.690	67.2	6.3	0.775	1.075	0.037	0.0
1.013	1.451	230.7	235.2	3.350	1.077	1.356	0.0
1.014	1.656	263.4	235.2	2.910	2.327	1.356	0.0
6.000	5.267	209.4	1.1	0.775	0.675	0.006	0.0
6.001	0.920	36.6	8.3	0.675	1.813	0.048	0.0
6.002	0.921	36.6	8.3	1.813	2.113	0.048	0.0
6.003	0.920	36.6	8.3	2.113	1.004	0.048	0.0
6.004	2.363	375.8	8.3	1.640	2.740	0.048	0.0
1.015	1.296	51.5	243.5	2.965	2.300	1.404	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	31.684	22.6	225	1 STANDARD	72.900	71.720	0.955	71.763	70.321	1.217
1.001	7.317	26.4	225	1 STANDARD	71.763	70.321	1.217	71.504	70.044	1.235
1.002	7.873	23.2	225	1 STANDARD	71.504	70.044	1.235	71.188	69.704	1.259
1.003	29.157	11.3	225	1 STANDARD	71.188	69.704	1.259	69.224	67.130	1.869
2.000	20.223	18.7	225	1 STANDARD	69.708	68.209	1.274	69.224	67.130	1.869
1.004	20.443	18.1	225	1 STANDARD	69.224	67.130	1.869	67.535	66.000	1.310
1.005	8.877	12.7	225	1 STANDARD	67.535	66.000	1.310	67.012	65.300	1.487

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	14A		Manhole	1 STANDARD	14		Manhole	1 STANDARD
1.001	14		Manhole	1 STANDARD	13		Manhole	1 STANDARD
1.002	13		Manhole	1 STANDARD	12		Manhole	1 STANDARD
1.003	12		Manhole	1 STANDARD	11		Manhole	1 STANDARD
2.000	12.1		Manhole	1 STANDARD	11		Manhole	1 STANDARD
1.004	11		Manhole	1 STANDARD	10		Manhole	1 STANDARD
1.005	10		Manhole	1 STANDARD	9		Manhole	1 STANDARD

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.006	12.004	61.9	225	1 STANDARD	67.012	65.300	1.487	66.815	65.106	1.484
1.007	15.114	85.4	300	1 STANDARD	66.815	65.106	1.409	66.545	64.929	1.316
1.008	6.721	61.7	300	1 STANDARD	66.545	64.929	1.316	66.305	64.820	1.185
1.009	27.776	12.9	300	1 STANDARD	66.305	64.820	1.185	64.140	62.659	1.181
1.010	23.846	10.7	300	1 STANDARD	64.140	62.659	1.181	62.511	60.429	1.782
3.000	26.533	31.6	225	1 STANDARD	66.671	65.140	1.306	65.856	64.300	1.331
3.001	20.386	68.4	225	1 STANDARD	65.856	64.300	1.331	65.473	64.002	1.246
3.002	6.291	35.5	225	1 STANDARD	65.473	64.002	1.246	65.392	63.825	1.342
3.003	48.043	17.7	225	1 STANDARD	65.392	63.825	1.342	63.073	61.118	1.730
3.004	5.843	51.3	300	1 STANDARD	63.073	61.118	1.655	62.972	61.004	1.668
3.005	41.865	137.7	300	1 STANDARD	62.972	61.004	1.668	62.700	60.700	1.700
3.006	29.360	108.3	300	1 STANDARD	62.700	60.700	1.700	62.511	60.429	1.782
1.011	37.745	93.4	450	1 STANDARD	62.511	60.429	1.632	63.935	60.025	3.460
4.000	9.419	149.5	225	1 STANDARD	71.734	70.534	0.975	72.009	70.471	1.313
4.001	21.520	199.3	225	1 STANDARD	72.009	70.471	1.313	72.553	70.363	1.965
4.002	30.506	30.7	225	1 STANDARD	72.553	70.363	1.965	70.570	69.370	0.975
4.003	19.363	12.1	225	1 STANDARD	70.570	69.370	0.975	68.970	67.770	0.975
4.004	54.706	11.0	225	1 STANDARD	68.970	67.770	0.975	65.036	62.800	2.011
4.005	11.418	30.0	225	1 STANDARD	65.036	62.800	2.011	64.523	62.419	1.879
4.006	18.440	30.0	225	1 STANDARD	64.523	62.419	1.879	63.935	61.804	1.906
1.012	5.009	200.4	450	1 STANDARD	63.935	60.025	3.460	63.800	60.000	3.350
5.000	30.036	60.1	225	1 STANDARD	64.000	63.000	0.775	63.800	62.500	1.075
1.013	3.322	195.4	450	1 STANDARD	63.800	60.000	3.350	61.510	59.983	1.077
1.014	34.111	150.3	450	1 STANDARD	61.510	58.150	2.910	60.700	57.923	2.327
6.000	5.627	6.3	225	1 STANDARD	61.000	60.000	0.775	60.000	59.100	0.675

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.006	9		Manhole	1 STANDARD	8	1200	Manhole	1 STANDARD
1.007	8	1200	Manhole	1 STANDARD	7	1200	Manhole	1 STANDARD
1.008	7	1200	Manhole	1 STANDARD	6		Manhole	1 STANDARD
1.009	6		Manhole	1 STANDARD	5	1200	Manhole	1 STANDARD
1.010	5	1200	Manhole	1 STANDARD	4	1350	Manhole	1 STANDARD
3.000	47		Manhole	1 STANDARD	46	1200	Manhole	1 STANDARD
3.001	46	1200	Manhole	1 STANDARD	45	1200	Manhole	1 STANDARD
3.002	45	1200	Manhole	1 STANDARD	44	1350	Manhole	1 STANDARD
3.003	44	1350	Manhole	1 STANDARD	43	1200	Manhole	1 STANDARD
3.004	43	1200	Manhole	1 STANDARD	42	1350	Manhole	1 STANDARD
3.005	42	1350	Manhole	1 STANDARD	41	1350	Manhole	1 STANDARD
3.006	41	1350	Manhole	1 STANDARD	4	1350	Manhole	1 STANDARD
1.011	4	1350	Manhole	1 STANDARD	3	1200	Manhole	1 STANDARD
4.000	2E		Manhole	1 STANDARD	1E		Manhole	1 STANDARD
4.001	1E		Manhole	1 STANDARD	51		Manhole	1 STANDARD
4.002	51		Manhole	1 STANDARD	50		Manhole	1 STANDARD
4.003	50		Manhole	1 STANDARD	49		Manhole	1 STANDARD
4.004	49		Manhole	1 STANDARD	14EX	1200	Manhole	1 STANDARD
4.005	14EX	1200	Manhole	1 STANDARD	48		Manhole	1 STANDARD
4.006	48		Manhole	1 STANDARD	3	1200	Manhole	1 STANDARD
1.012	3	1200	Manhole	1 STANDARD	2.1		Manhole	1 STANDARD
5.000	2.2		Manhole	1 STANDARD	2.1		Manhole	1 STANDARD
1.013	2.1		Manhole	1 STANDARD	2 IN		Manhole	1 STANDARD
1.014	2 IN		Manhole	1 STANDARD	1 OUT	1500	Manhole	1 STANDARD
6.000	5G		Manhole	1 STANDARD	4G	1350	Manhole	1 STANDARD

