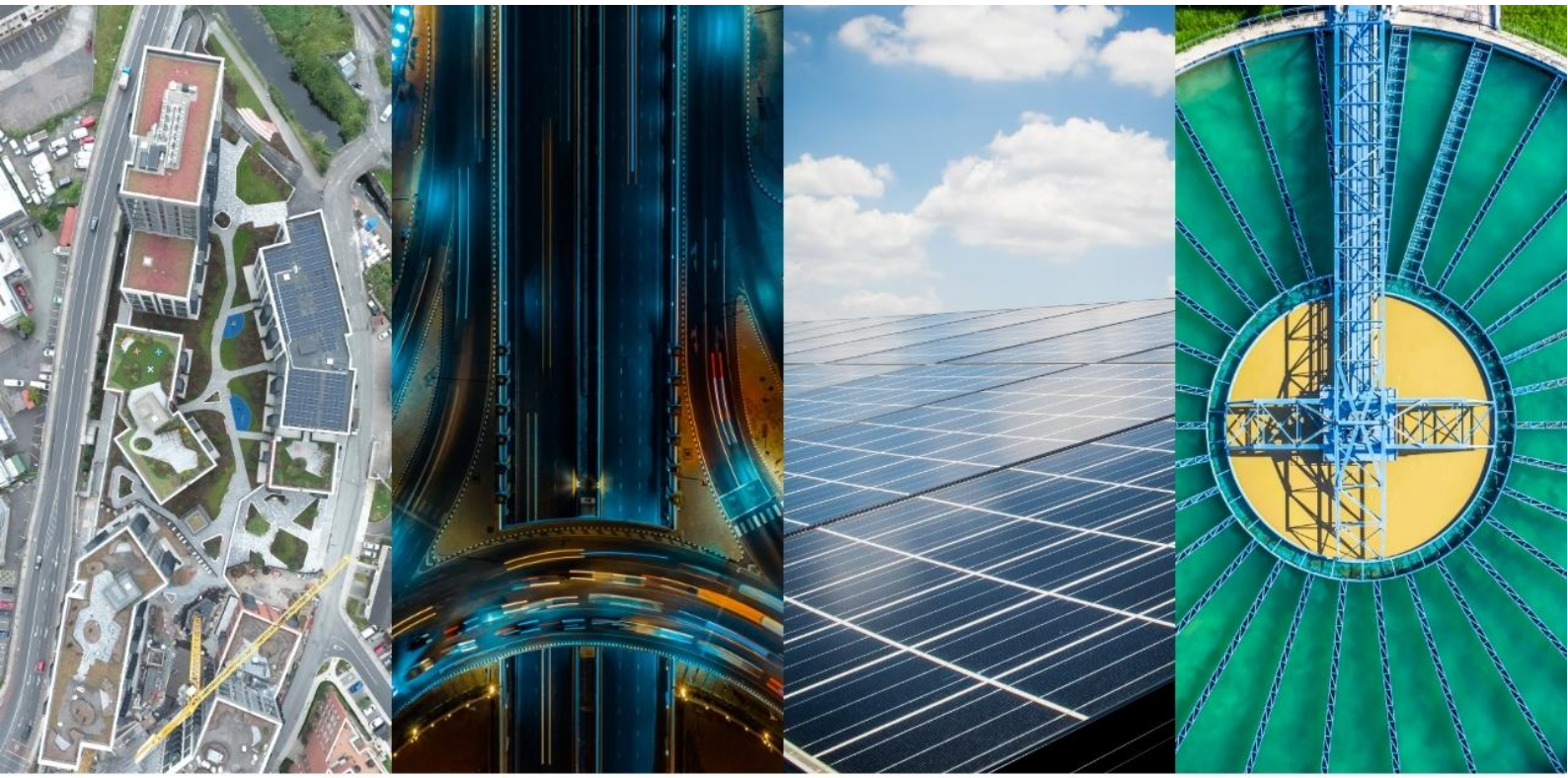
PHASE 1 LRD DEVELOPMENT AT 'THE FARM', BESSBOROUGH, BALLINURE, CORK

Drainage Impact Assessment

02 December 2025



Formerly JB Barry & Partners who became part of Egis in 2023.

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1 INTRODUCTION

1.1 General

Egis were engaged by Estuary View Enterprises 2020 Ltd to undertake a Drainage Impact Assessment (DIA) to support an LRD planning application at 'The Farm', Bessborough, Ballinure, Cork.

The purpose of this Drainage Impact Assessment Report is to provide details of the surface water management proposals associated with the proposed development. The proposed development is enclosed within the redline boundary as indicated in Figure 1-1 below.



FIGURE 1-1: LOCATION OF PROPOSED DEVELOPMENT

1.2 Proposed Development

The proposed development provides for the demolition of 10 no. existing agricultural buildings /sheds and log cabin residential structures and the construction of a residential development of 140 no. residential apartment units over 2 no. retained and repurposed farmyard buildings (A & B) with single storey extension and 3 no. new blocks of 3-5 storeys in height, with supporting resident amenity facilities, crèche, and all ancillary site development works. The proposed development includes 140 no. apartments to be provided as follows: Block C (9 no. 1-bedroom and 25 no. 2-bedroom over 3 storeys), Block D (34 no. 1-bedroom & 24 no. 2-bedroom over 3-4 storeys), Block E (27 no. 1-bedroom, 20 no. 2-bedroom & 1 no. 3-bedroom over 4-5 storeys). It is proposed to use retained Block A and Block B for resident amenities which include home workspace, library, lounge and function space.

The proposal includes for new pedestrian access to Bessborough Estate to the north including upgrades to an existing pedestrian crossing on Bessborough Road.

The proposed development provides for outdoor amenity areas including publicly accessible parkland, landscaping, surface car parking, bicycle parking, bin stores, substation, public lighting, roof mounted solar panels, wastewater infrastructure including new inlet sewer to the Bessborough Wastewater Pumping Station to the west, surface water attenuation, water utility services and all ancillary site development works. Vehicular access to the proposed development will be provided via the existing access road off the Bessborough Road.

A detailed description of the proposed development is provided in the Planning Report and enclosed with the submission package.

1.3 Topographical Survey

The proposed development is located at Phase 1 'The Farm', Bessborough, Ballinure, Cork, on a circa 5.1-hectare site, with a developable area of 4.28-hectares, see Figure 1.1. This proposed development will form Phase 1 of a larger development on a circa 16.59-hectare site.

The South Ring Road (N40) is located approximately 250m from the southern boundary of the proposed development. The boundaries of the site are formed by the buildings, outbuildings, roads and open spaces of the overall Bessborough complex. The site slopes gently from north to south, with ground levels falling from approximately 18.00 m OD in the north-east of the site to 10.50 m OD in the south-west of the site.

1.4 Existing Surface Water Drainage

Cork City Council drainage records indicate there is an existing 1350mmØ trunk storm sewer located approximately 200m to the west of the Phase 1 site, outside the boundary of the Applicant's lands, which runs in a north-south direction before crossing under the South Ring Road (N40) and discharging to the Douglas Estuary, see Appendix 4.

A feasibility study of the local area has revealed that there is an existing 225mmØ storm sewer in the road adjacent to the eastern boundary of the site (increasing downstream to a 450mm/750mmØ), which runs north to south before turning in a westerly direction and connecting to the 1350mmØ storm sewer described above, see as-built drawing in Appendix 1. This sewer was constructed under planning reference 03/27028.

1.5 Desktop Study

1.5.1 Existing Geology and Groundwater Vulnerability

The proposed development site does not contain any mapped watercourse. The nearest watercourse to the proposed Phase 1 development site is the Douglas Estuary which is located approximately 250m to the south of the site. The Douglas Estuary flows in an easterly direction and discharges to transitional water body Lough Mahon to the south of the site. The main hydrological features associated with the site are presented in Figure 1-2 below.

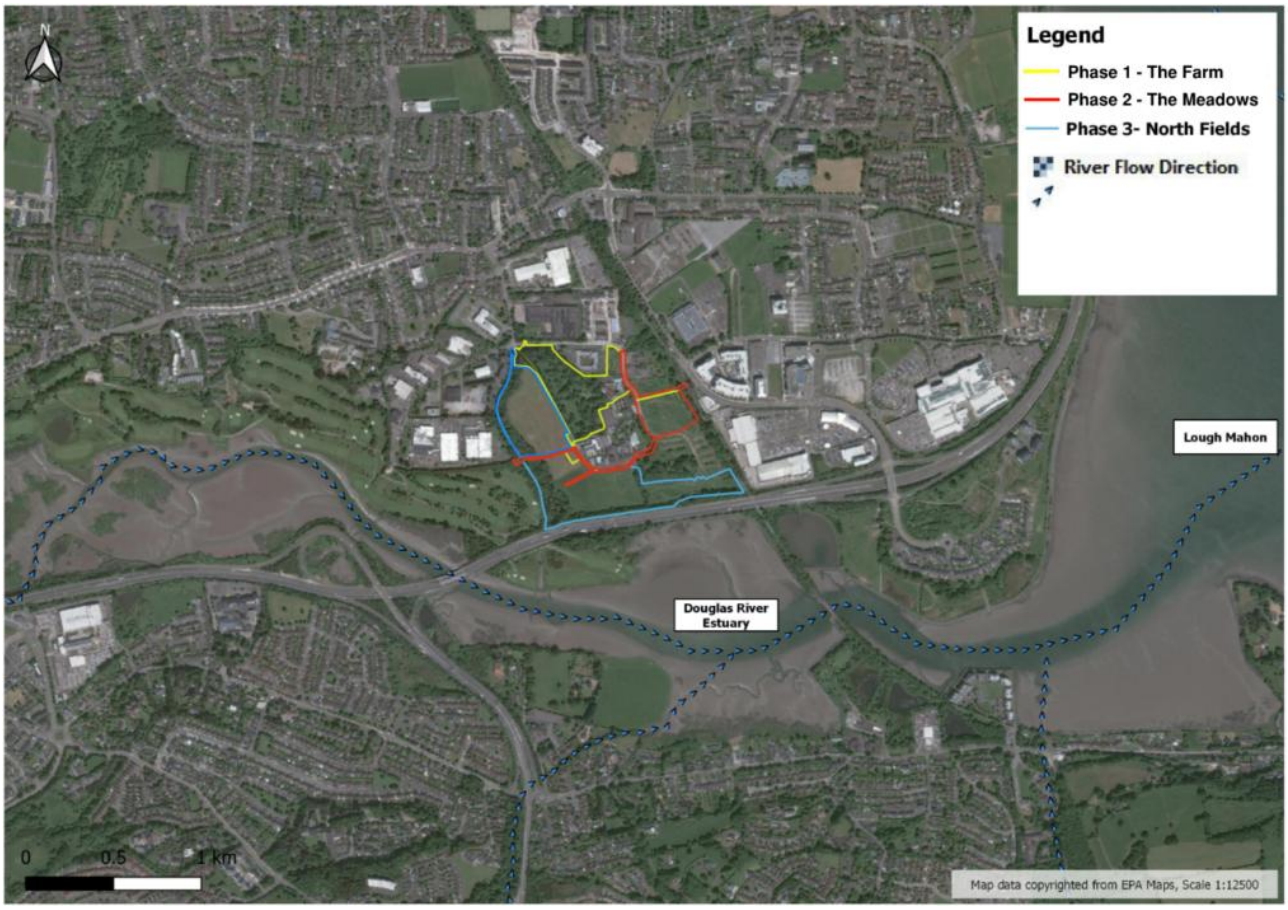


FIGURE 1-2: HYDROLOGICAL FEATURES OF THE AREA

The Geological Survey of Ireland (GSI) website provides information on their public online mapping service at www.gsi.ie on subsoil type. The map presented in Figure 1-3 depict the subsoil type for the proposed development site, indicating the site primarily sits on limestone.



FIGURE 1-3: GSI SUBSOIL MAPPING (SOURCE: WWW.GSI.IE, ANNOTATION BY EGIS)

Furthermore, the interactive web-mapping site classifies the aquifer vulnerability for the site to be *high vulnerability* (Figure 1-4). The GSI state that "Vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities". The GSI further describes that the vulnerability of groundwater depends on:

- The time of travel of infiltrating water (and contaminants);
- The relative quantity of contaminants that can reach the groundwater; and
- The contaminant attenuation capacity of the geological materials through which the water and contaminants infiltrate.



FIGURE 1-4: GSI AQUIFER VULNERABILITY MAPPING (SOURCE: WWW.GSI.IE, ANNOTATION BY EGIS)

1.5.2 Infiltration Capacity of Soils

The rate at which infiltration occurs largely depends on the soil properties and underlying geology through which the water is discharged. The capacity of the soil to infiltrate water is given by the infiltration coefficient, which is a long-term infiltration rate into the soil divided by the area of infiltration. This is related to the soil's permeability.

A geological desk study was completed to gain an initial understanding of the ground conditions. The soil permeability is categorised as 'moderate', see Figure 1-5 below.

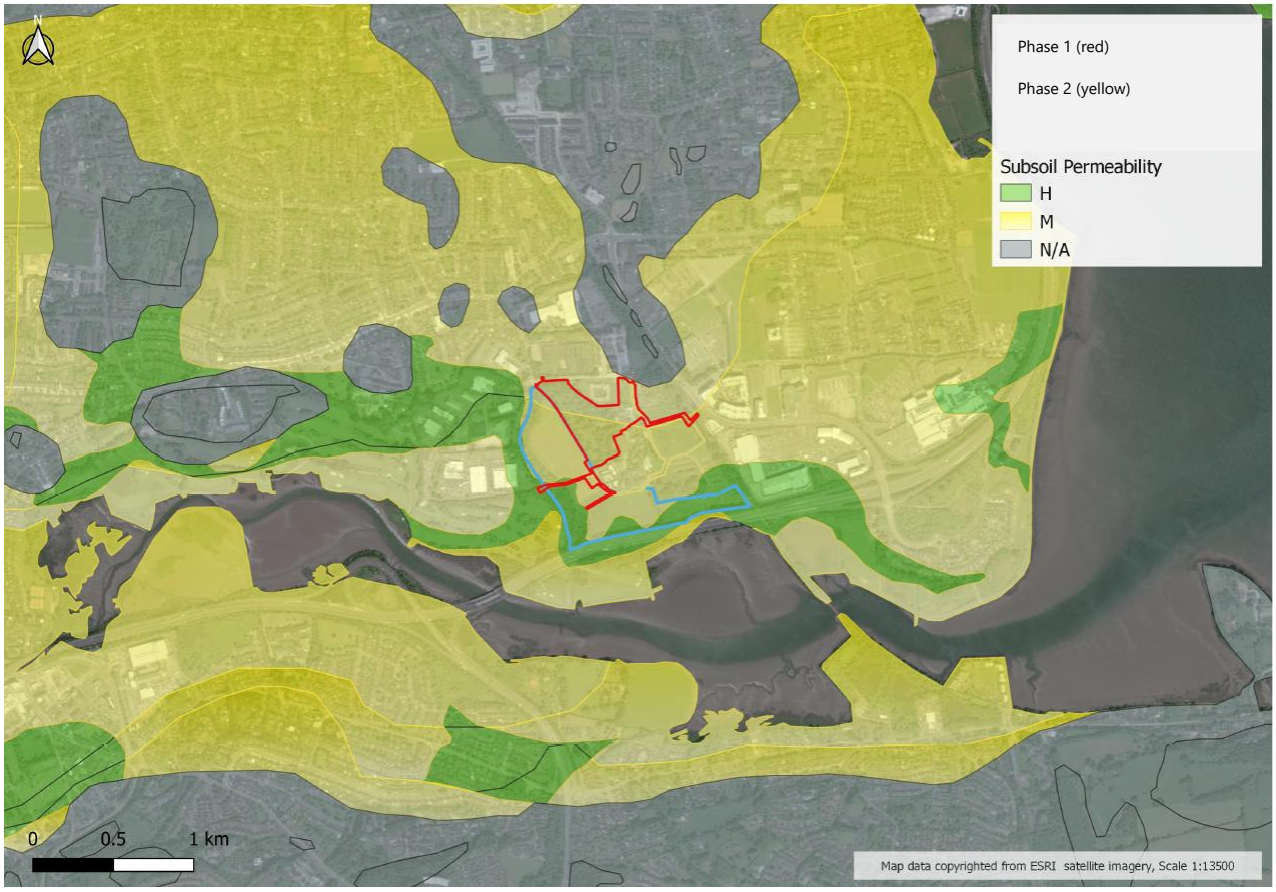


FIGURE 1-4 - SOIL PERMEABILITY (SOURCE: GSI, ANNOTATION BY EGIS)

1.6 On-Site Testing

A ground investigation was undertaken by Priority Geotechnical Ltd. in January 2022 to establish subsurface conditions at the proposed project site. An infiltration test was conducted in one of the boreholes (BH03), see Appendix 3, which resulted in an infiltration rate of $1.12x10^{-3}$ m/s. An infiltration test was also conducted in one of the boreholes (BH05), on the Phase 2 site which saw no drop in water level after 60 minutes. Due to the inconsistency of results, we have conservatively assumed there will be no reduction in runoff volumes applied for the various SuDS measures. However, it has been assumed that the first flush, 5mm of rainfall can be infiltrated to ground in specific areas designated for interception purposes, which is explained in greater detail below. Further infiltration testing in accordance with BRE 365 will be conducted in due course to determine accurate results.

TABLE 1-2 – CIRIA C753 INFILTRATION COEFFICIENTS

TABLE 25.1 Typical infiltration coefficients based on soil texture (after Bettess, 1996)

Soil type/texture	ISO 14688-1 description (after Blake, 2010)	Typical infiltration coefficients (m/s)
Good infiltration media		
• gravel	Sandy GRAVEL	$3 \times 10^{-4} – 3 \times 10^{-2}$
• sand	Slightly silty slightly clayey SAND	$1 \times 10^{-5} – 5 \times 10^{-5}$
• loamy sand	Silty slightly clayey SAND	$1 \times 10^{-4} – 3 \times 10^{-5}$
• sandy loam	Silty clayey SAND	$1 \times 10^{-7} – 1 \times 10^{-5}$
Poor infiltration media		
• loam	Very silty clayey SAND	$1 \times 10^{-7} – 5 \times 10^{-6}$
• silt loam	Very sandy clayey SILT	$1 \times 10^{-7} – 1 \times 10^{-5}$
• chalk (structureless)	N/A	$3 \times 10^{-8} – 3 \times 10^{-6}$
• sandy clay loam	Very clayey silty SAND	$3 \times 10^{-10} – 3 \times 10^{-7}$
Very poor infiltration media	–	
• silty clay loam	–	$1 \times 10^{-8} – 1 \times 10^{-6}$
• clay	Can be any texture of soil	$< 3 \times 10^{-8}$
• till	described above	$3 \times 10^{-9} – 3 \times 10^{-6}$
Other		
• rock* (note mass infiltration capacity will depend on the type of rock and the extent and nature of discontinuities and any infill)	N/A	$3 \times 10^{-9} – 3 \times 10^{-5}$

1.7 Flood Risk and Predictive Food Extent Mapping

Development on a greenfield site has the potential to increase flood risk elsewhere by:

- Causing a decrease in the volume of available flood storage
- Increasing the rate and volume of runoff to existing areas downstream

A Flood Risk Assessment Report for the proposed development is included within the planning pack which provides further details on this topic, a summary of which is as follows:

- The Douglas Estuary flows in an easterly direction and discharges to Lough Mahon to the south of the site. Historical flood data gathered from *www.floodmaps.ie* has indicated that the there is no history of flooding at the site.
- The CFRAMS Map and Cork City Council Flood Map both indicate that lies outside of Flood Zones A and B and can therefore be considered to be located within **Flood Zone C.**
- The type of development is defined as 'Highly Vulnerable Development'. Using the sequential approach mechanism, it is assessed that a justification test is not required for the proposed development.

2 SURFACE WATER DRAINAGE STRATEGY

2.1 Principal Design Consideration

The following design principles for surface water management including SuDS were considered in preparation for the proposed storm water drainage system for the proposed development:

- CIRIA report C753 The SuDS Manual -v6
- Greater Dublin Strategic Drainage Study (GDSDS)
- Nature Based Management of Urban Rainwater and Urban Surface Water Discharges - Department of Housing, Local Government and Heritage.
- Implementation of Urban Nature-Based Solutions Guidance Document for Planners, Developers and Developer Agents — LAWPRO.

