

AtkinsRéalis



Stormwater Impact Assessment Report

Castlethorn Old Connaught UCL

17 September 2026

0126446DG0009

OLD CONNAUGHT PHASE 1

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1. Introduction

The proposed development comprises 271 no. dwellings in a mix of houses and duplex/apartment units, including 103no. 2 to 3 storey houses (22no. 4-bedroom, 68no. 3-bedroom and 13no. 2-bedroom), 162no. apartments (113no. 2-bedroom and 49no. 1-bedroom) across 4no. blocks ranging from 1-5 storeys in building height and 6no. 3-bedroom duplex units; 1no. creche (c.574 sqm) at ground floor of Apartment Block 3; and all associated and ancillary site development and infrastructural works including on site attenuation, hard and soft landscaping and boundary treatment works , including : public open space; communal open space; components of the regional attenuation pond; public lighting ; surface car parking spaces ; bicycle parking spaces / stores for houses and duplex/ apartment units; 5no. ESB Substations; bin stores; Vehicular access via existing Old Connaught Avenue and a proposed new primary North-South Street into the eastern portion of the Central Character Area . The proposed development also includes the construction of a new pumping station , associated single storey building, twin rising mains extending circa 400m along Old Connaught Avenue under the M11 connecting to the existing gravity foul network on Old Connaught Avenue 125m east of the M11 bridge and associated storage, together with all ancillary site development and reinstatement works required to facilitate these elements.

This report presents the Storm Water Impact Assessment Report and covers the proposed Phase 1 of the development and should be read alongside the Flood Risk Assessment (0126446DG0010 - Stage 1 FRA) associated with this application.

- Existing Site and Hydrological Features
- Site Investigation Testing
- Soil Type Classification
- Storm Water Drainage Design
- Sustainable Urban Drainage System (SuDS)
- Flood Risk Assessment and Exceedance Flows
- SuDS Maintenance

1.1 Site Location

The proposed site is located within the client land ownership within the Old Connaught LAP. The land is bounded to the west of the M11 corridor, North of Old Connaught Avenue, and east of existing residential areas in Old Connaught. Figure 1-1 below indicates the extents of the site within the redline boundary. The site extends across the central and eastern fields of Old Connaught and includes frontage onto Old Connaught Avenue to the south.

The map highlights several features that help show the site's position within the surrounding areas. The M11 forms a clear landmark to the east, and Old Connaught Avenue defines the Southern Edge of the surrounding area. The wider setting comprises a combination of suburban neighbourhoods, community facilities and open green spaces, reflecting the mixed residential and semi-rural character typical of Old Connaught.





Figure 1-1 - Site Location

1.2 Existing Site Description

The existing topographical levels within the proposed site range from approximately 24.23mOD at the North-West Boundary, which is the highest point to around 18.89mOD at the lowest point in the southwest . Overall, the ground levels fall gradually across the site, sloping from the North-west area towards the South-West.

1.3 Principle Design Considerations

During the design of the storm Drainage for the proposed site, including SuDS, the following key documents / standards were taken into consideration.

- Dun Laoghaire Rathdown County Development Plan, 2022-2028
- Old Connaught Local Area Plan (LAP)
- Greater Dublin Strategic Drainage Study (GDSDS)
- CIRIA Report C753 The SuDS Manual -v6

The proposed stormwater drainage has been developed in consultation with the relevant authorities including Dun Laoghaire Rathdown County Council (DLRCC) Municipal services Department and will be further discussed prior to the final planning submission.



2. Surface Water Design

The storm drainage system has been designed in accordance with the key documents and standards listed in Section 1.3 above.

Surface water generated from the proposed residential development will be conveyed through a proposed surface water network including SuDS and attenuated / managed on site prior to final discharge at QBar greenfield run-off rates. The restricted discharge from the proposed site will be conveyed via a new surface water sewer proposed from the attenuation pond and discharged to the existing culvert located east of the proposed site which then discharges to the receiving Crinken Stream. The proposed Storm drainage Network for the development is as indicated on the planning drawings ATK-ZZ-ZZ-DR-CE-900500 - ATK-ZZ-ZZ-DR-CE-900504.

The principles behind the proposed design were discussed and agreed with DLRCC Municipal services department at multiple stages in advance of making this application. . Aspects of the proposed development that were discussed and agreed have been incorporated within this design.

The proposed measures included within the design proposal are as follows:

- Swales within Open Space / Park areas adjacent to roads
- Permeable Paving in light traffic areas (Parking Bays)
- Green Roofs to suitable Apartment Block
- Potential for use of Modular underground attenuation Systems within Park Areas
- Filter Drains in rear Gardens
- Tree Pits
- Flow Control Devices including Vortex and orifice Plates as required.
- A regional overground attenuation Pond

2.1 Proposed Sustainable Urban Drainage (SuDS) Strategy

For the proposed development a SuDS Triangle was utilized to ensure all three functions are provided for within the SuDS strategy.

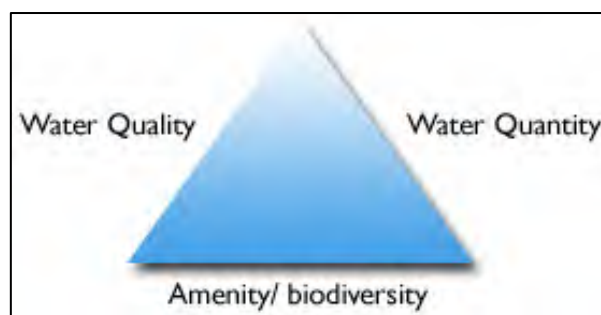


Figure 2-1 - SuDS Triangle

By considering the three functions of the triangle, a SuDS system will allow for water quality treatment through natural processes by;

- Encouraging infiltration (where appropriate) and attenuation peak flows.
- Improving Water Quality by providing treatment to storm water prior to discharge
- Providing Habitat and function were possible for those using the area (including wildlife)

The principles of a SuDS Treatment train were used during the design of the surface water drainage system. The treatment train as illustrated in the image below provides an understanding of prevention and source control to reduced water runoff from a site and improve water Quality.

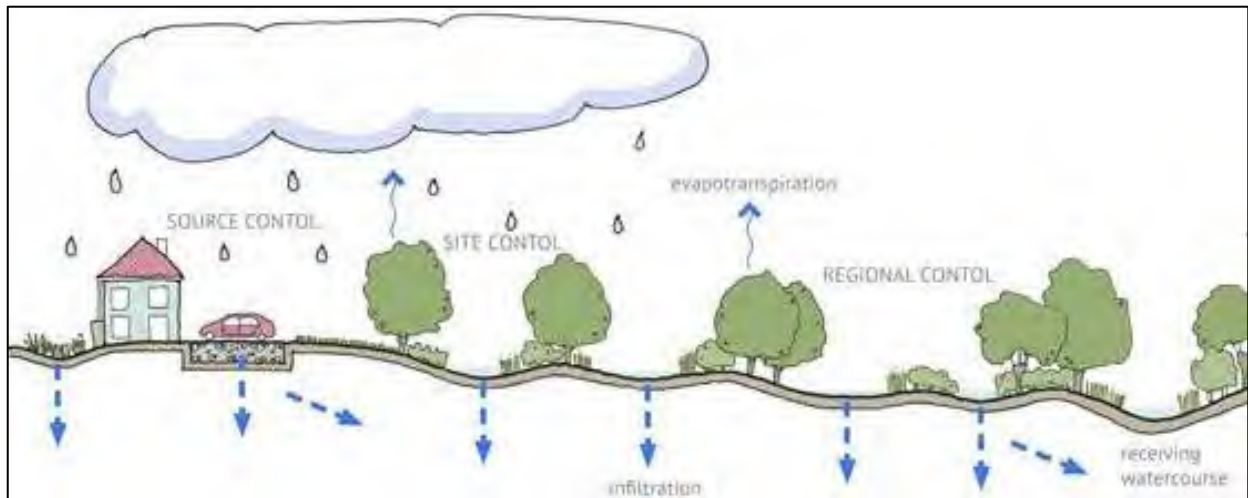


Figure 2-2 - SuDS Treatment Train

The treatment train principles include;

- Prevention of surface water run-off from the proposed site by use of filter drains, swales, permeable paving, tree pits, extensive green roofs, and modular attenuation systems with a permeable base. (where appropriate)
- Minimising impermeable paved areas using permeable paving, and extensive green roofs.
- Infiltration by use of Filter drains, swales, permeable paving and tree pits.
- Site control using underground modular attenuation storage and vortex flow control devices to manage flows and agreed final Qbar Run off rate.

Each of the items outlined above will help to improve water quality, reduce storm runoff quantity from the proposed site and ensure that there is no increased risk to downstream flooding where discharging to the existing culvert.

To facilitate the design of the Phase 1 stormwater drainage network, the full development extent (Phases 1 and 2) has been considered in the hydraulic assessment. The Phase 1 drainage layout has been developed using the proposed finished levels, while the Phase 2 lands have been assessed based on existing ground levels. Considering the overall development extent at this stage ensures that adequate drainage gradients and satisfactory invert levels can be achieved for the internal network, including the discharge to the proposed regional attenuation tank. The total area considered in the assessment is 11.538 ha, as illustrated in Figure 2-3.

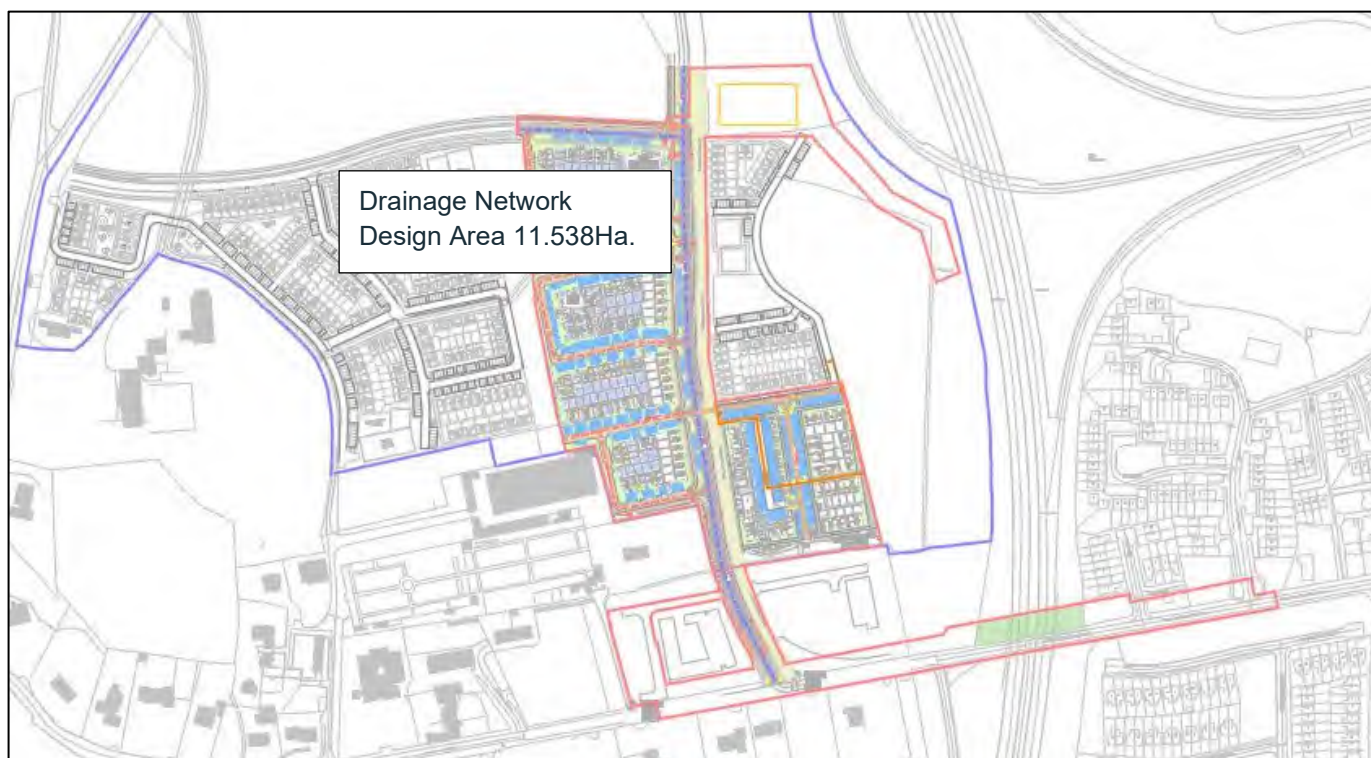


Figure 2-3 - Overall Catchment Area Considered for Drainage Network Design

There are 4 No proposed drainage Sub-catchment Areas (Catchment 1A, 1B, 2A, and 2B) Within the proposed development for the purpose of site control as outlined on planning drawing ATK-ZZ-ZZ-DR-CE-900103 Sub Catchment Areas Layout Plan.. The catchments are segregated by use of a vortex control device to limit / Manage discharge from each catchment. Section 7 provides further details on Catchment areas.

The SuDS techniques proposed within the development are outlined below:

- Swales are to be used within the site as conveyance systems for surface water runoff from sections of road, footpaths, or shared surfaces. Discharge into the swale will be via drop kerbs/ side inlet gullies or over edge flows.
- Permeable Paving will be used in light traffic areas to the front of residential units, courtyards and carparks, The permeable paving will allow for attenuation, infiltration to ground, reduction of peak flow rates and improved water quality. Roof Run-off from the front roof area of residential housing units will discharge directly into the Subbase below each permeable paving area allowing for reduced run off from these roof areas.
- Extensive Green roofs will be provided on suitable buildings as indicated on drawing ATK-ZZ-ZZ-DR-CE-900504 in accordance with Dun Laoghaire Rathdown County Development Plan, 2022-2028 and Old Connaught LAP. The green roofs will provide reduced peak flow rates, attenuation, evaporation and improved water quality.
- Filter drains within rear gardens of the housing units will allow for infiltration to ground, reduced peak flow rates and improved water quality. Only roof run off from the rear roof of the residential unit will discharge into the filter drain. The filter drain will allow for infiltration to ground and reduce the overall site runoff.
- Underground modular systems will be used within public green corridors / Park areas . The modular systems will allow for storm water attenuation underground for storm events up to 1 in 100 year events. The modular systems will also allow for infiltration to ground were suitable.
- Vortex flow control devices will be used throughout the site to allow for storm water control and reduce peak run-off.

The storm water drainage network will be assessed for compliance with Key design parameter as set out in Table 2-1 below.

Table 2-1 - Storm Drainage Design Parameters

Parameter	Value/Requirement
Minimum Depth	1.2m cover under highways 0.9m elsewhere*
Maximum Depth	5m
Minimum Sewer Size for Main Drainage	225mm
DLRCC Municipal services agreed coefficient runoff factors for pipe sizing and storage requirements	100% Roads / Cycletrack / Footpath / Roofs (when discharging directly to the proposed Storm drainage Network). 75% - Roads / Cycle tracks / Footpath / Roofs when discharging directly to swales, tree pits and filter drains. 60% - Roads / Cycle tracks / Footpaths / Roofs when discharging directly to permeable paving 85% - Extensive Green Roofs
Max velocity at Pipe full	3.0m/s
Min Velocity in	0.75m/s (1.0m/s used where achievable)
Roughness	0.6mm
Maximum discharge rate	A discharge rate of 15.1 l/s is controlled at the flow control manhole located at the final outfall from the local attenuation tank serving Catchment 1A. A discharge rate of 27.1 l/s is controlled at the final discharge point from the regional attenuation pond serving Catchments 1A and 1B.
Level of Service Critical Storm 1 in 2 year return period	No Surcharge within the pipe network, no flooding
Level of service Critical Storm 1 in 30 year return period	Surcharge allowed, No flooding
Level of service Critical Storm 1 in 100 year return period	No Flooding unless planned and contained on site.

**Without recourse to concrete, absolute minimum cover in roads is 0.9m. Pipes with cover between 0.9m and 1.2m shall be bedded and surrounded in concrete, 150mm thick, Class E, in accordance with Clause 1502 of the Specification for Roadworks.*

***Overall catchment area for storm water design purposes is 11.538Ha as discussed in Section 2.1 above.*

Causeway Flow which is an industry standard tool for the design and assessment of gravity sewer drainage networks, has been used to simulate the proposed storm drainage network including flow controls and attenuation requirements. Outputs from the model for the proposed storm network are contained in Appendix A-F of this report.



3. Site Investigations

Site Investigations were carried out by Ground Investigations Ireland Ltd in March 2026. Refer to Appendix G for a copy of the Ground Investigations Report.

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods. The scope of the site investigation works undertaken for this project included the following.

- 3 no. cable percussive boreholes
- 3 no. rotary coreholes at borehole locations
- 5 no. mechanically excavated trial pits
- 2 no. window samples
- 2 no. dynamic probes at window sample locations
- 7 no. plate bearing tests
- 7 no. infiltration tests
- 1 no. inspection (slit) trench
- Groundwater monitoring of standpipes
- A programme of geotechnical, chemical and environmental laboratory testing

The locations for the site investigation testing including soakaways and ground water monitoring wells were discussed and agreed with DLRCC Municipal services prior to works commencing on site. Refer to Figure 3-1 below for borehole and trial pit locations. The locations for the site investigation testing are indicated in the image below:

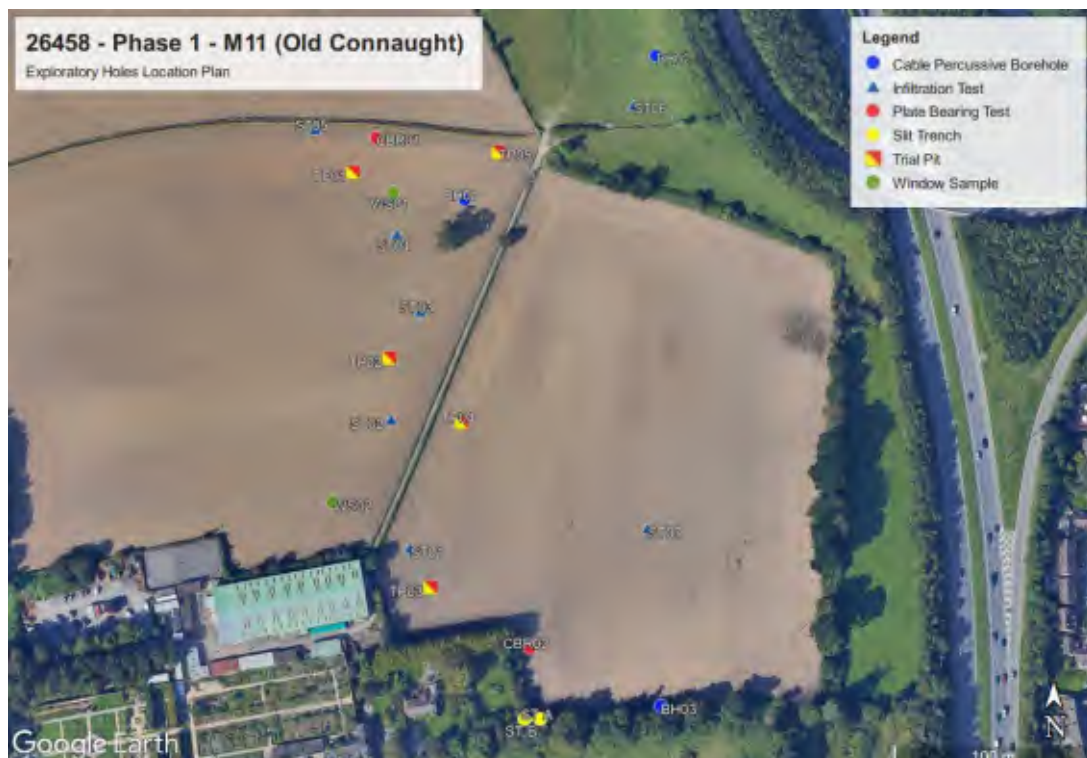


Figure 3-1 - Site Investigation Testing Locations

Review of the SI results including Trial Pit (TP) logs indicate that out of the 12No. TP (including 7No. soakaways), ground water was encountered within 11No. TP's. The ground water levels within the TP logs varied between 0.9m – 2.20m in depth.

The location of the trial pits, ground levels, and ground water levels are indicated on the storm water Layout Drawings ATK-ZZ-ZZ-DR-CE-900500-900502.



4. Existing Site Hydrology

4.1 EPA Based Assessment

The environmental Protection Agency (EPA) geoportal was consulted in relation to the proposed site to identify nearby waterbodies. The water bodies close to the proposed site are: Crinken Stream (EPA Code : 10R18) c. 326m to the North – East of the proposed site, Dargle Stream (EPA Code: 10D01) c.780m South – East of the proposed site, and the Irish Sea C1.5km East of the proposed site as shown in Figure Below.

The Dargle stream flows in a south – easterly direction and joins the Irish Sea. The Dargle stream flows in a North – Easterly manner into the Dargle Estuary C.1.3km East of the proposed site. The Old Connaught Local Area Plan 2025 identifies a primary watercourse relevant to the proposed site – a tributary of Crinken stream known as the Old Connaught Stream (also known as Ballyman Tributary) as shown in Figure 4-1, which flows through the site. The tributary rises from Carrickgollogan Hill on the eastern edge of the Dublin Mountains and flows down to Old Connaught where it enters a culvert upon converging with Ferndale Road. From here, the tributary runs in an Easterly direction in a series of culverts and open channels, diverted from its original route, before finally discharging to the Crinken Stream again on the eastern side of M11.



Figure 4-1 - Site Hydrology

4.2 Old Conna Local Area Plan Based Assessment

The Old Connaught Local Area Plan (LAP) identified four distinct character areas within the plan lands, namely the Northern, Central, Southern and Western Character Areas. As part of the LAP-wide drainage strategy, a Primary Regional Attenuation Pond and a Secondary Regional Attenuation Pond were identified to facilitate the management of surface water runoff across the overall development area. A review of the stormwater network strategy for the wider LAP lands has been undertaken to assess the feasibility of the drainage proposals and to confirm the continued functionality of the integrated surface water management strategy envisaged under the LAP.

The Central Character Area presents particular drainage challenges due to the existing site topography and the relatively flat gradients across portions of the lands. Notwithstanding these constraints, the drainage analysis has demonstrated that the majority of the Old Connaught Castlethorn lands within the Central Character Area can be conveyed to the Primary Regional Attenuation Pond identified in the LAP. This has been achieved through a carefully developed drainage strategy that accommodates the adverse gradients across the catchment, resulting in a relatively deep regional attenuation pond. In addition, surface water runoff from the proposed highway link connecting the Northern Character Area to the Central Character Area will also be directed to the Primary Regional Attenuation Pond.

A small portion of the Old Connaught Castlethorn lands, comprising approximately 0.5 ha, is located within an area where the existing ground gradients are insufficient to feasibly convey runoff to the Primary Regional Attenuation Pond. The lowest ground level within this area is approximately 18.975 mOD, which would not allow drainage to the regional attenuation facility. Consequently, runoff from this portion of the site will be attenuated locally and discharged to the final outfall location identified within the LAP, in accordance with the overall drainage strategy.

Surface water runoff from the Southern Character Area will be managed through localised attenuation measures within the respective development sites before being conveyed through the Secondary Regional Attenuation Pond. Similarly, runoff from the Western Character Area will be attenuated within the respective development sites and subsequently discharged via the proposed stormwater pipe network within Old Connaught Avenue. The outfalls from the Southern and Western Character Areas will combine and discharge to the existing ditch located south of the Old Connaught Castlethorn lands within the Central Character Area, at an indicative invert level of 18.6 mOD. This ditch subsequently conveys flows towards the same culvert that receives discharge from the Central Character Area, thereby maintaining the integrated surface water management strategy proposed under the Old Connaught LAP.

The proposed drainage arrangement is as shown below in fig 4-2, showing the relationship between the Northern, Central, Southern and Western Character Areas, the regional attenuation ponds, and the proposed discharge routes. The overall surface water management strategy described above is illustrated on Drawing, included in **Appendix H**.



5. Soil Type Classification

To determine the allowable QBar discharge rate from the proposed site, the SOIL value for the existing site was classified using the Winter Rain Acceptance Potential Classification . Table 2-1 from the Institute of Hydrology Report No.126 , See Figure 5-1 below.

Winter Rain Acceptance Class	Winter Rain-off Potential
1 Very High	1 Very Low
2 High	2 Low
3 Moderate	3 Moderate
4 Low	4 High
5 Very Low	5 Very High

Figure 5-1 - WRAP Table

The table considers four main soil and site properties which include :

- Soil Water Regime
- Depth to an Impermeable layer
- Slope Class
- Permeability of the Soil Horizons above the impermeable layer.

5.1 Soil Water Regime

The water regime class is taken from the Soil Survey field Handbook. The classes are identified as :

- 1) soils rarely waterlogged within 40 cm depth, and for less than 90 days within 70 cm in most years,
- 2) soils commonly waterlogged within 40 cm, but for less than 335 days within 70 cm in most years, and
- 3) soils waterlogged within 40 cm for more than 180 days, and for more than 335 days within 70 cm in most years.

Figure 5-2 - Water Regime Class

The Site Investigations findings indicated a ranging depth of topsoil for each of the 12No. Trial Pits including the 7 Soakaway Trial Pits from 200mm to 600mm.

Due to the maximum depth of the topsoil (600mm thk.) and the depth to impermeable layer discussed in Section 5.2 below, it was determined that water regime Class 2 “soils commonly waterlogged within 40cm, but for less than 335 days within the 70mm in most years” is the most suitable selection for this site.

5.2 Depth to an Impermeable Layer

Site Investigations were carried out on site as previously discussed in Section 3 of this report. During the Site Investigations 7No. soakaway tests were performed in accordance with BRE digest 365 at specified locations to determine the suitability of the soils for the infiltration of surface water.

The Site Investigations findings indicated a depth of topsoil for each of the 7No. soakaway Trial Pits as 200mm.

Below the topsoil the test medium varied between slightly sandy slightly gravelly CLAY, slightly silty sandy gravelly CLAY, sandy CLAY, slightly gravelly sandy CLAY, and sandy gravelly CLAY with occasional red brick and concrete fragments.

The Institute of Hydrology Report No. 126 outlines that “an impermeable layer is defined as a layer with a hydraulic conductivity of less than 0.1 m/day”.

Based on this information with predominant soil type for each of the soakaway tests being CLAY, the depth to an impermeable layer is determined to be located 200mm below surface level or at the underside of the topsoil or, accordance with the WRAP table a depth to impermeable horizon of <40cm.

5.3 Slope Class

Following a review of the topographical survey a 3D Heatmap model of the existing site gradients was generated. The 3D Model allowed for Identification of the slopes on site between the ranges set out in the winter Rain Acceptance Potential Classification. See Figure 5-3 below for slope classifications.

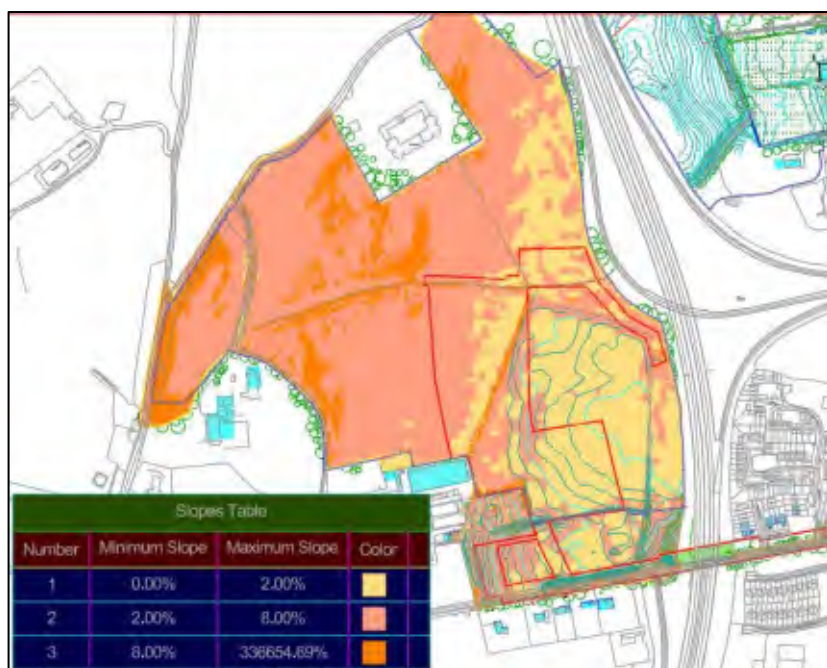


Figure 5-3 - Site Slope

The majority of the site has a slope of < 2 degrees or between 2 and 8 degrees. It is noted however that parts of the site have a slope of > 8 degrees. For this assessment based on the average, a 2-8 degrees slope will therefore be used.

5.4 Permeability Class

The Handbook of Soils for Landscape Architects by Robert F. Keeler Table 6.1 provides a soil characterisation for permeability from slow to rapid as outlined in Figure 5-4 Below:

Table 6.1 Soil Permeability Class Related to Flow of Water through a Saturated Soil	
Permeability Class	Rate of Flow (inches per hour)
Very slow	Less than 0.06
Slow	0.06-0.2
Moderately slow	0.2-0.6
Moderate	0.6-2.0
Moderately rapid	2.0-6.0
Rapid	6.0-20.0
Very rapid	More than 20

Figure 5-4 - Permeability Classifications

From review of the soakaway test results, the site has been subdivided into two areas based on permeability classes as per Figure 5-5 below.

The site investigation results indicate that infiltration across the area A is consistently poor, with water levels observed to fall too slowly to allow reliable determination of infiltration rates in most locations. Based on this it is determined that permeability class is ‘Very Slow’.

The site investigation results indicate that infiltration within area B is generally good, with water levels observed to fall readily during testing, allowing for the determination of infiltration rates. In parts of the site, infiltration was notably rapid, demonstrating favourable drainage characteristics. For Area B it is determined that the permeability class is ‘Moderately Rapid’.

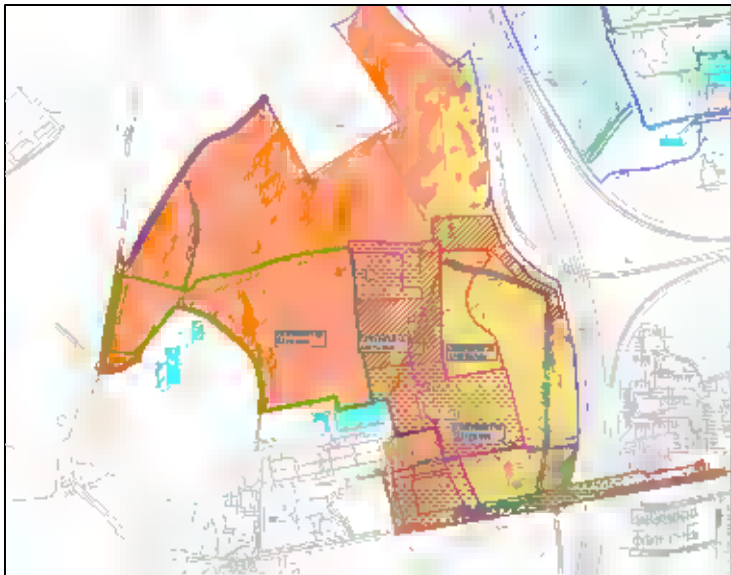


Figure 5-5 - Site Permeability CI

5.5 Soil Type Classification

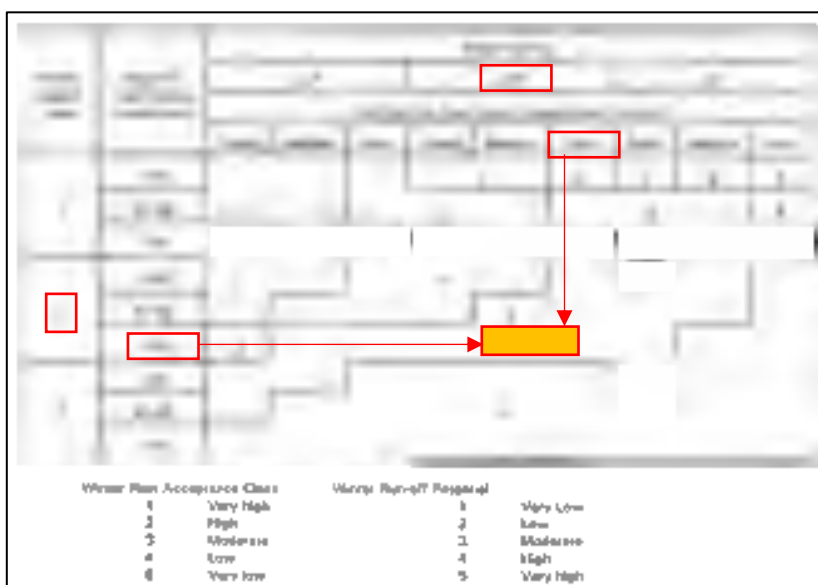
5.5.1 Area A

Based on the rationale discussed in Sections 5.1 to 5.4 above, Area A would fall into the Soil Type 4 classification as per Figure 5-6 below.

As indicated in **Figure 5.4**, and when compared against the catchment extents shown in **Figure 5.8**, it is evident that the majority of **Catchment 1A**, and **Catchment 1B** fall within **Area A**. In accordance with the soil classifications presented in Figure 5.4, Area A is characterized by negligible infiltration potential, indicating that infiltration to ground cannot be relied upon as part of the surface water management strategy. Consequently, this assumption has been adopted in the design of the proposed SuDS measures within these catchments, with attenuation tanks and associated drainage infrastructure sized and designed on the basis of providing attenuation only, without any allowance for infiltration losses.

No Site Investigation (SI) information is currently available for **Catchments 2A and 2B**. Therefore, for the purposes of this assessment and to adopt a conservative approach, these catchments have also been assumed to fall within **Area A** and have been classified as **Soil Type 4**. Accordingly, all proposed SuDS features and attenuation areas within Catchments 2A and 2B have been designed on the basis of negligible infiltration potential. This classification may be reviewed should future site investigation data become available.

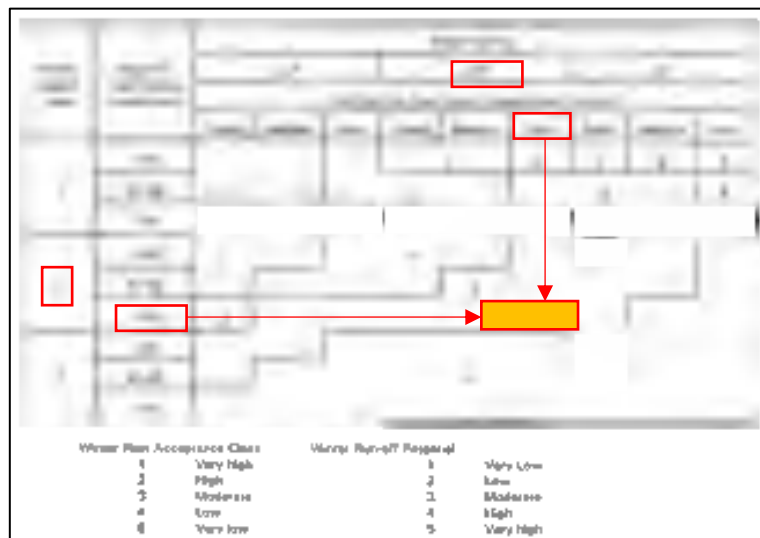
Figure 5-6 - Area A Soil Type Classification



5.5.2 Area B

Based on the rationale discussed in Sections 5.1 to 5.4 above, Area B would fall into the Soil Type 4 classification as per Figure 5-6 below.

Figure 5-7 - Area B Soil Type Classification



However, DLRCC Municipal Services has advised that areas with no infiltration potential should be classified as **Soil Type 4**, while areas exhibiting limited infiltration potential should be classified as **Soil Type 3**. On this basis, the portions of the site falling within **Area B** have been reclassified as **Soil Type 3** for the purposes of the QBAR runoff rate calculations. The adoption of Soil Type 3 results in a lower QBAR discharge rate compared to Soil Type 4 and, consequently, increases the attenuation storage requirements within the development. The use of Soil Type 3 is therefore considered a more conservative and onerous approach for the design of the proposed surface water drainage infrastructure.

Based on this classification, a portion of **Catchment 1A** located within Area B, together with the corresponding areas of **Catchment 1B**, have been assigned **Soil Type 3**. Accordingly, the design of the proposed SuDS features, attenuation tanks and attenuation ponds serving these areas has been undertaken using Soil Type 3 parameters. As a result, the QBAR discharge rates adopted for these catchments reflect the runoff characteristics associated with Soil Type 3, ensuring that the sizing of the attenuation measures is based on the more conservative hydraulic assessment.



Figure 5-8 - Catchments

6. Surface Water Storage Requirements

As agreed with DLRCC Municipal services, the www.uksuds.com surface water storage volume estimation tool was used to determine the maximum Qbar discharge rate from the site for a 1 in 100 year storm event. Site specific data was confirmed using Met Eireann Rainfall Data as indicated below.

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 325110, Northing: 219630,

DURATION	Interval	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.8, 3.9,	4.5,	5.3,	5.9,	6.3,	7.8,	9.4,	10.4,	11.9,	13.2,	14.2,	15.8,	17.0,	17.9,	N/A ,
10 mins	3.9, 5.4,	6.2,	7.4,	8.2,	8.8,	10.8,	13.1,	14.5,	16.6,	18.4,	19.8,	22.0,	23.6,	25.0,	N/A ,
15 mins	4.6, 6.4,	7.3,	8.7,	9.6,	10.4,	12.7,	15.4,	17.1,	19.5,	21.7,	23.3,	25.8,	27.8,	29.4,	N/A ,
30 mins	6.1, 8.3,	9.5,	11.2,	12.4,	13.3,	16.1,	19.3,	21.4,	24.3,	26.9,	28.8,	31.8,	34.1,	36.0,	N/A ,
1 hour	8.0, 10.8,	12.3,	14.4,	15.9,	16.9,	20.4,	24.3,	26.8,	30.3,	33.3,	35.6,	39.2,	41.9,	44.1,	N/A ,
2 hours	10.6, 14.1,	15.9,	18.6,	20.3,	21.7,	25.9,	30.6,	33.6,	37.7,	41.3,	44.1,	48.2,	51.4,	54.0,	N/A ,
3 hours	12.5, 16.5,	18.6,	21.5,	23.5,	25.0,	29.8,	35.0,	38.3,	42.9,	46.9,	49.9,	54.5,	58.0,	60.8,	N/A ,
4 hours	14.0, 18.4,	20.7,	23.9,	26.1,	27.7,	32.9,	38.5,	42.0,	47.0,	51.2,	54.5,	59.4,	63.1,	66.2,	N/A ,
6 hours	16.5, 21.5,	24.1,	27.7,	30.1,	32.0,	37.7,	44.0,	48.0,	53.4,	58.1,	61.7,	67.1,	71.1,	74.5,	N/A ,
9 hours	19.5, 25.1,	28.0,	32.2,	34.9,	36.9,	43.4,	50.3,	54.7,	60.7,	65.9,	69.8,	75.7,	80.2,	83.9,	N/A ,
12 hours	21.9, 28.1,	31.2,	35.7,	38.6,	40.9,	47.8,	55.3,	60.1,	66.5,	72.0,	76.2,	82.5,	87.3,	91.2,	N/A ,
18 hours	25.7, 32.8,	36.3,	41.4,	44.7,	47.2,	55.0,	63.3,	68.5,	75.6,	81.7,	86.3,	93.2,	98.4,	102.7,	N/A ,
24 hours	28.9, 36.6,	40.5,	46.0,	49.5,	52.2,	60.6,	69.6,	75.2,	82.8,	89.3,	94.3,	101.6,	107.2,	111.7,	126.9,
2 days	36.4, 45.3,	49.7,	56.0,	60.0,	63.0,	72.4,	82.2,	88.4,	96.6,	103.7,	109.0,	116.8,	122.8,	127.5,	143.6,
3 days	42.5, 52.4,	57.2,	64.1,	68.5,	71.7,	81.9,	92.5,	99.0,	107.9,	115.4,	121.0,	129.3,	135.5,	140.6,	157.4,
4 days	47.8, 58.6,	63.8,	71.1,	75.8,	79.3,	90.1,	101.4,	108.3,	117.7,	125.5,	131.4,	140.2,	146.7,	151.9,	169.5,
5 days	57.2, 69.4,	75.2,	83.5,	88.7,	92.6,	104.5,	116.9,	124.5,	134.6,	143.2,	149.6,	159.0,	166.0,	171.7,	190.5,
8 days	65.6, 78.9,	85.3,	94.3,	100.0,	104.2,	117.1,	130.4,	138.6,	149.5,	158.6,	165.4,	175.4,	182.9,	188.9,	208.7,
10 days	73.2, 87.7,	94.6,	104.2,	110.3,	114.8,	128.6,	142.7,	151.4,	162.9,	172.5,	179.7,	190.3,	198.1,	204.4,	225.2,
12 days	80.4, 95.8,	103.2,	113.4,	119.9,	124.6,	139.2,	154.1,	163.2,	175.3,	185.4,	192.9,	204.0,	212.2,	218.8,	240.5,
16 days	93.8, 110.9,	119.1,	130.4,	137.5,	142.8,	158.7,	175.0,	184.9,	198.1,	209.0,	217.1,	229.0,	237.9,	244.9,	268.2,
20 days	106.2, 124.9,	133.8,	146.1,	153.8,	159.5,	176.7,	194.1,	204.8,	218.8,	230.5,	239.2,	251.8,	261.2,	268.7,	293.4,
25 days	120.8, 141.3,	151.0,	164.3,	172.7,	178.9,	197.5,	216.3,	227.8,	242.8,	255.4,	264.6,	278.1,	288.1,	296.1,	322.3,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

A SAAR Value of 1010mm was utilised to calculate the green field runoff rate.

Refer to Appendix I of this document for the output from the www.uksuds.com surface water storage volume estimation tool and maximum Qbar discharge rate.

The Phase 1 drainage design calculations are summarised below and form the basis for the assessment of runoff rates, attenuation storage requirements and the sizing of the proposed surface water management infrastructure:

- Total Site Area (Red line Boundary) : 6.878Ha
- Total area drained (overall Catchment); 4.735ha
- Total Impermeable Area based on reduced coefficient runoff rate: 3.696Ha
- Total % of drainage area impermeable: 78.05%

Significant public open space (public open spaces, rear gardens etc.) has been calculated by subtracting the total site area from the total positively drained area

As outlined in **Section 5.5**, the Phase 1 development area has been divided into **two sub-catchments** based on the applicable soil type classifications. This approach allows the runoff characteristics of each area to be assessed independently and ensures that the QBAR calculations accurately reflect the underlying ground conditions. The resulting **QBAR runoff rates**, including a **20% climate change allowance and 10% Urban Creep allowance**, are summarised in **Table 6-1**, with the detailed UK SuDS calculation outputs provided in **Appendix I**.



Table 6-1 - Qbar Calculation Summary

Area Ref.	Soil Type	Area Size (ha)	% of Total Area (6.878ha)	Resulting Qbar (l/s)
1A	4	2.03	29.5	15.1
1B	3	2.705	39.3	12
(Regional Attenuation Pond)	Catchment 1A+Catchment 1B	4.73	68.77	27.1

The calculated **QBAR discharge rate of 27.1 l/s** has been agreed in principle with **DLRCC Municipal Services** as an appropriate discharge rate for the **Phase 1 Castlethorn lands** included within the current Planning Application. The proposed approach is that the Phase 1 drainage design, including the attenuation requirements and discharge rate assessment, is based solely on the catchment area associated with this phase of development.

It is acknowledged that the wider Old Connaught lands will be developed in subsequent phases and that the ultimate regional attenuation strategy will need to accommodate runoff from these additional catchments. Accordingly, the sizing and configuration of the proposed regional attenuation pond will be reviewed and expanded as necessary during the design of future phases to cater for the increased contributing catchment area and associated runoff volumes.

DLRCC Municipal Services has agreed that it is appropriate for the current application to assess and design the surface water drainage infrastructure based on the Phase 1 lands only, with the wider regional attenuation pond strategy to be refined and developed as future phases progress. Therefore, the QBAR value presented in this report relates exclusively to the Phase 1 development and represents the proposed permissible discharge rate for the current Planning Application.



7. Proposed Site Characteristics

For the purposes of this Phase 1 Planning Application, the overall catchment has been divided into **three sub-catchments (Catchments 1A, and 1B)**, as illustrated on the accompanying drainage drawings. Each sub-catchment incorporates a range of SuDS measures, as outlined in Section 2.1, to provide attenuation and treatment of surface water runoff prior to discharge.



Figure 7-1 - Site Catchment Areas

The proposed **regional attenuation pond forms part of the Phase 1 infrastructure works** and has been designed to accommodate runoff from **Catchments 1A and 1B**. The future development areas within **Phase 2** will be attenuated locally on site prior to discharging to the **Regional Attenuation Pond**. The drainage strategy has been developed to ensure that runoff from the Phase 2 catchments is controlled within the site before being conveyed to the regional attenuation system.

However, the extent of **Catchment 2A** within Phase 2 has been designed to provide local attenuation and discharge directly to the proposed outfall. This approach has been adopted due to the favourable site topography and drainage gradients, which allow runoff to gravitate naturally towards the outfall. Routing flows from Catchment 2A directly to the outfall avoids the need to convey these flows to the Regional Attenuation Pond, thereby reducing the required storage volume and excavation depth of the regional attenuation facility. This results in a more efficient, practical, and sustainable drainage solution for this catchment.

It should be noted that the drainage strategy presented at this stage is indicative of the future Phase 2 development. All design considerations, including drainage, attenuation requirements, network layouts, and supporting infrastructure associated with Phase 2, will be developed and assessed in detail as part of a future planning application for Phase 2.

Table 7-1 - Catchment Area Discharge Rates



Lands draining to attenuation	Area	Volume of attenuation	Discharge Rate	Allowance made for Climate Change + Urban Creep
Catchment 1A	2.03 Ha	1350m ³	15.1 L/s	30%
Regional Attenuation Pond (Catchment 1A + Catchment 1B)	2.7 Ha + Controlled flow from Catchment 1B	1312m ³	27.1 L/s	30%

Two flow control devices are proposed for phase 1 catchments due to the topography and layout of the site, before finally discharging from the overall catchment to the existing culvert in the East via a new storm water network as indicated on the planning drawings ATK-ZZ-ZZ-DR-CE-900500-ATK-ZZ-ZZ-DR-CE-900502.

7.1 Catchment Design Details

Localised attenuation within Catchment 1A will be provided by underground modular attenuation systems. Refer to Drawing ATK-ZZ-ZZ-DR-CE-900501 PROPOSED STORM DRAINAGE LAYOUT - SHEET 1 and ATK-ZZ-ZZ-DR-CE-900502 PROPOSED STORM DRAINAGE LAYOUT - SHEET 2 for further details of the proposed attenuation infrastructure.

A controlled discharge from both catchment 1A and 1B will be achieved by a vortex flow control device located downstream of the underground modular attenuation systems. The flow control devices have been sized based on the maximum design water level within each attenuation system. The design head for each catchment has been established to ensure that the discharge rates presented in Table 7-1 are not exceeded during the 1 in 100-year, 6-hour storm event. Penstocks will be incorporated within the hydrobrake chambers to facilitate maintenance activities when required. In accordance with DLRCC requirements, the flow control devices will not include bypass doors or high-level overflow arrangements.

Catchpit manholes will be provided at the inlet to the underground modular attenuation systems to minimise the ingress of silt and debris and to enhance the long-term performance of the attenuation infrastructure.

Where swales are proposed, they will primarily serve as conveyance features for surface water runoff from adjacent roads and footpaths. Runoff will enter the swales through dropped kerbs and/or side-entry gullies. Discharge from the swales to the stormwater network will be via perforated manhole covers. These covers will be set approximately 50 mm above the swale invert to provide an element of interception and promote water quality treatment prior to discharge.

