Client:

Estuary View Enterprises 2020 Ltd.

Project:

# Bessborough SHD Development

Report:

# Services Infrastructure Report

BARRY & PARTNERS

# Document Control Sheet

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# SECTION 1: INTRODUCTION

## 1.1 Scope of the Report

This Services Infrastructure Report outlines the proposed means of servicing the development with wastewater collection and disposal, stormwater management and disposal and water supply infrastructure. A Flood Risk Assessment is provided with this submission under a separate cover. Roads and traffic issues are dealt with separately by MHL Consulting Engineers on behalf of the Applicant and their submission should be consulted for such details.

The following should be read in conjunction with the engineering drawings which illustrate the servicing proposals and with the submissions by other members of the Applicant's design team.

## 1.2 Site Location

The proposed development is located at Phase 1- 'The Meadows', Bessborough, Ballinure, Blackrock, Cork, on a circa 2.29-hectare site, with a developable area of 1.53-hectares, see Figure 1.1. This proposed development will form Phase 1 of a larger development on a circa 16.59-hectare site, see Figure 1.2 for outline phasing proposals.

The Passage West Greenway forms the eastern boundary of the proposed development site, and the South Ring Road (N40) is located approximately 200m from the southern boundary of the proposed development. The western and northern boundaries of the Phase 1 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 14.50 m OD to 11.25 m OD across the site.

## 1.3 Proposed Development Brief

This report is prepared in support of a Strategic Housing Development (SHD) planning application by Estuary View Enterprises 2020 Ltd.

The development will consist of the construction of a residential development of 280 no. residential apartment units with supporting tenant amenity facilities, café, crèche, and all ancillary site development works. The proposed development includes 280 no. apartments to be provided as follows: Block A (6 no. studio apartments, 14 no. 1-bedroom, 34 no. 2-bedroom & 1 no. 3-bedroom over 1-6 storeys), Block B (37 no. 1-bedroom & 49 no. 2-bedroom over 6-10 storeys), Block C (31 no. 1-bedroom, 36 no. 2-bedroom & 6 no. 3-bedroom over 5-9 storeys) and Block D (30 no. 1-bedroom, 31 no. 2-bedroom & 5 no. 3-bedroom over 6-7 storeys).

The proposal includes a new pedestrian/cycle bridge over the adjoining Passage West Greenway to the east, connecting into the existing down ramp from Mahon providing direct access to the greenway and wider areas.

The proposed development provides for outdoor amenity areas, landscaping, under-podium and street car parking, bicycle parking, bin stores, 2 no. substations one of which is single storey free standing, a single storey carpark access building, 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 Bessboro Road.


**Figure 1-1: Location of Proposed Development**


**Figure 1-2: Phasing of Proposed Development**

# SECTION 2: WASTEWATER COLLECTION & DISPOSAL

## 2.1 Existing Wastewater Network

Cork City Council / Irish Water drainage records show an existing 375/450mmØ foul sewer located to the west of the Phase 3 lands which runs north to south before discharging to the Bessborough Wastewater Pumping Station (WWPS). From the WWPS a 350mmØ rising main heads east crossing through the greenfield area in the ownership of the applicant before turning north along the Passage West Greenway, see Appendix 2.

A feasibility study of the local area has revealed that there is an existing a 150mmØ foul sewer in the road adjacent to the western boundary of the Phase 1 site which runs north to south before turning in a westerly direction and connecting to the WWPS described above, see as-built drawing in Appendix 3. This sewer was constructed under planning reference 03/27028.

## 2.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Irish Water (IW) issued a Confirmation of Feasibility (COF) stating that the site can be serviced by its wastewater infrastructure network. This COF is included in Appendix 4.

IW have advised that the proposed connection should be made directly to the WWPS, via a new inlet sewer. The WWPS is almost at design loading capacity. However, Irish Water has a project underway to replace the existing pumps which will increase the pump rate and provide sufficient capacity to accommodate this development and subsequent phases of this development. This upgrade project is scheduled to be completed by Q4 2022 and the proposed connection could be completed as soon as possibly practicable after this date.

## 2.3 Design Acceptance Stage

The proposed designs were progressed in accordance with Irish Water's Code of Practice for Wastewater Infrastructure and were submitted to Irish Water for review and consideration for design acceptance as per the requirement of the SHD process. A Statement of Design Acceptance was issued by Irish Water and is included in Appendix 4.

The wastewater collection within the development will be via a network of gravity sewers. The wastewater flows will be collected and will be conveyed in in a westerly direction, from the south-western boundary of the proposed development site and will connect directly to the WWPS. A legal wayleave is in place across the Bessborough lands immediately to the west of the proposed development site to facilitate this connection.

The final connection from the western edge of the lands to the existing WWPS will be undertaken using directional-drilling techniques to ensure that the existing western boundary wall to the lands will remain undisturbed during construction.

The wastewater collection system is designed and will be constructed in accordance with Irish Water's Code of Practice for Wastewater Infrastructure to ensure self-cleansing velocities will be achieved on all pipe runs. The pipes proposed as part of this design have been sized in accordance with Table 2.1 below, an extract from IW-CDS-5030-03 (Revision 2 2020).

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 wastewater sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 5 of this report. The foul sewer layout plans are attached on Drawing No's. 21207-JBB-PH1-XX-DR-C-04000 & 04001.

| No. of Dwellings | Pipe Diameter | Minimum Gradient |
|---|---|---|
| 2 to 9 | 150mm (or 225mm) | 1:60 |
| 10 to 20 | | 1:150 |
| 21 to 210 | 225mm | 1:200 |
| 211 to 250 | | 1:150 |
| 250 to 330 | | 1:100 |
| 331 to 450 | 300mm | 1:300 |
| 451 to 565 | | 1:200 |
| 566 to 655 | | 1:150 |
| 656 to 830 | | 1:100 |

**Table 2-1: Foul Sewer Size/Gradient Criteria**

## 2.4 Loading Calculations

The design flows are calculated using the Irish Water Code of Practice for Wastewater Infrastructure Appendix B which is summarised in tables 2.2 and 2.3 below.

| Use | No. of Units | Occupancy Rate | Population (P) | Loading (G) (l/day/person) | Daily Loading (PxG) (l/day) | Daily Loading (l/s) |
|---|---|---|---|---|---|---|
| Residential | 280 | 2.7/ Unit | 756 | 150 | 113,400 | |
| | | | | | | |
| | | | | Infiltration (I) 10% (COP Appendix B – Table 2.4) | 11,340 | |
| | | | | Dry Weather Flow (PG +I) | 124,740 | |
| | | | | Residential Peaking Factor ($Pf_{Dom}$) (COP Appendix B – Table 2.5) | 6 | |
| | | | | Design Foul Flow [($Pf_{Dom}$ x PG + I] | 691,740 | 8.006 |
| | | | | Misconnection Allowance (SW) 3% (COP Appendix B - Section 2.2.10) | | 0.350 |
| | | | | Design Flow | | 8.356 |

**Table 2-2: Foul Flow Calculations for Residential Development**

| Use | Floor Area ($m^2$) | | Occupancy Rate | Population (P) | Loading (G) (l/day/person) | Daily Loading (PxG) (l/day) | Daily Loading (l/s) |
|---|---|---|---|---|---|---|---|
| Creche | 320 | | 4 | 42 | 50 | 2,100 | |
| Café | 89 | | 1 per 20$m^2$ | 4 | 50 | 200 | |
| | | | 1 per 5$m^2$ | 18 | 12 | 216 | |
| Communal Workspace | 166 | | 14 | 14 | 100 | 1,400 | |
| Lounge | 180 | | 31 | 31 | 15 | 465 | |
| Gym | 191 | | 1 per 5$m^2$ | 38 | 50 | 1,900 | |
| | Total | | | | | 6,281 | |
| | Total (Based on 12 Hour Day) | | | | | 3,141 | |
| | | | | | | | |
| | Infiltration (I) 10% (COP Appendix B – Table 2.4) | | | | | 314 | |
| | Dry Weather Flow (l/s) PG +I | | | | | 3,455 | |
| | Commercial Peaking Factor ($Pf_{Dom, Ind}$) (COP Appendix B – Table 2.7) | | | | | 4.5 | |
| | Design Foul Flow ($Pf_{Dom, Ind}$ x PG) + I (l/s) | | | | | 14,449 | 0.168 |
| | Misconnection Allowance (SW) 2% (COP Appendix B – Table 2.10) | | | | | | 0.233 |
| | Design Flow (l/s) | | | | | | 0.401 |

**Table 2-3: Foul Flow Calculations for Commercial Development**

The combined residential and commercial design flow is 8.8l/s. This figure has been proportionally applied as a base flow to the heads of the wastewater sewer runs within the MicroDrainage design model, see Appendix 5 for the results.

# SECTION 3: STORMWATER COLLECTION & DISPOSAL

## 3.1 Existing Hydrology

The proposed development site does not contain any mapped watercourse. The nearest watercourse to the proposed development site is the Douglas Estuary which is located approximately 260m 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 3.1 below.

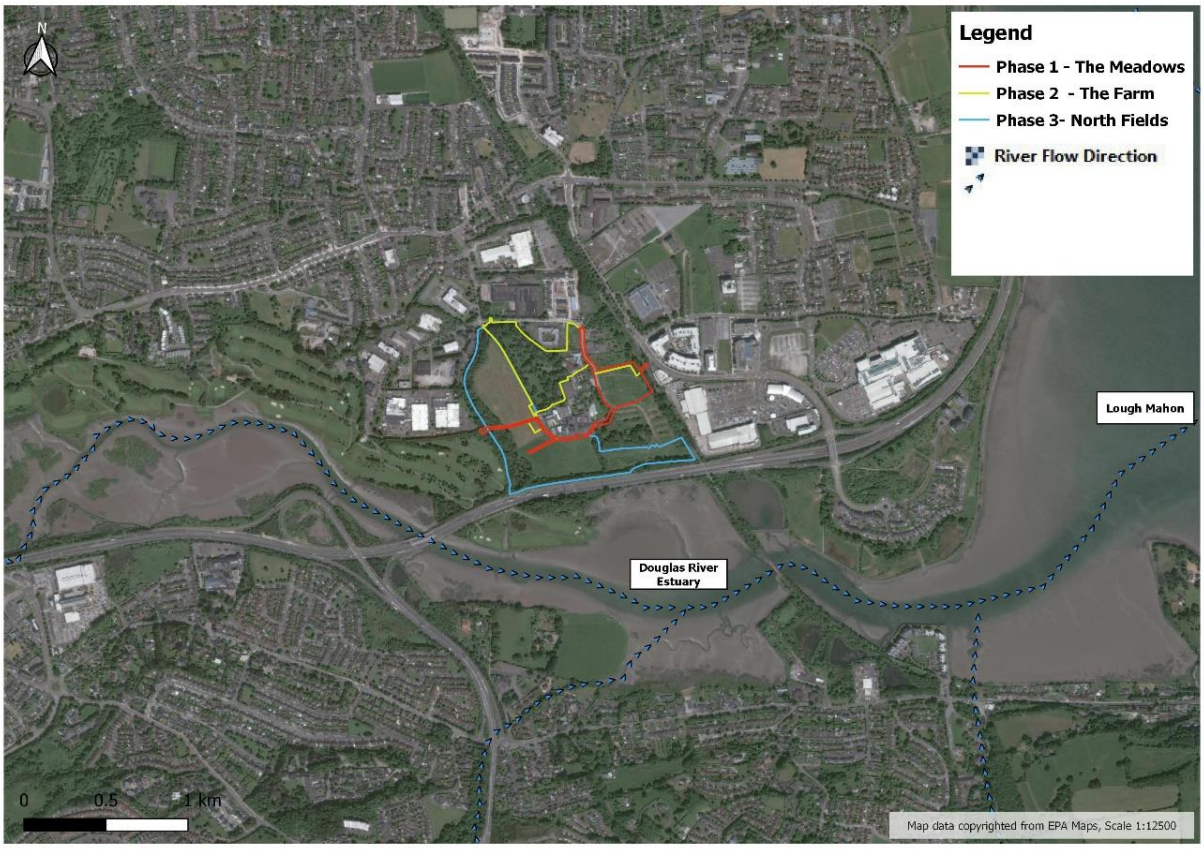



**Figure 3-1: Hydrological Features of the Area**

A geological desk study was conducted to gain an initial understanding of the existing ground conditions. The below Figure 3.2 is an extract from the Geological Survey of Ireland (GSI), where the soil permeability at the site is categorised as 'Moderate'. Further to this the groundwater vulnerability is categorised as 'High', see Figure 3.3. Groundwater vulnerability of an area is determined by the permeability and thickness of the subsoils overlying the groundwater, and the type of recharge sources (diffuse or point source). Therefore, areas where the infiltrating water and contaminants move faster from land to groundwater with high permeability are more vulnerable. Both sources of information would suggest that the site should have reasonable rates of permeability.

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 (BH05), see Appendix 6. The results were inconclusive as there was no drop in water level after 60 minutes and it is thought this result is unlikely to be an accurate representation of the existing ground conditions considering the GIS data above. Infiltration testing in accordance with BRE 365 will be conducted in due course as part of later detailed design. For now, conservative assumptions have been made, to ensure a robust design, and 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.

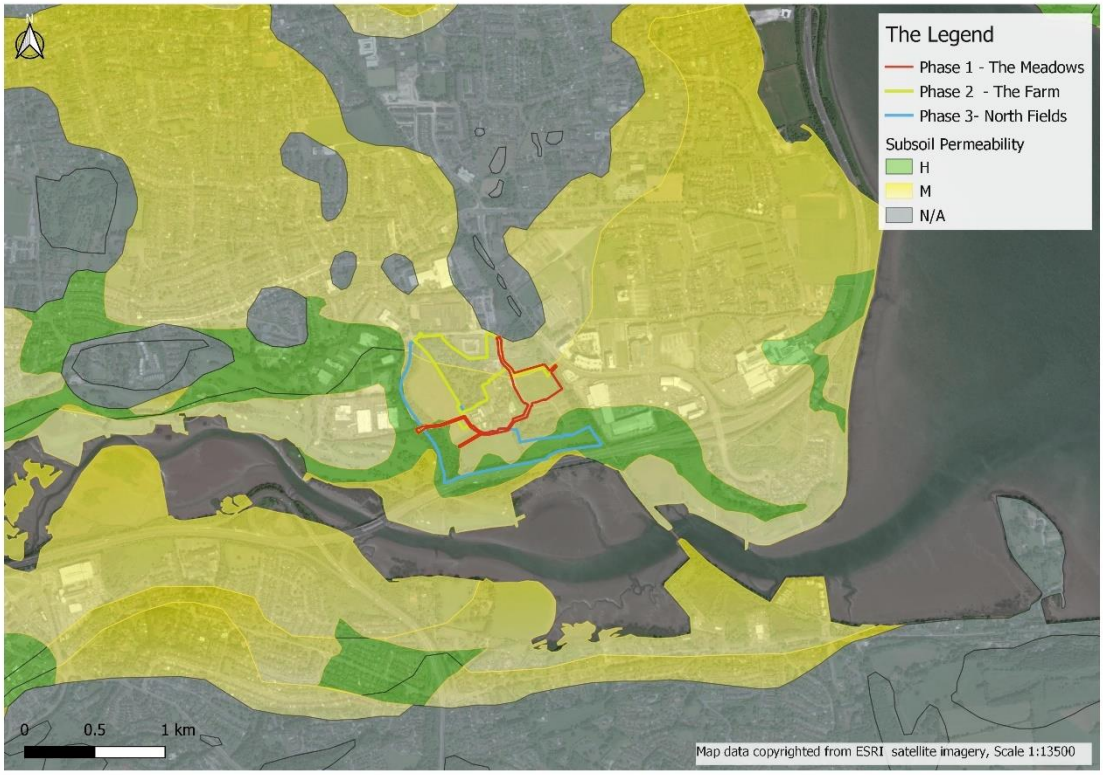



**Figure 3-2: Soil Permeability**


**Figure 3-3: Groundwater Vulnerability**

## 3.2 Existing Stormwater Network

Cork City Council drainage records indicate there is an existing 1350mmØ trunk storm sewer located approximately 400m to the west of the Phase 1 site, outside the boundary of the lands, which runs in a north-south direction before crossing under the South Ring Road (N40) and discharging to the Douglas Estuary, see Appendix 7.

A feasibility study of the local area has revealed that there is an existing 450mmØ storm sewer in the road adjacent to the western boundary of the Phase 1 site (increasing downstream to a 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 3. This sewer was constructed under planning reference 03/27028.

Pending further investigation and confirmation of the capacity of the 450mmØ pipe the proposal is to connect to the larger 750mmØ further downstream.

## 3.3 Greenfield Runoff Rate

The total site area for Phase 1 is 1.53ha. The greenfield runoff rate has been estimated using the HR Wallingford Greenfield runoff estimation online tool (report attached in Appendix 8). The online tool calculated a Qbar figure of 12.61 l/s (equivalent to 8.24 l/sec/ha). A summary of the design values output by the HR Wallingford Greenfield runoff estimation online tool is shown below:

| **Design Criteria** | Value |
|---|---|
| Site Area (ha) | 1.53 |
| Soil Type | 4 |
| SPR | 0.47 |
| SAAR (mm) | 1106 |
| 1 year factor | 0.85 |
| 30-year factor | 1.65 |
| 100-year factor | 1.95 |

**Table 3-1: HR Wallingford Design Value Outputs**

Given the proximity of the site to the final outfall to the Douglas Estuary, the controlled outflow from the development has been set to the Q100 figure (the flow from the site in its greenfield condition in a 100-year storm event). This approach was proposed to Cork City Council Drainage Department and they were satisfied with the approach. See correspondence from Cork City Council in Appendix 9.

The growth factor to be applied when calculating Q100 from QBAR is 1.95 giving an upper limit to the discharge from the site at 24.6 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.

## 3.4 Proposed Development Surface Water Management System

The proposed surface water management system will, as far as is feasible, be designed in accordance with the principles of Sustainable Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS).

The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimise the impact of urbanisation by replicating the runoff characteristics of a greenfield site. The criteria provide a consistent approach to addressing both rate and volume of runoff as well as ensuring the environment is protected from pollution that is washed off roads and buildings. These drainage design criteria are as follows:

- Criterion 1 - River Water Quality Protection
- Criterion 2 - River Regime Protection
- Criterion 3 - Flood Risk Assessment
- Criterion 4 - River Flood Protection

The requirements of SuDS are typically addressed by provision of the following:

- Interception storage
- Treatment storage (not required if interception storage is provided)
- Attenuation storage
- Long term storage (In discussion with Cork City Council there is no requirement for long term storage)

### 3.4.1 Layout of the Proposed Network

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.

An assessment of the potential SuDS measures that could be incorporated within the site was conducted using the SuDS Manual, CIRIA 753 as guidance. The following SuDS features have been identified as applicable and will be provided within the proposed scheme:

- Green Roofs: will be provided throughout the site, 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.

- Permeable Paving: will be provided for all paved areas, excluding the access road, the car park ramp and the pedestrian link corridor. Permeable paving will be a Type B as per SuDS Manual, CIRIA 753, a combination of infiltration and piped drainage.

- 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.

- StormTech Attenuation Tank: will be provided at the natural low point, at the south of the site for final storage of runoff volumes before discharging to the existing surface water network at a controlled rate.

- Permavoid Geocellular Units: will be provided at the base of the raised podium build up, which will provide storage and conveyance of surface water volumes. The raised podium will consist of impermeable surfaces and permeable surface (i.e., tree pits/bioretention planters).

The SuDS features will be designed to work in sequence thereby creating a treatment train. The proposed SuDS layout is shown on see Drawing No. 21207-JBB-PH1-XX-DR-C-04003 and the overall drainage arrangement is shown on Drawing No. 21207-JBB-PH1-XX-DR-C-04001, both included with this submission.

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 10 of this report.

The contributing surface areas of the development have been split up and tabulated below:

| Area Type | Units (ha) |
|---|---|
| Total Site Area | 1.53 |
| Roof Area (Blocks A, B, C & D) (Partially Green) | 0.50 (0.34 Green) |
| Raised Carpark Podium (Partially Green) | 0.23 (0.11 Green) |
| Permeable Paving | 0.17 |
| Tree Pits/Bioretention Planters | 0.25 |
| Impermeable Area | 0.54 |
| Open Space Without Formal Drainage | 0.12 |
| Total Drained Area | 1.41 |

**Table 3-2: Surface Areas**

### 3.4.2 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. Despite the infiltration test results we are confident that the existing ground will be able to disperse some runoff via infiltration. Further infiltration testing will be conducted in due course to confirm this assumption.

In the case of this development the total drained area is 1.41ha (14,100m²) as per Table 3.2 above. This results in a required interception storage volume of 70.50m³ (14,100 X 0.005) The proposed interception storage will be provided by green roofs, permeable paving, tree pits and bioretention areas.

Green roofs are proposed for each of residential blocks. These areas cover a total area of 3,400m². The build-up in the green roof system will provide a minimum of 5mm of interception storage per 1m², allowing for a total interception storage volume of 17.00m³.

Permeable surfaces including permeable paving, tree pits and bioretention planters are proposed throughout the development, for a total area of 4,200m². 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 63.00m³.

The proposed StormTech attenuation tank has a surface area of 299m². Interception storage will be provided within the base of the tanks for a depth of 260mm depth of stone below the StormTech Chambers. Assuming the tanks have a void ratio of 43% (which is conservative), the total interception storage volume provided is 33.43m³

The overall interception storage volume provided is therefore 113.43m³ which represents approximately 8mm of interception storage which is above the required minimum provision as detailed above.

### 3.4.3 Attenuation Storage

The proposed rate of surface water discharge from the development will be limited to that of the greenfield runoff for a 100-year storm event, as described in Section 4.2. Attenuation will be provided by StormTech attenuation chambers which will cater for the 100-year storm event with a 10% climate change allowance added. The proposed surface water network has been split into two catchments, A and B, see Figure 3.4.