2.1.1 Method of Design

The total developable site area is 4.28-hectares however this includes large open space and treed areas along the western and northern boundaries which will remain undeveloped and therefore will not be positively drained to the development surface water drainage system, and these areas are excluded from the surface water calculations of Qbar. In this context a figure of 1.48ha is used for the site area.

The attenuation facilities for the proposed phase are sized to cater for a 100-year storm event with a 20% climate change allowance added and a controlled discharge equal to the 1 in 1 year storm greenfield runoff rate for the site. The drainage calculations were carried out using MicroDrainage from Innovyze, which is the most widely used drainage design software in the UK and Ireland. The software uses the 'Modified Rational Method' to calculate run off from an impermeable area for a storm of a particular return period.

As noted above, SuDS drainage design shall be developed as a first preference and in accordance with the SuDS hierarchy. Direct discharge to an existing watercourse or drainage network shall only be considered where an appropriate SuDS scheme cannot be developed due to ground conditions or other local constraints, however in such a case online attenuation will be included to control the discharge rate as appropriate. SuDS design for the proposed development is discussed below.

2.2 Proposed Sustainable Urban Drainage (SuDS) Strategy

The SuDS Manual (CIRIA Report C753) -v6 is the current best practice guidance document which promotes sustainable surface water management through the use of SuDS. The four main attributes of a successful SuDS, are described in the SuDS Manual as follows:

- Control of runoff quantity;
- Management of runoff quality;
- Creating improved amenity; and
- Promoting biodiversity.

The SuDS Manual identifies a "management train" for runoff (also known as a preference hierarchy):

- Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hardstanding);
- Source Control – control of runoff at or very near its source (such as the use of soakways and rainwater harvesting);
- Site Control – management of water from several sub-catchments (including routing water from roofs and car parks to one/ several large soakaways for the whole site); and
- Regional Control – management of runoff from several sites, typically in a retention pond or wetland.

The CIRIA SuDS Manual recommends that when considering SuDS solutions, the preferred approach should be to manage runoff using Source scale solutions where reasonably practicable. Where Source type of solutions

cannot fully address an increase in runoff from a development, residual flows are discharged to be managed at the Site and Regional Controls.

Throughout the design when selecting the best solution, the SuDS Management Train is taken into consideration as well as maintenance aspects of each SuDS element. Well-designed SuDS are rarely used for a single function, hence it is noted that SuDS can be designed with different functions: water conservation and re-use (collection and re-use of surface water), infiltration (encourage stormwater to soak into the ground), detention/ attenuation (temporary storage of runoff and slow down flow), retention (permanent storage of runoff), filtration (runoff passes through a filter layer to remove pollutants) and conveyance of runoff.

2.2.1 SuDS Appraisal

The SUDS selection process used for this site is in accordance with SUDS selection flow chart, Volume 3, Section 6.5, Figure 48 of the GDSDS. The characteristics of the site are utilised to select the various SUDS technique that would be applicable are indicated in red outline below.

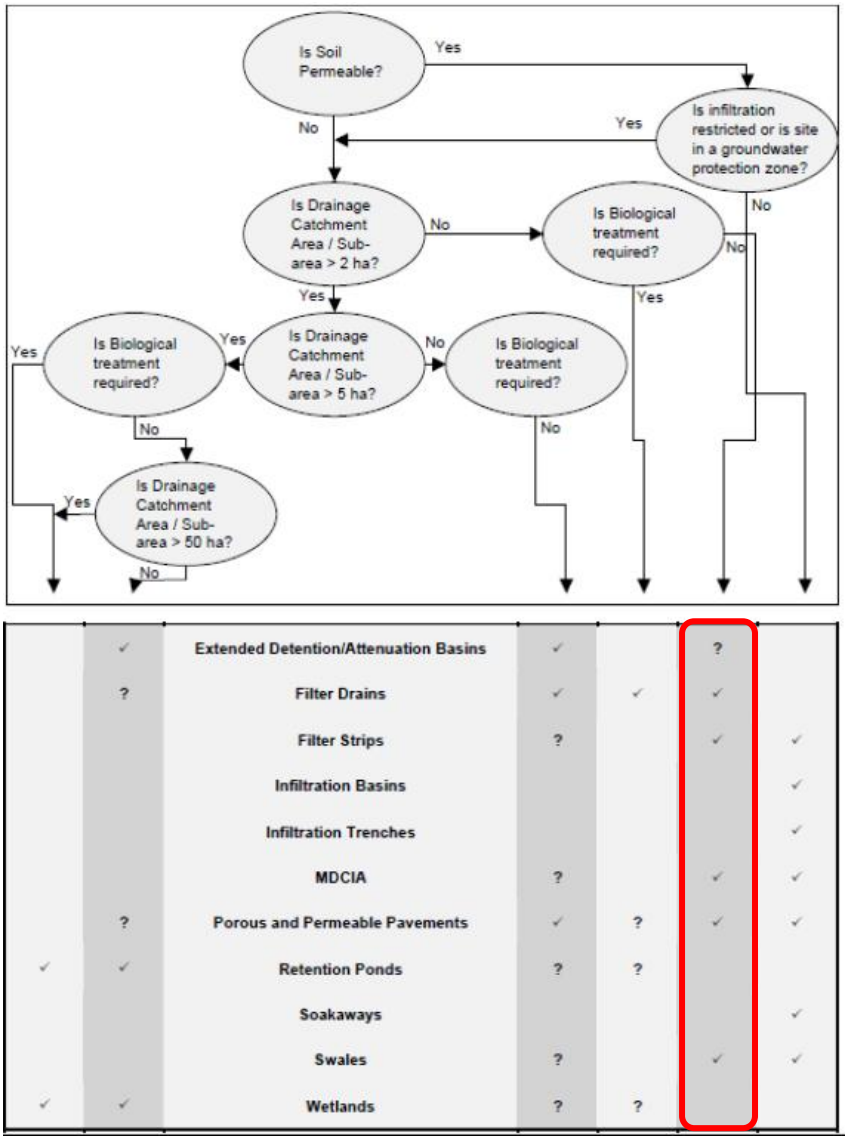


Figure 48 of GDSDS, Volume 3, Section 6.5 – SuDS Selection Flow Chart

The proposed surface water network will include a storm drainage pipe network, attenuation storage structures and several SuDS features which will aid the reduction of runoff volumes by slowing surface water flows, providing the opportunity for evapotranspiration and providing the opportunity for infiltration to ground. Both the interception and attenuation storage requirements of GDSDS will be sufficiently met.

The following SuDS features have been identified as applicable/achievable and will be provided within the proposed scheme:

Green Roofs: Will be provided on flat roofs, where possible. The green roof will be an extensive type with sedum planting at the surface with a drainage layer beneath. The drainage layer will convey flows to discharge locations. It is not proposed to restrict the discharges from the roofs. Where possible discharges from roofs will be tied into planters or permeable paving substrata via diffusers.

Detention Basin: A landscaped depression will be provided to the north of the site to collect surface water run-off from the domed roof of Apartment Block E. The basins will remain dry in most instances of light to moderate rainfall. This basin will be unlined to facilitate percolation into the ground and any overflow will enter into the main gravity storm system.

Tree Pits/Bioretention Planters: Will be provided in every feasible location where there is a proposed tree or planter. The tree pits will contain engineered soil filled tree boxes with drainage pipes beneath to link trees together and tie in with the proposed surface water sewer. The bioretention planters will consist of a shallow landscaped depression at the surface with a drainage layer beneath.

Permeable Paving: Will be provided for all private within-curtilage parking spaces. Permeable paving will be a Type B as per SuDS Manual, CIRIA 753, a combination of infiltration and piped drainage.

Attenuation Tank: Will be required to manage the volume of runoff expected from the development.

The existing mature trees in the parkland area to the west of the developed area are set to be retained as part of this application, which limits the implementation of further SuDS measures in this space such as swales and detention ponds. Hence attenuation storage shall be implemented as a final option to ensure no increase in site run-off as a result of the proposed development.

It is proposed to provide a hydro-brake, or similar approved, at the outfall of the surface water catchment to restrict the outflow of water from the subject site to pre-development levels. The hydro-brake will be fitted with a pull cord bypass and a penstock valve installed on the inlet to the manhole for maintenance purposes.

Manholes will be constructed on all pipe-runs at changes in sewer direction, changes in gradients, at significant sewer connections and at a maximum spacing of 90m on all straight sections of pipework The gravity surface water sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 5 of this report. The overall drainage arrangement is shown on Drawing No. 25629-EEI-UD-XX-DR-CE-04000, included with this submission.

The SuDS features will be designed to work in sequence thereby creating a treatment train. Please refer to Drawing No. 25629-EEI-UD-XX-DR-CE-04002 for the SuDS layout. Both the interception and attenuation storage requirements of GDSDS will be sufficiently met, therefore treatment and long-term storage are not required.

2.3 Surface Water Drainage Network

The surface water drainage network for the proposed development was modelled using the Microdrainage software application. The surface water pipe lengths, slopes, contributing impermeable areas, upstream invert levels, upstream cover levels and pipe diameters were entered into the model using the drawings supplied.

2.3.1 Compliance with GDSDS Surface Water Drainage Policy

The site's surface water management network has been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS). The GDSDS (Vol. 2, Chapter 6.3.4) requires the following design criteria are applied to all new developments.

Table 2-1 below provides an assessment of the proposed developed based of GDSDS, Vol 2, Chapter 6.3.4, Table 6.3 criteria for drainage design.

TABLE 2-1: ASSESSMENT OF DRAINAGE DESIGN - GDSDS CRITERIA FOR DRAINAGE DESIGN

Criteria	Objective	Assessment for proposed development
1	**Return Period 1-year** *1.1* Interception storage of at least 5mm, and preferably 10mm, of rainfall where runoff to the receiving water can be prevented. *1.2* Where initial runoff from at least 5mm of rainfall cannot be intercepted, treatment of runoff (treatment volume) is required. Retention pond (if used) to have minimum pool volume equivalent to 15mm rainfall.	Satisfied by providing stormwater attenuation by SUDS features i.e. Attenuation Tank at surface water discharge point.
2	**Return Period 1-year** *2.1* Discharge rate equal to 1 year greenfield site peak runoff rate or 2l/s, which ever is the greater. Site critical duration storm to be used to assess attenuation storage volume. **Return Period 100-year** *2.2* Discharge equal to 1 in 100-year greenfield site peak runoff rate. Site critical duration storm to be used to assess attenuation storage volume.	Satisfied by attenuating surface water run-off in association with flow control devices prior to discharge off site at Greenfield runoff rate. Site critical duration storm used to assess attenuation volume.
3	**Return Period 30-year** *3.1* No flooding on site except where specifically planned flooding is approved. Summer design storm of 15 or 30 minutes are normally critical. **Return Period 100-year** *3.2* No internal property flooding. Planned flood routing and temporary flood storage accommodated on site for short high intensity storms. Site critical duration events. *3.3* No internal property flooding. Floor levels at least 500mm above maximum river level and adjacent on-site storage retention. *3.4* No flooding of adjacent urban areas. Overland flooding managed within the development.	Satisfied by reviewing available flood hazard information (i.e. discussed in Flood Risk Assessment report). All overflow from the proposed drainage system has been assessed and will only occur in controlled environments.
4	**Return Period 100-year** *4.1* "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 to be used for assessment of the additional volume runoff. *4.2* Infiltration storage provided equal in volume to "long term" storage. Usually designed to operate for all events. 100-year, 6 hour duration to be used for assessment of the additional volume runoff. *4.3* Maximum discharge rate QBAR or 2 l/s/ ha, whichever is the greater, for all attenuation storage where separate "long term" storage cannot be provided.	Satisfied by attenuating surface water discharge to 1 year greenfield runoff rates and addressing flood risk associated with the 1 in 100-year storm and avoiding developments in flood plains.

2.3.2 Design Criteria

The proposed surface water drains have been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS). The following inputs sourced mainly from Met Eireann and GDSDS Volume 2 are used in the development of the drainage design. Table 2-2 below shows Rainfall Design Criteria Variables.

TABLE 2-2 RAINFALL DESIGN CITERIAL VARIABLE

Variable	Value
Region	Ireland
Return Period (GDSDS Volume 2, Section 6.2)	Drainage Network: 1 in 2 year, no surcharge, Drainage system: 1 in 100 year, no flooding in greenfield areas only; Drainage system: 1 in 30 years, no flooding for extending urban areas
M5-60 (Met Eireann Return Period Rainfall Depths for sliding Durations. Values derived from a Depth Duration Frequency Model)	18.8
Ratio R (Met Eireann Return Period Rainfall Depths for sliding Durations. Values derived from a Depth Duration Frequency Model)	0.250
Minimum Global Time of Entry (Recommendation for Site Development)	4 minutes
Max. Rainfall (GDSDS Volume 2, Table 6.4 Surface Water Design Criteria)	50 mm/hr
Max. Time of Concentration (Wallingford Procedure State Modified Rational Method has only been tested for time of concentration not greater than 30 minutes)	30 minutes
Climate Change (GDSDS, Table 6.2)	20%

Table 2-3 below summarises soil Standard percentage Runoff (SPR) values.

TABLE 2-3: SOIL SPR VALUES (GDSDS VOLUME 2, TABLE 6.7 SPR VALUES FOR SOIL)

Soil	SPR Value
Soil type 1	0.1
Soil type 2	0.3
Soil type 3	0.37
Soil type 4	**0.47**
Soil type 5	0.53

Surface water design criteria in accordance with GDSDS is summarised in the below table.

TABLE 2-4: SURFACE WATER DESIGN CRITERIA (GDSDS VOLUME 2, TABLE 6.4 SURFACE WATER DESIGN CRITERIA)

Parameter	Surface water Sewer
Minimum depth	1.2m cover under highways (without capping) 0.9m elsewhere
Maximum depth	Normally 5m
Minimum sewer size	150mm
Runoff factors for pipe sizing	100% paved and roof surfaces 0% off pervious surfaces
Rainfall for initial pipe sizing	50mm/hr rainfall intensity
Minimum velocity (pipe full)	0.75m/s
Flooding	Check made for adequate protection* No flooding for return period less than 30 years except where explicitly planned Simulation modelling is required for sites greater than 24ha**
Roughness - ks	0.6mm

Minimum pipe sizes, minimum depth of cover, minimum velocity and roughness coefficients are stated in the table above and fully tabulated in detail in the appendices of the Infrastructure Design Report included in the planning application.

It is important to check the effect (pollution, erosion and flooding) of the design on the upstream and downstream infrastructure, especially where the natural run-off is concentrated. The effect of possible backwater must be checked and investigated via SuDS infiltration system.

A summer rainfall profile was used for the design of the pipework, and a winter rainfall profile was used for the design of the SuDS infiltration system to give the critical design. A summer profile gives higher rainfall intensities and results in higher runoff rates used to determine the required capacity of the pipework. A winter rainfall profile gives a flatter more sustained profile and results in higher runoff volumes and is used to determine the attenuation/ storage requirements.

2.3.3 Pre-Development Conditions

The proposed development is located on a circa 4.28-hectare site. However, for the purposes of calculating the greenfield runoff estimation the areas that will remain green are excluded for the total catchment area; this is a conservative approach. Therefore, the catchment area for design purposes is deemed to be 1.48 hectares. For this development, the permissible outflow calculated using the estimation method contained in the Institute of Hydrology Report No. 124: Flood estimation for small catchments.

$QBAR = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$

QBAR = The Mean Annual Peak Flow (Permissible outflow in m^3/ sec)

AREA = Area of the Catchment (site) in km^2

SAAR = Standard Annual Average Rainfall

SOIL =Soil index

As the development is smaller than 50 ha, the analysis for determining the permissible outflow uses 50 ha in the formula and linearly interpolates the flow rate value based on the ratio of the development to 50 ha. The greenfield runoff estimation for the proposed development was calculated using the HR Wallingford Greenfield runoff estimation tool. This is a web-based estimation tool used to meet normal best practice criteria in line

with the Environmental Agency Guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015).

The greenfield runoff rate has been estimated initially using the HR Wallingford Greenfield runoff estimation online tool. The online tool calculated a Qbar figure of 12.2 l/s.

A summary of the design values output by the HR Wallingford Greenfield runoff estimation online tool is shown below:

TABLE 2-5: HR WALLINGFORD DESIGN VALUE OUTPUTS

Design Criteria	Actual Value
Catchment Area (ha)	1.48
Soil Type	4
SPR	0.47
SAAR (mm)	1106
1 year factor	0.85
30-year factor	1.65
100-year factor	1.95

2.3.4 Post-Development Conditions

All surface water runoff arising from the paved development will be drained away from the site. The SuDS infiltration system will be designed for a 100-year storm event. The maximum discharge from the site will be limited to calculated permissible runoff, the 1 in 1 year storm, for the catchment area.

The growth factor to be applied when calculating Q1 from Qbar is 0.85 giving an upper limit to the discharge from the site at 10.37 l/sec. This is the value that will be used in later detailed design as the upper limit of surface water discharge from the development.

2.3.4.1 Interception Storage

In accordance with the requirements of GDSGS, at least 5mm, and preferably 10mm, of interception storage should be provided on site, where runoff to the receiving water can be prevented.

In the case of this Phase 1 development the total drained area is 1.31ha (13,1 00m^2). This results in a required interception storage volume of 65.5m^3 (13,100 X 0.005).

Green roofs are proposed where there are flat roofs in the proposed development. These areas cover a total area of 1,377.5m^2. The build-up in the green roof system will provide a minimum of 5mm of interception storage per 1m^2, allowing for a total interception storage volume of 6.9m^3.

Permeable surfaces including tree pits and bioretention planters are proposed throughout the development, for a total area is 1,200m^2. The drainage pipe within the gravel bed for these areas will be set at 50mm above the bed formation giving (assumed 30% voids) interception stage equivalent to 15mm storage depth. Total interception volume provided in the permeable paving equals 18m^3.

The proposed dry basin has a surface area of 480m^2. Interception storage will be provided within the base of the basins for a depth of 250mm depth. Assuming porosity of 67%, the total interception storage volume provided is 80.4m^3.

The overall interception storage volume provided is therefore 104.5m^3 which represents approximately 8mm of interception storage which is above the required minimum provision as detailed above.

2.3.4.2 Attenuation Storage

The proposed rate of surface water discharge from the development will be limited to that of the greenfield runoff for a 1-year storm event, as described in Section 2.4. Attenuation will be provided by a concrete

attenuation tank which will cater for the 100-year storm event including for an additional 20% climate change allowance. The proposed surface water network will be contained in a single catchment, see Figure 2-1.