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.001	21.637	200.3	225	1 STANDARD	60.000	59.100	0.675	61.030	58.992	1.813
6.002	24.004	200.0	225	1 STANDARD	61.030	58.992	1.813	61.210	58.872	2.113
6.003	20.246	200.5	225	1 STANDARD	61.210	58.872	2.113	60.000	58.771	1.004
6.004	29.653	74.1	450	1 STANDARD	60.000	57.910	1.640	60.700	57.510	2.740
1.015	3.560	101.7	225	1 STANDARD	60.700	57.510	2.965	60.000	57.475	2.300

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
6.001	4G	1350	Manhole	1 STANDARD	3G	1350	Manhole	1 STANDARD
6.002	3G	1350	Manhole	1 STANDARD	2G	1350	Manhole	1 STANDARD
6.003	2G	1350	Manhole	1 STANDARD	1G IN	1350	Manhole	1 STANDARD
6.004	1G IN	1350	Manhole	1 STANDARD	1 OUT	1500	Manhole	1 STANDARD
1.015	1 OUT	1500	Manhole	1 STANDARD	0		Manhole	1 STANDARD

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	Scotland and Ireland	Additional Storage (m^3/ha)	20.0
M5-60 (mm)	17.200	Check Discharge Rate(s)	✓
Ratio-R	0.278	1 year (l/s)	5.4
Summer CV	0.750	30 year (l/s)	10.7
Winter CV	0.840	100 year (l/s)	12.7
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year 360 minute (m^3)	379

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	20	0	0
30	20	0	0
100	20	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.65
Greenfield Method	IH124	Growth Factor 100 year	1.96
Positively Drained Area (ha)	1.197	Betterment (%)	0
SAAR (mm)	774	QBar	6.5
Soil Index	4	Q 1 year (l/s)	5.4
SPR	0.47	Q 30 year (l/s)	10.7
Region	11	Q 100 year (l/s)	12.7
Growth Factor 1 year	0.83		

Pre-development Discharge Volume

Site Makeup	Greenfield	CWI	123.704
Greenfield Method	FSR/FEH	Return Period (years)	100
Positively Drained Area (ha)	1.197	Climate Change (%)	0
Soil Index	4	Storm Duration (mins)	360
SPR	0.47	Betterment (%)	0

Pre-development Discharge Volume

PR	0.507	Runoff Volume (m^3)	379

Node 1 OUT Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	57.510	Product Number	CTL-SHE-0171-1470-1200-1470
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	14.7	Min Node Diameter (mm)	1500

Node 1 OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	57.510
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	40

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	620.0	0.0	2.000	620.0	0.0	2.001	0.0	0.0

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	46	10	64.369	0.069	11.7	0.0911	0.0000	OK
15 minute winter	45	10	64.063	0.061	12.2	0.0704	0.0000	OK
15 minute winter	44	10	63.894	0.069	25.4	0.1486	0.0000	OK
15 minute winter	43	10	61.266	0.148	49.9	0.3304	0.0000	OK
15 minute winter	42	10	61.176	0.172	55.8	0.2946	0.0000	OK
15 minute winter	41	11	60.887	0.187	68.3	0.3726	0.0000	OK
15 minute winter	4G	10	59.187	0.087	11.0	0.2051	0.0000	OK
15 minute winter	8	10	65.282	0.176	64.6	0.2316	0.0000	OK
15 minute winter	7	10	65.113	0.184	74.7	0.3091	0.0000	OK
15 minute winter	5	10	62.794	0.135	144.3	0.3741	0.0000	OK
15 minute winter	14EX	10	62.906	0.106	39.7	0.1203	0.0000	OK
15 minute winter	3	11	60.629	0.604	284.3	0.6937	0.0000	SURCHARGED
15 minute winter	4	11	60.792	0.363	224.6	0.7409	0.0000	OK
15 minute winter	3G	10	59.078	0.086	11.0	0.1236	0.0000	OK
15 minute winter	2G	11	58.958	0.086	10.8	0.1234	0.0000	OK
480 minute winter	1G IN	352	57.991	0.081	1.5	0.1155	0.0000	OK
15 minute winter	10	10	66.085	0.085	44.9	0.0258	0.0000	OK
15 minute winter	11	10	67.223	0.093	39.6	0.0797	0.0000	OK
15 minute summer	12.1	1	68.209	0.000	0.0	0.0000	0.0000	OK
15 minute winter	12	10	69.757	0.053	19.0	0.0000	0.0000	OK
15 minute summer	13	10	70.116	0.072	19.0	0.0436	0.0000	OK
15 minute summer	14	10	70.366	0.045	8.8	0.0000	0.0000	OK
15 minute winter	9	10	65.503	0.203	61.2	0.1685	0.0000	OK
15 minute winter	47	10	65.185	0.045	8.1	0.0206	0.0000	OK
480 minute winter	1 OUT	352	57.991	0.481	45.0	298.9708	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	46	3.001	45	11.7	1.245	0.186	0.1918	
15 minute winter	45	3.002	44	12.2	1.294	0.139	0.0593	
15 minute winter	44	3.003	43	25.3	1.337	0.204	0.9118	
15 minute winter	43	3.004	42	49.5	1.296	0.318	0.2233	
15 minute winter	42	3.005	41	55.4	1.332	0.586	1.7993	
15 minute winter	41	3.006	4	65.9	1.113	0.618	1.7106	
15 minute winter	4G	6.001	3G	11.0	0.779	0.301	0.3055	
15 minute winter	8	1.007	7	64.5	1.463	0.536	0.6666	
15 minute winter	7	1.008	6	74.6	1.987	0.526	0.2528	
15 minute winter	5	1.010	4	144.1	2.839	0.422	1.2049	
15 minute winter	14EX	4.005	48	39.3	1.622	0.413	0.2806	
15 minute winter	3	1.012	2.1	285.1	1.799	1.251	0.7936	
15 minute winter	4	1.011	3	215.8	1.385	0.645	5.5763	
15 minute winter	3G	6.002	2G	10.8	0.790	0.295	0.3317	
15 minute winter	2G	6.003	1G IN	10.7	0.789	0.293	0.2754	
480 minute winter	1G IN	6.004	1 OUT	1.5	0.362	0.004	2.6344	
15 minute winter	10	1.005	9	44.9	1.696	0.305	0.2280	
15 minute winter	11	1.004	10	39.6	2.717	0.322	0.2979	
15 minute summer	12.1	2.000	11	0.0	0.000	0.000	0.1562	
15 minute winter	12	1.003	11	19.0	1.708	0.122	0.3288	
15 minute summer	13	1.002	12	19.0	2.129	0.175	0.0706	
15 minute summer	14	1.001	13	8.8	1.087	0.087	0.0600	
15 minute winter	9	1.006	8	61.0	1.711	0.922	0.4263	
15 minute winter	47	3.000	46	8.1	1.043	0.087	0.2095	
480 minute winter	1 OUT	1.015	0	14.7	1.025	0.285	0.0511	421.0