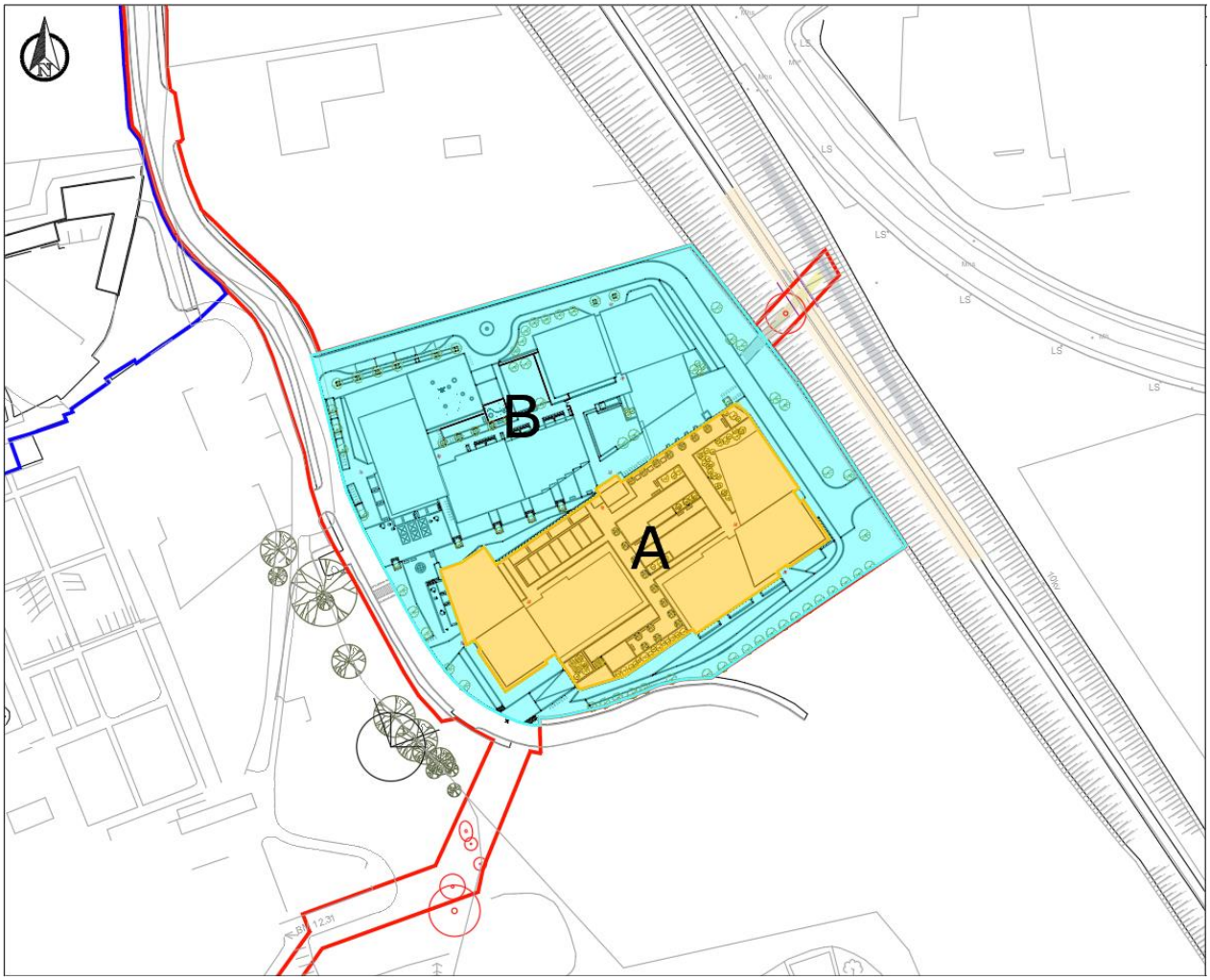



**Figure 3-4: Surface Water Catchment Areas**

It is proposed to use a geocellular attenuation system such as Polypipe's Permavoid Modular Cell 85 system (or similar approved), in the base of the podium for Catchment A. The Permavoid system provides at least 92% voids, which allow for conveyance and storage across the system. Based on a surface area of 2152m², Permavoid Modular Cell 85 system can provide 168m³ storage volume, in the geocellular units alone. Storage will also be available in the drainage stone above the geocellular units. There will be flow control devices installed at the invert level of the drainage system on the podium.

StormTech attenuation chambers are proposed for Catchment B. The restricted flows from the podium (Catchment A) will tie in upstream of the StormTech attenuation chambers.

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 required attenuation storage calculations. This will be revisited closer to construction stage, subject to a granted planning permission, to reduce the required attenuation storage volume if possible.

Preliminary attenuation volume calculations, based on the above criteria, are summarised in Table 3.3. (See Appendix 11 for detailed calculations)

| Ref. | Catchment Area (ha) | Q100 (l/s) | Max. Discharge Rate (l/s) | Required Storage Volume 100yr +10% C.C. ($m^3$) | Provided Attenuation Volume ($m^3$) | Attenuation Storage Type |
|---|---|---|---|---|---|---|
| A | 0.48 | 7.72 | 7.72 | 162 | 168 | Permavoid Modular Cell 85 |
| B | 1.05 | 16.88 | 24.60 | 355 | 360 | StormTech Chambers |

**Table 3-3: Summary of Attenuation Requirements and Proposals**

### 3.4.4 Water Quality

The proposed development is residential and therefore is considered a low-level pollution hazard. 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 StormTech attenuation tank (Catchment B). This catchment includes the drainage of the access road which has the potential to contaminate surface water runoff via oil spills etc. from vehicles.

#### 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.

| 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 |

**Table 3-4: Pollution Hazard Indices for Different Land Uses (Source: CIRIA C753)**

As can be seen in Table 3.5 below the total mitigation potential of the SuDS features far outweigh the contamination risks. Secondary (or further) stages in the treatment train are assigned 50% of the stated treatment indices value.

| SuDS Component | TSS | Metals | Hydrocarbons |
|---|---|---|---|
| Permeable paving | 0.7 | 0.6 | 0.6 |
| Bioretention/Tree pits | 0.8 | 0.8 | 0.8 |
| Petrol Interceptor | 0.4 | 0.4 | 0.4 |

**Table 3-5: Indicative SuDS Mitigation Indices for Discharges to Surface Waters (Source: CIRIA C753)**

### 3.4.5 Amenity and Biodiversity

Meeting amenity and biodiversity standards is all about creating attractive, pleasant, and liveable urban 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.

## 3.5 Conveyance of Surface Water Outflow to Final Discharge Location

A new 225mmØ surface water outfall pipe will convey the restricted flows from the site in a westerly direction across the overall Bessborough site 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.

A legal wayleave is in place across the Bessborough lands immediately to the west of the Phase 1 development to facilitate this connection.

The controlled discharge from the proposed development (a maximum of 24.8 l/sec) will be minimal in the context of the capacity of the existing 750mm and 1350mm pipes and given that this controlled outflow matches existing greenfield runoff from the site in a 100-year storm event these flows will not create a significant increase in the flow to the estuary.

The proposed route of this sewer is shown on Drawing No. 21207-JBB-PH1-XX-DR-C-04007.

# SECTION 4: WATER SUPPLY

## 4.1 Existing Watermain Network

Cork City Council watermain records show there is an existing 150mmØ watermain in the roadway adjacent to the western boundary of the Phase 1 site. There is also an existing 1200mmØ trunk watermain running through the greenfield area in the ownership of the Applicant to the south of development site, see Appendix 12.

## 4.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Irish Water (IW) have issued a Confirmation of Feasibility (COF) that the site can be serviced by its water infrastructure network. This COF is included in Appendix 4.

IW have advised that the connection is to be made to the existing 150mmØ ductile iron watermain in the roadway adjacent to the western boundary of the Phase 1 site.

## 4.3 Design Acceptance Stage

The proposed designs for water supply infrastructure within the development were progressed in accordance with Irish Water's Code of Practice for Water Infrastructure and were submitted to Irish Water for review and consideration for design acceptance as per the requirement of the SHD process. A Statement of Design Acceptance was issued by Irish Water and is included in Appendix 4.

To serve the development a 40mmØ watermain will be connected to the existing 150mmØ ductile iron watermain in the roadway adjacent to the western boundary of the site. This new connection will feed a cold-water storage tank that will supply boosted potable water to each apartment and commercial unit and supply a sprinkler system. A bulk water meter will be provided at the connection to the site. The supply arrangements will be carried out to the requirements of Irish Water.

A second and separate connection will be made to the existing 150mmØ ductile iron watermain for the purposes of fire-fighting water supply. A fire-main and fire hydrants will be provided such that each building will be within 46m of a hydrant and these hydrants will be fully accessible to the fire service. Apartment buildings will be subject to Fire Safety Certificate applications and the provision of appropriate water supply for firefighting will be addressed in these applications.

Preliminary water supply layout plans are shown on Drawing No. 21207-JBB-PH1-XX-DR-C-03001.

The water supply system is designed and will be constructed in accordance with Irish Water's Code of Practice for Water Infrastructure

## 4.4 Loading Calculations

Water demand for the development is determined in accordance with Irish Water Code of Practice for Water Infrastructure.

Per-capita consumption = 150 litres/person/day

Average day / peak week demand (ADPWD) = 1.25 x ADDD

Peak Water Demand = 5.00 x ADPWD

| Use | Floor Area ($m^2$) | Occupancy Rate | Population (P) | Average Daily Demand (l/day) | Average Daily Demand (l/s) | Average Day/Peak Week Demand (l/s) | Peak Hour Water Demand (l/s) |
|---|---|---|---|---|---|---|---|
| Residential | 280 | 2.7 | 756 | 113,400 | 1.31 | 1.64 | 8.2 |
| | | | | | | **Total** | **8.2** |

**Table 4-1: Water Demand for Residential Development**

| Use | Floor Area ($m^2$) | Occupancy Rate | Population (P) | Average Daily Demand (l/day) | Average Daily Demand (l/s) | Average Day/Peak Week Demand (l/s) | Peak Hour Water Demand (l/s) |
|---|---|---|---|---|---|---|---|
| Creche | 320 | 42 | 42 | 6,300 | 0.073 | 0.091 | 0.455 |
| Café | 89 | 1 per $20m^2$ | 4 | 600 | 0.038 | 0.048 | 0.240 |
| | | 1 per $5m^2$ | 18 | 2,700 | | | |
| Communal Workspace | 166 | 14 | 14 | 2,100 | 0.024 | 0.030 | 0.150 |
| Lounge | 180 | 31 | 31 | 4,650 | 0.054 | 0.068 | 0.340 |
| Gym | 191 | 1 per $5m^2$ | 38 | 5,700 | 0.066 | 0.083 | 0.415 |
| | | | | | | Total | 1.6 |
| | | | | | | **Total (Based on 12 Hour Day)** | **0.8** |

**Table 4-2: Water Demand for Commercial development**

# Appendix 1

**PROPOSED SITE LAYOUT PLAN**

NORTH POINT

Day Centre

Chy

Car Park

Car Park

Car Park

THE BESSBOROUGH CENTRE

Burial Ground

A

B

C

D

## THE MEADOWS BUILDINGS: A,B,C,D

| 280 APARTMENTS | NO. | % |
|---|---|---|
| STUDIO AP. | 6 | 2.1 % |
| 1 BEDROOM AP. | 112 | 40.0 % |
| 2 BEDROOM AP. 4P | 150 | 53.6% |
| 3 BEDROOM AP. | 12 | 4.3 % |
| TOTAL NO. | 280 | 100 % |
| DUAL ASPECT | 121 | 43.2% |
| NO. OF UNITS WITH AREA 10% GREATER THAN REQUIRED | 162 | 57.8% |
| TOTAL RESIDENT'S PRIVATE AMENITY AREA | 2,172 sqm | |
| PUBLIC OPEN SPACE | 3,958 sqm | 63,5 % |
| PARKING SPACES | 98 | 35.0% |
| CRECHE DROP OFF | 4 | |
| MOTORBIKE SPACES | 10 | |
| RESIDENT'S BIKE SPACES | 464 | |
| VISITOR'S BIKE SPACES | 140 | |

LEGEND

- POND
- VEGETATIONS
- PATHS
- GREEN ROOF
- EXISTING TREES
- ROOT PROTECTION ZONE
- PROPOSED TREES
- TREE TO BE REMOVED

SITE BOUNDARY AREA: 2.3 ha

Site Centre Point Coordinates:
X,Y = 571940.0,570405.0

- SITE BOUNDARY
- OTHER LANDS UNDER APPLICANT'S OWNERSHIP

1 SITE PLAN
SCALE 1:500

280 UNITS 1:500 A1

C. PLANNING 03.2022
B. FOR PLANNING 08.2021
A. FOR DISCUSSION 03.2021

# SITE PLAN

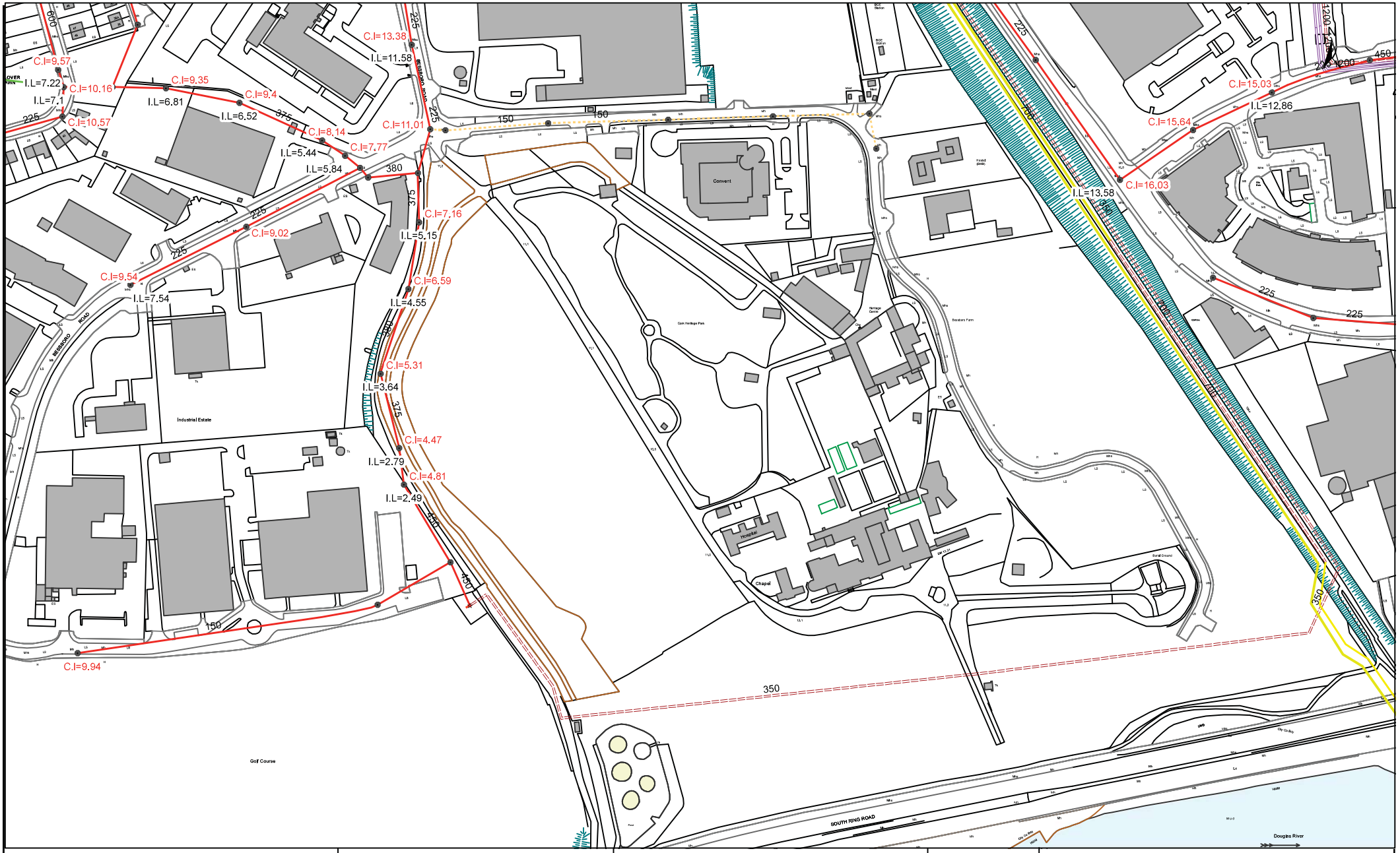
SHIPSEYBARRY
place makers

PROJECT: THE MEADOWS- BESSBOROUGH
SCALE: 1:500 @ A1
DATE: 03.2021
DRAWING DESCRIPTION: SITE PLAN
OVERSEEN BY: MD
APPROVED BY: GB
CLIENT: ESTUARY VIEW ENT. LTD
DRAWING NO.: SB-2020-107-200

28,Richmond Hill, Ballintemple, Cork, Ireland. t: + 353 (0)21 2398855 f: + 353 (0)21 2398827 e: info@shipseybarry.com www.shipseybarry.com

# Appendix 2

**CORK CITY COUNCIL - EXISTING WASTEWATER NETWORK**




# Drainage Records

**Legend**

**IW_FoulNetwork**
**PIPE_FUNCT**
- LOCAL COMBINED
- LOCAL FOUL
- RISING MAIN
- County Co
- CoCo Rising Main
- PRIVATE FOUL
- PRESSURE PIPE
- PUMP OVERFLOW
- UNPROCESSED

**IW_FoulManholes**
**MANHOLE_**
- Manhole
- Pumphouse

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**
**(As agents of Irish Water)**

**Drawn By:** A. Homan

**Checked by:** G.R.

**Date:** 25/07/2018

# Appendix 3

**AS-BUILT LOCAL DRAINAGE NETWORK**

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 13 FEB 2006

CORK CITY COUNCIL PLANNING DIRECTORATE 11 SEP 2006 Ref. 06/27020

John O'Donovan & Associates
Civil, Structural, Mechanical & Electrical Engineers
Model Farm Road, Cork 4, Ireland.
telephone: 021 454 4271 facsimile: 021 454 4277
e-mail: firstnames.surname@joda.ie web: www.joda.ie

joda ENGINEERING CONSULTANTS

| | |
|---|---|
| Bessborough Site Development Works Bessborough, Blackrock, Cork | 3699-103 |
| DWG TITLE: As Built Site Services – Foul & Storm Water Drainage | DN: A.T. CHK: 0'D.D |
| STATUS: CONSTRUCTION | |
| SCALE: Not To Scale | |
| DATE: APRIL 2006 | |

# Appendix 4

**IRISH WATER – CONFIRMATION OF FEASIBILITY**

**IRISH WATER – STATEMENT OF DESIGN ACCEPTANCE**

Tim Finn

JB Barry & Partners
3 Eastgate, Eastgate Business Park
Little Island
Co. Cork
T45KH74

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

9 February 2022

**Re: CDS21001326 pre-connection enquiry - Subject to contract | Contract denied**

**Connection for Multi/Mixed Use Development of 280 unit(s) and creche at Bessboro, Blackrock, Co. Cork**

Dear Sir/Madam,

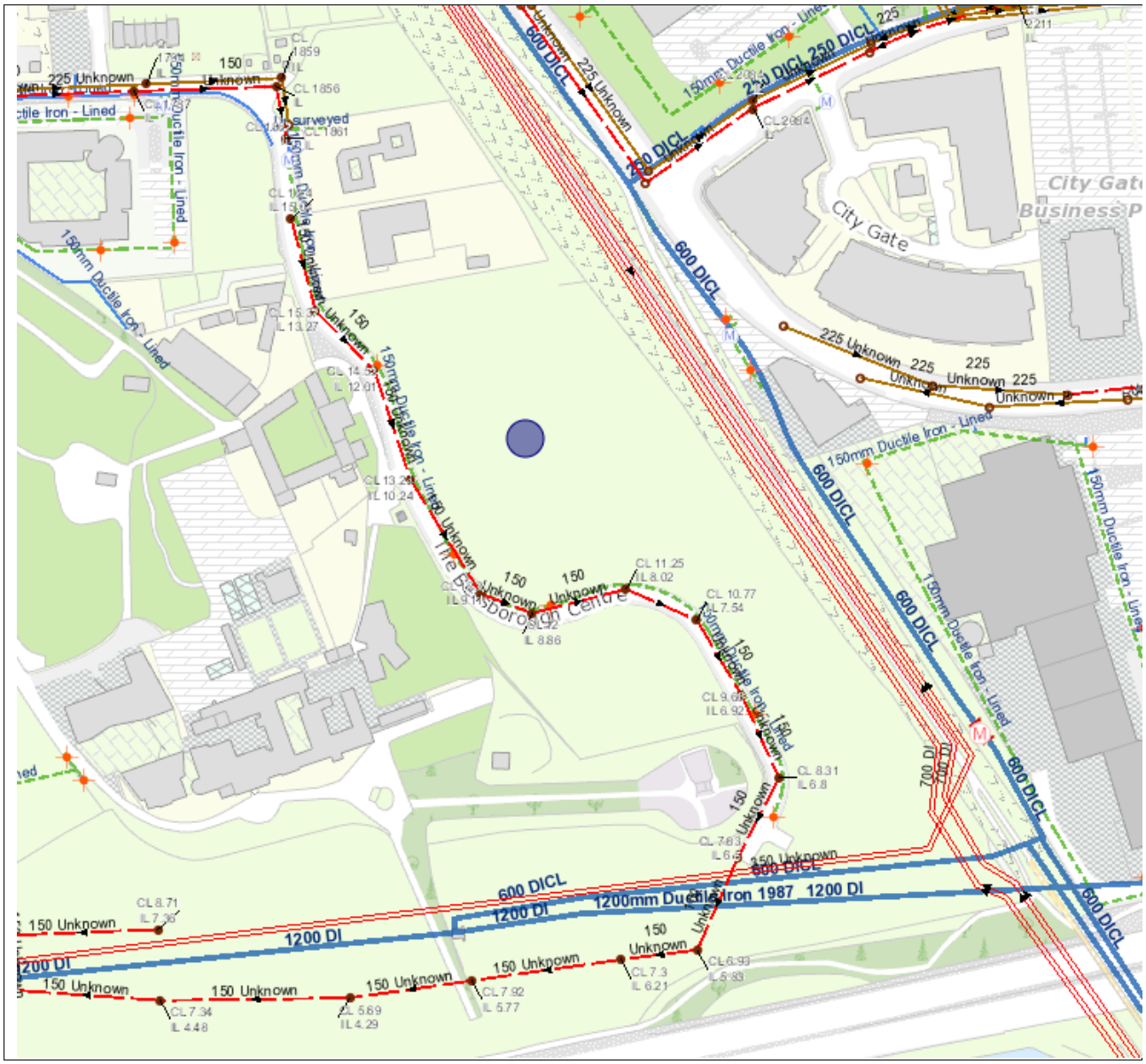
Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Bessboro, Blackrock, Co. Cork (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

| **SERVICE** | **OUTCOME OF PRE-CONNECTION ENQUIRY**<br>**THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.** |
|---|---|
| Water Connection | Feasible without infrastructure upgrade by Irish Water |
| Wastewater Connection | Feasible Subject to upgrades |
| **SITE SPECIFIC COMMENTS** | |
| Water Connection | Connection to be made to the existing 150mm DI adjacent to site.<br>No works to interfere with existing 1200mm trunkmain. No diversions of this main shall be permitted. |
| Wastewater Connection | Bessborough WWPS is almost at design loading capacity. Irish Water has a project underway to replace the existing pumps which will increase the pump rate and provide sufficient capacity to accommodate this development. This upgrade project is scheduled to be completed by Q4 2022 (this may be subject to change) and the proposed connection could be completed as soon as possibly practicable after this date. |
| Strategic Housing Development | Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a |

| | |
|---|---|
| | Statement of Design Acceptance in relation to the layout of water and wastewater services. |

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

**The map included below outlines the current Irish Water infrastructure adjacent to your site:**




Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the

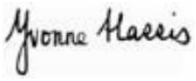
information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

**General Notes:**

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marko Komso from the design team on 022 54611 or email mkomso@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



**Yvonne Harris**

**Head of Customer Operations**

Diarmuid O' Brien
JB Barry & Partners
3 Eastgate, Eastgate Business Park
Little Island, Co. Cork T45KH74

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

28 February 2022

**Re: Design Submission for Bessboro, Blackrock, Co. Cork (the "Development") (the "Design Submission") / Connection Reference No: CDS21001326**

Dear Diarmuid O'Brien,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: Kyle Jackson
Email: kyle.jackson@water.ie

Yours sincerely,

Yvonne Harris

**Yvonne Harris**
**Head of Customer Operations**

# Appendix 5

**FOUL SEWER - MICRODRAINAGE CALCULATIONS**

## FOUL SEWERAGE DESIGN

### Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

| | | | |
|---|---|---|---|
| Industrial Flow (l/s/ha) | 0.00 | Add Flow / Climate Change (%) | 0 |
| Industrial Peak Flow Factor | 0.00 | Minimum Backdrop Height (m) | 0.200 |
| Flow Per Person (l/per/day) | 150.00 | Maximum Backdrop Height (m) | 4.000 |
| Persons per House | 2.70 | Min Design Depth for Optimisation (m) | 1.200 |
| Domestic (l/s/ha) | 0.00 | Min Vel for Auto Design only (m/s) | 0.75 |
| Domestic Peak Flow Factor | 6.00 | Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

### Network Design Table for Foul - Main

| PN | Length (m) | Fall (m) | Slope (1:X) | Area (ha) | Houses | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| F1.000 | 14.279 | 0.238 | 60.0 | 0.000 | 0 | 2.6 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.001 | 20.109 | 0.134 | 150.1 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.002 | 69.671 | 0.465 | 149.8 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F2.000 | 26.947 | 0.449 | 60.0 | 0.000 | 0 | 1.2 | 1.500 | o | 225 | Pipe/Conduit | |
| F2.001 | 26.434 | 1.088 | 24.3 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.003 | 27.027 | 0.180 | 150.2 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.004 | 31.230 | 0.208 | 150.1 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.005 | 29.246 | 0.195 | 150.0 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F3.000 | 10.497 | 0.175 | 60.0 | 0.000 | 0 | 0.9 | 1.500 | o | 225 | Pipe/Conduit | |
| F3.001 | 23.302 | 0.155 | 150.3 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F3.002 | 49.153 | 1.090 | 45.1 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.006 | 27.571 | 0.184 | 149.8 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.007 | 23.108 | 0.963 | 24.0 | 0.000 | 0 | 1.2 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.008 | 7.094 | 0.263 | 27.0 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |

### Network Results Table

| PN | US/IL (m) | Σ Area (ha) | Σ Base Flow (l/s) | Σ Hse | Add Flow (l/s) | P.Dep (mm) | P.Vel (m/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| F1.000 | 11.970 | 0.000 | 2.6 | 0 | 0.0 | 32 | 0.74 | 1.48 | 59.0 | 2.6 |
| F1.001 | 11.732 | 0.000 | 2.6 | 0 | 0.0 | 40 | 0.54 | 0.94 | 37.2 | 2.6 |
| F1.002 | 11.598 | 0.000 | 2.6 | 0 | 0.0 | 40 | 0.54 | 0.94 | 37.2 | 2.6 |
| F2.000 | 12.670 | 0.000 | 1.2 | 0 | 0.0 | 22 | 0.58 | 1.48 | 59.0 | 1.2 |
| F2.001 | 12.221 | 0.000 | 1.2 | 0 | 0.0 | 18 | 0.80 | 2.33 | 92.8 | 1.2 |
| F1.003 | 11.133 | 0.000 | 3.8 | 0 | 0.0 | 49 | 0.60 | 0.94 | 37.2 | 3.8 |
| F1.004 | 10.953 | 0.000 | 3.8 | 0 | 0.0 | 49 | 0.60 | 0.94 | 37.2 | 3.8 |
| F1.005 | 10.745 | 0.000 | 3.8 | 0 | 0.0 | 49 | 0.60 | 0.94 | 37.2 | 3.8 |
| F3.000 | 11.970 | 0.000 | 0.9 | 0 | 0.0 | 20 | 0.53 | 1.48 | 59.0 | 0.9 |
| F3.001 | 11.795 | 0.000 | 0.9 | 0 | 0.0 | 24 | 0.39 | 0.94 | 37.2 | 0.9 |
| F3.002 | 11.640 | 0.000 | 0.9 | 0 | 0.0 | 18 | 0.59 | 1.71 | 68.1 | 0.9 |
| F1.006 | 10.550 | 0.000 | 4.7 | 0 | 0.0 | 54 | 0.64 | 0.94 | 37.2 | 4.7 |
| F1.007 | 10.366 | 0.000 | 5.9 | 0 | 0.0 | 38 | 1.31 | 2.35 | 93.4 | 5.9 |
| F1.008 | 9.403 | 0.000 | 5.9 | 0 | 0.0 | 40 | 1.25 | 2.22 | 88.1 | 5.9 |

## Network Design Table for Foul - Main

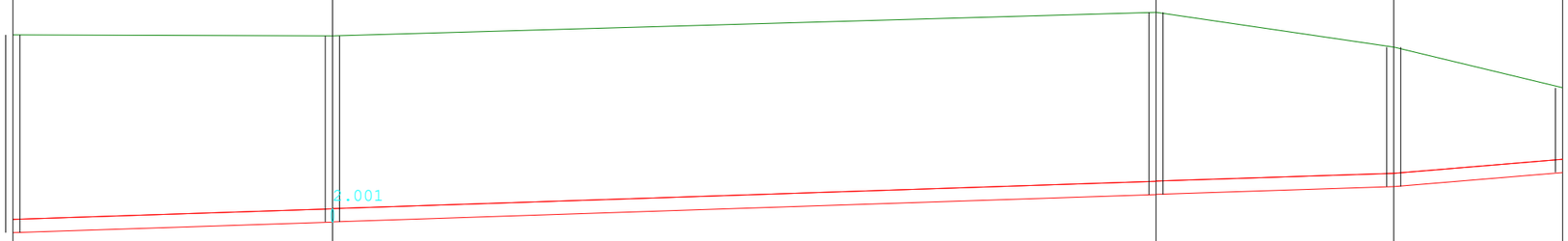
| PN | Length (m) | Fall (m) | Slope (1:X) | Area (ha) | Houses | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| F4.000 | 18.382 | 0.306 | 60.1 | 0.000 | 0 | 1.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F4.001 | 30.621 | 0.204 | 150.1 | 0.000 | 0 | 1.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F5.000 | 10.220 | 0.465 | 22.0 | 0.000 | 0 | 0.9 | 1.500 | o | 225 | Pipe/Conduit | |
| F4.002 | 10.047 | 0.067 | 150.0 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F4.003 | 52.923 | 0.353 | 149.9 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.009 | 57.818 | 0.578 | 100.0 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.010 | 37.535 | 0.375 | 100.1 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.011 | 36.298 | 0.363 | 100.0 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.012 | 64.690 | 0.647 | 100.0 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.013 | 27.697 | 0.277 | 100.0 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.014 | 24.176 | 0.242 | 99.9 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.015 | 27.035 | 0.270 | 100.1 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.016 | 33.938 | 0.339 | 100.1 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.017 | 45.563 | 1.478 | 30.8 | 0.000 | 0 | 8.8 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.018 | 45.563 | 0.456 | 99.9 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.019 | 78.650 | 2.044 | 38.5 | 0.000 | 0 | 6.1 | 1.500 | o | 225 | Pipe/Conduit | |
| F1.020 | 10.451 | 0.475 | 22.0 | 0.000 | 0 | 0.0 | 1.500 | o | 225 | Pipe/Conduit | |

## Network Results Table

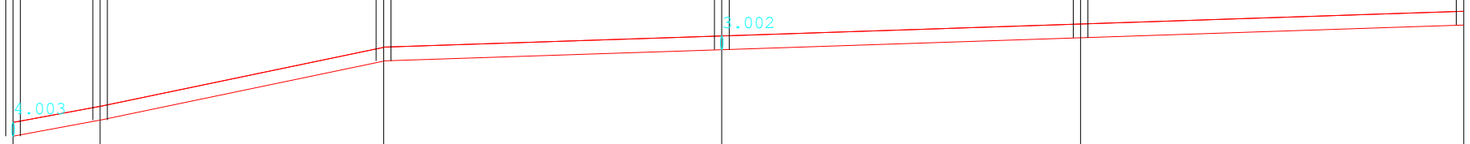
| PN | US/IL (m) | Σ Area (ha) | Σ Base Flow (l/s) | Σ Hse Add Flow (l/s) | P.Dep (mm) | P.Vel (m/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|
| F4.000 | 10.070 | 0.000 | 1.0 | 0 | 0.0 | 21 | 0.55 | 1.48 | 58.9 | 1.0 |
| F4.001 | 9.764 | 0.000 | 2.0 | 0 | 0.0 | 36 | 0.49 | 0.94 | 37.2 | 2.0 |
| F5.000 | 10.070 | 0.000 | 0.9 | 0 | 0.0 | 16 | 0.75 | 2.45 | 97.6 | 0.9 |
| F4.002 | 9.560 | 0.000 | 2.9 | 0 | 0.0 | 43 | 0.55 | 0.94 | 37.2 | 2.9 |
| F4.003 | 9.493 | 0.000 | 2.9 | 0 | 0.0 | 43 | 0.55 | 0.94 | 37.2 | 2.9 |
| F1.009 | 9.140 | 0.000 | 8.8 | 0 | 0.0 | 67 | 0.89 | 1.15 | 45.6 | 8.8 |
| F1.010 | 8.562 | 0.000 | 8.8 | 0 | 0.0 | 67 | 0.89 | 1.15 | 45.6 | 8.8 |
| F1.011 | 8.187 | 0.000 | 8.8 | 0 | 0.0 | 67 | 0.89 | 1.15 | 45.6 | 8.8 |
| F1.012 | 7.824 | 0.000 | 8.8 | 0 | 0.0 | 67 | 0.89 | 1.15 | 45.6 | 8.8 |
| F1.013 | 7.177 | 0.000 | 8.8 | 0 | 0.0 | 67 | 0.89 | 1.15 | 45.6 | 8.8 |
| F1.014 | 6.900 | 0.000 | 8.8 | 0 | 0.0 | 67 | 0.89 | 1.15 | 45.7 | 8.8 |
| F1.015 | 6.658 | 0.000 | 8.8 | 0 | 0.0 | 67 | 0.89 | 1.15 | 45.6 | 8.8 |
| F1.016 | 6.388 | 0.000 | 8.8 | 0 | 0.0 | 67 | 0.89 | 1.15 | 45.6 | 8.8 |
| F1.017 | 6.049 | 0.000 | 17.6 | 0 | 0.0 | 71 | 1.65 | 2.07 | 82.4 | 17.6 |
| F1.018 | 4.571 | 0.000 | 17.6 | 0 | 0.0 | 97 | 1.07 | 1.15 | 45.7 | 17.6 |
| F1.019 | 4.115 | 0.000 | 23.7 | 0 | 0.0 | 88 | 1.65 | 1.85 | 73.7 | 23.7 |
| F1.020 | 2.071 | 0.000 | 23.7 | 0 | 0.0 | 76 | 2.02 | 2.45 | 97.5 | 23.7 |

## Free Flowing Outfall Details for Foul - Main

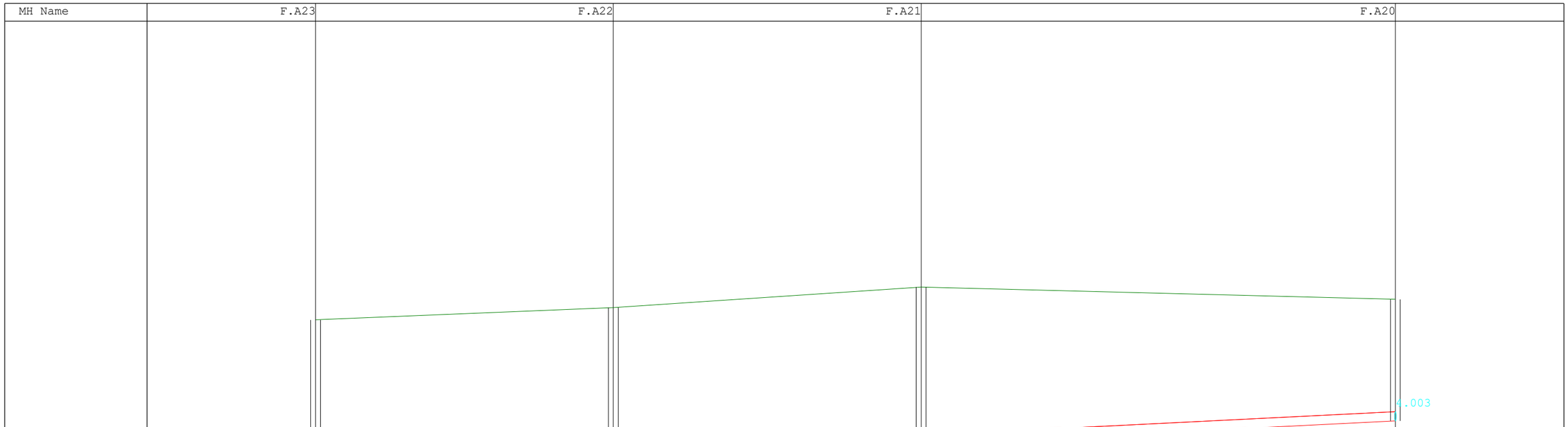
| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| F1.020 | F.A32 | 3.800 | 1.596 | 0.000 | 0 | 0 |



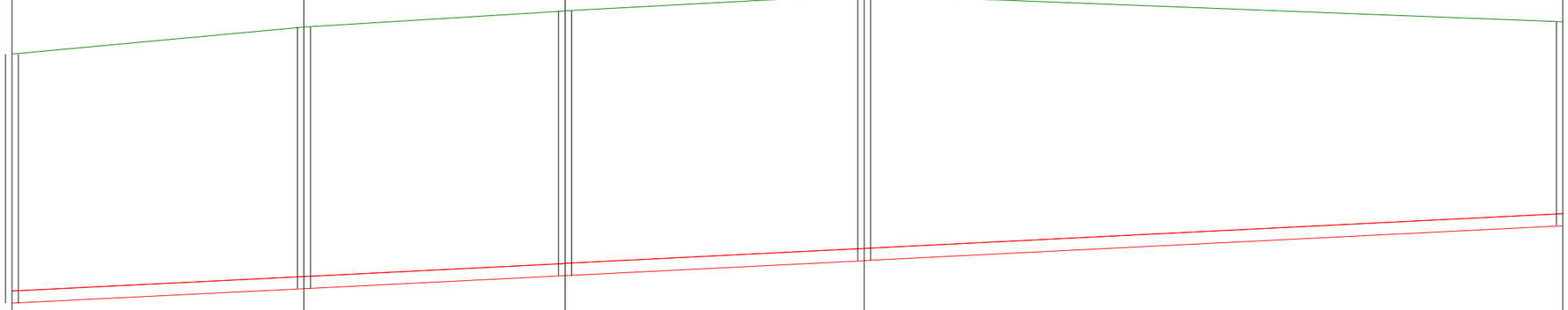

| MH Name | | F.A7 | F.A6 | F.A3 | F.A2 | F.A1 | |
|---|---|---|---|---|---|---|---|
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 4.000 | | | | | | | |
| PN | | F1.003 | F1.002 | F1.001 | F1.000 | | |
| Dia (mm) | | 225 | 225 | 225 | 225 | | |
| Slope (1:X) | | 150.2 | 149.8 | 150.1 | 60.0 | | |
| Cover Level (m) | 14.300 | 14.280 | 14.680 | 14.090 | 13.400 | | |
| Invert Level (m) | 10.953 | 11.133 | 11.133 | 11.598 | 11.598 | 11.732 | 11.732 | 11.970 | |
| Length (m) | | 27.027 | 69.671 | 20.109 | 14.279 | | |



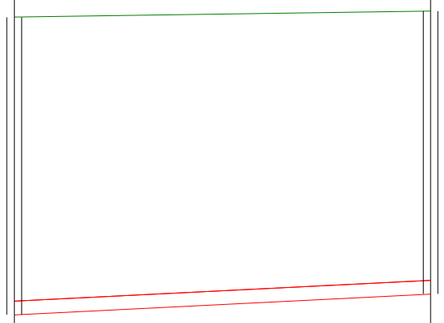

| MH Name | | F.A20 | F.A14 | F.A13 | F.A12 | F.A8 | F.A7 | |
|---|---|---|---|---|---|---|---|---|
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 3.000 | | | | | | | | |
| PN | | | F1.008 | F1.007 | F1.006 | F1.005 | F1.004 | |
| Dia (mm) | | | 225 | 225 | 225 | 225 | 225 | |
| Slope (1:X) | | | 27.0 | 24.0 | 149.8 | 150.0 | 150.1 | |
| Cover Level (m) | | 12.100 | 12.300 | 12.600 | 13.300 | 13.800 | 14.300 | |
| Invert Level (m) | | | 9.140<br>9.403 | 9.403<br>10.366 | 10.366<br>10.550 | 10.550<br>10.745 | 10.745<br>10.953 | |
| Length (m) | | | 7.094 | 23.108 | 27.571 | 29.246 | 31.230 | |

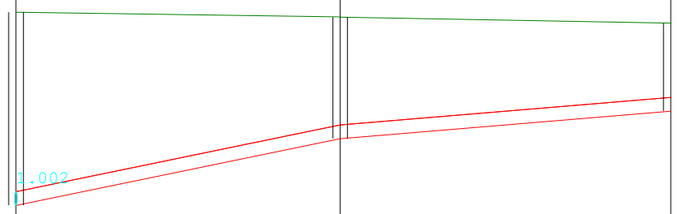


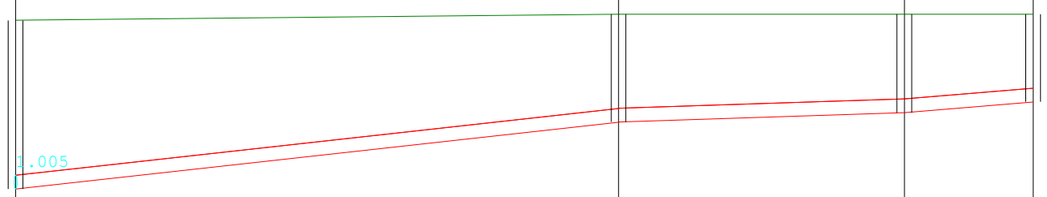

| MH Name | F.A23 | F.A22 | F.A21 | F.A20 | |
|---|---|---|---|---|---|
| Hor Scale 500<br>Ver Scale 100<br>Datum (m)2.000 | | | | | |
| PN | | F1.011 | F1.010 | F1.009 | |
| Dia (mm) | | 225 | 225 | 225 | |
| Slope (1:X) | | 100.0 | 100.1 | 100.0 | |
| Cover Level (m) | 11.600 | 11.900 | 12.400 | 12.100 | |
| Invert Level (m) | 7.824 | 8.187<br>8.187 | 8.562<br>8.562 | 9.140 | |
| Length (m) | | 36.298 | 37.535 | 57.818 | |

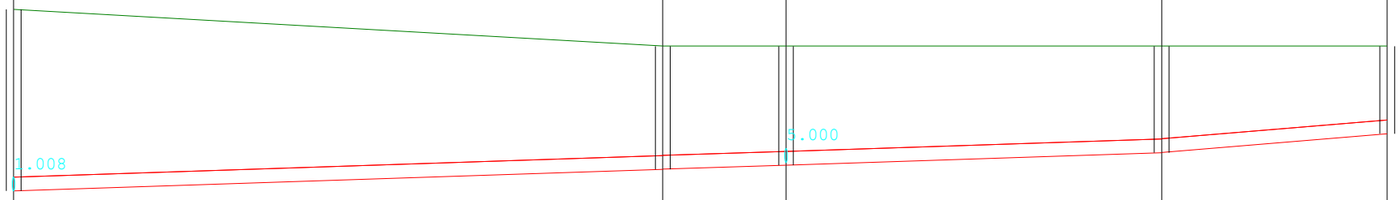


| MH Name | | F.A27 | F.A26 | F.A25 | F.A24 | F.A23 | |
|---|---|---|---|---|---|---|---|
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 1.000 | | | | | | | |
| PN | | | F1.015 | F1.014 | F1.013 | F1.012 | |
| Dia (mm) | | | 225 | 225 | 225 | 225 | |
| Slope (1:X) | | | 100.1 | 99.9 | 100.0 | 100.0 | |
| Cover Level (m) | | 11.000 | 11.500 | 11.800 | 12.100 | 11.600 | |
| Invert Level (m) | | 6.388 | 6.658 | 6.658 | 6.900 | 6.900 | 7.177 | 7.177 | 7.824 | |
| Length (m) | | | 27.035 | 24.176 | 27.697 | 64.690 | |

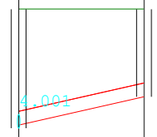
| MH Name | F.A28 | F.A27 | |
|---|---|---|---|
| |  | | |
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 0.000 | | | |
| PN | | F1.016 | |
| Dia (mm) | | 225 | |
| Slope (1:X) | | 100.1 | |
| Cover Level (m) | 10.900 | 11.000 | |
| Invert Level (m) | 6.049 | 6.388 | |
| Length (m) | | 33.938 | |

| MH Name | F.A6 | F.A5 | F.A4 | |
|---|---|---|---|---|
| | |  | | |
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 4.000 | | | | |
| PN | | F2.001 | F2.000 | |
| Dia (mm) | | 225 | 225 | |
| Slope (1:X) | | 24.3 | 60.0 | |
| Cover Level (m) | 14.280 | 14.200 | 14.100 | |
| Invert Level (m) | 11.133 | 12.221 | 12.221<br>12.670 | |
| Length (m) | | 26.434 | 26.947 | |

| MH Name | | F.A12 | F.A11 | F.A10 | F.A9 | |
|---|---|---|---|---|---|---|
| | |  | | | | |
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 4.000 | | | | | | |
| PN | | | F3.002 | F3.001 | F3.000 | |
| Dia (mm) | | | 225 | 225 | 225 | |
| Slope (1:X) | | | 45.1 | 150.3 | 60.0 | |
| Cover Level (m) | | 13.300 | 13.400 | 13.400 | 13.400 | |
| Invert Level (m) | | 10.550 | 11.640<br>11.640 | 11.795<br>11.795 | 11.970 | |
| Length (m) | | | 49.153 | 23.302 | 10.497 | |




| MH Name | | F.A20 | | F.A19 | F.A18 | F.A16 | F.A15 | |
|---|---|---|---|---|---|---|---|---|
| Hor Scale 500<br>Ver Scale 100<br>Datum (m)2.000 | | | | | | | | |
| PN | | | F4.003 | | F4.002 | F4.001 | F4.000 | |
| Dia (mm) | | | 225 | | 225 | 225 | 225 | |
| Slope (1:X) | | | 149.9 | | 150.0 | 150.1 | 60.1 | |
| Cover Level (m) | | 12.100 | | 11.500 | 11.500 | 11.500 | 11.500 | |
| Invert Level (m) | | | 9.140 | 9.493 | 9.493<br>9.560 | 9.560<br>9.764 | 9.764<br>10.070 | |
| Length (m) | | | 52.923 | | 10.047 | 30.621 | 18.382 | |

| MH Name | F.A18 | F.A17 | |
|---|---|---|---|
| | |  | |
| Hor Scale 500<br>Ver Scale 100<br>Datum (m)2.000 | | | |
| PN | | F5.000 | |
| Dia (mm) | | 225 | |
| Slope (1:X) | | 22.0 | |
| Cover Level (m) | 11.500 | 11.500 | |
| Invert Level (m) | 9.605 | 10.070 | |
| Length (m) | | 10.220 | |

# Appendix 6

**PRIORITY GEOTECHNICAL LTD - GROUND INVESTIAGTION**

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.