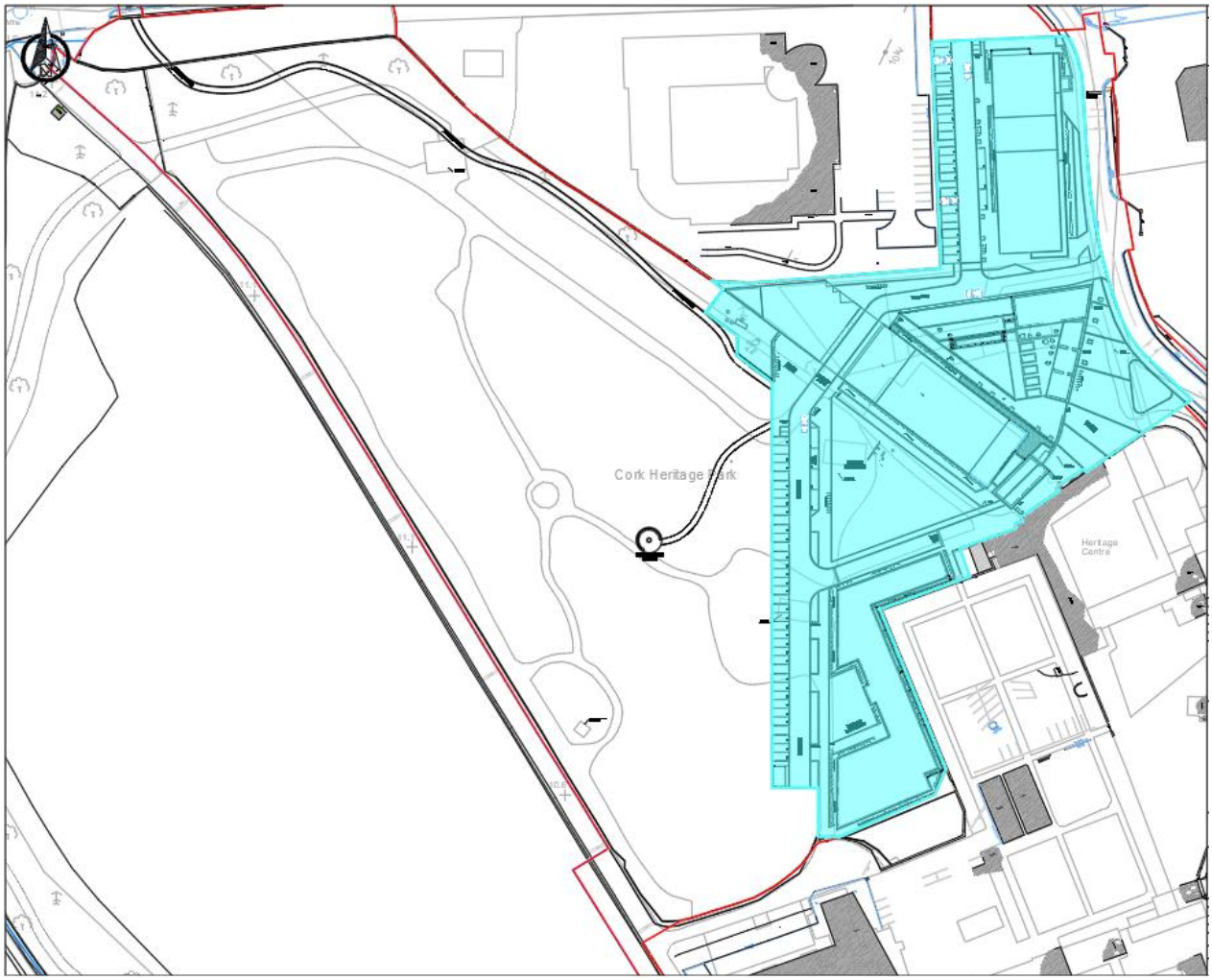


FIGURE 2-1: SURFACE WATER CATCHMENT AREAS

The various SuDS components being proposed as part of the development will provide some attenuation, reduce flow rates and will disperse surface water via evapotranspiration and infiltration. However, at this stage of the design process, and to ensure a robust design, we are designing for the worst case and have not assumed a reduction in runoff volume from the various SuDS features and permeable surfaces in the attenuation storage calculations. This will be revisited closer to construction stage, subject to a granted planning permission.

Preliminary attenuation volume calculations, based on the above criteria, are summarised in Table 2-6. (See Appendix 5 for detailed calculations).

TABLE 2-6 – STORMWATER CATCHMENT SUMMARY

Catchment	Catchment Area (ha)	Maximum Discharge Rate (l/s)	Storage Volume (m^3)
A	1.48	10.36	756

2.3.4.3 Water Quality

The proposed development will incorporate several measures to ensure a high quality of surface water is discharged from the site.

The proposed development is residential and therefore is considered a low-level pollution hazard. Where possible surface water runoff will be directed to the SuDS features as mentioned above and will therefore

benefit from their pollutant removal qualities. However, to ensure water quality standards are met, we are proposing a hydrocarbon interceptor upstream of the attenuation tank.

Simple Index Approach

The effectiveness of the chosen SuDS components to achieve water quality can be assessed using the 'simple index approach' as described in CIRIA C753.

The simple index approach designates risk indices to the various areas of development to determine their possible pollutant contribution. Similarly, the SuDS features are designated mitigation indices and if the mitigation indices are larger than the risk indices the water quality objectives are considered satisfied.

TABLE 2-7: POLLUTION HAZARD INDICES FOR DIFFERENT LAND USES

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Driveways, car parks, low traffic roads	Low	0.5	0.4	0.4

As can be seen in Table 2-8 the total mitigation potential of the SuDS features outweigh the contamination risks. Secondary (or further) stages in the treatment train are assigned 50% of the stated treatment indices value.

TABLE 2-8: INDICATIVE SUDS MITIGATION INDICES FOR DISCHARGES TO SURFACE WATERS

SuDS Component	TSS	Metals	Hydrocarbons
Tree pits	0.8	0.8	0.8
Permeable Paving	0.7	0.6	0.6
Petrol Interceptor	0.4	0.4	0.4

Amenity and Biodiversity

Meeting amenity and biodiversity standards is about creating attractive, pleasant, and liveable areas for both people and for nature. The proposed SuDS features within this development will not only be aesthetically pleasing, but they will also assist the creation of liveable habitats for nature by retaining rainfall at the source. The final details of these features will be drawn-up in consultation with the landscape design and ecological consultants on the design team.

2.3.5 Conveyance of Surface Water to Final Discharge Location

A new 225mmØ surface water outfall pipe will convey the restricted flows from the site in a south-westerly direction connecting to the existing 750mmØ surface water sewer upstream of its connection to the existing 1350mmØ surface water pipe which in turn discharges to the Douglas Estuary further to the south.

The proposed route of this sewer is shown on Drawing No. 25629-EEI-UD-XX-DR-CE-04000.

2.4 Maintenance Regime for SuDS

Table 20.15 of the SUDS manual indicates typical maintenance requirements for permeable pavement systems. This is indicated in the extract below.

TABLE 20.15 Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 19.3 of the SUDS manual indicates typical maintenance requirements for tree pit systems. This is indicated in the extract below.

TABLE 19.3 Operation and maintenance requirements for trees (after CRWA, 2009)

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets and outlets	Inspect monthly
Occasional maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
	Water	As required (in periods of drought)
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

Table 21.3 of the SUDS manual indicates typical maintenance requirements for attenuation storage tank systems. This is indicated in the extract below.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Table 22.1 of the SUDS manual indicates typical maintenance requirements for detention basins systems. This is indicated in the extract below.

TABLE 22.1 Operation and maintenance requirements for detention basins		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

3 CONCLUSIONS AND RECOMMENDATIONS

3.1 Summary of Results

A Drainage Impact Assessment of the proposed development has been carried out. The proposed SuDS measures includes tree pits, bioretention areas, a detention basin and an underground attenuation storage structure. Maximum outflow from the proposed development is 10.37 l/s, which is the current greenfield run-off rate from the developed area of the subject site in a 1-year storm event.

This assessment concludes that no significant impacts to existing surface water drainage regimes are envisaged as a result of the proposed development.

Data sensitivity - Public

APPENDIX 1: AS-BUILT LOCAL DRAINAGE NETWORK

Data sensitivity - Public

NOTES.

1.	To be read in conjunction with all relevant drawings and specification.
2.	Do not scale if in doubt ask.
3.	All dimensions to be checked on site.

Legend

Foul & Storm
150mm Ø Site Connections

Existing Services Connected

MAHON GOLF COURSE

CONVENT

Tank

Tank

1.	AS CONSTRUCTED	A.T.	0.0'D	06.09.'06
0.	ISSUED FOR CONSTRUCTION	M.M.	0.0'D	11.04.'06
REV.	DETAILS	REV.	CHKD.	DATE

CORK CITY COUNCIL
Scanned
PLANNING DIRECTORATE

John O'Donovan & Associates
Civil, Structural, Mechanical & Electrical Engineers
Model Farm Road, Cork 4, Ireland.
telephone: 021 454 4244 facsimile: 021 454 4277
e-mail: firstnames.surname@joda.ie web: www.joda.ie

jodo ENGINEERING CONSULTANTS

Bessborough Site Development Works
Bessborough, Blackrock, Cork

3699–103

DWG TITLE: As Built Site Services – Foul & Storm Water Drainage
DN: A.T.
CHKD: 0'D.D
STATUS: CONSTRUCTION
SCALE: Not To Scale
DATE: APRIL 2006

APPENDIX 2: HR WALLINGFORD – GREENFIELD RUNOFF ESTIMATION

Data sensitivity - Public

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Diarmuid O'Brien
Site name:	Phase 2 - Bessboro SHD
Site location:	Bessboro, Blackrock, Cork.

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.

Site Details

Latitude:	51.88555° N
Longitude:	8.41036° W
Reference:	1797377310
Date:	Feb 14 2022 11:01

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.48

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1106	1106
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	12.2	12.2
1 in 1 year (l/s):	10.37	10.37
1 in 30 years (l/s):	20.13	20.13
1 in 100 year (l/s):	23.79	23.79
1 in 200 years (l/s):	26.24	26.24

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at 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 www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of 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, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

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APPENDIX 3: PRIORITY GEOTECHNICAL LTD – GROUND INVESTIGATION

Data sensitivity - Public

Our Ref: JMS/Rp/P21239 + attachments (*.pdf)

16th March, 2022

JB Barry & Partners Limited
3 Eastgate Road,
Eastgate Business Park,
Little Island,
Co. Cork,
T45 KH74.

Re: Bessborough SHD Sites, Site Investigation, Factual report.

Introduction

In November 2021, Priority Geotechnical (PGL) were requested by JB Barry & Partners Limited acting on behalf of their client Estuary View Enterprises to undertake a site investigation as part of the Bessborough SHD Sites project.



Objectives

The objective of the site investigation contract is to determine the ground and groundwater conditions in order to inform the engineering design solutions for the proposed development.

Scope

The original scope of the site investigation, which was specified by JB Barry & Partners, comprised of:

- 06Nr. Cable percussion boreholes;
- Trial pits;
- Surveying of 'as-built' levels and co-ordinates;
- All associated sampling;
- All associated laboratory works;
- Associated reporting;

The final site works as completed is outlined, herein. This geotechnical data report presents the fieldworks records with regard to the site investigation for the Bessborough SHD Sites Project. The report should be read in conjunction with the exploratory records, the photographic records and the laboratory test data accompanying this report.

Site Works

This investigation was carried out in accordance with Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9).

The direct intrusive fieldworks were undertaken from the 10th and 17th January, 2022 to under the supervision of PGL, Engineering Geologist(s). Details of the plant and equipment used are detailed on the relevant exploratory records, accompanying this report.

Cable Percussion Boreholes

Six (06) cable percussion boreholes were drilled to depths 4.4m below existing ground level (bgl) to 9.1m bgl using PGL's Dando 2000 Rig and 200mm diameter casing. The logs are accompanying this factual report.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
BH01	4.4	13/01/2022
BH02	9.1	10/01/2022
BH03	8.4	12/01/2022
BH04	7.3	14/01/2022
BH05	7.4	17/01/2022
BH06	7.0	13/01/2022

Chiselling				
Location	**Depth Top (m bgl)**	**Depth Base (m bgl)**	**Duration (hh:mm)**	**Tool**
BH01	1.20	1.30	01:00	Chisel.
	4.30	4.40	01:00	Chisel.
BH02	2.75	2.90	01:00	Chisel.
	8.90	9.10	01:00	Chisel.
BH03	4.90	5.00	01:00	Chisel.
	8.30	8.40	01:00	Chisel.
BH04	3.80	4.00	01:00	Chisel.
	7.20	7.30	01:00	Chisel.
BH05	6.70	6.90	01:00	Chisel.
	7.30	7.40	01:00	Chisel.
BH06	5.75	5.95	01:00	Chisel.
	6.90	7.00	01:00	Chisel.

Trial Pits

Seven (07) trial pits were excavated to depths 0.3m bgl to 4.6m bgl using a 14t tracked excavator. The exploratory logs and photographic records accompany this factual report.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
TP01	3.9	11/01/2022
TP02	3.2	10/01/2022
TP03	4.5	11/01/2022
TP04	4.5	13/01/2022
TP05	4.5	14/01/2022
TP06	0.3	12/01/2022
TP06A	4.6	12/01/2022

Sampling

A total of sixty two (62) bulk disturbed samples (B) and twenty two (22) small disturbed samples (D) were recovered from the exploratory holes in accordance with Geotechnical Investigation and Sampling – Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

***In-Situ* Testing**

Standard Penetration Tests (SPT)

A total of thirty nine (39) standard penetration tests, were carried out in the cable percussion boreholes using the 60^{o} solid cone (CPT) in place of the standard split barrel sampler. The data was presented on the relevant logs accompanying this factual report.

Falling Head Tests

Two (02) *in situ* falling head permeability tests were carried out in boreholes; in accordance with BS5930: 1999, Section 4: Cl. 25.4, within the superficial deposits over duration of one (1) hour. The processed test data was presented on the relevant borehole log presented accompanying this factual report. The shape or intake factor, f was derived from the condition at the base of the borehole at the test depth and test geometry as per Hvorslev (1951).

$$k = \frac{A}{fd} \frac{\log_e (H_0 / H_t)}{t}$$

Generally for all tests the specific depth range of the test was the deposits below the depth of casing. A mean k measured ($k_H = k_V$), permeability in the soil was assumed equal in both horizontal and vertical direction, ($k_H / k_V = 1.$). The test geometry provided a shape factor, f for the test undertaken in the standpipe well.

Dynamic Probing

PGL's Competitor dynamic probing rig was used to undertake dynamic probing (DP(H); 50kg drop weight, 500mm drop height) in general accordance with Geotechnical Investigation and Testing, Part 2, Dynamic probing, BS EN ISO 22476-2:2005. The blows per 100mm ($N_{100\ H}$) were recorded to refusal being 25blows without progress over 100mm. Six (06) number dynamic probes progressed to refusal at depths 2.7m bgl to 8.8m bgl. The exploratory logs accompany this factual report.

Location	Refusal depth, m bgl
DP01	3.7
DP02	8.8
DP03	2.7
DP04	5.0
DP05	3.0
DP06	3.5

Survey and Drawings

The ‘as built’ exploration locations were surveyed to the Ordinance Survey Irish Transverse Mercator system of co-ordinates (ITM) and elevations to Malin Head datum and shown on the relevant exploratory logs and the Exploratory Location Plans (P21239-SI-A, P21239-SI-01) accompanying this report.

Location	Easting	Northing	Ground Level (mOD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
BH01	171820.78	70468.88	16.64	4.40	13/01/2022
BH02	171741.94	70395.18	13.07	9.10	10/01/2022
BH03	171738.42	70311.70	11.49	8.40	12/01/2022
BH04	172026.44	70364.45	12.50	7.30	14/01/2022
BH05	172034.00	70300.87	12.21	7.40	17/01/2022
BH06	171946.00	70338.05	13.57	7.00	13/01/2022
DP01	171821.58	70465.48	16.54	3.70	13/01/2022
DP02	171742.31	70392.88	12.93	8.80	13/01/2022
DP03	171735.89	70311.95	11.53	2.70	13/01/2022
DP04	172027.93	70363.86	12.40	5.00	13/01/2022
DP05	172033.97	70304.80	12.21	3.00	14/01/2022
DP06	171944.50	70343.17	13.61	3.50	13/01/2022
TP01	171822.48	70466.73	16.60	3.90	11/01/2022
TP02	171742.96	70394.13	13.04	3.20	10/01/2022
TP03	171736.67	70314.17	11.80	4.50	11/01/2022
TP04	172026.89	70362.36	12.35	4.50	13/01/2022
TP05	172033.99	70303.02	12.21	4.50	14/01/2022
TP06	171940.73	70337.93	13.69	0.30	12/01/2022
TP06A	171944.88	70339.22	13.61	4.60	12/01/2022

Laboratory Testing

Laboratory testing was ongoing at the time of reporting.

Published Geology

A search of the Geological Survey data base and 1:100,000 mapping (Sheet 25) identified two (02) major lithological units defining the area. The majority of the site is underlain by Waulsortian Limestones (WA) described as massive unbedded Lime-Mudstones. The Little Island Formation (LI) is mapped to the north and defined by massive and crinoidal fine Limestone.

Teagasc subsoil mapping indicates that the area is underlain by Made Ground deposits. The National Groundwater Vulnerability mapping indicates the area mostly has a rating of high vulnerability.

Ground and Groundwater Conditions

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, *in situ* testing and details of the samples taken, together with any observations made during the ground investigation.

Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. Low volume groundwater flow may be cut-off by borehole casing as it progresses in stiff glacial deposits. The duration trial pit excavations remain open may not be sufficient to allow for low volume flow to present. The groundwater regime should be assessed from standpipe well installations.

Groundwater was encountered at depths 3.10m bgl to 3.90m bgl during the period of fieldworks within the extent of the borehole and pit excavations, summarised below. The exploratory locations were backfilled with grout, gravel and arisings.

SUMMARY OF GROUNDWATER

Location	Depth Strike (m bgl)	Remarks	Standpipe (Y/N)
BH01	-	None encountered.	N
BH02	-	None encountered.	Y
BH03	-	None encountered.	N
BH04	-	None encountered.	N
BH05	-	None encountered.	N
BH06	-	None encountered.	Y
TP01	-	None encountered.	N
TP02	-	None encountered.	N
TP03	-	None encountered.	N
TP04	3.9	Trickle rate of flow	N
TP05	3.9	Slow rate of flow	N
TP06	-	None encountered.	N
TP06A	3.1	Trickle rate of flow	N

Two (02) number 50mm dia. HDPE standpipe wells were constructed to allow for groundwater monitoring. The construction details are summarised below.

SUMMARY OF STANDPIPE CONSTRUCTION

Location	Depth Top (m bgl)	Depth Base (bgl)	Diameter (mm)	Pipe Type	Pipe Details
BH02	0.00	2.00	50	PLAIN	Plain.
	2.00	8.50	50	SLOTTED	Slotted.
BH06	0.00	3.50	50	PLAIN	Plain.
	3.50	7.00	50	SLOTTED	Slotted.

Exploratory locations were backfilled with their arisings or gravel and bentonite for locations with monitoring wells. Backfill details are displayed graphically on the accompanying logs and summarised below.

SUMMARY OF STANDPIPE DIPS

Location	08/02/2022
	Depth (m bgl)
BH02	Dry
BH06	4.4

SUMMARY OF BACKFILL

 GRAVEL Backfill to installation/borehole

 ARISINGS Backfill

 uPVC slotted pipe

 BENTONITE Backfill to installation

Should you have any queries in relation to the data collected and presented herein, please do not hesitate to contact our office.

Yours sincerely,
For **Priority Geotechnical,**

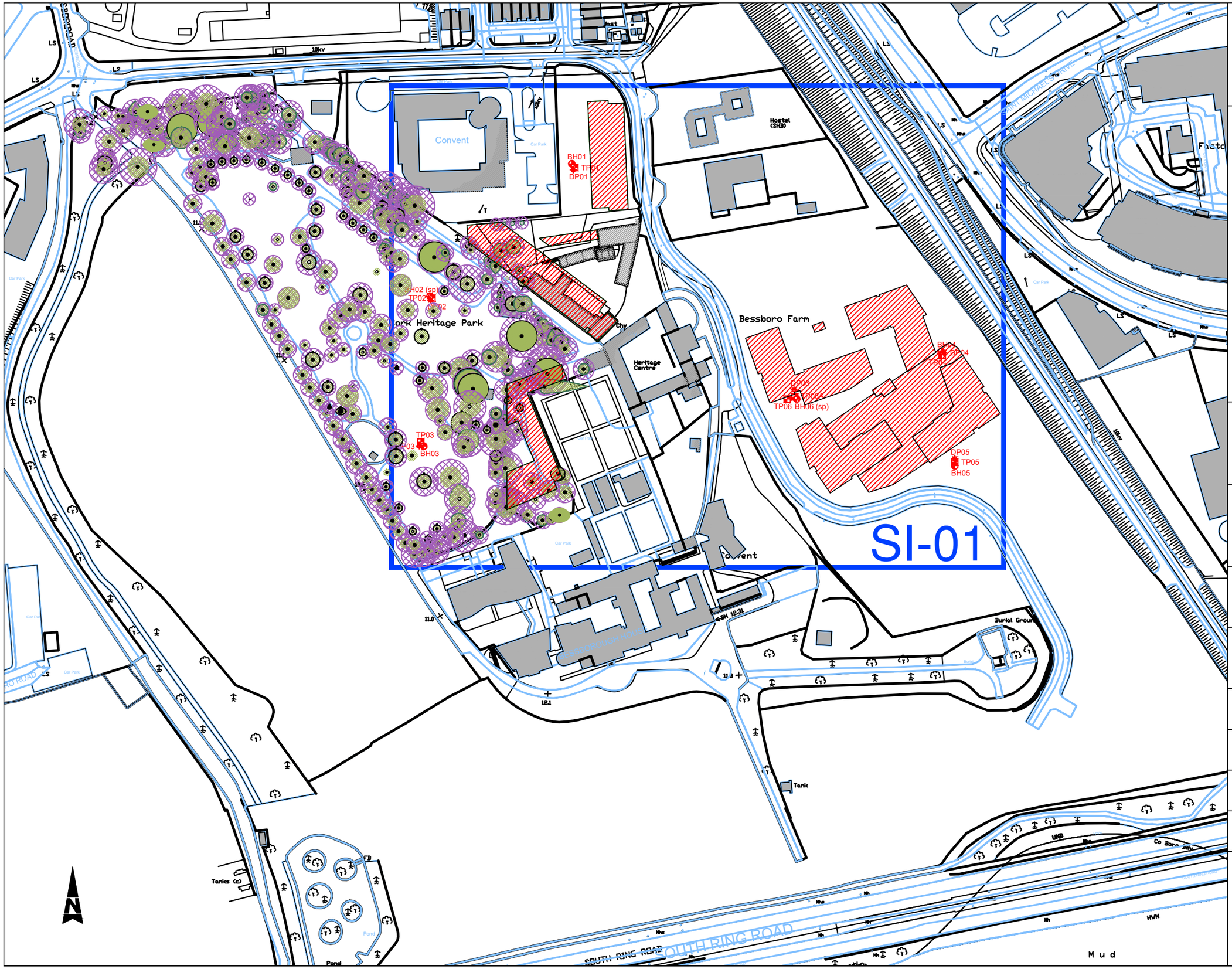


James McSweeney BSc
Engineering Geologist

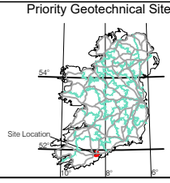
No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations.