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	0	176	57.557	0.082	14.7	0.0000	0.0000	OK
15 minute winter	2 IN	11	58.664	0.514	292.9	0.0000	0.0000	SURCHARGED
15 minute winter	2.1	11	60.507	0.507	292.7	0.0000	0.0000	SURCHARGED
15 minute winter	2.2	10	63.055	0.055	8.4	0.0399	0.0000	OK
15 minute winter	6	10	64.953	0.133	116.5	0.3261	0.0000	OK
15 minute winter	48	10	62.581	0.162	72.4	0.2229	0.0000	OK
15 minute winter	49	10	67.847	0.077	39.9	0.0741	0.0000	OK
15 minute summer	50	10	69.434	0.064	26.6	0.0249	0.0000	OK
15 minute summer	51	10	70.439	0.076	21.2	0.0213	0.0000	OK
15 minute summer	1E	10	70.571	0.100	14.2	0.0146	0.0000	OK
15 minute summer	2E	10	70.622	0.088	11.6	0.0745	0.0000	OK
15 minute winter	5G	10	60.014	0.014	1.5	0.0018	0.0000	OK
15 minute summer	14A	10	71.763	0.043	8.8	0.0282	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	2 IN	1.014	1 OUT	294.3	1.878	1.117	5.1298	
15 minute winter	2.1	1.013	2 IN	292.9	1.865	1.270	0.4992	
15 minute winter	2.2	5.000	2.1	8.4	1.148	0.125	0.2193	
15 minute winter	6	1.009	5	116.3	3.835	0.373	0.8426	
15 minute winter	48	4.006	3	72.0	2.492	0.755	0.5323	
15 minute winter	49	4.004	14EX	39.7	2.626	0.252	0.8309	
15 minute summer	50	4.003	49	26.6	2.515	0.177	0.2049	
15 minute summer	51	4.002	50	21.2	2.017	0.225	0.3215	
15 minute summer	1E	4.001	51	14.2	0.986	0.388	0.3112	
15 minute summer	2E	4.000	1E	11.6	0.737	0.273	0.1483	
15 minute winter	5G	6.000	4G	1.5	0.230	0.007	0.0428	
15 minute summer	14A	1.000	14	8.8	1.616	0.080	0.1725	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	46	10	64.384	0.084	17.1	0.1117	0.0000	OK
15 minute winter	45	10	64.078	0.076	17.8	0.0876	0.0000	OK
15 minute winter	44	10	63.909	0.084	37.1	0.1816	0.0000	OK
15 minute winter	43	11	61.706	0.588	73.1	1.3114	0.0000	SURCHARGED
15 minute winter	42	11	61.670	0.666	77.4	1.1415	0.0000	SURCHARGED
15 minute winter	41	11	61.491	0.791	92.5	1.5785	0.0000	SURCHARGED
15 minute winter	4G	10	59.209	0.109	16.1	0.2560	0.0000	OK
15 minute winter	8	10	65.343	0.237	94.2	0.3113	0.0000	OK
15 minute winter	7	10	65.168	0.239	108.8	0.4015	0.0000	OK
15 minute winter	5	10	62.845	0.186	210.5	0.5154	0.0000	OK
15 minute winter	14EX	11	63.003	0.203	58.4	0.2302	0.0000	OK
15 minute winter	3	11	60.878	0.853	395.8	0.9801	0.0000	SURCHARGED
15 minute winter	4	11	61.291	0.862	295.2	1.7585	0.0000	SURCHARGED
15 minute winter	3G	10	59.100	0.108	16.1	0.1543	0.0000	OK
15 minute winter	2G	11	58.980	0.108	15.9	0.1540	0.0000	OK
480 minute winter	1G IN	376	58.257	0.347	2.2	0.4967	0.0000	OK
15 minute winter	10	10	66.144	0.144	66.3	0.0438	0.0000	OK
15 minute summer	11	9	67.241	0.111	58.1	0.0951	0.0000	OK
15 minute summer	12.1	1	68.209	0.000	0.0	0.0000	0.0000	OK
15 minute winter	12	10	69.768	0.064	28.0	0.0000	0.0000	OK
15 minute winter	13	10	70.133	0.089	28.0	0.0545	0.0000	OK
15 minute winter	14	10	70.376	0.055	13.0	0.0000	0.0000	OK
15 minute winter	9	10	65.832	0.532	89.7	0.4429	0.0000	SURCHARGED
15 minute winter	47	10	65.194	0.054	11.9	0.0250	0.0000	OK
480 minute winter	1 OUT	376	58.257	0.747	63.6	464.6990	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	46	3.001	45	17.1	1.360	0.272	0.2565	
15 minute winter	45	3.002	44	17.8	1.416	0.203	0.0791	
15 minute winter	44	3.003	43	37.0	1.405	0.298	1.2789	
15 minute winter	43	3.004	42	68.1	1.393	0.438	0.4115	
15 minute winter	42	3.005	41	74.1	1.311	0.783	2.9481	
15 minute winter	41	3.006	4	95.0	1.494	0.890	2.0675	
15 minute winter	4G	6.001	3G	16.1	0.851	0.440	0.4092	
15 minute winter	8	1.007	7	93.9	1.576	0.780	0.9050	
15 minute winter	7	1.008	6	108.4	2.183	0.765	0.3348	
15 minute winter	5	1.010	4	209.1	3.247	0.612	1.3850	
15 minute winter	14EX	4.005	48	55.5	1.640	0.582	0.4429	
15 minute winter	3	1.012	2.1	396.0	2.500	1.738	0.7936	
15 minute winter	4	1.011	3	297.2	1.876	0.888	5.9804	
15 minute winter	3G	6.002	2G	15.9	0.861	0.434	0.4431	
15 minute winter	2G	6.003	1G IN	15.8	0.871	0.432	0.3674	
480 minute winter	1G IN	6.004	1 OUT	2.2	0.424	0.006	4.2947	
15 minute winter	10	1.005	9	65.7	1.789	0.447	0.2957	
15 minute summer	11	1.004	10	58.4	2.723	0.475	0.4701	
15 minute summer	12.1	2.000	11	0.0	0.000	0.000	0.1967	
15 minute winter	12	1.003	11	28.0	1.967	0.180	0.4188	
15 minute winter	13	1.002	12	28.0	2.339	0.258	0.0946	
15 minute winter	14	1.001	13	13.0	1.190	0.128	0.0808	
15 minute winter	9	1.006	8	88.9	2.235	1.343	0.4774	
15 minute winter	47	3.000	46	11.9	1.159	0.128	0.2764	
480 minute winter	1 OUT	1.015	0	14.7	1.025	0.285	0.0511	483.4