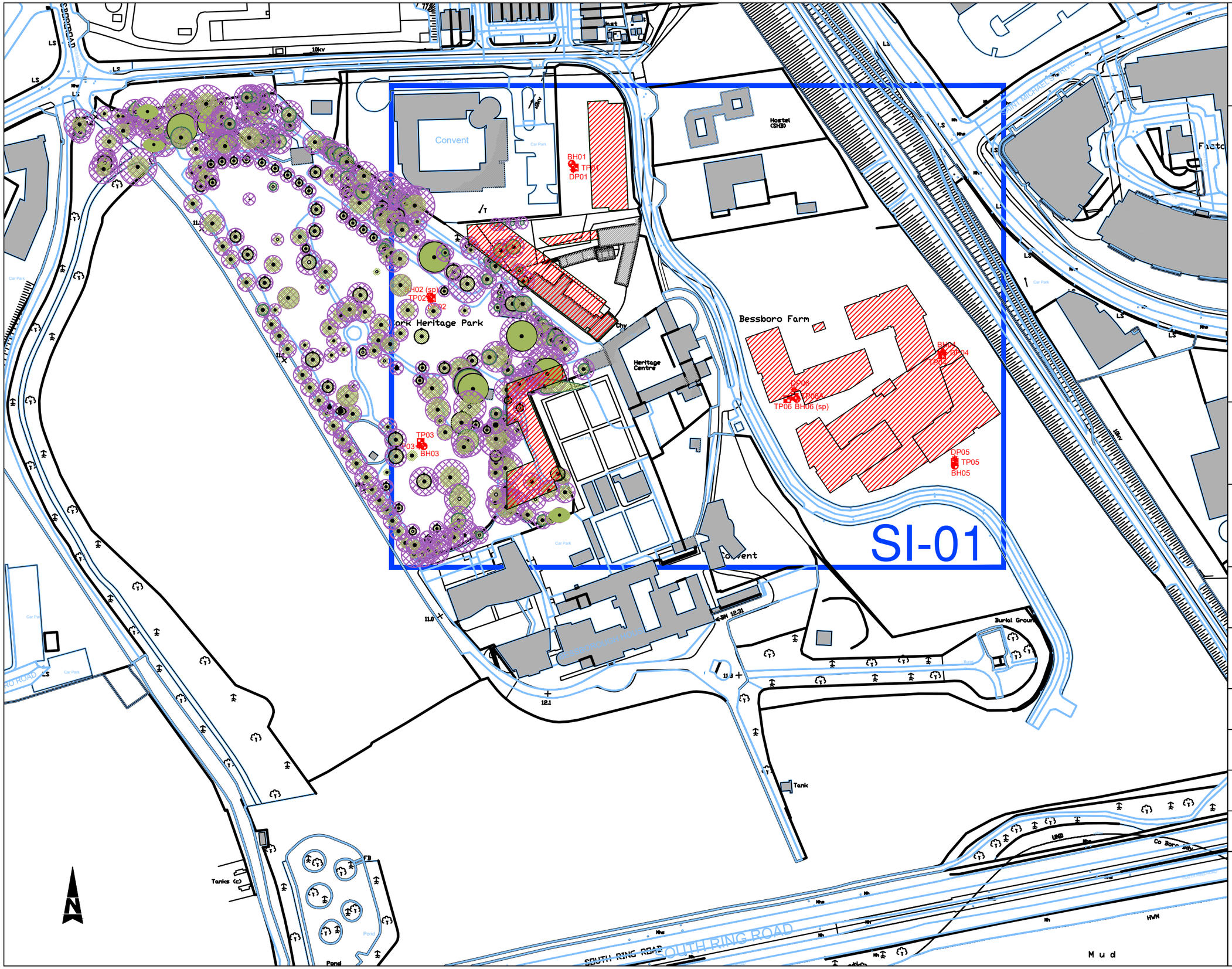
Yours sincerely,
For **Priority Geotechnical,**

**James McSweeney BSc**
**Engineering Geologist**

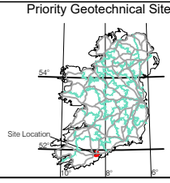
*No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory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

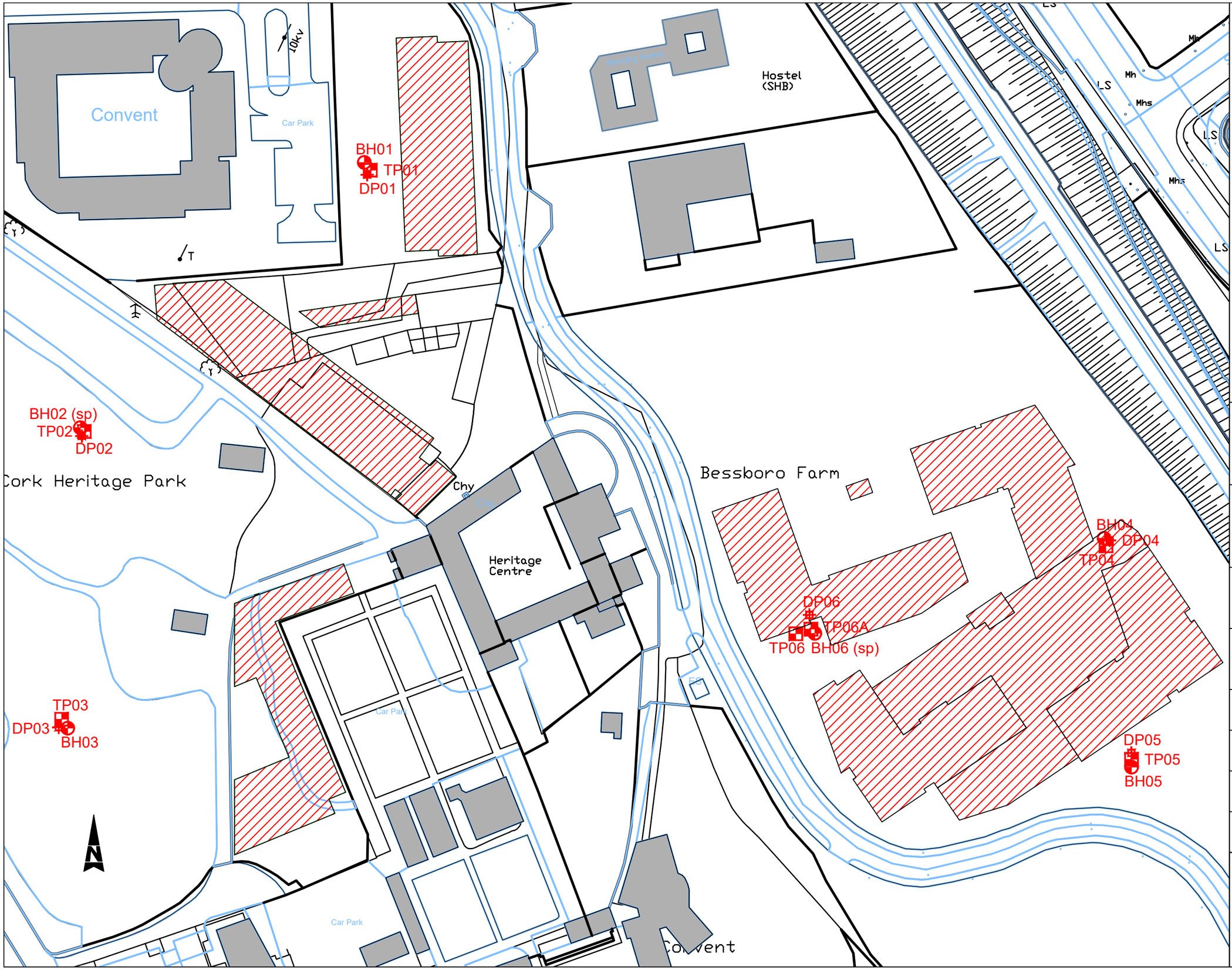
08/12/2021

| 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 |

| Priority Geotechnical Ltd.<br>Tel: 021 4631600<br>Fax: 021 4638690<br>www.prioritygeotechnical.ie | Drilled By: PC<br>Logged By: CS | Borehole No.<br>**BH01**<br>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<br>1.00 | B<br>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.<br>*1.20m - 1.30m: Driller noted: Boulders. Increased SPT blow counts locally.* |
| | | 2.00 - 3.00<br>2.00 | B<br>SPT (C) | N=15 (3,3/4,4,3,4) | | | | |
| | | 3.00 - 4.00<br>3.00 | B<br>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<br>1.00 | B<br>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<br>2.00 | B<br>SPT (C) | N=7 (1,1/1,2,2,2) | | | | *2.00m - 3.00m: Driller noted: Boulders.* |
| | | 3.00 - 4.00<br>3.00 | B<br>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<br>4.00 | B<br>SPT (C) | N=21 (4,4/5,5,6,5) | | | | |
| | | 5.00 - 6.00<br>5.00 | B<br>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<br>6.00 | B<br>SPT (C) | N=29 (6,6/7,7,8,7) | | | | |
| | | 7.00 - 8.00<br>7.00 | B<br>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. |

| | | | |
|---|---|---|---|
| pgl priority geotechnical | **Priority Geotechnical Ltd.**<br>**Tel: 021 4631600**<br>**Fax: 021 4638690**<br>**www.prioritygeotechnical.ie** | **Drilled By** PC<br>**Logged By** CS | Borehole No.<br>**BH03**<br>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<br>1.00 | B<br>SPT (C) | N=7 (1,1/1,2,2,2) | | | | |
| | | 2.00 - 3.00<br>2.00 | B<br>SPT (C) | N=7 (1,1/2,2,1,2) | | | | |
| | | 3.00 - 4.00<br>3.00 | B<br>SPT (C) | N=10 (2,3/3,2,3,2) | | | | |
| | | 4.00 - 5.00<br>4.00 | B<br>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<br>5.00 | B<br>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<br>6.00 | B<br>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.<br>*6.00m - 8.40m: Driller noted Boulder content.* |
| | | 7.00 - 8.00<br>7.00 | B<br>SPT (C) | N=34 (7,8/8,9,8,9) | | | | |
| | | 8.00 - 8.40<br>8.00 | B<br>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. |

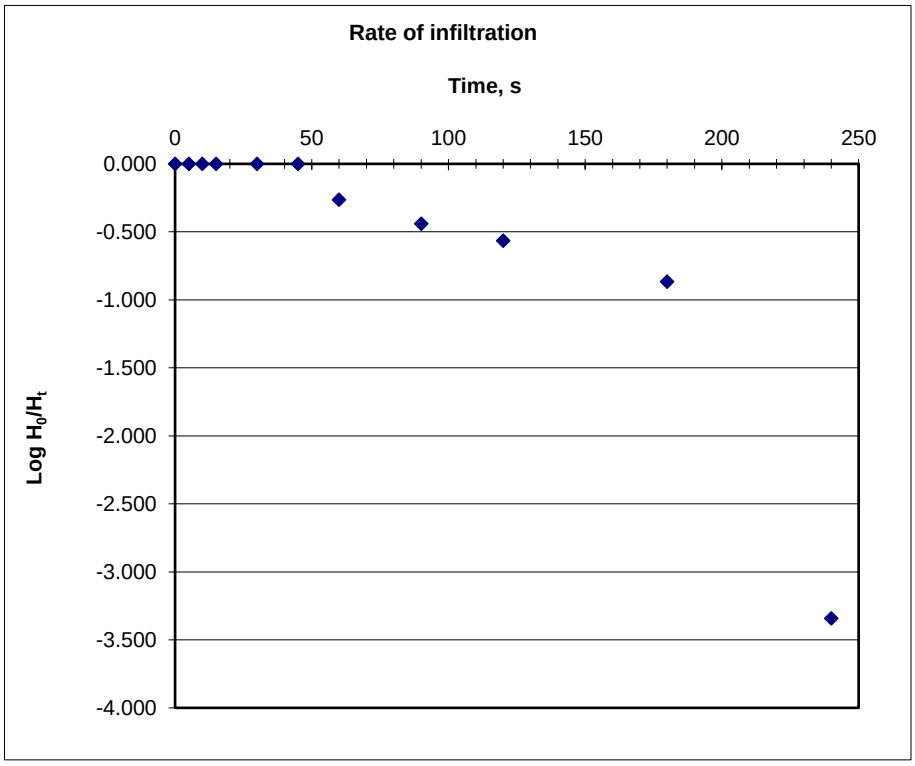
**P21239 Falling head permeability test**

| | | | | |
|---|---|---|---|---|
| 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** $ms^{-1}$

$k_H = k_V$



| Priority Geotechnical Ltd.<br>Tel: 021 4631600<br>Fax: 021 4638690<br>www.prioritygeotechnical.ie | Drilled By: PC<br>Logged By: CS | Borehole No.<br>**BH04**<br>Sheet 1 of 1 |
|---|---|---|

| | | | | |
|---|---|---|---|---|
| **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<br>1.00 | B<br>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<br>2.00 | B<br>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<br>3.00 | B<br>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<br>4.00 | B<br>SPT (C) | N=22 (4,4/5,6,5,6) | | | | |
| | | 5.00 - 6.00<br>5.00 | B<br>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<br>6.00 | B<br>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<br>1.00 | B<br>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<br>4.00 | B<br>SPT (C) | N=16 (3,4/3,4,4,5) | | | | |
| | | 5.00 - 6.00<br>5.00 | B<br>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<br>6.00 | B<br>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. |

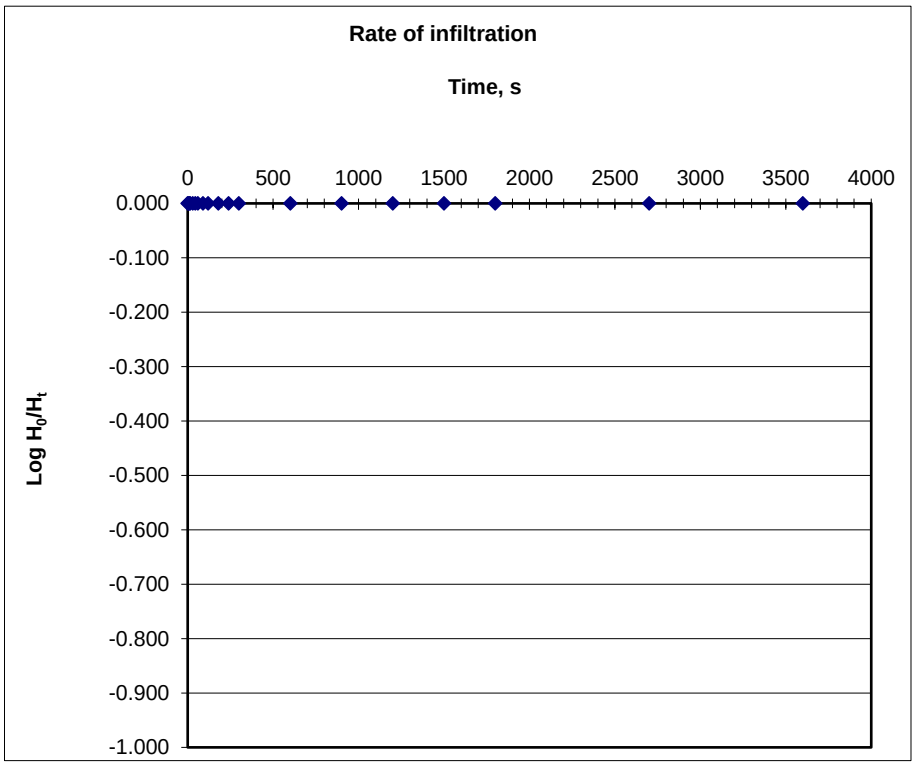
**P21239 Falling head permeability test**

| | | | | |
|---|---|---|---|---|
| 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<br>1.00 | B<br>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<br>2.00 | B<br>SPT (C) | N=8 (1,1/2,2,2,2) | | | | |
| | | 3.00 - 4.00<br>3.00 | B<br>SPT (C) | N=9 (2,2/3,2,2,2) | | | | |
| | | 4.00 - 5.00<br>4.00 | B<br>SPT (C) | N=13 (3,2/3,3,4,3) | | | | *4.00m - 6.00m: Driller described: 'wet' soils.* |
| | | 5.00 - 6.00<br>5.00 | B<br>SPT (C) | N=28 (4,6/6,7,7,8) | | | | |
| | | 6.00 - 7.00<br>6.00 | B<br>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<br>**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<br>0.70 - 1.50 | B<br>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<br>1.50 - 2.50 | B<br>D | | | | | |
| | 2.50 - 3.50<br>2.50 - 3.50 | B<br>D | | | | | |
| | | | | 3.90 | 12.70 | | End of Pit at 3.900m |

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**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 | |

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Trial Pit No
**TP02**
Sheet 1 of 1

| | | | |
|---|---|---|---|
| **Project Name:** Bessboro SHD | **Project No.** P21239 | **Co-ords:** 171743E - 70394N<br>**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<br>0.50 - 1.00 | B<br>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<br>1.20 - 2.30 | B<br>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<br>2.30 - 3.20 | B<br>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 |

1 2 3 4 5

**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 | |

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Trial Pit No
**TP03**
Sheet 1 of 1

| | | | |
|---|---|---|---|
| **Project Name:** Bessboro SHD | **Project No.** P21239 | **Co-ords:** 171737E - 70314N<br>**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<br>0.50 - 1.50 | B<br>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<br>1.50 - 2.50 | B<br>D | | | | | |
| | 2.50 - 3.50<br>2.50 - 3.50 | B<br>D | | | | | |
| | 3.50 - 4.50<br>3.50 - 4.50 | B<br>D | | | | | |
| | | | | 4.50 | 7.30 | | End of Pit at 4.500m |

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**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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Trial Pit No
**TP04**
Sheet 1 of 1

| | | | |
|---|---|---|---|
| **Project Name:** Bessboro SHD | **Project No.** P21239 | **Co-ords:** 172027E - 70362N<br>**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<br>0.50 - 1.50 | B<br>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 | 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. |
| | 1.50 - 2.50<br>1.50 - 2.50 | B<br>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. |
| | 2.50 - 3.50<br>2.50 - 3.50 | B<br>D | | | | | |
| | 3.50 - 4.50<br>3.50 - 4.50 | B<br>D | | | | | |
| | | | | 4.50 | 7.85 | | End of Pit at 4.500m |

1 2 3 4 5

**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

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

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Trial Pit No
**TP05**
Sheet 1 of 1

| | | | |
|---|---|---|---|
| **Project Name:** Bessboro SHD | **Project No.** P21239 | **Co-ords:** 172034E - 70303N<br>**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<br>0.70 - 1.50 | B<br>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<br>1.50 - 2.50 | B<br>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<br>2.50 - 3.50 | B<br>D | | | | | |
| ▼ | 3.50 - 4.50<br>3.50 - 4.50 | B<br>D | | | | | |
| | | | | 4.50 | 7.71 | | End of Pit at 4.500m |

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**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 | |

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Trial Pit No
**TP06**
Sheet 1 of 1

| | | | |
|---|---|---|---|
| **Project Name:** Bessboro SHD | **Project No.** P21239 | **Co-ords:** 171941E - 70338N<br>**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 |

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**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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Trial Pit No
**TP06A**
Sheet 1 of 1

| | | | |
|---|---|---|---|
| **Project Name:** Bessboro SHD | **Project No.** P21239 | **Co-ords:** 171945E - 70339N<br>**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<br>0.50 - 1.45 | B<br>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<br>1.50 - 2.50 | B<br>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<br>2.50 - 3.50 | B<br>D | | | | | |
| | 3.50 - 4.50<br>3.50 - 4.50 | B<br>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 | |

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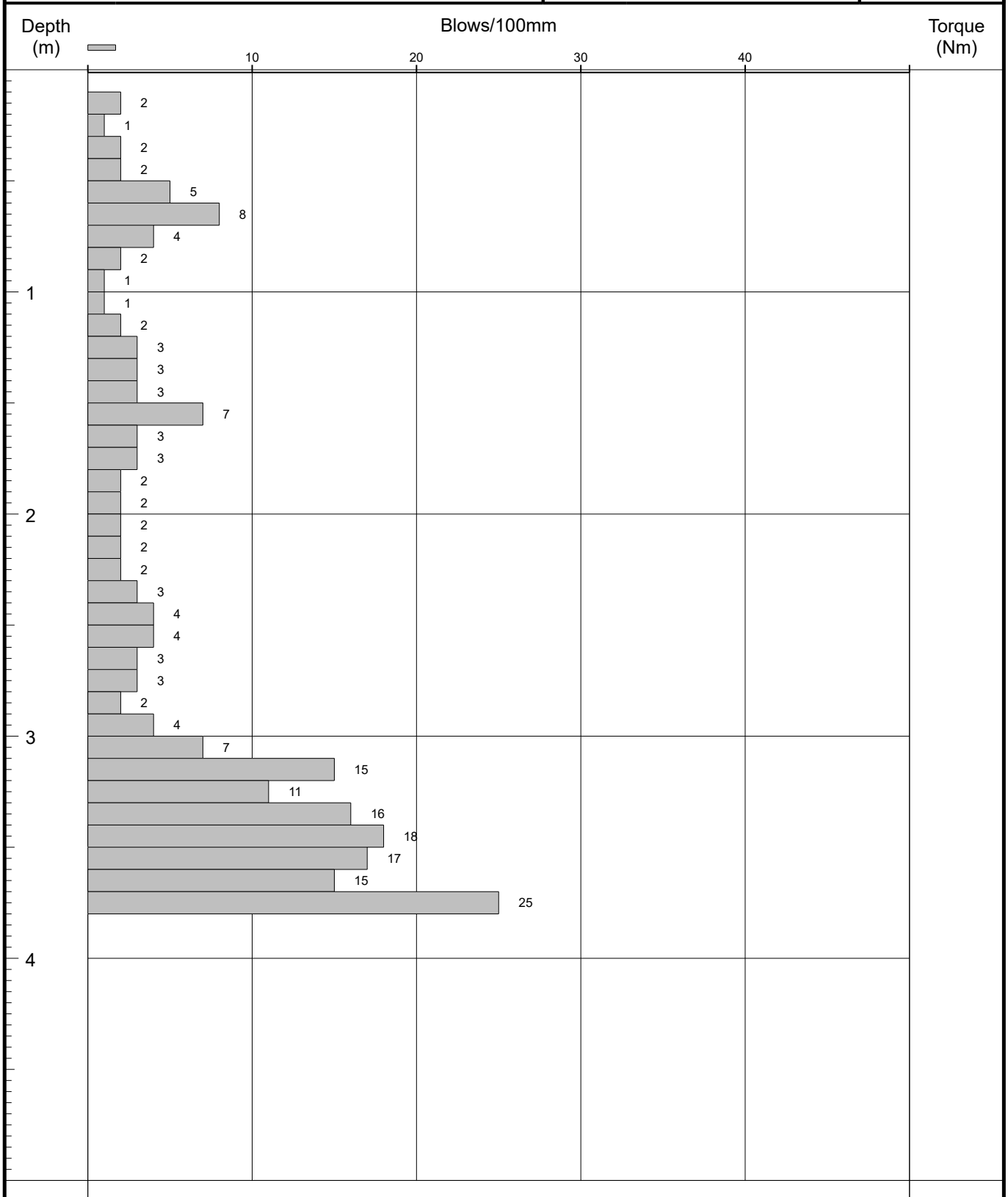
| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Bessboro SHD | **Project No.** P21239 | **Co-ords:** | 171822E - 70465N | **Hole Type** DP |
| **Location:** | Mahon, Cork | | **Level:** | 16.54m OD | **Scale** 1:25 |
| **Client:** | Estuary View Ent. Ltd | | **Dates:** | 13/01/2022 | **Logged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

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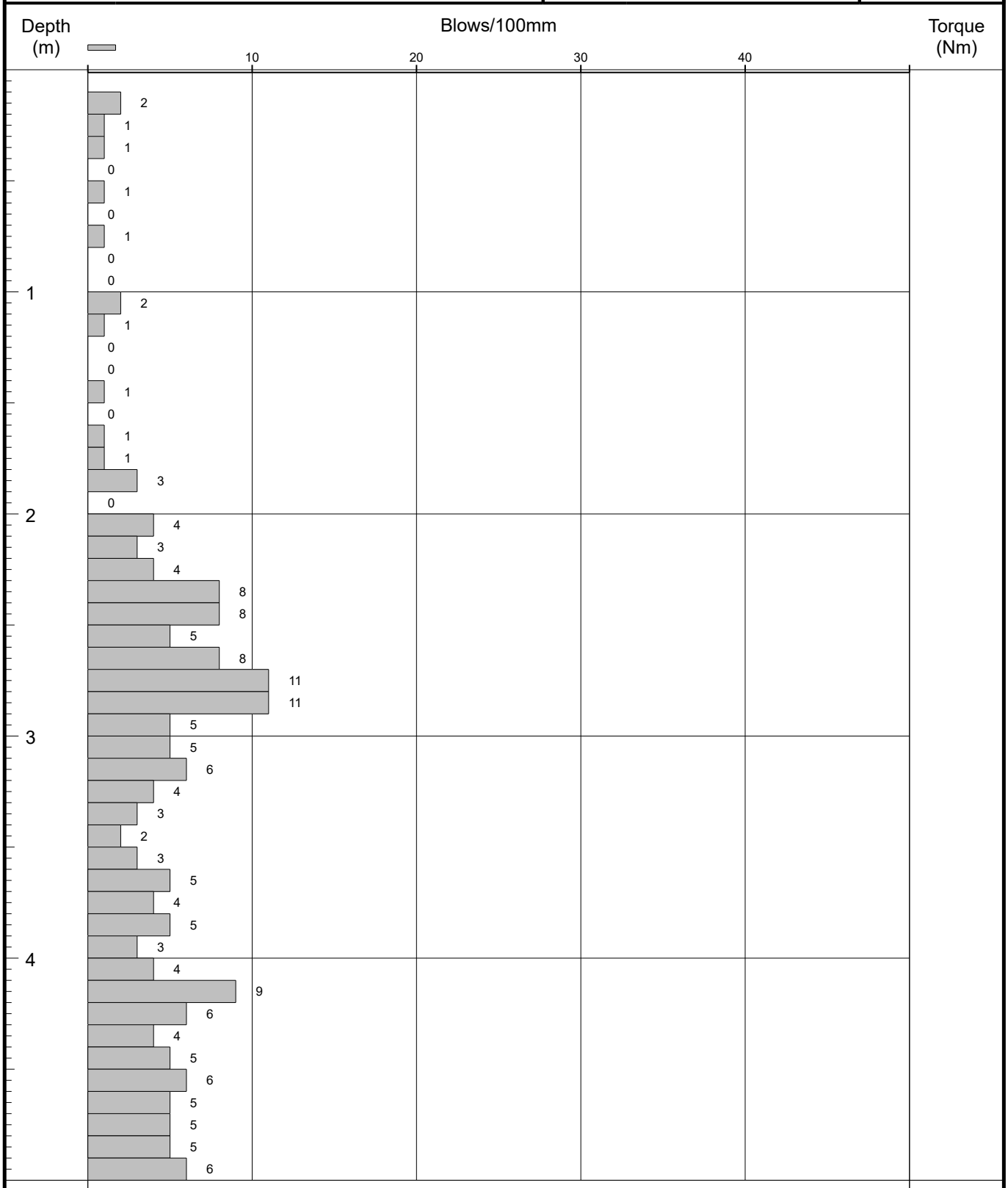
| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Bessboro SHD | **Project No.** P21239 | **Co-ords:** | 171742E - 70393N | **Hole Type** DP |
| **Location:** | Mahon, Cork | | **Level:** | 12.93m OD | **Scale** 1:25 |
| **Client:** | Estuary View Ent. Ltd | | **Dates:** | 13/01/2022 | **Logged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