No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

This report has been prepared for Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.



Priority Geotechnical Site



JOB NAME:

Bessborough SHD

Sheet Title:

EXPLORATORY LOCATION LAYOUT

JOB NUMBER:

P21239

DRAWING NUMBER:

P21239-SI-A

DRAWN BY:

Gary Curtin

DATE:

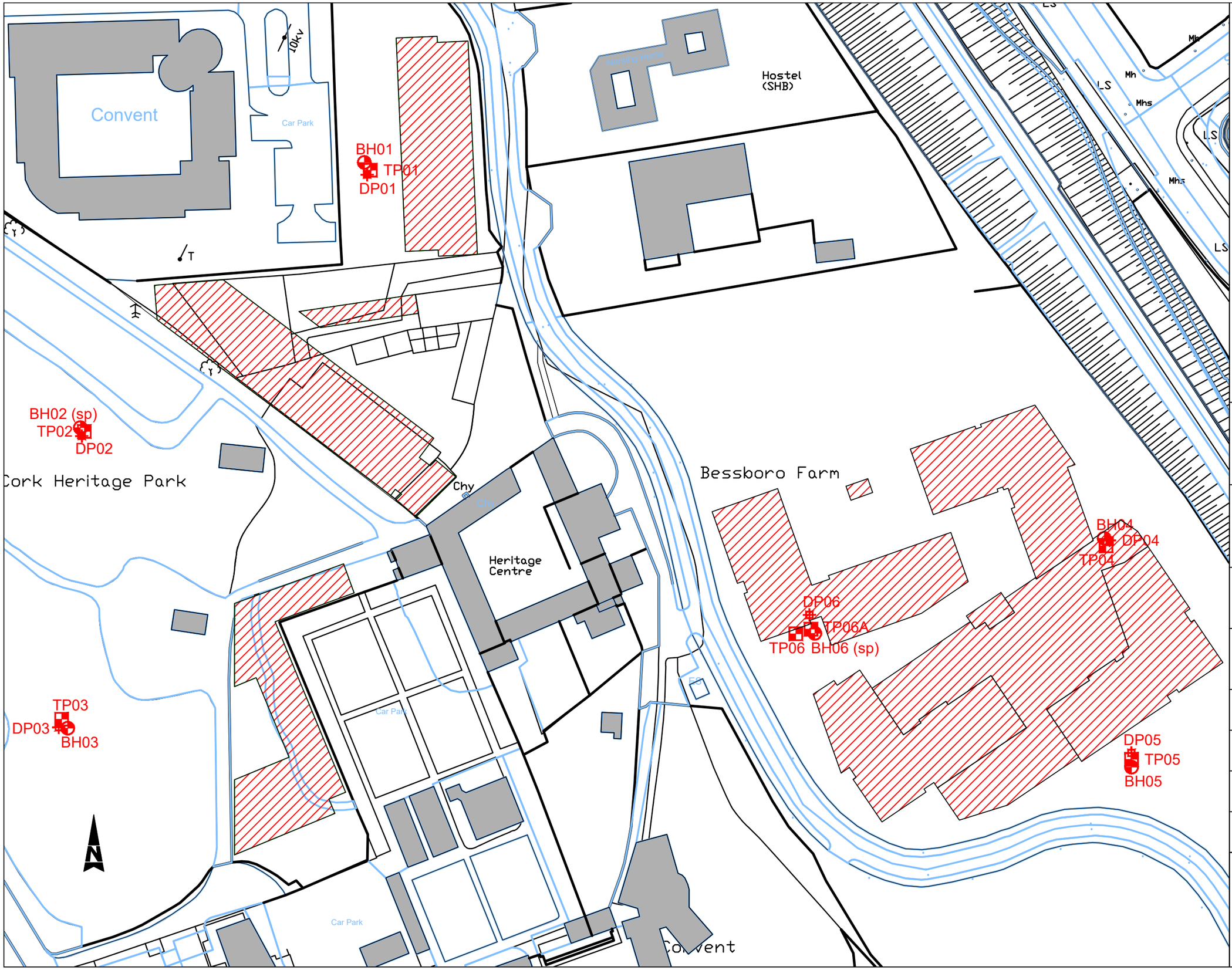
08/12/2021

SCALE:	APPROVED:
1:2000 ON A3	GH

REVISION:

D01

pgl priority geotechnical



KEY:

- TP00 Denotes Trial Pit location
- BH00 Denotes Borehole location
- DP00 Denotes Dynamic Probe location

Coordinates shown on ING.

TP01	171822.5	70466.7	16.6
TP02	171743	70394.1	13.04
TP03	171736.7	70314.2	11.8
TP04	172026.9	70362.4	12.35
TP05	172034	70303	12.213
TP06	171940.7	70337.9	13.69
TP06A	171944.9	70339.2	13.61
BH01	171820.8	70468.9	16.64
BH02 (sp)	171741.9	70395.2	13.07 stand pipe
BH03	171738.4	70311.7	11.49
BH04	172026.4	70364.5	12.5
BH05	172034	70300.9	12.21
BH06 (sp)	171946	70338.1	13.57 stand pipe
DP01	171821.6	70465.5	16.54
DP02	171742.3	70392.9	12.93
DP03	171735.9	70312	11.53
DP04	172027.9	70363.9	12.4
DP05	172034	70304.8	12.21
DP06	171944.5	70343.2	13.61

JOB NAME:

Bessborough SHD

Sheet Title:

EXPLORATION LOCATION PLAN

JOB NUMBER:

P21239

DRAWING NUMBER:

P21239-SI-01

DRAWN BY:

Gary Curtin

DATE:

05/12/2021

SCALE:

1:1000 ON A3

APPROVED:

GH

REVISION:

D01

pgl priority geotechnical

KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	Drillers Description
Friable	Easily crumbled

SAMPLES

U( )	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U( )F, U( )P	F- not recovered, P-partially recovered
U38	Undisturbed 38mm diameter sample
P(F), (P)	Piston sample - disturbed
B	Bulk sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
CBR	California Bearing Ratio mould sample
ES	Chemical Sample for Contamination Analysis
SPTLS	Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery (% of Core Run)
SCR	Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD	Rock Quality Designation (length of solid core greater than 100mm as % of core run)

Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column

If	Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL	Assumed Zone of Core Loss
NI	Non intact

GROUNDWATER

▽	Groundwater strike
▼	Groundwater level after standing period
Date/Water	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

S	Standard Penetration Test - split barrel sampler
C	Standard Penetration Test - solid 60^o cone
SW	Self Weight Penetration
Ivp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N	Standard Penetration Test - blows required to drive 300mm after seating drive
x/y	Denotes x blows for y mm within the Standard Penetration Test
x*/y	Denotes x blows for y mm within the seating drive
c_u	Undrained Shear Strength (kN/m^2)
CBR	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By** PC **Logged By** CS	Borehole No. **BH01** Sheet 1 of 1

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171821E - 70469N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	16.64 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	13/01/2022 - 14/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Driller describes: Fill clay with limestone boulders.
		1.00 - 2.00 1.00	B SPT (C)	65 (5,10/65 for 150mm)	1.00	15.64		Firm, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular, limestone with dia 63-80mm. *1.20m - 1.30m: Driller noted: Boulders. Increased SPT blow counts locally.*
		2.00 - 3.00 2.00	B SPT (C)	N=15 (3,3/4,4,3,4)				
		3.00 - 4.00 3.00	B SPT (C)	N=15 (3,3/4,4,3,4)	3.00	13.64		Firm, brown red, slightly sandy slightly gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-rounded, limestone with dia 63-120mm. Driller describes: Hard gravelly clay with boulders.
		4.00	SPT (C)	90 (9,10/90 for 225mm)				
					4.40	12.24		End of Borehole at 4.400m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
4.40	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
1.20	1.30	01:00	Chisel.
4.30	4.40	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 4.40m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	13/01/2022 08:00	0.00	Start of shift.
Dry	13/01/2022 18:00	2.00	End of shift.
Dry	14/01/2022 08:00	2.00	Start of shift.
Dry	14/01/2022 18:00	4.40	End of borehole.

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Drilled By	Borehole No.
PC	**BH02**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171742E - 70395N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	13.07 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	10/01/2022 - 11/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Driller describes: Gravel clay.
		1.00 - 2.00 1.00	B SPT (C)	N=6 (1,1/1,1,2,2)	1.00	12.07		Soft, brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Driller describes: Gravelly clay.
		2.00 - 3.00 2.00	B SPT (C)	N=7 (1,1/1,2,2,2)				*2.00m - 3.00m: Driller noted: Boulders.*
		3.00 - 4.00 3.00	B SPT (C)	N=12 (3,3/2,3,3,4)	3.00	10.07		Firm to stiff, brown red, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-rounded, Limestone with dia 63-170mm dia.
		4.00 - 5.00 4.00	B SPT (C)	N=21 (4,4/5,5,6,5)				
		5.00 - 6.00 5.00	B SPT (C)	N=24 (5,6/5,6,7,6)	5.00	8.07		Stiff, brown red, slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-rounded, limestone with dia 63-170. Driller describes: boulders.
		6.00 - 7.00 6.00	B SPT (C)	N=29 (6,6/7,7,8,7)				
		7.00 - 8.00 7.00	B SPT (C)	N=33 (7,7/8,8,9,8)				
		8.00	SPT (C)	N=32 (7,8/9,5,9,9)				
					9.10	3.97		End of Borehole at 9.100m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
9.10	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
2.75	2.90	01:00	Chisel.
8.90	9.10	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 9.10m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	10/01/2022 08:00	0.00	Start of shift.
	10/01/2022 18:00	0.00	End of shift.
	11/01/2022 08:00	0.00	Start of shift.
Dry	11/01/2022 18:00	9.10	End of borehole.

Priority Geotechnical Ltd. Tel: 021 4631600 Fax: 021 4638690 www.prioritygeotechnical.ie	Drilled By: PC Logged By: CS	Borehole No. **BH03** Sheet 1 of 1

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171738E - 70312N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	11.49 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	12/01/2022 - 12/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Soft becoming firm, brown red, slightly sandy slightly gravelly CLAY.
		1.00 - 2.00 1.00	B SPT (C)	N=7 (1,1/1,2,2,2)				
		2.00 - 3.00 2.00	B SPT (C)	N=7 (1,1/2,2,1,2)				
		3.00 - 4.00 3.00	B SPT (C)	N=10 (2,3/3,2,3,2)				
		4.00 - 5.00 4.00	B SPT (C)	N=20 (3,4/4,5,5,6)	4.00	7.49		Stiff, brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse.
		5.00 - 6.00 5.00	B SPT (C)	N=26 (6,7/6,6,7,7)	5.00	6.49		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-80mm.
		6.00 - 7.00 6.00	B SPT (C)	N=28 (7,6/6,8,7,7)	6.00	5.49		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-80mm. *6.00m - 8.40m: Driller noted Boulder content.*
		7.00 - 8.00 7.00	B SPT (C)	N=34 (7,8/8,9,8,9)				
		8.00 - 8.40 8.00	B SPT (C)	40 (9,10/40 for 150mm)	8.40	3.09		End of Borehole at 8.400m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
8.40	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
4.90	5.00	01:00	Chisel.
8.30	8.40	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 8.40m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	12/01/2022 08:00	0.00	Start of shift.
Dry	12/01/2022 18:00	8.40	End of borehole.

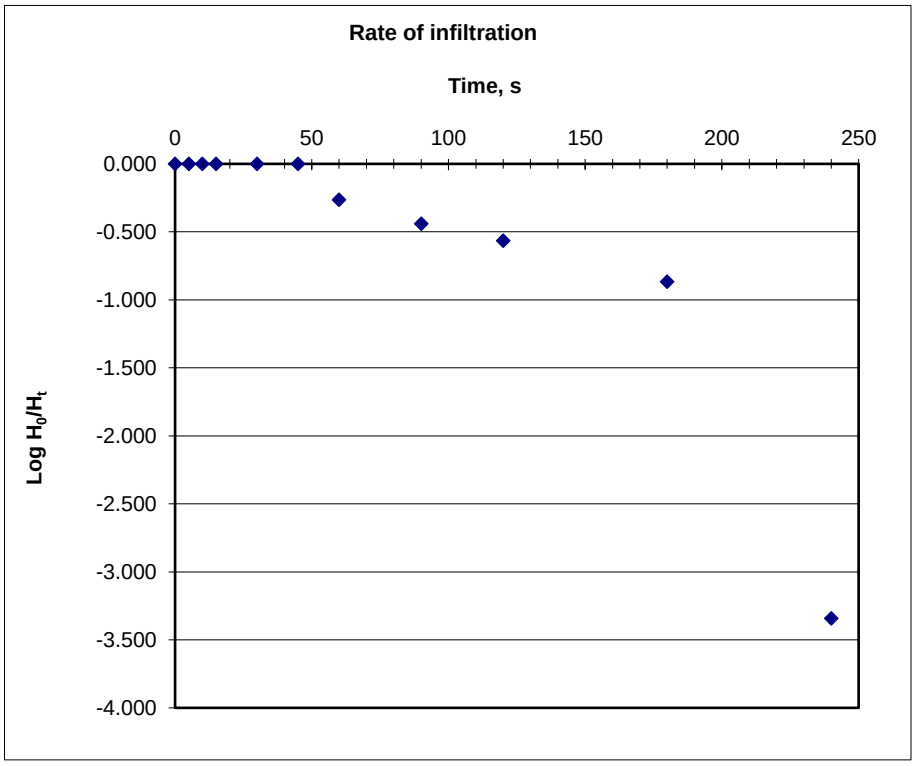
P21239 Falling head permeability test

Location	**Bessborough SHD**			
BH ID	**BH03**		H_w / H_o	**2.20**
Test	**1**			
Casing diameter	**200**	mm		
Casing depth	**2.00**	m		
Borehole depth	**2.20**	m		
GW Influence	**2.20**	m bgl		
Date	**12/01/2022**			

Min	Sec	depth, m bgl	vol, cu.m	H_t	log H_0/H_t
0	0	0.000	0.00000	2.200	0.000
0.083	5	0.000	0.00000	2.200	0.000
0.17	10	0.000	0.00000	2.200	0.000
0.25	15	0.000	0.00000	2.200	0.000
0.5	30	0.000	0.00000	2.200	0.000
0.75	45	0.000	0.00000	2.200	0.000
1	60	1.000	0.03140	1.200	-0.263
1.5	90	1.400	0.04396	0.800	-0.439
2	120	1.600	0.05024	0.600	-0.564
3	180	1.900	0.05966	0.300	-0.865
4	240	2.199	0.06905	0.001	-3.342

k_{mean} 1.12E-03 ms^{-1}

$k_H = k_V$



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Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172026E - 70364N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	12.50 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	14/01/2022 - 14/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
								Dark brown, slightly sandy slightly gravelly SILT with plant material.
		1.00 - 2.00 1.00	B SPT (C)	N=9 (1,1/2,2,3,2)	1.00	11.50		Firm, dark brown, slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse.
		2.00 - 3.00 2.00	B SPT (C)	N=9 (2,2/2,3,2,2)	2.00	10.50		Firm, brown, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-120mm.
		3.00 - 4.00 3.00	B SPT (C)	N=14 (2,3/3,4,3,4)	3.00	9.50		Firm to stiff, brown, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-120mm. Driller describes: boulders.
		4.00 - 5.00 4.00	B SPT (C)	N=22 (4,4/5,6,5,6)				
		5.00 - 6.00 5.00	B SPT (C)	N=29 (6,5/7,7,8,7)	5.00	7.50		Stiff, brown, slightly sandy slightly gravelly silty CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-70mm. Boulders are sub-rounded, Limestone with dia 200.
		6.00 - 7.00 6.00	B SPT (C)	N=37 (7,8/8,9,9,11)	6.00	6.50		Stiff, brown, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, Limestone with dia 63-90mm.
		7.00	SPT (C)	75 (10,15/75 for 150mm)				
					7.30	5.20		End of Borehole at 7.300m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.30	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
3.80	4.00	01:00	Chisel.
7.20	7.30	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 7.30m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	14/01/2022 08:00	0.00	Start of shift.
Dry	14/01/2022 18:00	7.30	End of borehole.

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Drilled By	Borehole No.
PC	**BH05**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172034E - 70301N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	12.21 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	17/01/2022 - 17/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00 - 1.00	B					Firm becoming stiff, brown red, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		1.00 - 2.00 1.00	B SPT (C)	N=8 (1,1/2,2,2,2)				
		2.00 - 3.00	B					
		3.00	SPT (C)	N=13 (2,3/3,4,3,3)				
		4.00 - 5.00 4.00	B SPT (C)	N=16 (3,4/3,4,4,5)				
		5.00 - 6.00 5.00	B SPT (C)	N=30 (5,6/7,7,8,8)	5.00	7.21		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded, 63-120mm dia., Limestone lithology.
		6.00 - 7.00 6.00	B SPT (C)	N=38 (7,8/9,9,10,10)	6.00	6.21		Stiff, brown red, slightly sandy slightly gravelly CLAY with low cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub--rounded. Cobbles are sub-angular to sub-rounded, 63-120mm dia., Limestone lithology. Boulders are sub-angular, 200-250mm dia., Limestone lithology.
		7.00	SPT (C)	90 (9,10/90 for 225mm)				
					7.40	4.81		End of Borehole at 7.400m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.40	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
6.70	6.90	01:00	Chisel.
7.30	7.40	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 7.40m bgl, obstruction.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	17/01/2022 08:00	0.00	Start of shift.
Dry	17/01/2022 18:00	7.40	End of borehole.