Porous paving areas will accommodate runoff from the paved surface itself, adjacent roads and footpaths, as well as roof runoff from the front of residential dwellings. The underlying sub-base will provide infiltration, attenuation of peak flows, and approximately 30% storage within the voided aggregate layer. An orifice plate or flow control structure will be installed within the outfall chamber serving each porous paving area to restrict discharge rates and maximise the available storage volume within the sub-base.



Filter drains incorporating perforated carrier pipes will be provided within rear gardens to collect and convey roof runoff from the rear of the proposed dwellings.

Tree pits will be incorporated at the locations indicated on the relevant drawings. Surface water runoff from adjacent roads, footpaths and other impermeable areas will be directed into the tree pits via dropped kerbs. Interception, filtration and infiltration will occur within the identified locations in Area B, as described in Section 5.5.2. An overflow pipe set 50 mm above the finished surface level of the tree pit will provide a controlled overflow route to the stormwater drainage network during higher-intensity rainfall events.

Extensive green roofs will be provided on suitable apartment blocks and retail units. Refer to Drawing ATK-ZZ-ZZ-DR-CE-900504 PROPOSED EXTENSIVE GREEN ROOF LAYOUTS for the proposed green roof extents within Phase 1. For the purposes of the drainage assessment and hydraulic modelling, a runoff coefficient of 80% has been adopted for the green roof areas.

A detailed summary on different types of Surfaces identified within the Phase A1 lands is presented in Appendix J.

7.2 Catchment 1A- Drainage Design Details

Attenuation is proposed for Catchment 1A using an underground modular attenuation system. It was determined during modelling of the network that based a maximum discharge rate of 15.1l/s via a vortex flow control device that a volume of 1350m³ is required for 1 in 100 – year 6-hour storm event including 20% climate change and 10% urban creep.

Modelling of the 1 in 30 year storm for upto 24-hour event confirmed that the attenuation storage volume of 1350m³ provided was also sufficient.

Table 7-2 - Design Summary - Catchment 1A

Catchment Reference	Maximum Design Flow from Vortex Flow Control	Resulting Maximum Design Flow for 1 in 100 year	Resulting Maximum Design Flow for 1 in 30 year	Minimum Tank Volume
Catchment 1A	15.1 l/s	15.1 l/s	15.1 l/s	1350 m ³

Table 7-3 - Site Impermeable Areas - Catchment 1A

Catchment 1A	Total Site Area	Total Impervious Area
	2.03Ha	1.003Ha

Table 7-4 - Interception Volume Required - Catchment 1A



	Total Paved Site
Paved Surfaces (roads, footpaths, permeable paving & roof areas)	1.003
Volume of Interception Required	$10030 \times 0.005 \times 0.8 = 40.12\text{m}^3$

Table 7-5 - Interception Volume Provided – Catchment 1A

SuDS	Volume
Permeable Paving	$2328.2\text{m}^2 \times 0.05 = 141.41\text{m}^3$ $141.41 \times 35\% = 49.49\text{m}^3$
Extensive Green Roof (>150mm thk.)	$806.09\text{m}^2 \times 0.005 = 4.03\text{m}^3$
Swales	$22(\text{L}) \times 0.5(\text{W}) \times 0.05(\text{D}) \times 2 = 1.1\text{m}^3$
Underground Modular Attenuation System	$35.14(\text{W}) \times 35.14(\text{L}) = 1235\text{m}^2$ $0.688(\text{D}) \times 1235\text{m}^2 = 849.68\text{m}^3$ $849.68 \times 35\% \text{ Voids} = 297.388\text{m}^3$
Tree pits and Bioretention Gardens	$3926 \times 0.05 = 196.3\text{m}^3$ $65.9 \times 35\% \text{ Voids} = 68.71\text{m}^3$
Total	$420.718\text{m}^3 > 40.12\text{m}^3$ required (OK)

7.3 Catchment 1B- Drainage Design Details

Attenuation for **Catchment 1B** is proposed within the Regional Attenuation Pond, as identified in the Old Connaught Local Area Plan (LAP). The controlled discharge from **Catchment 1A** will be directed into Catchment 1B and subsequently conveyed to the Regional Attenuation Pond.

Hydraulic modelling of the proposed drainage network determined that, with a maximum discharge rate of **27.1 l/s** controlled by a vortex flow control device, a minimum attenuation storage volume of **1,312 m³** is required to accommodate the **1 in 100-year, 6-hour storm event**, including allowances for **20% climate change** and **10% urban creep**.

In addition, modelling of the **1 in 30-year storm event** for durations of up to **24 hours** confirmed that the proposed attenuation storage volume of **1,312 m³** provides sufficient capacity to manage runoff without exceeding the design criteria

Table 7-6 - Design Summary - Catchment 1B



Catchment Reference	Maximum Design Flow from Vortex Flow Control	Resulting Maximum Design Flow for 1 in 100 year	Resulting Maximum Design Flow for 1 in 30 year	Minimum Tank Volume
Catchment 1B	27.1 l/s	27.1 l/s	27.1 l/s	1312 m ³

Table 7-7 - Site Impermeable Areas - Catchment 1B

Catchment 1B	Total Site Area	Total Impervious Area
	2.71Ha	2.117Ha

Table 7-8 - Interception Volume Required - Catchment 1B

	Total Paved Site
Paved Surfaces (roads, footpaths, permeable paving & roof areas)	2.117Ha
Volume of Interception Required	$21170 \times 0.005 \times 0.8 = 84.68\text{m}^3$

Table 7-9 - Interception Volume Provided – Catchment 1B

SuDS	Volume
Permeable Paving	$652.9\text{m}^2 \times 0.05 = 32.645\text{m}^3$ $32.645 \times 35\% \text{ Voids} = 11.42\text{m}^3$
Extensive Green Roof (>150mm thk.)	$2,299.05\text{m}^2 \times 0.005 = 11.495\text{m}^3$
Intensive Green Roof (landscape courtyard areas with soil >500mm thk.)	$200.88\text{m}^2 \times 0.005 = 1.004\text{m}^3$
Tree pits and Bioretention Gardens	$1,922.63 \times 0.05 = 96.13\text{m}^3$ $96.13 \times 35\% \text{ Voids} = 33.64\text{m}^3$
Detention Pond (Regional Attenuation)	1,312m ³ of storage provided
Total	1,369.559m ³ provided > 84.68m ³ required (OK)

7.4 Compliance with GDSDS Design Criteria

Outfall section 6.3.4 of the GDSDS Volume 2 New Development sets out four design criterion which are required to be met by the proposed drainage system. Compliance with these criteria are outlined below:



7.4.1 Interception Volume – Criterion 1.1

Criterion 1 is satisfied by providing interception storage and treatment of runoff within SuDS features i.e., petrol interceptor and attenuation systems. Interception volumes are based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 5mm rainfall.

	Total Paved Site
Paved surfaces (roads, footpaths, permeable paving & roof areas)	3.12Ha
Volume of Interception Required	$31200 \times 0.005 \times 0.8 = 124.8\text{m}^3$

Interception volume of $1,369.559\text{m}^3$ is being provided for the overall site which is >than 124.8m^3 required for the site. Interception volume has been provided on the proposed site using the SuDS features noted below.

- Filter Drains
- Permeable Pavement to Parking Bays
- Conveyance Swales
- Green Roofs (apartment buildings only)
- Green Courtyards (Apartment Buildings only)
- Tree Pits (along Main avenue)
- Underground Modular Systems (within green open spaces)

7.4.2 Treatment Volume – Criterion 1.2

Interception volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 15mm rainfall .

Table 7-10 - Treatment Volume

	Total Paved Site
Paved surfaces (roads, footpaths, permeable paving & roof areas)	3.12Ha
Volume of Treatment Storage Required	$31200 \times 0.015 \times 0.8 = 374.4\text{m}^3$

A storage volume of **1312 m^3** is provided within the detention pond, which has been identified as the **regional attenuation pond** for the site. The pond receives runoff from the entire development and discharges at a controlled rate of 27.1l/s to the designated outfall. On this basis, it is considered that the required treatment volume is fully achieved. The required treatment volume is **374.4 m^3** ; however, the detention pond provides **1312m^3** of storage, which is approximately **3.5 times greater** than the minimum requirement, providing a significant surplus in treatment and attenuation capacity.



7.4.3 River Regime Protection – Criterion 2

As discussed in Section 7, the site is divided into two drainage catchments, namely Catchments 1A, and 1B, each incorporating attenuation measures as part of the overall surface water management strategy. Catchment 1A is served by a localised underground modular attenuation system providing 1,350 m³ of attenuation storage, with discharge controlled to 15.1 l/s before conveying flows to the regional attenuation pond. Catchment 1B provides 1312 m³ of attenuation storage and drains directly to the regional attenuation pond. The regional attenuation pond therefore receives runoff from the entirety of Catchment 1B together with the controlled discharge from Catchment 1A and acts as the principal attenuation feature for the site. The discharge from the regional attenuation pond is regulated by a flow control device set at 27.1 l/s, ensuring runoff is released to the outfall at the approved controlled rate.

7.4.4 Level of Service - Criterion 3

Criterion 3 is satisfied by majority of the site being outside the 1000-year coastal and fluvial flood levels. The eastern boundary is identified to have flooding, however there is no building proposed along this extent. Pluvial flood risk is addressed by designing the development to accommodate storage for a 100 year storm (plus climate change) as per GDSDS. Planned flood routing for storms upto 100-year level was considered in the design and development run-off contained within the site.

There are 4 criteria for levels of service. These are

- Criterion 3.1 : No external flooding (30-year high intensity rainfall event)
- Criterion 3.2 : No internal Flooding (100 – year high intensity rainfall event)
- Criterion 3.3 : No internal Flooding (100 year river event and critical duration for site storage)
- Criterion 3.4 : No flood routing off site except where specifically planned (100 year high intensity rainfall event)

Criteria 3.1, 3.2, 3.3, 3.4 : All potential flooding has been reviewed and modelled using causeway flow for upto the required 1 in 100 year storm event including 30% uplift for a climate change. Outputs from the model for the proposed storm network are contained in Appendix A-F of this report.

7.4.5 River Flood Protection - Criterion 4

Attenuation for surface water runoff is provided through Sustainable Drainage Systems (SuDS), including attenuation in Detention/Wetland Basins designed to manage post development flows. In accordance with the Greater Dublin Strategic Drainage Study (GDSDS), three methods are available for assessing River Flood Protection – Outline under Criterion 4.1, 4.2 and 4.3

Following a comparative review, Criterion 4.3 has been identified as the most appropriate for application at the proposed site. This criterion focuses on the comparison of pre and post development runoff volumes, ensuring that the post development discharge does not exceed the natural runoff rate. An extract from the GDSDS outlining Criterion 4 is provided below for reference.



Criterion 4 River flood protection (Criterion 4.1, or 4.2 or 4.3 to be applied)	4.1	100	"Long-term" floodwater accommodated on site for development runoff volume which is in excess of the greenfield runoff volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme events only. 100 year, 6 hour duration storm to be used for assessment of the additional volume of runoff.
	4.2	100	Infiltration storage provided equal in volume to "long term" storage. Usually designed to operate for all events. 100year, 6-hour duration storm to be used for assessment of the additional volume of runoff.
	4.3	100	Maximum discharge rate of QBAR or 2 l/s/ha, whichever is the greater, for all attenuation storage where separate "long term" storage cannot be provided.

Figure 7-2 - GDSDS River Flood Protection

Criterion 4.3 has been satisfied for the proposed site by providing an agreed Maximum discharge rate of QBar (27.1/s) and on site attenuation for upto the 1 in 100 year storm event (including 30% for Climate Change).



8. Flooding & Exceedance Flows

8.1 Flood Risk Assessment

A Flood risk assessment (FRA) has been undertaken for the site to satisfy the requirements of the Planning System and Flood Risk Management Guidelines. The report Aimed at scoping source of flooding, assessing whether any significant flood risk issues exist and proposing appropriate flood risk management measures as required, The Stage 1 Flood Risk Identification identified areas potentially affected by fluvial flood risk. A Stage 2 Initial Flood Risk Assessment was undertaken using the available flood mapping and the proposed development layout. In relation to the proposed Old Connaught development, the findings are :

- The eastern boundary of the proposed site is located within Flood Zone A and B and is at a high risk of flooding (i.e. greater than 1 in 100 year / 1% AEP). A historic flood event (ID2030 – Old Connaught Avenue) has been identified C.200M West of the proposed site.
- The old Connaught LAP SFRA hydraulic model clearly shows part of the proposed site boundary is located in the 1% AEP (Flood Zone A) and 0.1% AEP (Flood Zone B) predicted flood extents.
- The DLR county development Plan 2022-2028 Flood Zone Map similarly shows Flood Zone A and B extending into the eastern and southern lower – lying portion of the site, with the remainder of the proposed site located in Flood Zone C.
- Site levels range broadly from C.24.9 mOD (high ground) to C. 16.3 mOD (low ground). The areas of lowest elevation correspond to those overlapping the mapped flood extents and therefore align with the identified risk.

Based on these findings, a Stage 2 Initial Flood Risk Assessment has been completed using available flood mapping and development layout information. The assessment confirms that the proposed residential development is located within Flood Zone C and that flood risk has been appropriately managed through the site design.

This report presents the Storm Water Impact Assessment for the proposed Phase 1 of the development. This Impact assessment report should be read in conjunction with AtkinsRéalis' Flood Risk Assessment Report (0126446DG0010) associated with this application.

8.2 Exceedance Flows

Surface water exceedance flows from the site have been considered as part of the drainage design. A modelling exercise was carried out with a 50% blockage within the vortex Flow control units at all 3 attenuation locations.

The table below outlines the Catchments and vortex flow control that had restriction applied. There was no flooding in the 1 in 100 year 360 minute event. However there was flooding in the 1 in 30 year 1440 minute event.

Table 8-1 - Blockage Analysis - Phase 1

Catchment	Vortex Flow Control Restriction	Storm Event	Maximum Flood Volume
Catchment 1A	50%	1 in 30-year 1440-minute event + (30% CC)	No Flooding
Catchment 1B	50%	1 in 30-year 1440-minute event + (30% CC)	No Flooding



Catchment 1A

A review of the hydraulic model outputs confirms that **no flooding occurs during either the 1 in 30-year or the 1 in 100-year storm events**, demonstrating that the proposed drainage system has sufficient capacity to manage the design storm events. An assessment of the site levels indicates that, in the unlikely event of a blockage occurring within the vortex flow control, any exceedance flows would follow natural overland flow routes towards the **north, west and east** of the site. To further manage exceedance flows, **dropped kerbs are provided at regular intervals along the road network**, allowing surface water to discharge safely into adjacent green spaces and reducing the risk of flooding to developed areas. The indicative exceedance flow routes are shown in **Image 8.1** below..

Catchment 1B

A review of the hydraulic model outputs indicates that **no flooding occurs during either the 1 in 30-year or the 1 in 100-year storm events**. An assessment of the site levels further demonstrates that, in the unlikely event of flooding arising from factors outside the design assumptions, such as a blockage of the vortex flow control caused by inadequate maintenance or pipework clogging, any exceedance flows would be directed along a defined overland flow route towards the eastern side of the site. The indicative exceedance flow path is shown in **Image 8.1** below.

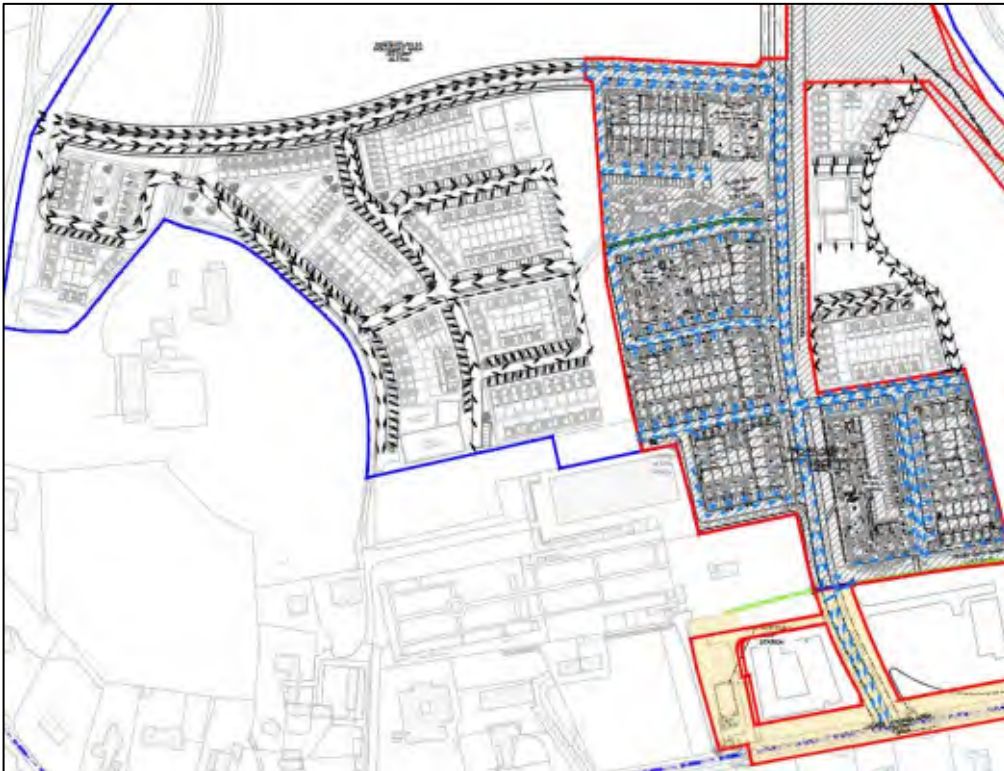


Figure 8-1 - Overland Flow Path

9. SuDS Maintenance

Regular checks and maintenance of the SUDS systems is required and have been considered as part of the overall drainage design for the proposed development. This will ensure both the design life of the SuDS systems, ongoing improved water quality, reduced water runoff and reduce the risk of onsite flooding and exceedance flows.

9.1 Permeable Paving

Paving should be inspected regularly, preferable during and after heavy rainfall to ensure effective operation. Vacuum brushing or jetting of the permeable paving should be carried out once a year. Cleaning is generally carried out after Autumn leaf fall to remove silts and sediments.

9.2 Underground modular attenuation systems

Inspection of the system should be carried out monthly for the first 3 month and then annually to ensure the system is working correctly.

Debris should be removed monthly from the catchment surface where it may cause risk to the performance of the underground attenuation system

As required sediment from Pre- treatment (catchpit) manholes prior to the attenuation system should be removed to ensure on going performance of the system.

The inside of the tank should be surveyed every 5 years or as required if performance is reduced. Sediment build up removed if necessary.

9.3 Green Roofs

All components (Soil substrate, vegetation, drains, membranes and roof structure) should be inspected annually and after severe storms.

Underside of roof should also be inspected annually and after severe storms for evidence of leakage.

Debris, fallen leaves and litter should be regularly removed to prevent clogging of inlet drains.

9.4 Wetland/Detention Basins

- Remove litter and debris from the basin, inlets, outlets, and overflows on a routine (monthly) basis.
- Inspect and clear inlets/outlets to prevent blockages and ensure correct hydraulic operation.
- Manage vegetation, including grass cutting and removal of nuisance or overgrown plants.
- Remove accumulated sediment annually from inlets, outlets, and forebay areas; undertake larger sediment removal as required.
- Inspect basin structures and embankments, repairing erosion, damaged components, or stability issues as needed.



9.5 Tree Pits

Maintenance of trees will be greatest in the first few years , which will include regular inspection of tree condition including Inlets and outlets , removal of invasive and possibly irrigation during long dry periods.

9.6 Swales

Mowing in the first year is critical to eliminate competition from weeds. Lawn Mowing to an ideal height of 100mm should be maintained as grasses tend to flatten down when water is flowing over them, reducing sedimentation. Maintenance of the swale should include:

- Periodic litter removal with the swale and self-clearing inlet grid.
- Occasional stabilisation of eroded side slopes and base
- Check Removal of sediment buildup
- Ongoing maintenance should form part of the site landscaping proposals.

9.7 Filter Drains

Inspection of the system should be carried out monthly on the inlet / outlet pipework and any control systems for blockages.

Inspection of pre-treatment systems including should be carried out every 6 months for catch pits manholes prior to the filter drain with removal of silt or other build ups. Removal of silt built up may be required more frequent.

Annual cleaning of roof runoff gutters etc should be part of the generally maintenance of the drainage system to ensure debris is removed prior to entering the network.

Perforated pipework should be cleared of blockage if required.



10. SuDS Audit Overview

The Stage 1 Surface Water Audit was undertaken by Punch Consulting Engineers in July 2026. The audit considered the proposed development site, which has a total area of approximately 6.9 ha, as submitted as part of the planning application.

The audit identified ten items and associated recommendations for consideration. Each of these items was reviewed in detail and either fully addressed or further discussed as appropriate.

Atkins amended the storm drainage design where required. In several instances, alternative solutions or technical justifications were proposed and subsequently accepted by the auditors.

The audit process was successfully completed, with final sign-off by both Atkins and Punch Consulting Engineers on 22 July 2026.

Refer to Appendix K of this report for the audit comments, responses, and associated correspondence.



APPENDICES

Appendix A. Simulation Criteria



Simulation Settings

Rainfall Methodology	FSR	Winter CV	1.000	Check Discharge Rate(s)	✓
Rainfall Events	Singular	Analysis Speed	Normal	100 year (l/s)	18.8
FSR Region	Scotland and Ireland	Skip Steady State	x	Check Discharge Volume	✓
M5-60 (mm)	16.900	Drain Down Time (mins)	240	100 year 360 minute (m³)	
Ratio-R	0.268	Additional Storage (m³/ha)	20.0		
Summer CV	1.000	Starting Level (m)			

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	30	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Soil Index	1	Growth Factor 30 year	1.95	Q 1 year (l/s)
Greenfield Method	IH124	SPR	0.10	Growth Factor 100 year	2.48	Q 30 year (l/s)
Positively Drained Area (ha)		Region	1	Betterment (%)	0	Q 100 year (l/s)
SAAR (mm)		Growth Factor 1 year	0.85	QBar		

Pre-development Discharge Volume

Site Makeup	Greenfield	Soil Index	1	Return Period (years)	100	Betterment (%)	0
Greenfield Method	FSR/FEH	SPR	0.10	Climate Change (%)	0	PR	
Positively Drained Area (ha)		CWI		Storm Duration (mins)	360	Runoff Volume (m³)	

Appendix B. Pipeline Schedules



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)
1.002	28.837	324.0	375	Circular	20.630	19.123	1.132	21.052	19.034	1.643
1.003	41.199	400.0	450	Circular	21.052	19.034	1.568	20.681	18.931	1.300
2.000	38.108	320.0	375	Circular	20.300	19.268	0.657	20.681	19.149	1.157
1.004	13.912	400.0	450	Circular	20.681	18.931	1.300	21.521	18.896	2.175
1.005	36.016	400.0	450	Circular	21.521	18.896	2.175	21.830	18.806	2.574
1.006	16.028	550.0	600	Circular	21.830	18.806	2.424	22.336	18.777	2.959
3.000	33.709	320.0	375	Circular	20.552	19.277	0.900	21.394	19.172	1.847
3.001	25.750	320.0	375	Circular	21.394	19.172	1.847	22.038	19.092	2.571
3.002	24.821	320.0	375	Circular	22.038	19.092	2.571	22.336	19.014	2.947
1.007	47.363	577.6	600	Circular	22.336	18.777	2.959	21.717	18.695	2.422
1.008	57.104	432.6	600	Circular	21.717	18.695	2.422	21.317	18.563	2.154
1.009	17.810	742.1	750	Circular	21.317	18.413	2.154	21.075	18.389	1.936
1.010	19.814	700.0	750	Circular	21.075	18.389	1.936	20.815	18.361	1.704
1.011	13.391	700.0	750	Circular	20.815	18.361	1.704	20.627	18.342	1.535
1.012	59.076	700.0	750	Circular	20.627	18.342	1.535	20.724	18.258	1.716
1.013	15.033	700.0	750	Circular	20.724	18.258	1.716	20.988	18.237	2.001
6.000	14.277	240.0	300	Circular	21.157	18.579	2.278	20.988	18.520	2.168
1.014	15.009	887.4	900	Circular	20.988	18.168	1.920	21.311	18.151	2.260
1.015	59.219	875.0	900	Circular	21.311	18.151	2.260	21.359	18.083	2.376
7.000	33.173	21.0	225	Circular	44.368	42.414	1.729	42.375	40.834	1.316
7.001	29.969	21.0	225	Circular	42.375	40.134	2.016	40.413	38.707	1.481
7.002	35.543	28.0	300	Circular	40.413	37.200	2.913	38.579	35.931	2.348
7.003	46.101	28.0	300	Circular	38.579	35.227	3.052	36.023	33.581	2.142
7.004	29.174	38.0	375	Circular	36.023	32.775	2.873	34.415	32.007	2.033
7.005	47.653	38.0	375	Circular	34.415	30.967	3.073	32.091	29.713	2.003
7.006	32.287	47.0	450	Circular	32.091	28.566	3.075	29.974	27.879	1.645
7.007	36.751	47.0	450	Circular	29.974	27.000	2.524	27.375	26.218	0.707
7.008	44.489	67.0	600	Circular	27.375	24.700	2.075	25.252	24.036	0.616
7.009	58.799	90.0	750	Circular	25.252	21.950	2.552	22.643	21.297	0.596
7.010	53.125	90.0	750	Circular	22.643	20.335	1.558	21.359	19.745	0.864
1.016	16.218	875.0	900	Circular	21.359	18.083	2.376	20.991	18.064	2.027
1.017	8.490	850.0	900	Circular	20.991	18.064	2.027	20.705	18.054	1.751
4.000	51.196	169.0	225	Circular	20.992	19.567	1.200	20.634	19.264	1.145
4.001	50.059	320.0	375	Circular	20.634	18.843	1.416	21.308	18.687	2.246
5.000	37.593	240.0	300	Circular	20.200	19.000	0.900	20.634	18.843	1.491
1.000	26.801	240.0	300	Circular	20.500	19.375	0.825	20.609	19.263	1.046
12.000	30.215	590.0	600	Circular	18.915	17.834	0.481	19.338	17.783	0.955
12.001	18.237	590.0	600	Circular	19.338	17.789	0.949	19.552	17.758	1.194

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.002	1	1350	Manhole	Adoptable	2	1350	Manhole	Adoptable
1.003	2	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable
2.000	3	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable
1.004	4	1350	Manhole	Adoptable	5	1350	Manhole	Adoptable
1.005	5	1350	Manhole	Adoptable	6	1500	Manhole	Adoptable
1.006	6	1500	Manhole	Adoptable	10	1500	Manhole	Adoptable
3.000	7	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable
3.001	8	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
3.002	9	1350	Manhole	Adoptable	10	1500	Manhole	Adoptable
1.007	10	1500	Manhole	Adoptable	11	1500	Manhole	Adoptable
1.008	11	1500	Manhole	Adoptable	12	1800	Manhole	Adoptable
1.009	12	1800	Manhole	Adoptable	13	1800	Manhole	Adoptable
1.010	13	1800	Manhole	Adoptable	14	1800	Manhole	Adoptable
1.011	14	1800	Manhole	Adoptable	15	1800	Manhole	Adoptable
1.012	15	1800	Manhole	Adoptable	16	1800	Manhole	Adoptable
1.013	16	1800	Manhole	Adoptable	18	1800	Manhole	Adoptable
6.000	17	1800	Manhole	Adoptable	18	1800	Manhole	Adoptable
1.014	18	1800	Manhole	Adoptable	19	1800	Manhole	Adoptable
1.015	19	1800	Manhole	Adoptable	31	1800	Manhole	Adoptable
7.000	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
7.001	21	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable
7.002	22	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable
7.003	23	1200	Manhole	Adoptable	24	1350	Manhole	Adoptable
7.004	24	1350	Manhole	Adoptable	25	1350	Manhole	Adoptable
7.005	25	1350	Manhole	Adoptable	26	1350	Manhole	Adoptable
7.006	26	1350	Manhole	Adoptable	27	1350	Manhole	Adoptable
7.007	27	1350	Manhole	Adoptable	28	1500	Manhole	Adoptable
7.008	28	1500	Manhole	Adoptable	29	1800	Manhole	Adoptable
7.009	29	1800	Manhole	Adoptable	30	1800	Manhole	Adoptable
7.010	30	1800	Manhole	Adoptable	31	1800	Manhole	Adoptable
1.016	31	1800	Manhole	Adoptable	32	1800	Manhole	Adoptable
1.017	32	1800	Manhole	Adoptable	32_OUT	1800	Manhole	Adoptable
4.000	33	1200	Manhole	Adoptable	35	1350	Manhole	Adoptable
4.001	35	1350	Manhole	Adoptable	34	1350	Manhole	Adoptable
5.000	39	1200	Manhole	Adoptable	35	1350	Manhole	Adoptable
1.000	37	1200	Manhole	Adoptable	36	1200	Manhole	Adoptable
12.000	40	1500	Manhole	Adoptable	41	1500	Manhole	Adoptable
12.001	41	1500	Manhole	Adoptable	44	1500	Manhole	Adoptable

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)
11.000	58.807	319.6	375	Circular	20.077	18.172	1.530	19.536	17.988	1.173
11.001	8.957	319.9	375	Circular	19.536	17.988	1.173	19.552	17.960	1.217
11.002	13.688	590.0	600	Circular	19.552	17.758	1.194	19.574	17.735	1.239
11.003	14.950	598.0	600	Circular	19.574	17.735	1.239	19.633	17.710	1.323
10.000	36.085	169.4	225	Circular	20.760	18.926	1.609	20.742	18.713	1.804
10.001	17.168	169.0	225	Circular	20.742	18.713	1.804	21.127	18.611	2.291
10.002	51.360	240.3	300	Circular	21.127	18.536	2.291	19.974	18.322	1.352
10.003	27.428	240.0	300	Circular	19.974	18.322	1.352	19.831	18.208	1.323
10.004	31.771	240.7	300	Circular	19.831	18.208	1.323	19.633	18.076	1.257
8.000	18.240	450.0	450	Circular	20.917	18.104	2.363	20.696	18.063	2.183
8.001	54.419	450.0	450	Circular	20.696	18.063	2.183	19.908	17.942	1.516
8.002	45.518	450.0	450	Circular	19.908	17.942	1.516	19.871	17.841	1.580
8.003	29.431	450.0	450	Circular	19.871	17.841	1.580	19.555	17.776	1.329
9.000	9.656	580.0	600	Circular	19.586	17.860	1.126	19.543	17.843	1.100
9.001	47.256	580.0	600	Circular	19.543	17.843	1.100	19.159	17.762	0.797
9.002	55.085	580.0	600	Circular	19.159	17.762	0.797	19.255	17.667	0.988
9.003	9.598	580.0	600	Circular	19.255	17.667	0.988	19.555	17.650	1.305
8.004	11.866	580.0	600	Circular	19.555	17.626	1.329	19.731	17.606	1.525
13.000	18.071	25.0	225	Circular	43.992	42.482	1.285	43.874	41.759	1.890
13.001	18.276	35.0	225	Circular	43.874	41.759	1.890	43.798	41.237	2.336
13.002	5.112	35.0	300	Circular	43.798	41.162	2.336	43.511	41.016	2.195
14.000	29.479	25.0	225	Circular	44.160	42.735	1.200	43.975	41.556	2.194
14.001	8.582	30.0	300	Circular	43.975	41.481	2.194	43.511	41.195	2.016
13.003	24.866	42.6	300	Circular	43.511	41.016	2.195	42.011	40.432	1.279
13.004	23.763	21.0	300	Circular	42.011	40.432	1.279	40.844	39.300	1.244
15.000	16.610	21.0	225	Circular	42.721	41.191	1.305	41.770	40.400	1.145
15.001	17.189	23.6	300	Circular	41.770	40.325	1.145	41.097	39.597	1.200
15.002	26.742	30.0	300	Circular	41.097	39.597	1.200	40.570	38.706	1.564
15.003	5.365	40.0	375	Circular	40.570	38.631	1.564	40.670	38.497	1.798
15.004	5.898	310.4	375	Circular	40.670	38.497	1.798	40.844	38.478	1.991
13.005	8.482	28.0	375	Circular	40.844	38.478	1.991	40.587	38.175	2.037
13.006	30.953	40.0	375	Circular	40.587	37.500	2.712	40.688	36.726	3.587
13.007	4.722	40.0	375	Circular	40.688	36.726	3.587	40.559	36.608	3.576
13.008	31.315	40.0	375	Circular	40.559	35.500	4.684	38.844	34.717	3.752
13.009	37.278	40.0	375	Circular	38.844	34.717	3.752	36.556	33.785	2.396
13.010	35.148	40.0	375	Circular	36.556	33.000	3.181	34.107	32.121	1.611
16.000	46.059	150.0	300	Circular	32.722	31.222	1.200	34.107	30.915	2.892
13.011	33.816	48.0	450	Circular	34.107	30.650	3.007	31.792	29.946	1.396
13.012	21.273	48.0	450	Circular	31.792	29.361	1.981	30.431	28.918	1.063

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
11.000	42	1350	Manhole	Adoptable	43	1350	Manhole	Adoptable
11.001	43	1350	Manhole	Adoptable	44	1500	Manhole	Adoptable
11.002	44	1500	Manhole	Adoptable	45	1500	Manhole	Adoptable
11.003	45	1500	Manhole	Adoptable	45_OUT	1500	Manhole	Adoptable
10.000	46	1200	Manhole	Adoptable	47	1200	Manhole	Adoptable
10.001	47	1200	Manhole	Adoptable	48	1200	Manhole	Adoptable
10.002	48	1200	Manhole	Adoptable	49	1200	Manhole	Adoptable
10.003	49	1200	Manhole	Adoptable	50	1200	Manhole	Adoptable
10.004	50	1200	Manhole	Adoptable	45_OUT	1500	Manhole	Adoptable
8.000	51	2400	Manhole	Adoptable	52	1350	Manhole	Adoptable
8.001	52	1350	Manhole	Adoptable	53	1350	Manhole	Adoptable
8.002	53	1350	Manhole	Adoptable	54	1350	Manhole	Adoptable
8.003	54	1350	Manhole	Adoptable	59	1500	Manhole	Adoptable
9.000	55	1500	Manhole	Adoptable	56	1500	Manhole	Adoptable
9.001	56	1500	Manhole	Adoptable	57	1500	Manhole	Adoptable
9.002	57	1500	Manhole	Adoptable	58	1500	Manhole	Adoptable
9.003	58	1500	Manhole	Adoptable	59	1500	Manhole	Adoptable
8.004	59	1500	Manhole	Adoptable	59_OUT	1500	Manhole	Adoptable
13.000	60	1200	Manhole	Adoptable	61	1200	Manhole	Adoptable
13.001	61	1200	Manhole	Adoptable	62	1200	Manhole	Adoptable
13.002	62	1200	Manhole	Adoptable	65	1200	Manhole	Adoptable
14.000	63	1200	Manhole	Adoptable	64	1200	Manhole	Adoptable
14.001	64	1200	Manhole	Adoptable	65	1200	Manhole	Adoptable
13.003	65	1200	Manhole	Adoptable	66	1200	Manhole	Adoptable
13.004	66	1200	Manhole	Adoptable	72	1350	Manhole	Adoptable
15.000	67	1200	Manhole	Adoptable	68	1200	Manhole	Adoptable
15.001	68	1200	Manhole	Adoptable	69	1200	Manhole	Adoptable
15.002	69	1200	Manhole	Adoptable	70	1350	Manhole	Adoptable
15.003	70	1350	Manhole	Adoptable	71	1350	Manhole	Adoptable
15.004	71	1350	Manhole	Adoptable	72	1350	Manhole	Adoptable
13.005	72	1350	Manhole	Adoptable	73	1350	Manhole	Adoptable
13.006	73	1350	Manhole	Adoptable	74	1350	Manhole	Adoptable
13.007	74	1350	Manhole	Adoptable	75	1350	Manhole	Adoptable
13.008	75	1350	Manhole	Adoptable	76	1350	Manhole	Adoptable
13.009	76	1350	Manhole	Adoptable	77	1350	Manhole	Adoptable
13.010	77	1350	Manhole	Adoptable	79	1350	Manhole	Adoptable
16.000	78	1200	Manhole	Adoptable	79	1350	Manhole	Adoptable
13.011	79	1350	Manhole	Adoptable	80	1350	Manhole	Adoptable
13.012	80	1350	Manhole	Adoptable	81	1350	Manhole	Adoptable

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)
13.013	25.460	48.0	450	Circular	30.431	28.399	1.582	28.757	27.869	0.438
13.014	31.903	48.0	450	Circular	28.757	27.344	0.963	27.328	26.679	0.199
17.000	31.439	21.0	225	Circular	33.762	31.250	2.287	32.362	29.753	2.384
17.001	27.978	21.0	225	Circular	32.362	29.753	2.384	30.462	28.421	1.816
17.002	26.055	28.0	300	Circular	30.462	28.346	1.816	28.703	27.415	0.988
17.003	26.109	38.0	375	Circular	28.703	26.000	2.328	27.328	25.313	1.640
13.015	35.120	68.0	600	Circular	27.328	24.890	1.838	25.636	24.374	0.662
13.016	43.705	22.0	600	Circular	25.636	23.819	1.217	23.656	21.832	1.224
18.000	48.875	25.0	225	Circular	29.879	27.200	2.454	26.966	25.245	1.496
18.001	38.091	28.0	300	Circular	26.966	25.170	1.496	24.796	23.810	0.686
19.000	48.714	48.0	375	Circular	26.520	25.026	1.119	24.796	24.011	0.410
18.002	56.754	67.0	600	Circular	24.796	22.996	1.200	23.656	22.149	0.907
13.017	32.341	90.1	750	Circular	23.656	21.682	1.224	23.346	21.323	1.273
13.018	23.269	90.0	750	Circular	23.346	21.323	1.273	23.280	21.064	1.466
20.000	25.947	25.0	225	Circular	29.637	28.395	1.017	28.686	27.357	1.104
20.001	19.588	35.0	225	Circular	28.686	27.357	1.104	28.444	26.797	1.422
20.002	32.246	35.0	300	Circular	28.444	26.722	1.422	28.155	25.801	2.054
20.003	32.536	28.0	300	Circular	28.155	25.801	2.054	26.576	24.639	1.637
20.004	27.189	38.0	375	Circular	26.576	24.564	1.637	25.505	23.849	1.281
21.000	28.931	69.5	225	Circular	25.430	24.417	0.788	25.505	24.001	1.279
20.005	22.446	37.0	375	Circular	25.505	23.849	1.281	24.817	23.242	1.200
20.006	31.097	38.0	375	Circular	24.817	23.242	1.200	24.004	22.424	1.205
20.007	28.102	100.0	450	Circular	24.004	22.150	1.404	23.109	21.869	0.790
20.008	18.584	100.2	600	Circular	23.109	21.309	1.200	23.225	21.124	1.501
20.009	26.680	100.0	600	Circular	23.225	21.124	1.501	23.280	20.857	1.823
22.000	18.371	21.0	225	Circular	26.724	25.074	1.425	26.006	24.200	1.581
22.001	26.884	28.0	300	Circular	26.006	24.125	1.581	25.341	23.165	1.876
22.002	35.895	40.5	375	Circular	25.341	23.090	1.876	24.101	22.203	1.523
22.003	35.629	45.3	450	Circular	24.101	22.128	1.523	23.280	21.342	1.488
13.019	20.322	90.0	750	Circular	23.280	20.707	1.823	22.467	20.481	1.236
23.000	29.980	169.0	225	Circular	21.773	20.348	1.200	21.922	20.171	1.526
23.001	10.015	244.3	300	Circular	21.922	20.096	1.526	22.020	20.055	1.665
23.002	25.242	242.7	300	Circular	22.020	20.055	1.665	22.139	19.951	1.888
23.003	26.277	243.3	300	Circular	22.139	19.951	1.888	22.352	19.843	2.209
24.000	35.191	109.3	225	Circular	21.665	20.240	1.200	22.352	19.918	2.209
23.004	24.210	322.8	375	Circular	22.352	19.768	2.209	22.569	19.693	2.501
23.005	4.176	321.2	375	Circular	22.569	19.693	2.501	22.554	19.680	2.499
23.006	23.731	320.7	375	Circular	22.554	19.680	2.499	22.547	19.606	2.566
23.007	30.863	320.0	375	Circular	22.547	19.606	2.566	22.467	19.510	2.582

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
13.013	81	1350	Manhole	Adoptable	82	1350	Manhole	Adoptable
13.014	82	1350	Manhole	Adoptable	87	1500	Manhole	Adoptable
17.000	83	1200	Manhole	Adoptable	84	1200	Manhole	Adoptable
17.001	84	1200	Manhole	Adoptable	85	1200	Manhole	Adoptable
17.002	85	1200	Manhole	Adoptable	86	1350	Manhole	Adoptable
17.003	86	1350	Manhole	Adoptable	87	1500	Manhole	Adoptable
13.015	87	1500	Manhole	Adoptable	88	1500	Manhole	Adoptable
13.016	88	1500	Manhole	Adoptable	93	1800	Manhole	Adoptable
18.000	89	1200	Manhole	Adoptable	90	1200	Manhole	Adoptable
18.001	90	1200	Manhole	Adoptable	92	1500	Manhole	Adoptable
19.000	91	1350	Manhole	Adoptable	92	1500	Manhole	Adoptable
18.002	92	1500	Manhole	Adoptable	93	1800	Manhole	Adoptable
13.017	93	1800	Manhole	Adoptable	94	1800	Manhole	Adoptable
13.018	94	1800	Manhole	Adoptable	110	1800	Manhole	Adoptable
20.000	95	1200	Manhole	Adoptable	96	1200	Manhole	Adoptable
20.001	96	1200	Manhole	Adoptable	97	1200	Manhole	Adoptable
20.002	97	1200	Manhole	Adoptable	98	1200	Manhole	Adoptable
20.003	98	1200	Manhole	Adoptable	99	1350	Manhole	Adoptable
20.004	99	1350	Manhole	Adoptable	101	1350	Manhole	Adoptable
21.000	100	1200	Manhole	Adoptable	101	1350	Manhole	Adoptable
20.005	101	1350	Manhole	Adoptable	102	1350	Manhole	Adoptable
20.006	102	1350	Manhole	Adoptable	103	1350	Manhole	Adoptable
20.007	103	1350	Manhole	Adoptable	104	1500	Manhole	Adoptable
20.008	104	1500	Manhole	Adoptable	105	1500	Manhole	Adoptable
20.009	105	1500	Manhole	Adoptable	110	1800	Manhole	Adoptable
22.000	106	1200	Manhole	Adoptable	107	1200	Manhole	Adoptable
22.001	107	1200	Manhole	Adoptable	108	1350	Manhole	Adoptable
22.002	108	1350	Manhole	Adoptable	109	1350	Manhole	Adoptable
22.003	109	1350	Manhole	Adoptable	110	1800	Manhole	Adoptable
13.019	110	1800	Manhole	Adoptable	122	1800	Manhole	Adoptable
23.000	111	1200	Manhole	Adoptable	112	1200	Manhole	Adoptable
23.001	112	1200	Manhole	Adoptable	113	1200	Manhole	Adoptable
23.002	113	1200	Manhole	Adoptable	114	1200	Manhole	Adoptable
23.003	114	1200	Manhole	Adoptable	116	1350	Manhole	Adoptable
24.000	115	1200	Manhole	Adoptable	116	1350	Manhole	Adoptable
23.004	116	1350	Manhole	Adoptable	117	1350	Manhole	Adoptable
23.005	117	1350	Manhole	Adoptable	118	1350	Manhole	Adoptable
23.006	118	1350	Manhole	Adoptable	119	1350	Manhole	Adoptable
23.007	119	1350	Manhole	Adoptable	122	1800	Manhole	Adoptable

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)
25.000	48.654	169.5	225	Circular	21.328	19.903	1.200	22.401	19.616	2.560
25.001	21.036	244.6	300	Circular	22.401	19.541	2.560	22.467	19.455	2.712
13.020	9.104	700.0	750	Circular	22.467	19.005	2.712	22.549	18.992	2.807
13.021	44.943	700.0	750	Circular	22.549	18.992	2.807	22.743	18.928	3.065
13.022	8.651	700.0	750	Circular	22.743	18.928	3.065	22.837	18.916	3.171
13.023	24.440	700.0	750	Circular	22.837	18.916	3.171	22.562	18.881	2.931
26.000	36.587	243.9	300	Circular	21.489	19.989	1.200	22.562	19.839	2.423
13.024	23.435	700.0	750	Circular	22.562	18.881	2.931	21.743	18.848	2.145
27.000	26.151	169.0	225	Circular	24.798	21.750	2.823	23.922	21.595	2.102
27.001	14.446	240.0	300	Circular	23.922	21.520	2.102	23.484	21.460	1.724
27.002	6.286	320.0	375	Circular	23.484	21.385	1.724	23.243	21.365	1.503
27.003	24.304	320.0	375	Circular	23.243	21.365	1.503	22.501	21.289	0.837
28.000	33.979	244.5	300	Circular	20.617	19.492	0.825	21.795	19.353	2.142
28.001	23.189	322.1	375	Circular	21.795	19.353	2.067	22.501	19.281	2.845
27.004	20.183	320.4	375	Circular	22.501	19.281	2.845	21.743	19.218	2.150
4.002	15.820	322.8	375	Circular	21.308	18.687	2.246	21.317	18.638	2.304
1.001	15.617	240.3	300	Circular	20.609	19.263	1.046	20.630	19.198	1.132

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
25.000	120	1200	Manhole	Adoptable	121	1200	Manhole	Adoptable
25.001	121	1200	Manhole	Adoptable	122	1800	Manhole	Adoptable
13.020	122	1800	Manhole	Adoptable	123	1800	Manhole	Adoptable
13.021	123	1800	Manhole	Adoptable	124	1800	Manhole	Adoptable
13.022	124	1800	Manhole	Adoptable	125	1800	Manhole	Adoptable
13.023	125	1800	Manhole	Adoptable	127	1800	Manhole	Adoptable
26.000	126	1200	Manhole	Adoptable	127	1800	Manhole	Adoptable
13.024	127	1800	Manhole	Adoptable	127_OUT	1800	Manhole	Adoptable
27.000	128	1200	Manhole	Adoptable	129	1200	Manhole	Adoptable
27.001	129	1200	Manhole	Adoptable	130	1350	Manhole	Adoptable
27.002	130	1350	Manhole	Adoptable	131	1350	Manhole	Adoptable
27.003	131	1350	Manhole	Adoptable	134	1350	Manhole	Adoptable
28.000	132	1200	Manhole	Adoptable	133	1350	Manhole	Adoptable
28.001	133	1350	Manhole	Adoptable	134	1350	Manhole	Adoptable
27.004	134	1350	Manhole	Adoptable	127_OUT	1800	Manhole	Adoptable
4.002	34	1350	Manhole	Adoptable	12	1800	Manhole	Adoptable
1.001	36	1200	Manhole	Adoptable	1	1350	Manhole	Adoptable

Appendix C. Storage Structures



Node 51 Pond Storage Structure

Invert Level (m) 18.104 | Time to half empty (mins) | Analyse flow through structure x

Inlets
32_OUT

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	750.0	1.750	750.0	1.751	0.0

Node 55 Tank Storage Structure

Invert Level (m) 17.860 | Time to half empty (mins) | Analyse flow through structure x

Inlets
45_OUT

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	475.0	0.815	475.0	0.816	0.0

Node 17 Tank Storage Structure

Invert Level (m) 18.579 | Time to half empty (mins) | Analyse flow through structure x

Inlets
127_OUT

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	698.5	1.828	698.5	1.829	0.0