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
60 minute winter	0	44	57.557	0.082	14.7	0.0000	0.0000	OK
15 minute winter	2 IN	11	59.047	0.897	407.3	0.0000	0.0000	SURCHARGED
15 minute winter	2.1	11	60.643	0.643	407.1	0.0000	0.0000	SURCHARGED
15 minute winter	2.2	10	63.067	0.067	12.3	0.0487	0.0000	OK
15 minute winter	6	10	64.984	0.164	169.8	0.4044	0.0000	OK
15 minute winter	48	10	62.845	0.426	99.8	0.5843	0.0000	SURCHARGED
15 minute winter	49	10	67.864	0.094	58.5	0.0912	0.0000	OK
15 minute summer	50	10	69.449	0.079	39.0	0.0307	0.0000	OK
15 minute summer	51	10	70.457	0.094	31.1	0.0263	0.0000	OK
15 minute summer	1E	10	70.596	0.125	20.8	0.0182	0.0000	OK
15 minute summer	2E	10	70.646	0.112	17.0	0.0945	0.0000	OK
15 minute winter	5G	10	60.016	0.016	2.2	0.0021	0.0000	OK
15 minute winter	14A	10	71.773	0.053	13.0	0.0343	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute winter	2 IN	1.014	1 OUT	407.7	2.573	1.548	5.3289	
15 minute winter	2.1	1.013	2 IN	407.3	2.571	1.765	0.5189	
15 minute winter	2.2	5.000	2.1	12.3	1.278	0.183	0.2889	
15 minute winter	6	1.009	5	169.6	4.047	0.544	1.1843	
15 minute winter	48	4.006	3	97.6	2.488	1.024	0.7332	
15 minute winter	49	4.004	14EX	58.4	2.787	0.370	1.4394	
15 minute summer	50	4.003	49	39.0	2.779	0.260	0.2722	
15 minute summer	51	4.002	50	31.1	2.222	0.331	0.4281	
15 minute summer	1E	4.001	51	20.8	1.088	0.568	0.4120	
15 minute summer	2E	4.000	1E	17.0	0.805	0.401	0.1990	
15 minute winter	5G	6.000	4G	2.2	0.259	0.011	0.0571	
15 minute winter	14A	1.000	14	13.0	1.800	0.118	0.2289	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	46	10	64.397	0.097	22.2	0.1292	0.0000	OK
15 minute summer	45	10	64.090	0.088	23.1	0.1025	0.0000	OK
15 minute winter	44	10	63.922	0.097	48.2	0.2096	0.0000	OK
15 minute winter	43	12	62.375	1.257	95.0	2.8035	0.0000	SURCHARGED
15 minute winter	42	12	62.321	1.317	84.1	2.2562	0.0000	SURCHARGED
15 minute winter	41	11	62.049	1.349	101.4	2.6909	0.0000	SURCHARGED
15 minute winter	4G	10	59.228	0.128	20.8	0.3007	0.0000	OK
15 minute winter	8	11	65.448	0.342	114.9	0.4500	0.0000	SURCHARGED
15 minute winter	7	11	65.215	0.286	133.0	0.4819	0.0000	OK
15 minute winter	5	11	63.268	0.609	263.6	1.6927	0.0000	SURCHARGED
15 minute winter	14EX	11	63.577	0.777	75.9	0.8783	0.0000	SURCHARGED
15 minute winter	3	11	61.125	1.100	489.0	1.2637	0.0000	SURCHARGED
15 minute winter	4	11	61.753	1.324	366.7	2.7027	0.0000	SURCHARGED
15 minute winter	3G	10	59.119	0.127	20.8	0.1811	0.0000	OK
15 minute winter	2G	11	58.998	0.126	20.6	0.1805	0.0000	OK
480 minute winter	1G IN	448	58.527	0.617	2.8	0.8825	0.0000	SURCHARGED
15 minute winter	10	11	66.525	0.525	83.9	0.1595	0.0000	SURCHARGED
15 minute winter	11	10	67.267	0.137	75.5	0.1175	0.0000	OK
15 minute summer	12.1	1	68.209	0.000	0.0	0.0000	0.0000	OK
15 minute summer	12	10	69.778	0.074	36.3	0.0000	0.0000	OK
15 minute summer	13	10	70.149	0.105	36.3	0.0638	0.0000	OK
15 minute summer	14	10	70.384	0.063	16.8	0.0000	0.0000	OK
15 minute winter	9	11	66.193	0.893	110.3	0.7426	0.0000	SURCHARGED
15 minute summer	47	10	65.202	0.062	15.4	0.0285	0.0000	OK
480 minute winter	1 OUT	448	58.527	1.017	79.0	632.1486	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	46	3.001	45	22.2	1.441	0.353	0.3145	
15 minute summer	45	3.002	44	23.1	1.503	0.264	0.0968	
15 minute winter	44	3.003	43	48.2	1.475	0.388	1.3475	
15 minute winter	43	3.004	42	73.9	1.369	0.475	0.4115	
15 minute winter	42	3.005	41	90.6	1.309	0.958	2.9481	
15 minute winter	41	3.006	4	114.3	1.624	1.071	2.0675	
15 minute winter	4G	6.001	3G	20.8	0.900	0.568	0.5007	
15 minute winter	8	1.007	7	115.6	1.645	0.961	1.0558	
15 minute winter	7	1.008	6	133.0	2.339	0.938	0.3831	
15 minute winter	5	1.010	4	245.1	3.569	0.717	1.6792	
15 minute winter	14EX	4.005	48	71.3	1.793	0.748	0.4541	
15 minute winter	3	1.012	2.1	488.5	3.084	2.145	0.7936	
15 minute winter	4	1.011	3	365.1	2.304	1.091	5.9804	
15 minute winter	3G	6.002	2G	20.6	0.909	0.561	0.5427	
15 minute winter	2G	6.003	1G IN	20.4	0.927	0.559	0.4464	
480 minute winter	1G IN	6.004	1 OUT	2.4	0.407	0.006	4.6983	
15 minute winter	10	1.005	9	81.2	2.042	0.553	0.3530	
15 minute winter	11	1.004	10	73.7	2.730	0.600	0.6651	
15 minute summer	12.1	2.000	11	0.0	0.000	0.000	0.2529	
15 minute summer	12	1.003	11	36.3	2.084	0.234	0.5292	
15 minute summer	13	1.002	12	36.3	2.483	0.334	0.1155	
15 minute summer	14	1.001	13	16.8	1.247	0.165	0.0994	
15 minute winter	9	1.006	8	109.1	2.744	1.648	0.4774	
15 minute summer	47	3.000	46	15.4	1.237	0.166	0.3346	
480 minute winter	1 OUT	1.015	0	14.7	1.025	0.285	0.0511	461.8