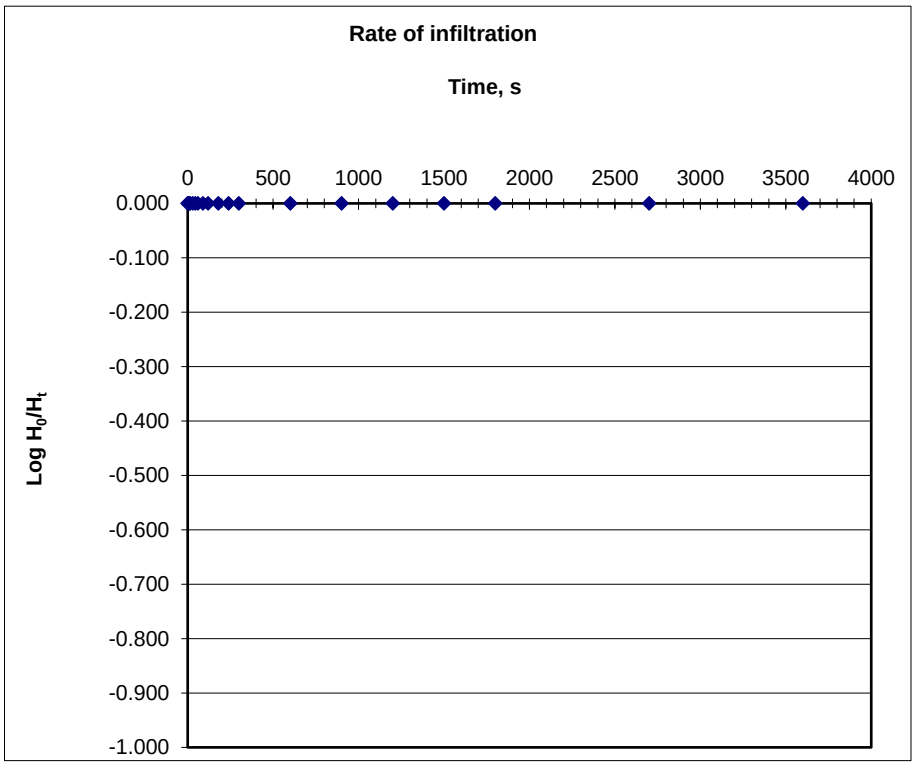
P21239 Falling head permeability test

Location	**Bessborough SHD**			
BH ID	**BH05**		H_w / H_o	**2.00**
Test	**1**			
Casing diameter	**200**	mm		
Casing depth	**1.50**	m		
Borehole depth	**2.00**	m		
GW Influence	**2.00**	m bgl		
Date	**17/01/2022**			

Min	Sec	depth, m bgl	vol, cu.m	H_t	log H_0/H_t
0	0	0.000	0.00000	2.000	0.000
0.083	5	0.000	0.00000	2.000	0.000
0.17	10	0.000	0.00000	2.000	0.000
0.25	15	0.000	0.00000	2.000	0.000
0.5	30	0.000	0.00000	2.000	0.000
0.75	45	0.000	0.00000	2.000	0.000
1	60	0.000	0.00000	2.000	0.000
1.5	90	0.000	0.00000	2.000	0.000
2	120	0.000	0.00000	2.000	0.000
3	180	0.000	0.00000	2.000	0.000
4	240	0.000	0.00000	2.000	0.000
5	300	0.000	0.00000	2.000	0.000
10	600	0.000	0.00000	2.000	0.000
15	900	0.000	0.00000	2.000	0.000
20	1200	0.000	0.00000	2.000	0.000
25	1500	0.000	0.00000	2.000	0.000
30	1800	0.000	0.00000	2.000	0.000
45	2700	0.000	0.00000	2.000	0.000
60	3600	0.000	0.00000	2.000	0.000

k_{mean} - ms^{-1}

$k_H = k_V$



Notes:
No Change in groundwater level observed after 60 mins. Infiltration rate mot determined.

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Drilled By	Borehole No.
PC	**BH06**
Logged By	Sheet 1 of 1
CS	

Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171946E - 70338N	**Hole Type** CP
Location:	Mahon, Cork		**Level:**	13.57 m OD	**Scale** 1:50
Client:	Estuary View Ent. Ltd		**Date:**	13/01/2022 - 13/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mOD)	Legend	Stratum Description
		0.00 - 1.00	B					Brown, CLAY.
		1.00 - 2.00 1.00	B SPT (C)	N=6 (1,1/2,2,1,1)	1.00	12.57		Soft becoming stiff, brown red, slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.
		2.00 - 3.00 2.00	B SPT (C)	N=8 (1,1/2,2,2,2)				
		3.00 - 4.00 3.00	B SPT (C)	N=9 (2,2/3,2,2,2)				
		4.00 - 5.00 4.00	B SPT (C)	N=13 (3,2/3,3,4,3)				*4.00m - 6.00m: Driller described: 'wet' soils.*
		5.00 - 6.00 5.00	B SPT (C)	N=28 (4,6/6,7,7,8)				
		6.00 - 7.00 6.00	B SPT (C)	N=33 (7,7/8,8,9,8)	6.00	7.57		Stiff, brown red, slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded. Cobbles are sub-angular, limestone with dia 63-130mm.
					7.00	6.57		End of Borehole at 7.000m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				None encountered.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
7.00	200	200

Equipment: Dando 2000.

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool
5.75	5.95	01:00	Chisel.
6.90	7.00	01:00	Chisel.

Remarks:

Cable percussion borehole terminated at 7.0m bgl.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	13/01/2022 08:00	0.00	Start of shift.
Dry	13/01/2022 18:00	7.00	End of borehole.

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Trial Pit No
TP01
Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171822E - 70467N **Level:** 16.60m OD	**Date** 11/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.60 x 1.10	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 3.90m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20	16.40		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
				0.65	15.95		(MADE GROUND) Soft to firm, brown, slightly sandy slightly gravelly CLAY with pottery fragments, blocks, timber and plastics. Sand is fine to coarse, Gravel is fine to coarse, sub-rounded to rounded.
	0.70 - 1.50 0.70 - 1.50	B D					Soft to firm becoming stiff from 2.80m, brown, slightly sandy slightly gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded. Boulders sub-rounded to rounded. (Assumed Natural).
	1.50 - 2.50 1.50 - 2.50	B D					
	2.50 - 3.50 2.50 - 3.50	B D					
				3.90	12.70		End of Pit at 3.900m

1
2
3
4
5

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 3.90m bgl on rock/ large boulders.

Photographic Record





Number:	**TP01**	**Project**	Bessborough SHD	
		Project No	P21239	
		Engineer	J.B. Barry & Partners	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No
TP02
Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171743E - 70394N **Level:** 13.04m OD	**Date** 10/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.20 x 1.00	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 3.20m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	12.74		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	0.50 - 1.00 0.50 - 1.00	B D					(MADE GROUND) Soft to firm, light brown, slightly sandy slightly gravelly SILT with medium cobble content, medium boulder content and pottery fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded. Cobbles are angular to sub-rounded. Boulders are angular to sub-rounded.
	1.20 - 2.30 1.20 - 2.30	B D		1.20	11.84		Soft, light purple brown, slightly gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded.
	2.30 - 3.20 2.30 - 3.20	B D		2.30	10.74		Soft to firm, purple brown, slightly sandy gravelly CLAY with medium cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded. Boulders are sub-rounded to rounded.
				3.20	9.84		End of Pit at 3.200m

Stability: Poor
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 3.20m bgl due to collapsing walls.

Photographic Record





Number:	**TP02**	**Project**	Bessborough SHD	
		Project No	P21239	
		Engineer	J.B. Barry & Partners	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No
TP03
Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171737E - 70314N **Level:** 11.80m OD	**Date** 11/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.80 x 1.20	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.50m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.35	11.45		(TOPSOIL) Soft, dark brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded.
	0.50 - 1.50 0.50 - 1.50	B D					(MADE GROUND) Soft to firm, purple brown, slightly sandy gravelly CLAY with medium cobble content and rare pottery and glass fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
				1.10	10.70		(ASSUMED NATURAL) Soft to firm, purple brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D					
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.50	7.30		End of Pit at 4.500m

1
2
3
4
5

Stability: Moderate
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated 4.50m bgl, scheduled depth.

Photographic Record





Number:	**TP03**	**Project**	Bessborough SHD	
		Project No	P21239	
		Engineer	J.B. Barry & Partners	

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Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No
TP04
Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 172027E - 70362N **Level:** 12.35m OD	**Date** 13/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.60 x 1.10	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.50m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	12.05		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to medium, sub-angular to sub-rounded.
	0.50 - 1.50 0.50 - 1.50	B D		0.70	11.65		(MADE GROUND): Soft, brown slightly silty slightly gravelly SAND with plastic waste. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D		1.50	10.85		(ASSUMED NATURAL): Soft, brown, slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	2.50 - 3.50 2.50 - 3.50	B D					Soft to firm, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	3.50 - 4.50 3.50 - 4.50	B D		4.50	7.85		End of Pit at 4.500m

Stability: Moderate
Plant: 14T track machine
Backfill: Arisings.

Groundwater: 3.90m: Trickle rate of flow

Remarks: Trial pit terminated at 4.50m bgl, scheduled depth.

Photographic Record





Number:	**TP04**	**Project**	Bessborough SHD	
		Project No	P21239	
		Engineer	J.B. Barry & Partners	

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Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No
TP05
Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 172034E - 70303N **Level:** 12.21m OD	**Date** 14/01/2022
Location: Mahon, Cork		**Dimensions (m):** 4.10 x 1.20	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.50m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30	11.91		(TOPSOIL) Soft to firm, brown, slightly sandy slightly gravelly SILT with grass and rootlets. Sand is fine to coarse. Gravel is fine to medium, sub-angular to sub-rounded.
	0.70 - 1.50 0.70 - 1.50	B D		0.70	11.51		(MADE GROUND) Soft to firm, brown orange, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D					Firm to stiff, purple brown, slightly sandy slightly gravelly CLAY with medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded. Boulders are sub-rounded to rounded. (Assumed Natural).
	2.50 - 3.50 2.50 - 3.50	B D					
▼	3.50 - 4.50 3.50 - 4.50	B D					
				4.50	7.71		End of Pit at 4.500m

1 2 3 4 5

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: 3.90m: Slow rate of flow

Remarks: Trial pit terminated at 4.50m bgl, scheduled depth.

Photographic Record





Number:	**TP05**	**Project**	Bessborough SHD	
		Project No	P21239	
		Engineer	J.B. Barry & Partners	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No
TP06
Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171941E - 70338N **Level:** 13.69m OD	**Date** 12/01/2022
Location: Mahon, Cork	**Dimensions (m):** 3.40 x 1.10		**Scale** 1:25
Client: Estuary View Ent. Ltd	**Depth:** 0.30m BGL		**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.15	13.54		(TOPSOIL) Soft to firm, slightly sandy slightly gravelly SILT with grass and rootlets.
				0.30	13.39		(MADE GROUND) Firm to stiff, light blue grey, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular.
							Concrete Slab - drain/sewer access cover.
							End of Pit at 0.300m

1
2
3
4
5

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 0.30m bgl, due to encountering a concrete slab covering an apparent un-used drain. Pit relocated.

Photographic Record





Number:	**TP06**	**Project**	Bessborough SHD	
		Project No	P21239	
		Engineer	J.B. Barry & Partners	

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www.prioritygeotechnical.ie

Trial Pit No
TP06A
Sheet 1 of 1

Project Name: Bessboro SHD	**Project No.** P21239	**Co-ords:** 171945E - 70339N **Level:** 13.61m OD	**Date** 12/01/2022
Location: Mahon, Cork		**Dimensions (m):** 3.80 x 1.10	**Scale** 1:25
Client: Estuary View Ent. Ltd		**Depth:** 4.60m BGL	**Logged** OD

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.10	13.51		(TOPSOIL) Soft to firm, slightly sandy slightly gravelly SILT with grass and rootlets.
	0.50 - 1.45 0.50 - 1.45	B D					(MADE GROUND) Soft to firm, slightly sandy slightly gravelly CLAY with low cobble content and waste (pottery fragments, glass, plastics). Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	1.50 - 2.50 1.50 - 2.50	B D		1.45	12.16		Soft to firm, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to rounded. Cobbles are sub-rounded to rounded.
	2.50 - 3.50 2.50 - 3.50	B D					
	3.50 - 4.50 3.50 - 4.50	B D					
				4.60	9.01		End of Pit at 4.600m

1 2 3 4 5

Stability: Good
Plant: 14T track machine
Backfill: Arisings.

Groundwater: 3.10m: Trickle rate of flow

Remarks: Trial pit terminated at 4.60m bgl, scheduled depth.

Photographic Record

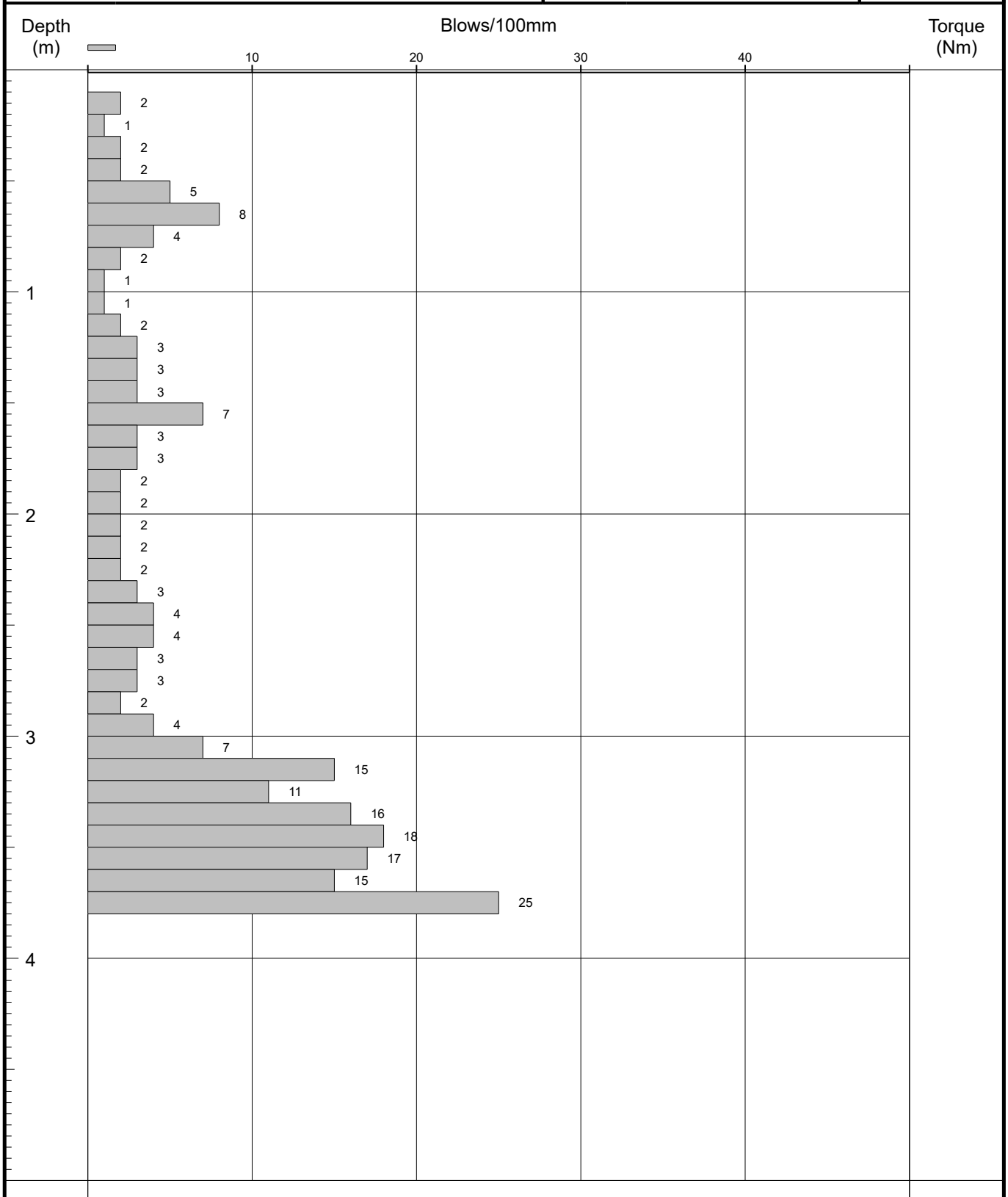




Number:	**TP06A**	**Project**	Bessborough SHD	
		Project No	P21239	
		Engineer	J.B. Barry & Partners	

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP01** Sheet 1 of 1

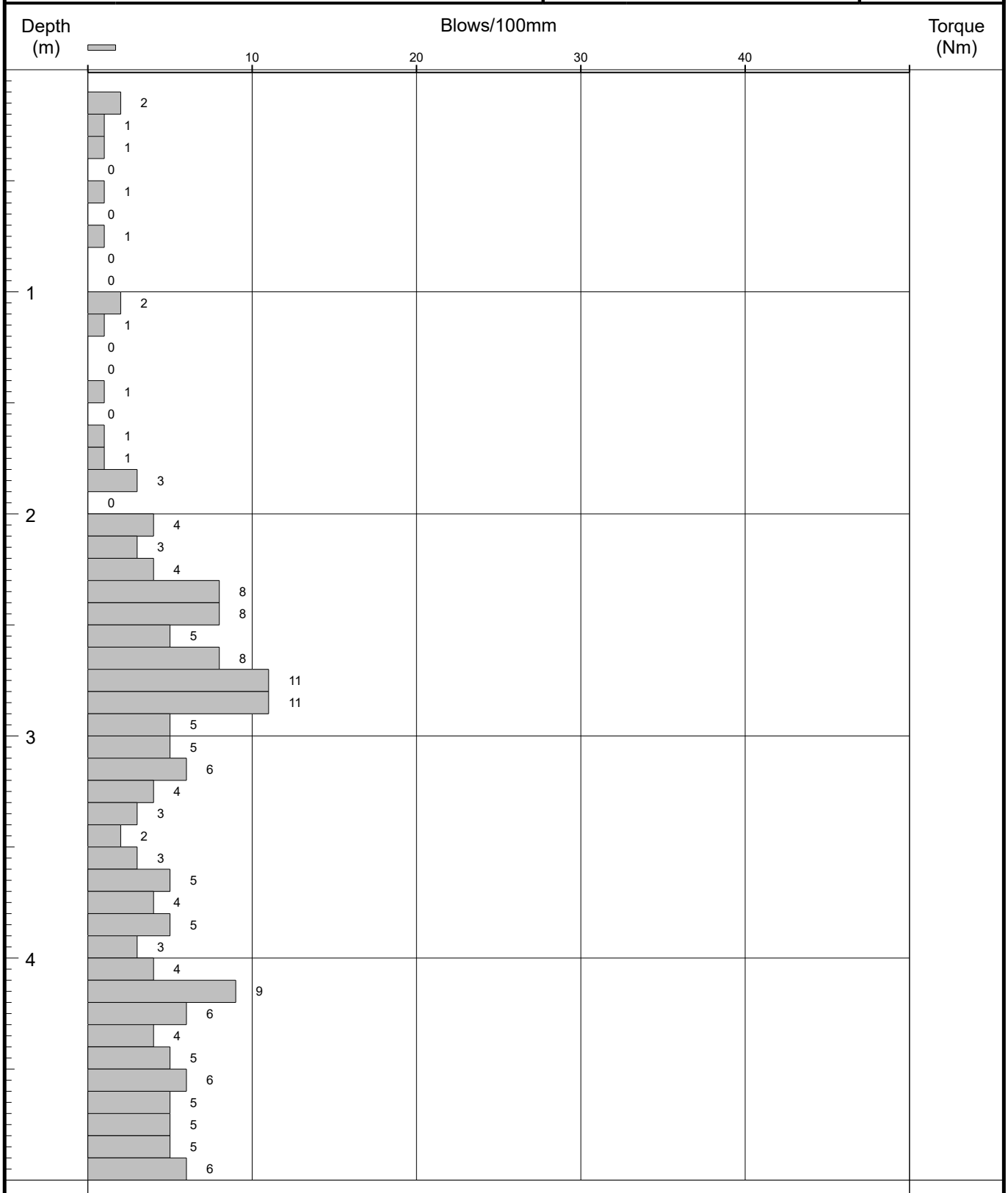
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171822E - 70465N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	16.54m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 3.70m bgl, refusal.		**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45
		Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
		Probe Type:	DPH	**Final Depth (m bgl):**	3.70