Appendix D. Online Controls



Node 51 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	18.099	Product Number	CTL-SHE-0216-2710-1750-2710
Design Depth (m)	1.750	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	27.1	Min Node Diameter (mm)	2100

Node 55 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	18.050	Product Number	CTL-SHE-0094-3700-0815-3700
Design Depth (m)	0.815	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	3.7	Min Node Diameter (mm)	1200

Node 17 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	18.579	Product Number	CTL-SHE-0163-1510-1828-1510
Design Depth (m)	1.828	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	15.1	Min Node Diameter (mm)	1800

Appendix E. Summary of Results

E.1 Results Status Description

E.2 1 in 100 year Outputs

E.3 1 in 30 year Outputs



Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +30% CC 15 minute summer	259.564	73.448	30 year +30% CC 360 minute summer	39.547	10.177
30 year +30% CC 15 minute winter	182.150	73.448	30 year +30% CC 360 minute winter	25.706	10.177
30 year +30% CC 30 minute summer	179.080	50.674	30 year +30% CC 480 minute summer	31.681	8.372
30 year +30% CC 30 minute winter	125.670	50.674	30 year +30% CC 480 minute winter	21.048	8.372
30 year +30% CC 60 minute summer	125.576	33.186	30 year +30% CC 600 minute summer	26.298	7.193
30 year +30% CC 60 minute winter	83.430	33.186	30 year +30% CC 600 minute winter	17.968	7.193
30 year +30% CC 120 minute summer	80.290	21.218	30 year +30% CC 720 minute summer	23.702	6.352
30 year +30% CC 120 minute winter	53.343	21.218	30 year +30% CC 720 minute winter	15.929	6.352
30 year +30% CC 180 minute summer	63.030	16.220	30 year +30% CC 960 minute summer	19.822	5.220
30 year +30% CC 180 minute winter	40.971	16.220	30 year +30% CC 960 minute winter	13.131	5.220
30 year +30% CC 240 minute summer	50.622	13.378	30 year +30% CC 1440 minute summer	14.764	3.957
30 year +30% CC 240 minute winter	33.632	13.378	30 year +30% CC 1440 minute winter	9.922	3.957

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	19	19.988	0.865	51.7	1.8683	0.0000	SURCHARGED
30 minute summer	2	19	20.017	0.983	95.6	2.3984	0.0000	SURCHARGED
15 minute summer	3	12	19.991	0.723	33.8	1.0856	0.0000	SURCHARGED
30 minute summer	4	19	19.932	1.001	126.0	2.3201	0.0000	SURCHARGED
30 minute summer	5	19	19.909	1.013	144.0	1.9803	0.0000	SURCHARGED
360 minute summer	6	352	19.859	1.053	43.3	1.8606	0.0000	SURCHARGED
15 minute summer	7	11	19.882	0.605	19.5	1.1674	0.0000	SURCHARGED
360 minute summer	8	360	19.860	0.688	13.6	1.3982	0.0000	SURCHARGED
360 minute summer	9	360	19.860	0.768	23.8	1.4896	0.0000	SURCHARGED
360 minute winter	10	344	19.858	1.081	53.3	2.5513	0.0000	SURCHARGED
360 minute summer	11	360	19.859	1.164	99.2	3.5838	0.0000	SURCHARGED
360 minute summer	1.008:50%	360	19.861	1.232	93.4	0.0000	0.0000	SURCHARGED
360 minute summer	12	360	19.859	1.446	165.7	5.4934	0.0000	SURCHARGED
360 minute summer	13	360	19.861	1.472	168.4	4.3850	0.0000	SURCHARGED
360 minute summer	14	360	19.857	1.496	169.6	4.3031	0.0000	SURCHARGED
360 minute summer	15	360	19.861	1.519	170.1	4.2646	0.0000	SURCHARGED
360 minute summer	16	360	19.859	1.601	200.2	7.3837	0.0000	SURCHARGED
360 minute winter	17	352	20.181	1.602	82.4	1112.4400	0.0000	SURCHARGED
360 minute summer	18	360	19.859	1.691	211.9	4.3039	0.0000	SURCHARGED
360 minute summer	19	360	19.858	1.707	235.2	6.2990	0.0000	SURCHARGED
15 minute summer	20	1	42.414	0.000	0.0	0.0000	0.0000	OK
15 minute summer	21	1	40.134	0.000	0.0	0.0000	0.0000	OK
15 minute summer	22	1	37.200	0.000	0.0	0.0000	0.0000	OK
15 minute summer	23	1	35.227	0.000	0.0	0.0000	0.0000	OK
15 minute summer	24	1	32.775	0.000	0.0	0.0000	0.0000	OK
15 minute summer	25	1	30.967	0.000	0.0	0.0000	0.0000	OK
15 minute summer	26	1	28.566	0.000	0.0	0.0000	0.0000	OK
15 minute summer	27	1	27.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	28	1	24.700	0.000	0.0	0.0000	0.0000	OK
15 minute summer	29	10	22.016	0.066	21.6	0.1826	0.0000	OK
15 minute summer	30	10	20.471	0.136	91.4	0.4819	0.0000	OK
360 minute winter	31	352	19.856	1.773	181.3	5.4773	0.0000	SURCHARGED
360 minute winter	32	352	19.856	1.792	182.5	4.8120	0.0000	SURCHARGED
360 minute winter	32_OUT	352	19.855	1.801	181.9	0.0000	0.0000	OK
15 minute summer	33	11	20.236	0.669	65.4	1.7615	0.0000	SURCHARGED
30 minute summer	4.000:50%	21	20.020	0.605	67.9	11.1506	0.0000	SURCHARGED
360 minute summer	34	360	19.860	1.173	53.8	1.9723	0.0000	SURCHARGED
30 minute summer	35	20	19.915	1.072	166.5	3.9414	0.0000	SURCHARGED
360 minute summer	4.001:50%	352	19.858	1.093	53.4	11.2123	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)
30 minute summer	1	1.002	2	45.0	0.617	0.407	3.1806	
30 minute summer	2	1.003	4	96.9	0.704	0.603	6.5277	
15 minute summer	3	2.000	4	-31.6	-0.466	-0.284	4.2032	
30 minute summer	4	1.004	5	122.1	0.771	0.760	2.2043	
30 minute summer	5	1.005	6	138.4	0.873	0.861	5.7065	
360 minute summer	6	1.006	10	39.5	0.456	0.135	4.5147	
15 minute summer	7	3.000	8	29.0	0.421	0.261	3.7180	
360 minute summer	8	3.001	9	13.4	0.542	0.121	2.8401	
360 minute summer	9	3.002	10	23.5	0.822	0.212	2.7377	
360 minute winter	10	1.007	11	51.5	0.689	0.181	13.3411	
360 minute summer	11	1.008	1.008:50%	90.8	0.880	0.276	8.0424	
360 minute summer	11	1.008	12	88.7	0.918	0.269	8.0424	
360 minute summer	12	1.009	13	160.3	0.639	0.356	7.8386	
360 minute summer	13	1.010	14	163.9	0.645	0.353	8.7206	
360 minute summer	14	1.011	15	165.9	0.661	0.358	5.8937	
360 minute summer	15	1.012	16	164.8	0.586	0.355	26.0006	
360 minute summer	16	1.013	18	197.4	0.746	0.426	6.6163	
360 minute winter	17	6.000	18	14.8	0.774	0.207	1.0054	
360 minute summer	18	1.014	19	210.1	0.509	0.316	9.5123	
360 minute summer	19	1.015	31	230.5	0.506	0.345	37.5315	
15 minute summer	20	7.000	21	0.0	0.000	0.000	0.0000	
15 minute summer	21	7.001	22	0.0	0.000	0.000	0.0000	
15 minute summer	22	7.002	23	0.0	0.000	0.000	0.0000	
15 minute summer	23	7.003	24	0.0	0.000	0.000	0.0000	
15 minute summer	24	7.004	25	0.0	0.000	0.000	0.0000	
15 minute summer	25	7.005	26	0.0	0.000	0.000	0.0001	
15 minute summer	26	7.006	27	0.0	0.000	0.000	0.0000	
15 minute summer	27	7.007	28	0.0	0.000	0.000	0.0000	
15 minute summer	28	7.008	29	0.0	0.000	0.000	0.0001	
15 minute summer	29	7.009	30	20.9	1.125	0.016	1.0946	
15 minute summer	30	7.010	31	90.6	1.717	0.070	2.8050	
360 minute winter	31	1.016	32	180.7	0.631	0.270	10.2785	
360 minute winter	32	1.017	32_OUT	181.9	0.917	0.268	5.3807	
15 minute summer	33	4.000	4.000:50%	59.3	1.491	1.487	1.0181	
15 minute summer	33	4.000	35	59.0	1.485	1.479	1.0181	
360 minute summer	34	4.002	12	52.4	0.917	0.473	1.7449	
30 minute summer	35	4.001	4.001:50%	155.5	1.410	1.398	2.7607	
30 minute summer	35	4.001	34	163.5	1.483	1.470	2.7607	

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	36	20	19.971	0.708	44.9	1.2253	0.0000	SURCHARGED
30 minute summer	37	20	20.042	0.667	35.7	0.7539	0.0000	SURCHARGED
30 minute summer	39	19	19.955	0.955	49.0	2.4603	0.0000	FLOOD RISK
30 minute summer	5.000:50%	20	19.936	1.015	45.4	4.5099	0.0000	SURCHARGED
360 minute winter	40	368	17.968	0.134	0.2	0.2366	0.0000	OK
360 minute winter	41	376	17.968	0.185	0.5	0.3266	0.0000	OK
15 minute summer	42	10	18.344	0.172	46.0	0.3811	0.0000	OK
15 minute summer	43	11	18.163	0.175	46.4	0.2503	0.0000	OK
360 minute winter	44	376	17.968	0.210	6.8	0.3708	0.0000	OK
360 minute winter	45	368	17.968	0.233	6.3	0.4115	0.0000	OK
15 minute summer	46	1	18.926	0.000	0.0	0.0000	0.0000	OK
15 minute summer	47	1	18.713	0.000	0.0	0.0000	0.0000	OK
15 minute summer	48	1	18.536	0.000	0.0	0.0000	0.0000	OK
15 minute summer	49	1	18.322	0.000	0.0	0.0000	0.0000	OK
15 minute summer	50	1	18.208	0.000	0.0	0.0000	0.0000	OK
360 minute winter	45_OUT	368	17.968	0.258	6.2	0.0000	0.0000	OK
360 minute winter	51	344	19.834	1.730	103.9	1317.8520	0.0000	SURCHARGED
60 minute winter	52	39	18.193	0.130	27.1	0.1860	0.0000	OK
30 minute summer	53	229	18.073	0.131	27.1	0.1872	0.0000	OK
30 minute summer	54	230	17.972	0.131	27.1	0.1881	0.0000	OK
360 minute winter	55	600	17.968	0.108	3.0	50.5333	0.0000	OK
15 minute summer	56	1	17.843	0.000	0.0	0.0000	0.0000	OK
15 minute summer	57	1	17.762	0.000	0.0	0.0000	0.0000	OK
30 minute winter	58	241	17.750	0.083	4.3	0.1468	0.0000	OK
30 minute winter	59	239	17.750	0.124	27.1	0.2192	0.0000	OK
30 minute winter	59_OUT	238	17.709	0.103	27.1	0.0000	0.0000	OK
15 minute summer	60	1	42.482	0.000	0.0	0.0000	0.0000	OK
15 minute summer	61	1	41.759	0.000	0.0	0.0000	0.0000	OK
15 minute summer	62	1	41.162	0.000	0.0	0.0000	0.0000	OK
15 minute summer	63	1	42.735	0.000	0.0	0.0000	0.0000	OK
15 minute summer	64	1	41.481	0.000	0.0	0.0000	0.0000	OK
15 minute summer	65	1	41.016	0.000	0.0	0.0000	0.0000	OK
15 minute summer	66	1	40.432	0.000	0.0	0.0000	0.0000	OK
15 minute summer	67	1	41.191	0.000	0.0	0.0000	0.0000	OK
15 minute summer	68	1	40.325	0.000	0.0	0.0000	0.0000	OK
15 minute summer	69	1	39.597	0.000	0.0	0.0000	0.0000	OK
15 minute summer	70	1	38.631	0.000	0.0	0.0000	0.0000	OK
15 minute summer	71	1	38.497	0.000	0.0	0.0000	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)
30 minute summer	36	1.001	1	28.1	0.769	0.393	1.0997	
30 minute summer	37	1.000	36	-35.7	-0.667	-0.499	1.8873	
30 minute summer	39	5.000	5.000:50%	41.5	0.634	0.581	1.3236	
30 minute summer	39	5.000	35	38.1	0.541	0.533	1.3236	
360 minute winter	40	12.000	41	0.2	-0.022	0.001	1.8193	
360 minute winter	41	12.001	44	-0.5	-0.047	-0.002	1.4418	
15 minute summer	42	11.000	43	46.4	0.934	0.417	2.9225	
15 minute summer	43	11.001	44	44.8	0.969	0.403	0.4144	
360 minute winter	44	11.002	45	6.3	0.227	0.023	1.2919	
360 minute winter	45	11.003	45_OUT	6.2	0.114	0.022	1.6204	
15 minute summer	46	10.000	47	0.0	0.000	0.000	0.0000	
15 minute summer	47	10.001	48	0.0	0.000	0.000	0.0000	
15 minute summer	48	10.002	49	0.0	0.000	0.000	0.0000	
15 minute summer	49	10.003	50	0.0	0.000	0.000	0.0000	
15 minute summer	50	10.004	45_OUT	0.0	0.000	0.000	0.0000	
360 minute winter	51	8.000	52	27.1	0.695	0.179	0.7113	
60 minute winter	52	8.001	53	27.1	0.712	0.179	2.0698	
30 minute summer	53	8.002	54	27.1	0.728	0.179	1.7458	
30 minute summer	54	8.003	59	27.1	0.785	0.179	1.0165	
360 minute winter	55	9.000	56	0.0	0.000	0.000	0.0000	
15 minute summer	56	9.001	57	0.0	0.000	0.000	0.0001	
15 minute summer	57	9.002	58	0.0	0.000	0.000	0.6446	
30 minute winter	58	9.003	59	-4.3	-0.287	-0.015	0.2606	
30 minute winter	59	8.004	59_OUT	27.1	0.731	0.095	0.4405	401.5
15 minute summer	60	13.000	61	0.0	0.000	0.000	0.0000	
15 minute summer	61	13.001	62	0.0	0.000	0.000	0.0000	
15 minute summer	62	13.002	65	0.0	0.000	0.000	0.0000	
15 minute summer	63	14.000	64	0.0	0.000	0.000	0.0000	
15 minute summer	64	14.001	65	0.0	0.000	0.000	0.0000	
15 minute summer	65	13.003	66	0.0	0.000	0.000	0.0000	
15 minute summer	66	13.004	72	0.0	0.000	0.000	0.0000	
15 minute summer	67	15.000	68	0.0	0.000	0.000	0.0000	
15 minute summer	68	15.001	69	0.0	0.000	0.000	0.0000	
15 minute summer	69	15.002	70	0.0	0.000	0.000	0.0000	
15 minute summer	70	15.003	71	0.0	0.000	0.000	0.0000	
15 minute summer	71	15.004	72	0.0	0.000	0.000	0.0000	

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	72	1	38.478	0.000	0.0	0.0000	0.0000	OK
15 minute summer	73	1	37.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	74	1	36.726	0.000	0.0	0.0000	0.0000	OK
15 minute summer	75	1	35.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	76	1	34.717	0.000	0.0	0.0000	0.0000	OK
15 minute summer	77	1	33.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	78	1	31.222	0.000	0.0	0.0000	0.0000	OK
15 minute summer	79	1	30.650	0.000	0.0	0.0000	0.0000	OK
15 minute summer	80	1	29.361	0.000	0.0	0.0000	0.0000	OK
15 minute summer	81	1	28.399	0.000	0.0	0.0000	0.0000	OK
15 minute summer	82	1	27.344	0.000	0.0	0.0000	0.0000	OK
15 minute summer	83	1	31.250	0.000	0.0	0.0000	0.0000	OK
15 minute summer	84	1	29.753	0.000	0.0	0.0000	0.0000	OK
15 minute summer	85	1	28.346	0.000	0.0	0.0000	0.0000	OK
15 minute summer	86	1	26.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	87	1	24.890	0.000	0.0	0.0000	0.0000	OK
15 minute summer	88	1	23.819	0.000	0.0	0.0000	0.0000	OK
15 minute summer	89	1	27.200	0.000	0.0	0.0000	0.0000	OK
15 minute summer	90	1	25.170	0.000	0.0	0.0000	0.0000	OK
15 minute summer	91	1	25.026	0.000	0.0	0.0000	0.0000	OK
15 minute summer	92	1	22.996	0.000	0.0	0.0000	0.0000	OK
15 minute summer	93	1	21.682	0.000	0.0	0.0000	0.0000	OK
15 minute summer	94	1	21.323	0.000	0.0	0.0000	0.0000	OK
15 minute summer	95	1	28.395	0.000	0.0	0.0000	0.0000	OK
15 minute summer	96	1	27.357	0.000	0.0	0.0000	0.0000	OK
15 minute summer	97	1	26.722	0.000	0.0	0.0000	0.0000	OK
15 minute summer	98	1	25.801	0.000	0.0	0.0000	0.0000	OK
15 minute summer	99	1	24.564	0.000	0.0	0.0000	0.0000	OK
15 minute summer	100	1	24.417	0.000	0.0	0.0000	0.0000	OK
15 minute summer	101	1	23.849	0.000	0.0	0.0000	0.0000	OK
15 minute summer	102	1	23.242	0.000	0.0	0.0000	0.0000	OK
15 minute summer	103	1	22.150	0.000	0.0	0.0000	0.0000	OK
15 minute summer	104	1	21.309	0.000	0.0	0.0000	0.0000	OK
15 minute summer	105	1	21.124	0.000	0.0	0.0000	0.0000	OK
15 minute summer	106	1	25.074	0.000	0.0	0.0000	0.0000	OK
15 minute summer	107	1	24.125	0.000	0.0	0.0000	0.0000	OK
15 minute summer	108	1	23.090	0.000	0.0	0.0000	0.0000	OK
15 minute summer	109	1	22.128	0.000	0.0	0.0000	0.0000	OK
15 minute summer	110	1	20.707	0.000	0.0	0.0000	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 summer	72	13.005	73	0.0	0.000	0.000	0.0000	
15 minute summer	73	13.006	74	0.0	0.000	0.000	0.0000	
15 minute summer	74	13.007	75	0.0	0.000	0.000	0.0000	
15 minute summer	75	13.008	76	0.0	0.000	0.000	0.0000	
15 minute summer	76	13.009	77	0.0	0.000	0.000	0.0000	
15 minute summer	77	13.010	79	0.0	0.000	0.000	0.0000	
15 minute summer	78	16.000	79	0.0	0.000	0.000	0.0000	
15 minute summer	79	13.011	80	0.0	0.000	0.000	0.0000	
15 minute summer	80	13.012	81	0.0	0.000	0.000	0.0000	
15 minute summer	81	13.013	82	0.0	0.000	0.000	0.0000	
15 minute summer	82	13.014	87	0.0	0.000	0.000	0.0000	
15 minute summer	83	17.000	84	0.0	0.000	0.000	0.0000	
15 minute summer	84	17.001	85	0.0	0.000	0.000	0.0000	
15 minute summer	85	17.002	86	0.0	0.000	0.000	0.0000	
15 minute summer	86	17.003	87	0.0	0.000	0.000	0.0000	
15 minute summer	87	13.015	88	0.0	0.000	0.000	0.0001	
15 minute summer	88	13.016	93	0.0	0.000	0.000	0.0001	
15 minute summer	89	18.000	90	0.0	0.000	0.000	0.0000	
15 minute summer	90	18.001	92	0.0	0.000	0.000	0.0000	
15 minute summer	91	19.000	92	0.0	0.000	0.000	0.0001	
15 minute summer	92	18.002	93	0.0	0.000	0.000	0.0001	
15 minute summer	93	13.017	94	0.0	0.000	0.000	0.0001	
15 minute summer	94	13.018	110	0.0	0.000	0.000	0.0000	
15 minute summer	95	20.000	96	0.0	0.000	0.000	0.0000	
15 minute summer	96	20.001	97	0.0	0.000	0.000	0.0000	
15 minute summer	97	20.002	98	0.0	0.000	0.000	0.0000	
15 minute summer	98	20.003	99	0.0	0.000	0.000	0.0000	
15 minute summer	99	20.004	101	0.0	0.000	0.000	0.0000	
15 minute summer	100	21.000	101	0.0	0.000	0.000	0.0000	
15 minute summer	101	20.005	102	0.0	0.000	0.000	0.0000	
15 minute summer	102	20.006	103	0.0	0.000	0.000	0.0000	
15 minute summer	103	20.007	104	0.0	0.000	0.000	0.0000	
15 minute summer	104	20.008	105	0.0	0.000	0.000	0.0000	
15 minute summer	105	20.009	110	0.0	0.000	0.000	0.0000	
15 minute summer	106	22.000	107	0.0	0.000	0.000	0.0000	
15 minute summer	107	22.001	108	0.0	0.000	0.000	0.0000	
15 minute summer	108	22.002	109	0.0	0.000	0.000	0.0000	
15 minute summer	109	22.003	110	0.0	0.000	0.000	0.0000	
15 minute summer	110	13.019	122	0.0	0.000	0.000	0.0000	

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	111	11	21.367	1.019	29.9	1.1530	0.0000	SURCHARGED
15 minute summer	112	11	21.362	1.266	70.7	3.0365	0.0000	SURCHARGED
15 minute summer	113	11	21.325	1.270	52.8	1.4361	0.0000	SURCHARGED
15 minute summer	114	11	21.253	1.302	108.3	2.7624	0.0000	SURCHARGED
15 minute summer	115	11	21.196	0.956	50.4	2.1860	0.0000	SURCHARGED
15 minute summer	116	11	20.953	1.185	189.3	2.5119	0.0000	SURCHARGED
15 minute summer	117	11	20.661	0.968	194.9	1.4866	0.0000	SURCHARGED
15 minute summer	118	11	20.543	0.863	193.4	1.2346	0.0000	SURCHARGED
15 minute summer	119	11	20.238	0.632	206.2	1.0246	0.0000	SURCHARGED
15 minute summer	120	11	21.295	1.392	77.6	4.0541	0.0000	FLOOD RISK
15 minute summer	121	10	20.358	0.817	168.6	1.8986	0.0000	SURCHARGED
360 minute winter	122	352	20.196	1.191	68.9	3.2619	0.0000	SURCHARGED
360 minute winter	123	352	20.196	1.204	74.7	3.5791	0.0000	SURCHARGED
360 minute winter	124	352	20.197	1.269	71.2	3.2868	0.0000	SURCHARGED
360 minute winter	125	352	20.196	1.280	79.3	4.1501	0.0000	SURCHARGED
15 minute summer	126	10	21.129	1.140	180.3	5.7725	0.0000	SURCHARGED
360 minute winter	127	352	20.196	1.315	103.0	3.3473	0.0000	SURCHARGED
15 minute summer	128	10	21.907	0.157	31.1	0.2307	0.0000	OK
15 minute summer	129	10	21.722	0.202	51.2	0.2839	0.0000	OK
15 minute summer	130	10	21.629	0.244	55.2	0.3642	0.0000	OK
15 minute summer	131	10	21.607	0.242	79.5	0.4504	0.0000	OK
15 minute summer	132	10	20.532	1.040	24.6	1.7797	0.0000	FLOOD RISK
15 minute summer	133	10	20.513	1.160	65.3	2.3978	0.0000	SURCHARGED
15 minute summer	134	10	20.480	1.199	361.6	4.4176	0.0000	SURCHARGED
360 minute winter	127_OUT	352	20.197	1.617	152.4	0.0000	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 summer	111	23.000	112	-29.9	-0.849	-0.751	1.1923	
15 minute summer	112	23.001	113	52.8	0.942	0.746	0.7052	
15 minute summer	113	23.002	114	58.4	0.829	0.822	1.7775	
15 minute summer	114	23.003	116	104.2	1.480	1.469	1.8504	
15 minute summer	115	24.000	116	40.0	1.067	0.804	1.3996	
15 minute summer	116	23.004	117	187.3	1.699	1.691	2.6703	
15 minute summer	117	23.005	118	193.4	1.754	1.742	0.4606	
15 minute summer	118	23.006	119	192.2	1.742	1.729	2.6175	
15 minute summer	119	23.007	122	204.7	1.861	1.840	3.2782	
15 minute summer	120	25.000	121	69.5	1.747	1.745	1.9350	
15 minute summer	121	25.001	122	165.8	2.355	2.344	1.4664	
360 minute winter	122	13.020	123	67.8	0.585	0.146	4.0069	
360 minute winter	123	13.021	124	70.4	0.591	0.152	19.7803	
360 minute winter	124	13.022	125	67.0	0.539	0.145	3.8075	
360 minute winter	125	13.023	127	76.7	0.607	0.165	10.7565	
15 minute summer	126	26.000	127	169.4	2.406	2.392	2.5504	
360 minute winter	127	13.024	127_OUT	100.0	0.881	0.216	10.3142	
15 minute summer	128	27.000	129	31.0	1.085	0.779	0.7480	
15 minute summer	129	27.001	130	51.2	1.097	0.716	0.6731	
15 minute summer	130	27.002	131	54.9	0.727	0.494	0.4750	
15 minute summer	131	27.003	134	78.3	1.148	0.704	1.6614	
15 minute summer	132	28.000	133	23.8	0.339	0.337	2.3928	
15 minute summer	133	28.001	134	69.6	0.631	0.628	2.5577	
15 minute summer	134	27.004	127_OUT	355.2	3.221	3.195	2.2036	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	1	1140	19.729	0.606	4.0	1.3091	0.0000	SURCHARGED
1440 minute summer	2	1140	19.729	0.695	8.2	1.6946	0.0000	SURCHARGED
1440 minute summer	3	1140	19.729	0.461	1.1	0.6919	0.0000	SURCHARGED
1440 minute summer	4	1140	19.729	0.798	11.4	1.8486	0.0000	SURCHARGED
1440 minute summer	5	1140	19.729	0.833	14.2	1.6281	0.0000	SURCHARGED
1440 minute summer	6	1140	19.729	0.923	14.1	1.6306	0.0000	SURCHARGED
1440 minute summer	7	1140	19.729	0.452	1.3	0.8725	0.0000	SURCHARGED
1440 minute summer	8	1140	19.729	0.557	4.0	1.1309	0.0000	SURCHARGED
1440 minute summer	9	1140	19.729	0.637	7.1	1.2354	0.0000	SURCHARGED
1440 minute summer	10	1140	19.729	0.952	24.5	2.2472	0.0000	SURCHARGED
1440 minute summer	11	1140	19.729	1.034	31.1	3.1842	0.0000	SURCHARGED
1440 minute summer	1.008:50%	1140	19.729	1.100	29.8	0.0000	0.0000	SURCHARGED
1440 minute summer	12	1140	19.729	1.316	52.7	4.9999	0.0000	SURCHARGED
1440 minute summer	13	1140	19.729	1.340	53.4	3.9898	0.0000	SURCHARGED
1440 minute summer	14	1140	19.729	1.368	53.8	3.9335	0.0000	SURCHARGED
1440 minute summer	15	1140	19.729	1.387	53.9	3.8925	0.0000	SURCHARGED
1440 minute summer	16	1140	19.729	1.471	62.4	6.7843	0.0000	SURCHARGED
1440 minute summer	17	1050	19.917	1.338	41.7	929.4901	0.0000	SURCHARGED
1440 minute summer	18	1140	19.729	1.561	75.9	3.9719	0.0000	SURCHARGED
1440 minute summer	19	1140	19.729	1.578	83.1	5.8230	0.0000	SURCHARGED
15 minute summer	20	1	42.414	0.000	0.0	0.0000	0.0000	OK
15 minute summer	21	1	40.134	0.000	0.0	0.0000	0.0000	OK
15 minute summer	22	1	37.200	0.000	0.0	0.0000	0.0000	OK
15 minute summer	23	1	35.227	0.000	0.0	0.0000	0.0000	OK
15 minute summer	24	1	32.775	0.000	0.0	0.0000	0.0000	OK
15 minute summer	25	1	30.967	0.000	0.0	0.0000	0.0000	OK
15 minute summer	26	1	28.566	0.000	0.0	0.0000	0.0000	OK
15 minute summer	27	1	27.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	28	1	24.700	0.000	0.0	0.0000	0.0000	OK
15 minute summer	29	10	22.008	0.058	16.7	0.1609	0.0000	OK
15 minute summer	30	10	20.454	0.119	70.4	0.4212	0.0000	OK
1440 minute summer	31	1140	19.729	1.645	92.6	5.0846	0.0000	SURCHARGED
1440 minute summer	32	1140	19.728	1.664	93.2	4.4690	0.0000	SURCHARGED
1440 minute summer	32_OUT	1140	19.728	1.674	92.9	0.0000	0.0000	OK
15 minute summer	33	11	19.931	0.364	50.4	0.9582	0.0000	SURCHARGED
15 minute summer	4.000:50%	12	19.769	0.353	58.9	3.7894	0.0000	SURCHARGED
1440 minute summer	34	1140	19.729	1.042	17.5	1.7523	0.0000	SURCHARGED
1440 minute summer	35	1140	19.729	0.886	17.4	3.2566	0.0000	SURCHARGED
1440 minute summer	4.001:50%	1140	19.729	0.964	17.3	8.7120	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)
1440 minute summer	1	1.002	2	4.0	0.370	0.036	3.1806	
1440 minute summer	2	1.003	4	8.1	0.458	0.051	6.5277	
1440 minute summer	3	2.000	4	-1.1	0.249	-0.010	4.2032	
1440 minute summer	4	1.004	5	11.4	0.533	0.071	2.2043	
1440 minute summer	5	1.005	6	14.1	0.554	0.088	5.7065	
1440 minute summer	6	1.006	10	13.2	0.380	0.045	4.5147	
1440 minute summer	7	3.000	8	1.4	0.222	0.012	3.7180	
1440 minute summer	8	3.001	9	4.0	0.393	0.036	2.8401	
1440 minute summer	9	3.002	10	7.1	0.593	0.064	2.7377	
1440 minute summer	10	1.007	11	23.0	0.539	0.081	13.3411	
1440 minute summer	11	1.008	1.008:50%	29.0	0.679	0.088	8.0424	
1440 minute summer	11	1.008	12	28.4	0.703	0.086	8.0424	
1440 minute summer	12	1.009	13	51.0	0.460	0.113	7.8386	
1440 minute summer	13	1.010	14	52.1	0.454	0.112	8.7206	
1440 minute summer	14	1.011	15	52.7	0.461	0.114	5.8937	
1440 minute summer	15	1.012	16	51.9	0.393	0.112	26.0006	
1440 minute summer	16	1.013	18	61.5	0.518	0.133	6.6163	
1440 minute summer	17	6.000	18	14.6	0.761	0.204	1.0054	
1440 minute summer	18	1.014	19	75.7	0.367	0.114	9.5123	
1440 minute summer	19	1.015	31	82.7	0.349	0.124	37.5315	
15 minute summer	20	7.000	21	0.0	0.000	0.000	0.0000	
15 minute summer	21	7.001	22	0.0	0.000	0.000	0.0000	
15 minute summer	22	7.002	23	0.0	0.000	0.000	0.0000	
15 minute summer	23	7.003	24	0.0	0.000	0.000	0.0000	
15 minute summer	24	7.004	25	0.0	0.000	0.000	0.0000	
15 minute summer	25	7.005	26	0.0	0.000	0.000	0.0001	
15 minute summer	26	7.006	27	0.0	0.000	0.000	0.0000	
15 minute summer	27	7.007	28	0.0	0.000	0.000	0.0000	
15 minute summer	28	7.008	29	0.0	0.000	0.000	0.0001	
15 minute summer	29	7.009	30	16.1	1.035	0.012	0.9125	
15 minute summer	30	7.010	31	69.4	1.593	0.053	2.3150	
1440 minute summer	31	1.016	32	92.4	0.366	0.138	10.2785	
1440 minute summer	32	1.017	32_OUT	92.9	0.420	0.137	5.3807	
15 minute summer	33	4.000	4.000:50%	47.1	1.186	1.183	1.0181	
15 minute summer	33	4.000	35	46.3	1.196	1.161	1.0181	
1440 minute summer	34	4.002	12	16.8	0.695	0.152	1.7449	
1440 minute summer	35	4.001	4.001:50%	16.7	0.695	0.150	2.7607	
1440 minute summer	35	4.001	34	16.2	0.635	0.146	2.7607	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	36	1140	19.729	0.466	1.7	0.8059	0.0000	SURCHARGED
1440 minute summer	37	1140	19.729	0.354	1.2	0.4004	0.0000	SURCHARGED
1440 minute summer	39	1140	19.729	0.729	3.6	1.8784	0.0000	SURCHARGED
1440 minute summer	5.000:50%	1140	19.728	0.807	3.9	2.8509	0.0000	SURCHARGED
1440 minute winter	40	1470	17.996	0.162	0.1	0.2862	0.0000	OK
1440 minute winter	41	1470	17.996	0.213	0.2	0.3763	0.0000	OK
15 minute summer	42	10	18.320	0.148	35.4	0.3284	0.0000	OK
15 minute summer	43	11	18.140	0.152	35.7	0.2169	0.0000	OK
1440 minute winter	44	1470	17.996	0.238	2.1	0.4205	0.0000	OK
1440 minute winter	45	1470	17.996	0.261	2.0	0.4611	0.0000	OK
15 minute summer	46	1	18.926	0.000	0.0	0.0000	0.0000	OK
15 minute summer	47	1	18.713	0.000	0.0	0.0000	0.0000	OK
15 minute summer	48	1	18.536	0.000	0.0	0.0000	0.0000	OK
15 minute summer	49	1	18.322	0.000	0.0	0.0000	0.0000	OK
15 minute summer	50	1	18.208	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	45_OUT	1470	17.996	0.286	1.9	0.0000	0.0000	OK
1440 minute summer	51	1140	19.709	1.605	59.5	1222.9990	0.0000	SURCHARGED
60 minute winter	52	45	18.193	0.130	27.1	0.1860	0.0000	OK
60 minute winter	53	251	18.073	0.131	27.1	0.1872	0.0000	OK
60 minute summer	54	252	17.972	0.131	27.1	0.1881	0.0000	OK
1440 minute winter	55	1680	17.996	0.136	1.0	63.6685	0.0000	OK
15 minute summer	56	1	17.843	0.000	0.0	0.0000	0.0000	OK
15 minute summer	57	1	17.762	0.000	0.0	0.0000	0.0000	OK
60 minute summer	58	253	17.750	0.083	2.9	0.1468	0.0000	OK
60 minute summer	59	254	17.750	0.124	27.1	0.2192	0.0000	OK
60 minute summer	59_OUT	254	17.709	0.103	27.1	0.0000	0.0000	OK
15 minute summer	60	1	42.482	0.000	0.0	0.0000	0.0000	OK
15 minute summer	61	1	41.759	0.000	0.0	0.0000	0.0000	OK
15 minute summer	62	1	41.162	0.000	0.0	0.0000	0.0000	OK
15 minute summer	63	1	42.735	0.000	0.0	0.0000	0.0000	OK
15 minute summer	64	1	41.481	0.000	0.0	0.0000	0.0000	OK
15 minute summer	65	1	41.016	0.000	0.0	0.0000	0.0000	OK
15 minute summer	66	1	40.432	0.000	0.0	0.0000	0.0000	OK
15 minute summer	67	1	41.191	0.000	0.0	0.0000	0.0000	OK
15 minute summer	68	1	40.325	0.000	0.0	0.0000	0.0000	OK
15 minute summer	69	1	39.597	0.000	0.0	0.0000	0.0000	OK
15 minute summer	70	1	38.631	0.000	0.0	0.0000	0.0000	OK
15 minute summer	71	1	38.497	0.000	0.0	0.0000	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)
1440 minute summer	36	1.001	1	1.7	0.437	0.024	1.0997	
1440 minute summer	37	1.000	36	-1.2	-0.024	-0.017	1.8873	
1440 minute summer	39	5.000	5.000:50%	3.6	0.521	0.050	1.3236	
1440 minute summer	39	5.000	35	3.9	0.270	0.054	1.3236	
1440 minute winter	40	12.000	41	-0.1	-0.007	0.000	2.2781	
1440 minute winter	41	12.001	44	-0.2	-0.013	-0.001	1.7335	
15 minute summer	42	11.000	43	35.7	0.879	0.321	2.3955	
15 minute summer	43	11.001	44	34.6	0.899	0.311	0.3444	
1440 minute winter	44	11.002	45	2.0	0.140	0.007	1.5165	
1440 minute winter	45	11.003	45_OUT	1.9	0.056	0.007	1.8691	
15 minute summer	46	10.000	47	0.0	0.000	0.000	0.0000	
15 minute summer	47	10.001	48	0.0	0.000	0.000	0.0000	
15 minute summer	48	10.002	49	0.0	0.000	0.000	0.0000	
15 minute summer	49	10.003	50	0.0	0.000	0.000	0.0000	
15 minute summer	50	10.004	45_OUT	0.0	0.000	0.000	0.0000	
1440 minute summer	51	8.000	52	27.1	0.695	0.179	0.7112	
60 minute winter	52	8.001	53	27.1	0.712	0.179	2.0705	
60 minute winter	53	8.002	54	27.1	0.706	0.179	1.7458	
60 minute summer	54	8.003	59	27.1	0.785	0.179	1.0165	
1440 minute winter	55	9.000	56	0.0	0.000	0.000	0.0000	
15 minute summer	56	9.001	57	0.0	0.000	0.000	0.0001	
15 minute summer	57	9.002	58	0.0	0.000	0.000	0.6204	
60 minute summer	58	9.003	59	-2.9	-0.220	-0.010	0.2606	
60 minute summer	59	8.004	59_OUT	27.1	0.731	0.095	0.4405	429.5
15 minute summer	60	13.000	61	0.0	0.000	0.000	0.0000	
15 minute summer	61	13.001	62	0.0	0.000	0.000	0.0000	
15 minute summer	62	13.002	65	0.0	0.000	0.000	0.0000	
15 minute summer	63	14.000	64	0.0	0.000	0.000	0.0000	
15 minute summer	64	14.001	65	0.0	0.000	0.000	0.0000	
15 minute summer	65	13.003	66	0.0	0.000	0.000	0.0000	
15 minute summer	66	13.004	72	0.0	0.000	0.000	0.0000	
15 minute summer	67	15.000	68	0.0	0.000	0.000	0.0000	
15 minute summer	68	15.001	69	0.0	0.000	0.000	0.0000	
15 minute summer	69	15.002	70	0.0	0.000	0.000	0.0000	
15 minute summer	70	15.003	71	0.0	0.000	0.000	0.0000	
15 minute summer	71	15.004	72	0.0	0.000	0.000	0.0000	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	72	1	38.478	0.000	0.0	0.0000	0.0000	OK
15 minute summer	73	1	37.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	74	1	36.726	0.000	0.0	0.0000	0.0000	OK
15 minute summer	75	1	35.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	76	1	34.717	0.000	0.0	0.0000	0.0000	OK
15 minute summer	77	1	33.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	78	1	31.222	0.000	0.0	0.0000	0.0000	OK
15 minute summer	79	1	30.650	0.000	0.0	0.0000	0.0000	OK
15 minute summer	80	1	29.361	0.000	0.0	0.0000	0.0000	OK
15 minute summer	81	1	28.399	0.000	0.0	0.0000	0.0000	OK
15 minute summer	82	1	27.344	0.000	0.0	0.0000	0.0000	OK
15 minute summer	83	1	31.250	0.000	0.0	0.0000	0.0000	OK
15 minute summer	84	1	29.753	0.000	0.0	0.0000	0.0000	OK
15 minute summer	85	1	28.346	0.000	0.0	0.0000	0.0000	OK
15 minute summer	86	1	26.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	87	1	24.890	0.000	0.0	0.0000	0.0000	OK
15 minute summer	88	1	23.819	0.000	0.0	0.0000	0.0000	OK
15 minute summer	89	1	27.200	0.000	0.0	0.0000	0.0000	OK
15 minute summer	90	1	25.170	0.000	0.0	0.0000	0.0000	OK
15 minute summer	91	1	25.026	0.000	0.0	0.0000	0.0000	OK
15 minute summer	92	1	22.996	0.000	0.0	0.0000	0.0000	OK
15 minute summer	93	1	21.682	0.000	0.0	0.0000	0.0000	OK
15 minute summer	94	1	21.323	0.000	0.0	0.0000	0.0000	OK
15 minute summer	95	1	28.395	0.000	0.0	0.0000	0.0000	OK
15 minute summer	96	1	27.357	0.000	0.0	0.0000	0.0000	OK
15 minute summer	97	1	26.722	0.000	0.0	0.0000	0.0000	OK
15 minute summer	98	1	25.801	0.000	0.0	0.0000	0.0000	OK
15 minute summer	99	1	24.564	0.000	0.0	0.0000	0.0000	OK
15 minute summer	100	1	24.417	0.000	0.0	0.0000	0.0000	OK
15 minute summer	101	1	23.849	0.000	0.0	0.0000	0.0000	OK
15 minute summer	102	1	23.242	0.000	0.0	0.0000	0.0000	OK
15 minute summer	103	1	22.150	0.000	0.0	0.0000	0.0000	OK
15 minute summer	104	1	21.309	0.000	0.0	0.0000	0.0000	OK
15 minute summer	105	1	21.124	0.000	0.0	0.0000	0.0000	OK
15 minute summer	106	1	25.074	0.000	0.0	0.0000	0.0000	OK
15 minute summer	107	1	24.125	0.000	0.0	0.0000	0.0000	OK
15 minute summer	108	1	23.090	0.000	0.0	0.0000	0.0000	OK
15 minute summer	109	1	22.128	0.000	0.0	0.0000	0.0000	OK
15 minute summer	110	1	20.707	0.000	0.0	0.0000	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 summer	72	13.005	73	0.0	0.000	0.000	0.0000	
15 minute summer	73	13.006	74	0.0	0.000	0.000	0.0000	
15 minute summer	74	13.007	75	0.0	0.000	0.000	0.0000	
15 minute summer	75	13.008	76	0.0	0.000	0.000	0.0000	
15 minute summer	76	13.009	77	0.0	0.000	0.000	0.0000	
15 minute summer	77	13.010	79	0.0	0.000	0.000	0.0000	
15 minute summer	78	16.000	79	0.0	0.000	0.000	0.0000	
15 minute summer	79	13.011	80	0.0	0.000	0.000	0.0000	
15 minute summer	80	13.012	81	0.0	0.000	0.000	0.0000	
15 minute summer	81	13.013	82	0.0	0.000	0.000	0.0000	
15 minute summer	82	13.014	87	0.0	0.000	0.000	0.0000	
15 minute summer	83	17.000	84	0.0	0.000	0.000	0.0000	
15 minute summer	84	17.001	85	0.0	0.000	0.000	0.0000	
15 minute summer	85	17.002	86	0.0	0.000	0.000	0.0000	
15 minute summer	86	17.003	87	0.0	0.000	0.000	0.0000	
15 minute summer	87	13.015	88	0.0	0.000	0.000	0.0001	
15 minute summer	88	13.016	93	0.0	0.000	0.000	0.0001	
15 minute summer	89	18.000	90	0.0	0.000	0.000	0.0000	
15 minute summer	90	18.001	92	0.0	0.000	0.000	0.0000	
15 minute summer	91	19.000	92	0.0	0.000	0.000	0.0001	
15 minute summer	92	18.002	93	0.0	0.000	0.000	0.0001	
15 minute summer	93	13.017	94	0.0	0.000	0.000	0.0001	
15 minute summer	94	13.018	110	0.0	0.000	0.000	0.0000	
15 minute summer	95	20.000	96	0.0	0.000	0.000	0.0000	
15 minute summer	96	20.001	97	0.0	0.000	0.000	0.0000	
15 minute summer	97	20.002	98	0.0	0.000	0.000	0.0000	
15 minute summer	98	20.003	99	0.0	0.000	0.000	0.0000	
15 minute summer	99	20.004	101	0.0	0.000	0.000	0.0000	
15 minute summer	100	21.000	101	0.0	0.000	0.000	0.0000	
15 minute summer	101	20.005	102	0.0	0.000	0.000	0.0000	
15 minute summer	102	20.006	103	0.0	0.000	0.000	0.0000	
15 minute summer	103	20.007	104	0.0	0.000	0.000	0.0000	
15 minute summer	104	20.008	105	0.0	0.000	0.000	0.0000	
15 minute summer	105	20.009	110	0.0	0.000	0.000	0.0000	
15 minute summer	106	22.000	107	0.0	0.000	0.000	0.0000	
15 minute summer	107	22.001	108	0.0	0.000	0.000	0.0000	
15 minute summer	108	22.002	109	0.0	0.000	0.000	0.0000	
15 minute summer	109	22.003	110	0.0	0.000	0.000	0.0000	
15 minute summer	110	13.019	122	0.0	0.000	0.000	0.0000	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	111	11	20.797	0.449	23.3	0.5080	0.0000	SURCHARGED
15 minute summer	112	11	20.761	0.665	54.5	1.5952	0.0000	SURCHARGED
15 minute summer	113	11	20.742	0.687	40.6	0.7768	0.0000	SURCHARGED
15 minute summer	114	11	20.707	0.756	81.7	1.6039	0.0000	SURCHARGED
15 minute summer	115	11	20.660	0.420	38.8	0.9611	0.0000	SURCHARGED
15 minute summer	116	11	20.519	0.751	149.7	1.5916	0.0000	SURCHARGED
15 minute summer	117	11	20.336	0.643	155.0	0.9864	0.0000	SURCHARGED
15 minute summer	118	11	20.261	0.581	153.6	0.8308	0.0000	SURCHARGED
15 minute summer	119	11	20.067	0.461	163.2	0.7470	0.0000	SURCHARGED
15 minute summer	120	11	20.686	0.783	59.8	2.2789	0.0000	SURCHARGED
15 minute summer	121	10	20.105	0.564	132.4	1.3122	0.0000	SURCHARGED
1440 minute summer	122	1050	19.931	0.926	31.4	2.5350	0.0000	SURCHARGED
1440 minute summer	123	1050	19.931	0.939	34.0	2.7902	0.0000	SURCHARGED
1440 minute summer	124	1050	19.930	1.002	32.7	2.5975	0.0000	SURCHARGED
1440 minute summer	125	1050	19.930	1.014	36.6	3.2890	0.0000	SURCHARGED
15 minute summer	126	10	20.702	0.713	139.0	3.6099	0.0000	SURCHARGED
1440 minute summer	127	1050	19.930	1.049	47.6	2.6709	0.0000	SURCHARGED
15 minute summer	128	10	21.881	0.131	24.0	0.1921	0.0000	OK
15 minute summer	129	10	21.691	0.171	39.6	0.2408	0.0000	OK
15 minute summer	130	10	21.591	0.206	42.6	0.3070	0.0000	OK
15 minute summer	131	10	21.571	0.206	61.3	0.3829	0.0000	OK
15 minute summer	132	10	20.138	0.646	24.9	1.1046	0.0000	SURCHARGED
15 minute summer	133	10	20.143	0.790	50.0	1.6331	0.0000	SURCHARGED
15 minute summer	134	10	20.136	0.855	280.3	3.1512	0.0000	SURCHARGED
1440 minute summer	127_OUT	1050	19.930	1.351	69.9	0.0000	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 summer	111	23.000	112	-23.3	-0.587	-0.585	1.1923	
15 minute summer	112	23.001	113	40.6	0.953	0.574	0.7052	
15 minute summer	113	23.002	114	45.0	0.729	0.633	1.7775	
15 minute summer	114	23.003	116	83.9	1.192	1.183	1.8504	
15 minute summer	115	24.000	116	33.7	1.066	0.678	1.3996	
15 minute summer	116	23.004	117	149.1	1.352	1.347	2.6703	
15 minute summer	117	23.005	118	153.6	1.393	1.384	0.4606	
15 minute summer	118	23.006	119	152.4	1.382	1.371	2.6175	
15 minute summer	119	23.007	122	160.0	1.485	1.439	3.1348	
15 minute summer	120	25.000	121	55.1	1.386	1.385	1.9350	
15 minute summer	121	25.001	122	130.2	1.850	1.841	1.4453	
1440 minute summer	122	13.020	123	30.9	0.478	0.067	4.0069	
1440 minute summer	123	13.021	124	32.3	0.480	0.070	19.7803	
1440 minute summer	124	13.022	125	31.0	0.430	0.067	3.8075	
1440 minute summer	125	13.023	127	35.5	0.458	0.077	10.7565	
15 minute summer	126	26.000	127	131.1	1.863	1.851	2.5155	
1440 minute summer	127	13.024	127_OUT	46.2	0.660	0.100	10.3142	
15 minute summer	128	27.000	129	24.0	1.031	0.602	0.6082	
15 minute summer	129	27.001	130	39.5	1.017	0.553	0.5614	
15 minute summer	130	27.002	131	42.4	0.685	0.381	0.3891	
15 minute summer	131	27.003	134	60.2	1.066	0.541	1.3801	
15 minute summer	132	28.000	133	16.8	0.282	0.238	2.3928	
15 minute summer	133	28.001	134	52.5	0.476	0.473	2.5577	
15 minute summer	134	27.004	127_OUT	279.3	2.533	2.512	2.2036	

Appendix F. Ground Investigation Report



IGSL Limited

Atkins

**Ground Investigation for
Old Connaught South Dublin
Phase 1**

Factual Report

Report No. 26458

June 2026



Report



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Atkins	Preliminary Factual Report	0	28/04/2026	D. Green BA BAI CEng MIEI FGS	D. Mourdeka BSc MSc Eng Geo
Atkins	Factual Report	0	11/06/2026	D. Mourdeka BSc MSc Eng Geo	D. Green BA BAI CEng MIEI FGS



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FOREWORD

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

Standards

The ground investigation works for this project have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930:2015 and BS 1377 (Parts 1 to 9) and the following European Norms:

- EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- EN ISO 14688-1:2018 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2018 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Classification Principles
- EN ISO 14689-1:2018 Geotechnical Investigation and Testing - Identification & Classification of Rock, Part 1: Identification & Description

Reporting

This report has been prepared for Atkins and the information should not be used without prior written permission of either party. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended. No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations.