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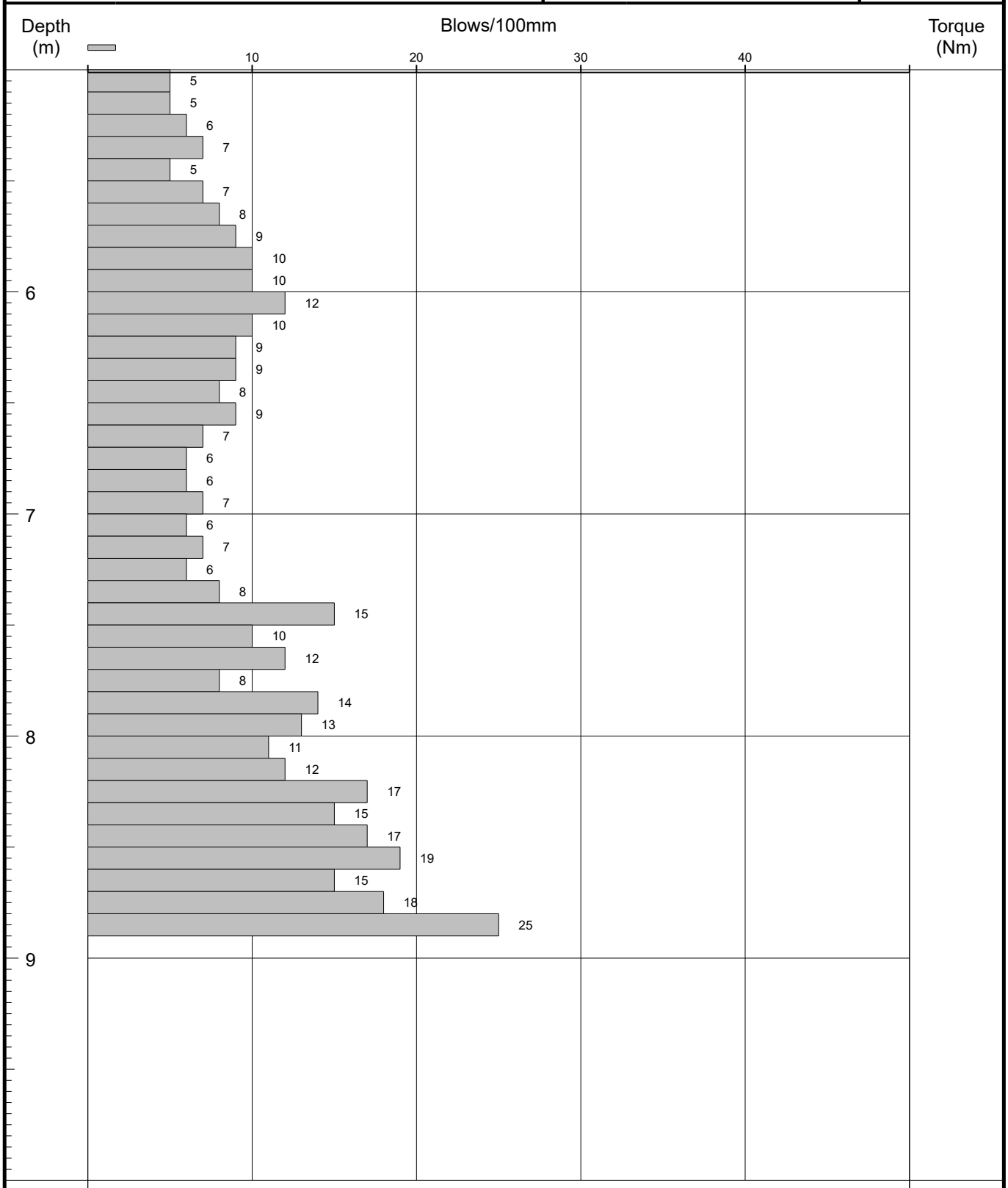
| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Bessboro SHD | **Project No.** P21239 | **Co-ords:** | 171742E - 70393N | **Hole Type** DP |
| **Location:** | Mahon, Cork | | **Level:** | 12.93m OD | **Scale** 1:25 |
| **Client:** | Estuary View Ent. Ltd | | **Dates:** | 13/01/2022 | **Logged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

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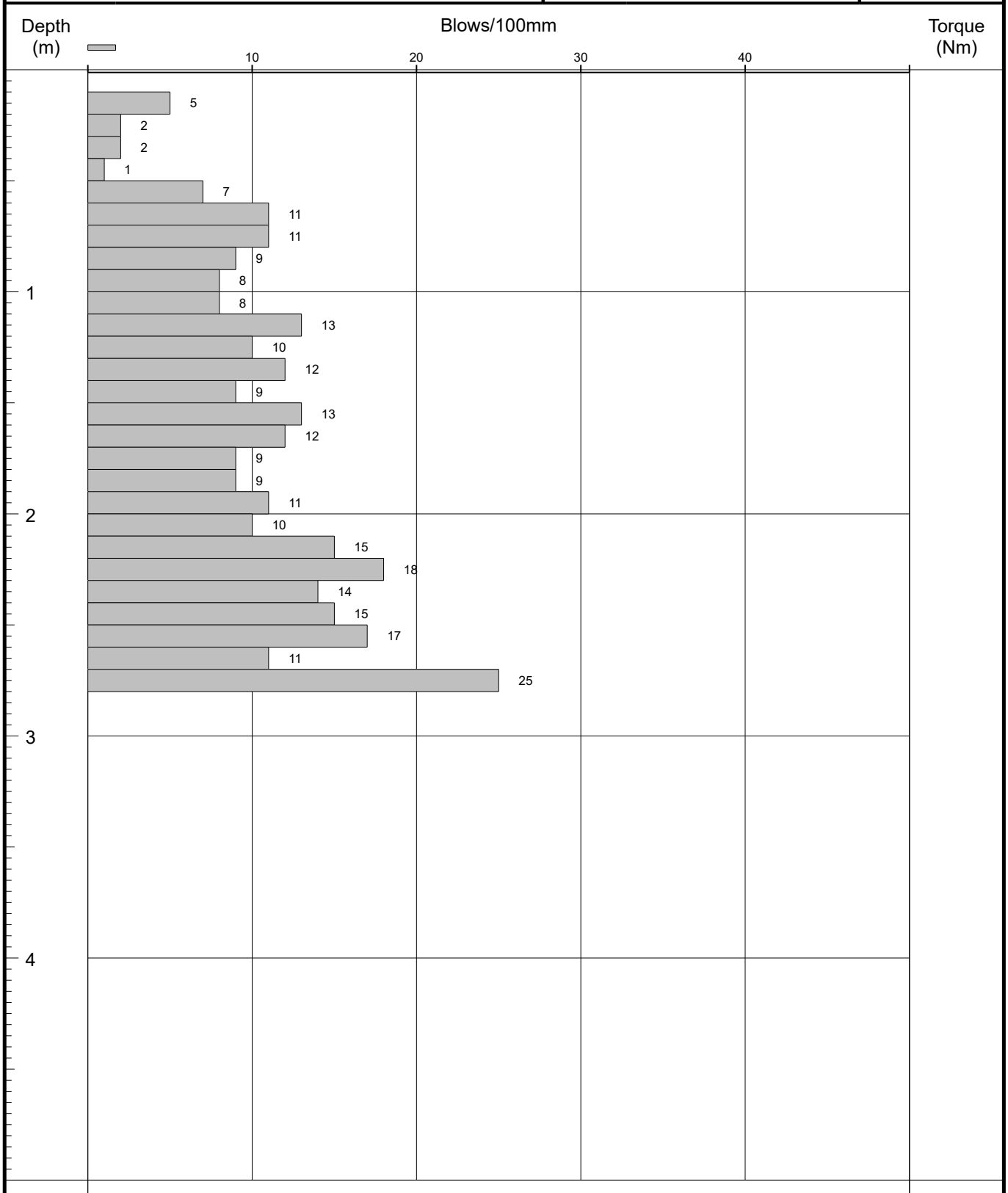
| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Bessboro SHD | **Project No.** P21239 | **Co-ords:** | 171736E - 70312N | **Hole Type** DP |
| **Location:** | Mahon, Cork | | **Level:** | 11.53m OD | **Scale** 1:25 |
| **Client:** | Estuary View Ent. Ltd | | **Dates:** | 13/01/2022 | **Logged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

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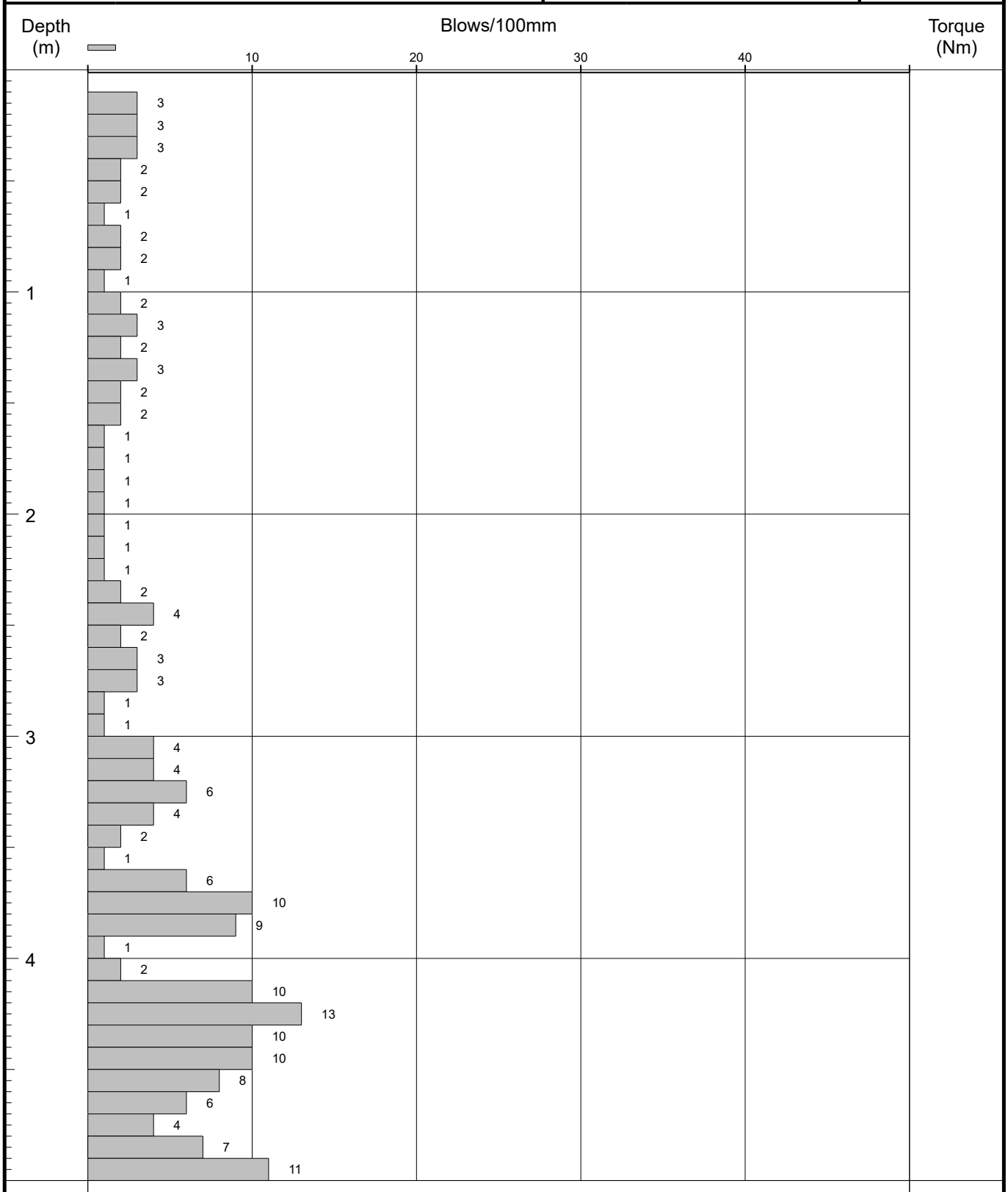
| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Bessboro SHD | **Project No.** P21239 | **Co-ords:** | 172028E - 70364N | **Hole Type** DP |
| **Location:** | Mahon, Cork | | **Level:** | 12.40m OD | **Scale** 1:25 |
| **Client:** | Estuary View Ent. Ltd | | **Dates:** | 13/01/2022 | **Logged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

| | | |
|---|---|---|
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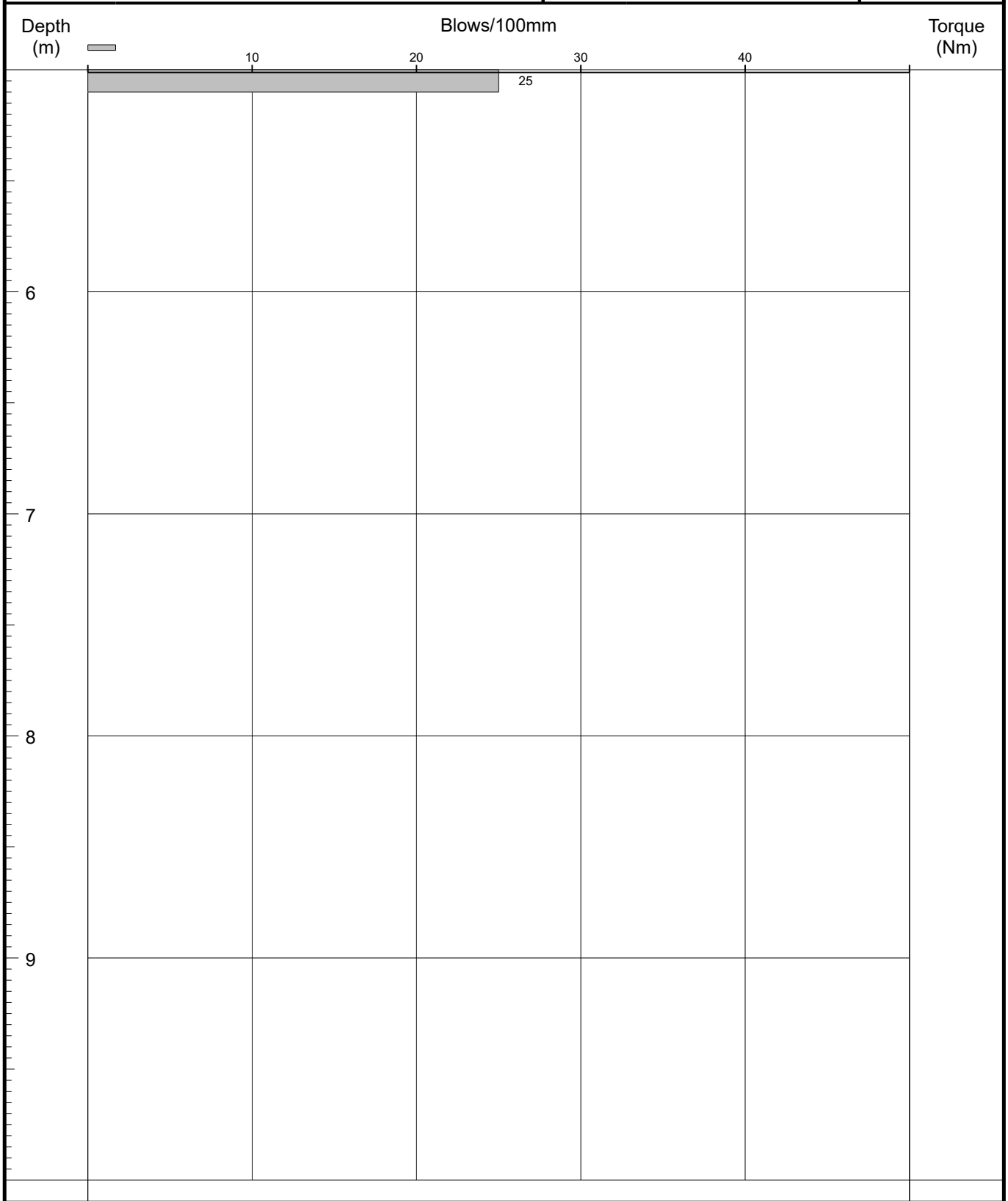
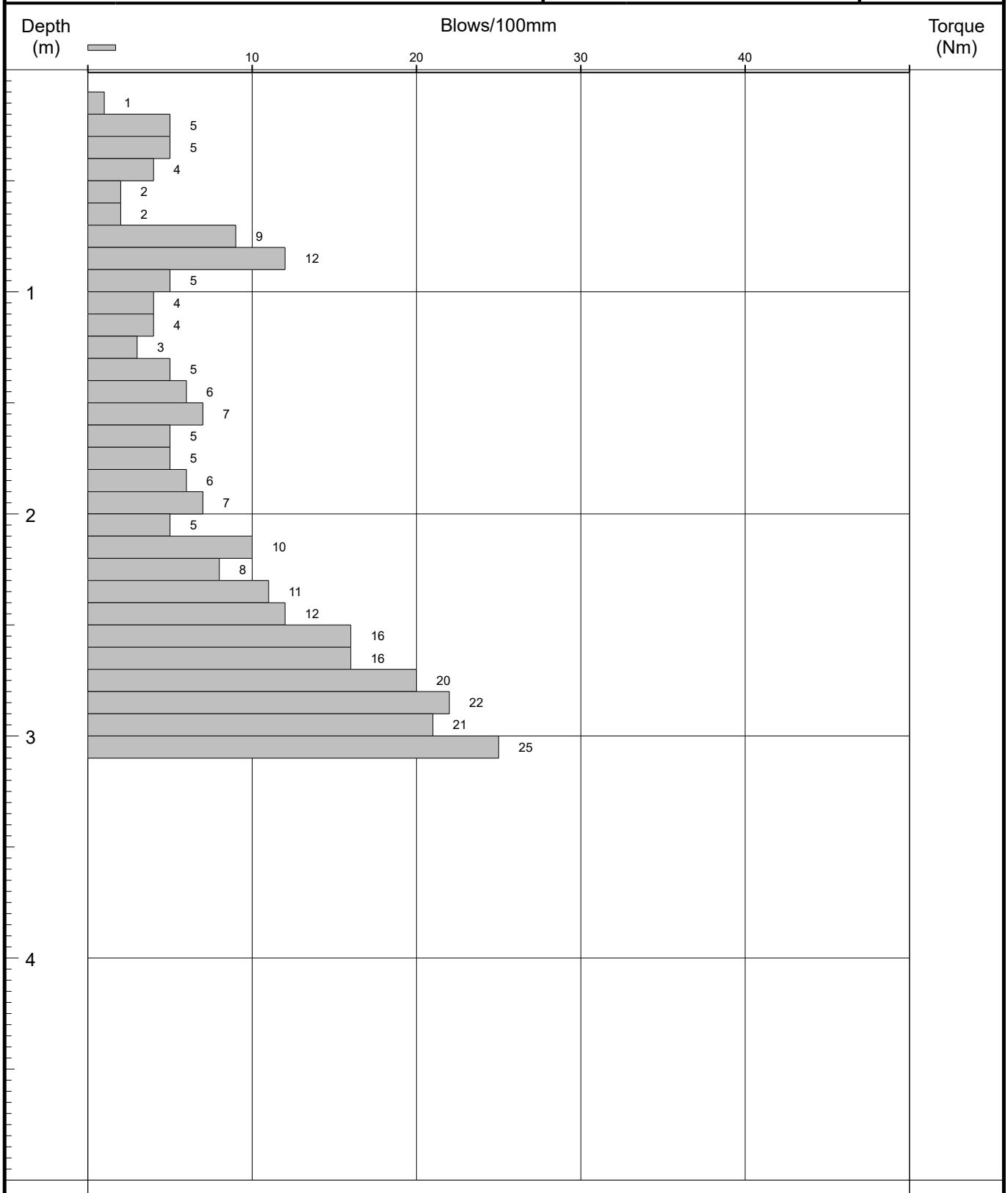
| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Bessboro SHD | **Project No.** P21239 | **Co-ords:** | 172028E - 70364N | **Hole Type** DP |
| **Location:** | Mahon, Cork | | **Level:** | 12.40m OD | **Scale** 1:25 |
| **Client:** | Estuary View Ent. Ltd | | **Dates:** | 13/01/2022 | **Logged 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.**<br>**Tel: 021 4631600**<br>**Fax: 021 4638690**<br>**www.prioritygeotechnical.ie** | Probe No<br>**DP05**<br>Sheet 1 of 1 |