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP02** Sheet 1 of 2

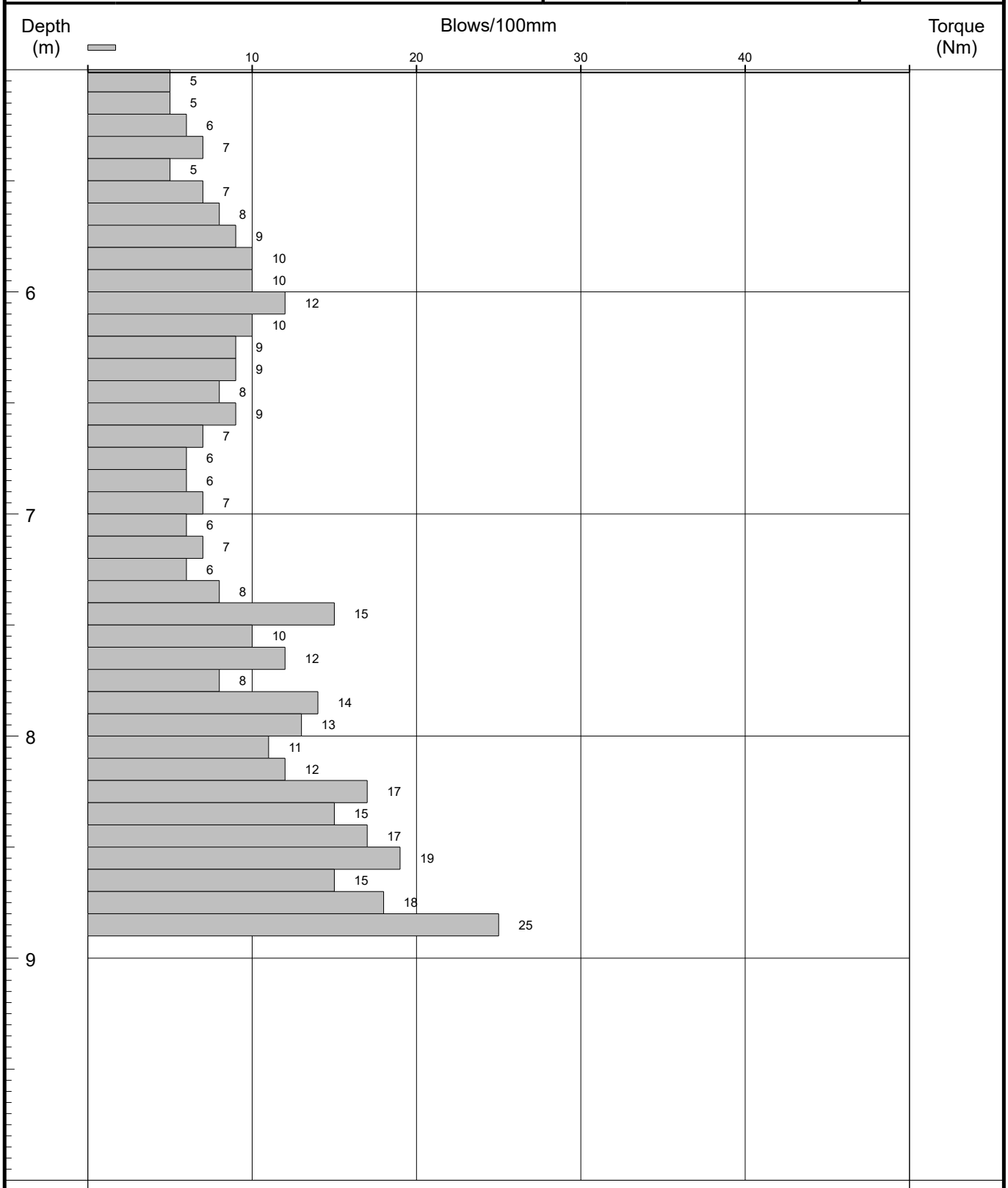
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171742E - 70393N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	12.93m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 8.80m bgl, refusal.	**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45	
	Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90	
	Probe Type:	DPH	**Final Depth (m bgl):**	8.80	

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP02** Sheet 2 of 2

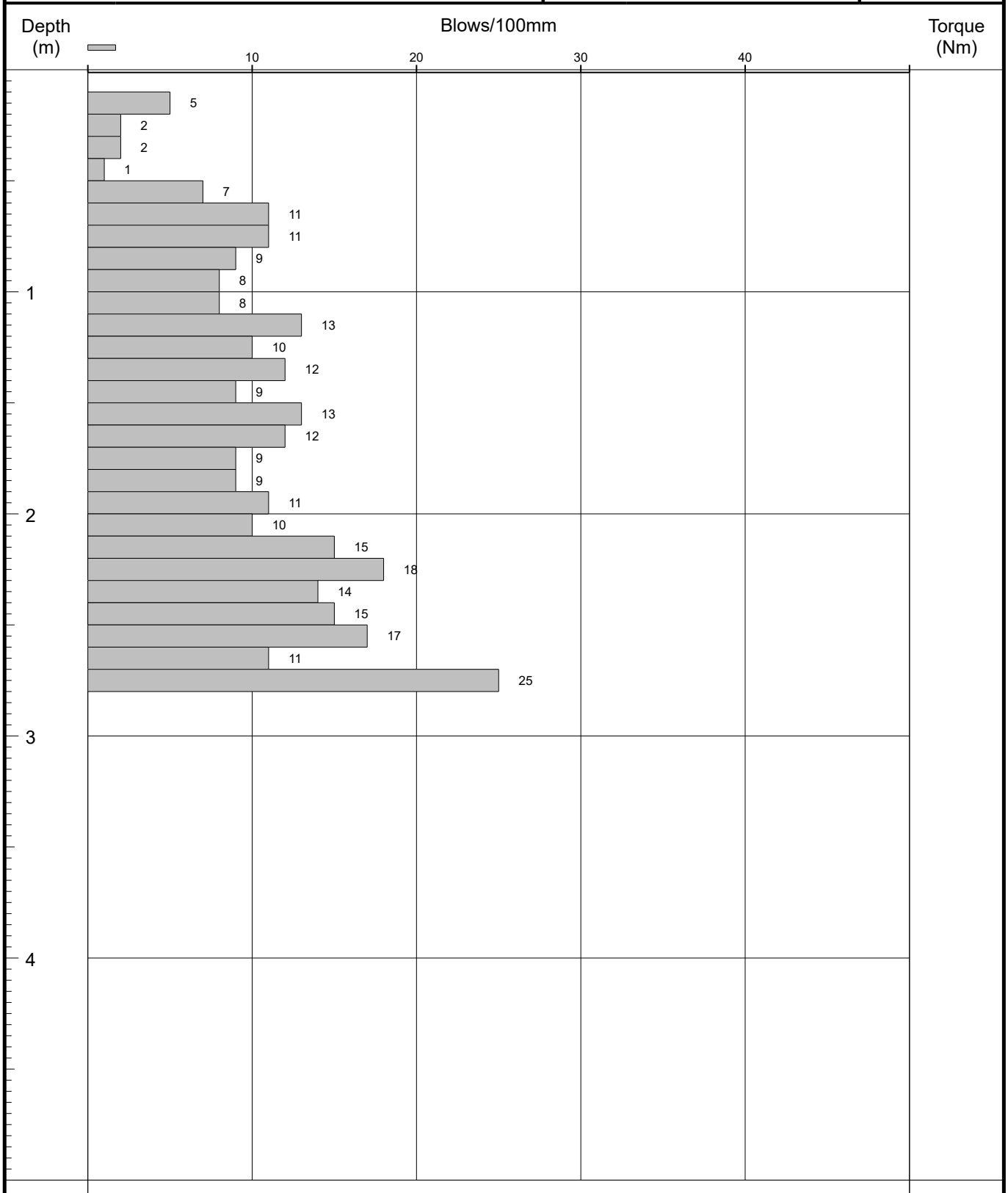
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171742E - 70393N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	12.93m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 8.80m bgl, refusal.		**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45
		Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
		Probe Type:	DPH	**Final Depth (m bgl):**	8.80

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP03** Sheet 1 of 1

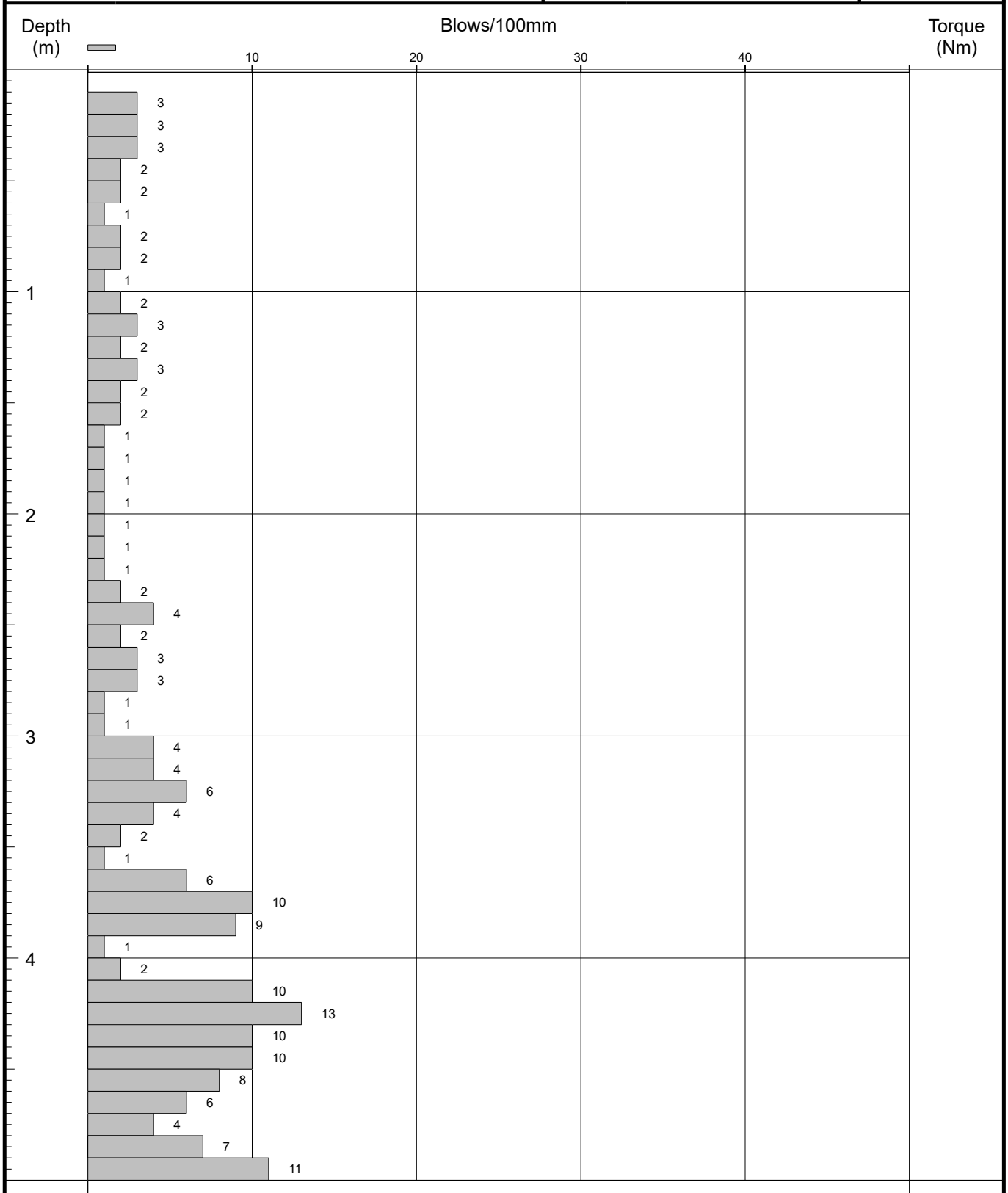
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	171736E - 70312N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	11.53m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 2.70m bgl, refusal.		**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45
		Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
		Probe Type:	DPH	**Final Depth (m bgl):**	2.70

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP04** Sheet 1 of 2

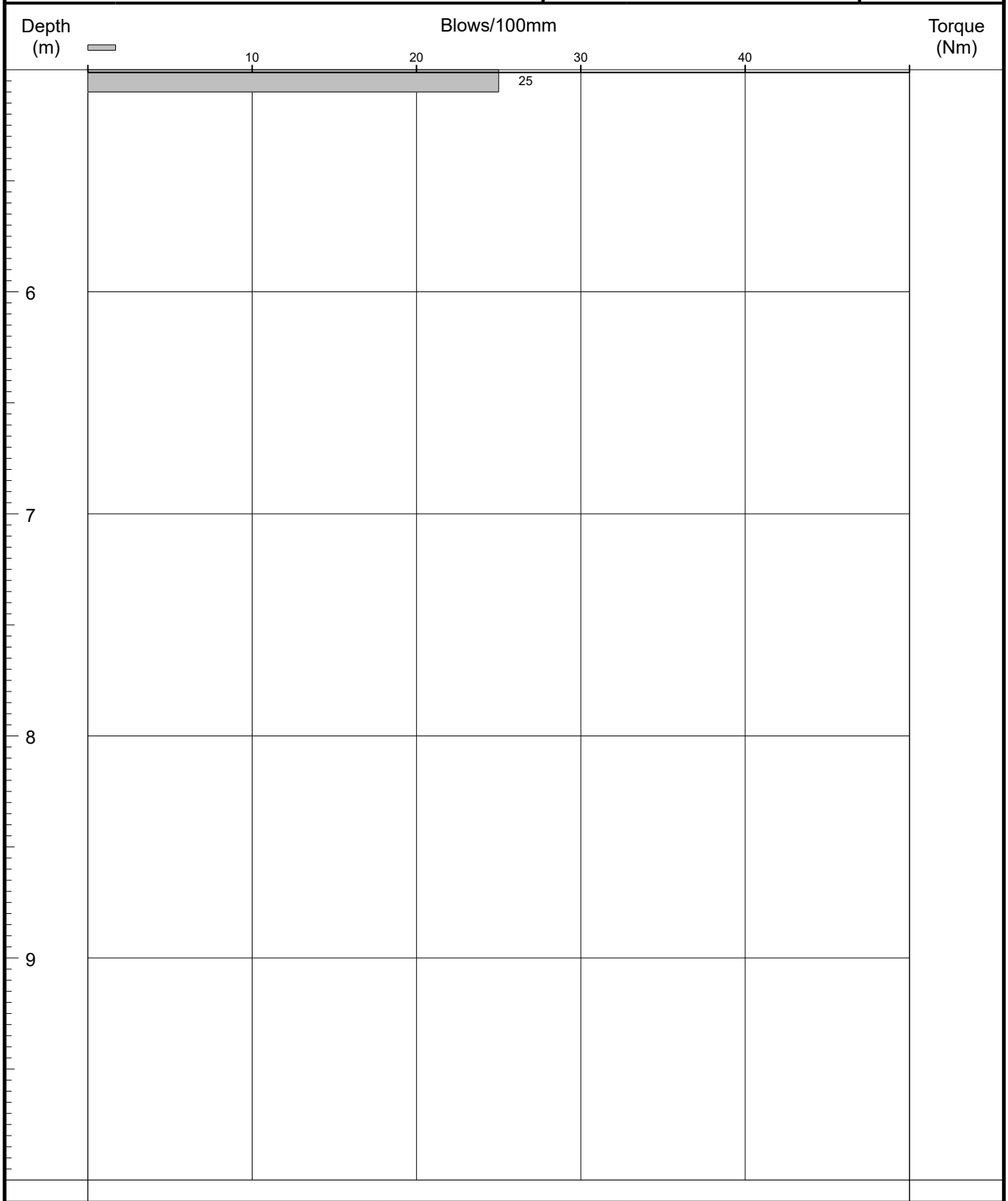
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172028E - 70364N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	12.40m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 5.00m bgl, refusal.		**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45
		Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
		Probe Type:	DPH	**Final Depth (m bgl):**	5.00

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP04** Sheet 2 of 2

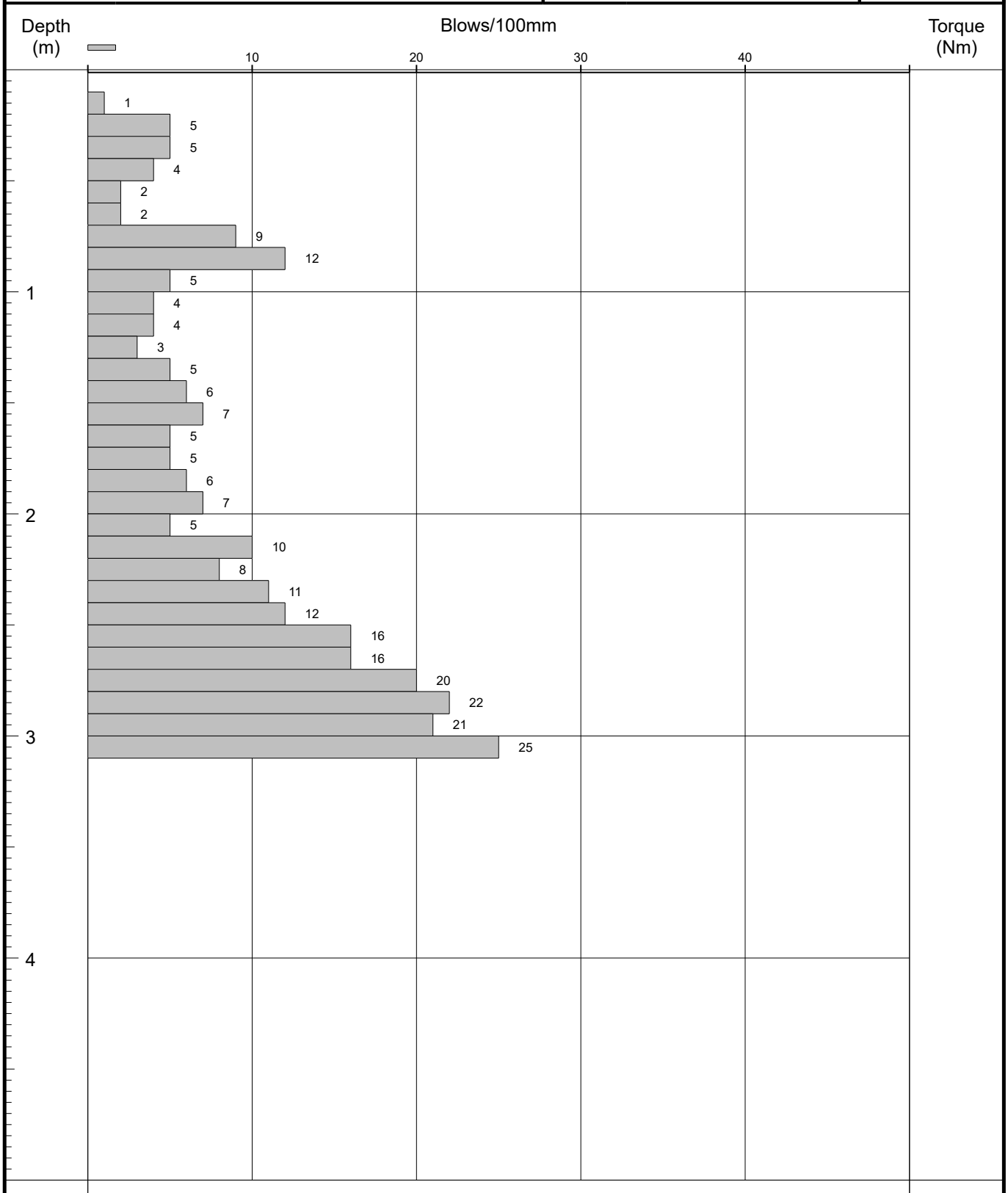
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172028E - 70364N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	12.40m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 5.00m bgl, refusal.		**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45
		Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
		Probe Type:	DPH	**Final Depth (m bgl):**	5.00