The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

Boring Procedures

Unless otherwise stated, 'shell and auger' or cable percussive boring technique has been employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing complies with the recommendations of IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005+A1:2011. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variations is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

Rotary Drilling Procedures

Rotary drilling methods are used to recover very heavily over-consolidated glacial till and bedrock samples in line with Section 3.5 of IS EN 1997-2:2007 and IS EN ISO 22475-1. Open hole drilling methods (odex or symmetrix) are utilized to advance the drillholes through granular dominant superficial deposits, with coring in hard ('cemented') fine grained or cohesive glacial deposits and bedrock.

In-Situ Testing

Standard penetration tests are conducted by IGSL strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005+A1:2011 and the Energy Ratio (E_r) is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005+A1:2011).

Groundwater

The depth of entry of any influx of groundwater is recorded during the course of boring or drilling operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Soil Sampling

Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2007 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Where appropriate Class 1 thin wall undisturbed tube samples (UT100) are obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2007 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2007) is shown in Table A.

Table A – Details of Sample Quality Requirements

EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S
5.5.6	Particle Size Analysis	N/S
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S
5.5.9	Soil Dispersivity	N/S
5.5.10	Frost Susceptibility	N/S
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S
5.11	Permeability	2

N/S – not stated. Presume a representative sample of appropriate size.

Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Engineering Logging

Soil and rock identification is based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2018 and IS EN ISO 14689-1:2018. Rock weathering classification conforms to IS EN ISO 14689-1:2018 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2018. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Retention of Samples

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

1.0 Introduction and Objectives

Proposed construction works between Shankill and Bray in Co. Wicklow will include a new overbridge at the M11 motorway and an associated approach road on the western side of the M11. Ground investigation works have been carried out for the project and these have been segregated into two phases as follows:

Phase 1 – Approach Road

Phase 2 – Overbridge at M11

This report relates to the Phase 1 ground investigation that has been undertaken on behalf of Mountclare and Castlethorn in accordance with a technical specification prepared by Atkins. The objectives of the investigation were to ascertain the ground and groundwater conditions, and to produce a report which will assist in the geotechnical design of the project.

The site location is shown in Figure 1 with the area of the Phase 1 investigation approximately outlined in red.



Figure 1 – Site Location

This report presents the fieldwork data and the results of laboratory testing.

2.0 Scope of Works

The programme of exploratory works included the following:

- 3 no. cable percussive boreholes
- 3 no. rotary coreholes at borehole locations
- 5 no. mechanically excavated trial pits
- 2 no. window samples
- 2 no. dynamic probes at window sample locations
- 7 no. plate bearing tests
- 7 no. infiltration tests
- 1 no. inspection (slit) trench
- Groundwater monitoring of standpipes
- A programme of geotechnical, chemical and environmental laboratory testing

The exploratory hole locations are shown on the as-surveyed aerial plan in Appendix 12 of this report.

2.1 Cable Percussive Boreholes

Boreholes were constructed in 3 locations (BH01 to BH03) using a Dando 2000 rig equipped with 200 mm casing. The bored depths ranged from 7.9 to 11.8 metres below existing ground level (m BGL).

A hand dug inspection pit was excavated at each location prior to commencing drilling works and the locations were scanned for services using a CAT detection tool.

During the course of boring, in-situ Standard Penetration Tests (SPT) were undertaken at metre intervals. Samples were also recovered to assist in the visual description of recovered soils and to provide specimens for laboratory testing. In low strength soils, driven tube samples (U100) were obtained. Instances of groundwater ingress were recorded and monitored for a further 20 minutes to permit the water to rise.

The borehole records are presented in Appendix 1 of this report.

2.2 Rotary Coreholes

Rotary drilling was carried out at 3 locations (RC01 to RC03) adjacent to the cable percussive boreholes, using a Beretta T44 tracked rig. Symmetrex drilling was utilized in the soil deposits, with coring techniques used in the bedrock. The rotary drilling produced 78mm diameter cores. The holes extended to depths of 15 to 25 m BGL, with bedrock reached in RC01.

The retrieved cores were placed in 3m capacity timber boxes and transported to IGSL's laboratory in Naas, Co. Kildare.

The cores were then logged by an engineering geologist, including photography of the cores with a digital camera. Where rock is recovered, a graphic fracture log is also presented alongside the mechanical indices. This illustrates the fracture state of the rock cores and allows easy identification of highly fractured / non-intact zones and discontinuity spacings. It should be noted that no correction for dip of the joints has been made and that the spacings shown are successive joint / core intersections within the core.

Groundwater monitoring standpipes were installed in RC02 and RC03. The standpipes consisted of 50mm diameter pipe and incorporated pea gravel filter pack and bentonite seal. Standup covers were concreted in place and timber fence posts were placed around them.

The core log records are presented in Appendix 2, including the engineering geological descriptions, details of the bedding / discontinuities and mechanical indices (TCR, SCR and RQD's) for each core run and details of the installation. Core photographs are also presented in Appendix 2 and they illustrate the structure and fracture state of the bedrock.

2.3 Trial Pits

Trial pitting was performed at 5 locations (TP01 to TP05) using an 8.5-tonne tracked excavator. The trial pits were logged and sampled by an IGSL geotechnical engineer in accordance with BS 5930:2015 +A1:2020.

Hand shear vane tests (set of 3) were performed within the upper soils to permit an assessment of the in-situ shear strengths.

Pit sidewalls were assessed in terms of their short-term stability and any instances of groundwater ingress were recorded. Bulk soil samples were also recovered to provide specimens for laboratory testing.

The samples were placed in heavy duty polyethene bags and sealed before being transported to Naas for laboratory testing. For this project, environmental samples were obtained and placed in appropriate containers (tubs, jars and vials).

The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site geotechnical engineer. The trial pit logs in Appendix 3 include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls. Photographs of the open pits and spoil are also presented in Appendix 3.

2.4 Window Samples

Window samples were undertaken in 2 locations (WS01 and WS02) in order to obtain undisturbed samples of the upper soils for detailed examination and logging.

Window samples are advanced by driving a steel sampling tube under constant percussive effort. The soils enter the tube within a protective plastic liner, which is withdrawn after every metre of progress. The liners are then placed in wooden channel boxes.

The window sample records and photographs are presented in Appendix 4.

2.5 Dynamic Probes

Dynamic probes DP01 and DP02 were undertaken adjacent to corresponding window samples. The dynamic probe utilised by IGSL Ltd complies with the requirements of BS 1377, Part 9 (1990) and Eurocode 7: Part 3.

The super-heavy probe (DPSH) probe was used, comprising a 63.5 kg drop weight, 500mm drop height and a 45 mm diameter (90°) cone. In accordance with the standards, the number of blows required to drive the probe through each 100mm increment of penetration was recorded. Probing was terminated when blow counts, N_{100} values, exceeded 25, in order to avoid damage to equipment.

Detailed probe records are provided in Appendix 5 on which the blow counts are recorded both numerically and graphically.

2.6 Inspection (Slit) Trenches

Inspection trench ST01 was excavated towards the south of the site to investigate for the presence of buried utilities or services. Excavation comprised a combination of mini-digger and hand digging methods.

A photograph of the open trench and a detailed geological description of the soils encountered are included on the record in Appendix 6, although no buried services or utilities were encountered.

2.7 Plate Bearing Tests

Plate bearing tests were performed in 7 locations to obtain a measure of the moduli of subgrade reaction and equivalent in-situ CBR values. A 450 mm diameter plate was used in 5 locations (adjacent to the trial pits) and tests were performed in accordance with BS 1377 Part 9: 1990. "In-situ Tests". In 2 locations (marked CBR01 and CBR02 on site plan), the test was performed using a 300 mm diameter plate.

The maximum applied load was estimated on the basis of obtaining an accumulative displacement of at least 1.25 mm. The load was then applied in five approximately equal increments to the design load. To measure recovery the load was removed in three increments. A second phase of loading and unloading was performed to assess the benefits of further compaction.

The settlement under each increment was measured against time until movement had effectively ceased and the results are presented as graphs of applied pressure against settlement. Calculation of Modulus of Sub-grade Reaction (k) and CBR values are in accordance with NRA HD25-26/10 Volume7: Pavement Design and Maintenance.

The plate bearing test records are presented in Appendix 7.

2.8 Infiltration Tests

Infiltration tests were performed in seven locations (SA01 to SA07) to investigate the soakage characteristics of the overburden soils. Testing was performed in each test pit in accordance with BRE Digest 365 'Soakaway Design'.

To obtain a measure of the infiltration rate, water was poured into the test pit to ensure total saturation of the sub-soils. The infiltration rate is the volume of water dispersed per unit exposed area per unit of time, and is generally expressed as metres/minute or metres/second.

Two monitored stages were typically performed, during which records were taken of the fall in water level against time. The exceptions were tests SA01, 04, 05 and 07, where very low or negligible egress was measured during the initial test stage and further test stages were both impractical and unnecessary.

The infiltration test results are presented in numerical and graphical format in Appendix 8.

2.9 Groundwater Monitoring

Groundwater was recorded in all five trial pits and in six infiltration test locations. The depths ranged between 0.9 and 2.2m BGL. In the trial pits, water strikes were mostly rapid with strikes in the infiltration tests observed as seepage.

The boreholes and coreholes reported deeper strikes in the range 9.30m to 19.70m BGL, and the rate of ingress was reported as slow. Standpipes were installed in two of the coreholes (RC02 and RC03) and the site was revisited to measure the water levels.

The groundwater readings are presented in Appendix 9.

2.10 As-Built Survey

On completion of fieldworks, the location (x,y) and elevation (z) of each exploratory location was determined by detailed survey using GPS Realtime Kinetic survey instrument.

The Irish Transverse Mercator (ITM) survey co-ordinates and ground levels related to Malin Head Datum are presented on the exploratory hole records and these were used to plot the as-built locations on the site plans in Appendix 12 of this report.

3.0 Laboratory Testing

Geotechnical laboratory testing was performed at IGSL'S INAB accredited laboratory in accordance with BS1377; British Standard Methods of Test for Soils for Civil Engineering Purposes; British Standards Institute:1990. The schedule of the geotechnical testing contained:

- Moisture Content
- Atterberg Limits (Plasticity Index)
- Particle Size Distribution (PSD)
- Unconsolidated Undrained (UU) Triaxial
- Irregular Point Loads on rock core specimens

Chemical and environmental testing were performed by Eurofins Chemtest with the schedule including:

- BRE SD1 Sulphate Suite (Acid-Soluble Sulphate, Water-Soluble Sulphate, Total Sulphur, Water-Soluble Magnesium, Water-Soluble Chloride, Water-Soluble Nitrate, Water-Soluble Ammonium and pH)
- RILTA (WAC) Suite

Laboratory, chemical and environmental test results are segregated and presented as follows:

- Appendix 10 – Geotechnical Laboratory Testing
- Appendix 11 – Chemical and Environmental Testing

4.0 References

1. BS 5930:2015+A1:2020 Code of Practice for Site Investigations; British Standards Institute
2. Manual of Contract Documents for Highway Works, Volume 5, Section 3, Ground Investigation, Part 4: Specification
3. BRE Special Digest 1: 2005 – Concrete in aggressive ground
4. EN 1997-3; Eurocode 7: Geotechnical Design – Part 3: Design assisted by field testing; 1997
5. BS1377; British Standard Methods of Test for Soils for Civil Engineering Purposes; British Standards Institute;1990.
6. BRE Digest 365, September 1991, British Research Establishment
7. Manual of Contract Documents for Road Works, Volume 1: Specification for Road Works (March 2007)
8. Manual of Soil Laboratory Testing, Volume 3; K.H. Head
9. ISRM – Suggested Methods for Determining Point Load Strength
10. ISRM – Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials
11. TRL Report 447- Sulfate specification for structural backfills
12. CIRIA C580
13. Specification for Roadworks Series 600 – Specification for Roadworks

Appendix 1

Cable Percussive Borehole Records



GEOTECHNICAL BORING RECORD

REPORT NUMBER

26458

CONTRACT Phase 1 - M11 - Old Connaught

BOREHOLE NO. BH01

SHEET Sheet 1 of 1

CO-ORDINATES 725,011.71 E
719,700.87 NRIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 7.90

DATE COMMENCED 10/03/2026

DATE COMPLETED 11/03/2026

CLIENT Castlethorne Construction
ENGINEER AtkinsSPT HAMMER REF. NO.
ENERGY RATIO (%)BORED BY A.Delaney
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL		20.60	0.20						
1	Firm brown sandy SILT/CLAY with occasional gravel				AA260236	B	1.00		N = 11 (2, 1, 2, 3, 3, 3)	
2					AA260237	B	2.00		N = 10 (3, 3, 4, 3, 2, 1)	
	Very soft grey/brown very sandy SILT/CLAY		18.40	2.40	AA260238	B	2.50			
3	Soft brown sandy SILT/CLAY with occasional gravel		17.80	3.00	AA260239	B	3.00		N = 5 (1, 0, 1, 0, 2, 2)	
4					AA260240	B	4.00		N = 7 (1, 1, 2, 1, 2, 2)	
5	Medium dense grey/brown clayey GRAVEL (Possibly very gravelly Clay)		15.90	4.90	AA260241	B	5.00		N = 28 (3, 4, 5, 7, 7, 9)	
6	Dense grey/brown fine to coarse clayey GRAVEL with some angular cobbles and boulders		15.00	5.80	AA260242	B	6.00		N = 46 (5, 7, 9, 10, 12, 15)	
7					AA260243	B	7.00		N = 50/225 mm (7, 9, 12, 17, 21)	
					AA260244	B	7.50			
8	Obstruction End of Borehole at 7.90 m		12.90	7.90					N = 50/75 mm (25, 50)	
9										

HARD STRATA BORING/CHISELLING

WATER STRIKE DETAILS

From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
7.20	7.40	1		2.50	2.50	No	2.00	20	Slow
7.70	7.90	1.5		5.40	5.40	No	1.20	20	Rapid

GROUNDWATER PROGRESS

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS 2hrs standing on horses at Landowners request.CAT scanned location and hand dug inspection pit was carried out .

Sample Legend

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



GEOTECHNICAL BORING RECORD

REPORT NUMBER

26458

CONTRACT Phase 1 - M11 - Old Connaught

BOREHOLE NO. BH02

SHEET Sheet 1 of 2

CO-ORDINATES 725,111.89 E
719,781.91 NRIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 11.80

DATE COMMENCED 18/03/2026

DATE COMPLETED 19/03/2026

CLIENT Castlethorne Construction
ENGINEER AtkinsSPT HAMMER REF. NO.
ENERGY RATIO (%)BORED BY A.Delaney
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL		20.67	0.20						
	Soft brown sandy SILT/CLAY with occasional gravel				AA265207 AA265208	B U	1.00 1.00	70%rec	N = 6 (2, 1, 1, 2, 2, 1)	
1										
2	Medium dense grey/grey brown fine to coarse sandy silty/clayey GRAVEL with occasional cobbles		19.07	1.80	AA265209	B	2.00		N = 17 (6, 4, 5, 3, 4, 5)	
3					AA265210	B	3.00		N = 17 (5, 5, 4, 6, 3, 4)	
4					AA265211	B	4.00		N = 16 (3, 4, 4, 3, 5, 4)	
5					AA265212	B	5.00		N = 23 (2, 3, 3, 8, 6, 6)	
6					AA265213	B	6.00		N = 20 (3, 5, 4, 5, 5, 6)	
7					AA265214	B	7.00		N = 26 (6, 5, 6, 7, 6, 7)	
8	Very stiff to hard brown very gravelly CLAY with some cobbles		13.07	7.80	AA265215	B	8.00		N = 56 (7, 13, 14, 16, 14, 12)	
9					AA265216	B	9.00		N = 48 (6, 8, 10, 13, 13, 12)	
			11.17	9.70						

HARD STRATA BORING/CHISELLING

WATER STRIKE DETAILS

From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
11.10	11.30	1		2.50	2.50	3.80	1.60		Moderate
11.60	11.80	1.5		6.10	6.10	No	1.80	20	Rapid

GROUNDWATER PROGRESS

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS 4 hrs standing on Landowner to move horses .CAT scanned location and hand dug inspection pit was carried out .

Sample Legend

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



GEOTECHNICAL BORING RECORD

REPORT NUMBER

26458

CONTRACT Phase 1 - M11 - Old Connaught

BOREHOLE NO. BH02

SHEET Sheet 2 of 2

CO-ORDINATES 725,111.89 E
719,781.91 NRIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 11.80

DATE COMMENCED 18/03/2026

DATE COMPLETED 19/03/2026

GROUND LEVEL (mOD) 20.87

CLIENT Castlethorne Construction
ENGINEER AtkinsSPT HAMMER REF. NO.
ENERGY RATIO (%)BORED BY A.Delaney
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
10	Very stiff brown sandy gravelly CLAY with occasional cobbles (<i>continued</i>)		10.07	10.80	AA265217	B	10.00		N = 50 (9, 13, 5, 15, 16, 14) N = 50/150 mm (6, 11, 18, 32) N = 50/75 mm (25, 50)	
11	Dense grey fine to coarse angular GRAVEL with broken angular cobbles and boulders				AA265218	B	11.00			
12	Obstruction End of Borehole at 11.80 m		9.07	11.80						
13										
14										
15										
16										
17										
18										
19										

HARD STRATA BORING/CHISELLING

WATER STRIKE DETAILS

From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
11.10	11.30	1							
11.60	11.80	1.5							

GROUNDWATER PROGRESS

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					

REMARKS 4 hrs standing on Landowner to move horses .CAT scanned location and hand dug inspection pit was carried out .

Sample Legend

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



GEOTECHNICAL BORING RECORD

REPORT NUMBER

26458

CONTRACT Phase 1 - M11 - Old Connaught

BOREHOLE NO. BH03

SHEET Sheet 1 of 2

CO-ORDINATES 725,120.17 E
719,441.67 N

RIG TYPE Dando 2000

BOREHOLE DIAMETER (mm) 200

GROUND LEVEL (mOD) 20.02

BOREHOLE DEPTH (m) 9.90

DATE COMMENCED 12/03/2026

DATE COMPLETED 13/03/2026

CLIENT Castlethorne Construction
ENGINEER AtkinsSPT HAMMER REF. NO.
ENERGY RATIO (%)BORED BY A.Delaney
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL		19.72	0.30						
1	Soft brown sandy SILT/CLAY with occasional fine gravel				AA260245	B	1.00		N = 7 (1, 0, 1, 2, 2, 2)	
					AA260246	U	1.50			
2					AA260247	B	2.00		N = 8 (2, 2, 1, 2, 3, 2)	
					AA260248	B	3.00			
4	Medium dense grey fine to medium silty sandy GRAVEL with large cobbles		15.92	4.10	AA260249	B	4.00		N = 9 (1, 2, 2, 2, 2, 3)	
5					AA260250	B	5.00		N = 12 (1, 2, 3, 2, 3, 4)	
6					AA260251	B	6.00		N = 11 (1, 2, 1, 2, 2, 6)	
7	Stiff brown sandy gravelly CLAY with some cobbles		13.22	6.80	AA260252	B	7.00		N = 30 (2, 4, 5, 7, 8, 10)	
8	Stiff reddish brown laminated SILT/CLAY		12.32	7.70	AA260253	B	8.00		N = 23 (4, 4, 4, 6, 6, 7)	
9					AA260254	B	9.00		N = 19 (2, 3, 3, 4, 4, 8)	
	Dense grey fine to coarse angular GRAVEL with some clayey bands		10.82	9.20	AA260255	B	9.80		N = 50/75 mm (25, 50)	
			10.12	9.90	AA260255	B	9.80			

HARD STRATA BORING/CHISELLING

WATER STRIKE DETAILS

From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
9.40	9.60	0.75		1.80	1.80	6.50	1.00	20	Slow
9.70	9.90	1.5		8.50	8.50	No	6.30	20	Rapid

GROUNDWATER PROGRESS

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					

REMARKS 3hrs manouvering rig into position .CAT scanned location and hand dug inspection pit was carried out . Blowing sands noted 6.80-4.90m

Sample Legend

D - Small Disturbed (tub)

B - Bulk Disturbed

LB - Large Bulk Disturbed

Env - Environmental Sample (Jar + Vial + Tub)

UT - Undisturbed 100mm Diameter

Sample

P - Undisturbed Piston Sample

W - Water Sample



GEOTECHNICAL BORING RECORD

REPORT NUMBER

26458

CONTRACT Phase 1 - M11 - Old Connaught

BOREHOLE NO. BH03

SHEET Sheet 2 of 2

CO-ORDINATES 725,120.17 E
719,441.67 N

RIG TYPE Dando 2000

BOREHOLE DIAMETER (mm) 200

DATE COMMENCED 12/03/2026

GROUND LEVEL (mOD) 20.02

BOREHOLE DEPTH (m) 9.90

DATE COMPLETED 13/03/2026

CLIENT Castlethorne Construction
ENGINEER AtkinsSPT HAMMER REF. NO.
ENERGY RATIO (%)BORED BY A.Delaney
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
10	Obstruction End of Borehole at 9.90 m									
11										
12										
13										
14										
15										
16										
17										
18										
19										

HARD STRATA BORING/CHISELLING

WATER STRIKE DETAILS

From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
9.40	9.60	0.75							
9.70	9.90	1.5							

GROUNDWATER PROGRESS

INSTALLATION DETAILS					Date	Hole Depth	Casing Depth	Depth to Water	Comments
Date	Tip Depth	RZ Top	RZ Base	Type					

REMARKS 3hrs manouvering rig into position .CAT scanned location and hand dug inspection pit was carried out . Blowing sands noted 6.80-4.90m

Sample Legend

D - Small Disturbed (tub)

B - Bulk Disturbed

LB - Large Bulk Disturbed

Env - Environmental Sample (Jar + Vial + Tub)

UT - Undisturbed 100mm Diameter

Sample

P - Undisturbed Piston Sample

W - Water Sample

Appendix 2

Rotary Coreholes Records

										GEOTECHNICAL CORE LOG RECORD										REPORT NUMBER 26458	
CONTRACT Phase 1 - M11 - Old Connaught												DRILLHOLE NO RC01									
CO-ORDINATES 725,011.71 E 719,700.87 N						RIG TYPE Beretta T-44						SHEET Sheet 1 of 2									
GROUND LEVEL (mOD) 20.80						FLUSH Air/Mist						DATE DRILLED 30/05/2026									
CLIENT Castlethorne Construction						INCLINATION (deg) -90						DATE LOGGED 30/05/2026									
ENGINEER Atkins						CORE DIAMETER (mm) 78						DRILLED BY IGSL - DH									
												LOGGED BY D. O' Shea									
Downhole Depth (m)	Core Run Depth (m)	T.C.R. %	S.C.R. %	R.Q.D. %	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)									
0					0 250 500			SYMMETRIX DRILLING: No recovery, observed by driller as returns of TOPSOIL	0.20	20.60											
1								SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown sandy SILT/CLAY with occasional gravel													
2									2.40	18.40											
3								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/brown very sandy SILT/CLAY	3.00	17.80											
4								SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown sandy SILT/CLAY with occasional gravel													
5									4.90	15.90											
6								SYMMETRIX DRILLING: No recovery, observed by driller as returns of dense grey/brown clayey GRAVEL	5.80	15.00											
7								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/brown fine to coarse clayey GRAVEL with some cobbles													
8									7.60	13.20											
9								SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown gravelly CLAY													
9.80									9.80	11.00		N = 31 (7, 9, 5, 8, 9, 9)									
REMARKS Hole cased from 0.0-9.80m.								WATER STRIKE DETAILS													
								Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments								
								9.30	9.30	N/S			Slow								
								GROUNDWATER DETAILS													
INSTALLATION DETAILS								Date	Hole Depth	Casing Depth	Depth to Water	Comments									
Date	Tip Depth	RZ Top	RZ Base	Type																	

IGSL RC Fl 10M 26458.GPJ IGSL GDT 8/6/26

 GEOTECHNICAL CORE LOG RECORD REPORT NUMBER 26458													
CONTRACT Phase 1 - M11 - Old Connaught							DRILLHOLE NO RC01 SHEET Sheet 2 of 2						
CO-ORDINATES 725,011.71 E 719,700.87 N GROUND LEVEL (mOD) 20.80				RIG TYPE Beretta T-44 FLUSH Air/Mist INCLINATION (deg) -90 CORE DIAMETER (mm) 78			DATE DRILLED 30/05/2026 DATE LOGGED 30/05/2026						
CLIENT Castlethorpe Construction ENGINEER Atkins							DRILLED BY IGSL - DH LOGGED BY D. O' Shea						
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)	
10		100	14	0				Weak to moderately weak, medium bedded to thinly laminated, light to dark blueish/grey, fine-grained interbedded SILTSTONE/MUDSTONE (possibly metamorphosed, graphitic appearance on surfaces), slightly to locally moderately/highly weathered (at 10.12-10.17m, 11.07-11.31m & 12.53-12.57m) Frequent incipient fractures - core predominantly non-intact					
11	11.30												
12		100	19	0				Discontinuities are medium to closely spaced, smooth to rough, fractures are planar to irregular. Apertures are tight to locally moderately open, locally clay smeared, locally moderately iron-oxide stained. Dips are subhorizontal to 20-30° & irregular. (continued)					
13	12.80												
13		75	9	0				Highly weathered ROCK - recovered as green very sandy clay	13.30	7.50			
14	13.80							Weak to moderately weak, medium to thinly bedded, light greenish grey, fine-grained interbedded SILTSTONE/SANDSTONE, slightly weathered. Frequent incipient fractures - core predominantly non-intact	13.40	7.40			
14		100	24	11									
15	14.80							Discontinuities are medium to closely spaced, smooth to rough, fractures are planar to irregular. Apertures are tight to locally moderately open, locally clay smeared, locally moderately iron-oxide stained, locally quartz-veined (1-8mm thick). Dips are subhorizontal to 20-40° & irregular.	14.80	6.00			
16								End of Borehole at 14.80 m					
17													
18													
19													
REMARKS								WATER STRIKE DETAILS					
Hole cased from 0.0-9.80m.								Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
								9.30	9.30	N/S			Slow
INSTALLATION DETAILS								GROUNDWATER DETAILS					
Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments				
					30-05-26	14.80	9.80	7.40	Water level recorded 5mins after end of drilling				

IGSL RC FI 10M 26458.GPJ IGSL GDT 8/6/26

										GEOTECHNICAL CORE LOG RECORD										REPORT NUMBER 26458	
CONTRACT Phase 1 - M11 - Old Connaught												DRILLHOLE NO RC02									
CO-ORDINATES 725,111.89 E 719,781.91 N												SHEET Sheet 1 of 3									
GROUND LEVEL (mOD) 20.87												RIG TYPE Beretta T-44 FLUSH Air/Mist INCLINATION (deg) -90 CORE DIAMETER (mm)									
CLIENT Castlethorne Construction ENGINEER Atkins												DATE DRILLED 27/05/2026 DATE LOGGED 27/05/2026									
												DRILLED BY IGSL - DH/JK LOGGED BY D. O' Shea									
Downhole Depth (m)	Core Run Depth (m)	T.C.R. %	S.C.R. %	R.Q.D. %	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)									
0					0 250 500			SYMMETRIX DRILLING: No recovery, observed by driller as returns of TOPSOIL SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown sandy SILT/CLAY with occasional gravel	0.20	20.67											
1									1.80	19.07											
2								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/grey brown fine to coarse sandy silty/clayey GRAVEL with occasional cobbles													
3																					
4																					
5																					
6																					
7																					
8								SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown very gravelly CLAY with some cobbles	7.80	13.07											
9									9.70	11.17											
REMARKS Hole cased from 0.0-25.00m.									WATER STRIKE DETAILS												
									Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments							
														No water strike recorded							
									GROUNDWATER DETAILS												
INSTALLATION DETAILS									Date	Hole Depth	Casing Depth	Depth to Water	Comments								
Date	Tip Depth	RZ Top	RZ Base	Type																	
27-05-26	15.00	1.00	15.00	50mm SP																	

IGSL RC FI 10M 26458.GPJ IGSL_GDT_8/6/26

 GEOTECHNICAL CORE LOG RECORD REPORT NUMBER 26458													
CONTRACT Phase 1 - M11 - Old Connaught							DRILLHOLE NO RC02						
CO-ORDINATES 725,111.89 E 719,781.91 N					RIG TYPE Beretta T-44 FLUSH Air/Mist INCLINATION (deg) -90 CORE DIAMETER (mm)		SHEET Sheet 2 of 3						
GROUND LEVEL (mOD) 20.87							DATE DRILLED 27/05/2026 DATE LOGGED 27/05/2026						
CLIENT Castlethorne Construction ENGINEER Atkins							DRILLED BY IGSL - DH/JK LOGGED BY D. O' Shea						
Downhole Depth (m)	Core Run Depth (m)	T.C.R. %	S.C.R. %	R.Q.D. %	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)	
10					0 250 500			SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown sandy gravelly CLAY with occasional cobbles (<i>continued</i>)	10.80	10.07			
11								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey fine to coarse angular GRAVEL with cobbles and boulders	11.80	9.07			
12								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/brown silty sandy gravelly CLAY					
13													
14									14.90	5.97			
15								SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown clayey sandy GRAVEL					
16													
17													
18												N = 26 (2, 6, 4, 8, 7, 7)	
19									19.70	1.17		N = 32 (5, 9, 7, 8, 8, 9)	
REMARKS								WATER STRIKE DETAILS					
Hole cased from 0.0-25.00m.								Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
													No water strike recorded
								GROUNDWATER DETAILS					
INSTALLATION DETAILS								Date	Hole Depth	Casing Depth	Depth to Water	Comments	
Date	Tip Depth	RZ Top	RZ Base	Type									
27-05-26	15.00	1.00	15.00	50mm SP									

IGSL RC FI 10M 26458.GPJ IGSL_GDT 8/6/26

										GEOTECHNICAL CORE LOG RECORD										REPORT NUMBER 26458	
CONTRACT Phase 1 - M11 - Old Connaught												DRILLHOLE NO RC02									
CO-ORDINATES 725,111.89 E 719,781.91 N												SHEET Sheet 3 of 3									
GROUND LEVEL (mOD) 20.87												RIG TYPE Beretta T-44 FLUSH Air/Mist INCLINATION (deg) -90 CORE DIAMETER (mm)									
CLIENT Castlethorne Construction ENGINEER Atkins												DATE DRILLED 27/05/2026 DATE LOGGED 27/05/2026									
												DRILLED BY IGSL - DH/JK LOGGED BY D. O' Shea									
Downhole Depth (m)	Core Run Depth (m)	T.C.R. %	S.C.R. %	R.Q.D. %	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)									
20					0 250 500			SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown gravelly CLAY (<i>continued</i>)													
21								SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown sandy gravelly CLAY	21.30	-0.43		N = 34 (3, 5, 8, 9, 8, 9)									
22												N = 27 (2, 4, 6, 6, 7, 8)									
23												N = 36 (3, 6, 7, 9, 9, 11)									
24																					
25								End of Borehole at 25.00 m	25.00	-4.13											
26																					
27																					
28																					
29																					
REMARKS Hole cased from 0.0-25.00m.								WATER STRIKE DETAILS													
								Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments								
													No water strike recorded								
INSTALLATION DETAILS								GROUNDWATER DETAILS													
								Date	Hole Depth	Casing Depth	Depth to Water	Comments									
								27-05-26	25.00	25.00	14.20	Water level recorded 5mins after end of drilling									
Date	Tip Depth	RZ Top	RZ Base	Type																	
27-05-26	15.00	1.00	15.00	50mm SP																	

 GEOTECHNICAL CORE LOG RECORD REPORT NUMBER 26458														
CONTRACT Phase 1 - M11 - Old Connaught							DRILLHOLE NO RC03 SHEET Sheet 1 of 3							
CO-ORDINATES 725,120.17 E 719,441.67 N GROUND LEVEL (mOD) 20.02				RIG TYPE Beretta T-44 FLUSH Air/Mist INCLINATION (deg) -90 CORE DIAMETER (mm)			DATE DRILLED 02/05/2026 DATE LOGGED 03/05/2026							
CLIENT Castlethorne Construction ENGINEER Atkins							DRILLED BY IGSL - JK LOGGED BY D. O' Shea							
Downhole Depth (m)	Core Run Depth (m)	T.C.R. %	S.C.R. %	R.Q.D. %	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)		
0					0 250 500			SYMMETRIX DRILLING: No recovery, observed by driller as returns of TOPSOIL SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown sandy SILT/CLAY with occasional fine gravel	0.30	19.72				
1														
2														
3														
4								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey fine to medium silty sandy GRAVEL with large cobbles	4.10	15.92				
5														
6														
7								SYMMETRIX DRILLING: No recovery, observed by driller as returns of brown sandy gravelly CLAY with some cobbles	6.80	13.22				
8								SYMMETRIX DRILLING: No recovery, observed by driller as returns of reddish brown laminated SILT/CLAY	7.70	12.32				
9								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey fine to coarse angular GRAVEL with some clayey bands	9.20	10.82				
									9.90	10.12				
REMARKS Hole cased from 0.0-20.00m.									WATER STRIKE DETAILS					
									Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
									11.40	11.40	16.50			Slow Slow
									19.70	19.70	N/S			
INSTALLATION DETAILS									GROUNDWATER DETAILS					
									Date	Hole Depth	Casing Depth	Depth to Water	Comments	
									04-06-26	16.50	8.50	16.50	50mm SP	

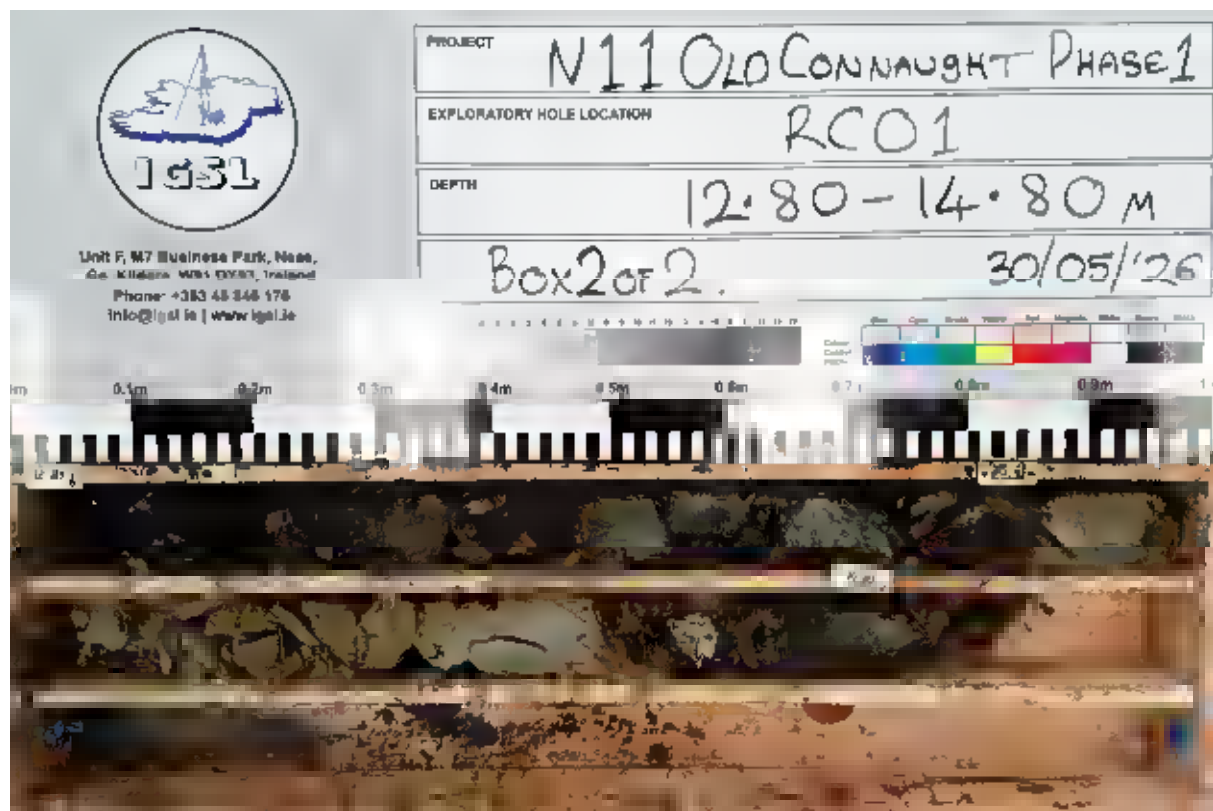
 GEOTECHNICAL CORE LOG RECORD REPORT NUMBER 26458														
CONTRACT Phase 1 - M11 - Old Connaught							DRILLHOLE NO RC03 SHEET Sheet 2 of 3							
CO-ORDINATES 725,120.17 E 719,441.67 N GROUND LEVEL (mOD) 20.02				RIG TYPE Beretta T-44 FLUSH Air/Mist INCLINATION (deg) -90 CORE DIAMETER (mm)			DATE DRILLED 02/05/2026 DATE LOGGED 03/05/2026							
CLIENT Castlethorne Construction ENGINEER Atkins							DRILLED BY IGSL - JK LOGGED BY D. O' Shea							
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)		
10					0 250 500			SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/brown sandy gravelly CLAY with occasional cobbles <i>(continued)</i>				N = 40/230 mm (4, 5, 8, 11, 16, 5)		
11									11.40	8.62				
12								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/brown clayey sandy GRAVEL Driller notes gravels blowing				N = 50/105 mm (6, 12, 21, 29)		
13												N = 50/155 mm (5, 10, 21, 22, 7)		
14												N = 50/90 mm (11, 19, 27, 23)		
15														
16									16.50	3.52		N = 10/5 mm (40, 10)		
17								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/brown gravelly CLAY				N = 15/10 mm (35, 15)		
18														
19									19.70	0.32		N = 22/10 mm (17, 25, 22)		
								SYMMETRIX DRILLING: No recovery, observed by driller	20.00	0.02				
REMARKS Hole cased from 0.0-20.00m.									WATER STRIKE DETAILS					
									Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
									11.40 19.70	11.40 19.70	16.50 N/S			Slow Slow
INSTALLATION DETAILS									GROUNDWATER DETAILS					
									Date	Hole Depth	Casing Depth	Depth to Water	Comments	
									04-06-26	20.00	20.00	12.20	Water level recorded 5mins after end of drilling	
Date	Tip Depth	RZ Top	RZ Base	Type										
04-06-26	16.50	8.50	16.50	50mm SP										

IGSL RC FI 10M 26458.GPJ IGSL GDT 8/6/26

RC01 – Box 1 of 2 – 9.80-12.80m



RC01 – Box 2 of 2 – 12.80-14.80m



Appendix 3

Trial Pit Records

		TRIAL PIT RECORD						REPORT NUMBER 26458	
CONTRACT Phase 1 - M11 - Old Connaught							TRIAL PIT NO. ST01		
LOGGED BY DM		CO-ORDINATES 725,059.15 E 719,433.57 N				SHEET Sheet 1 of 1			
CLIENT ENGINEER Castlethorne Construction Atkins		GROUND LEVEL (m) 20.77				DATE STARTED 23/03/2026 DATE COMPLETED 23/03/2026			
						EXCAVATION METHOD TB280FR			

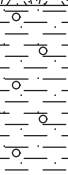
	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY. MADE GROUND: Firm brown slightly gravelly sandy CLAY with rare plastic and red brick fragments (<2%). Gravel is subangular fine to medium.		0.10	20.67						
1.0	Medium dense dark grey sandy GRAVEL. Gravel is subangular fine to medium. Firm brown slightly gravelly sandy CLAY. Gravel is subangular fine to medium. End of Trial Pit at 1.60m		1.20 1.30 1.60	19.57 19.47 19.17	 (Seepage)	260166	B	1.40-1.50		
2.0										
3.0										
4.0										

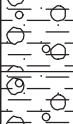
Groundwater Conditions Seepage at 1.20m										
Stability Good										
General Remarks Location CAT scanned prior to excavation.										

		TRIAL PIT RECORD						REPORT NUMBER 26458	
CONTRACT Phase 1 - M11 - Old Connaught							TRIAL PIT NO. TP/SA01		
LOGGED BY DM							SHEET Sheet 1 of 1		
CO-ORDINATES 724,989.66 E 719,517.55 N							DATE STARTED 25/03/2026 DATE COMPLETED 25/03/2026		
GROUND LEVEL (m) 21.11							EXCAVATION METHOD TB280FR		
CLIENT ENGINEER Castlethorne Construction Atkins									

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY.									
	Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of limestone.		0.20	20.91						
1.0	End of Trial Pit at 1.10m		1.10	20.01		260181	B	1.00		
2.0										
3.0										
4.0										

Groundwater Conditions Seepage at 0.90m										
Stability Slight instability - Sidewall collapse from 0.90m										
General Remarks Location CAT scanned prior to excavation.										

 TRIAL PIT RECORD REPORT NUMBER 26458										
CONTRACT Phase 1 - M11 - Old Connaught						TRIAL PIT NO. TP/SA02				
LOGGED BY DM		CO-ORDINATES 724,977.32 E 719,583.42 N		SHEET Sheet 1 of 1						
CLIENT Castlethorne Construction		GROUND LEVEL (m) 21.54		DATE STARTED 23/03/2026						
ENGINEER Atkins				DATE COMPLETED 23/03/2026						
				EXCAVATION METHOD TB280FR						
	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY.									
	Firm brown slightly silty sandy gravelly CLAY. Gravel is subangular fine to medium of limestone.		0.20	21.34						
1.0	Firm greyish brown slightly sandy gravelly CLAY with a low cobble content. Gravel is subangular fine to medium of limestone. Cobbles are subangular of limestone.		1.00	20.54		260167	B	0.80-0.90	18 20 14	
	End of Trial Pit at 1.40m		1.40	20.14	 (Slow)	260168	B	1.30-1.40		
2.0										
3.0										
4.0										
Groundwater Conditions Slow ingress at 1.40m										
Stability Slight instability - Sidewall collapse from 1.00m										
General Remarks Location CAT scanned prior to excavation.										

 TRIAL PIT RECORD REPORT NUMBER 26458										
CONTRACT Phase 1 - M11 - Old Connaught						TRIAL PIT NO. TP/SA03				
LOGGED BY DM						SHEET Sheet 1 of 1				
CO-ORDINATES 724,990.34 E 719,640.37 N						DATE STARTED 24/03/2026 DATE COMPLETED 24/03/2026				
GROUND LEVEL (m) 21.10						EXCAVATION METHOD TB280FR				
CLIENT ENGINEER Castlethorne Construction Atkins										
	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY.									
	Firm brown sandy gravelly CLAY with a low cobble content. Gravel is subangular fine to medium. Cobbles are subangular of limestone.		0.20	20.90						
1.0	Medium dense grey slightly clayey sandy GRAVEL with a medium cobble content. Gravel is subangular fine to medium. Cobbles are subangular to subrounded of limestone.		1.10	20.00		260169	B	0.80-0.90		
	End of Trial Pit at 1.40m		1.40	19.70	 (Seepage)	260170	B	1.30-1.40		
2.0										
3.0										
4.0										

Groundwater Conditions

Seepage at 1.40m

Stability

Slight instability - Sidewall collapse from 1.20m

General Remarks

Location CAT scanned prior to excavation.

		TRIAL PIT RECORD						REPORT NUMBER 26458	
CONTRACT Phase 1 - M11 - Old Connaught							TRIAL PIT NO. TP/SA04		
LOGGED BY DM							SHEET Sheet 1 of 1		
CO-ORDINATES 724,976.54 E 719,681.11 N							DATE STARTED 24/03/2026 DATE COMPLETED 24/03/2026		
GROUND LEVEL (m) 21.10							EXCAVATION METHOD TB280FR		
CLIENT ENGINEER Castlethorne Construction Atkins									

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY.									
	Firm brown slightly gravelly sandy CLAY. Gravel is subangular fine of limestone.		0.20	20.90						
	Stiff light brown mottled light grey slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of limestone.		0.60	20.50		260171	B	0.50-0.60	20 22 18	
1.0					↓ (Seepage)					
						260172	B	1.50-1.60		
2.0	End of Trial Pit at 2.00m		2.00	19.10						
3.0										
4.0										

Groundwater Conditions Seepage at 0.90m	
Stability Good	
General Remarks Location CAT scanned prior to excavation.	

 TRIAL PIT RECORD REPORT NUMBER 26458										
CONTRACT Phase 1 - M11 - Old Connaught						TRIAL PIT NO. TP/SA06 SHEET Sheet 1 of 1				
LOGGED BY DM		CO-ORDINATES 725,100.45 E 719,754.40 N		DATE STARTED 25/03/2026 DATE COMPLETED 25/03/2026						
CLIENT ENGINEER Castlethorne Construction Atkins		GROUND LEVEL (m) 20.87		EXCAVATION METHOD TB280FR						
	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY.									
	MADE GROUND: Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of limestone.		0.20	20.67						
	MADE GROUND: Soft to firm brown sandy gravelly CLAY with occasional red brick and concrete fragments.		0.50	20.37		260183	B	0.50		
	Medium dense grey/brown sandy GRAVEL.		0.70	20.17						
1.0										
	End of Trial Pit at 1.60m		1.60	19.27		260184	B	1.60		
2.0										
3.0										
4.0										
Groundwater Conditions Seepage at 1.40m										
Stability Poor Stability - Sidewall collapse from 1.0m										
General Remarks Location CAT scanned prior to excavation.										