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	0	38	57.557	0.082	14.7	0.0000	0.0000	OK
15 minute winter	2 IN	11	59.418	1.268	502.7	0.0000	0.0000	SURCHARGED
15 minute winter	2.1	11	60.766	0.766	502.9	0.0000	0.0000	SURCHARGED
15 minute winter	2.2	10	63.077	0.077	16.0	0.0560	0.0000	OK
15 minute winter	6	11	65.002	0.182	211.6	0.4474	0.0000	OK
15 minute winter	48	11	63.291	0.872	122.9	1.1965	0.0000	SURCHARGED
15 minute winter	49	10	67.879	0.109	75.9	0.1057	0.0000	OK
15 minute summer	50	10	69.461	0.091	50.6	0.0356	0.0000	OK
15 minute summer	51	10	70.472	0.109	40.4	0.0307	0.0000	OK
15 minute summer	1E	10	70.618	0.147	27.0	0.0214	0.0000	OK
15 minute summer	2E	10	70.668	0.134	22.1	0.1129	0.0000	OK
15 minute summer	5G	10	60.018	0.018	2.8	0.0024	0.0000	OK
15 minute winter	14A	10	71.780	0.060	16.8	0.0390	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	2 IN	1.014	1 OUT	502.2	3.170	1.907	5.3500	
15 minute winter	2.1	1.013	2 IN	502.7	3.173	2.179	0.5210	
15 minute winter	2.2	5.000	2.1	16.0	1.372	0.238	0.3502	
15 minute winter	6	1.009	5	210.4	4.049	0.675	1.5988	
15 minute winter	48	4.006	3	122.6	3.084	1.286	0.7330	
15 minute winter	49	4.004	14EX	75.9	2.844	0.481	1.6111	
15 minute summer	50	4.003	49	50.7	2.964	0.337	0.3311	
15 minute summer	51	4.002	50	40.5	2.365	0.430	0.5222	
15 minute summer	1E	4.001	51	27.0	1.159	0.737	0.5007	
15 minute summer	2E	4.000	1E	22.1	0.851	0.521	0.2446	
15 minute summer	5G	6.000	4G	2.8	0.257	0.013	0.0698	
15 minute winter	14A	1.000	14	16.8	1.914	0.153	0.2781	

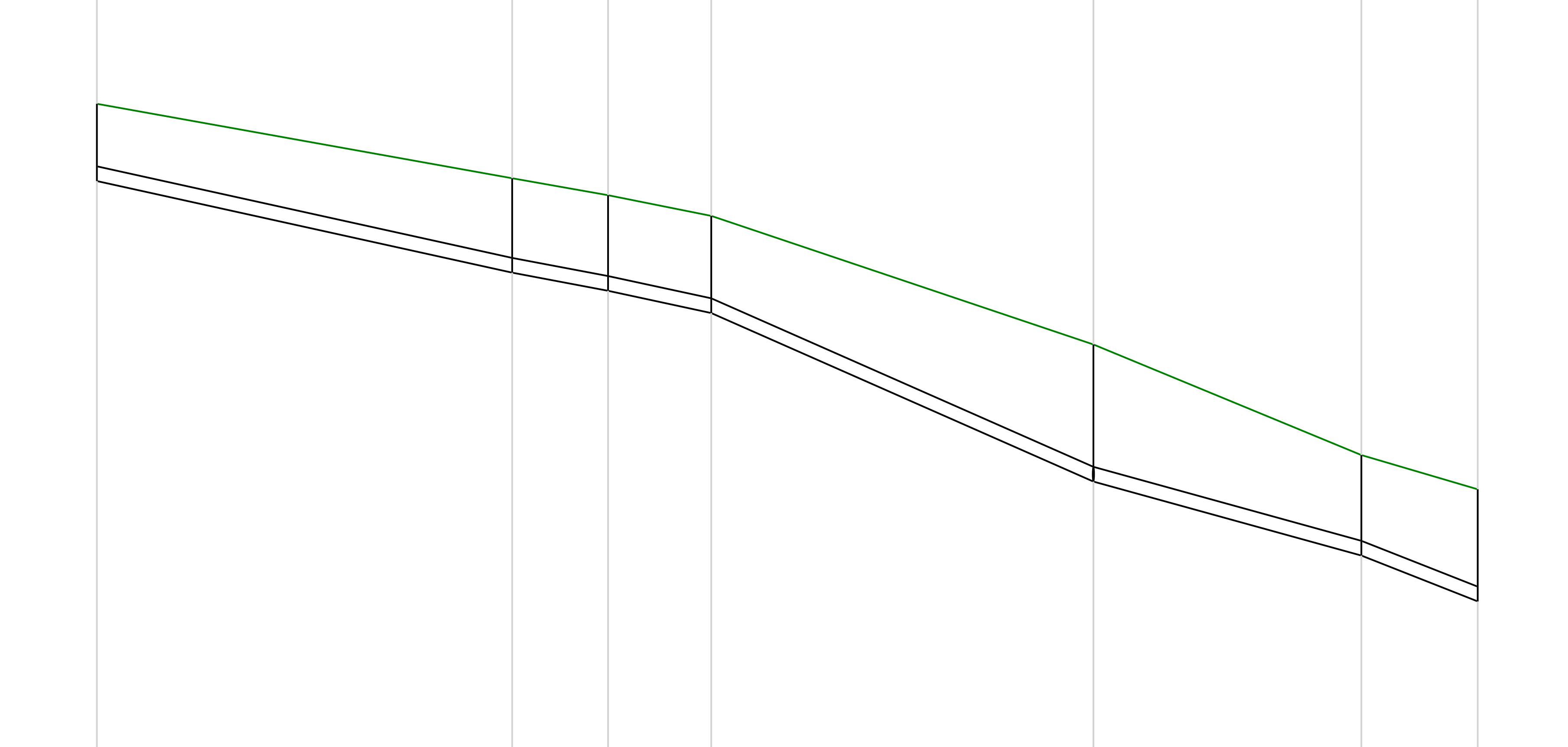
H. Long Sections

Waterman Moylan Block S, EastPoint Business Park, Alfie Byrne Road, Dublin D03 H3F4	File: 2024-09-04 Head Rev.pfd Network: Storm JU 05/09/2024	Page 1 20-086 Knockrabo	