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP05** Sheet 1 of 1

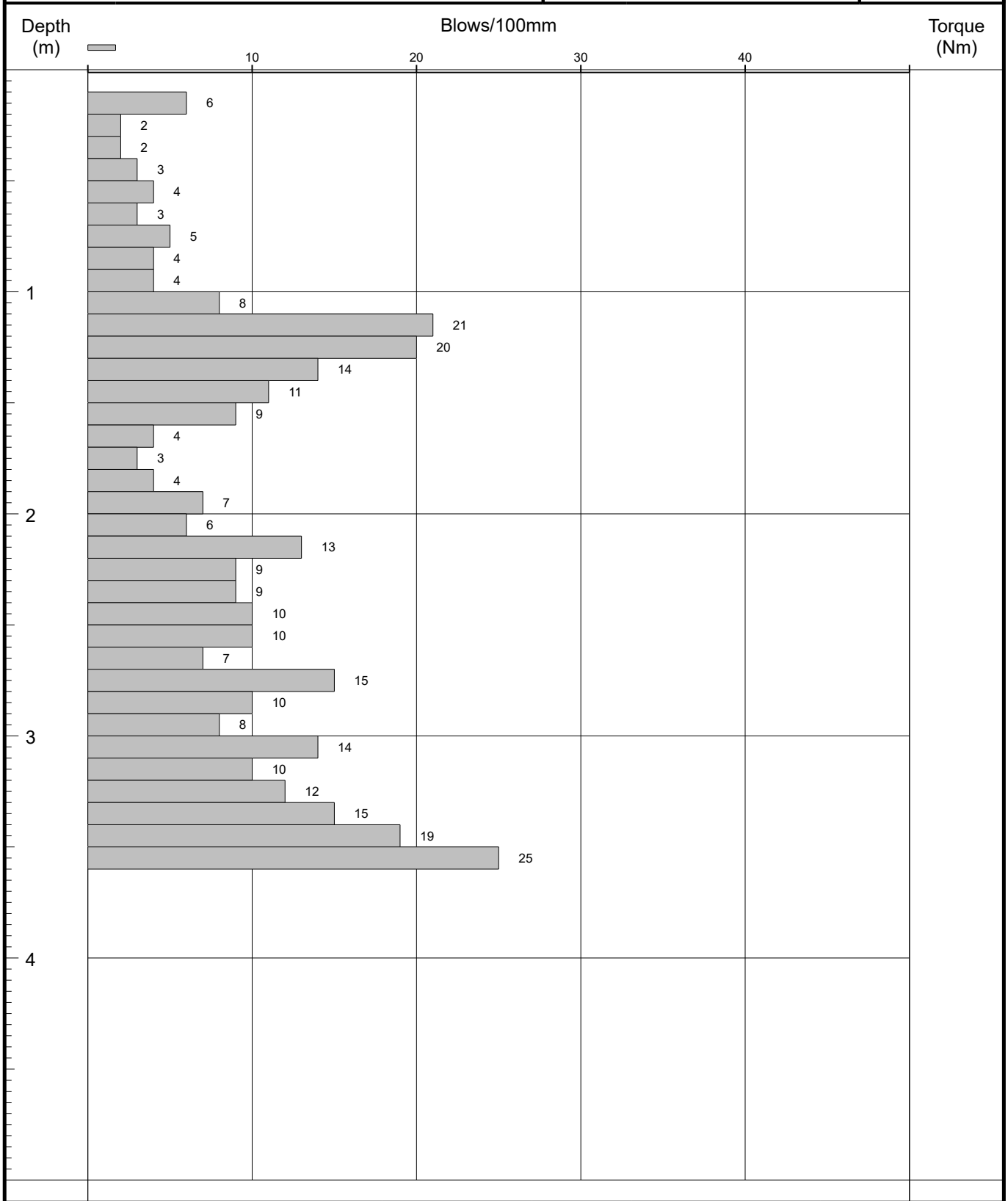
Project Name:	Bessboro SHD	**Project No.** P21239	**Co-ords:**	172034E - 70305N	**Hole Type** DP
Location:	Mahon, Cork		**Level:**	12.21m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd		**Dates:**	14/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 3.00m bgl, refusal.		**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45
		Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
		Probe Type:	DPH	**Final Depth (m bgl):**	3.00

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	Probe No **DP06** Sheet 1 of 1

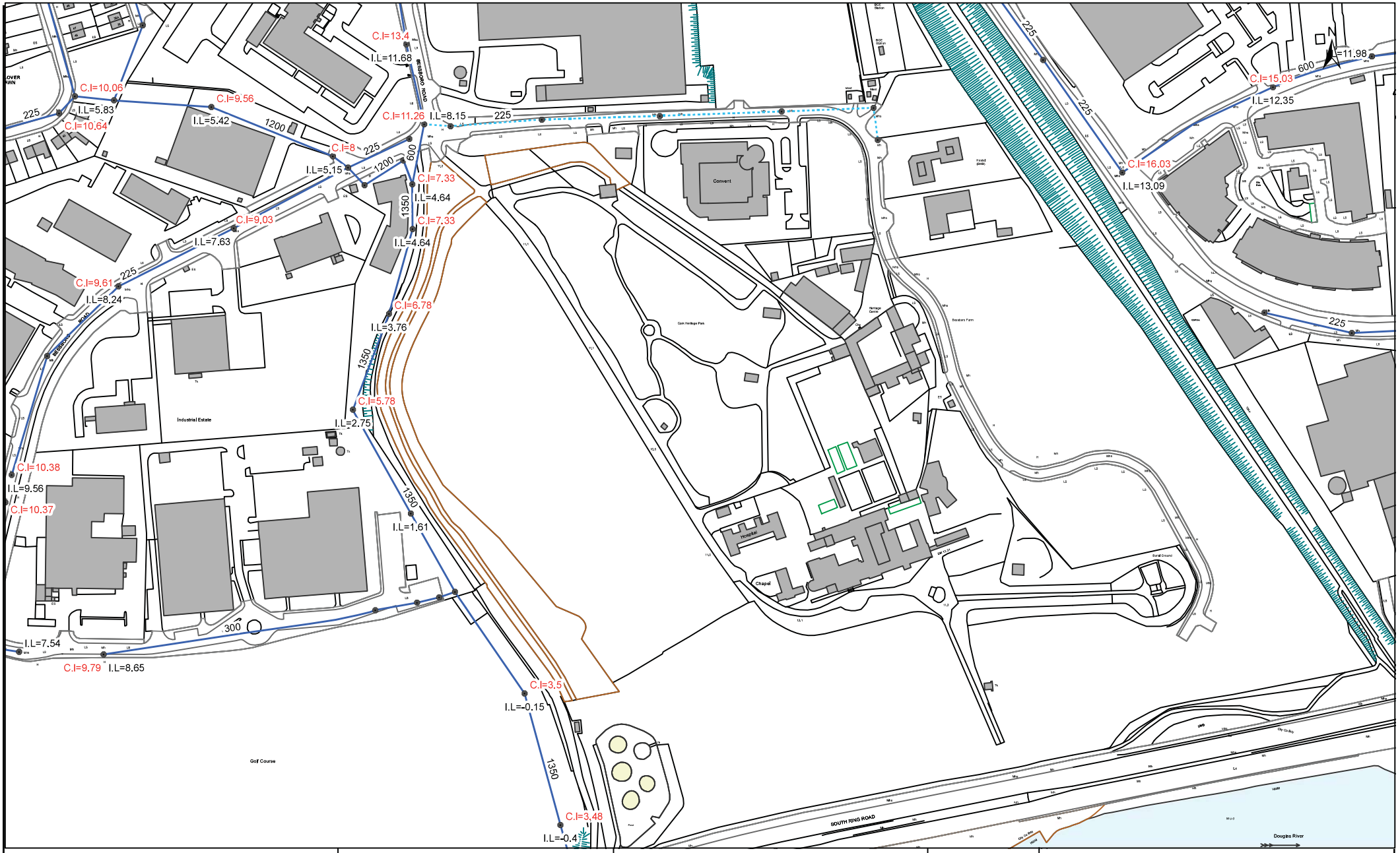
Project Name:	Bessboro SHD	**Project No.**	P21239	**Co-ords:** 171944E - 70343N	**Hole Type** DP
Location:	Mahon, Cork			**Level:** 13.61m OD	**Scale** 1:25
Client:	Estuary View Ent. Ltd			**Dates:** 13/01/2022	**Logged By** LM



Remarks: Dynamic probe terminated at 3.50m bgl, refusal.		**Fall Height (mm):**	500	**Cone Base Dia. (mm):**	45
		Hammer Mass (Kg):	50.0	**Cone Angle (Deg):**	90
		Probe Type:	DPH	**Final Depth (m bgl):**	3.50

APPENDIX 4: CORK CITY COUNCIL – EXISTING STORMWATER NETWORK

Data sensitivity - Public



Drainage Records

Legend

CCC_StormManholes
MANHOLE_
Manhole

CCC_StormNetwork
PIPE_FUNCT
LOCAL STORM
PRIVATE STORM

THE SEWERS SHOWN ON THIS MAP ARE FOR REFERENCE ONLY. THE LOCATION AND PROPERTIES OF ALL SEWERS, LEVELS, PIPESIZES, etc, MUST BE CONFIRMED ON SITE.

1:2,500

N

CORK CITY COUNCIL ENVIRONMENT DIRECTORATE
Storm Network

Drawn By: A. Homan

Checked by: G.R.

Date: 25/07/2018

APPENDIX 5: ATTENUATION ASSESSMENT, STORAGE TANK SIZING & DETAILS

Data sensitivity - Public

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	4.000
M5-60 (mm)	18.800	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.250	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Inverts

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	67.342	1.981	34.0	0.200	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	25.606	0.301	85.1	0.141	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	28.275	0.785	36.0	0.048	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.50	15.800	0.200	0.0	0.0	0.0	2.25	89.5	27.1
S2.000	50.00	4.30	14.100	0.141	0.0	0.0	0.0	1.42	56.4	19.1
S1.001	50.00	4.68	13.799	0.389	0.0	0.0	0.0	2.63	185.8	52.6

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.002	25.583	0.171	150.0	0.025	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	33.931	0.226	150.0	0.092	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	58.040	0.726	80.0	0.154	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	6.525	0.060	108.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	33.667	0.168	200.4	0.081	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	22.174	0.125	177.4	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.000	34.639	0.517	67.0	0.092	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.002	26.316	0.132	200.0	0.053	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.003	4.338	0.022	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.002	50.00	5.01	13.014	0.413	0.0	0.0	0.0	1.28	90.6	56.0
S3.000	50.00	4.53	13.070	0.092	0.0	0.0	0.0	1.07	42.4	12.4
S1.003	50.00	5.56	12.843	0.659	0.0	0.0	0.0	1.76	124.4	89.2
S1.004	50.00	5.63	11.020	0.659	0.0	0.0	0.0	1.51	106.5	89.2
S4.000	50.00	4.61	12.776	0.081	0.0	0.0	0.0	0.92	36.6	11.0
S4.001	50.00	4.99	12.608	0.102	0.0	0.0	0.0	0.98	38.9	13.8
S5.000	50.00	4.36	13.000	0.092	0.0	0.0	0.0	1.60	63.6	12.5
S4.002	50.00	5.46	12.483	0.247	0.0	0.0	0.0	0.92	36.6	33.5
S4.003	50.00	5.54	10.960	0.247	0.0	0.0	0.0	0.92	36.6	33.5

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.005	58.403	0.730	80.0	0.075	0.00	0.0	0.600	o	375	Pipe/Conduit	
S6.000	42.571	0.213	200.0	0.078	4.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	9.507	0.048	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	21.636	0.270	80.0	0.016	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.007	33.709	0.674	50.0	0.210	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.008	12.673	0.253	50.0	0.048	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.009	26.281	0.526	50.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.010	35.823	1.433	25.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.011	37.725	1.150	32.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.012	6.145	0.225	27.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.013	29.282	0.063	464.8	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.005	49.96	6.11	10.938	0.981	0.0	0.0	0.0	2.03	223.9	132.7
S6.000	50.00	4.77	12.320	0.078	0.0	0.0	0.0	0.92	36.6	10.6
S6.001	50.00	4.94	12.107	0.078	0.0	0.0	0.0	0.92	36.6	10.6
S1.006	49.41	6.29	10.208	1.075	0.0	0.0	0.0	2.03	223.9	143.8
S1.007	48.75	6.51	9.938	1.285	0.0	0.0	0.0	2.57	283.6	169.6
S1.008	48.51	6.59	9.264	1.332	0.0	0.0	0.0	2.57	283.6	175.0
S1.009	48.01	6.76	9.010	1.332	0.0	0.0	0.0	2.57	283.6	175.0
S1.010	47.55	6.93	8.485	1.332	0.0	0.0	0.0	3.64	401.7	175.0
S1.011	47.01	7.12	7.052	1.332	0.0	0.0	0.0	3.17	350.5	175.0
S1.012	46.93	7.15	5.902	1.332	0.0	0.0	0.0	3.48	384.2	175.0
S1.013	45.71	7.63	5.677	1.332	0.0	0.0	0.0	1.03	223.5	175.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.014	30.804	0.154	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.015	27.061	0.135	200.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.016	94.491	2.645	35.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.014	50.00	4.56	5.614	0.000	23.8	0.0	0.0	0.92	36.6	23.8
S1.015	50.00	5.05	5.460	0.000	23.8	0.0	0.0	0.92	36.6	23.8
S1.016	50.00	5.77	5.325	0.000	23.8	0.0	0.0	2.20	87.3	23.8

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.800	Cv (Summer)	0.750
Return Period (years)	2	Ratio R	0.250	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S.B22, DS/PN: S1.014, Volume (m³): 12.0

Unit Reference	MD-SHE-0132-1040-2100-1040	Sump Available	Yes
Design Head (m)	2.100	Diameter (mm)	132
Design Flow (l/s)	10.4	Invert Level (m)	5.614
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1500
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	10.4	Kick-Flo®	1.179	7.9
Flush-Flo™	0.578	10.0	Mean Flow over Head Range	-	8.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.7	0.600	10.0	1.600	9.1	2.600	11.5	5.000	15.7	7.500	19.1
0.200	8.4	0.800	9.8	1.800	9.7	3.000	12.3	5.500	16.4	8.000	19.7
0.300	9.3	1.000	9.2	2.000	10.2	3.500	13.2	6.000	17.1	8.500	20.2
0.400	9.8	1.200	8.0	2.200	10.6	4.000	14.1	6.500	17.8	9.000	20.8
0.500	10.0	1.400	8.6	2.400	11.1	4.500	14.9	7.000	18.4	9.500	21.3

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Storage Structures for Storm

Tank or Pond Manhole: S.B22, DS/PN: S1.014

Invert Level (m) 5.614

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	360.0	0.400	360.0	0.800	360.0	1.200	360.0	1.600	360.0	2.000	360.0	2.400	0.0
0.100	360.0	0.500	360.0	0.900	360.0	1.300	360.0	1.700	360.0	2.100	360.0	2.500	0.0
0.200	360.0	0.600	360.0	1.000	360.0	1.400	360.0	1.800	360.0	2.101	0.0		
0.300	360.0	0.700	360.0	1.100	360.0	1.500	360.0	1.900	360.0	2.300	0.0		

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.800 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.250 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S.B1	15 Winter	100	+20%	100/15 Summer				16.563	0.538	0.000	0.90			77.9	SURCHARGED
S2.000	S.B2	15 Winter	100	+20%	30/15 Summer				15.553	1.228	0.000	0.89			46.5	FLOOD RISK
S1.001	S.B3	15 Winter	100	+20%	30/15 Summer				15.354	1.255	0.000	0.73			122.5	FLOOD RISK
S1.002	S.B4	15 Winter	100	+20%	30/15 Summer				14.939	1.625	0.000	1.58			127.8	FLOOD RISK
S3.000	S.B5	15 Winter	100	+20%	30/15 Summer	100/15 Summer			14.505	1.210	5.190	1.37			54.5	FLOOD
S1.003	S.B6	15 Winter	100	+20%	30/15 Summer	100/15 Summer			14.502	1.359	2.369	1.57			185.2	FLOOD
S1.004	S7	15 Winter	100	+20%	1/15 Summer				13.383	2.063	0.000	2.76			169.5	SURCHARGED
S4.000	S.B7	15 Winter	100	+20%	30/15 Summer				13.827	0.826	0.000	0.84			28.8	SURCHARGED
S4.001	S.B8	15 Winter	100	+20%	30/15 Summer				13.767	0.934	0.000	0.94			33.5	SURCHARGED
S5.000	S.B9	15 Winter	100	+20%	30/15 Winter				13.774	0.549	0.000	0.58			34.7	SURCHARGED

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S1.000	S.B1	
S2.000	S.B2	
S1.001	S.B3	
S1.002	S.B4	
S3.000	S.B5	4
S1.003	S.B6	4
S1.004	S7	
S4.000	S.B7	
S4.001	S.B8	
S5.000	S.B9	

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S4.002	S.B10	15 Winter	100	+20%	30/15 Summer				13.699	0.991	0.000	2.51			85.1	SURCHARGED
S4.003	S12	15 Winter	100	+20%	1/15 Summer				13.231	2.046	0.000	2.74			70.6	SURCHARGED
S1.005	S.B11	15 Winter	100	+20%	30/15 Summer				13.005	1.692	0.000	1.15			241.5	SURCHARGED
S6.000	S.B12	15 Winter	100	+20%	100/15 Summer				12.551	0.006	0.000	0.98			34.2	SURCHARGED
S6.001	S.B13	15 Winter	100	+20%	100/15 Summer				12.334	0.002	0.000	1.06			32.2	SURCHARGED
S1.006	S.B14	15 Winter	100	+20%	30/15 Summer				12.030	1.447	0.000	1.42			270.2	SURCHARGED
S1.007	S.B15	30 Winter	100	+20%	30/15 Summer				11.508	1.196	0.000	1.22			309.3	SURCHARGED
S1.008	S.B16	30 Winter	100	+20%	30/15 Summer				10.516	0.877	0.000	1.62			319.2	SURCHARGED
S1.009	S.B17	30 Winter	100	+20%	30/15 Summer				9.875	0.490	0.000	1.29			317.4	SURCHARGED
S1.010	S.B18	30 Winter	100	+20%	100/15 Summer				9.042	0.182	0.000	0.86			309.6	SURCHARGED
S1.011	S.B19	30 Winter	100	+20%	30/15 Summer				8.000	0.573	0.000	0.97			308.5	SURCHARGED
S1.012	S.B20	720 Winter	100	+20%	1/15 Winter				7.689	1.413	0.000	0.35			64.4	SURCHARGED
S1.013	S.B21	720 Winter	100	+20%	1/360 Winter				7.686	1.485	0.000	0.34			64.1	SURCHARGED
S1.014	S.B22	720 Winter	100	+20%	1/15 Winter				7.683	1.844	0.000	0.30			10.3	SURCHARGED
S1.015	S.B23	720 Winter	100	+20%					5.545	-0.140	0.000	0.30			10.3	OK
S1.016	S.B24	720 Winter	100	+20%					5.377	-0.173	0.000	0.12			10.3	OK

PN	US/MH Name	Level Exceeded
S4.002	S.B10	
S4.003	S12	
S1.005	S.B11	
S6.000	S.B12	
S6.001	S.B13	
S1.006	S.B14	
S1.007	S.B15	
S1.008	S.B16	
S1.009	S.B17	
S1.010	S.B18	
S1.011	S.B19	

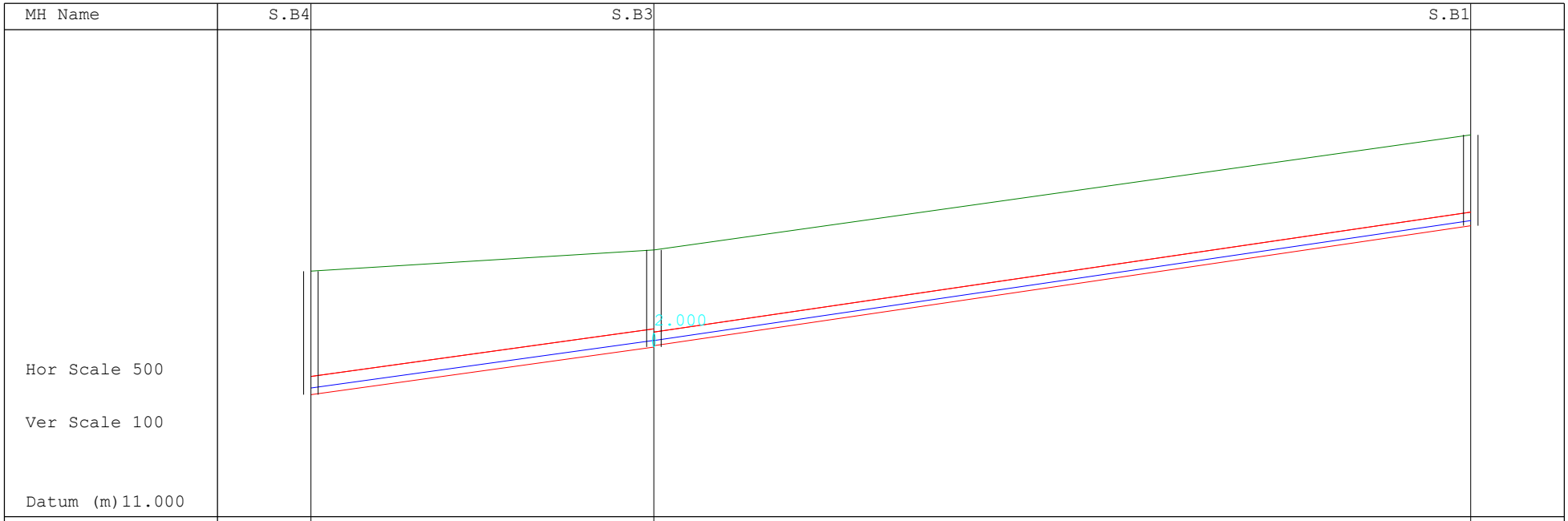
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S1.012	S.B20	
S1.013	S.B21	
S1.014	S.B22	
S1.015	S.B23	
S1.016	S.B24	

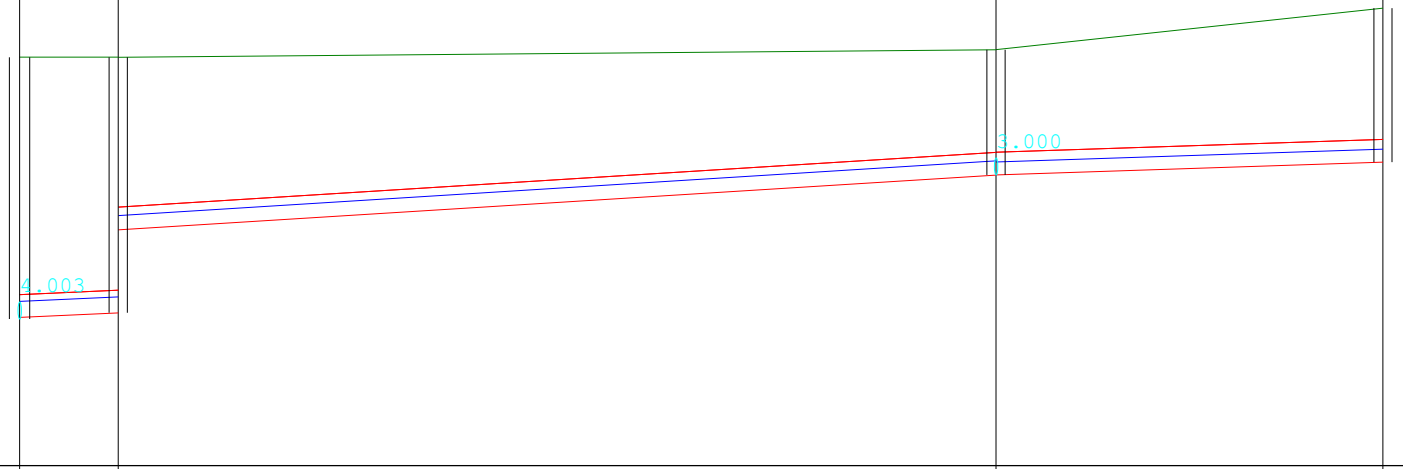
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APPENDIX 6: STORMWATER LONGSECTIONS



PN		S1.001	S1.000
Dia (mm)		300	225
Slope (1:X)		36.0	34.0
Cover Level (m)	15.050	15.400	17.300
Invert Level (m)	13.014	13.799 13.819	15.800
Length (m)		28.275	67.342

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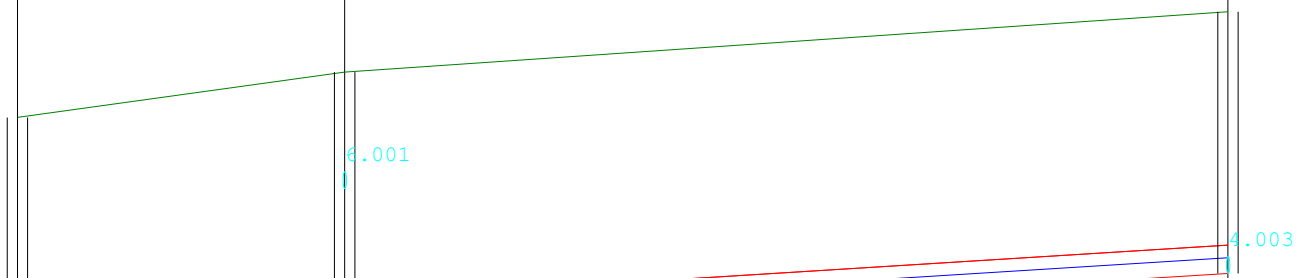
Hor Scale 500

Ver Scale 100

Datum (m) 9.000

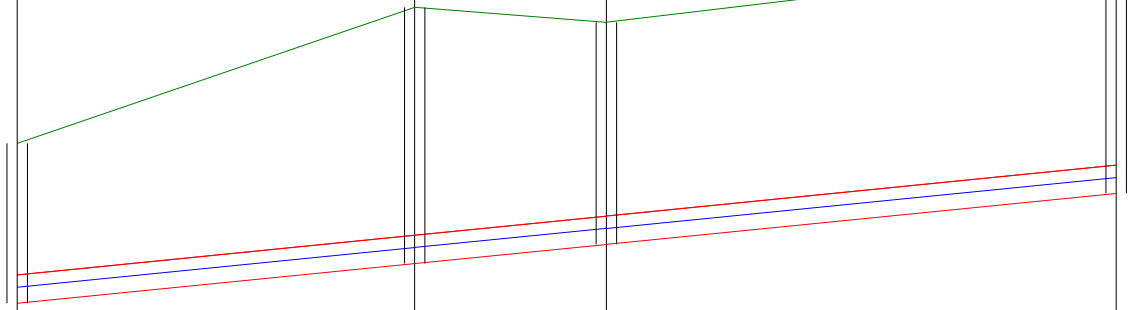
MH Name	S.B11	S7	S.B6	S.B4	
PN		S1.004	S1.003	S1.002	
Dia (mm)		300	300	300	
Slope (1:X)		108.8	80.0	150.0	
Cover Level (m)	14.400	14.400	14.500	15.050	
Invert Level (m)		10.960 11.020	12.118 12.843	12.843 13.014	
Length (m)		6.525	58.040	25.583	

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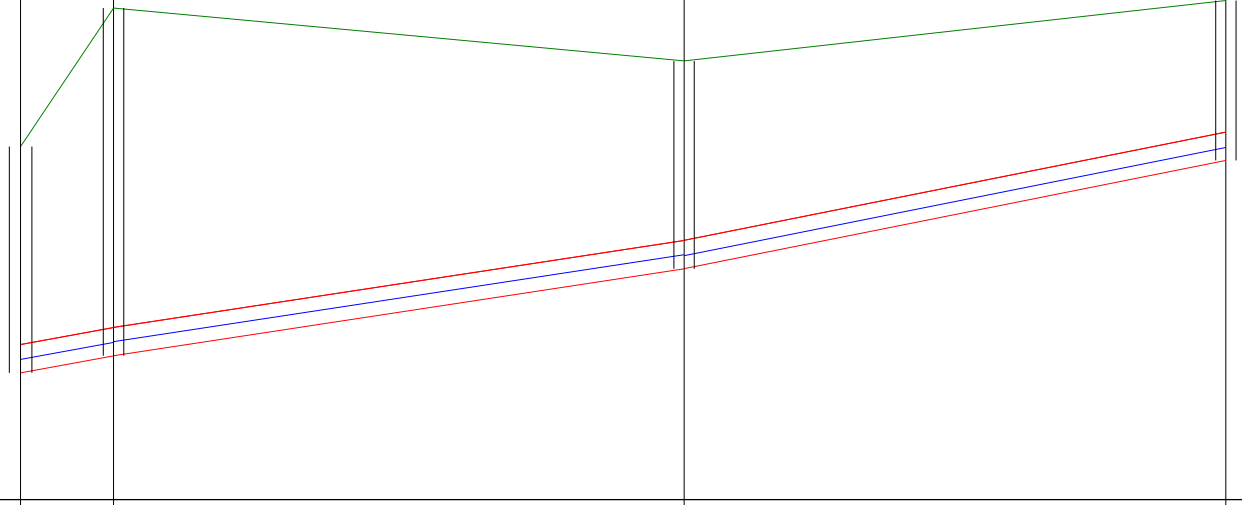


MH Name	S.B15	S.B14	S.B11	
Hor Scale 500 Ver Scale 100 Datum (m) 8.000				
PN		S1.006	S1.005	
Dia (mm)		375	375	
Slope (1:X)		80.0	80.0	
Cover Level (m)	13.000	13.600	14.400	
Invert Level (m)	9.938	10.208	10.208	10.938
Length (m)		21.636	58.403	

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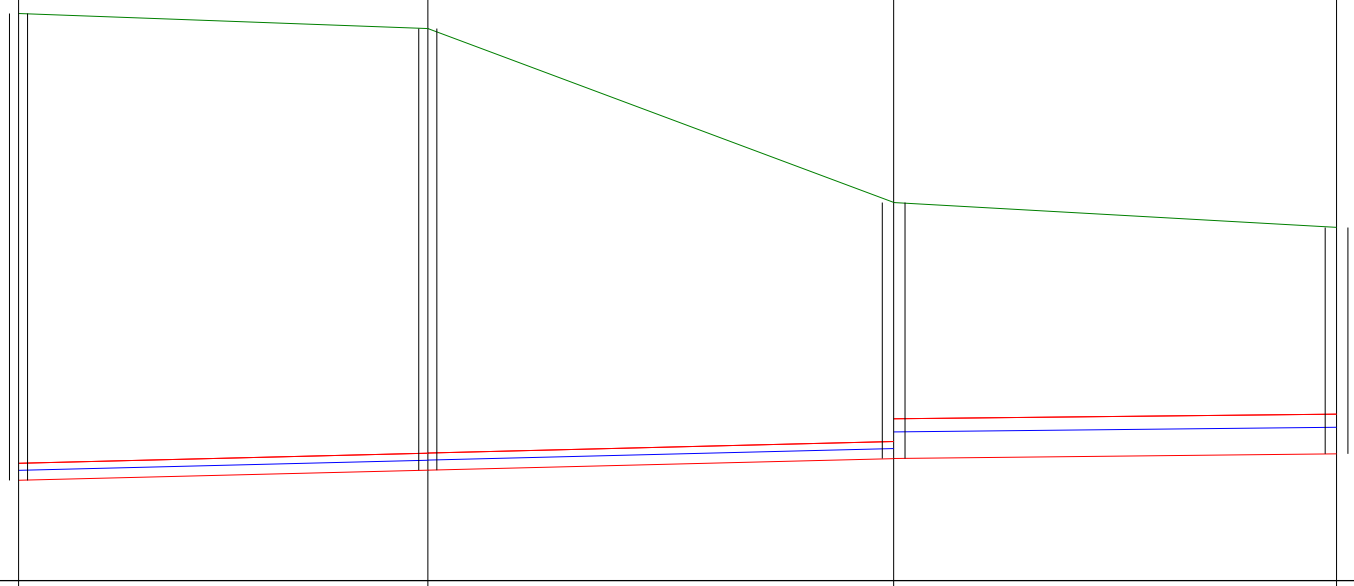
MH Name	S.B18	S.B17	S.B16	S.B15	
Hor Scale 500 Ver Scale 100 Datum (m) 7.000					
PN		S1.009	S1.008	S1.007	
Dia (mm)		375	375	375	
Slope (1:X)		50.0	50.0	50.0	
Cover Level (m)	10.600	12.400	12.200	13.000	
Invert Level (m)	8.485	9.010	9.010 9.264	9.264 9.938	
Length (m)		26.281	12.673	33.709	

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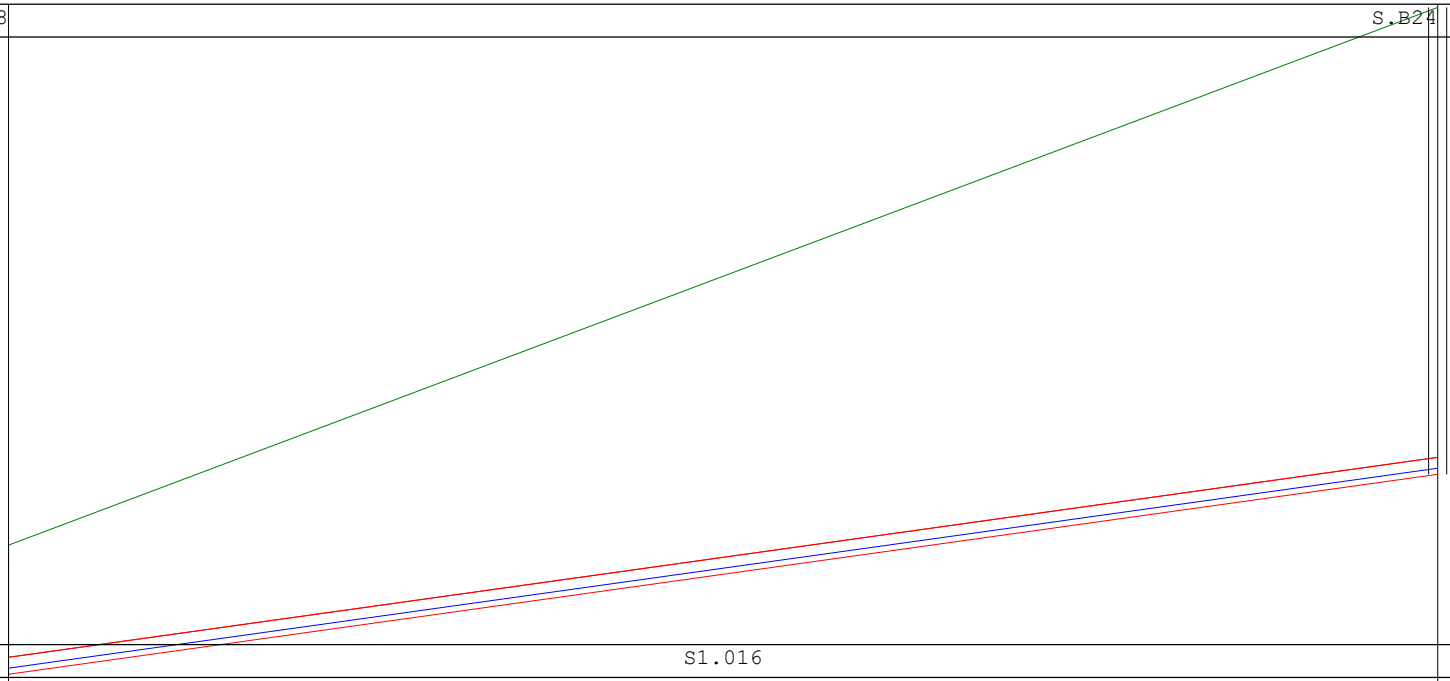
MH Name	S.B21		S.B19	S.B18	
Hor Scale 500 Ver Scale 100 Datum (m) 4.000					
PN			S1.011	S1.010	
Dia (mm)			375	375	
Slope (1:X)			32.8	25.0	
Cover Level (m)	8.670	10.500	9.800	10.600	
Invert Level (m)		5.677 5.902	5.902 7.052	7.052 8.485	
Length (m)			37.725	35.823	

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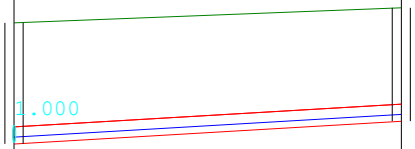


MH Name	S.B24	S.B23	S.B22	S.B21
PN		S1.015	S1.014	S1.013
Dia (mm)		225	225	525
Slope (1:X)		200.5	200.0	464.8
Cover Level (m)	11.500	11.300	9.000	8.670
Invert Level (m)	5.325	5.460	5.460 / 5.614	5.614 / 5.677
Length (m)		27.061	30.804	29.282

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MH Name	S.A28		S.B24
Hor Scale 500 Ver Scale 100 Datum (m) 3.073			
PN		S1.016	
Dia (mm)		225	
Slope (1:X)		35.7	
Cover Level (m)	4.390		11.500
Invert Level (m)	2.680		5.325
Length (m)		94.491	

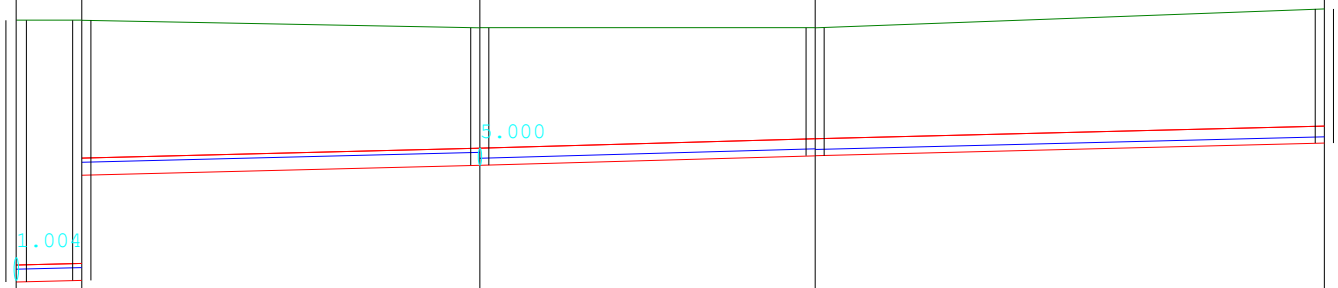
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MH Name	S.B3	S.B2	
Hor Scale 500 Ver Scale 100 Datum (m) 11.000			
PN		S2.000	
Dia (mm)		225	
Slope (1:X)		85.1	
Cover Level (m)	15.400	15.600	
Invert Level (m)	13.799	14.100	
Length (m)		25.606	

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MH Name	S.B6	S.B5	
Hor Scale 500 Ver Scale 100 Datum (m) 10.000		1.002	
PN		S3.000	
Dia (mm)		225	
Slope (1:X)		150.0	
Cover Level (m)	14.500	14.500	
Invert Level (m)	12.844	13.070	
Length (m)		33.931	

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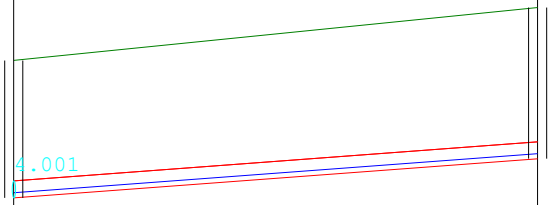
Hor Scale 500

Ver Scale 100

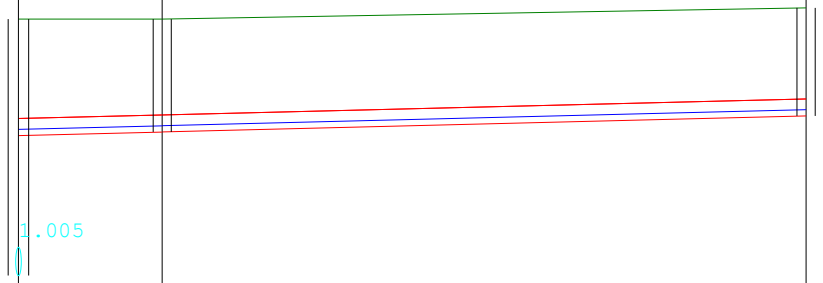
Datum (m) 9.000

MH Name	S.B11		S.B10	S.B8	S.B7	
PN			S4.002	S4.001	S4.000	
Dia (mm)			225	225	225	
Slope (1:X)			200.0	177.4	200.4	
Cover Level (m)	14.400	14.400	14.300	14.300	14.550	
Invert Level (m)		10.938 10.960	12.351 12.483	12.483 12.608	12.608 12.776	
Length (m)			26.316	22.174	33.667	

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MH Name	S.B10	S.B9	
Hor Scale 500 Ver Scale 100 Datum (m) 10.000			
PN		S5.000	
Dia (mm)		225	
Slope (1:X)		67.0	
Cover Level (m)	14.300	15.000	
Invert Level (m)	12.483	13.000	
Length (m)		34.639	

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MH Name	S.B14	S.B13	S.B12	
Hor Scale 500 Ver Scale 100 Datum (m) 8.000				
PN		S6.001	S6.000	
Dia (mm)		225	225	
Slope (1:X)		200.0	200.0	
Cover Level (m)	13.600	13.600	13.750	
Invert Level (m)		12.060 12.107	12.107 12.320	
Length (m)		9.507	42.571	

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