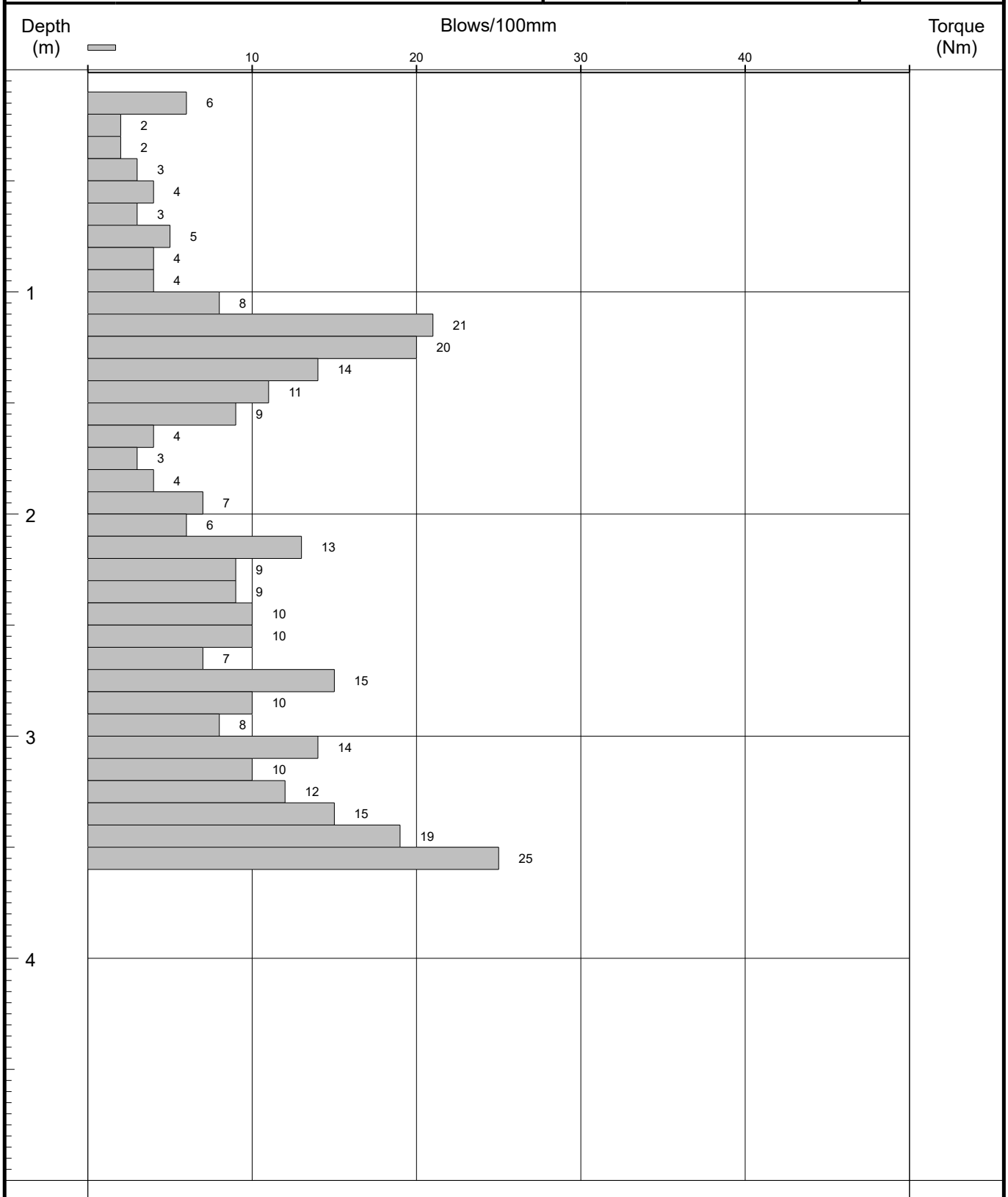
| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Bessboro SHD | **Project No.** P21239 | **Co-ords:** | 172034E - 70305N | **Hole Type** DP |
| **Location:** | Mahon, Cork | | **Level:** | 12.21m OD | **Scale** 1:25 |
| **Client:** | Estuary View Ent. Ltd | | **Dates:** | 14/01/2022 | **Logged 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.**<br>**Tel: 021 4631600**<br>**Fax: 021 4638690**<br>**www.prioritygeotechnical.ie** | Probe No<br>**DP06**<br>Sheet 1 of 1 |

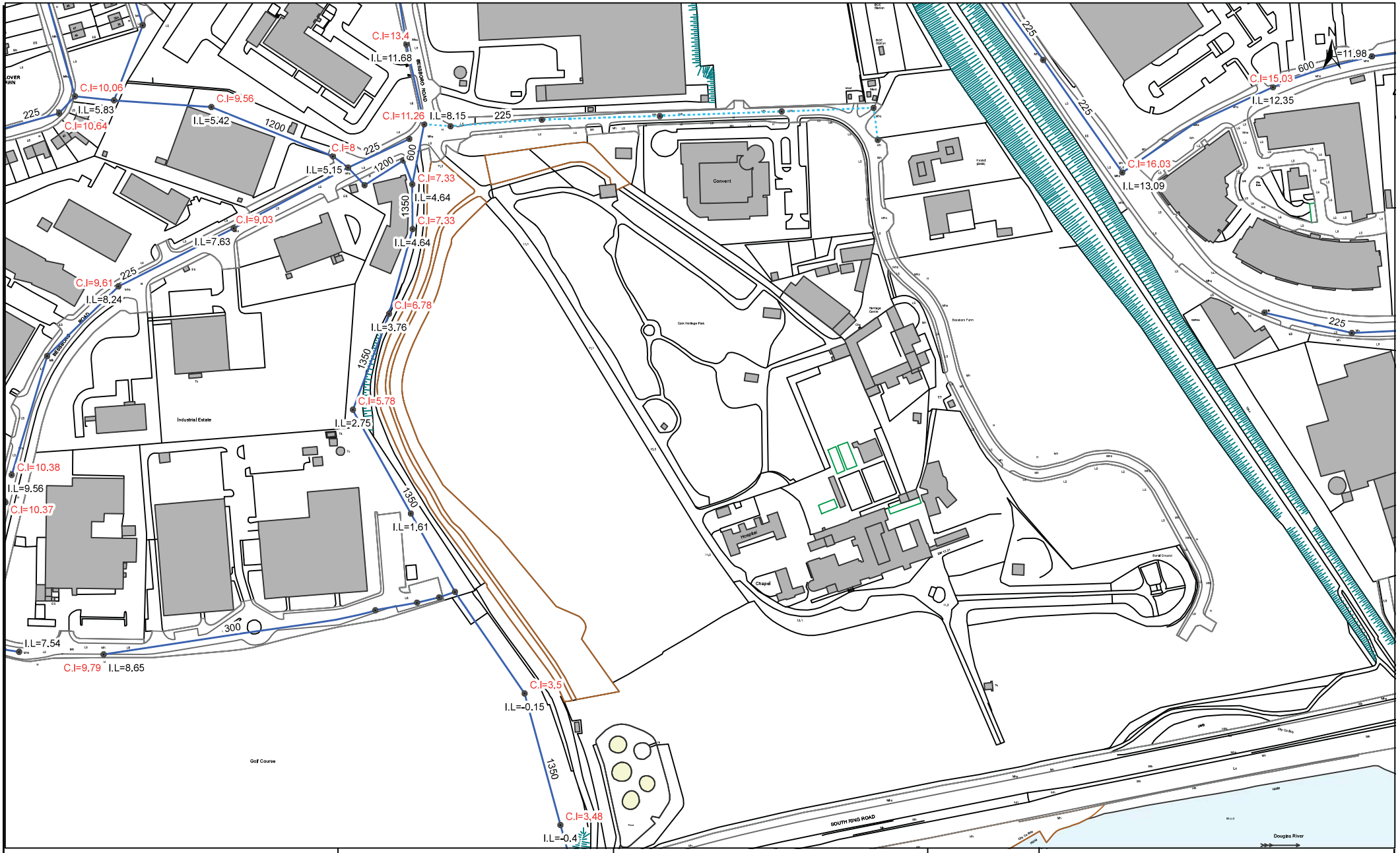
| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Bessboro SHD | **Project No.** P21239 | **Co-ords:** | 171944E - 70343N | **Hole Type** DP |
| **Location:** | Mahon, Cork | | **Level:** | 13.61m OD | **Scale** 1:25 |
| **Client:** | Estuary View Ent. Ltd | | **Dates:** | 13/01/2022 | **Logged 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 7

**CORK CITY COUNCIL - EXISTING STORMWATER NETWORK**




# 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 8

**HR WALLINGFORD - GREENFIELD RUNOFF ESTIMATION**

# Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

| | |
|---|---|
| Calculated by: | Diarmuid O'Brien |
| Site name: | Phase 1 - Bessboro SHD |
| Site location: | Bessboro, Blackrock, Cork. |

**Site Details**

| | |
|---|---|
| Latitude: | 51.88489° N |
| Longitude: | 8.40755° W |
| Reference: | 1191625915 |
| Date: | Feb 16 2022 16:07 |

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.

**Runoff estimation approach** IH124

**Site characteristics**

Total site area (ha): 1.53

**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): | 12.61 | 12.61 |
| 1 in 1 year (l/s): | 10.72 | 10.72 |
| 1 in 30 years (l/s): | 20.81 | 20.81 |
| 1 in 100 year (l/s): | 24.6 | 24.6 |
| 1 in 200 years (l/s): | 27.12 | 27.12 |

# Appendix 9

**CORK CITY COUNCIL CORRESPONDENCE**

*Figure 3. – Status of Taken in Charge / Not in Charge Roads in the Vicinity of the Bessboro SHD Site.*

**3.4.14.2 Sustainable Urban Drainage Systems (SuDS) & Stormwater:**

The report of the Senior Executive Engineer from the Drainage Section states that:

"*I note the applicant's proposal to use Q100 instead of Qbar as the greenfield run-off rate. This is acceptable, considering the proximity of the development to outfall to the estuary and the size of the existing outfall pipe at 1350mm. This approach is in line with that taken on other previously proposed developments within the Bessboro site. I have checked the Q100 estimate against my own estimate from the uksuds.com website and I am satisfied it is accurate.*

*I am pleased to see interception storage being provided for up to 5mm of rainfall…this will have a positive impact on downstream water quality, avoiding the "first flush" which would otherwise be reliant solely on an oil interceptor.*

*I am pleased to see the number of SuDS measures proposed and would request that design / drawing details are submitted as part of the application for each of the measures proposed. I would request in particular details of how the bio-retention areas are intention to function.*

*I note from Section 4.3.4 of the Infrastructure Report that it is proposed to discharge surface water from the car park via an interceptor to the storm line (as shown on drawing 21207-JBB-PH1-XX-DR-C-04001). However, based on a review of drawing SB-2020-107-404 it is apparent that this is effectively a "basement carpark", insofar as it is enclosed. As such, in accordance with Section 3.18 of the Greater Dublin Regional Code of Practice for Drainage Works, all drainage from basement areas shall be pumped to ground level prior to discharging by gravity to the public foul sewerage system. Basement car parks must be discharged to the foul system via a petrol/oil interceptor. Access to basement car parks shall be designed such that surface water run-off from the surrounding paved areas cannot flow down the ramp".*

**3.4.14.3 Flooding:**

The report of the Senior Executive Engineer from the Drainage Section states that "*I am satisfied with the Applicant's conclusion that the site is located in Flood Zone 'C' and hence, does not merit further assessment*".

# Appendix 10

**SURFACE WATER - MICRODRAINAGE CALCULATIONS**

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

Designed with Level Soffits

### 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 | 51.087 | 0.511 | 100.0 | 0.115 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S2.000 | 30.932 | 0.309 | 100.1 | 0.175 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S2.001 | 31.021 | 0.302 | 102.7 | 0.039 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.001 | 36.395 | 0.243 | 149.8 | 0.120 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.002 | 9.219 | 0.061 | 151.1 | 0.010 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.003 | 34.183 | 0.567 | 60.3 | 0.045 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.000 | 31.863 | 0.570 | 55.9 | 0.042 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S3.001 | 39.599 | 0.200 | 198.0 | 0.065 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S3.002 | 67.106 | 0.412 | 162.9 | 0.118 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.004 | 14.780 | 0.321 | 46.0 | 0.020 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.005 | 35.342 | 0.832 | 42.5 | 0.038 | 0.00 | 3.9 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.006 | 13.916 | 0.257 | 54.1 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.007 | 5.732 | 0.102 | 56.2 | 0.000 | 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 | 4.65 | 12.830 | 0.115 | 0.0 | 0.0 | 0.0 | 1.31 | 52.0 | 15.6 |
| S2.000 | 50.00 | 4.39 | 12.670 | 0.175 | 0.0 | 0.0 | 0.0 | 1.31 | 52.0 | 23.7 |
| S2.001 | 50.00 | 4.80 | 12.361 | 0.214 | 0.0 | 0.0 | 0.0 | 1.29 | 51.3 | 29.0 |
| S1.001 | 50.00 | 5.27 | 11.984 | 0.449 | 0.0 | 0.0 | 0.0 | 1.28 | 90.6 | 60.8 |
| S1.002 | 50.00 | 5.39 | 11.741 | 0.459 | 0.0 | 0.0 | 0.0 | 1.28 | 90.2 | 62.2 |
| S1.003 | 50.00 | 5.67 | 11.680 | 0.505 | 0.0 | 0.0 | 0.0 | 2.03 | 143.4 | 68.3 |
| S3.000 | 50.00 | 4.30 | 12.370 | 0.042 | 0.0 | 0.0 | 0.0 | 1.75 | 69.7 | 5.7 |
| S3.001 | 50.00 | 5.02 | 11.800 | 0.107 | 0.0 | 0.0 | 0.0 | 0.93 | 36.8 | 14.5 |
| S3.002 | 49.96 | 6.11 | 11.600 | 0.225 | 0.0 | 0.0 | 0.0 | 1.02 | 40.6 | 30.5 |
| S1.004 | 49.63 | 6.22 | 11.113 | 0.750 | 0.0 | 0.0 | 0.0 | 2.32 | 164.2 | 100.8 |
| S1.005 | 48.89 | 6.46 | 10.792 | 0.788 | 3.9 | 0.0 | 0.0 | 2.42 | 171.0 | 108.2 |
| S1.006 | 48.57 | 6.57 | 9.960 | 0.788 | 3.9 | 0.0 | 0.0 | 2.14 | 151.4 | 108.2 |
| S1.007 | 48.44 | 6.61 | 9.703 | 0.788 | 3.9 | 0.0 | 0.0 | 2.10 | 148.6 | 108.2 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1.008 | 44.748 | 0.050 | 895.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 525 | Pipe/Conduit | |
| S4.000 | 16.604 | 0.166 | 100.0 | 0.026 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S4.001 | 19.498 | 0.134 | 145.5 | 0.017 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S4.002 | 10.100 | 0.300 | 33.7 | 0.015 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S4.003 | 16.086 | 0.100 | 160.9 | 0.010 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S4.004 | 33.680 | 1.020 | 33.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S4.005 | 2.186 | 0.124 | 17.6 | 0.000 | 0.00 | 3.8 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.009 | 34.516 | 0.181 | 190.7 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.010 | 17.091 | 0.087 | 196.4 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.011 | 57.377 | 0.284 | 202.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.012 | 41.156 | 0.206 | 199.8 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.013 | 36.345 | 0.182 | 199.7 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.014 | 63.431 | 1.321 | 48.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.015 | 29.911 | 0.602 | 49.7 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S1.016 | 94.491 | 3.780 | 25.0 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.008 | 45.72 | 7.62 | 9.376 | 0.788 | 3.9 | 0.0 | 0.0 | 0.74 | 160.3 | 108.2 |
| S4.000 | 50.00 | 4.21 | 11.170 | 0.026 | 0.0 | 0.0 | 0.0 | 1.31 | 52.0 | 3.6 |
| S4.001 | 50.00 | 4.51 | 11.004 | 0.043 | 0.0 | 0.0 | 0.0 | 1.08 | 43.0 | 5.9 |
| S4.002 | 50.00 | 4.59 | 10.870 | 0.058 | 0.0 | 0.0 | 0.0 | 2.26 | 90.0 | 7.8 |
| S4.003 | 50.00 | 4.85 | 10.570 | 0.068 | 0.0 | 0.0 | 0.0 | 1.03 | 40.9 | 9.2 |
| S4.004 | 50.00 | 5.09 | 10.470 | 0.068 | 0.0 | 0.0 | 0.0 | 2.28 | 90.8 | 9.2 |
| S4.005 | 50.00 | 5.10 | 9.450 | 0.068 | 3.8 | 0.0 | 0.0 | 3.13 | 124.5 | 13.0 |
| S1.009 | 50.00 | 4.61 | 9.326 | 0.000 | 24.6 | 0.0 | 0.0 | 0.94 | 37.5 | 24.6 |
| S1.010 | 50.00 | 4.92 | 9.145 | 0.000 | 24.6 | 0.0 | 0.0 | 0.93 | 36.9 | 24.6 |
| S1.011 | 50.00 | 5.96 | 9.058 | 0.000 | 24.6 | 0.0 | 0.0 | 0.92 | 36.4 | 24.6 |
| S1.012 | 48.18 | 6.70 | 8.774 | 0.000 | 24.6 | 0.0 | 0.0 | 0.92 | 36.6 | 24.6 |
| S1.013 | 46.38 | 7.36 | 8.568 | 0.000 | 24.6 | 0.0 | 0.0 | 0.92 | 36.6 | 24.6 |
| S1.014 | 44.99 | 7.92 | 8.386 | 0.000 | 24.6 | 0.0 | 0.0 | 1.89 | 75.3 | 24.6 |
| S1.015 | 44.35 | 8.19 | 7.065 | 0.000 | 24.6 | 0.0 | 0.0 | 1.86 | 74.0 | 24.6 |
| S1.016 | 43.02 | 8.79 | 6.463 | 0.000 | 24.6 | 0.0 | 0.0 | 2.63 | 104.5 | 24.6 |

## Free Flowing Outfall Details for Storm

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| S1.016 | S.A29 | 4.390 | 2.683 | 0.000 | 0 | 0 |

## Online Controls for Storm

### Hydro-Brake® Optimum Manhole: S.A21, DS/PN: S1.009, Volume (m³): 14.1

| | |
|---|---|
| Unit Reference | MD-SHE-0208-2460-1680-2460 |
| Design Head (m) | 1.680 |
| Design Flow (l/s) | 24.6 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 208 |
| Invert Level (m) | 9.326 |
| Minimum Outlet Pipe Diameter (mm) | 225 |
| Suggested Manhole Diameter (mm) | 1800 |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.680 | 24.6 | Kick-Flo® | 1.086 | 20.0 |
| Flush-Flo™ | 0.497 | 24.6 | Mean Flow over Head Range | - | 21.2 |

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) |
|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 7.1 | 0.800 | 23.6 | 2.000 | 26.7 | 4.000 | 37.3 | 7.000 | 48.9 |
| 0.200 | 20.0 | 1.000 | 21.7 | 2.200 | 28.0 | 4.500 | 39.5 | 7.500 | 50.5 |
| 0.300 | 23.5 | 1.200 | 20.9 | 2.400 | 29.2 | 5.000 | 41.5 | 8.000 | 52.1 |
| 0.400 | 24.4 | 1.400 | 22.5 | 2.600 | 30.3 | 5.500 | 43.5 | 8.500 | 53.7 |
| 0.500 | 24.6 | 1.600 | 24.0 | 3.000 | 32.5 | 6.000 | 45.4 | 9.000 | 55.2 |
| 0.600 | 24.4 | 1.800 | 25.4 | 3.500 | 35.0 | 6.500 | 47.2 | 9.500 | 56.7 |

## Storage Structures for Storm

### Cellular Storage Manhole: S.A21, DS/PN: S1.009

Invert Level (m) 9.326 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 284.0 | 0.0 | 0.900 | 284.0 | 0.0 | 1.681 | 0.0 | 0.0 |
| 0.100 | 284.0 | 0.0 | 1.000 | 284.0 | 0.0 | 1.900 | 0.0 | 0.0 |
| 0.200 | 284.0 | 0.0 | 1.100 | 284.0 | 0.0 | 2.000 | 0.0 | 0.0 |
| 0.300 | 284.0 | 0.0 | 1.200 | 284.0 | 0.0 | 2.100 | 0.0 | 0.0 |
| 0.400 | 284.0 | 0.0 | 1.300 | 284.0 | 0.0 | 2.200 | 0.0 | 0.0 |
| 0.500 | 284.0 | 0.0 | 1.400 | 284.0 | 0.0 | 2.300 | 0.0 | 0.0 |
| 0.600 | 284.0 | 0.0 | 1.500 | 284.0 | 0.0 | 2.400 | 0.0 | 0.0 |
| 0.700 | 284.0 | 0.0 | 1.600 | 284.0 | 0.0 | 2.500 | 0.0 | 0.0 |
| 0.800 | 284.0 | 0.0 | 1.680 | 284.0 | 0.0 | | | |

## 1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

| | | | |
|---|---|---|---|
| Areal Reduction Factor | 1.000 | Additional Flow - % of Total Flow | 0.000 |
| Hot Start (mins) | 0 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start Level (mm) | 0 | Inlet Coeffiecient | 0.800 |
| Manhole Headloss Coeff (Global) | 0.500 | Flow per Person per Day (l/per/day) | 0.000 |
| Foul Sewage per hectare (l/s) | 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 |
| Region | Scotland and Ireland | Ratio R | 0.250 |
| Cv (Summer) | 0.750 | | |
| Cv (Winter) | 0.840 | | |

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

| | |
|---|---|
| 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 (%) | 10, 10, 10 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S.A1 | 15 Winter | 1 | +10% | 100/15 Summer | | | | 12.920 | -0.135 |
| S2.000 | S.A2 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 12.786 | -0.109 |
| S2.001 | S.A3 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 12.491 | -0.095 |
| S1.001 | S.A4 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 12.174 | -0.110 |
| S1.002 | S.A5 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 11.978 | -0.063 |
| S1.003 | S.A6 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 11.829 | -0.151 |
| S3.000 | S.A7 | 15 Winter | 1 | +10% | 100/15 Summer | | | | 12.416 | -0.179 |
| S3.001 | S.A8 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 11.898 | -0.127 |
| S3.002 | S.A9 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 11.736 | -0.089 |
| S1.004 | S.A10 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 11.294 | -0.119 |
| S1.005 | S.A11 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 10.967 | -0.125 |
| S1.006 | S.A12 | 15 Winter | 1 | +10% | 30/15 Summer | | | | 10.206 | -0.054 |
| S1.007 | S.A13 | 15 Winter | 1 | +10% | 1/15 Summer | | | | 10.042 | 0.039 |
| S1.008 | S.A14 | 15 Winter | 1 | +10% | 30/60 Summer | | | | 9.702 | -0.199 |
| S4.000 | S.A15 | 15 Summer | 1 | +10% | | | | | 11.214 | -0.181 |
| S4.001 | S.A16 | 15 Winter | 1 | +10% | | | | | 11.062 | -0.167 |
| S4.002 | S.A17 | 15 Winter | 1 | +10% | | | | | 10.918 | -0.177 |
| S4.003 | S.A18 | 15 Winter | 1 | +10% | | | | | 10.644 | -0.151 |
| S4.004 | S.A19 | 15 Winter | 1 | +10% | | | | | 10.518 | -0.177 |
| S4.005 | S.A20 | 180 Winter | 1 | +10% | 30/15 Summer | | | | 9.675 | 0.000 |
| S1.009 | S.A21 | 180 Winter | 1 | +10% | 1/30 Winter | | | | 9.673 | 0.122 |
| S1.010 | S.A22 | 180 Winter | 1 | +10% | | | | | 9.286 | -0.084 |
| S1.011 | S.A23 | 180 Winter | 1 | +10% | | | | | 9.193 | -0.090 |
| S1.012 | S.A24 | 180 Winter | 1 | +10% | | | | | 8.909 | -0.090 |
| S1.013 | S.A25 | 180 Winter | 1 | +10% | | | | | 8.704 | -0.089 |
| S1.014 | S.A26 | 180 Winter | 1 | +10% | | | | | 8.473 | -0.138 |
| S1.015 | S.A27 | 180 Winter | 1 | +10% | | | | | 7.155 | -0.135 |
| S1.016 | S.A28 | 180 Winter | 1 | +10% | | | | | 6.535 | -0.152 |

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

| PN | US/MH Name | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S1.000 | S.A1 | 0.000 | 0.34 | | | 16.9 | OK | |
| S2.000 | S.A2 | 0.000 | 0.52 | | | 25.5 | OK | |
| S2.001 | S.A3 | 0.000 | 0.62 | | | 29.6 | OK | |
| S1.001 | S.A4 | 0.000 | 0.71 | | | 59.6 | OK | |
| S1.002 | S.A5 | 0.000 | 0.97 | | | 60.1 | OK | |
| S1.003 | S.A6 | 0.000 | 0.49 | | | 65.0 | OK | |
| S3.000 | S.A7 | 0.000 | 0.09 | | | 6.2 | OK | |
| S3.001 | S.A8 | 0.000 | 0.38 | | | 13.4 | OK | |
| S3.002 | S.A9 | 0.000 | 0.65 | | | 25.6 | OK | |
| S1.004 | S.A10 | 0.000 | 0.67 | | | 92.3 | OK | |
| S1.005 | S.A11 | 0.000 | 0.63 | | | 99.5 | OK | |
| S1.006 | S.A12 | 0.000 | 0.79 | | | 99.5 | OK | |
| S1.007 | S.A13 | 0.000 | 1.24 | | | 99.3 | SURCHARGED | |
| S1.008 | S.A14 | 0.000 | 0.69 | | | 97.0 | OK | |
| S4.000 | S.A15 | 0.000 | 0.08 | | | 3.9 | OK | |
| S4.001 | S.A16 | 0.000 | 0.15 | | | 5.8 | OK | |
| S4.002 | S.A17 | 0.000 | 0.10 | | | 7.5 | OK | |
| S4.003 | S.A18 | 0.000 | 0.24 | | | 8.6 | OK | |
| S4.004 | S.A19 | 0.000 | 0.10 | | | 8.6 | OK | |
| S4.005 | S.A20 | 0.000 | 0.13 | | | 6.6 | OK | |
| S1.009 | S.A21 | 0.000 | 0.66 | | 96 | 23.4 | SURCHARGED | |
| S1.010 | S.A22 | 0.000 | 0.71 | | | 23.4 | OK | |
| S1.011 | S.A23 | 0.000 | 0.67 | | | 23.4 | OK | |
| S1.012 | S.A24 | 0.000 | 0.67 | | | 23.4 | OK | |
| S1.013 | S.A25 | 0.000 | 0.68 | | | 23.4 | OK | |
| S1.014 | S.A26 | 0.000 | 0.32 | | | 23.4 | OK | |
| S1.015 | S.A27 | 0.000 | 0.34 | | | 23.4 | OK | |
| S1.016 | S.A28 | 0.000 | 0.23 | | | 23.4 | OK | |

## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

| | | | |
|---|---|---|---|
| Areal Reduction Factor | 1.000 | Additional Flow - % of Total Flow | 0.000 |
| Hot Start (mins) | 0 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start Level (mm) | 0 | Inlet Coeffiecient | 0.800 |
| Manhole Headloss Coeff (Global) | 0.500 | Flow per Person per Day (l/per/day) | 0.000 |
| Foul Sewage per hectare (l/s) | 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 |
| Region | Scotland and Ireland | Ratio R | 0.250 |
| Cv (Summer) | 0.750 | | |
| Cv (Winter) | 0.840 | | |

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

| | |
|---|---|
| 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 (%) | 10, 10, 10 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S.A1 | 15 Winter | 30 | +10% | 100/15 Summer | | | | 12.977 | -0.078 |
| S2.000 | S.A2 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 13.300 | 0.405 |
| S2.001 | S.A3 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 13.052 | 0.466 |
| S1.001 | S.A4 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 12.735 | 0.451 |
| S1.002 | S.A5 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 12.415 | 0.374 |
| S1.003 | S.A6 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 12.274 | 0.294 |
| S3.000 | S.A7 | 15 Winter | 30 | +10% | 100/15 Summer | | | | 12.448 | -0.147 |
| S3.001 | S.A8 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 12.425 | 0.400 |
| S3.002 | S.A9 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 12.358 | 0.533 |
| S1.004 | S.A10 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 11.930 | 0.517 |
| S1.005 | S.A11 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 11.550 | 0.458 |
| S1.006 | S.A12 | 15 Winter | 30 | +10% | 30/15 Summer | | | | 10.699 | 0.439 |
| S1.007 | S.A13 | 15 Winter | 30 | +10% | 1/15 Summer | | | | 10.296 | 0.293 |
| S1.008 | S.A14 | 240 Winter | 30 | +10% | 30/60 Summer | | | | 10.126 | 0.225 |
| S4.000 | S.A15 | 15 Winter | 30 | +10% | | | | | 11.235 | -0.160 |
| S4.001 | S.A16 | 15 Summer | 30 | +10% | | | | | 11.098 | -0.131 |
| S4.002 | S.A17 | 15 Winter | 30 | +10% | | | | | 10.946 | -0.149 |
| S4.003 | S.A18 | 15 Winter | 30 | +10% | | | | | 10.697 | -0.098 |
| S4.004 | S.A19 | 15 Winter | 30 | +10% | | | | | 10.547 | -0.148 |
| S4.005 | S.A20 | 240 Winter | 30 | +10% | 30/15 Summer | | | | 10.122 | 0.447 |
| S1.009 | S.A21 | 240 Winter | 30 | +10% | 1/30 Winter | | | | 10.120 | 0.569 |
| S1.010 | S.A22 | 480 Summer | 30 | +10% | | | | | 9.290 | -0.080 |
| S1.011 | S.A23 | 600 Winter | 30 | +10% | | | | | 9.197 | -0.086 |
| S1.012 | S.A24 | 480 Winter | 30 | +10% | | | | | 8.914 | -0.085 |
| S1.013 | S.A25 | 480 Winter | 30 | +10% | | | | | 8.708 | -0.085 |
| S1.014 | S.A26 | 360 Winter | 30 | +10% | | | | | 8.476 | -0.135 |
| S1.015 | S.A27 | 720 Summer | 30 | +10% | | | | | 7.157 | -0.133 |
| S1.016 | S.A28 | 720 Summer | 30 | +10% | | | | | 6.537 | -0.151 |

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S1.000 | S.A1 | 0.000 | 0.74 | | | 36.9 | OK | |
| S2.000 | S.A2 | 0.000 | 0.92 | | | 44.9 | SURCHARGED | |
| S2.001 | S.A3 | 0.000 | 1.08 | | | 51.8 | SURCHARGED | |
| S1.001 | S.A4 | 0.000 | 1.34 | | | 112.1 | SURCHARGED | |
| S1.002 | S.A5 | 0.000 | 1.74 | | | 107.9 | SURCHARGED | |
| S1.003 | S.A6 | 0.000 | 0.86 | | | 113.8 | SURCHARGED | |
| S3.000 | S.A7 | 0.000 | 0.21 | | | 13.7 | OK | |
| S3.001 | S.A8 | 0.000 | 0.68 | | | 23.9 | SURCHARGED | |
| S3.002 | S.A9 | 0.000 | 1.25 | | | 49.1 | SURCHARGED | |
| S1.004 | S.A10 | 0.000 | 1.11 | | | 152.3 | SURCHARGED | |
| S1.005 | S.A11 | 0.000 | 1.01 | | | 158.9 | SURCHARGED | |
| S1.006 | S.A12 | 0.000 | 1.26 | | | 157.4 | SURCHARGED | |
| S1.007 | S.A13 | 0.000 | 1.96 | | | 157.0 | SURCHARGED | |
| S1.008 | S.A14 | 0.000 | 0.44 | | | 62.3 | SURCHARGED | |
| S4.000 | S.A15 | 0.000 | 0.19 | | | 8.7 | OK | |
| S4.001 | S.A16 | 0.000 | 0.36 | | | 14.1 | OK | |
| S4.002 | S.A17 | 0.000 | 0.25 | | | 18.8 | OK | |
| S4.003 | S.A18 | 0.000 | 0.59 | | | 21.5 | OK | |
| S4.004 | S.A19 | 0.000 | 0.25 | | | 21.7 | OK | |
| S4.005 | S.A20 | 0.000 | 0.17 | | | 8.5 | SURCHARGED | |
| S1.009 | S.A21 | 0.000 | 0.69 | | 160 | 24.5 | SURCHARGED | |
| S1.010 | S.A22 | 0.000 | 0.74 | | | 24.5 | OK | |
| S1.011 | S.A23 | 0.000 | 0.70 | | | 24.5 | OK | |
| S1.012 | S.A24 | 0.000 | 0.70 | | | 24.5 | OK | |
| S1.013 | S.A25 | 0.000 | 0.71 | | | 24.5 | OK | |
| S1.014 | S.A26 | 0.000 | 0.34 | | | 24.5 | OK | |
| S1.015 | S.A27 | 0.000 | 0.35 | | | 24.5 | OK | |
| S1.016 | S.A28 | 0.000 | 0.24 | | | 24.5 | OK | |

## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

| | | | |
|---|---|---|---|
| Areal Reduction Factor | 1.000 | Additional Flow - % of Total Flow | 0.000 |
| Hot Start (mins) | 0 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start Level (mm) | 0 | Inlet Coeffiecient | 0.800 |
| Manhole Headloss Coeff (Global) | 0.500 | Flow per Person per Day (l/per/day) | 0.000 |
| Foul Sewage per hectare (l/s) | 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 |
| Region | Scotland and Ireland | Ratio R | 0.250 |
| Cv (Summer) | 0.750 | | |
| Cv (Winter) | 0.840 | | |

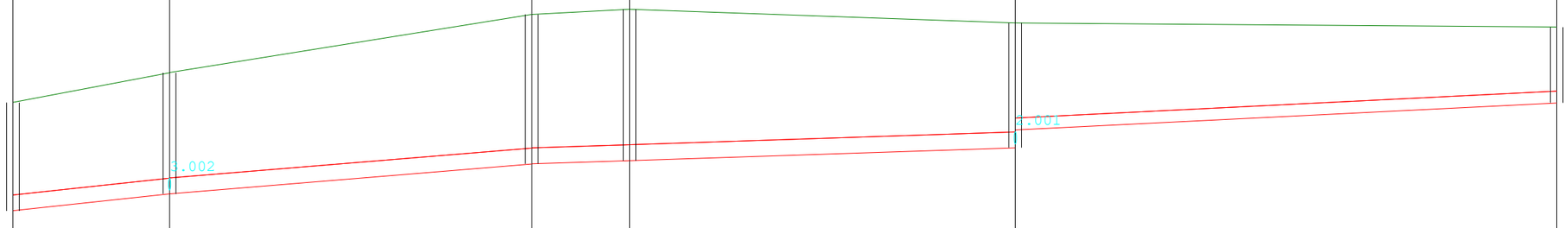
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

| | |
|---|---|
| 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 (%) | 10, 10, 10 |

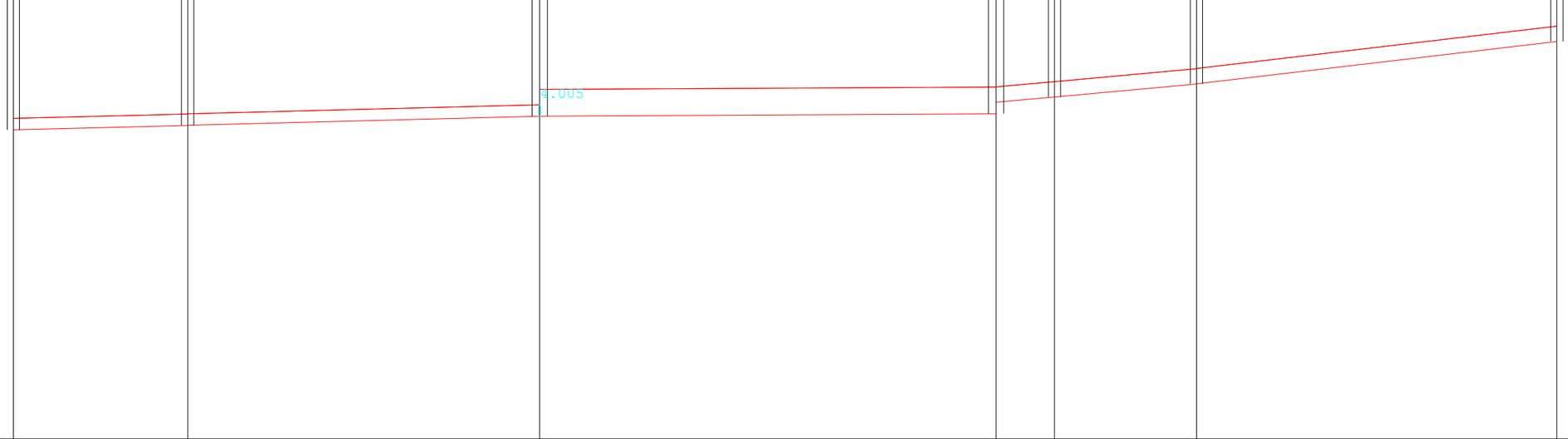
| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S.A1 | 15 Winter | 100 | +10% | 100/15 Summer | | | | 13.660 | 0.605 |
| S2.000 | S.A2 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 14.089 | 1.194 |
| S2.001 | S.A3 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 13.863 | 1.277 |
| S1.001 | S.A4 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 13.532 | 1.248 |
| S1.002 | S.A5 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 13.151 | 1.110 |
| S1.003 | S.A6 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 12.968 | 0.988 |
| S3.000 | S.A7 | 15 Winter | 100 | +10% | 100/15 Summer | | | | 13.183 | 0.588 |
| S3.001 | S.A8 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 13.163 | 1.138 |
| S3.002 | S.A9 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 13.093 | 1.268 |
| S1.004 | S.A10 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 12.514 | 1.101 |
| S1.005 | S.A11 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 12.024 | 0.932 |
| S1.006 | S.A12 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 10.946 | 0.686 |
| S1.007 | S.A13 | 240 Winter | 100 | +10% | 1/15 Summer | | | | 10.461 | 0.458 |
| S1.008 | S.A14 | 240 Winter | 100 | +10% | 30/60 Summer | | | | 10.455 | 0.554 |
| S4.000 | S.A15 | 15 Winter | 100 | +10% | | | | | 11.245 | -0.150 |
| S4.001 | S.A16 | 15 Summer | 100 | +10% | | | | | 11.113 | -0.116 |
| S4.002 | S.A17 | 15 Winter | 100 | +10% | | | | | 10.958 | -0.137 |
| S4.003 | S.A18 | 15 Winter | 100 | +10% | | | | | 10.722 | -0.073 |
| S4.004 | S.A19 | 15 Winter | 100 | +10% | | | | | 10.560 | -0.135 |
| S4.005 | S.A20 | 240 Winter | 100 | +10% | 30/15 Summer | | | | 10.451 | 0.776 |
| S1.009 | S.A21 | 240 Winter | 100 | +10% | 1/30 Winter | | | | 10.449 | 0.898 |
| S1.010 | S.A22 | 360 Summer | 100 | +10% | | | | | 9.290 | -0.080 |
| S1.011 | S.A23 | 720 Summer | 100 | +10% | | | | | 9.197 | -0.086 |
| S1.012 | S.A24 | 480 Winter | 100 | +10% | | | | | 8.914 | -0.085 |
| S1.013 | S.A25 | 600 Summer | 100 | +10% | | | | | 8.708 | -0.085 |
| S1.014 | S.A26 | 1440 Summer | 100 | +10% | | | | | 8.476 | -0.135 |
| S1.015 | S.A27 | 1440 Summer | 100 | +10% | | | | | 7.157 | -0.133 |
| S1.016 | S.A28 | 1440 Summer | 100 | +10% | | | | | 6.537 | -0.151 |

## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

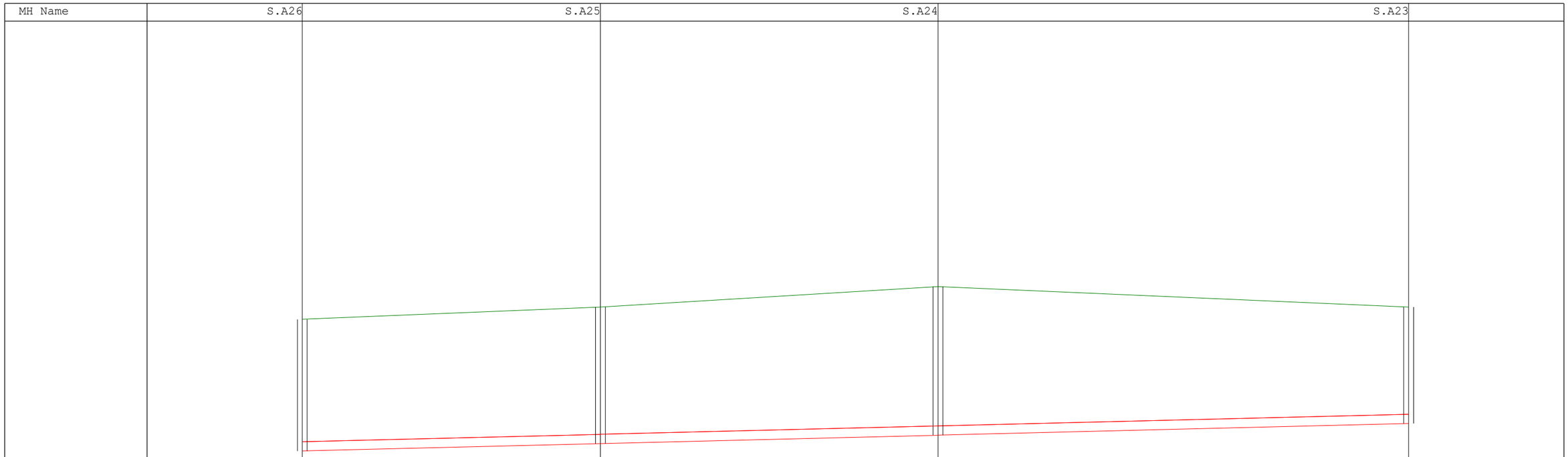
| PN | US/MH Name | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S1.000 | S.A1 | 0.000 | 0.84 | | | 41.7 | SURCHARGED | |
| S2.000 | S.A2 | 0.000 | 1.02 | | | 49.4 | FLOOD RISK | |
| S2.001 | S.A3 | 0.000 | 1.16 | | | 55.7 | FLOOD RISK | |
| S1.001 | S.A4 | 0.000 | 1.43 | | | 119.6 | SURCHARGED | |
| S1.002 | S.A5 | 0.000 | 1.84 | | | 114.0 | SURCHARGED | |
| S1.003 | S.A6 | 0.000 | 0.91 | | | 120.4 | SURCHARGED | |
| S3.000 | S.A7 | 0.000 | 0.25 | | | 16.3 | SURCHARGED | |
| S3.001 | S.A8 | 0.000 | 0.69 | | | 23.9 | FLOOD RISK | |
| S3.002 | S.A9 | 0.000 | 1.39 | | | 54.8 | FLOOD RISK | |
| S1.004 | S.A10 | 0.000 | 1.25 | | | 171.3 | SURCHARGED | |
| S1.005 | S.A11 | 0.000 | 1.15 | | | 180.7 | SURCHARGED | |
| S1.006 | S.A12 | 0.000 | 1.43 | | | 178.9 | SURCHARGED | |
| S1.007 | S.A13 | 0.000 | 0.97 | | | 77.4 | SURCHARGED | |
| S1.008 | S.A14 | 0.000 | 0.54 | | | 76.8 | SURCHARGED | |
| S4.000 | S.A15 | 0.000 | 0.24 | | | 11.2 | OK | |
| S4.001 | S.A16 | 0.000 | 0.47 | | | 18.3 | OK | |
| S4.002 | S.A17 | 0.000 | 0.33 | | | 24.4 | OK | |
| S4.003 | S.A18 | 0.000 | 0.77 | | | 27.8 | OK | |
| S4.004 | S.A19 | 0.000 | 0.33 | | | 28.2 | OK | |
| S4.005 | S.A20 | 0.000 | 0.20 | | | 9.7 | SURCHARGED | |
| S1.009 | S.A21 | 0.000 | 0.69 | | 188 | 24.5 | SURCHARGED | |
| S1.010 | S.A22 | 0.000 | 0.74 | | | 24.5 | OK | |
| S1.011 | S.A23 | 0.000 | 0.70 | | | 24.5 | OK | |
| S1.012 | S.A24 | 0.000 | 0.70 | | | 24.5 | OK | |
| S1.013 | S.A25 | 0.000 | 0.71 | | | 24.5 | OK | |
| S1.014 | S.A26 | 0.000 | 0.34 | | | 24.5 | OK | |
| S1.015 | S.A27 | 0.000 | 0.35 | | | 24.5 | OK | |
| S1.016 | S.A28 | 0.000 | 0.24 | | | 24.5 | OK | |



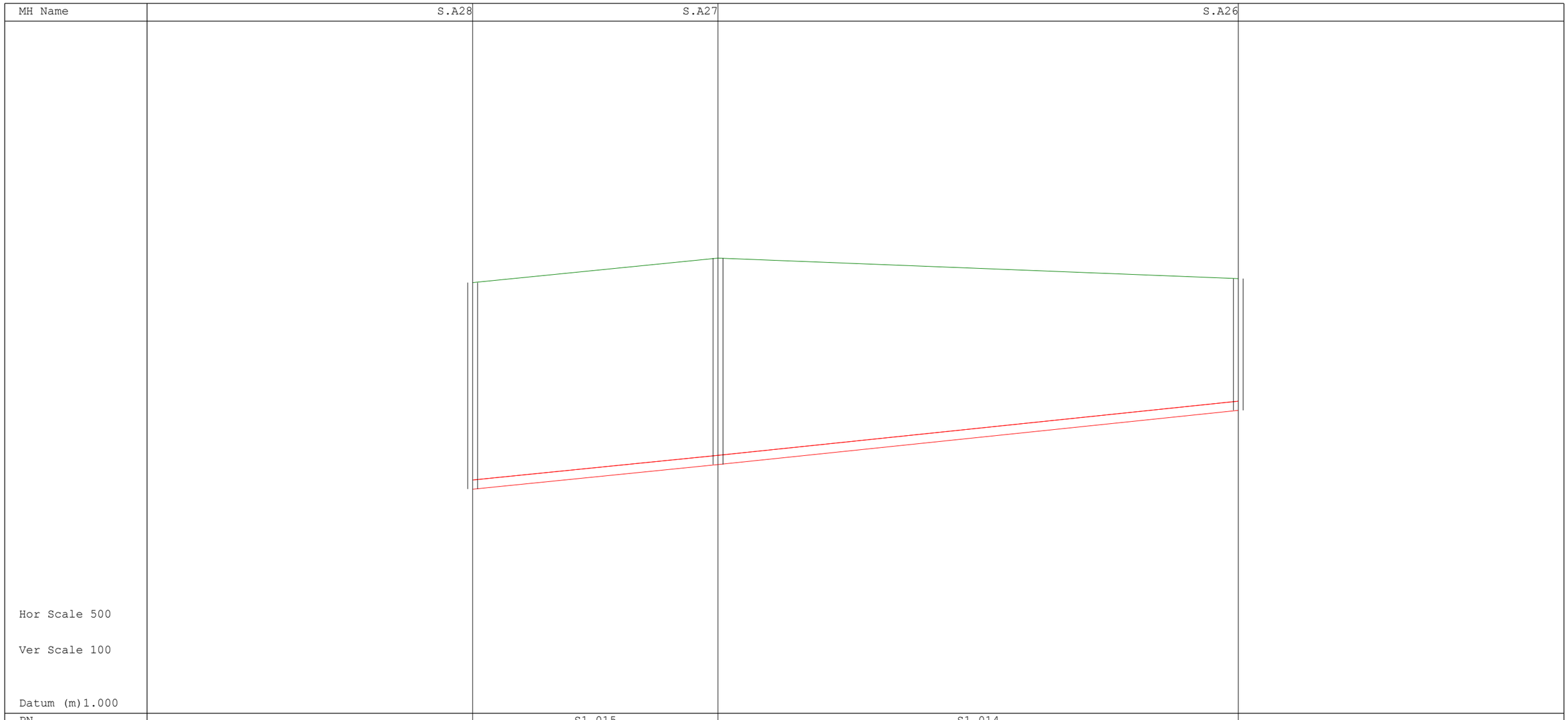

| MH Name | | S.A11 | S.A10 | S.A6 | S.A5 | S.A4 | S.A1 | |
|---|---|---|---|---|---|---|---|---|
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 4.000 | | | | | | | | |
| PN | | | S1.004 | S1.003 | S1.002 | S1.001 | S1.000 | |
| Dia (mm) | | | 300 | 300 | 300 | 300 | 225 | |
| Slope (1:X) | | | 46.0 | 60.3 | 151.1 | 149.8 | 100.0 | |
| Cover Level (m) | | 12.840 | 13.400 | 14.500 | 14.600 | 14.340 | 14.260 | |
| Invert Level (m) | | | 10.792 | 11.113<br>11.113 | 11.680<br>11.680 | 11.741<br>11.741 | 11.984<br>12.319 | 12.830 | |
| Length (m) | | | 14.780 | 34.183 | 9.219 | 36.395 | 51.087 | |