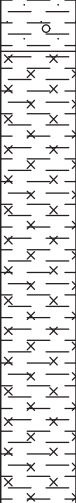
		TRIAL PIT RECORD						REPORT NUMBER 26458	
CONTRACT Phase 1 - M11 - Old Connaught							TRIAL PIT NO. TP/SA07		
LOGGED BY DM							CO-ORDINATES 725,111.95 E 719,530.93 N		
CLIENT ENGINEER Castlethorne Construction Atkins							GROUND LEVEL (m) 19.16		
							SHEET Sheet 1 of 1		
							DATE STARTED 25/03/2026 DATE COMPLETED 25/03/2026		
							EXCAVATION METHOD TB280FR		

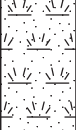
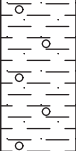
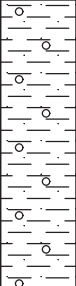
	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY.									
	Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of limestone.		0.20	18.96						
1.0	Firm to stiff greyish brown slightly sandy gravelly CLAY with a low cobble content. Gravel is subangular fine to medium of limestone. Cobbles are subangular of limestone.		1.00	18.16		260182	B	1.00		
	End of Trial Pit at 1.40m		1.40	17.76						
2.0										
3.0										
4.0										

Groundwater Conditions
 Seepage at 1.40m

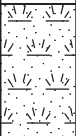
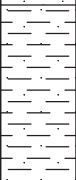
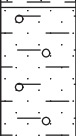
Stability
 Slight instability - Sidewall collapse from 1.10m

General Remarks
 Location CAT scanned prior to excavation.

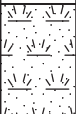
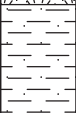
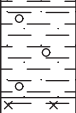
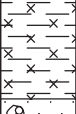
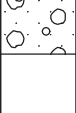
 TRIAL PIT RECORD REPORT NUMBER 26458										
CONTRACT Phase 1 - M11 - Old Connaught						TRIAL PIT NO. TP01 SHEET Sheet 1 of 1				
LOGGED BY O.A		CO-ORDINATES 724,951.97 E 719,714.15 N		DATE STARTED 20/03/2026 DATE COMPLETED 20/03/2026						
CLIENT ENGINEER Castlethorne Construction Atkins		GROUND LEVEL (m) 21.93		EXCAVATION METHOD TB280FR						
	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft grey very sandy CLAY with rootlets					ENV01	Env	0.00-1.00		
	Soft brown silty sandy CLAY		0.40	21.53						
	Soft to firm greyish brown sandy gravelly CLAY. Gravel is subangular fine to medium of limestone.		0.60	21.33		258592	B	0.50-0.50	9	11
1.0										
	Firm grey silty CLAY		1.20	20.73		258593	B	1.00-1.00		
						258594	B	1.50-1.50		
2.0					 (Rapid)					
3.0										
	End of Trial Pit at 3.20m		3.20	18.73						
4.0										
Groundwater Conditions Rapid at 2.0m										
Stability Poor Stability - Sidewall collapse from 2.00m										
General Remarks Location CAT scanned prior to excavation. Pit ended due to sidewall instability and water ingress.										

 TRIAL PIT RECORD REPORT NUMBER 26458										
CONTRACT Phase 1 - M11 - Old Connaught							TRIAL PIT NO. TP02 SHEET Sheet 1 of 1			
LOGGED BY O.A		CO-ORDINATES 724,975.07 E 719,615.58 N		DATE STARTED 20/03/2026 DATE COMPLETED 20/03/2026						
CLIENT ENGINEER Castlethorne Construction Atkins		GROUND LEVEL (m) 21.48		EXCAVATION METHOD TB280FR						
	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft grey very sandy CLAY with rootlets					ENV01	Env	0.00-1.00		
	Soft to firm brown sandy gravelly CLAY. Gravel is subangular fine to medium of limestone.		0.60	20.88		258589	B	0.80-1.00	19 18 16	
1.0	Firm to stiff grey sandy gravelly CLAY. Gravel is subangular fine to medium of limestone.		1.30	20.18		258590	B	1.50-1.50		
2.0					 (Seepage)					
	Grey very silty fine SAND		2.60	18.88		258591	B	2.70-2.70		
3.0	End of Trial Pit at 2.90m		2.90	18.58						
4.0										
Groundwater Conditions Seepage at 1.90m										
Stability Poor Stability - Sidewall collapse from 1.80m										
General Remarks Location CAT scanned prior to excavation. Pit ended due to sidewall instability.										

		TRIAL PIT RECORD						REPORT NUMBER 26458	
CONTRACT Phase 1 - M11 - Old Connaught							TRIAL PIT NO. TP03 SHEET Sheet 1 of 1		
LOGGED BY O.A		CO-ORDINATES 725,000.87 E 719,498.06 N		DATE STARTED 20/03/2026 DATE COMPLETED 20/03/2026					
CLIENT ENGINEER Castlethorne Construction Atkins		GROUND LEVEL (m) 20.83		EXCAVATION METHOD TB280FR					

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft dark grey slightly sandy CLAY (planted arable field)					ENV01	Env	0.00-1.00		
	Soft to firm brown sandy CLAY		0.60	20.23					18 24 22	
1.0						258583	B	1.10-1.20		
	Brownish grey slightly clayey gravelly SAND. Gravel is subangular fine to medium of limestone.		1.40	19.43	↓ (Rapid)	258584	B	1.80-1.90		
2.0	End of Trial Pit at 2.00m		2.00	18.83						
3.0										
4.0										

Groundwater Conditions Rapid ingress at 1.70m										
Stability Poor Stability - Sidewall collapse from 1.50m										
General Remarks Location CAT scanned prior to excavation. Pit ended due to sidewall instability and water ingress.										

		TRIAL PIT RECORD						REPORT NUMBER 26458		
CONTRACT Phase 1 - M11 - Old Connaught							TRIAL PIT NO. TP04 SHEET Sheet 1 of 1			
LOGGED BY O.A		CO-ORDINATES 725,014.08 E 719,583.19 N				DATE STARTED 20/03/2026 DATE COMPLETED 20/03/2026				
CLIENT ENGINEER Castlethorne Construction Atkins		GROUND LEVEL (m) 20.56				EXCAVATION METHOD TB280FR				
	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft dark grey slightly sandy CLAY (planted arable field)					ENV01	Env	0.00-1.00		
	Soft to firm brown sandy CLAY		0.50	20.06					20 25 28	
1.0						258585	B	1.00-1.00		
	Soft to firm dark grey very sandy gravelly CLAY. Gravel is subangular fine to medium of limestone.		1.30	19.26	 (Rapid)	258586	B	1.50-1.50		
	Firm grey silty CLAY		1.70	18.86		258587	B	1.80-1.80		
2.0										
	Grey gravelly fine to coarse SAND with a low cobble content. Gravel is subangular to subrounded fine to medium of limestone.		2.20	18.36		258588	B	2.30-2.30		
	End of Trial Pit at 2.50m		2.50	18.06						
3.0										
4.0										
Groundwater Conditions Rapid ingress at 1.50m										
Stability Poor Stability - Sidewall collapse from 1.50m										
General Remarks Location CAT scanned prior to excavation. Pit ended due to sidewall instability and water ingress.										

		TRIAL PIT RECORD						REPORT NUMBER 26458	
CONTRACT Phase 1 - M11 - Old Connaught							TRIAL PIT NO. TP05		
LOGGED BY O.A							CO-ORDINATES 725,028.90 E 719,727.04 N		
CLIENT ENGINEER Castlethorne Construction Atkins							GROUND LEVEL (m) 20.73		
							SHEET Sheet 1 of 1		
							DATE STARTED 20/03/2026 DATE COMPLETED 20/03/2026		
							EXCAVATION METHOD TB280FR		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TPOSOIL: Soft grey very sandy CLAY					ENV01	Env	0.00-1.00		
	Soft to firm brown silty sandy gravelly CLAY. Gravel is subangular fine to medium of limestone.		0.40	20.33		258595	B	0.60-0.60	15 18 19	
1.0	Firm grey silty sandy gravelly CLAY. Gravel is subangular fine to medium of limestone.		1.20	19.53		258596	B	1.50-1.50		
2.0					 (Moderate)					
	End of Trial Pit at 2.80m		2.80	17.93						
3.0										
4.0										

Groundwater Conditions Flow at 2.20m										
Stability Poor Stability - Sidewall collapse from 2.00m										
General Remarks Location CAT scanned prior to excavation. Pit ended due to sidewall instability and water ingress.										

TP01 – 1 of 2



TP01 – 2 of 2



TP02 – 1 of 2



TP02 – 2 of 2



TP03 – 1 of 2



TP03 – 2 of 2



TP04 – 1 of 2



TP04 – 2 of 2



TP05 – 1 of 2



TP05 – 2 of 2



Appendix 4

Window Sample Records



WINDOW SAMPLE RECORD

REPORT NUMBER

26458

CONTRACT Phase 1 - M11 - Old Connaught

PROBE NO. WS01

CO-ORDINATES 724,973.71 E
719,703.63 N

SHEET Sheet 1 of 1

GROUND LEVEL (mOD) 21.35

DATE DRILLED 23/03/2026

DATE LOGGED 23/03/2026

CLIENT Castlethorne Construction
ENGINEER Atkins

SAMPLED BY IGSL

LOGGED BY HM

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is subrounded to subangular fine to coarse.		0.20	21.15						
1.0	Soft to firm brown sandy slightly gravelly CLAY. Gravel is subrounded to subangular fine to coarse.		0.90	20.45		0.00-1.00	70			
			2.00	19.35		1.00-2.00	100			
2.0	Soft brown sandy slightly gravelly CLAY. Gravel is subrounded to subangular fine to coarse									
						2.00-3.00	70			
3.0										
			3.50	17.85						
	Soft to firm brown sandy slightly gravelly CLAY. Gravel is subrounded to subangular fine to coarse.									
4.0	Final Depth 4.00m		4.00	17.35		3.00-4.00	80			
5.0										

General Remarks

Installations



WINDOW SAMPLE RECORD

REPORT NUMBER

26458

CONTRACT Phase 1 - M11 - Old Connaught

PROBE NO. **WS02**

CO-ORDINATES 724,948.87 E
719,539.85 N

SHEET Sheet 1 of 1

GROUND LEVEL (mOD) 22.30

DATE DRILLED 23/03/2026

DATE LOGGED 23/03/2026

CLIENT Castlethorne Construction
ENGINEER Atkins

SAMPLED BY IGSL
LOGGED BY HM

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL		0.20	22.10						
	Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is subrounded to subangular fine to coarse.		0.50	21.80						
	Firm to stiff brown sandy gravelly CLAY. Gravel is subrounded to subangular fine to coarse					0.00-1.00	90			
1.0						1.00-2.00	60			
2.0	Final Depth 2.00m		2.00	20.30						
3.0										
4.0										
5.0										

General Remarks

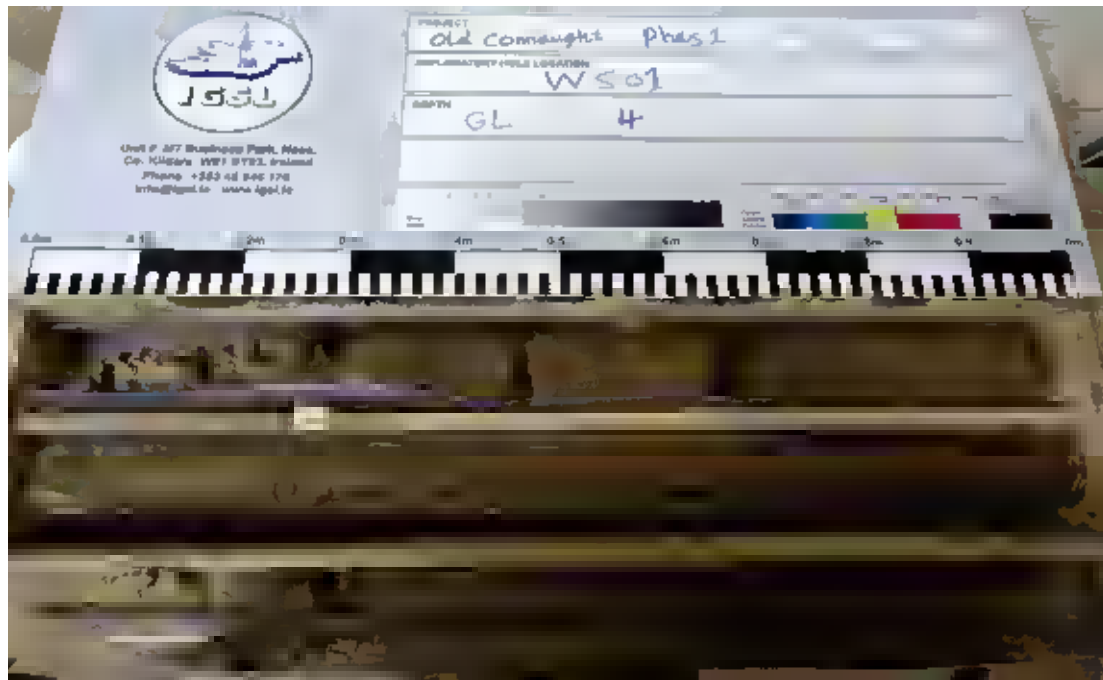
Installations

Project Number: 26458

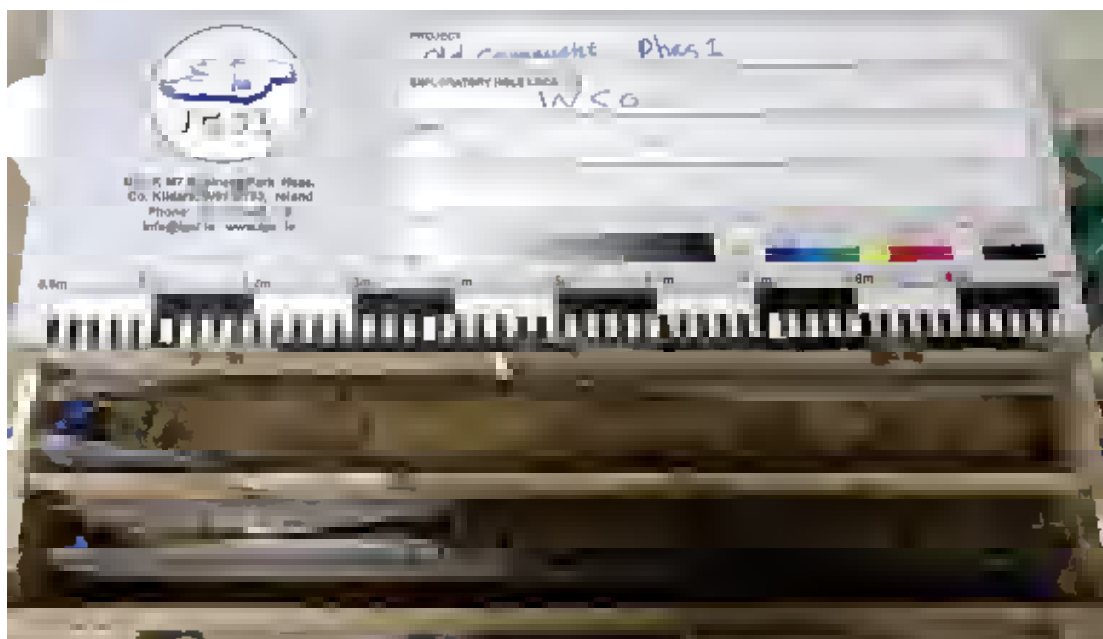


Phase 1 Old Connaught – Window Sample Photographs

WS01



WS02



Appendix 5

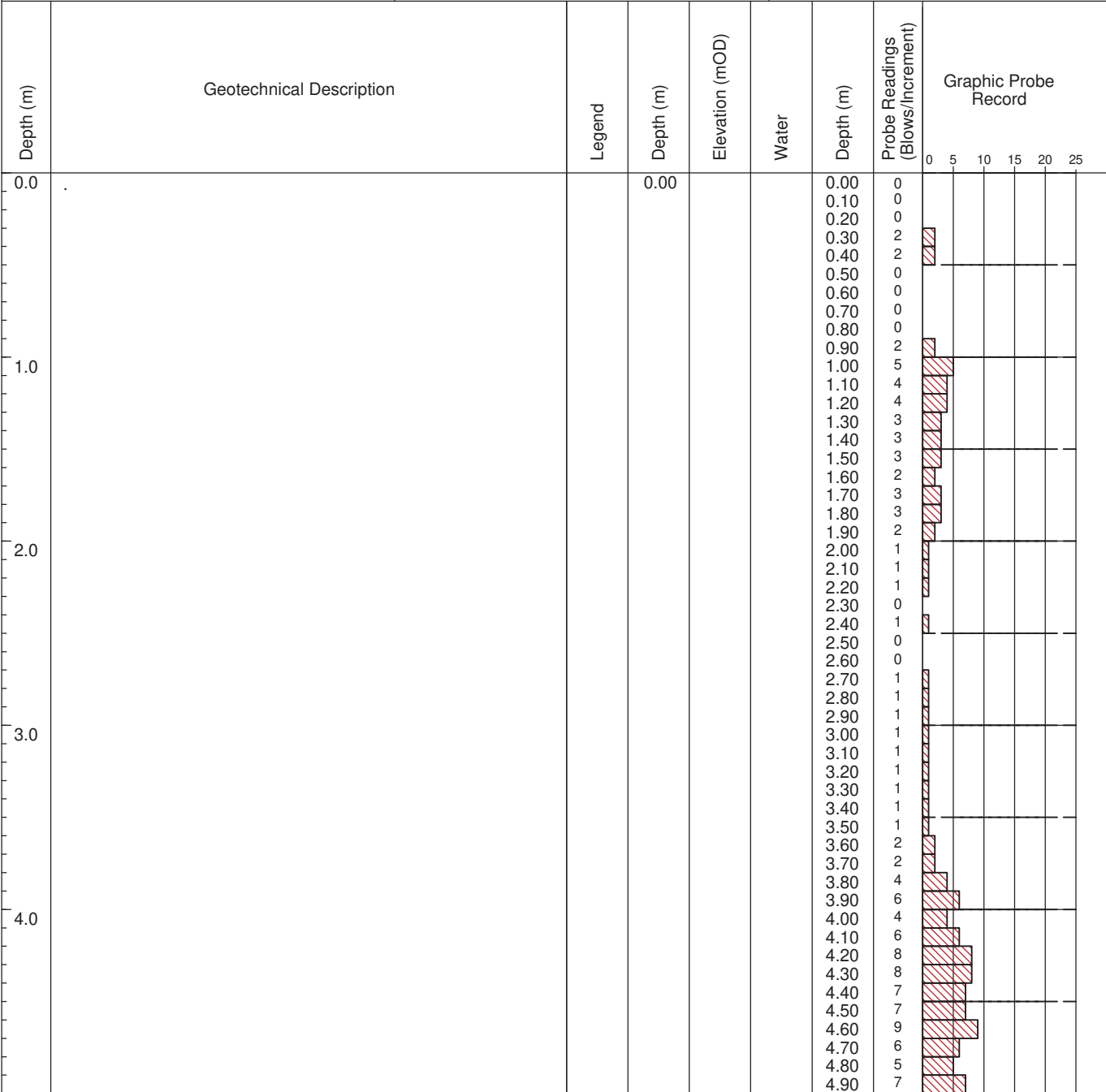
Dynamic Probe Records



DYNAMIC PROBE RECORD

REPORT NUMBER
26458

CONTRACT Phase 1 - M11 - Old Connaught				PROBE NO. DP01	
CO-ORDINATES 724,973.71 E 719,703.63 N				SHEET Sheet 1 of 2	
GROUND LEVEL (mOD) 21.35				DATE DRILLED 23/03/2024	
CLIENT Castlethorne Construction				DATE LOGGED 23/03/2024	
ENGINEER Atkins				PROBE TYPE DPH	
				HAMMER MASS (kg) 64	
				INCREMENT SIZE (mm) 100	
				FALL HEIGHT (mm) 750	



GROUNDWATER OBSERVATIONS

REMARKS



DYNAMIC PROBE RECORD

REPORT NUMBER
26458

CONTRACT Phase 1 - M11 - Old Connaught				PROBE NO. DP01	
CO-ORDINATES 724,973.71 E 719,703.63 N				SHEET Sheet 2 of 2	
GROUND LEVEL (mOD) 21.35		HAMMER MASS (kg) 64		DATE DRILLED 23/03/2024	
CLIENT Castlethorne Construction		INCREMENT SIZE (mm) 100		DATE LOGGED 23/03/2024	
ENGINEER Atkins		FALL HEIGHT (mm) 750		PROBE TYPE DPH	

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
5.0	. (continued)					5.00 5.10 5.20 5.30	13 21 25 25	
	End of Probe at 5.40 m			15.95				
6.0								
7.0								
8.0								
9.0								

GROUNDWATER OBSERVATIONS								
REMARKS								

Appendix 6

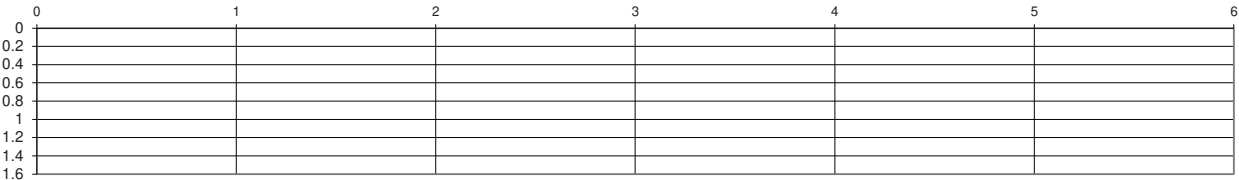
Inspection (Slit) Trench Record

Report No. 26458		SLIT TRENCH RECORD			FACING DIRECTION: W  E			
Project: Phase 1 - M11 Old Connaught Engineer: Mountclare Crew: DM			Survey			Slit Trench No. ST01		
			Easting (m)	Northing (m)	Elevation (mOD)	Sheet 1 of 1		
			Start of Trench	725059.147	719433.573	20.77	Date Commenced 23/03/2026	
			End of Trench	725051.064	719433.287	21.036	Date Completed 23/03/2026	

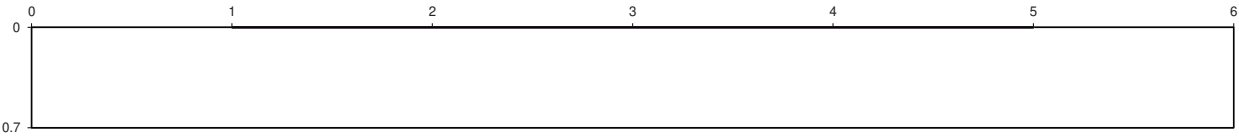
Ground Conditions			
From (m)	To (m)	Soil Description	Photograph
0.00	0.10	TOPSOIL	
0.1	1.2	MADE GROUND: Firm brown slightly gravelly sandy CLAY with rare plastic and red brick fragments (<2%). Gravel is subangular fine to medium.	
1.2	1.3	Medium dense dark grey sandy GRAVEL. Gravel is subangular fine to medium.	
1.3	1.6	Firm brown slightly gravelly sandy CLAY. Gravel is subangular fine to medium.	

Trench Dimensions		Location	Excavation Quantities		
LHS of Trench (m)	0.0		Surface	Length (m)	Material
RHS of Trench (m)	6.0		Road		
Trench Depth (m)	1.6		Path (LHS)		
Trench Width (m)	0.7		Path (RHS)		
			Grass Verge (LHS)		
			Grass Verge (RHS)		
Facing Direction	South	SAMPLES		Other	
Facing Features	Stream	sample 1: 1.4-1.5 (260166)		Total Length	6.0
Groundwater	Seepage at 1.20m			Zero Metres Taken As:	

X-Section



Plan



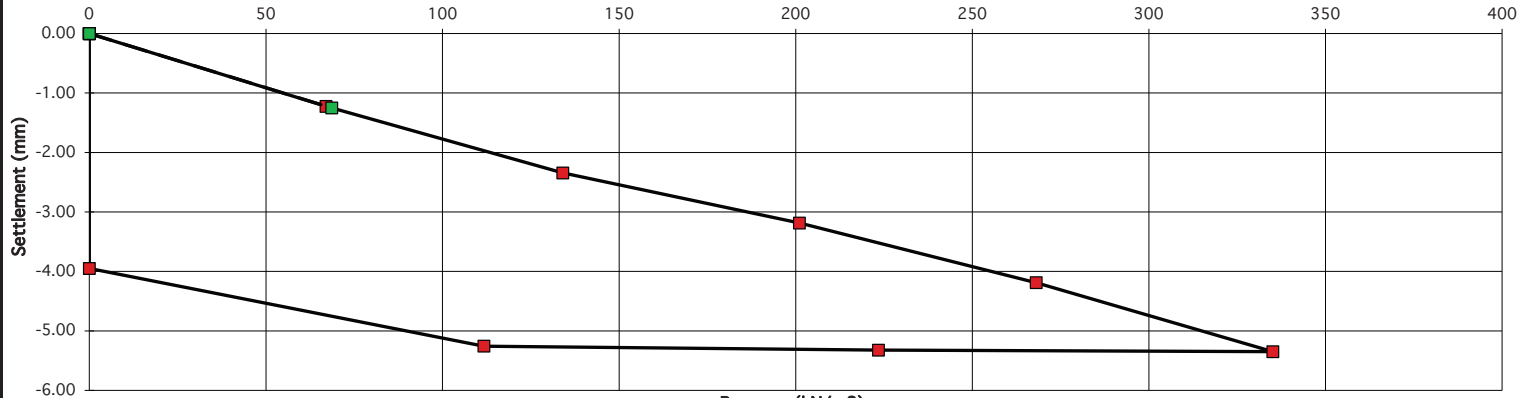
	Diameter (mm)	Material	Description	Distance (m)	Depth to crown (m)	Angle (deg.)
Service A						
Service B						
Service C						
Service D						
Service E						
Service F						
Service G						
Service H						
Service I						
Service J						
Service K						
Service L						
Service M						

Appendix 7

Plate Bearing Test Records

PLATE TEST REPORT SHEET (F3.1)		Applied Pressure/Settlement Curve	
Reference No.	R178005	Description of soil under test (natural soil, placed fill, sub-base) Brown slightly gravelly sandy CLAY	 
Contract	Phase 1 - M11 - Old Connaught		
Test No.	PBT01 - Load		
Location	E:724963.445 N:719733.331 L:21.874		
Depth	0.5 BGL		
Client	Castlethorne	Sample Ref No.	
Plate Diameter:	300 mm	Depth	
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test		
Technician	DM		
Authorised by	<i>HA Ryan</i>		
Date	20/03/2026		

Pressure / Settlement



Pressure (kN/m ²)	Settlement (mm) - Series 1	Settlement (mm) - Series 2
0	0.00	-4.00
75	-1.25	-4.50
150	-2.50	-5.25
225	-3.75	-5.50
300	-5.00	-5.50
375	-5.50	-5.50

Gradient at 1.25 mm settlement intersection = 55

Modulus of subgrade reaction = 25 MPa/m

Correction factor applied = 0.46 as per HD 25-26/10

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

2.6 %

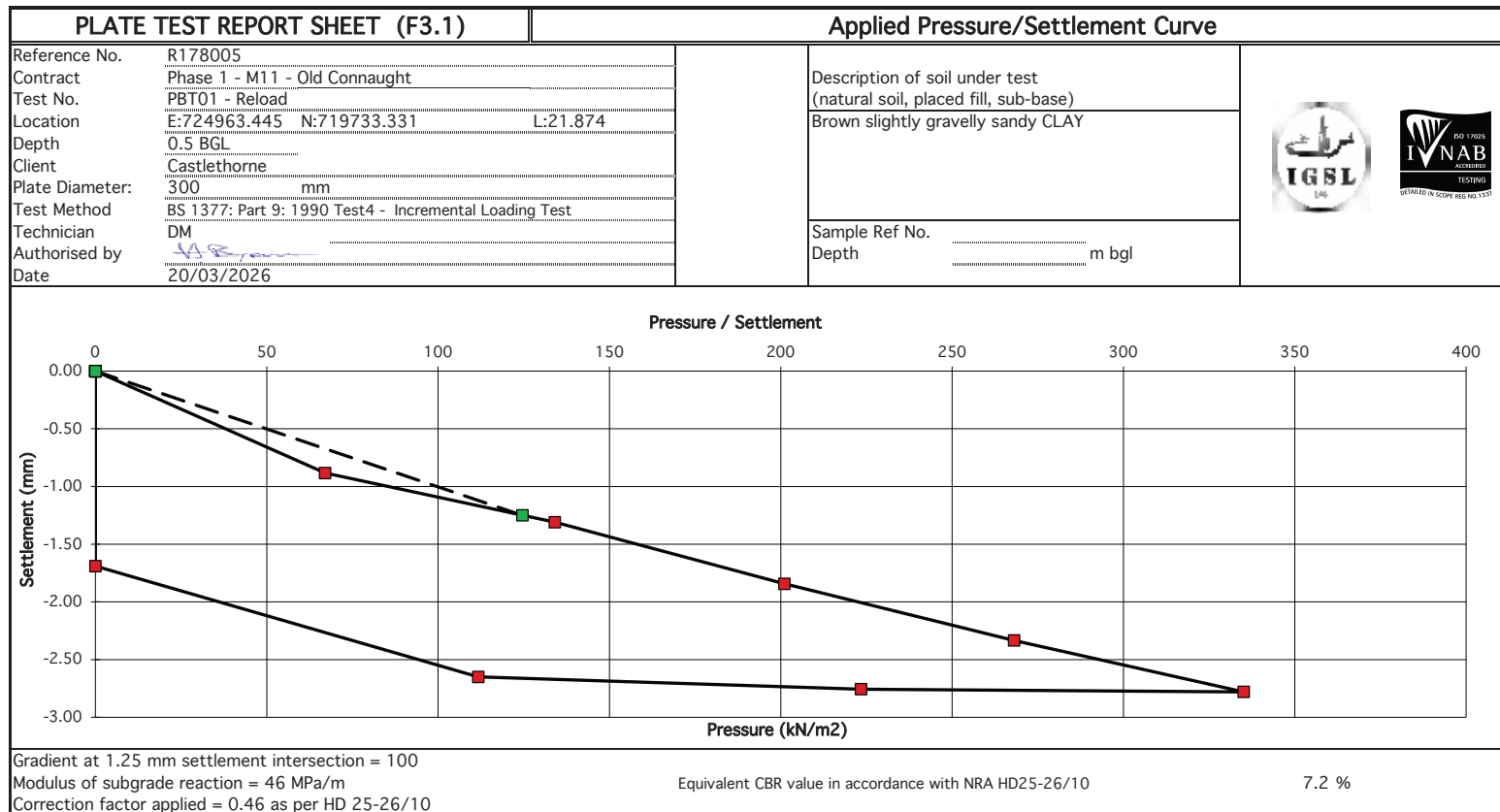
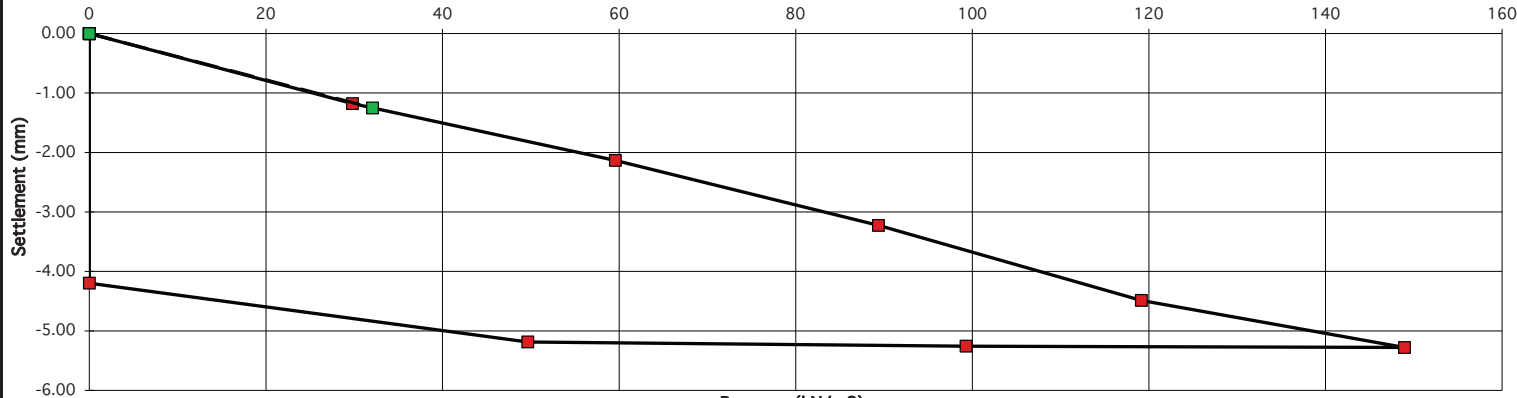


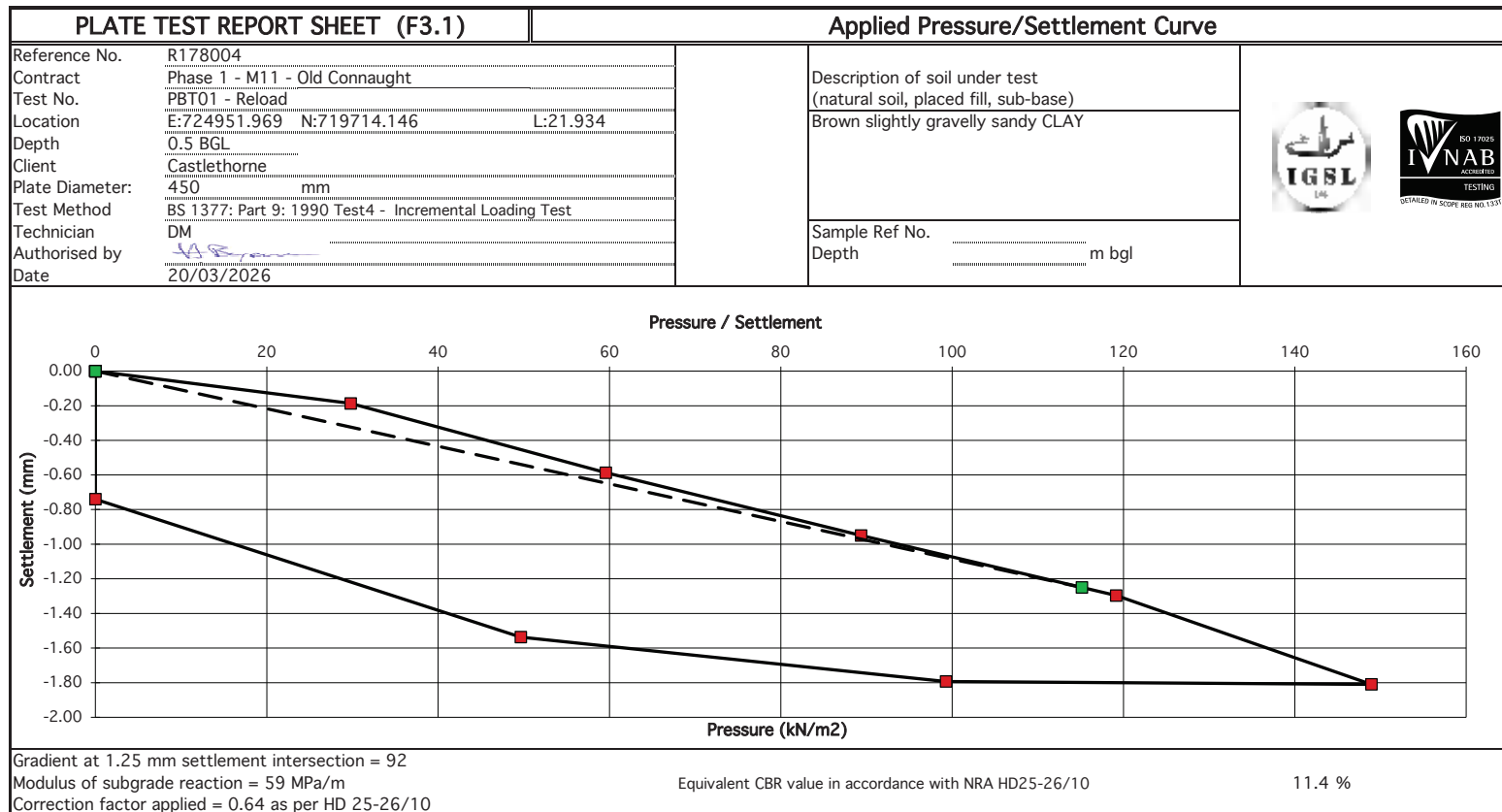
PLATE TEST REPORT SHEET (F3.1)		Applied Pressure/Settlement Curve	
Reference No.	R178004	Description of soil under test (natural soil, placed fill, sub-base)	 
Contract	Phase 1 - M11 - Old Connaught		
Test No.	PBT01 - Load	Brown slightly gravelly sandy CLAY	Sample Ref No. _____ Depth _____ m bgl
Location	E:724951.969 N:719714.146 L:21.934		
Depth	0.5 BGL		
Client	Castlethorne		
Plate Diameter:	450 mm		
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test		
Technician	DM		
Authorised by	<i>HA Ryan</i>		
Date	20/03/2026		

Pressure / Settlement



Pressure (kN/m ²)	Settlement (mm) - Series 1	Settlement (mm) - Series 2
0	0.00	-4.25
30	-1.25	-4.75
60	-2.25	-5.25
90	-3.25	-5.25
120	-4.25	-5.25
150	-5.25	-5.25

Gradient at 1.25 mm settlement intersection = 26	Equivalent CBR value in accordance with NRA HD25-26/10	1.2 %
Modulus of subgrade reaction = 16 MPa/m		
Correction factor applied = 0.64 as per HD 25-26/10		



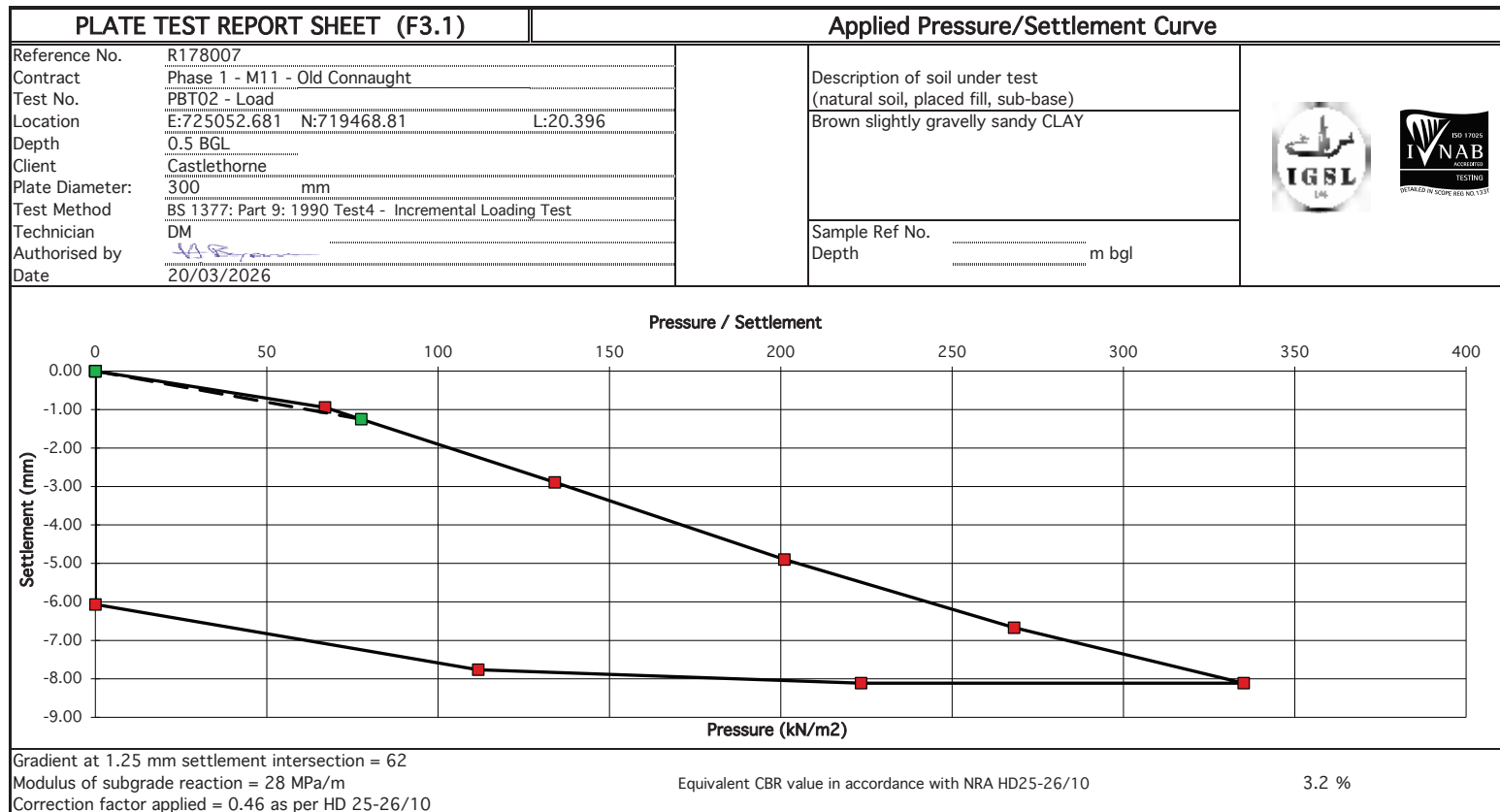
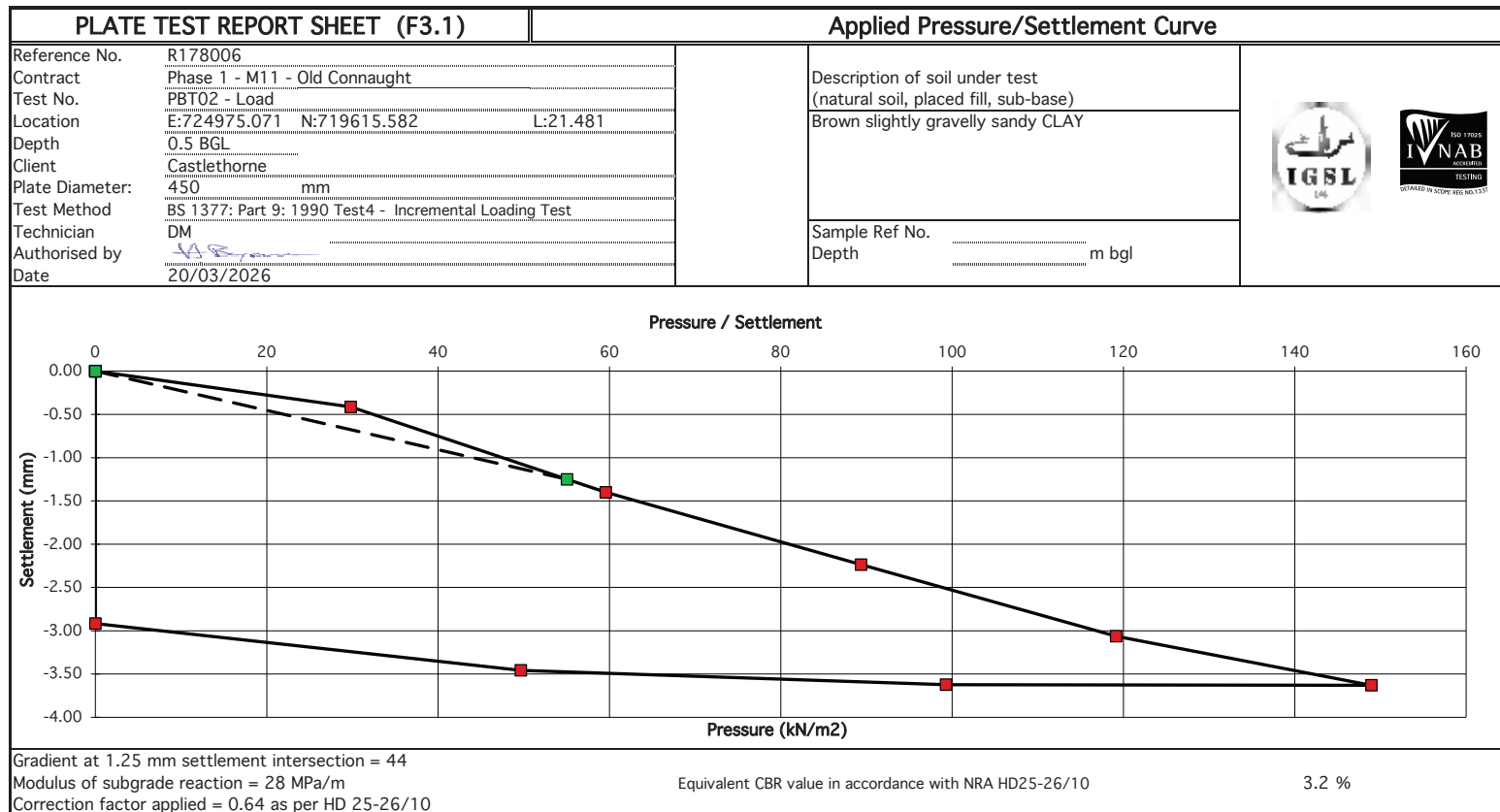


PLATE TEST REPORT SHEET (F3.1)		Applied Pressure/Settlement Curve	
Reference No.	R178007	Description of soil under test (natural soil, placed fill, sub-base) Brown slightly gravelly sandy CLAY	 
Contract	Phase 1 - M11 - Old Connaught		
Test No.	PBT02 - Reload		
Location	E:725052.681 N:719468.81 L:20.396		
Depth	0.5 BGL		
Client	Castlethorne	Sample Ref No.	
Plate Diameter:	300 mm	Depth	
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test		
Technician	DM		
Authorised by	<i>HA Ryan</i>		
Date	20/03/2026		

Pressure / Settlement

Pressure (kN/m ²)	Settlement (mm) - Upper Curve	Settlement (mm) - Lower Curve
0	0.00	-2.50
75	-1.25	-4.50
100	-1.50	-4.80
150	-2.00	-4.90
200	-2.50	-5.00
250	-3.00	-5.00
300	-3.50	-5.00
350	-4.00	-5.00

Gradient at 1.25 mm settlement intersection = 75	Equivalent CBR value in accordance with NRA HD25-26/10	4.4 %
Modulus of subgrade reaction = 34 MPa/m		
Correction factor applied = 0.46 as per HD 25-26/10		



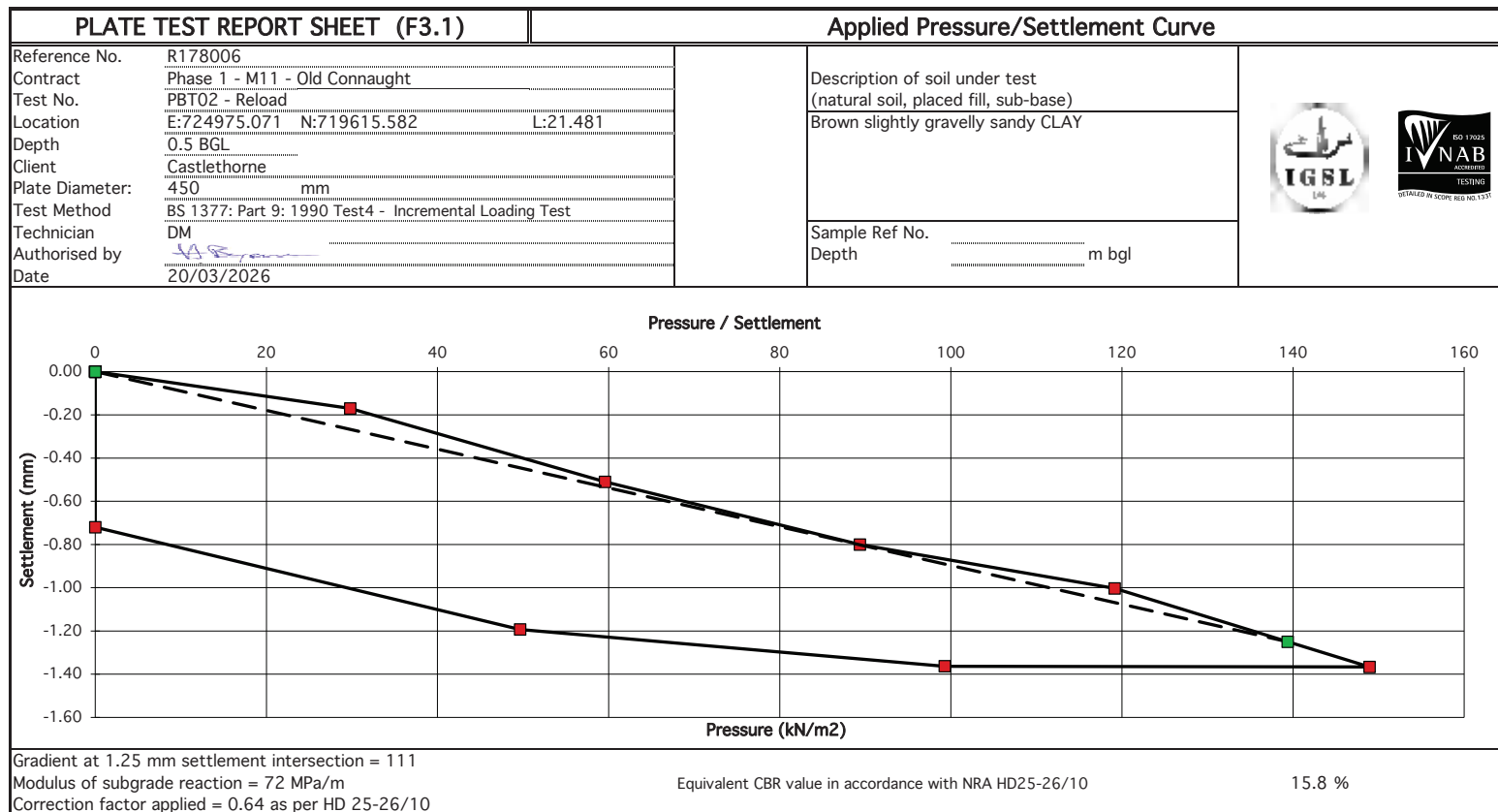
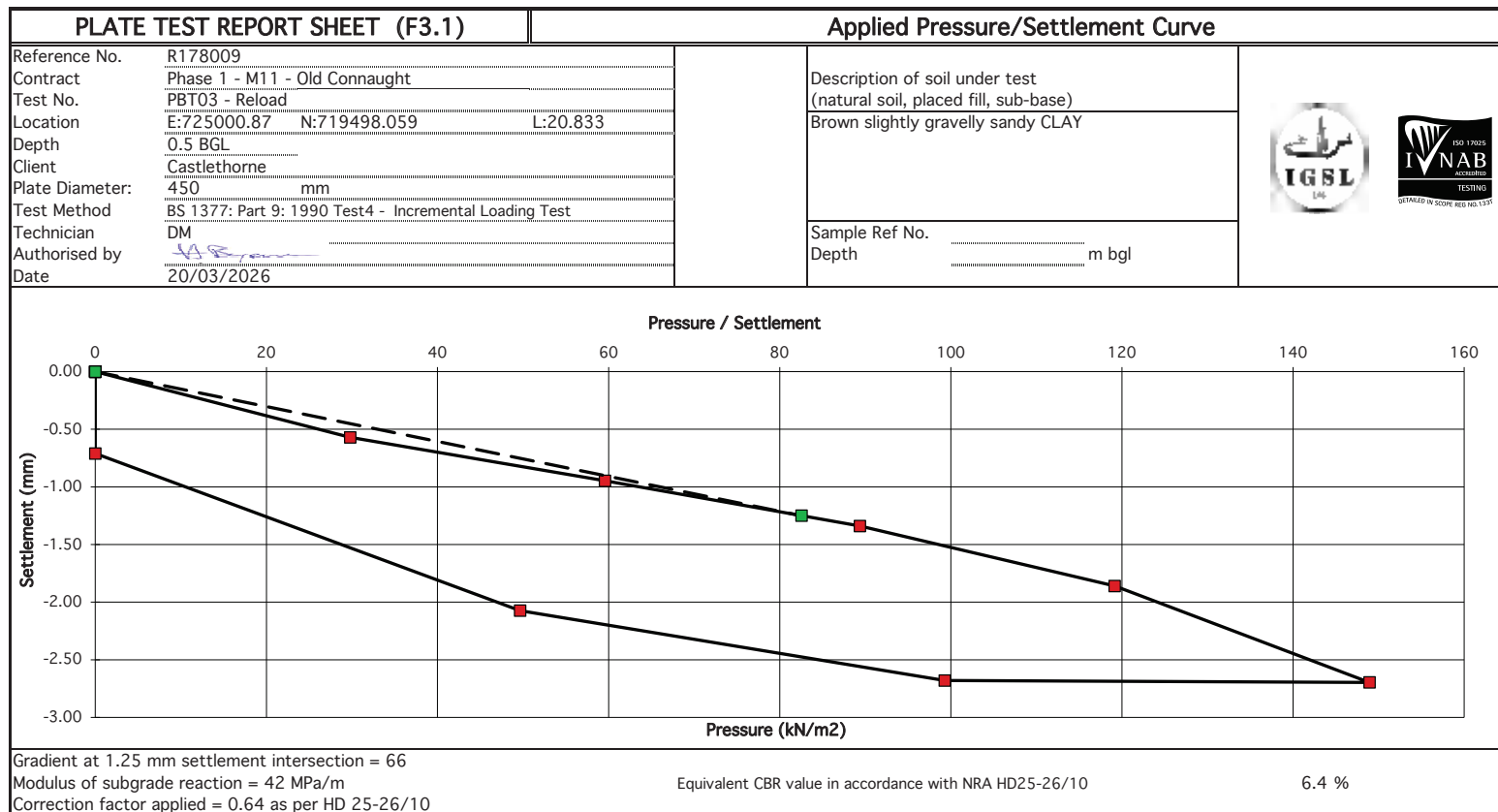


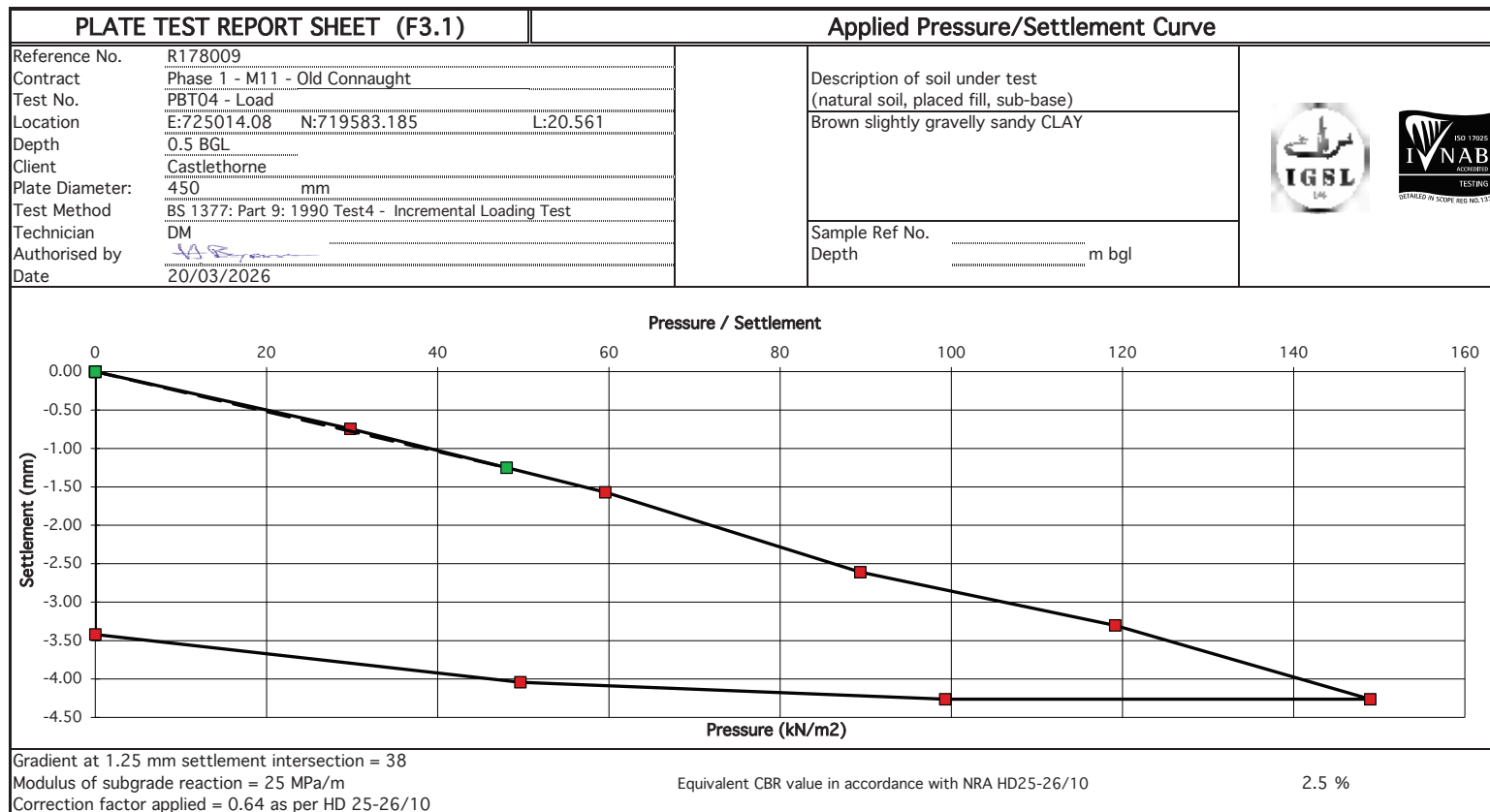
PLATE TEST REPORT SHEET (F3.1)			Applied Pressure/Settlement Curve	
Reference No.	R178008		Description of soil under test (natural soil, placed fill, sub-base)	
Contract	Phase 1 - M11 - Old Connaught			
Test No.	PBT03 - Load		Brown slightly gravelly sandy CLAY	
Location	E:725000.87 N:719498.059 L:20.833			
Depth	0.5 BGL		Sample Ref No. _____ Depth _____ m bgl	
Client	Castlethorne			
Plate Diameter:	450 mm			
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test			
Technician	DM			
Authorised by	<i>HA Ryan</i>			
Date	20/03/2026			

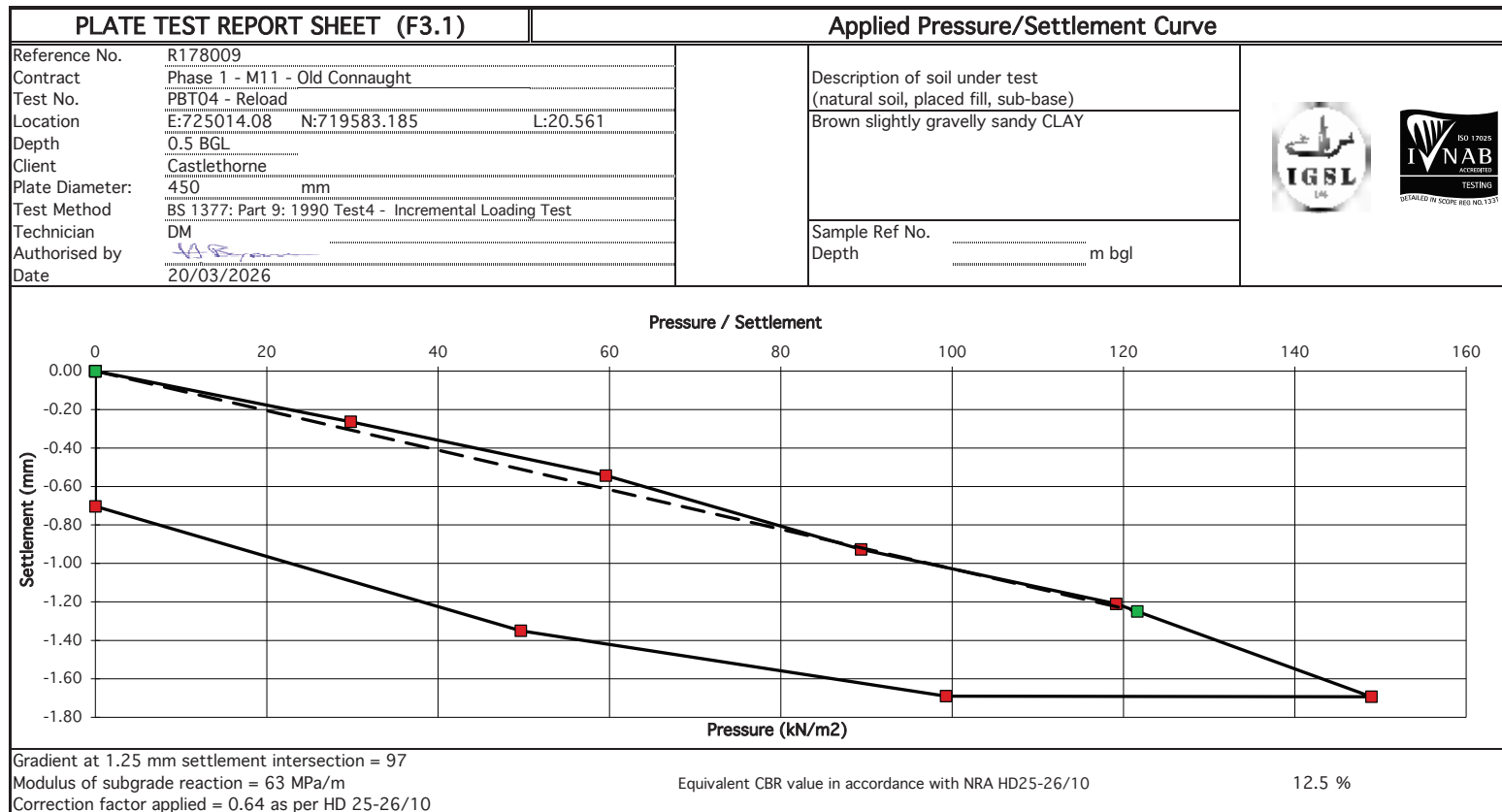
Pressure / Settlement

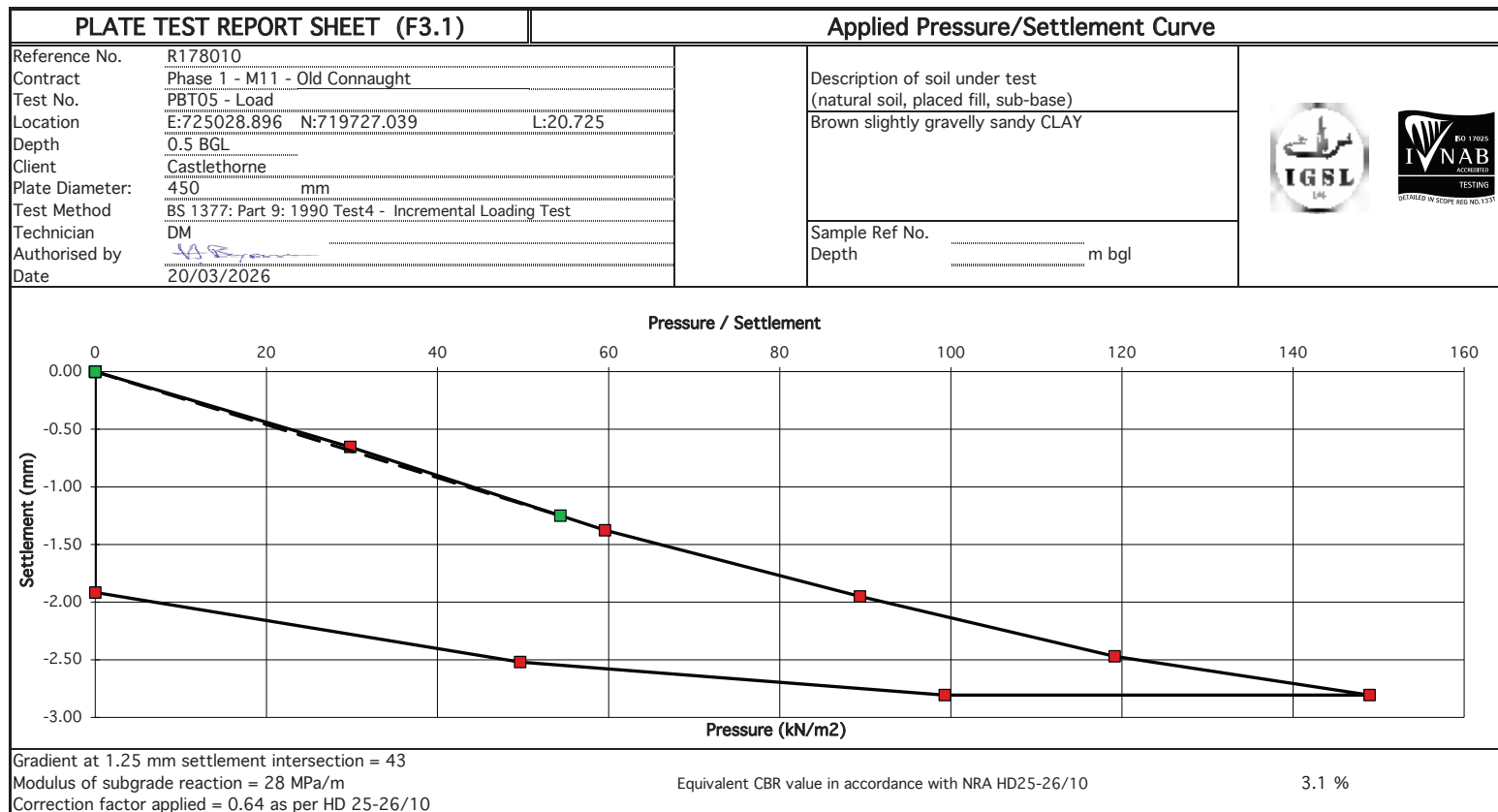
Pressure (kN/m ²)	Settlement (mm) - Upper Series	Settlement (mm) - Lower Series
0	0.00	-6.5
30	-1.2	-7.5
60	-3.0	-8.0
90	-5.2	-8.5
120	-6.8	-8.8
150	-8.5	-9.0

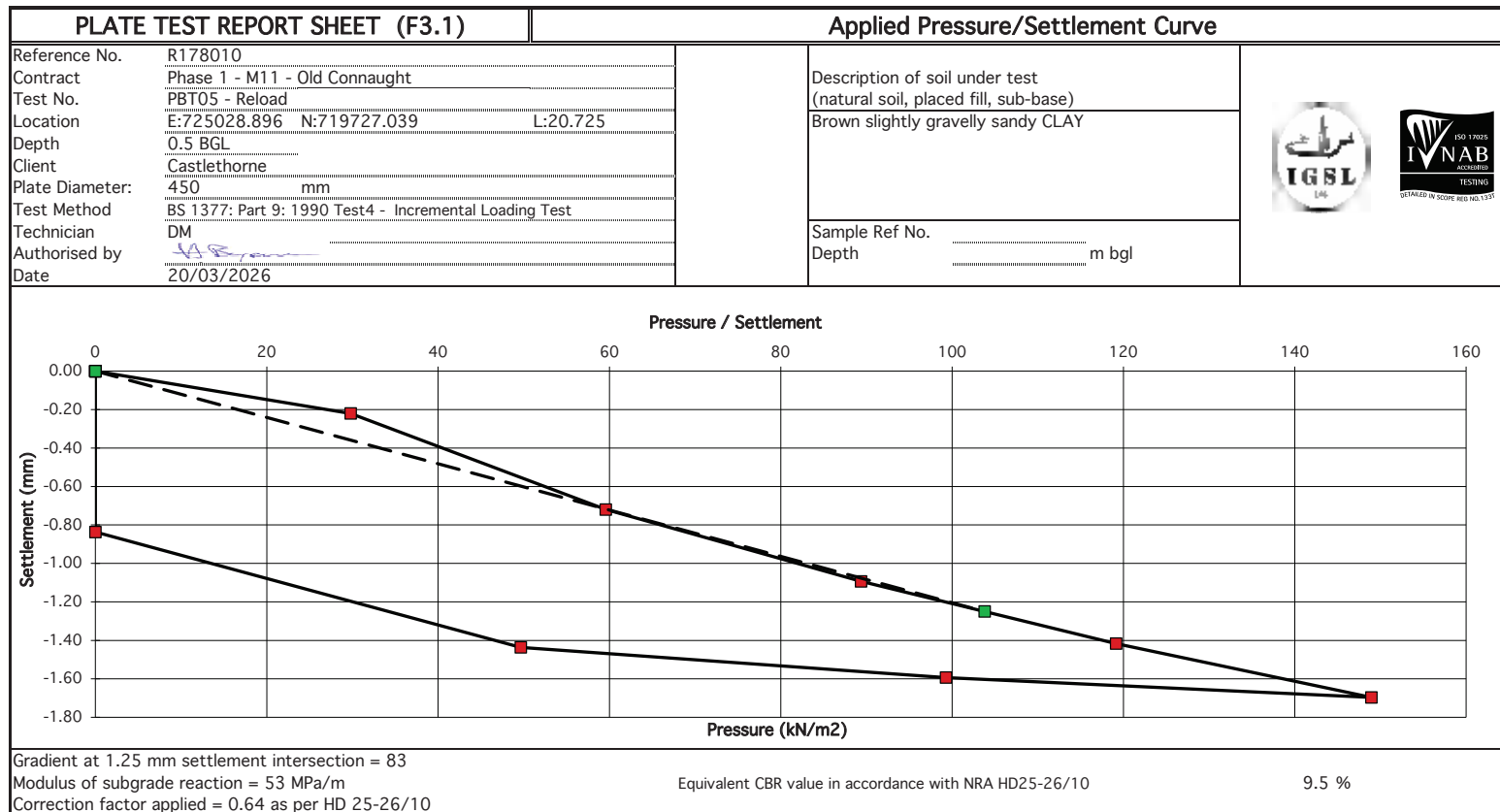
Gradient at 1.25 mm settlement intersection = 25	Equivalent CBR value in accordance with NRA HD25-26/10	1.2 %
Modulus of subgrade reaction = 16 MPa/m		
Correction factor applied = 0.64 as per HD 25-26/10		











Appendix 8

Infiltration Test Records

Soakaway Design f -value from field tests

IGSL

Contract: Old Connaught, Phase 1
Test No. SA01
Engineer NP
Date: 25/03/2026

Contract No. 26458

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	1.10	Soft to firm brown slightly sandy slightly gravelly CLAY.	

Notes: For all trial pit information, see TP/SA01.

Field Data

Depth to Water (m)	Elapsed Time (min)
0.580	0.00
0.580	1.00
0.580	2.00
0.580	3.00
0.590	4.00
0.590	5.00
0.590	6.00
0.600	7.00
0.600	8.00
0.600	9.00
0.610	10.00
0.610	12.00
0.610	14.00
0.610	16.00
0.610	18.00
0.620	20.00
0.630	25.00
0.630	30.00
0.630	40.00
0.630	50.00
0.640	60.00

Field Test

Depth of Pit (D)	1.10	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.50	m

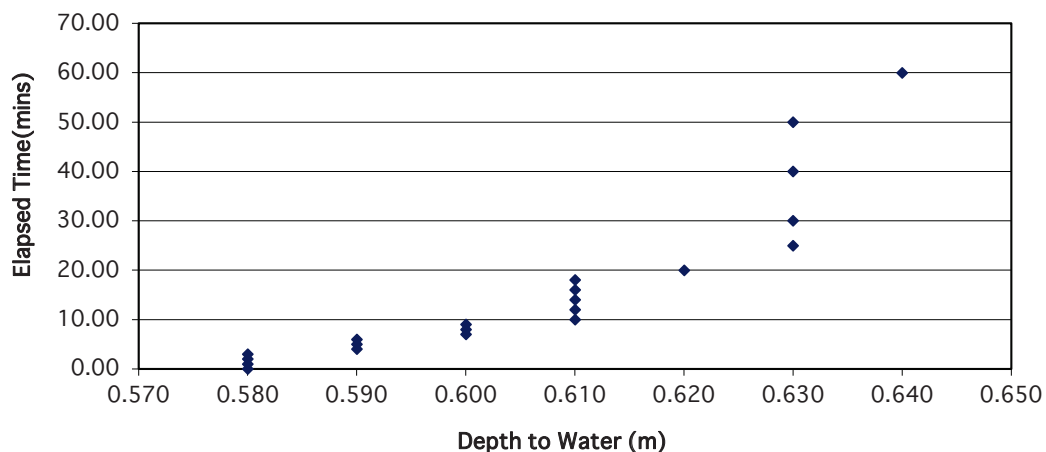
Initial depth to Water =	0.58	m
Final depth to water =	0.64	m
Elapsed time (mins)=	60.00	

Top of permeable soil		m
Base of permeable soil		m

Base area=	0.6	m ²
*Av. side area of permeable stratum over test period	1.862	m ²
Total Exposed area =	2.462	m ²

Infiltration rate (f) = Volume of water used/unit exposed area / unit time |
f= 0.00024 m/min or 4.06174E-06 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests

IGSL

Contract: Old Connaught, Phase 1
Test No. SA02 (Stage 1)
Engineer DM
Date: 23/03/2026

Contract No. 26458

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	1.00	Firm brown slightly silty sandy gravelly CLAY.	
1.00	1.40	Firm greyish brown slightly sandy gravelly CLAY with cobbles.	

Notes: For all trial pit information, see TP/SA02.

Field Data

Depth to Water (m)	Elapsed Time (min)
0.650	0.00
0.670	1.00
0.700	2.00
0.720	3.00
0.740	4.00
0.760	5.00
0.770	6.00
0.780	7.00
0.790	8.00
0.800	9.00
0.810	10.00
0.840	12.00
0.860	14.00
0.870	16.00
0.880	18.00
0.900	20.00
0.930	25.00
0.960	30.00
0.990	40.00
1.030	50.00
1.070	60.00

Field Test

Depth of Pit (D)	1.40	m
Width of Pit (B)	0.50	m
Length of Pit (L)	1.50	m

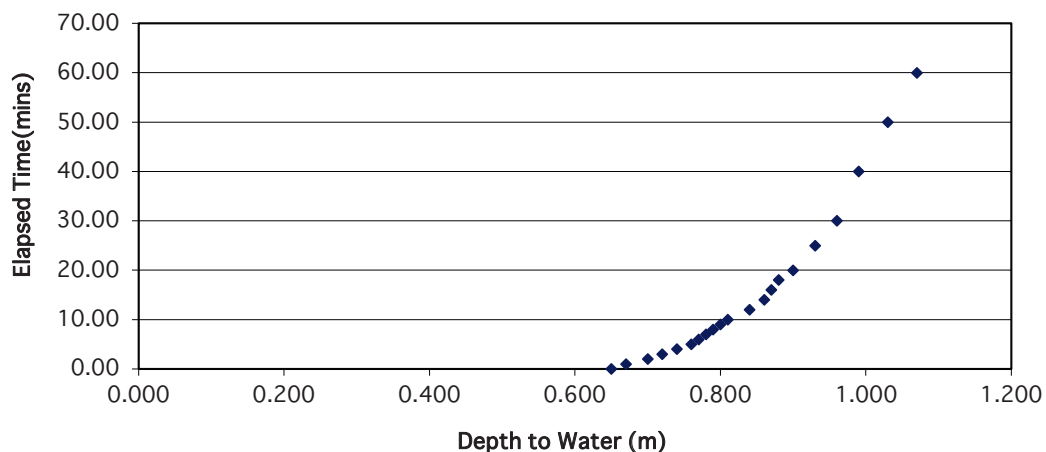
Initial depth to Water =	0.65	m
Final depth to water =	1.07	m
Elapsed time (mins)=	60.00	

Top of permeable soil		m
Base of permeable soil		m

Base area=	0.75	m ²
*Av. side area of permeable stratum over test period	2.16	m ²
Total Exposed area =	2.91	m ²

Infiltration rate (f) = Volume of water used/unit exposed area / unit time |
f= 0.0018 m/min or 3.00687E-05 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests

IGSL

Contract: Old Connaught, Phase 1
Test No. SA02 (Stage 2)
Engineer DM
Date: 23/03/2026

Contract No. 26458

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	1.00	Firm brown slightly silty sandy gravelly CLAY.	
1.00	1.40	Firm greyish brown slightly sandy gravelly CLAY with cobbles.	

Notes: For all trial pit information, see TP/SA02.

Field Data

Depth to Water (m)	Elapsed Time (min)
0.630	0.00
0.640	1.00
0.650	2.00
0.660	3.00
0.670	4.00
0.680	5.00
0.690	6.00
0.700	7.00
0.710	8.00
0.720	9.00
0.730	10.00
0.740	12.00
0.750	14.00
0.750	16.00
0.760	18.00
0.770	20.00
0.780	25.00
0.790	30.00
0.810	40.00
0.820	50.00
0.830	60.00

Field Test

Depth of Pit (D)	1.40	m
Width of Pit (B)	0.50	m
Length of Pit (L)	1.50	m

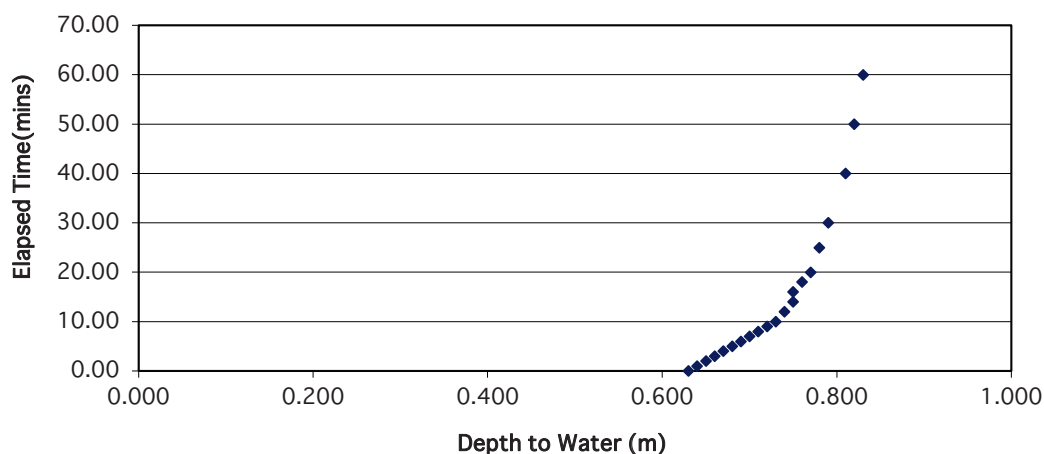
Initial depth to Water =	0.63	m
Final depth to water =	0.830	m
Elapsed time (mins)=	60.00	

Top of permeable soil		m
Base of permeable soil		m

Base area=	0.75	m ²
*Av. side area of permeable stratum over test period	2.68	m ²
Total Exposed area =	3.43	m ²

Infiltration rate (f) = Volume of water used/unit exposed area / unit time |
f= 0.00073 m/min or 1.21477E-05 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests

IGSL

Contract: Old Connaught, Phase 1
Test No. SA03 (Stage 1)
Engineer DM
Date: 23/03/2026

Contract No. 26458

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	1.10	Firm brown sandy gravelly CLAY with cobbles.	
1.10	1.40	Medium dense grey slightly clayey sandy GRAVEL with cobbles.	

Notes: For all trial pit information, see TP/SA03.

Field Data

Depth to Water (m)	Elapsed Time (min)
0.850	0.00
0.870	1.00
0.900	2.00
0.920	3.00
0.940	4.00
0.950	5.00
0.970	6.00
0.980	7.00
0.990	8.00
1.000	9.00
1.020	10.00
1.030	12.00
1.050	14.00
1.070	16.00
1.100	18.00
1.120	20.00
1.150	25.00
1.190	30.00
1.200	40.00
1.210	50.00
1.220	60.00

Field Test

Depth of Pit (D)	1.40	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.70	m

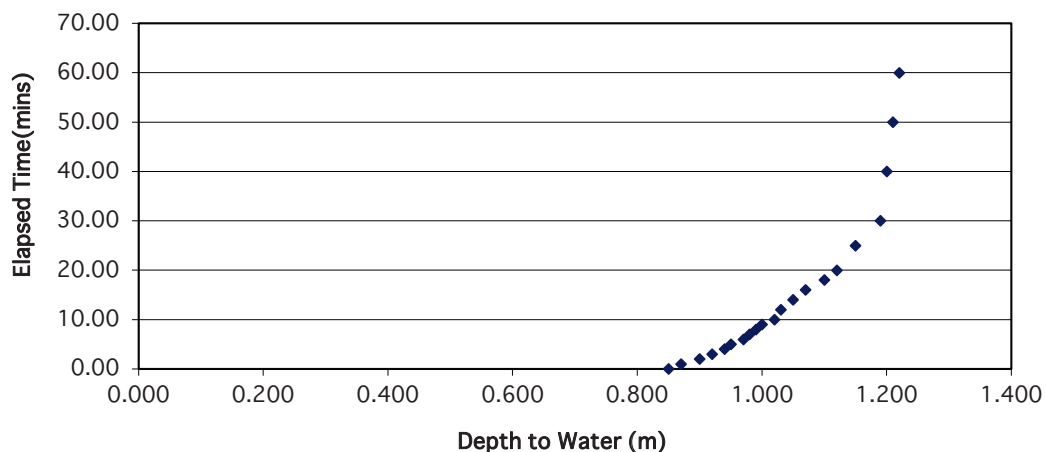
Initial depth to Water =	0.85	m
Final depth to water =	1.220	m
Elapsed time (mins)=	60.00	

Top of permeable soil		m
Base of permeable soil		m

Base area=	1.02	m ²
*Av. side area of permeable stratum over test period	1.679	m ²
Total Exposed area =	2.699	m ²

Infiltration rate (f) = Volume of water used/unit exposed area / unit time |
f= 0.00233 m/min or 3.88415E-05 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design

f -value from field tests

IGSL

Contract: Old Connaught, Phase 1

Contract No. 26458

Test No. SA03 (Stage 2)

Engineer DM

Date: 23/03/2026

Summary of ground conditions			
from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	1.10	Firm brown sandy gravelly CLAY with cobbles.	
1.10	1.40	Medium dense grey slightly clayey sandy GRAVEL with cobbles.	

Notes: For all trial pit information, see TP/SA03.

Field Data

Depth to Water (m)	Elapsed Time (min)
0.800	0.00
0.800	1.00
0.810	2.00
0.820	3.00
0.830	4.00
0.850	5.00
0.860	6.00
0.870	7.00
0.890	8.00
0.900	9.00
0.910	10.00
0.920	12.00
0.940	14.00
0.950	16.00
0.960	18.00
0.970	20.00
0.990	25.00
1.000	30.00
1.020	40.00
1.040	50.00
1.060	60.00

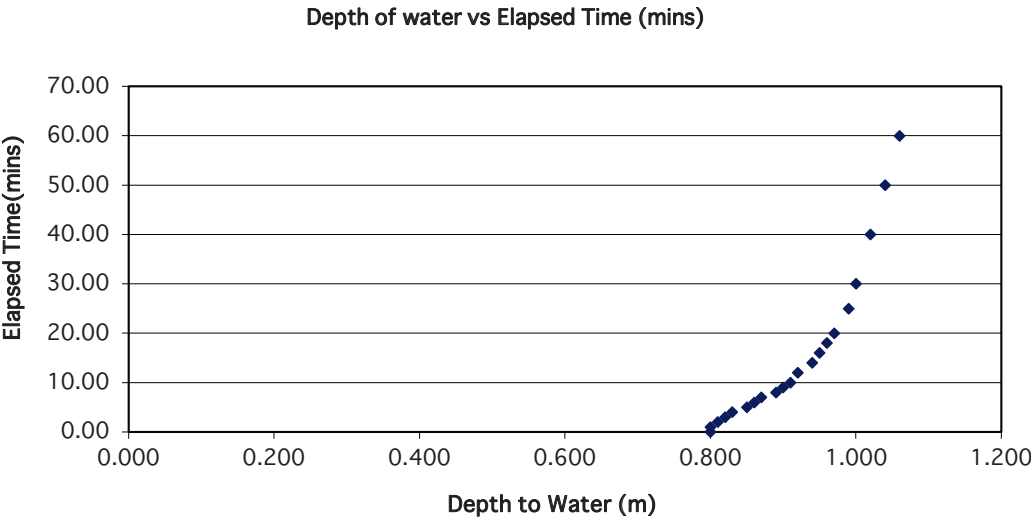
Field Test

Depth of Pit (D)	1.40	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.70	m
Initial depth to Water =	0.80	m
Final depth to water =	1.060	m
Elapsed time (mins)=	60.00	
Top of permeable soil		
Base of permeable soil		

Base area=	1.02	m2
*Av. side area of permeable stratum over test period =	2.162	m2
Total Exposed area =	3.182	m2

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

f= 0.00139 m/min or 2.31511E-05 m/sec



Soakaway Design f -value from field tests

IGSL

Contract: Old Connaught, Phase 1

Contract No. 26458

Test No. SA04

Engineer DM

Date: 23/03/2026

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	0.60	Firm brown slightly gravelly sandy CLAY.	
0.60	2.00	Stiff light brown mottled light grey slightly sandy slightly gravelly CLAY.	

Notes: For all trial pit information, see TP/SA04.

Field Data

Field Test

Depth to Water (m)	Elapsed Time (min)
0.780	0.00
0.780	1.00
0.780	2.00
0.780	3.00
0.780	4.00
0.780	5.00
0.780	6.00
0.780	7.00
0.780	8.00
0.780	9.00
0.780	10.00
0.780	12.00
0.780	14.00
0.780	16.00
0.780	18.00
0.780	20.00
0.780	25.00
0.780	30.00
0.780	40.00
0.780	50.00
0.780	60.00

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.50	m
Length of Pit (L)	1.50	m

Initial depth to Water =	0.78	m
Final depth to water =	0.78	m
Elapsed time (mins)=	60.00	

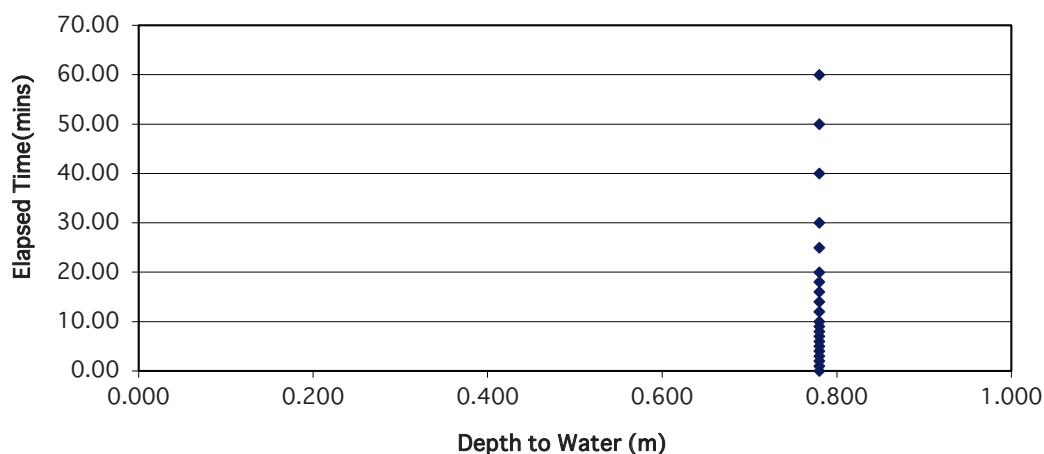
Top of permeable soil		m
Base of permeable soil		m

Base area=	0.75	m ²
*Av. side area of permeable stratum over test period	4.88	m ²
Total Exposed area =	5.63	m ²

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

f= 0 m/min or 0 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests

IGSL

Contract: Old Connaught, Phase 1

Contract No. 26458

Test No. SA05

Engineer DM

Date: 23/03/2026

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	0.90	Firm brown slightly gravelly sandy CLAY.	
0.90	1.80	Firm to stiff greyish brown slightly sandy slightly gravelly silty CLAY.	

Notes: For all trial pit information, see TP/SA05.

Field Data

Field Test

Depth to Water (m)	Elapsed Time (min)
0.600	0.00
0.600	1.00
0.600	2.00
0.600	3.00
0.600	4.00
0.600	5.00
0.600	6.00
0.600	7.00
0.600	8.00
0.600	9.00
0.600	10.00
0.600	12.00
0.600	14.00
0.610	16.00
0.610	18.00
0.610	20.00
0.610	25.00
0.610	30.00
0.610	40.00
0.610	50.00
0.610	60.00

Depth of Pit (D)	1.80	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.70	m

Initial depth to Water =	0.60	m
Final depth to water =	0.61	m
Elapsed time (mins)=	60.00	

Top of permeable soil		m
Base of permeable soil		m

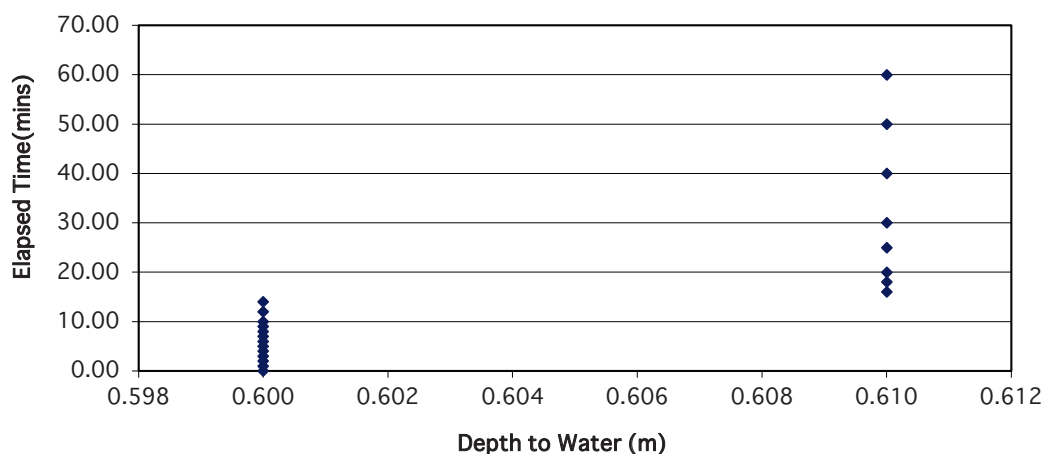
Base area=	1.02	m ²
*Av. side area of permeable stratum over test period	5.497	m ²
Total Exposed area =	6.517	m ²

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

f= 0 m/min or 0 m/sec

No fall in water after 16 mins

Depth of water vs Elapsed Time (mins)



IGSL

Contract No. 26458

Engineer NP

Date: 25/03/2026

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	0.50	MADE GROUND: Soft to firm brown slightly sandy slightly gravelly CLAY.	
0.50	0.70	MADE GROUND	
0.70	1.60	Medium dense grey/brown sandy GRAVEL.	

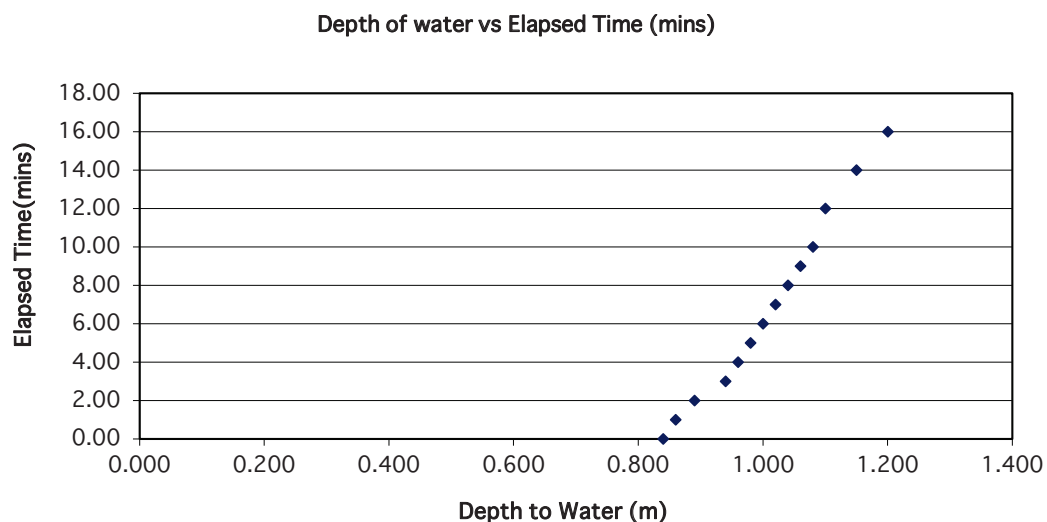
Field Data

[illegible]

Base area=	0.6	m2
le stratum over test period	2.204	m2
Total Exposed area =	2.804	m2

$$\text{Infiltration rate (f)} = \frac{\text{Volume of water used/unit}}{\text{exposed area / unit time}}$$

f= 0.00481 m/min or 8.02425E-05 m/sec



Soakaway Design f -value from field tests

IGSL

Contract: Old Connaught, Phase 1
Test No. SA06 (Stage 2)
Engineer NP
Date: 25/03/2026

Contract No. 26458

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	0.50	MADE GROUND: Soft to firm brown slightly sandy slightly gravelly CLAY.	
0.50	0.70	MADE GROUND	
0.70	1.60	Medium dense grey/brown sandy GRAVEL.	

Notes: For all trial pit information, see TP/SA06. Pit was dry after 25min.

Field Data

Depth to Water (m)	Elapsed Time (min)
1.050	0.00
1.050	1.00
1.080	2.00
1.100	3.00
1.110	4.00
1.130	5.00
1.150	6.00
1.160	7.00
1.190	8.00
1.200	9.00
1.220	10.00
1.240	12.00
1.260	14.00
1.280	16.00
1.300	18.00
1.320	20.00
1.400	25.00

Field Test

Depth of Pit (D)	1.40	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.50	m

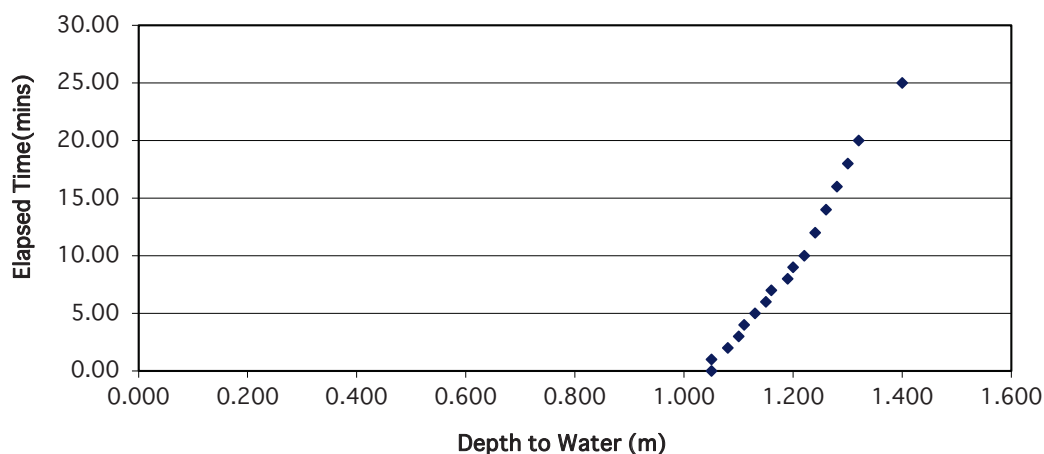
Initial depth to Water =	1.05	m
Final depth to water =	1.400	m
Elapsed time (mins)=	25.00	

Top of permeable soil		m
Base of permeable soil		m

Base area=	0.6	m ²
*Av. side area of permeable stratum over test period	0.665	m ²
Total Exposed area =	1.265	m ²

Infiltration rate (f) = Volume of water used/unit exposed area / unit time |
f= 0.00664 m/min or 0.000110672 m/sec

Depth of water vs Elapsed Time (mins)



Soakaway Design f -value from field tests

IGSL

Contract: Old Connaught, Phase 1

Contract No. 26458

Test No. SA07

Engineer NP

Date: 25/03/2026

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	1.00	Soft to firm brown slightly sandy slightly gravelly CLAY.	
1.00	1.40	Firm to stiff greyish brown slightly sandy gravelly CLAY with cobbles.	

Notes: For all trial pit information, see TP/SA07.

Field Data

Field Test

Depth to Water (m)	Elapsed Time (min)
0.710	0.00
0.710	1.00
0.710	2.00
0.710	3.00
0.710	4.00
0.710	5.00
0.710	6.00
0.710	7.00
0.710	8.00
0.710	9.00
0.710	10.00
0.710	12.00
0.710	14.00
0.710	16.00
0.710	18.00
0.710	20.00
0.710	25.00
0.710	30.00
0.710	40.00
0.710	50.00
0.710	60.00

Depth of Pit (D)	1.40	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.60	m

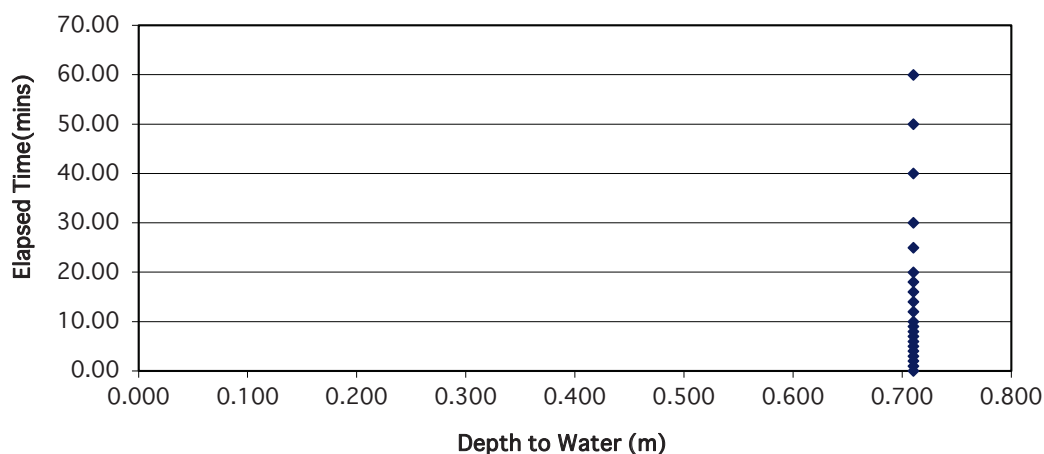
Initial depth to Water =	0.71	m
Final depth to water =	0.71	m
Elapsed time (mins)=	60.00	

Top of permeable soil		m
Base of permeable soil		m

Base area=	0.64	m ²
*Av. side area of permeable stratum over test period	2.76	m ²
Total Exposed area =	3.4	m ²

Infiltration rate (f) = Volume of water used/unit exposed area / unit time |
f= 0 m/min or 0 m/sec

Depth of water vs Elapsed Time (mins)



Appendix 9

Groundwater Monitoring Records

26458	GROUNDWATER MONITORING DATA SHEET IGSL Ltd										
Project: Phase 1 - M11 - Old Connaught Engineer: Atkins											
Exploratory Hole No.	Hole Depth		Ground Level	Response Zone Top	Response Zone Base	Groundwater Level 04/06/2026		Groundwater Level 05/06/2026		Groundwater Level 10/06/2026	
	m BGL	mOD	mOD	m BGL	m BGL	m BGL	mOD	m BGL	mOD	m BGL	mOD
RC02	25.00	-4.13	20.87	3.00	15.00	10.00	10.87	-		10.60	10.27
RC03	20.00	0.02	20.022	8.50	16.50	-		5.10	14.92	4.95	15.07
Notes: Water levels measured using electric dipmeter RC - denotes rotary drillhole											

Appendix 10

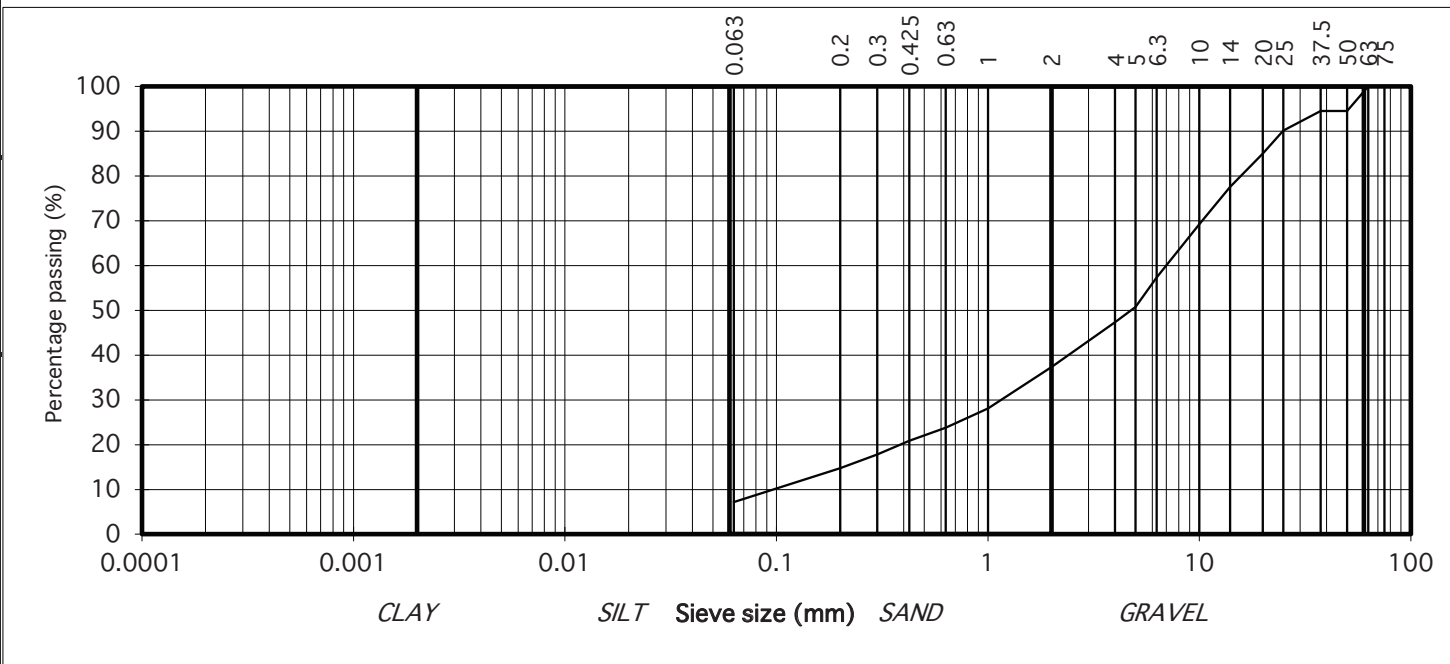
Geotechnical Laboratory Testing

IGSL Ltd Materials Laboratory Unit J5, M7 Business Park Newhall, Naas Co. Kildare 045 846176				Test Report										
				Determination of Water Content, Liquid & Plastic Limits Tested in accordance with BS1377-2-2022/EN17892-1 and EN17892-12										
Report No. R180387				Contract No. 26458		Contract Name: Old Connaught Bray Phase 1 Castlethorne								
Customer Atkins CE														
Samples Received: 14/05/26		Date Tested: 14/05/26												
BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Water Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description	
BH01	AA260236	1.0	A26/1040	B	14	30	16	14	88	WS	5.3	C L	Brown sandy gravelly CLAY	
BH01	AA260240	4.0	A26/1041	B	9.8	32	15	17	56	WS	5.3	C L	Brown sandy gravelly CLAY	
BH02	AA265208	1.0	A26/1043	B	19	30	NP	NP	94	WS	5.3		Brown sandy gravelly SILT	
BH02	AA265216	9.0	A26/1046	B	16.2	35	15	20	59	WS	5.3	C L	Brown slightly sandy, slightly gravelly, CLAY	
BH03	AA260246	1.5	A26/1047	B	15.7	37	18	19	47	WS	5.3	C I	Brown sandy gravelly CLAY	
BH03	AA260252	7.0	A26/1049	B	17.1	31	12	19	76	WS	5.3	C L	Brown sandy gravelly CLAY	
TP01	AA258594	1.5	A26/1051	B	21.2	39	18	21	98	WS	5.3	C I	Brown sandy gravelly CLAY	
TP02	AA258590	1.5	A26/1052	B	16.4	28	15	13	86	WS	5.3	C L	Brown sandy gravelly CLAY	
TP04	AA258585	1.0	A26/1055	B	17.3	33	NP	NP	47	WS	5.3		Brown sandy gravelly SILT	
TP05	AA258596	1.5	A26/1057	B	18.1	35	17	18	87	WS	5.3	C L	Brown slightly sandy, slightly gravelly, CLAY	
Preparation: WS - Wet sieved AR - As received NP - Non plastic Liquid Limit 5.2 Cone Penetrometer definitive method Clause: 5.3 Cone Penetrometer single point method				Sample Type: B - Bulk Disturbed U - Undisturbed				Remarks: Results relate only to the specimen tested, in as received condition unless otherwise noted. Opinions and interpretations are outside the scope of accreditation. * denotes Customer supplied information. This report shall not be reproduced except in full without written approval from the Laboratory.						
IGSL Ltd Materials Laboratory				Persons authorized to approve reports H Byrne (Laboratory Manager)					Approved by		Date		Page	
											03/06/26		1 of 1	

TEST REPORT
Determination of Particle Size Distribution
 Tested in accordance with: BS1377-2:2022 Clause 10
 (note: Sedimentation stage not accredited)



particle size	% passing		Contract No. 26458	Report No. R180388	
75	100	COBBLES	Contract Name : Old Connaught Bray Phase 1 Castlethorne		Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.
63	100		BH/TP No. BH01		
50	95		Sample No.* AA260241	Lab. Sample No. A26/1042	
37.5	95		Sample Type: B		
25	90		Depth* (m) 5.00	Customer: Atkins CE	
20	85	GRAVEL	Date Received 14/05/2026	Date Testing started 14/05/2026	
14	78		Description: Brown clayey/silty, very sandy, GRAVEL		
10	69		Remarks		
6.3	57				
5.0	51				
4.0	47				
2.0	37				
1.0	28				
0.63	24				
0.425	21	SAND			
0.3	18				
0.2	15				
0.063	7				
		SILT/CLAY			



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
<i>H Byrne</i>	29/05/26	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

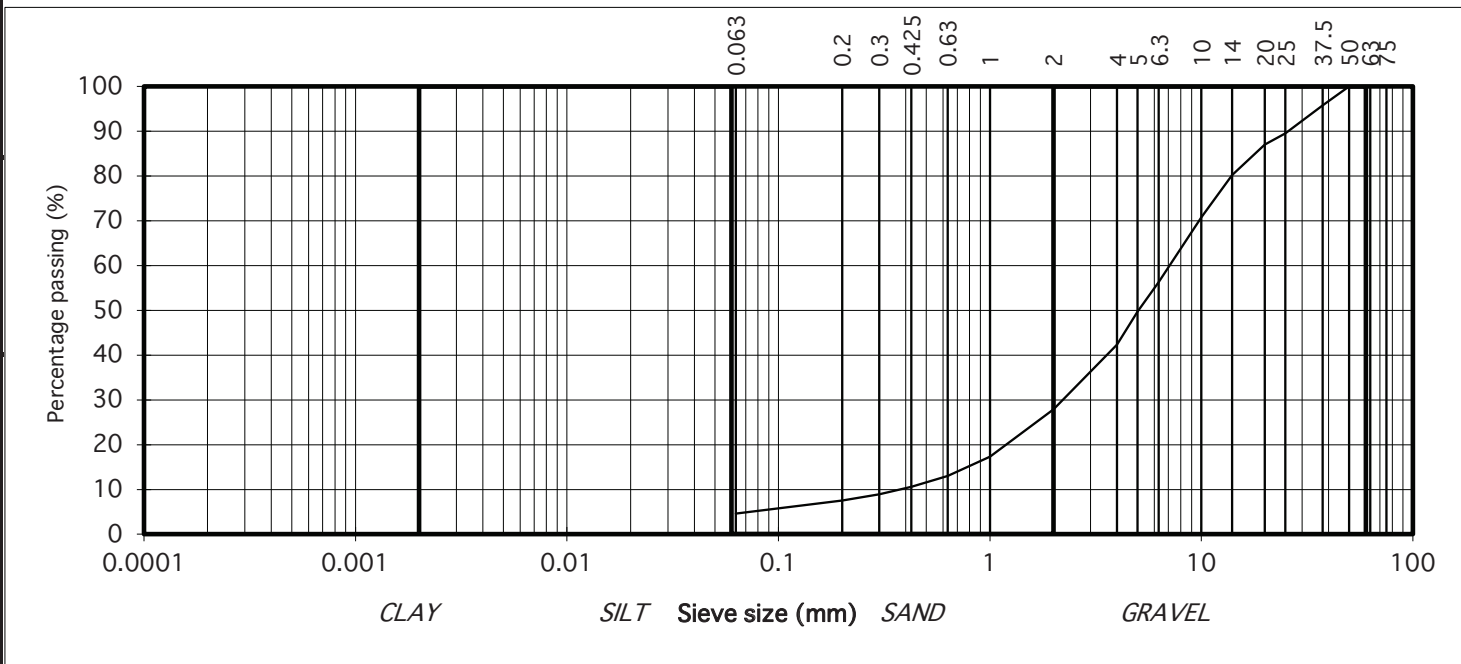
TEST REPORT

Determination of Particle Size Distribution

Tested in accordance with: BS1377-2:2022 Clause 10
(note: Sedimentation stage not accredited)



particle size	% passing		Contract No. 26458	Report No. R180503	
75	100	COBBLES	Contract Name : Old Connaught Bray Phase 1 Castlethorne		Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.
63	100		BH/TP No. BH02		
50	100		Sample No.* AA265213	Lab. Sample No. A26/1045	
37.5	96	GRAVEL	Sample Type: B		
25	90		Depth* (m) 6.00	Customer: Atkins CE	
20	87		Date Received 14/05/2026	Date Testing started 14/05/2026	
14	80		Description: Brown slightly clayey/silty, very sandy, GRAVEL		
10	71		Remarks		
6.3	56				
5.0	50				
4.0	42	SAND			
2.0	28				
1.0	17				
0.63	13				
0.425	11	SILT/CLAY			
0.3	9				
0.2	8				
0.063	5				



IGSL Ltd Materials Laboratory	Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

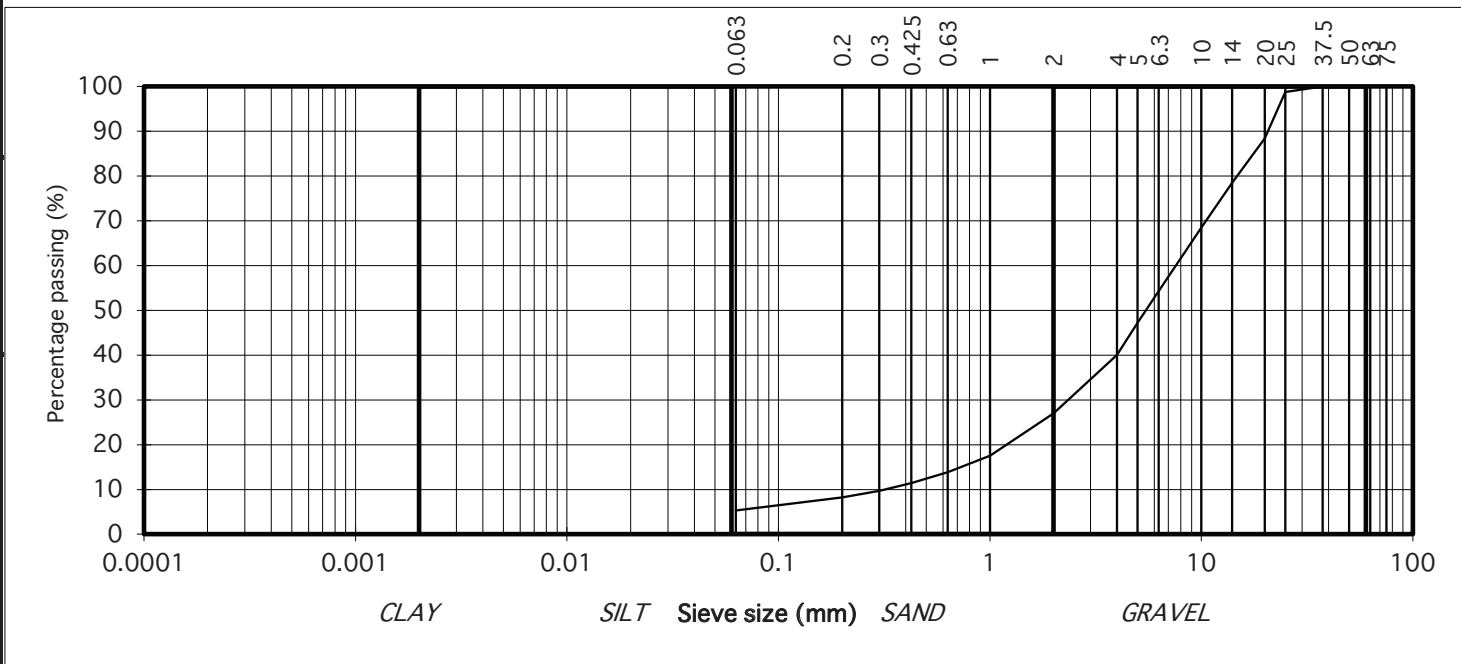
TEST REPORT

Determination of Particle Size Distribution

Tested in accordance with: BS1377-2:2022 Clause 10
(note: Sedimentation stage not accredited)



particle size	% passing		Contract No. 26458	Report No. R180500	
75	100	COBBLES	Contract Name : Old Connaught Bray Phase 1 Castlethorne		Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.
63	100		BH/TP No. BH02		
50	100		Sample No.* AA265210	Lab. Sample No. A26/1044	
37.5	100		Sample Type: B		
25	99	GRAVEL	Depth* (m) 3.00	Customer: Atkins CE	Remarks
20	88		Date Received 14/05/2026	Date Testing started 14/05/2026	
14	78		Description: Brown clayey/silty, very sandy, GRAVEL		
10	69				
6.3	54				
5.0	47				
4.0	40				
2.0	27				
1.0	18	SAND			
0.63	14				
0.425	11				
0.3	10				
0.2	8	SILT/CLAY			
0.063	5				



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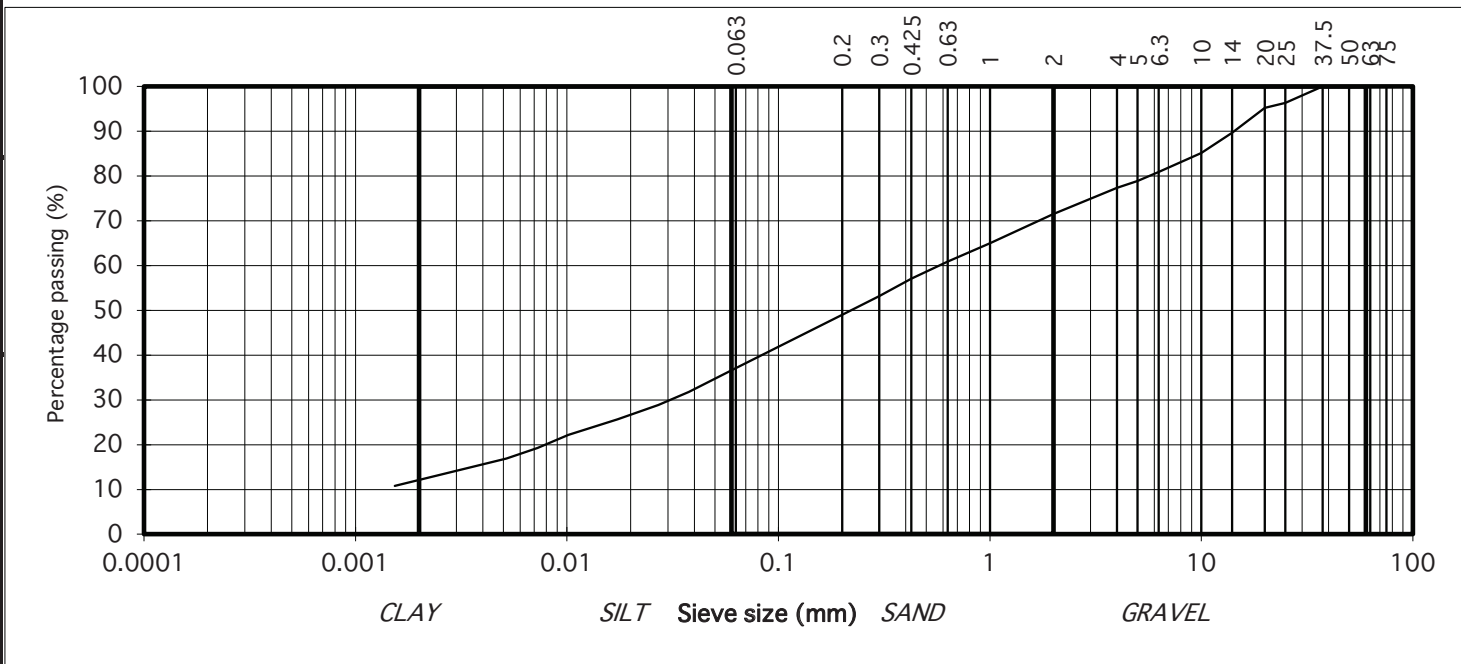
Approved by:	Date:	Page no:
<i>H Byrne</i>	29/05/26	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
 Tested in accordance with: BS1377-2:2022 Clause 10
 (note: Sedimentation stage not accredited)



particle size	% passing		Contract No. 26458	Report No. R180501	
75	100	COBBLES	Contract Name : Old Connaught Bray Phase 1 Castlethorne		Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.
63	100		BH/TP No. BH02		
50	100		Sample No.* AA265216	Lab. Sample No. A26/1046	
37.5	100		Sample Type: B		
25	96		Depth* (m) 9.00	Customer: Atkins CE	
20	95	GRAVEL	Date Received 14/05/2026	Date Testing started 14/05/2026	
14	90		Description: Brown slightly sandy, slightly gravelly, CLAY		
10	85		Remarks		
6.3	81				
5.0	79				
4.0	77	SAND			
2.0	72				
1.0	65				
0.63	61				
0.425	57				
0.3	53	SILT/CLAY			
0.2	49				
0.063	37				
0.038	32				
0.027	29				
0.017	26				
0.010	22				
0.007	19				
0.005	17				
0.002	11				



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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT

Determination of Particle Size Distribution

Tested in accordance with: BS1377-2:2022 Clause 10
(note: Sedimentation stage not accredited)



particle size	% passing		Contract No.	26458	Report No.	R180389		
			Contract Name :	Old Connaught Bray Phase 1 Castlethorne			Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.	
75	100	COBBLES	BH/TP No.	BH03				
63	73		Sample No.*	AA260250	Lab. Sample No.	A26/1048		
50	70	GRAVEL	Sample Type:	B				
37.5	62		Depth* (m)	5.00	Customer:	Atkins CE		
25	53		Date Received	14/05/2026	Date Testing started	14/05/2026		
20	44		Description:	Brown slightly clayey/silty, sandy, GRAVEL with many cobbles				
14	31		SAND	Remarks				
10	23			Sample size did not meet the requirements of BS1377				
6.3	17							
5.0	16							
4.0	15	SILT/CLAY						
2.0	12							
1.0	10							
0.63	9							
0.425	8							
0.3	8							
0.2	6							
0.063	3							

Sieve size (mm)	Percentage passing (%)
0.0001	0
0.063	3
0.425	8
0.75	16
2.0	31
4.75	44
75	73
150	100

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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

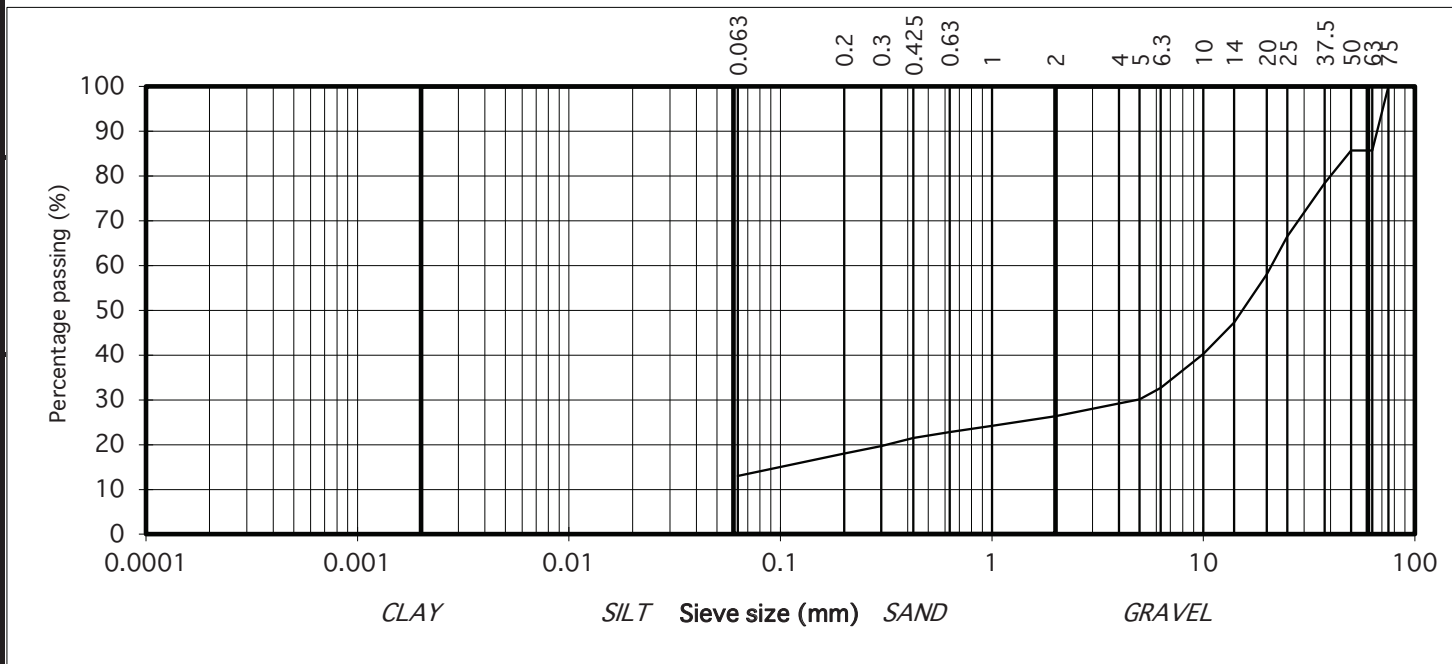
TEST REPORT

Determination of Particle Size Distribution

Tested in accordance with: BS1377-2:2022 Clause 10
(note: Sedimentation stage not accredited)



particle size	% passing		Contract No. 26458	Report No. R180390	
75	100	COBBLES	Contract Name : Old Connaught Bray Phase 1 Castlethorne		Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.
63	86		BH/TP No. BH03		
50	86		Sample No.* AA260254	Lab. Sample No. A26/1050	
37.5	78		Sample Type: B		
25	67		Depth* (m) 9.00	Customer: Atkins CE	
20	58	GRAVEL	Date Received 14/05/2026	Date Testing started 14/05/2026	
14	47		Description: Brown clayey/silty, sandy, GRAVEL with some cobbles		
10	40		Remarks		
6.3	33				
5.0	30				
4.0	29	SAND			
2.0	26				
1.0	24				
0.63	23				
0.425	21				
0.3	20	SILT/CLAY			
0.2	18				
0.063	13				



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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
 Tested in accordance with: BS1377-2:2022 Clause 10
 (note: Sedimentation stage not accredited)



particle size	% passing		Contract No. 26458	Report No. R180391	
			Contract Name : Old Connaught Bray Phase 1 Castlethorne		
75	100	COBBLES	BH/TP No. TP02		
63	100		Sample No.* AA258591	Lab. Sample No. A26/1053	
50	100		Sample Type: B		
37.5	100		Depth* (m) 2.70	Customer: Atkins CE	
25	100		Date Received 14/05/2026	Date Testing started 14/05/2026	
20	100		Description: Brown sandy, slightly gravelly, SILT/CLAY		
14	100	GRAVEL			
10	100		Remarks		
6.3	100		Percentage passing (%) Sieve size (mm) CLAY SILT SAND GRAVEL		
5.0	100				
4.0	100				
2.0	99				
1.0	99				
0.63	98				
0.425	98	SAND			
0.3	96				
0.2	93				
0.063	52				
		SILT/CLAY			

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.
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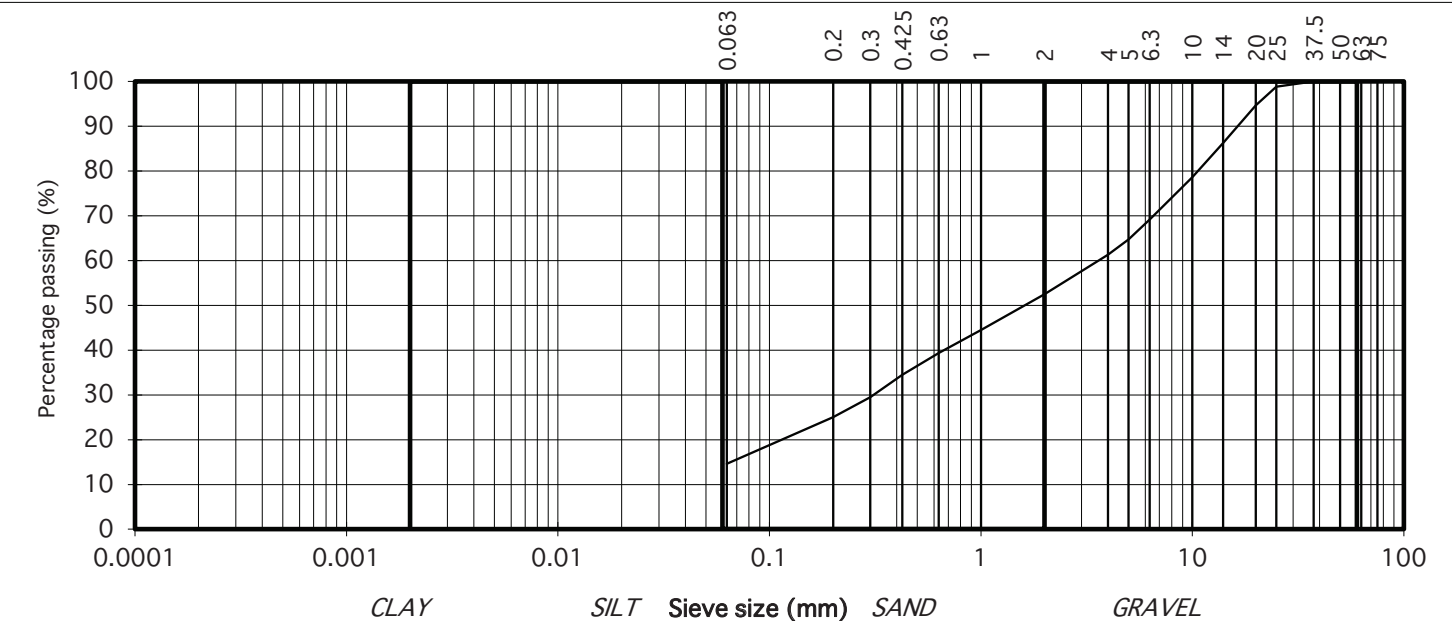
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
 Tested in accordance with: BS1377-2:2022 Clause 10
 (note: Sedimentation stage not accredited)



particle size	% passing		Contract No.	26458	Report No.	R180502				
			Contract Name :	Old Connaught Bray Phase 1 Castlethorne				Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.		
75	100	COBBLES	BH/TP No.	TP03						
63	100		Sample No.*	AA258584	Lab. Sample No.	A26/1054				
50	100	GRAVEL	Sample Type:	B						
37.5	100		Depth* (m)	1.80	Customer:	Atkins CE				
25	99		Date Received	14/05/2026	Date Testing started	14/05/2026				
20	95		Description:	Brown clayey/silty, very sandy, GRAVEL						
14	86		SAND	Remarks 						
10	79									
6.3	69									
5.0	65									
4.0	61	SILT/CLAY								
2.0	52									
1.0	45									
0.63	39									
0.425	34									
0.3	29									
0.2	25									
0.063	15									

IGSL Ltd Materials Laboratory

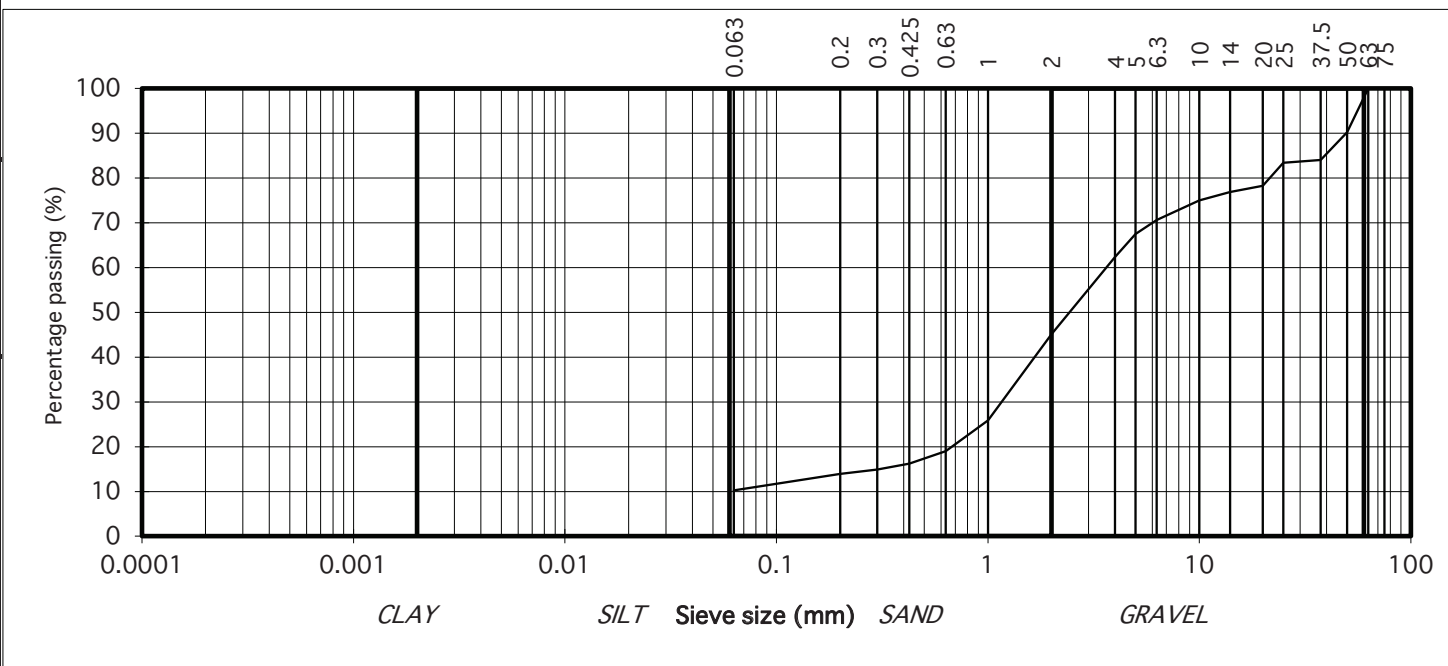
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
 Tested in accordance with: BS1377-2:2022 Clause 10
 (note: Sedimentation stage not accredited)



particle size	% passing		Contract No. 26458	Report No. R180392	
75	100	COBBLES	Contract Name : Old Connaught Bray Phase 1 Castlethorne		Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.
63	100		BH/TP No. TP04		
50	90		Sample No.* AA258588	Lab. Sample No. A26/1056	
37.5	84		Sample Type: B		
25	83		Depth* (m) 2.30	Customer: Atkins CE	
20	78	GRAVEL	Date Received 14/05/2026	Date Testing started 14/05/2026	
14	77		Description: Brown clayey/silty, very sandy, GRAVEL		
10	75		Remarks		
6.3	71				
5.0	67				
4.0	62	SAND			
2.0	45				
1.0	26				
0.63	19				
0.425	16				
0.3	15	SILT/CLAY			
0.2	14				
0.063	10				



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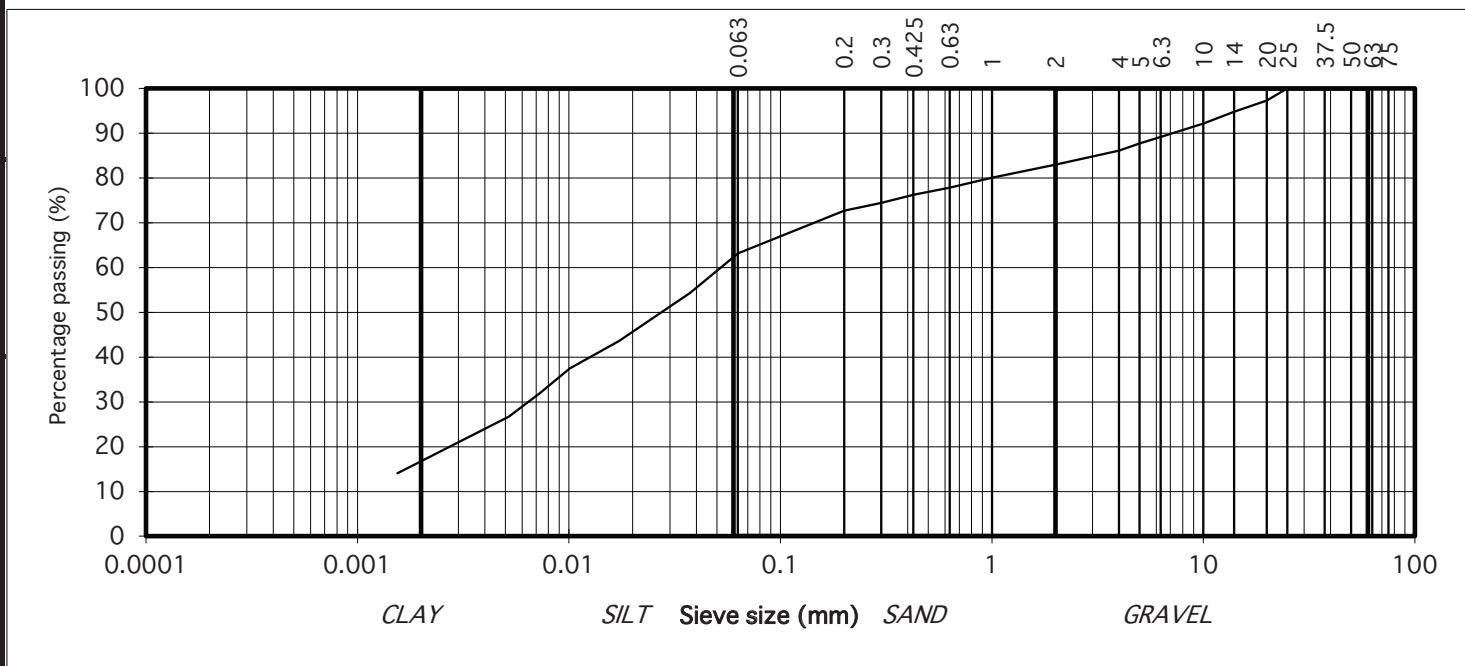
TEST REPORT

Determination of Particle Size Distribution

Tested in accordance with: BS1377-2:2022 Clause 10
(note: Sedimentation stage not accredited)



particle size	% passing		Contract No. 26458	Report No. R180393	
75	100	COBBLES	Contract Name : Old Connaught Bray Phase 1 Castlethorne		Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory.
63	100		BH/TP No. TP05		
50	100		Sample No.* AA258596	Lab. Sample No. A26/1057	
37.5	100		Sample Type: B		
25	100		Depth* (m) 1.50	Customer: Atkins CE	
20	97	GRAVEL	Date Received 14/05/2026	Date Testing started 14/05/2026	
14	95		Description: Brown slightly sandy, slightly gravelly, CLAY		
10	92		Remarks		
6.3	89				
5.0	88				
4.0	86				
2.0	83				
1.0	80				
0.63	78				
0.425	76				
0.3	74	SAND			
0.2	73				
0.063	63				
0.037	54				
0.027	50				
0.017	44	SILT/CLAY			
0.010	38				
0.007	32				
0.005	27				
0.002	14				



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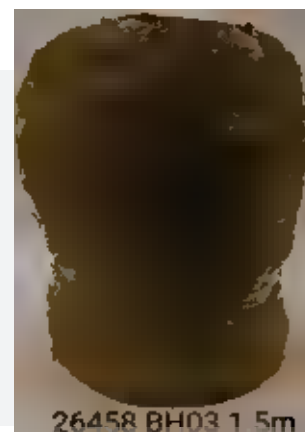
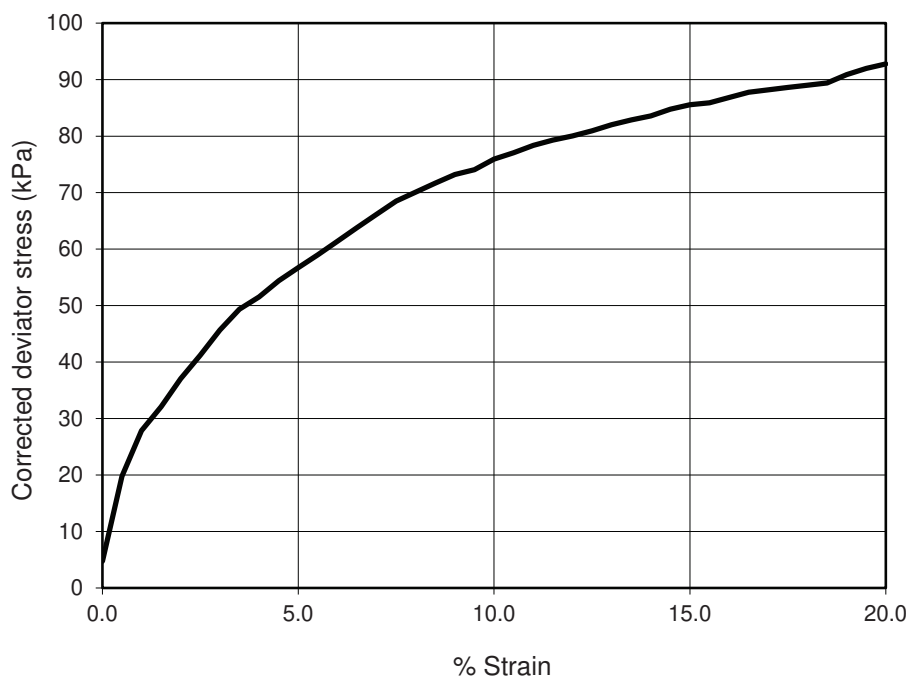
Approved by:	Date:	Page no:
<i>H Byrne</i>	03/06/26	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

IGSL Ltd Materials Laboratory Unit F, M7 Business Park Naas Co. Kildare 045-899324	Test Report	
	Unconsolidated Undrained Triaxial Test Tested in accordance with BS EN ISO 17892 - 8 : 2018	

Report no: R179300
 Contract Name: Old Connaught Bray Phase 1 Contract No: 26458
 Location*: BH3 1.5m Sample No*: 260246
 Description: Brown silty sandy GRAVEL with cobbles
 Customer: Atkins

Height (mm) 200.0 Diameter 103.0 Cell pressure(kPa) 30
 Water Content % 16.8 Bulk density (Mg/m³) 2.19 Dry density (Mg/m³) 1.87

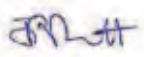


Strain at failure % 20.0 Cohesion C_u (kPa) 46
 (Undrained shear strength kPa)
 Rate of strain (%/minute) 2.0
 Thickness of membrane 0.48 Membrane correction (at failure) 5.000
 Date received - Date tested 19/05/26

Results relate only to the specimen tested, in as received condition unless otherwise noted. Opinions and interpretations are outside the scope of accreditation.

* denotes Customer supplied information

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Person authorised to approve report: J Barrett (Quality Manager)				
	IGSL Materials Laboratory	Approved by	Date	Page
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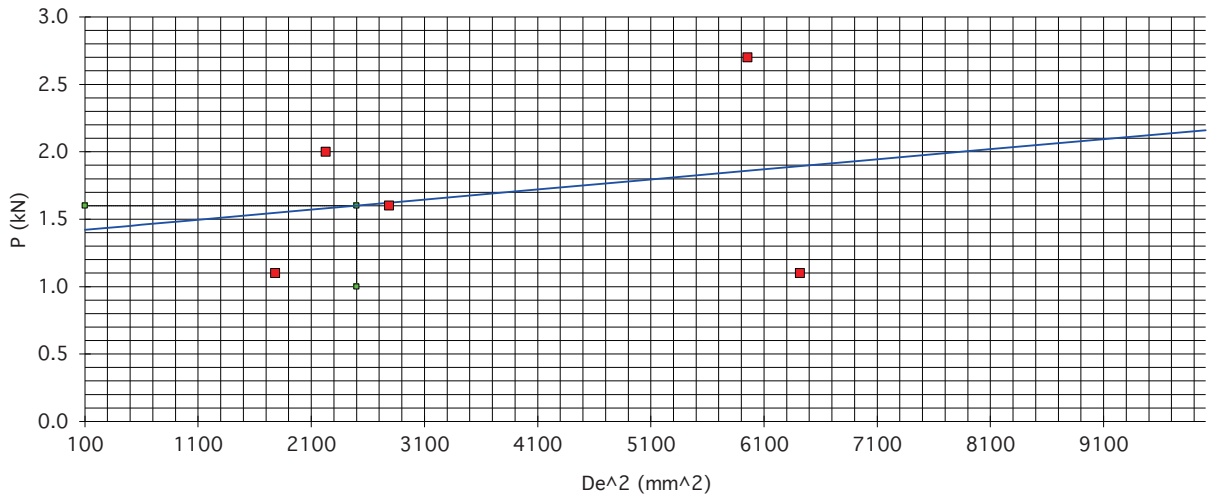
Point Load Irregular - Test Results

Contract: Phase 1 - M11 - Old Connaught

Sample Type: Irregular Core Pieces

Contract No.: 26458

Tested by: D. O'Shea

[illegible]

Calculation of $I_s(50)$

P = 7.5E-05 De^2 + 1.413485609

1.60 kN

0.6 MN/m²

12.802546 MPa

Appendix 11

Chemical & Environmental Laboratory Testing (Eurofins Chemtest Laboratory)



Final Report

Report No.: 26-10992-1

Initial Date of Issue: 22-Apr-2026

Re-Issue Details:

Client IGSL

Client Address: M7 Business Park
Naas
County Kildare
Ireland

Contact(s): Darren Keogh

Project 26458 Old Conna (Phase 1)

Quotation No.: Q26-41264

Date Received: 08-Apr-2026

Order No.:

Date Instructed: 09-Apr-2026

No. of Samples: 4

Turnaround (Wkdays): 7

Results Due: 17-Apr-2026

Date Approved: 22-Apr-2026

Approved By:

Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: 26458 Old Conna (Phase 1)

Client: IGSL		Chemtest Job No.:							
Quotation No.: Q26-41264		Chemtest Sample ID.:							
		<i>Client Reference:</i>							
		<i>Sample Type:</i>							
		<i>Top Depth (m):</i>							
		<i>Date Sampled:</i>							
Determinand	HWOL Code	Accred.	SOP	Units	LOD				
Moisture		N	2030	%	0.020	16	17	15	18
Soil Colour		N	2030		N/A	Brown	Brown	Brown	Brown
Other Material		N	2030		N/A	Stones	Stones	Stones	Roots
Soil Texture		N	2030		N/A	Clay	Clay	Clay	Clay
pH (2.5:1) at 20C		N	2010		4.0	8.2	8.1	8.0	7.6
Magnesium (Water Soluble)		N	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	< 0.010	0.010	< 0.010	< 0.010
Total Sulphur		U	2175	%	0.010	0.014	0.017	0.019	0.037
Chloride (Water Soluble)		M	2220	g/l	0.010	< 0.010	< 0.010	< 0.010	0.016
Nitrate (Water Soluble)		N	2220	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Ammonium (Water Soluble)		N	2220	g/l	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sulphate (Acid Soluble)		U	2430	%	0.010	0.019	0.018	0.032	0.042

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measurement by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Text example All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at $\leq 30^{\circ}\text{C}$ prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Where analysis is performed on a dried and crushed sample, it has been prepared by crushing all of the sample. If material has been removed prior to crushing, or by request of the client, this will be stated on the report.

NEW_ASB Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL

DURHAM Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Report Information

Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

DW - Drinking Water (Non-Regulatory)
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
cs@etuki.eurofins.com



Final Report

Report No.: 26-09996-1

Initial Date of Issue: 29-Apr-2026

Re-Issue Details:

Client IGSL

Client Address: M7 Business Park
Naas
County Kildare
Ireland

Contact(s): Darren Keogh

Project Old Conna Phase 1

Quotation No.: **Date Received:** 31-Mar-2026

Order No.: **Date Instructed:** 02-Apr-2026

No. of Samples: 5

Turnaround (Wkdays): 7 **Results Due:** 14-Apr-2026

Date Approved: 29-Apr-2026

Approved By:

Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: Old Conna Phase 1

Client: IGSL	Chemtest Job No.:					26-09996	26-09996	26-09996	26-09996	26-09996
Quotation No.:	Chemtest Sample ID.:					2103258	2103259	2103260	2103261	2103262
	<i>Client Sample ID.:</i>					<i>TP01</i>	<i>TP02</i>	<i>TP03</i>	<i>TP04</i>	<i>TP05</i>
	<i>Sample Type:</i>					<i>SOIL</i>	<i>SOIL</i>	<i>SOIL</i>	<i>SOIL</i>	<i>SOIL</i>
	<i>Top Depth (m):</i>					<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>	<i>0.00</i>
	<i>Bottom Depth (m):</i>					<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>
	<i>Date Sampled:</i>					<i>20-Mar-2026</i>	<i>20-Mar-2026</i>	<i>20-Mar-2026</i>	<i>20-Mar-2026</i>	<i>20-Mar-2026</i>
Determinand	Accred.	SOP	Type	Units	LOD					
Ammonium	U	1220	10:1	mg/l	0.050	0.21	0.14	0.23	0.16	0.20
Ammonium	N	1220	10:1	mg/kg	0.10	2.2	1.8	2.3	2.0	2.1

Results - Soil

Project: Old Conna Phase 1

Client: IGSL		Chemtest Job No.:		26-09996	26-09996	26-09996	26-09996	26-09996
Quotation No.:		Chemtest Sample ID.:		2103258	2103259	2103260	2103261	2103262
		Client Sample ID.:		TP01	TP02	TP03	TP04	TP05
		Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):		0.00	0.00	0.00	0.00	0.00
		Bottom Depth (m):		1.00	1.00	1.00	1.00	1.00
		Date Sampled:		20-Mar-2026	20-Mar-2026	20-Mar-2026	20-Mar-2026	20-Mar-2026
		Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
ACM Type		N	2192		N/A	-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	21	19	16
Soil Colour		N	2030		N/A	Brown	Brown	Brown
Other Material		N	2030		N/A	Stones	Stones	Stones
Soil Texture		N	2030		N/A	Sand	Clay	Clay
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	0.65	0.55	< 0.40
Sulphur (Elemental)		M	2180	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Cyanide (Total)		M	2300	mg/kg	0.50	0.80	0.80	< 0.50
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	2.7	4.0	5.0
Sulphate (Total)		U	2430	%	0.010	0.085	0.056	0.042
Arsenic		M	2455	mg/kg	0.5	18	17	21
Barium		M	2455	mg/kg	0.5	61	38	39
Cadmium		M	2455	mg/kg	0.10	0.95	0.53	0.65
Chromium		M	2455	mg/kg	0.5	26	25	29
Molybdenum		M	2455	mg/kg	0.5	1.2	0.7	0.8
Antimony		N	2455	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Copper		M	2455	mg/kg	0.50	19	15	17
Mercury		M	2455	mg/kg	0.05	0.07	< 0.05	0.06
Nickel		M	2455	mg/kg	0.50	25	24	26
Lead		M	2455	mg/kg	0.50	57	29	23
Selenium		M	2455	mg/kg	0.25	0.83	0.54	0.40
Zinc		M	2455	mg/kg	0.50	85	67	74
Chromium (Trivalent)		N	2490	mg/kg	1.0	26	25	29
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Aliphatic EPH >C10-C12	EH_2D_AL_#1	M	5002	mg/kg	2.00	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C12-C16	EH_2D_AL_#1	M	5002	mg/kg	2.00	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C16-C21	EH_2D_AL_#1	M	5002	mg/kg	2.00	130	< 2.0	< 2.0
Aliphatic EPH >C21-C35	EH_2D_AL_#1	M	5002	mg/kg	3.00	46	< 3.0	< 3.0
Aliphatic EPH >C35-C40	EH_2D_AL_#1	N	5002	mg/kg	10.00	< 10	< 10	< 10

Results - Soil

Project: Old Conna Phase 1

Client: IGS		Chemtest Job No.:		26-09996	26-09996	26-09996	26-09996	26-09996
Quotation No.:		Chemtest Sample ID.:		2103258	2103259	2103260	2103261	2103262
		Client Sample ID.:		TP01	TP02	TP03	TP04	TP05
		Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):		0.00	0.00	0.00	0.00	0.00
		Bottom Depth (m):		1.00	1.00	1.00	1.00	1.00
		Date Sampled:		20-Mar-2026	20-Mar-2026	20-Mar-2026	20-Mar-2026	20-Mar-2026
		Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
Total Aliphatic EPH >C10-C35	EH_2D_AL_#1	M	5002	mg/kg	7.00	180	< 7.0	< 7.0
Aromatic EPH >C10-C12	EH_2D_AR_#1	U	5002	mg/kg	2.00	< 2.0	< 2.0	< 2.0
Aromatic EPH >C12-C16	EH_2D_AR_#1	U	5002	mg/kg	2.00	19	< 2.0	< 2.0
Aromatic EPH >C16-C21	EH_2D_AR_#1	U	5002	mg/kg	2.00	< 2.0	< 2.0	< 2.0
Aromatic EPH >C21-C35	EH_2D_AR_#1	U	5002	mg/kg	2.00	2.7	< 2.0	2.4
Aromatic EPH >C35-C40	EH_2D_AR_#1	N	5002	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Total Aromatic EPH >C10-C35	EH_2D_AR_#1	U	5002	mg/kg	4.00	22	< 4.0	5.7
Total EPH >C10-C35	EH_2D_Total_#1	U	5002	mg/kg	10.00	200	< 10	12
Mineral Oil EPH	EH_2D_AL_#1	N	5002	mg/kg	10	180	< 10	< 10
Benzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Toluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Naphthalene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Acenaphthene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Fluorene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Phenanthrene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Anthracene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Fluoranthene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Pyrene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Benzo[a]anthracene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Chrysene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Benzo[b]fluoranthene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Benzo[k]fluoranthene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Benzo[a]pyrene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-c,d)Pyrene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)Anthracene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Benzo[g,h,i]perylene		M	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Coronene		N	5003	mg/kg	0.05	< 0.05	< 0.05	< 0.05
PCB 28		U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 52		U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 101		U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 118		U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 153		U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 138		U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 180		U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Tot PCBs Low (7 Congeners)		N	2815	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Phenols		M	2920	mg/kg	0.10	0.16	< 0.10	< 0.10

Results - Single Stage WAC

Project: Old Conna Phase 1

Chemtest Job No: 26-09996 Chemtest Sample ID: 2103258 Sample Ref: Sample ID: TP01 Client Reference: Top Depth(m): 0.00 Bottom Depth(m): 1.00 Sampling Date: 20-Mar-2026						Landfill Waste Acceptance Criteria Limits		
Determinand	SOP	HWOL Code	Accred.	Units		Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon	2625		M	%	1.7	3	5	6
Loss On Ignition	2610		M	%	6.2	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.05	1	--	--
WAC Total C10-C40	5002	EH_2D_Total_#1	N	mg/kg	180	500	--	--
Total (Of 17) PAH's	5003		N	mg/kg	< 0.1	100	--	--
pH at 20C	2010		M		7.2	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.020	--	To evaluate	To evaluate
Eluate Analysis				10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455		U	0.0055	0.055	0.5	2	25
Barium	1455		U	0.033	0.33	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0017	0.017	0.5	10	70
Copper	1455		U	0.0040	0.040	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0055	0.056	0.5	10	30
Nickel	1455		U	0.0037	0.037	0.4	10	40
Lead	1455		U	0.0042	0.042	0.5	10	50
Antimony	1455		N	0.0014	0.014	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.015	0.15	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.38	3.8	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	53	530	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	5.4	54	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.1
WAC Sample Weight	646.7

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: Old Conna Phase 1

Chemtest Job No: 26-09996						Landfill Waste Acceptance Criteria		
Chemtest Sample ID: 2103259						Inert Waste Landfill	Limits	
Sample Ref:							Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID: TP02								
Client Reference:								
Top Depth(m): 0.00								
Bottom Depth(m): 1.00								
Sampling Date: 20-Mar-2026								
Determinand	SOP	HWOL Code	Accred.	Units				
Total Organic Carbon	2625		M	%	1.0	3	5	6
Loss On Ignition	2610		M	%	4.9	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.05	1	--	--
WAC Total C10-C40	5002	EH_2D_Total_#1	N	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	5003		N	mg/kg	< 0.1	100	--	--
pH at 20C	2010		M		7.2	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	< 0.0020	--	To evaluate	To evaluate
Eluate Analysis				10:1 Eluate mg/kg	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455		U	0.0035	0.035	0.5	2	25
Barium	1455		U	< 0.005	< 0.050	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0041	0.041	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0009	0.0090	0.5	10	30
Nickel	1455		U	0.0018	0.018	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		N	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	< 0.003	< 0.025	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.26	2.6	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	120	1200	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	4.0	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.1
WAC Sample Weight	683.6

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: Old Conna Phase 1

Chemtest Job No: 26-09996 Chemtest Sample ID: 2103260 Sample Ref: Sample ID: TP03 Client Reference: Top Depth(m): 0.00 Bottom Depth(m): 1.00 Sampling Date: 20-Mar-2026						Landfill Waste Acceptance Criteria Limits		
Determinand	SOP	HWOL Code	Accred.	Units		Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon	2625		M	%	0.69	3	5	6
Loss On Ignition	2610		M	%	3.3	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.05	1	--	--
WAC Total C10-C40	5002	EH_2D_Total_#1	N	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	5003		N	mg/kg	< 0.1	100	--	--
pH at 20C	2010		M		7.6	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.014	--	To evaluate	To evaluate
Eluate Analysis				10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455		U	0.0028	0.028	0.5	2	25
Barium	1455		U	< 0.005	< 0.050	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0021	0.021	0.5	10	70
Copper	1455		U	0.0030	0.030	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0006	0.0062	0.5	10	30
Nickel	1455		U	0.0012	0.012	0.4	10	40
Lead	1455		U	0.0018	0.018	0.5	10	50
Antimony	1455		N	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.007	0.073	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.21	2.1	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	30	300	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	5.3	53	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11
WAC Sample Weight	805.7

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: Old Conna Phase 1

Chemtest Job No: 26-09996 Chemtest Sample ID: 2103261 Sample Ref: Sample ID: TP04 Client Reference: Top Depth(m): 0.00 Bottom Depth(m): 1.00 Sampling Date: 20-Mar-2026						Landfill Waste Acceptance Criteria Limits		
						Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Determinand	SOP	HWOL Code	Accred.	Units				
Total Organic Carbon	2625		M	%	1.4	3	5	6
Loss On Ignition	2610		M	%	4.5	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.05	1	--	--
WAC Total C10-C40	5002	EH_2D_Total_#1	N	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	5003		N	mg/kg	< 0.1	100	--	--
pH at 20C	2010		M		7.3	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	< 0.0020	--	To evaluate	To evaluate
Eluate Analysis				10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455		U	0.0009	0.0095	0.5	2	25
Barium	1455		U	< 0.005	< 0.050	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0009	0.0087	0.5	10	70
Copper	1455		U	0.0016	0.016	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0011	0.011	0.5	10	30
Nickel	1455		U	0.0009	0.0086	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		N	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.005	0.047	4	50	200
Chloride	1220		U	1.3	13	800	15000	25000
Fluoride	1220		U	0.25	2.5	10	150	500
Sulphate	1220		U	1.3	13	1000	20000	50000
Total Dissolved Solids	1020		N	82	810	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	2.9	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	9.4
WAC Sample Weight	748.0

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: Old Conna Phase 1

Chemtest Job No: 26-09996 Chemtest Sample ID: 2103262 Sample Ref: Sample ID: TP05 Client Reference: Top Depth(m): 0.00 Bottom Depth(m): 1.00 Sampling Date: 20-Mar-2026						Landfill Waste Acceptance Criteria Limits		
						Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Determinand	SOP	HWOL Code	Accred.	Units				
Total Organic Carbon	2625		M	%	2.3	3	5	6
Loss On Ignition	2610		M	%	6.5	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.05	1	--	--
WAC Total C10-C40	5002	EH_2D_Total_#1	N	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	5003		N	mg/kg	< 0.1	100	--	--
pH at 20C	2010		M		7.6	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	< 0.0020	--	To evaluate	To evaluate
Eluate Analysis				10:1 Eluate mg/l	10:1 Eluate mg/kg	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1455		U	0.0024	0.024	0.5	2	25
Barium	1455		U	< 0.005	< 0.050	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0019	0.019	0.5	10	70
Copper	1455		U	0.0030	0.030	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0008	0.0078	0.5	10	30
Nickel	1455		U	0.0015	0.015	0.4	10	40
Lead	1455		U	0.0012	0.012	0.5	10	50
Antimony	1455		N	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.006	0.057	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.34	3.4	10	150	500
Sulphate	1220		U	1.0	10	1000	20000	50000
Total Dissolved Solids	1020		N	45	450	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	4.1	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10
WAC Sample Weight	781.1

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation	PL SW GW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW
2010	pH Value of Soils	pH at 20°C	pH Meter	
2015	Acid Neutralisation Capacity	Acid Reserve	Titration	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection	
2192	Asbestos Quantification in Soils Sediments Ballast & Aggregate Crushed Concrete & Demolition Rubble	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N-dimethyl-p-phenylenediamine.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8–C10 Aromatics: >C5–C7,>C7–C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS. Reported PCB 101 results may contain contributions from PCB 90 due to inseparable chromatography.	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
5002	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Hexane extraction / GCxGC FID detection	
5003	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Hexane / Acetone extraction GC-MS	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	
650	Characterisation of Waste (Leaching C2,C8,C10,WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Text example All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at $\leq 30^{\circ}\text{C}$ prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Where analysis is performed on a dried and crushed sample, it has been prepared by crushing all of the sample. If material has been removed prior to crushing, or by request of the client, this will be stated on the report.

NEW_ASB Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL

DURHAM Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - The required amount of sample for analysis was not received
- H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water (Non-Regulatory)
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

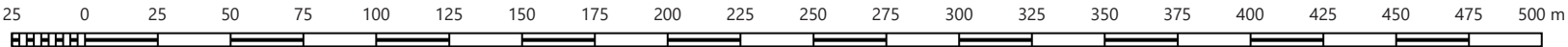
If you require extended retention of samples, please email your requirements to:
cs@etuki.eurofins.com

Appendix 12

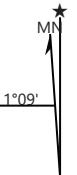
As-Surveyed Site Plan



26458 Old Connaught South Dublin - Phase 1

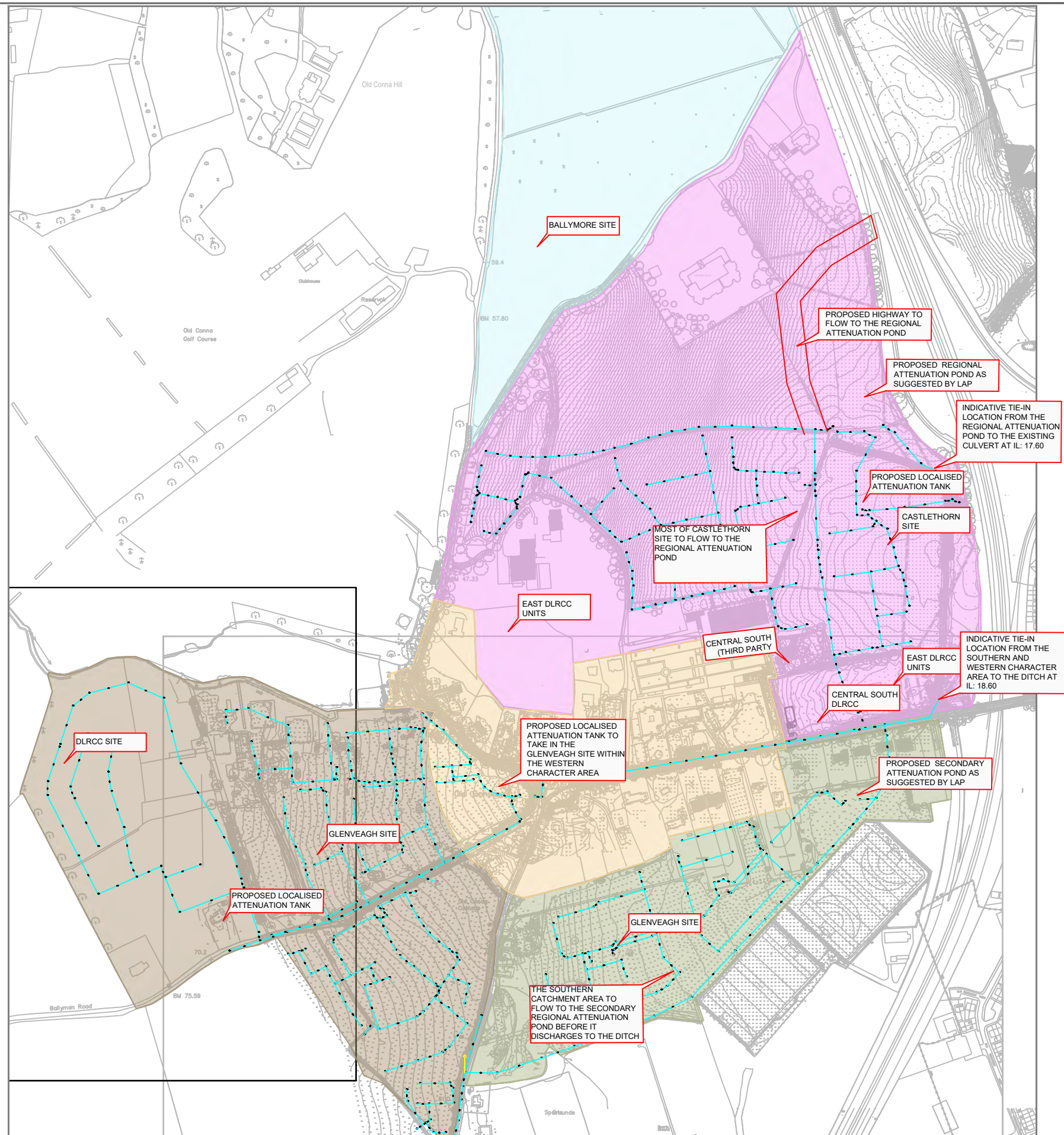


Scale: 1 : 2500.



Appendix G. LAP Storm Drainage Design





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GOVERNMENT OF IRELAND

ATKINS WILL NOT BE HELD LIABLE FOR THE
USE OF THIS DATA ON ANY PROJECT OTHER
THAN THE PROJECT:

Risk Level	Atkins Base Line - Low Risk
	Atkins Sensitive - Medium Risk
	Atkins Private - High Risk
	Client Critical - Already Marked

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ATKINS HOUSE, 150 AIRSIDE BUSINESS PARK,
SWORDS, DUBLIN, K67 K5W4.
Tel : +353 1 810 8000 Email : info.ie@atkinsrealis.com

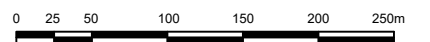
Atkins House, 150-155 Airside Business Park, Swords, Co. Dublin Tel (+353) 01 810 8000 Fax (+353) 01 810 8001	Unit 2B, 2200 Cork Airport Business Park, Cork Tel (+353) 021 429 0300 Fax (+353) 021 429 0360	1st Floor Technology House Parkmore Technology Park, Galway Tel (+353) 091 776 050 Fax (+353) 091 778 830
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Client

Project	
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GENERAL NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE
2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION



SCALE 1:2500 @ A1; 1:5000 @ A3

DRAFT

Purpose	FOR INFORMATION
---------	-----------------

Title	OLD CONNA LAP OVERALL STORM DRAINAGE STRATEGY
-------	--

Original Scale AS SHOWN	Drawn	Checked	Reviewed	Authorised
	PM	IPR	IPR	GH
	Date 20.11.25	Date 20.11.25	Date 20.11.25	Date 20.11.25

Status	Drawing Number	Rev
I		

Appendix H. UK SuDS Output



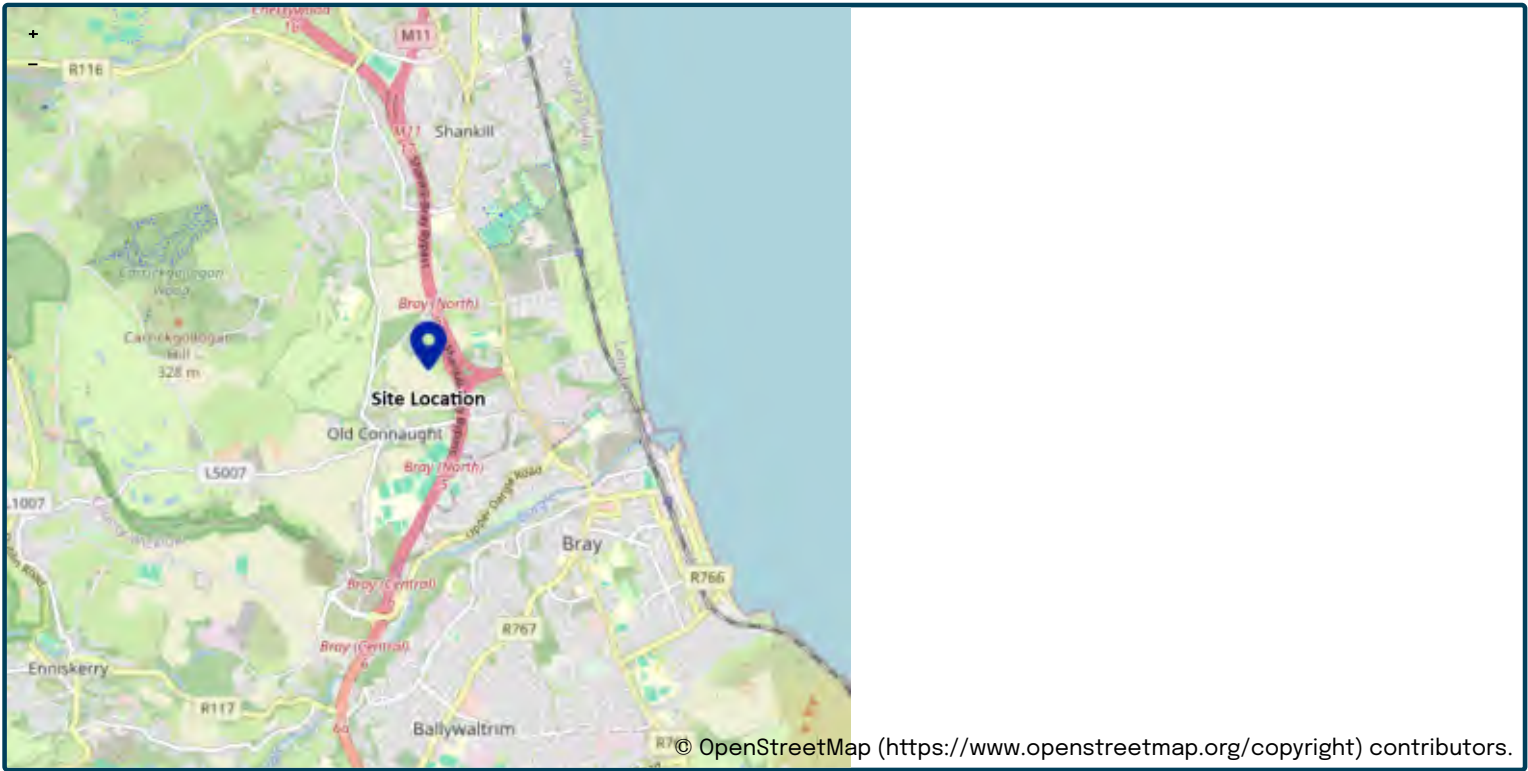
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	13/07/2026
Calculated by	
Reference	
Model version	2.2.3

Location

Site name	Catchment 1A
Site location	



Site easting (Irish Grid)	325088
Site northing (Irish Grid)	219558
Site easting (Irish Transverse Mercator)	725011
Site northing (Irish Transverse Mercator)	719587

Site details

Total site area (ha)	2.03	ha
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Greenfield runoff

Method

Method	IH124
--------	-------

IH124

	<u>My value</u>		<u>Map value</u>
SAAR (mm)	1010	mm	1010
How should SPR be derived?	WRAP soil type		
WRAP soil type	4		2
SPR	0.47		
QBar (IH124) (l/s)	15.1	l/s	

Growth curve factors

	<u>My value</u>		<u>Map value</u>
Hydrological region	12		12
1 year growth factor	0.85		
2 year growth factor	0.95		
10 year growth factor	1.72		
30 year growth factor	2.13		
100 year growth factor	2.61		
200 year growth factor	2.86		

Results

Method	IH124	
Flow rate 1 year (l/s)	12.8	l/s
Flow rate 2 year (l/s)	14.3	l/s
Flow rate 10 years (l/s)	25.9	l/s
Flow rate 30 years (l/s)	32.1	l/s
Flow rate 100 years (l/s)	39.3	l/s
Flow rate 200 years (l/s)	43.0	l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.3) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com/) (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

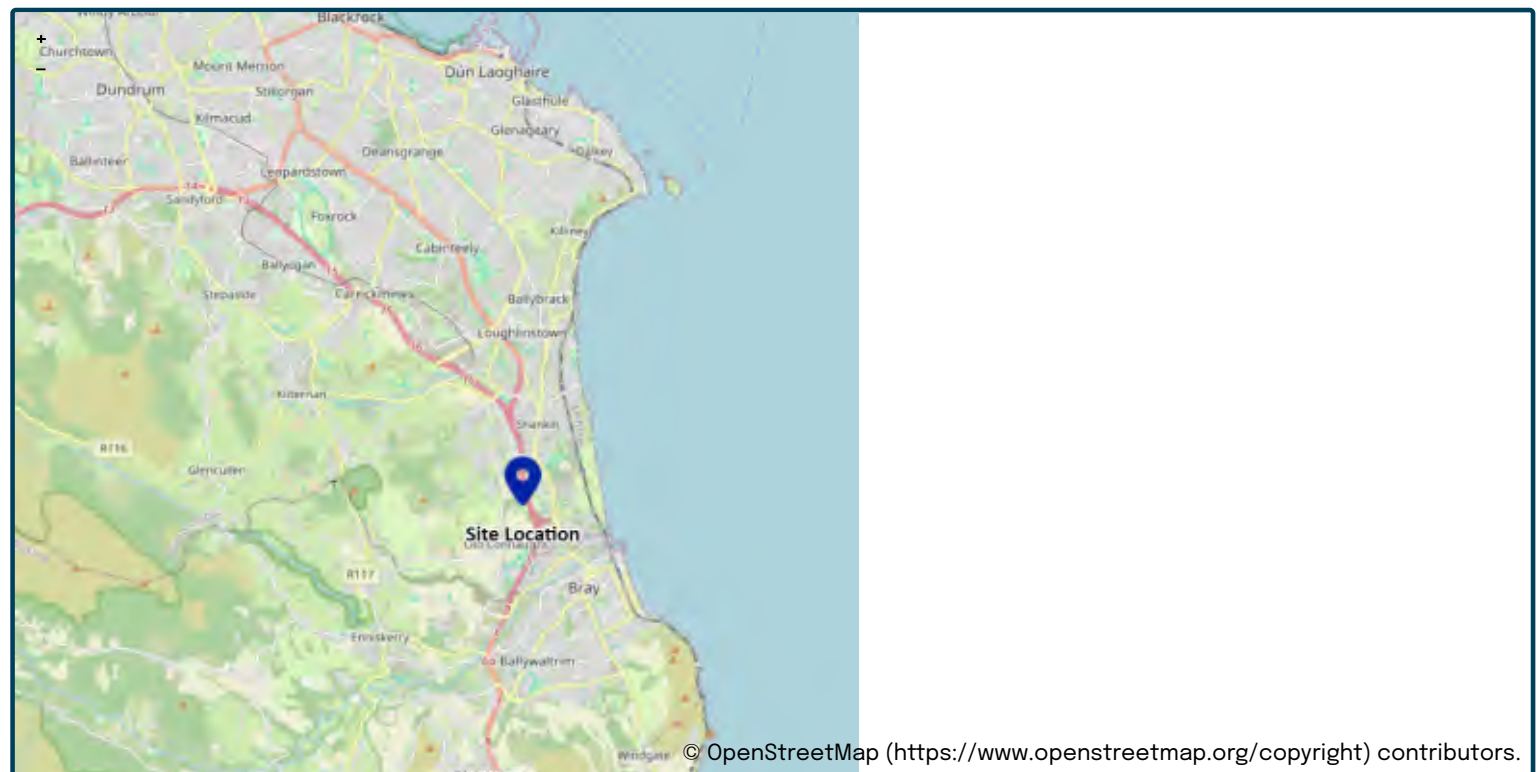
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	13/07/2026
Calculated by	
Reference	
Model version	2.2.3

Location

Site name	Catchment 1B
Site location	



Site easting (Irish Grid)	325088
Site northing (Irish Grid)	219558
Site easting (Irish Transverse Mercator)	725011
Site northing (Irish Transverse Mercator)	719587

Site details

Total site area (ha)	2.71	ha
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Greenfield runoff

Method

Method	IH124	
IH124		
	<u>My value</u>	<u>Map value</u>
SAAR (mm)	1010 mm	☐ 1010
How should SPR be derived?	WRAP soil type	
WRAP soil type	3 ☐	2
SPR	0.37	
QBar (IH124) (l/s)	12 l/s	

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	12	☐ 12
1 year growth factor	0.85	
2 year growth factor	0.95	
10 year growth factor	1.72	
30 year growth factor	2.13	
100 year growth factor	2.61	
200 year growth factor	2.86	

Results

Method	IH124	
Flow rate 1 year (l/s)	10.2	l/s
Flow rate 2 year (l/s)	11.4	l/s
Flow rate 10 years (l/s)	20.6	l/s
Flow rate 30 years (l/s)	25.5	l/s
Flow rate 100 years (l/s)	31.2	l/s
Flow rate 200 years (l/s)	34.2	l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.3) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Appendix I. Underground Modular Attenuation Tank Designs.



User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	
Engineer:	Indhu Rajavadivelu
Project Location:	
Measurement Type:	Metric
Required Storage Volume:	1350.00 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	339 mm.
Stone Above Chambers:	351 mm.
Design Constraint Dimensions:	(18.01 m. x 71.01 m.)

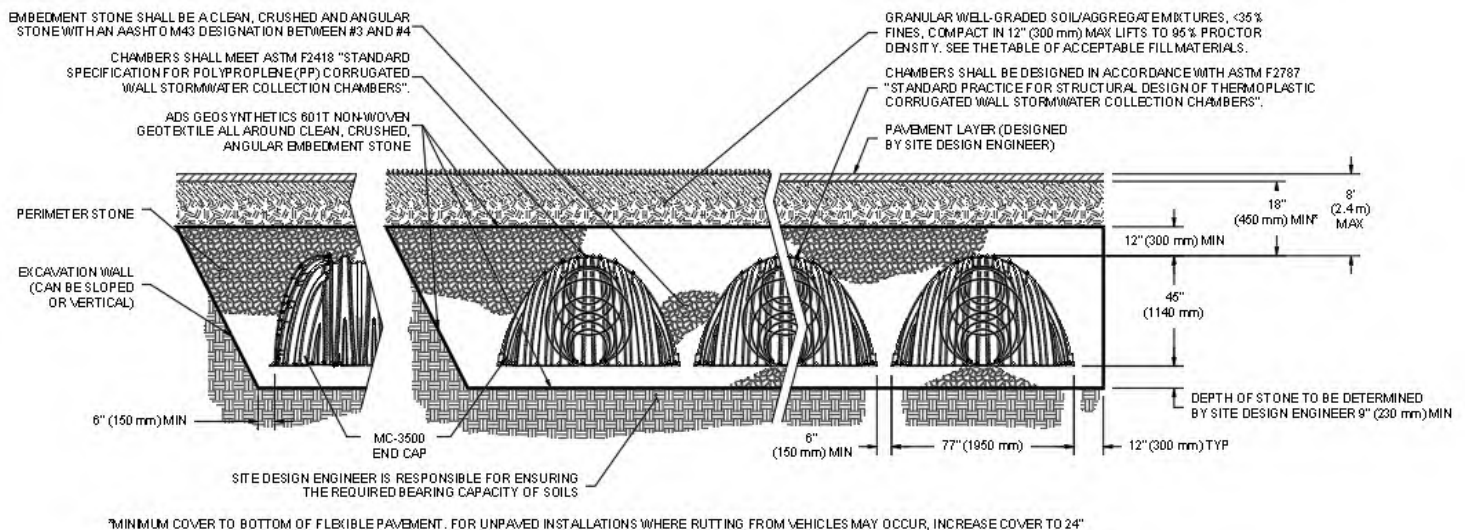
Results

System Volume and Bed Size

Installed Storage Volume:	1362.56 cubic meters.
Storage Volume Per Chamber:	3.12 cubic meters.
Number Of Chambers Required:	247
Number Of End Caps Required:	16
Chamber Rows:	8
Maximum Length:	70.72 m.
Maximum Width:	17.51 m.
Approx. Bed Size Required:	1226.35 square meters.
Average Cover Over Chambers:	N/A .

System Components

Amount Of Stone Required	
(0% Overage):	1471 cubic meters
(Cubic yard to ton factor:1.4):	2692.01 tons
Volume Of Excavation (Not Including Fill):	2246 cubic meters
Total Non-woven Geotextile Required:	3331 square meters
Woven Geotextile Required (excluding Isolator Row):	122 square meters
Woven Geotextile Required (Isolator Row):	221 square meters
Total Woven Geotextile Required:	343 square meters
Impervious Liner Required:	0 square meters



Appendix J. Surface Cover Type Table



Surface Cover Type Table

Table 2-2 Surface Cover Type - Completed by Scheme Designer

Surface Cover Type	Area (m ²)
*Wetland or open water (semi-natural; not chlorinated) maintained or established on site.	1318m²
*Semi-natural vegetation (e.g. hedgerows, trees, woodland, species-rich grassland) maintained or established on site.	3631m²
*Reuse of existing soils and seed source to develop vegetation cover	4625m²
*Standard trees planted in connected tree pits with a minimum soil volume equivalent to at least two thirds of the projected canopy area of the mature tree.	103 No. Tress
*Standard trees planted in pits with soil volumes less than two thirds of the projected canopy area of the mature tree.	77 No. Trees
Intensive green roof or vegetation over structure. Substrate minimum settled depth of 150mm.	200.88m²
Non intensive Brown Roof (Biodiversity Roof). Substrate minimum settled depth of 150mm. Design will be site specific and developed by a suitably qualified ecologist.	N/A
Extensive green roof with substrate of minimum settled depth of 80mm (or 60mm beneath vegetation blanket)	N/A
Extensive green roof of sedum mat or other lightweight systems	3107.14m²
*Green wall –modular system or climbers rooted in soil.	N/A
Rain gardens and other vegetated sustainable drainage elements.	5848m²
*Flower-rich perennial planting.(Ornamental Planting including Rain Gardens)	4130m²
*Hedges (line of mature shrubs one or two shrubs wide). Car Park Hedge	61m²
*Hedgerows or double hedgerow of native species (may have an associated ditch and bank)All proposed native hedgerows with and without trees	431m²
*Groundcover planting.	N/A
*Amenity grassland entire area or sections managed for lesser mowing frequencies for pollinators (e.g. six week meadow) Wildflowers	8152m²
*Amenity grassland (species-poor, regularly mown lawn, Back Gardens).	4799m²
Water features (chlorinated) or unplanted detention basins.	1318m²
Permeable paving.	2981m²
Sealed surfaces (e.g. concrete, asphalt, waterproofing, stone)	17845m²
Blue roof	N/A

S

Appendix K. SuDS Audit Review



Old Connaught Phase 1

Stage 1 Stormwater Audit

262197-PUNCH-XX-XX-RP-C-0001

July 2026

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1 Introduction

1.1 Purpose of Report

This report presents a Stage 1 Stormwater Audit carried out for a proposed residential development at Allies River Road, Old Connaught, Co. Dublin.

AtkinsRéalis (The Scheme Design Engineer) was appointed by Castlethorn Old Conna ULC to provide Engineering Services, which includes design of the surface water network and associated sustainable drainage systems (SuDS) proposed.

PUNCH Consulting Engineers have been appointed to carry out a Stage 1 Stormwater Audit in line with Dún Laoghaire-Rathdown County Council requirements.

1.2 Site Details

The proposed site is located within the client land ownership within the Old Connaught LAP. The land is bounded to the west of the M11 corridor, North of Old Connaught Avenue, and east of existing residential areas in Old Connaught. The site extends across the central and eastern fields of Old Connaught and includes frontage onto Old Connaught Avenue to the south.

The existing topographical levels within the proposed site range from approximately 24.23mOD at the North-West Boundary, which is the highest point to around 18.89mOD at the lowest point in the southwest. Overall, the ground levels fall gradually across the site, sloping from the North-west area towards the South-West.

The hydrological environment of the area is influenced by Crinken Stream (EPA Code: 10R18) c. 326m to the North-East of the proposed site, Dargle Stream (EPA Code: 10D01) c.780m South-East of the proposed site, and the Irish Sea c.1.5km East of the proposed site.

1.3 Report Details

The audit was carried out by Jennings Chikomba, Khathutshelo Manavhela, and Donal Gallery between the dates of July 14th and July 17th, 2026.

This Stage 1 Stormwater Audit has been carried out in accordance with the Dún Laoghaire-Rathdown County Council (DLRCC) procedures outlined in the Dun Laoghaire Rathdown Development Plan 2022–2028, Appendix 7 “Stormwater Management Policy – Including Stormwater Audit Procedure”. The auditor has examined only those issues within the design relating to surface water drainage and Sustainable Drainage Systems (SuDS) implications of the scheme and has therefore not examined or verified the compliance of the design to any other criteria. Design responsibility for the stormwater drainage and SuDS remains solely with The Engineer.

Appendix A contains the Stage 1 Stormwater Audit Feedback form. Appendix B contains copies of drawings and documents examined by the auditor. All findings outlined in Section 2 of this report are considered by the auditor to require action to improve the stormwater credentials of the scheme.

1.4 Drawings & Documents Reviewed

Drawings:

1. ATK-ZZ-ZZ-DR-CE-900100 SITE LOCATION MAPS
2. ATK-ZZ-ZZ-DR-CE-900103 PROPOSED SUB-CATCHMENT AREAS LAYOUT PLAN
3. ATK-ZZ-ZZ-DR-CE-900500 PROPOSED STORM DRAINAGE OVERALL PLAN
4. ATK-ZZ-ZZ-DR-CE-900503 PROPOSED REGIONAL ATTENUATION POND SECTION
5. ATK-ZZ-ZZ-DR-CE-900504 PROPOSED EXTENSIVE GREEN ROOF LAYOUTS
6. ATK-ZZ-ZZ-DR-CE-900505 PROPOSED FLOOD FLOW PATHS LAYOUT PLAN
7. ATK-ZZ-ZZ-DR-CE-900510 PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 1
8. ATK-ZZ-ZZ-DR-CE-900511 PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 2
9. ATK-ZZ-ZZ-DR-CE-900512 PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 3
10. ATK-ZZ-ZZ-DR-CE-900513 PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 4
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12. ATK-ZZ-ZZ-DR-CE-900515 PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 6
13. ATK-ZZ-ZZ-DR-CE-909001 STANDARD CONSTRUCTION DETAILS - SHEET 1
14. ATK-ZZ-ZZ-DR-CE-909002 STANDARD CONSTRUCTION DETAILS - SHEET 2
15. ATK-ZZ-ZZ-DR-CE-909003 STANDARD CONSTRUCTION DETAILS - SHEET 3
16. ATK-ZZ-ZZ-DR-CE-909004 STANDARD CONSTRUCTION DETAILS - SHEET 4
17. ATK-ZZ-ZZ-DR-CE-909005 STANDARD CONSTRUCTION DETAILS - SHEET 5
18. ATK-ZZ-ZZ-DR-CE-909006 STANDARD CONSTRUCTION DETAILS - SHEET 6
19. ATK-ZZ-ZZ-DR-CE-909007 STANDARD CONSTRUCTION DETAILS - SHEET 7
20. ATK-ZZ-ZZ-DR-CE-909008 STANDARD CONSTRUCTION DETAILS - SHEET 8

Reports and other Documents:

1. 0126446DG0009 rev 4 - Storm Water Impact Assessment Report
2. 0126446DG0010 rev 3 - Stage 1 FRA

2 Stage 1 Audit Findings

2.1 General Requirements as per DLRCC County Development Plan 2022–2028

Table 2–1 below outlines the result of a review of the scheme designer's proposals against the general requirements outlined in the DLRCC County Development Plan 2022–2028, Appendix 7, section 7.1.1.

Table 2–1 General Requirements for all developments greater than a single house

	Requirements as per DLRCC 2022–2028 Development Plan	Addressed by Scheme Designer?
2.1.1	Climate Change All developments must apply a minimum factor of 1.2 to their drainage design and attenuation volumes to accommodate climate change.	Y
2.1.2	Urban Creep All developments must apply a factor of 1.1 to their drainage design and attenuation volumes to accommodate urban creep.	Y
2.1.3	Blockage Analysis Scheme Designers must submit details of the proposed surface water drainage system in the event of blockage or partial blockage of the system, commenting on any surcharging or flood risk that may be identified, particularly in relation to freeboard used in the simulation analysis. The proposal must include a drawing confirming that safe overland flow routes do not negatively impact properties both within and without the site. The overland flow route plan should identify drop kerbs or ramps required for channelling the flow and address low point areas in the site and detail how properties, both within the development and on adjacent lands, will be protected in the event of excessive overland flows.	Y
2.1.4	Utility Clash Check The Scheme Designer must undertake a utilities clash check to ensure all utilities' vertical and horizontal separation distances can be provided throughout the scheme. The Scheme Designer should demonstrate this with cross-sections at critical locations such as junctions, site thresholds and connection points to public utilities. Minimum separation distances must be in accordance with applicable Codes of Practice.	Highlighted as part of Section 2.3 of this audit.
2.1.5	Private Drains Where an applicant's land is crossed by a private drain, the applicant is responsible for acquiring any rights or permissions necessary to connect to, or to increase the discharge into, or to build over, or divert, or to ensure the adequate capacity is not exceeded, or otherwise alter any private drains not in their exclusive ownership or control, and for ensuring their adequacy.	Highlighted as part of Section 2.4 of this audit.
2.1.6	Pumping of Surface Water	N/A
2.1.7	Sustainable Drainage Systems (SuDS): The proposal must demonstrate that they meet the requirements of the Greater Dublin Strategic Drainage Study (GSDS) policies in relation to Sustainable Drainage Systems (SuDS). The design must incorporate SuDS measures appropriate to the scale of the	Highlighted as part of Section Error! Reference source

	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. The Scheme Designer should provide cross-sections and long-sections, and commentary that demonstrates all proposed SuDS measures have been designed in accordance with the relevant industry standards and the recommendations of The SuDS Manual (CIRIA C753)	not found. to 2.6 of this audit.
2.1.8	Infiltration: The Scheme Designer should submit Site Investigation Report and results, including infiltration tests, and a plan showing the trial pits/soakaway test locations across the site. The report should address instances where groundwater, if any, was encountered during testing and its impact.	Highlighted as part of Section 2.7 of this audit.
2.1.9	Hardstanding/Parking Areas: All proposed parking and hardstanding areas should maximise local infiltration before discharge to the surface water drainage system, via a specifically designed permeable paving/porous asphalt system, in accordance with the requirements of Section 12.4.8 of the County Development Plan 2022-2028.	Y
2.1.10	Basement: If basement carparking is provided, then all incidental run-off from the basement should be shown to drain to the foul system and not the surface water system	N/A
2.1.11	Run-off Factors: Where Scheme Designers propose to use reduced run-off factors (or reduced impermeable contributing areas) for areas of their site that drain to SuDS measures these factors must be agreed with Municipal Services, preferable during the pre-planning process. It should be noted that standard surface water simulation software uses default Cv values of 0.84 for Winter and 0.75 for Summer. If the Scheme Designer proposes to use their own reduced run-off rates, then the default Cv values should be amended to a value of 1.0. Maintaining the default Cv values in conjunction with the Scheme Designers proposed rates reduces the run-off in simulations of rainfall events, giving inaccurate simulation results which may lead to under sizing of the drainage system and attenuation storage required.	Y
2.1.12	Hydrological Parameters Scheme Designers must use site specific or local data in their Qbar, attenuation volume and surface water system design such as: • SAAR • Soil Type • Rainfall Return Period Table (available from MET Eireann) • Rainfall intensity • Other hydrological parameters	Y
2.1.13	Discharge Rate: Surface Water discharge from a development must be restricted to 2 l/s/ha or the calculated Qbar, whichever is greater. The Qbar should be calculated using the net area drained and not the gross area of the site (i.e. red line boundary). This discharge rate should be marked on the drainage drawing on the manhole in which the flow restricting device is located. The manhole in which the flow restricting device is located should not have a bypass pipe and, a penstock and silt trap should be provided. Flow restricting devices with an orifice of less than 50mm in diameter should be avoided. Where this is not possible then the Scheme Designer must submit a robust maintenance regime to ensure blockages are avoided, to the satisfaction of dlrc. Scheme Designers are recommended to use the HR	Highlighted as part of Section Error! Reference source not found. of this audit.