A4 drawing

Hor Scale 500
Ver Scale 100

Datum (m) 63.000

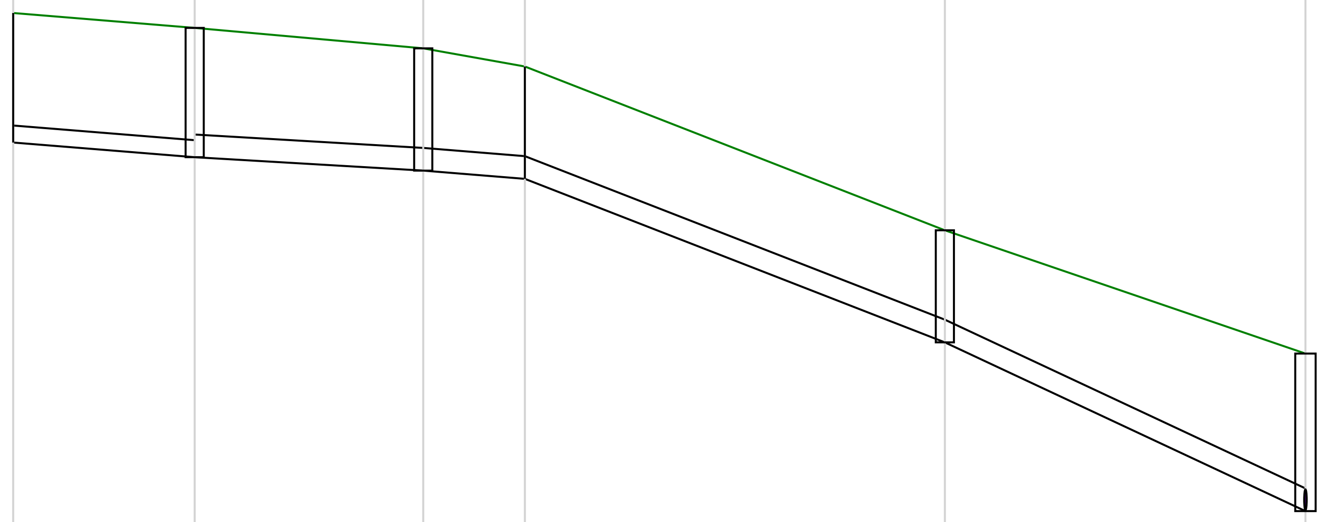


Node Name	14A	14	13	12	11	10	9
Cover Level (m)	72.900	71.763	71.504	71.188	69.224	67.535	67.012
Invert Level (m)	71.720	70.321 / 70.321	70.044 / 70.044	69.704 / 69.704	67.130 / 67.130	66.000 / 66.000	65.300

Link Name	1.000	1.001	1.002	1.003	1.004	1.005
Section Type	225mm	225mm	225mm	225mm	225mm	225mm
Slope (1:X)	22.6	26.4	23.2	11.3	18.1	12.7
Length (m)	31.684	7.317	7.873	29.157	20.443	8.877

Waterman Moylan Block S, EastPoint Business Park, Alfie Byrne Road, Dublin D03 H3F4	File: 2024-09-04 Head Rev.pfd Network: Storm JU 05/09/2024	 20-086 Knockrabo

Node Name	9	8	7	6	5	4
Cover Level (m)	67.012	66.815	66.545	66.305	64.140	62.511



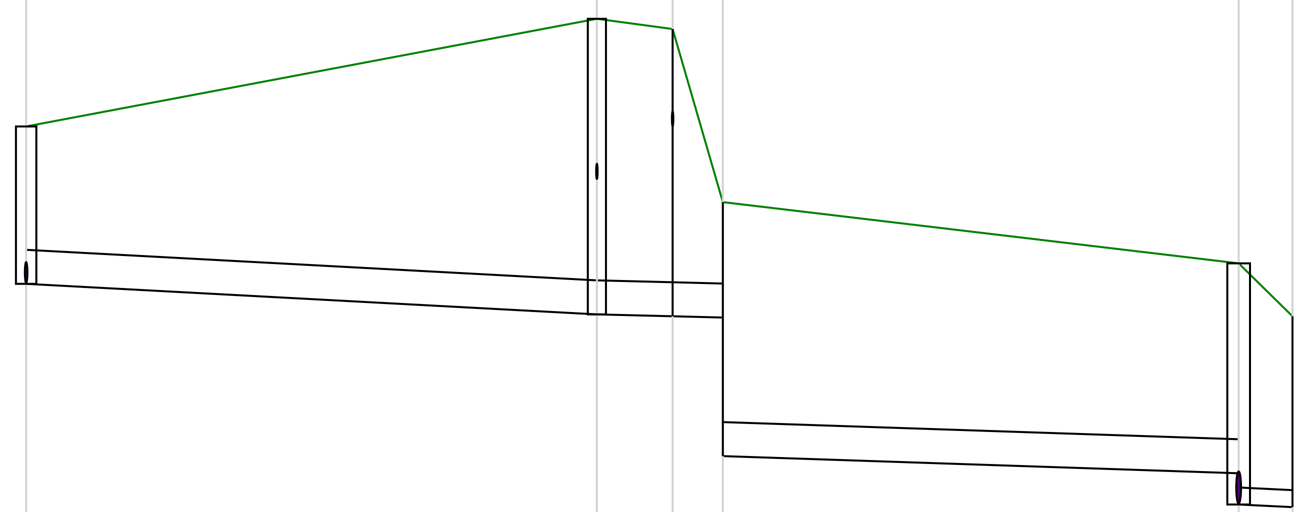
A4 drawing

Hor Scale 500
Ver Scale 100

Datum (m) 58.000

Link Name	1.006	1.007	1.008	1.009	1.010
Section Type	225mm	300mm	300mm	300mm	300mm
Slope (1:X)	61.9	85.4	61.7	12.9	10.7
Invert Level (m)	65.300 / 65.106	65.106 / 64.929	64.929 / 64.820	64.820 / 62.659	62.659 / 60.429
Length (m)	12.004	15.114	6.721	27.776	23.846

Node Name	4		3		2.1		2 IN		1 OUT		



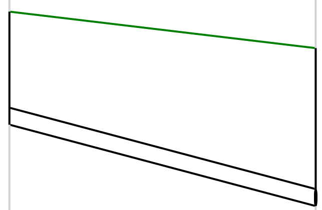
A4 drawing

Hor Scale 500
Ver Scale 100

Datum (m) 55.000

Link Name		1.011		1.012	1.01		1.014		1.01	
Section Type		450mm		450mm	450r		450mm		225n	
Slope (1:X)		93.4		200.4	195.		150.3		101.	
Cover Level (m)	62.511		63.935		63.800	61.510		60.700		60.000
Invert Level (m)	60.429	60.025	60.025	60.000	60.000 59.983	58.150	57.923	57.510	57.475	
Length (m)		37.745		5.009	3.32		34.111		3.56	

Node Name	12.1		11



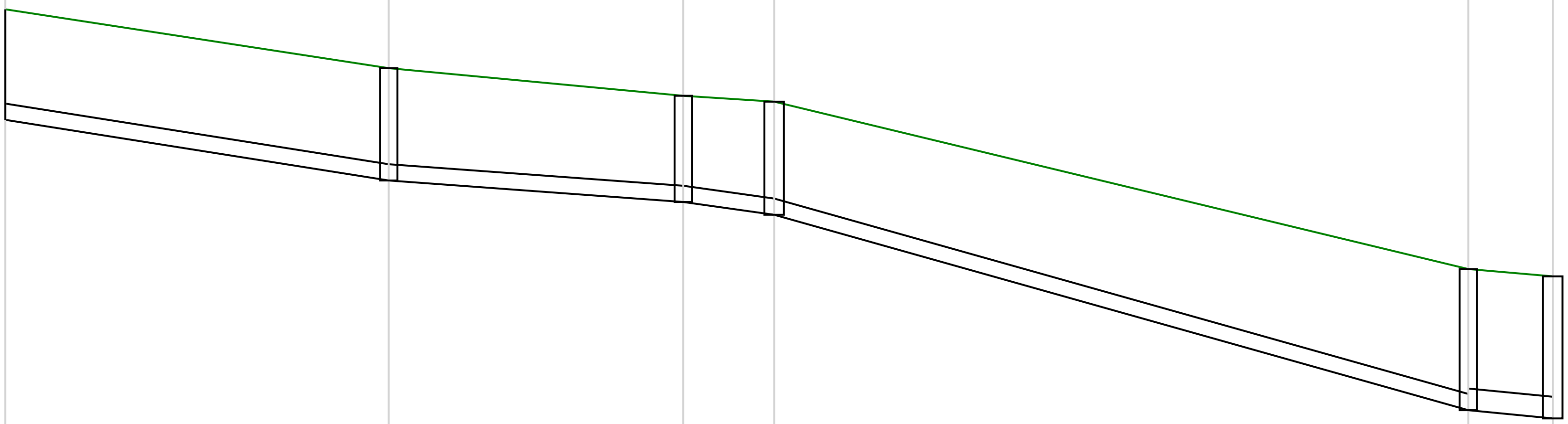
A4 drawing

Hor Scale 500
Ver Scale 100

Datum (m) 63.000

Link Name		2.000	
Section Type		225mm	
Slope (1:X)		18.7	
Cover Level (m)	69.708		69.224
Invert Level (m)	68.209	67.130	
Length (m)		20.223	

CAUSEWAY	Waterman Moylan Block S, EastPoint Business Park, Alfie Byrne Road, Dublin D03 H3F4	File: 2024-09-04 Head Rev.pfd Network: Storm JU 05/09/2024	Page 5 20-086 Knockrabo



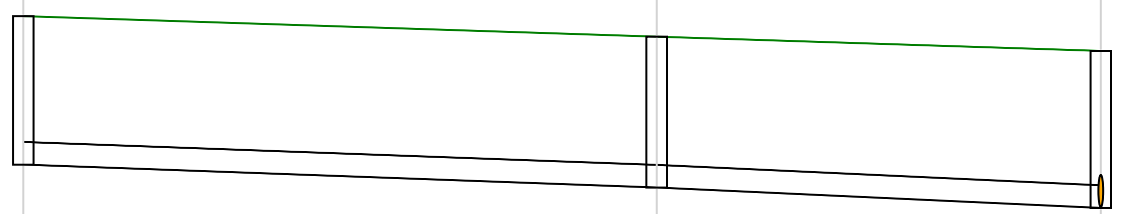
A4 drawing

Hor Scale 500
Ver Scale 100

Datum (m) 58.000

Node Name	47		46		45		44		43		42
Link Name		3.000		3.001		3.002		3.003		3.004	
Section Type		225mm		225mm		225mm		225mm		300mm	
Slope (1:X)		31.6		68.4		35.5		17.7		51.3	
Cover Level (m)	66.671		65.856		65.473		65.392		63.073		62.972
Invert Level (m)	65.140		64.300 / 64.300		64.002 / 64.002		63.825 / 63.825		61.118 / 61.118		61.004
Length (m)		26.533		20.386		6.291		48.043		5.843	

Node Name	42		41		4



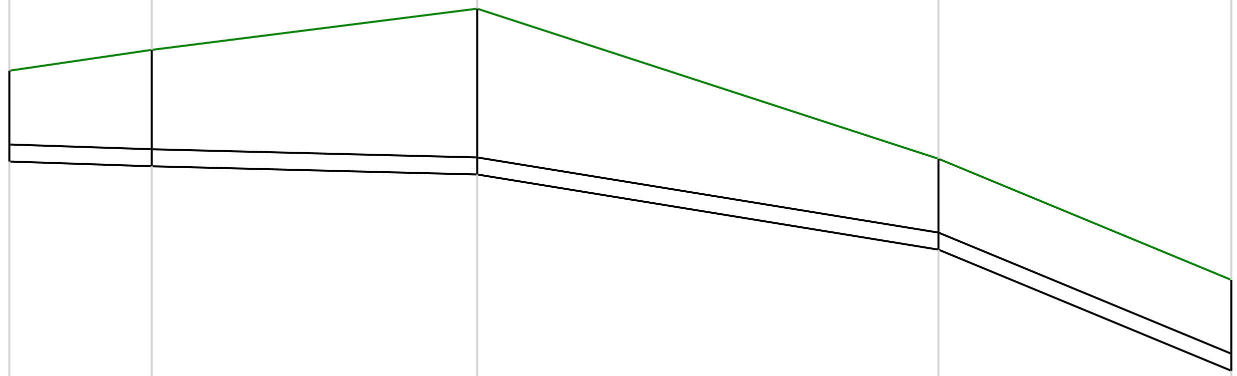
A4 drawing

Hor Scale 500
Ver Scale 100

Datum (m) 56.000

Link Name		3.005		3.006	
Section Type		300mm		300mm	
Slope (1:X)		137.7		108.3	
Cover Level (m)	62.972		62.700		62.511
Invert Level (m)	61.004		60.700 / 60.700		60.429
Length (m)		41.865		29.360	

Node Name	2E		1E		51		50		49
Link Name		4.000		4.001		4.002		4.003	
Section Type		225mm		225mm		225mm		225mm	
Slope (1:X)		149.5		199.3		30.7		12.1	
Cover Level (m)	71.734		72.009		72.553		70.570		68.970
Invert Level (m)	70.534	70.471	70.471	70.363	70.363	69.370	69.370	67.770	
Length (m)		9.419		21.520		30.506		19.363	



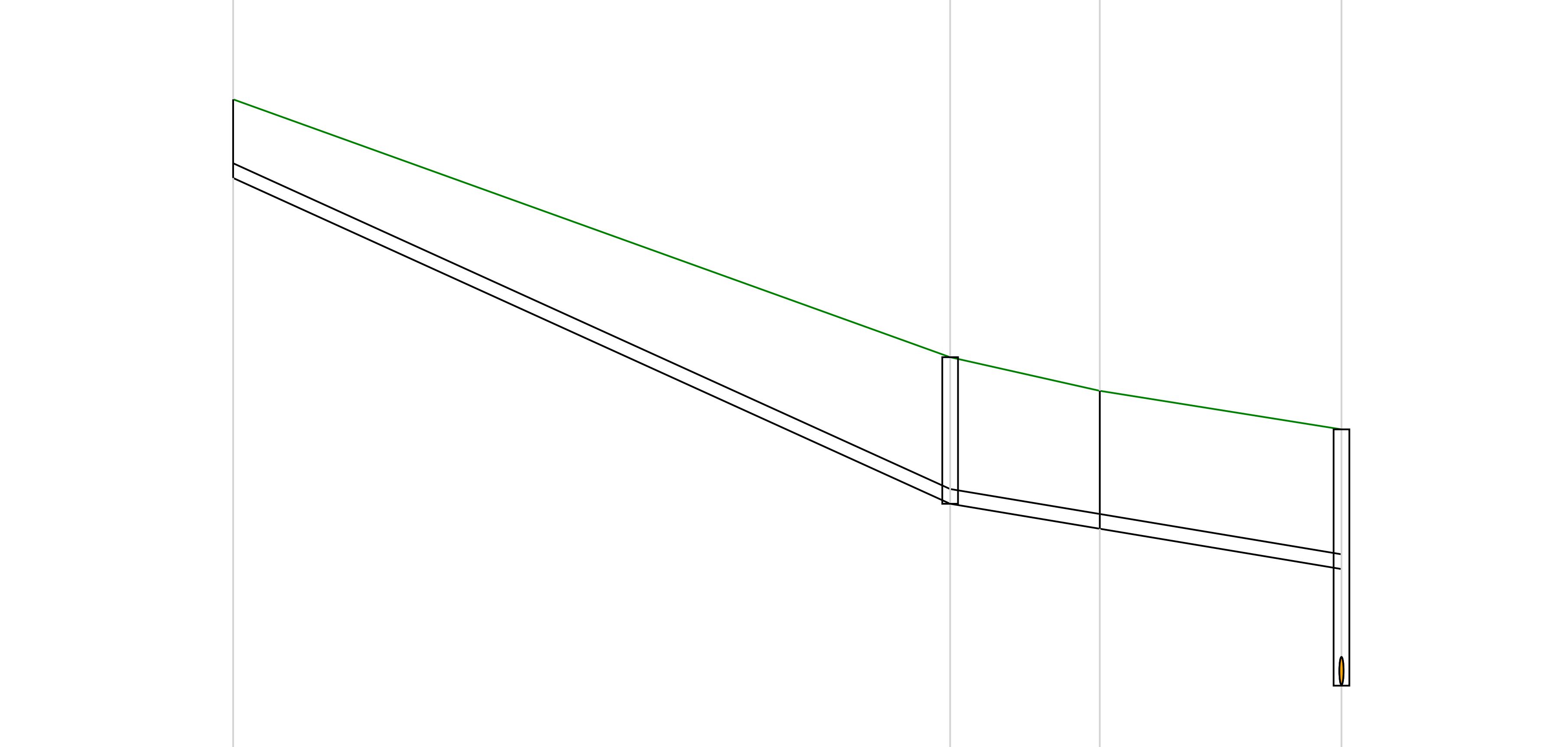
A4 drawing

Hor Scale 500
Ver Scale 100

Datum (m) 64.000

CAUSEWAY	Waterman Moylan Block S, EastPoint Business Park, Alfie Byrne Road, Dublin D03 H3F4	File: 2024-09-04 Head Rev.pfd Network: Storm JU 05/09/2024	Page 8 20-086 Knockrabo

Node Name	49		14EX	48	3



A4 drawing

Hor Scale 500
Ver Scale 100

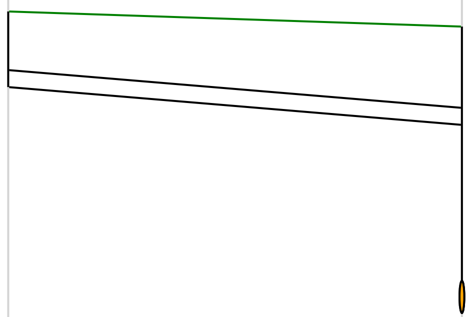
Datum (m) 59.000

Link Name	4.004	4.005	4.006
Section Type	225mm	225mm	225mm
Slope (1:X)	11.0	30.0	30.0

	49	14EX	48	3
Cover Level (m)	68.970	65.036	64.523	63.935
Invert Level (m)	67.770	62.800 / 62.800	62.419 / 62.419	61.804

Length (m)	54.706	11.418	18.440

Node Name	2.2	2.1



A4 drawing

Hor Scale 500
Ver Scale 100

Datum (m) 56.000

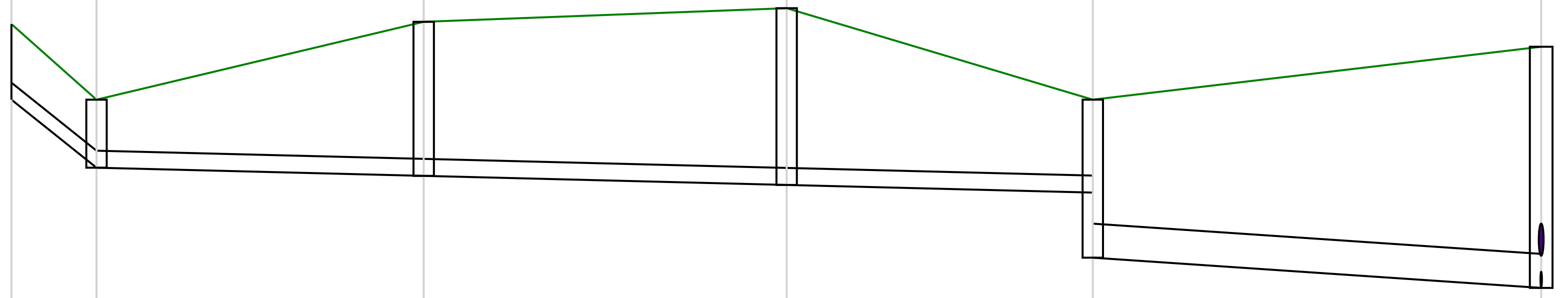
	2.2		2.1
Link Name		5.000	
Section Type		225mm	
Slope (1:X)		60.1	
Cover Level (m)	64.000		63.800
Invert Level (m)	63.000	62.500	
Length (m)		30.036	

CAUSEWAY	Waterman Moylan Block S, EastPoint Business Park, Alfie Byrne Road, Dublin D03 H3F4	File: 2024-09-04 Head Rev.pfd Network: Storm JU 05/09/2024	Page 10 20-086 Knockrabo

A4 drawing

Hor Scale 500
Ver Scale 100

Datum (m) 54.000



Node Name	5G		4G		3G		2G		1G IN		1 OUT
Link Name		6.000		6.001		6.002		6.003		6.004	
Section Type		225mm		225mm		225mm		225mm		450mm	
Slope (1:X)		6.3		200.3		200.0		200.5		74.1	
Cover Level (m)	61.000		60.000		61.030		61.210		60.000		60.700
Invert Level (m)	60.000		59.100 59.100		58.992 58.992		58.872 58.872		58.771 57.910		57.510
Length (m)		5.627		21.637		24.004		20.246		29.653	

UK and Ireland Office Locations