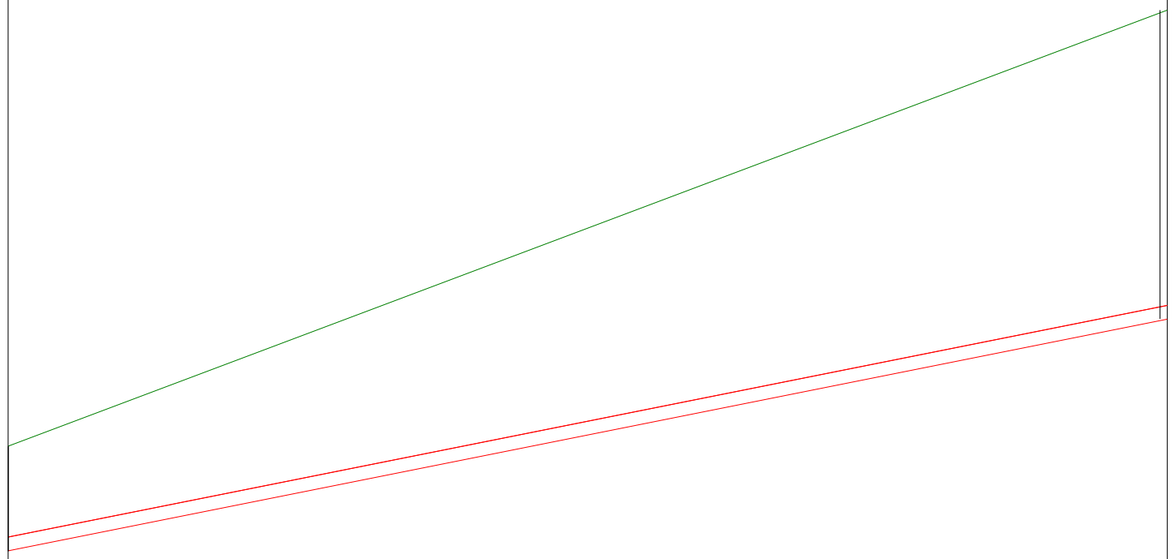

| MH Name | | S.A23 | S.A22 | S.A21 | S.A14 | S.A13 | S.A12 | S.A11 | |
|---|---|---|---|---|---|---|---|---|---|
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 3.000 | | | | | | | | | |
| PN | | | S1.010 | S1.009 | S1.008 | S1.007 | S1.006 | S1.005 | |
| Dia (mm) | | | 225 | 225 | 525 | 300 | 300 | 300 | |
| Slope (1:X) | | | 196.4 | 190.7 | 895.0 | 56.2 | 54.1 | 42.5 | |
| Cover Level (m) | | 11.900 | 11.900 | 12.000 | 11.900 | 11.800 | 11.750 | 12.840 | |
| Invert Level (m) | | 9.058 | 9.145 | 9.145<br>9.326 | 9.326<br>9.376 | 9.601<br>9.703 | 9.703<br>9.960 | 9.960<br>10.792 | |
| Length (m) | | | 17.091 | 34.516 | 44.748 | 5.732 | 13.916 | 35.342 | |

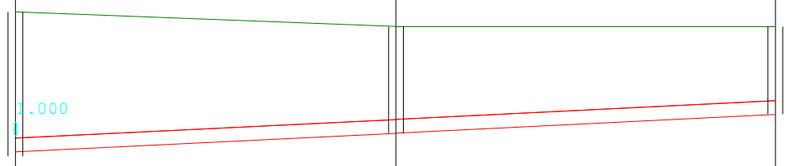


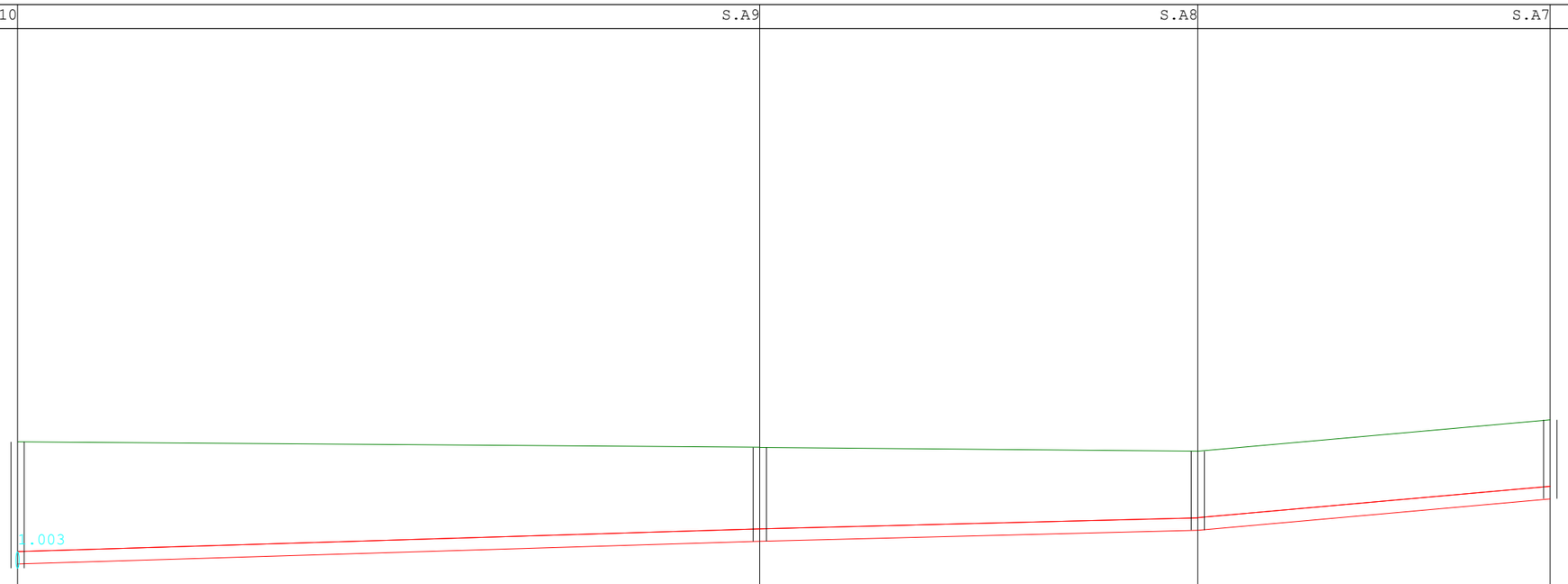
| MH Name | | S.A26 | S.A25 | S.A24 | S.A23 | |
|---|---|---|---|---|---|---|
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 2.000 | | | | | | |
| PN | | | S1.013 | S1.012 | S1.011 | |
| Dia (mm) | | | 225 | 225 | 225 | |
| Slope (1:X) | | | 199.7 | 199.8 | 202.0 | |
| Cover Level (m) | | 11.600 | 11.900 | 12.400 | 11.900 | |
| Invert Level (m) | | 8.386 | 8.568 | 8.568 | 8.774 | 8.774 | 9.058 | |
| Length (m) | | | 36.345 | 41.156 | 57.377 | |

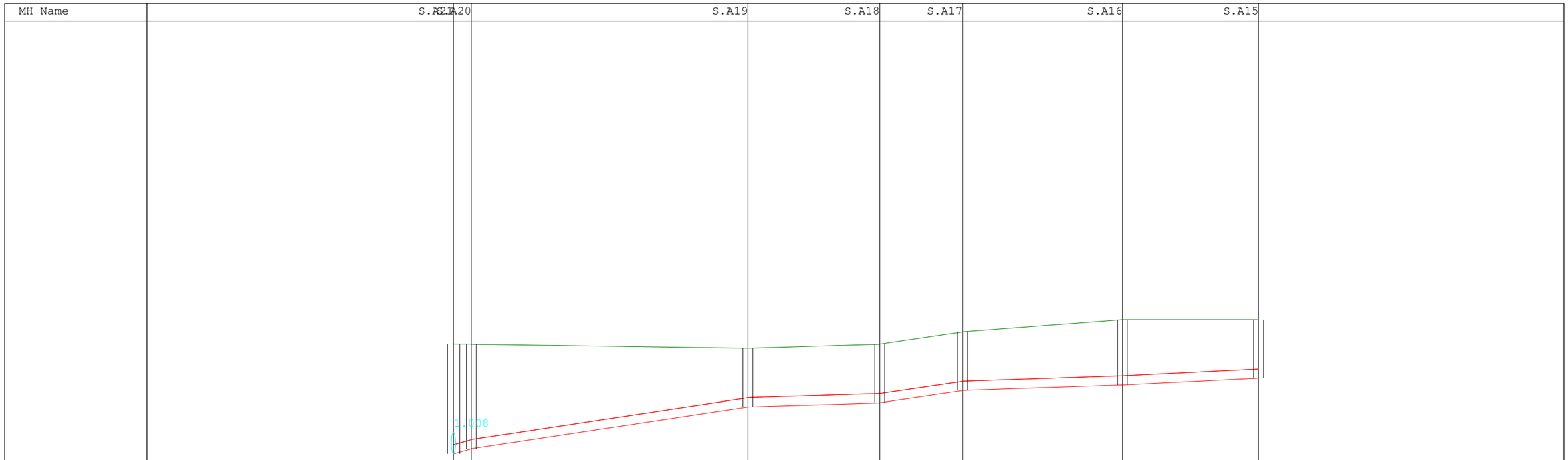


| MH Name | S.A28 | S.A27 | S.A26 | |
|---|---|---|---|---|
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 1.000 | | | | |
| PN | | S1.015 | S1.014 | |
| Dia (mm) | | 225 | 225 | |
| Slope (1:X) | | 49.7 | 48.0 | |
| Cover Level (m) | 11.500 | 12.100 | 11.600 | |
| Invert Level (m) | 6.463 | 7.065 | 7.065 | 8.386 |
| Length (m) | | 29.911 | 63.431 | |

| MH Name | S.A29 | | S.A28 | |
|---|---|---|---|---|
| | |  | | |
| Hor Scale 500<br>Ver Scale 100<br>Datum (m)-1.000 | | | | |
| PN | | S1.016 | | |
| Dia (mm) | | 225 | | |
| Slope (1:X) | | 25.0 | | |
| Cover Level (m) | 4.390 | | 11.500 | |
| Invert Level (m) | 2.683 | | 6.463 | |
| Length (m) | | 94.491 | | |

| MH Name | S.A4 | S.A3 | S.A2 | |
|---|---|---|---|---|
| | |  | | |
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 5.000 | | | | |
| PN | | S2.001 | S2.000 | |
| Dia (mm) | | 225 | 225 | |
| Slope (1:X) | | 102.7 | 100.1 | |
| Cover Level (m) | 14.340 | 14.100 | 14.100 | |
| Invert Level (m) | | 12.059<br>12.361 | 12.361<br>12.670 | |
| Length (m) | | 31.021 | 30.932 | |

| MH Name | S.A10 | S.A9 | S.A8 | S.A7 | |
|---|---|---|---|---|---|
| | |  | | | |
| Hor Scale 500<br>Ver Scale 100<br>Datum (m) 4.000 | | | | | |
| PN | | S3.002 | S3.001 | S3.000 | |
| Dia (mm) | | 225 | 225 | 225 | |
| Slope (1:X) | | 162.9 | 198.0 | 55.9 | |
| Cover Level (m) | 13.400 | 13.300 | 13.230 | 13.800 | |
| Invert Level (m) | 11.188 | 11.600 / 11.600 | 11.800 / 11.800 | 12.370 | |
| Length (m) | | 67.106 | 39.599 | 31.863 | |




| PN | S4.005 | S4.004 | S4.003 | S4.002 | S4.001 | S4.000 | |
|---|---|---|---|---|---|---|---|
| Dia (mm) | 225 | 225 | 225 | 225 | 225 | 225 | |
| Slope (1:X) | 17.6 | 33.0 | 160.9 | 33.7 | 145.5 | 100.0 | |
| Cover Level (m) | 12.000 | 12.000 / 11.900 | 12.000 | 12.300 | 12.600 | 12.600 | |
| Invert Level (m) | 9.450 | 9.450 / 10.470 | 10.470 / 10.570 | 10.570 / 10.870 | 10.870 / 11.004 | 11.004 / 11.170 | |
| Length (m) | 2.186 | 33.680 | 16.086 | 10.100 | 19.498 | 16.604 | |

# Appendix 11

**ATTENUATION ESTIMATES, STORAGE TANK SIZING**

# CATCHMENT A

**PROJECT:** **Bessborough SHD Development**

**DESCRIPTION:** **21207-JBB-PH1-XX-CA-C-04401_Attenuation_Assessment_A_(Phase_1)**

**DATE:** 17/02/2022 **SHEET** 100 Year +10%

BARRY & PARTNERS consulting engineers

**Sheet 1**

Catchment Characteristics

| | | | | |
|---|---|---|---|---|
| Site Area | | | 0.480 | ha |
| SAAR | | | 1106 | mm |
| Soil Category | 4 | SOIL = | **0.47** | |
| M5-60 | | | 16.3 | mm |
| M5-2D | | | 76.6 | mm |
| r = M5-60 / M5-2d = | | | 0.21 | |

**Permissible flow (Q100) =** **7.72** l/s

Developent Area = 0.480 ha
Impervious Area = 0.480 ha

| Rainfall duration hrs | Rainfall depth (R100) mm | Including CCF (R100)*1.1 mm | Total volume of runoff m3 | Average flow m3/s | Permsble Flow m3/s | Flow to be stored m3/s | Storage Volume m3 |
|---|---|---|---|---|---|---|---|
| 0.25 | 16.1 | 17.7 | 85.01 | 0.094 | 0.0077 | 0.087 | 78 |
| 0.5 | 21.6 | 23.8 | 114.05 | 0.063 | 0.0077 | 0.056 | 100 |
| 1 | 28.9 | 31.8 | 152.59 | 0.042 | 0.0077 | 0.035 | 125 |
| 2 | 38.7 | 42.6 | 204.34 | 0.028 | 0.0077 | 0.021 | 149 |
| 4 | 51.8 | 57.0 | 273.50 | 0.019 | 0.0077 | 0.011 | 162 |
| 6 | 61.5 | 67.7 | 324.72 | 0.015 | 0.0077 | 0.007 | 158 |
| 12 | 82.3 | 90.5 | 434.54 | 0.010 | 0.0077 | 0.002 | 101 |
| 24 | 110.3 | 121.3 | 582.38 | 0.007 | 0.0077 | -0.001 | -84 |
| 48 | 128.3 | 141.1 | 677.42 | 0.004 | 0.0077 | -0.004 | -656 |
| Required Volume = Maxum of storage volume, V100 = | | | | | | | **162** m3 |

Total attenuation storage required (m3) = **162** m3

# CATCHMENT B

**PROJECT:** **Bessborough SHD Development**

**DESCRIPTION:** **21207-JBB-PH1-XX-CA-C-04403_Attenuation_Assessment_B_(Phase_1)**

**DATE:** 17/02/2022 **SHEET** 100 Year +10%

BARRY & PARTNERS consulting engineers

**Sheet 1**

Catchment Characteristics

| | | | | |
|---|---|---|---|---|
| Site Area | | | 1.050 | ha |
| SAAR | | | 1106 | mm |
| Soil Category | 4 | SOIL = | **0.47** | |
| M5-60 | | | 16.3 | mm |
| M5-2D | | | 76.6 | mm |
| r = M5-60 / M5-2d = | | | 0.21 | |

**Permissible flow (Q100) =** **16.88** l/s

Developent Area = 1.050 ha
Impervious Area = 1.050 ha

| Rainfall duration hrs | Rainfall depth (R100) mm | Including CCF (R100)*1.1 mm | Total volume of runoff m3 | Average flow m3/s | Permsble Flow m3/s | Flow to be stored m3/s | Storage Volume m3 |
|---|---|---|---|---|---|---|---|
| 0.25 | 16.1 | 17.7 | 185.96 | 0.207 | 0.0169 | 0.190 | 171 |
| 0.5 | 21.6 | 23.8 | 249.48 | 0.139 | 0.0169 | 0.122 | 219 |
| 1 | 28.9 | 31.8 | 333.80 | 0.093 | 0.0169 | 0.076 | 273 |
| 2 | 38.7 | 42.6 | 446.99 | 0.062 | 0.0169 | 0.045 | 325 |
| 4 | 51.8 | 57.0 | 598.29 | 0.042 | 0.0169 | 0.025 | 355 |
| 6 | 61.5 | 67.7 | 710.33 | 0.033 | 0.0169 | 0.016 | 346 |
| 12 | 82.3 | 90.5 | 950.57 | 0.022 | 0.0169 | 0.005 | 221 |
| 24 | 110.3 | 121.3 | 1273.97 | 0.015 | 0.0169 | -0.002 | -185 |
| 48 | 128.3 | 141.1 | 1481.87 | 0.009 | 0.0169 | -0.008 | -1435 |
| Required Volume = Maxum of storage volume, V100 = | | | | | | | **355** m3 |

Total attenuation storage required (m3) = **355** m3

# STORMTECH Stormwater Management System Design Tool

ver: Aug15

| | |
|---|---|
| **PROJECT REF:** | Bessborough SHD Development |
| **LOCATION:** | Bessborough, Blackrock, Cork |
| **DATE:** | 17-Feb-22 |
| **CREATED BY:** | DOB |

## SYSTEM PARAMETERS

| | | |
|---|---|---|
| **Required Total Storage** | **355** | $m^3$ |
| **Stormtech chamber model** | **MC3500** | |
| Filtration Permeable Geo or Impermeable Geo | Filter geo | |
| Number of Isolator Rows (IR) | 1 | |

## SITE PARAMETERS

| | | | |
|---|---|---|---|
| Stone Porosity | 43% | | |
| Excavation Batter Angle (degrees) | 60 | ° | *Minimum Requirement* |
| Stone Above Chambers | 0.3 | m | *0.30* |
| Stone Below Chambers | 0.26 | m | *0.23* |
| In-between Row Spacing | 0.23 | m | *0.23* |
| Additional Storage outside Excavation. E.g manholes, Header Pipe | 0 | $m^3$ | |

## HEADER PIPE

| | | |
|---|---|---|
| Is Header pipe required within excavation | No | |
| Orientation of Header Pipe | Parrallel to IR | |
| Diameter of Header Pipe | 0.6 | m |
| Length of Header Pipe | 0 | m |

## CHAMBER SYSTEM DIMENSIONS

| | Calculated | Adopted | |
|---|---|---|---|
| Number of Rows | | 3 | ea |
| Number of units per Row | | 19 | ea |
| System Installed Storage Depth (effective storage depth) | 1.705 | | m |
| Tank overall installed Width at base | 6.93 | 6.93 | m |
| Tank overall installed Length at Base | 43.16 | 43.16 | m |
| **Total Effective System Storage** | **359.7** | **359.7** | $m^3$ |

## STORMTECH SYSTEM DETAIL

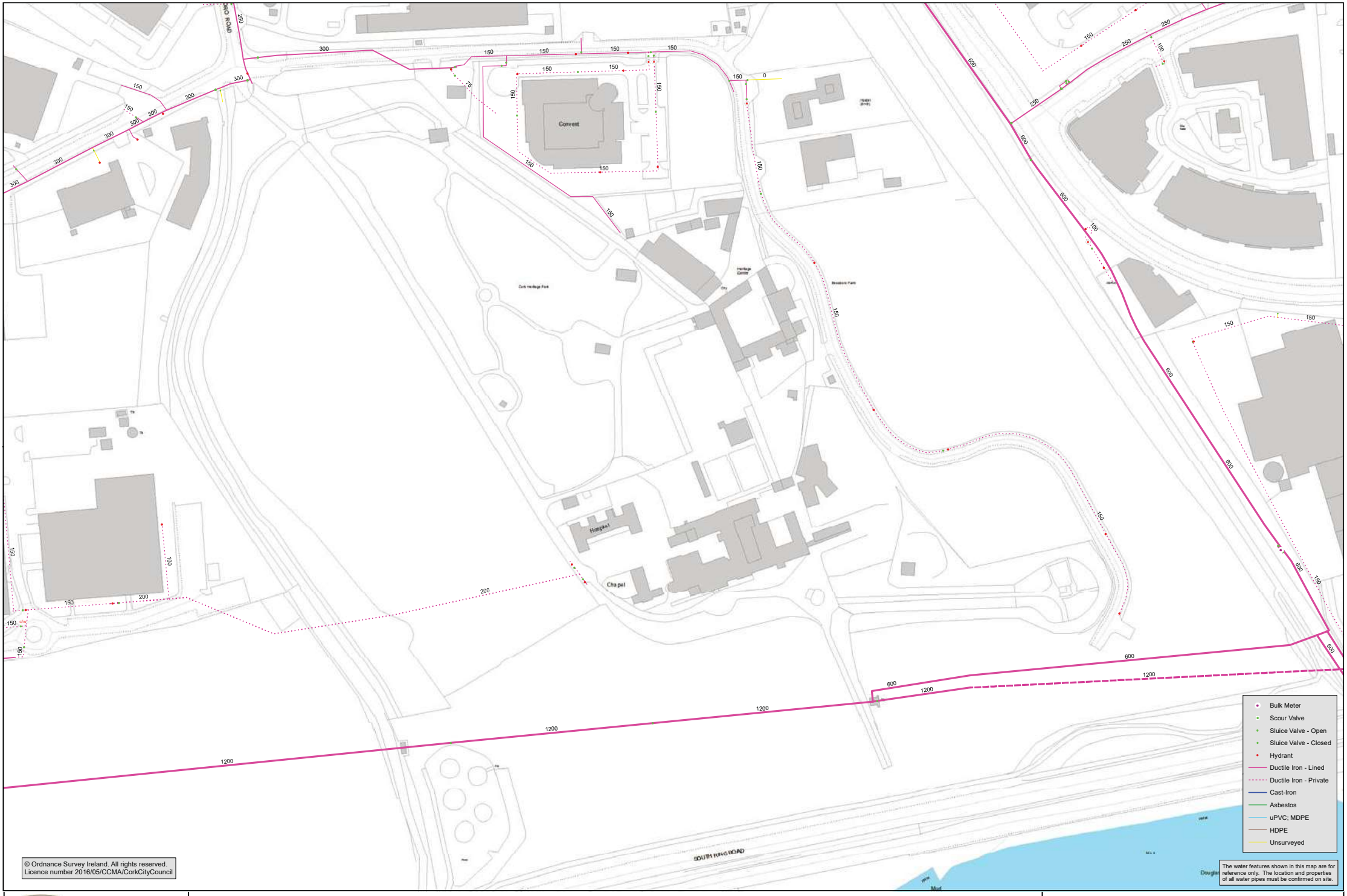
| | | |
|---|---|---|
| StormTech Chamber Model | MC3500 | |
| Unit Width | 1.955 | m |
| Unit Length | 2.18 | m |
| Unit Height | 1.145 | m |
| Min Cover Over System | 0.3 | m |
| Max Cover Over Chamber | 2.4 | m |
| Chamber Internal Storage Vol. | 3.11 | $m^3$ |
| Header Pipe Internal Storage Vol in Excavation | 0.0 | $m^3$ |

## STONE AND EXCAVATION DETAIL

| | | |
|---|---|---|
| Volume of Dig for System | 597 | $m^3$ |
| Width at base | 6.93 | m |
| Width at top | 8.89 | m |
| Length at base | 43.16 | m |
| Length at top | 45.13 | m |
| Depth Of System | 1.71 | m |
| Area of Dig at Base of System | 299 | $m^2$ |
| Area of Dig at Top of System | 401 | $m^2$ |
| Void Ratio | 60% | |
| Stone Requirement - m3 | 415 | $m^3$ |
| Stone Requirement - tonne | 681 | tonne |

# Appendix 12

**CORK CITY COUNCIL - EXISTING WATERMAIN RECORDS**






The water features shown in this map are for reference only. The location and properties of all water pipes must be confirmed on site.

Comhairle Cathrach Chorcai
Cork City Council
Environment Directorate
Water Services (Distribution) Section
Tel: 021-4924228
Fax: 021-4924006
Web: www.corkcity.ie

# Bessboro, Mahon
## Public Watermain Records

Scale: 1:1000 Date: Jul 2018 DrgNo.
Drawn: LG Checked: