AECOM

Proposed Residential Development in Stoney Hill Road, Rathcoole, Co. Dublin.

Infrastructure Report

Project number: 60659192
60659192-ACM-XX-00-RP-CE-0001

August 2022

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Quality information

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	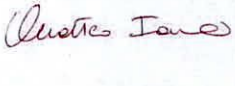	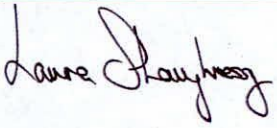	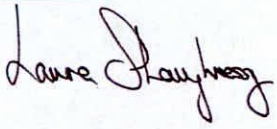
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
0	19/08/2022	Planning Issue	LS	Laura Shaughnessy	Associate Director

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1. Introduction

1.1 Background

AECOM Ireland have been appointed by to undertake the infrastructure design in support of a planning application to South Dublin County Council (SDCC) for a proposed residential development at Stoney Hill Road, Rathcoole, Co. Dublin.

The Phase 1 development propose to construct 42 residential dwellings within a red line boundary which has a total area of 2.9 ha. The site is located to the east of Stoney Hill Road. The development's red line boundary area also includes part of Stoney Hill Road and the roadway to the western side of Rathcoole Park. Refer to Figure 1-1 for location of proposed development.

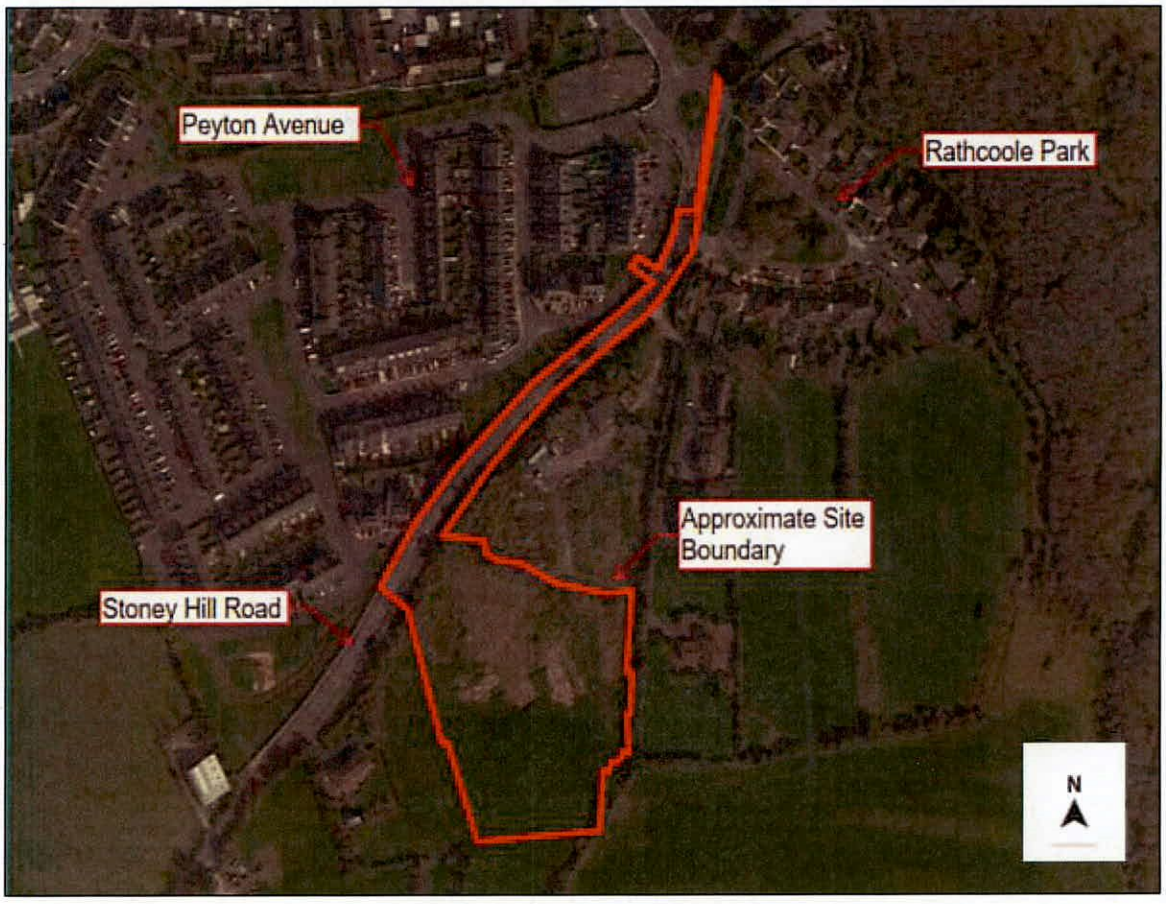


Figure 1-1: Site Location (Source: Google Maps)

1.2 Development Description

Romeville Developments Limited, intend to apply for planning permission at a site of circa 2.9 hectares at Stoney Hill Road, Rathcoole, County Dublin. The site is located to the east of Stoney Hill Road and includes part of Stoney Hill Road.

The proposed development comprises of the demolition of 1 no. residential property and 1 no. ancillary outbuilding and will consist of the construction of a residential development of 42 no. 3 bedroom dwellings in a mix of terraced and semi-detached units. The proposed dwellings will comprise of 2 no. typologies (Typology F and Typology L). Typology F will comprise of 21 no. dwellings and Typology L will comprise of 21 no. dwellings. Typology L are two storey and typology F are two storey, plus second floor loft accommodation with front dormer windows. The total proposed residential development gross floorspace is circa: 5,622 sqm.

The proposed development also includes 84 no. in curtilage surface car parking spaces, circa 3,281 sq.m public open spaces in an eastern park and a western park, (including proposed play equipment), an additional large parkland to the

south of the site of circa 11,797 sq.m comprising the first phase of a linear park, private domestic gardens, a new vehicular, pedestrian and cycle entrance from Stoney Hill Road, an internal road network, including footpaths / cycleways, 3 no. refuse/bin stores, public lighting, landscaping, boundary treatments, drainage and engineering works and all other associated and ancillary development / works.

1.3 Strategic Housing Development (SHD) Pre-Planning Consultations

1.3.1 Planning Authorities

As part of the previous SHD Application previously submitted, AECOM attended the Stage 1 Pre-planning meeting with South Dublin County Council at the SDCC County Hall in Tallaght on 21st May 2019, as documented under Reg. Ref. SHD1SPP014/19. The Water Services and Drainage department was represented by Ronan Toft. Regarding surface water drainage, the use of green infrastructure was required as part of the development strategy. It was also recommended a Flood Risk Assessment to be carried out. A record of the Meeting is included in Appendix A.

Following the Stage 1 Pre-planning meeting, a Flood Risk Assessment for the proposed development has been carried out by JBA Consulting Engineers. The provision of Sustainable Urban Drainage measures was also included in the development strategy.

AECOM also attended the pre-application meeting with the An Bord Pleanala and South Dublin County Council on 27th November 2019, as documented under Reg. Ref. SHD2ABP-305677-19. The An Bord Pleanala Planning Authority's opinion, considerations and concerns on the proposed development were issued on 12th November 2019, including the SDCC internal reports of the Water Services and Drainage department and the Parks and Landscape Services / Public Realm department. The SDCC internal reports are included in Appendix B.

The issues raised by the Water Services and Drainage department of SDCC regarding the drainage proposal are addressed below.

- **Item 1.1:** A detailed breakdown of each surface area type such as roads, paths, building roofs, green roofs, permeable paving and their corresponding run-off coefficients have been included in section 2.2.1 of this report.
- **Item 1.2**: The total site area has been revised throughout this report to avoid any inconsistencies.
- **Item 1.3:** All proposed surface water attenuation systems locations have been revised to provide a minimum 5m distance to any building structures.
- **Item 2.1:** The Flood Risk Assessment has been revised in order to fully correlate to the surface water layout and infrastructure design report in terms of locations and capacities of proposed attenuation systems.

The issues raised by the Parks and Landscape Services / Public Realm department of SDCC in relation to the Infrastructure & Environmental Quality Policy 2 (IE2) and the Green Infrastructure Policy 5 (G5) of the SDCC Development Plan 2016-2022 are addressed in section 2.3 of this report.

The SHD has been granted permission with conditions in November 2020 under ABP-307698-20.

1.3.2 SDCC Engagement post Tripartite Meeting

Following the tripartite meeting, AECOM has engaged with South Dublin County Council to respond to the comments raised by the Planning Authorities' opinion under Reg. Ref. SHD2ABP-305677-19. A technical note was prepared focusing on the SuDS proposals and the constraints on site. Subsequently another Technical Note, responding to each comment together with the surface water drainage proposals, has been issued to Ronan Toft of SDCC for review on 26 March 2020. The records of the consultation with SDCC are included in Appendix C.

The SHD was submitted in July 2020 and received Grant Planning permission in November 2020.

2. Existing Gas, Power & Telecommunication Services

2.1 Existing Gas

The existing gas services mapping, shown in Figure 2-1 below, shows an existing gas pipe within the vicinity of the proposed site within the northern boundary on Stoney Hill Road. Please refer to Appendix D for full mapping.

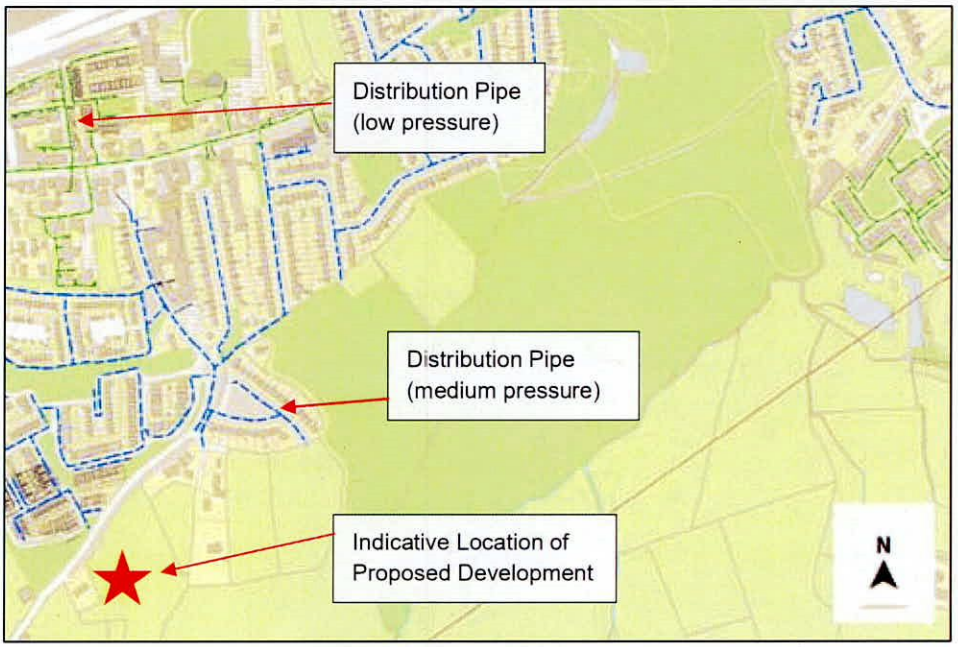


Figure 2-1: Existing Gas Services

2.2 Existing Eircom Services

Figure 2-2 shows that there are existing 100mm and 50mm PP Eircom services available in Rathcoole Park and 100mm PP along the western boundary along Stoney Hill Road. Please refer to Appendix D for full mapping.

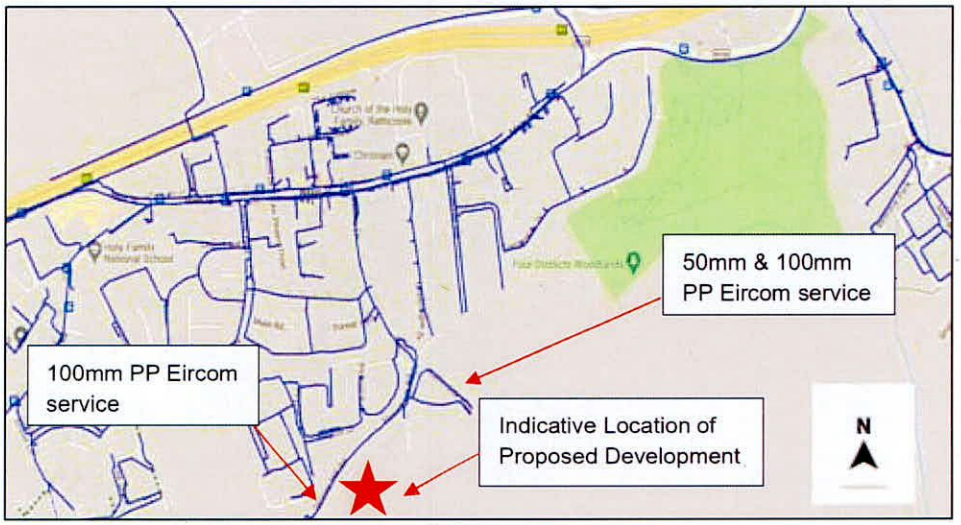


Figure 2-2: Existing Eircom Services

2.3 Existing ESB Services

As shown in Figure 2-3 below, there are existing Medium Voltage (MV) (10KV/20KV) overhead cables within the site boundary (in green), Low Voltage (LV) (400V/230V) overhead cables located north of the proposed site (in

blue) and MV/LV (10KV/ 20KV/400V/230V) underground cables located in Peyton Avenue, west of the proposed site (in red). Please refer to Appendix D for full mapping.

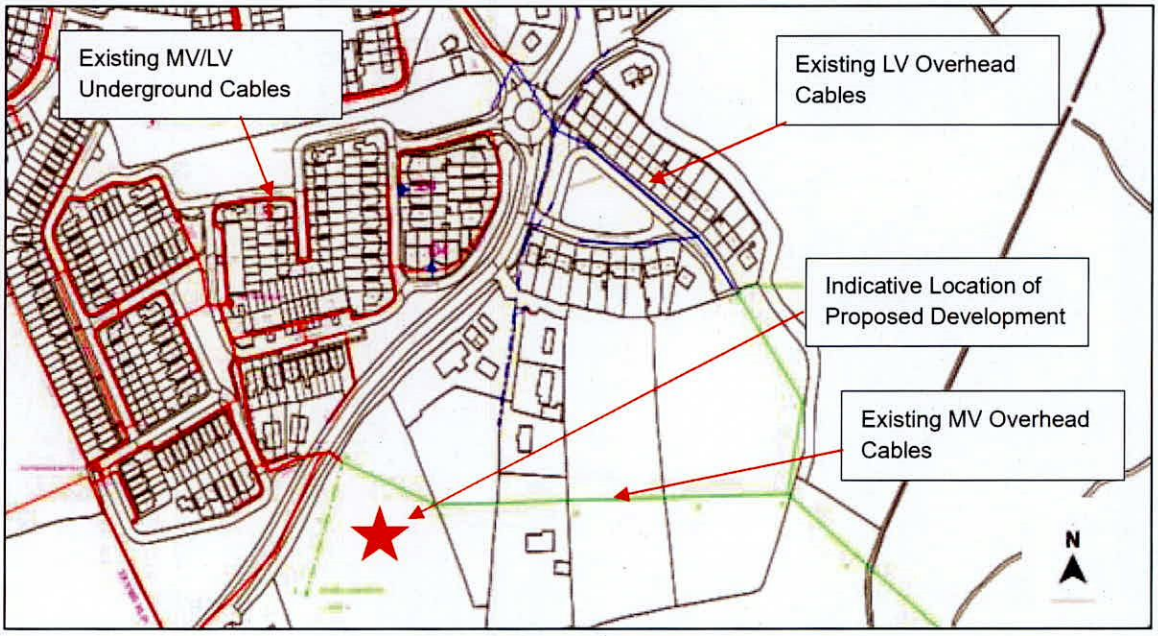


Figure 2-3: Existing ESB services

3. Surface Water Drainage

3.1 Existing Surface Water Drainage

Record drawings provided by SDCC (refer to Appendix D for the full record drawings and Figure 3-1 below for a plan of the existing storm and foul sewers) indicate that there is a number of surface water sewers in the vicinity of the site. There are as follows:

- An existing 300mm diameter concrete surface water sewer running in a northerly direction along Stoney Hill Road discharging into a 375mm diameter concrete surface water sewer.
- An existing 375mm diameter concrete surface water sewer (inverts not confirmed) running in a northerly direction along Stoney Hill Road, discharging into a 525mm concrete surface water sewer.
- An existing 225mm diameter concrete surface water sewer discharging into the 375mm diameter surface water sewer.

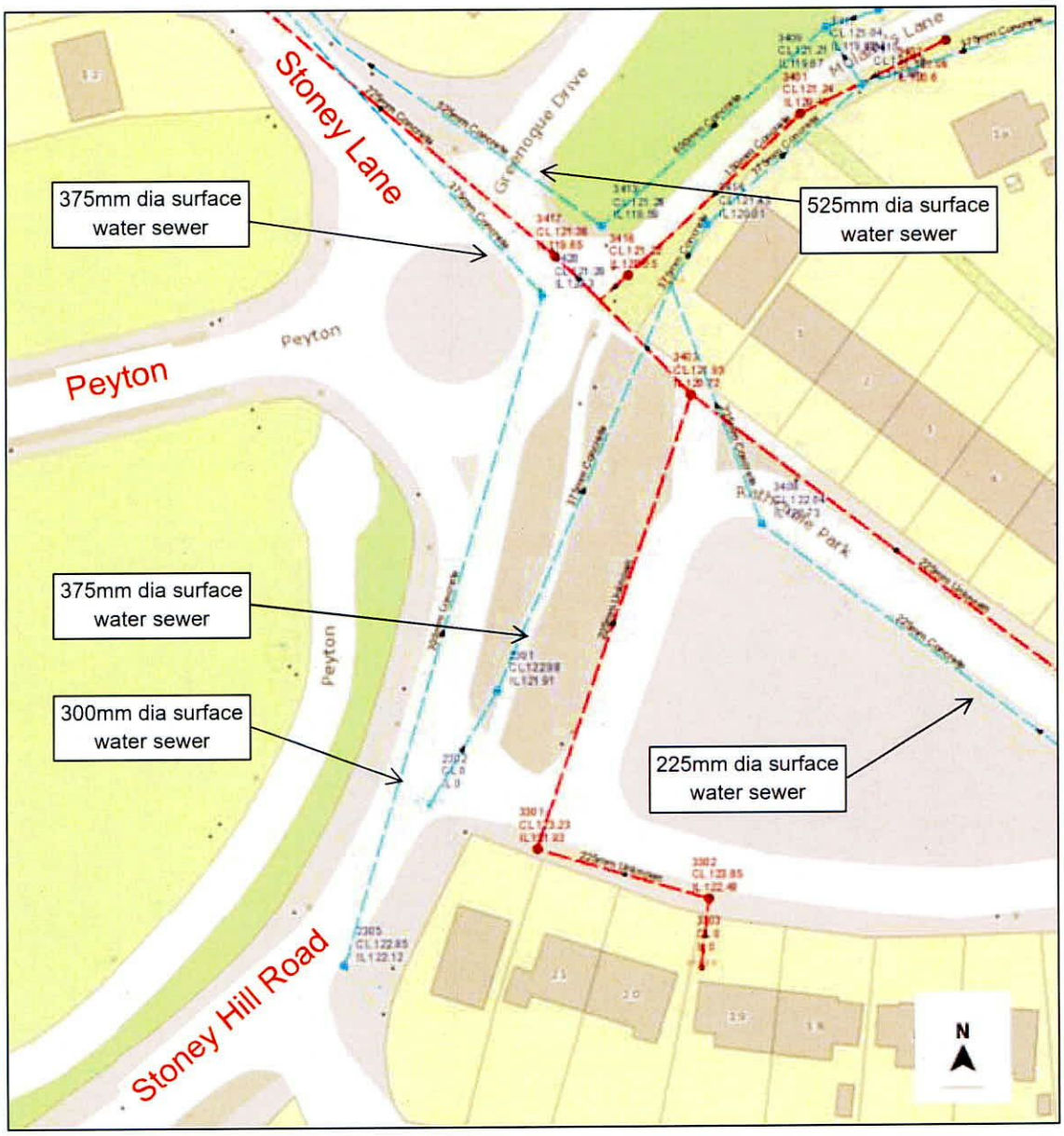


Figure 3-1: SDCC Surface Water Record Drawing

3.2 Proposed Surface Water Drainage

It is proposed to discharge the surface water runoff from the proposed development by gravity via a new 225mm diameter surface water outfall discharging into the existing 300mm diameter surface water sewer (I.D 2305 in Figure 3-1) running in a northerly direction along Stoney Hill Road. The proposed connection point is located approximately 140m north of the Phase 1 development. Refer to Figure 3-2 for the proposed surface water outfall location.

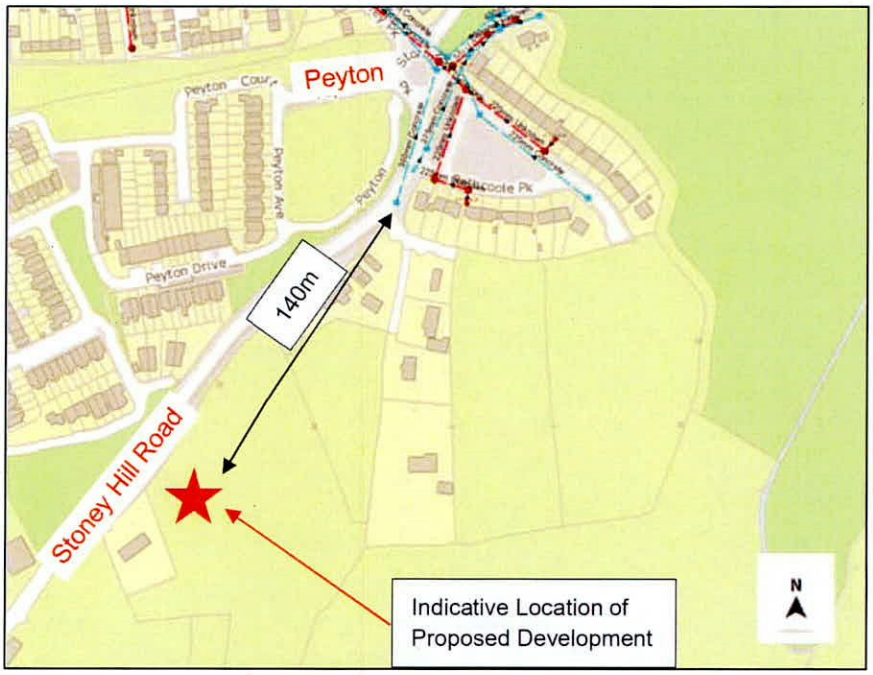


Figure 3-2: Proposed Surface Water Outfall Location

Whilst it is noted that the proposed red boundary line extends up to the Peyton Roundabout, the surface water network will cater for the generated runoff from the development only. The surface water runoff from the portion of the existing Stoney Hill Road included in the red boundary line has not been taken into consideration in the drainage model as it will discharge as per the current scenario.

That portion has not been included in the Qbar calculation as this will not generate any runoff that will be intercepted by our proposed surface water network. Only the contributing area has been included in the Qbar calculations.

The proposed on-site storm water network has been designed using Innovyze Microdrainage software. The following design standards and guidelines have been followed in the design of the proposed surface water drainage network for the site:

- BS EN 752 – Drains and sewer system outside buildings.
- Greater Dublin Strategic Drainage Study (GDSDS) Volume 2 – New Developments.
- Ciria C753 – The SuDS Manual
- BS EN 858-2 – Separator System for Light Liquids (e.g., oil and petrol).
- Pipe network has been designed to ensure no surcharging during a 1 in 5-year return period rainfall event.
- No pipe flooding during a 1 in 100-year return period rainfall event.
- Surface water storage sized based on a 1 in 100-year return period rainfall event.
- An additional 20% has been allowed for climate change in relation to rainfall intensities.
- The following design criteria have been used in the design of the proposed surface water drainage network:
    - Carrier pipe network – 1.0m/s to 3.0m/s.
    - Colebrook White roughness value of 0.6mm for all pipework.

- Time of entry: 4 minutes.
- Return Period: 5 years.
- Met Eireann rainfall data for site.
- M5/60 = 21.30 mm.
- Ratio r = 0.271.

Refer to Appendix E for the Met Eireann rainfall data for the subject site.

The surface water network was simulated with all runoffs coming from roofs and impermeable areas from the site taken as 100% impermeable and limited to the QBar rate via hydro-brake devices. These storage capacities are required to ensure that no flooding occurs on site for the 1 in 100-year event plus 20% climate change allowance.

It is proposed to restrict runoff from the site to the associated Qbar which has been calculated to be 6.0 l/s. The Qbar calculation was carried out using https://www.uksuds.com, and the calculation input parameters are as follows:

- Contributing site area of 2.9 ha.
- Soil Type 2 (SPR value of 0.3); and
- The Standard Annual Average Rainfall (SAAR) of 863mm.

Based on the equation developed by the Institute of Hydrology (Report 124 "Flood Estimation for small catchments, 1994):

$$\mathbf{Qbar_{rural} = 0.00108AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}}$$

Where:

- $Qbar_{rural}$ is the mean annual flood flow from a rural catchment in m^3/s.
- AREA is the area of the catchment in km^2.
- SAAR is the Standard Average Annual Rainfall for the period from 1941 to 1970 (mm).
- SOIL is the soil index.

Refer to Appendix F for Qbar calculations report.

Refer to AECOM Drawing No. 60659192-ACM-01-00-DR-CE-10-0501 for the proposed drainage layout.

3.3 Infiltration Tests

Infiltration Tests were carried out on site to estimate the permeability of the soil in May 2022.

Six different Tests were carried out across the site, refer to Table 1 for a summary of the infiltration rates:

Table 1: Summary of Infiltration Tests on site

Tests ID	Infiltration Rate (m/s)	Soil Classification*
IT01	3.63583e-06	Partial Infiltration
IT02	0	No Infiltration
IT03	1.3349e-06	Partial Infiltration
IT04	1.51576e-06	Partial Infiltration
IT05	2.45789e-06	Partial Infiltration
IT06	2.02608e-06	Partial Infiltration

*Please note that Soil Classification is based on Figure 20.17 of Ciria C753 The SuDS Manual.

As noted in the table above, the tests have highlighted that the vast majority of the site is suitable for systems with partial infiltration.

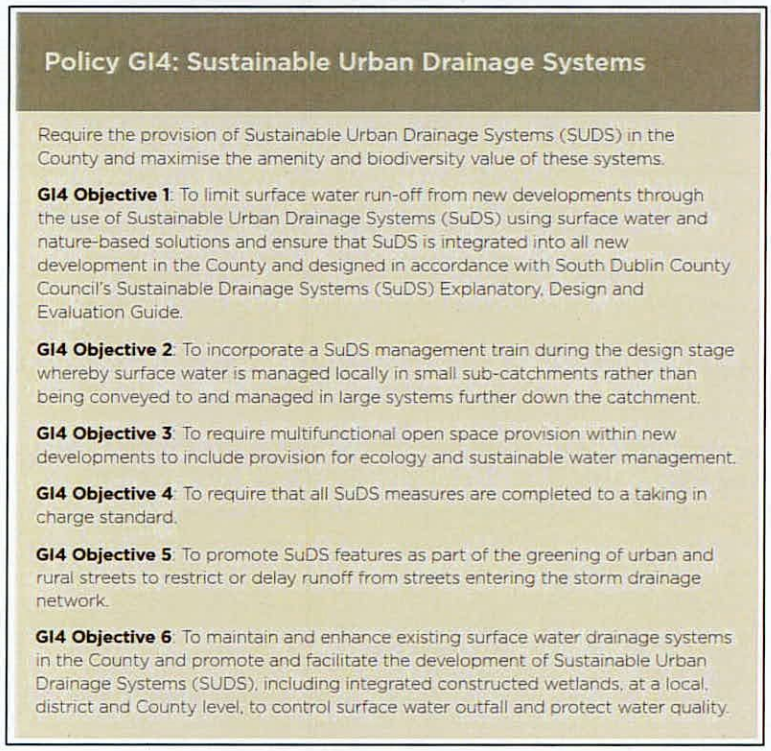
Please refer to Appendix G for the full Site Investigation Report for the site.

3.4 Proposed SuDS (Sustainable urban Drainage Systems)

The proposed development has been assessed in relation to Sustainable Urban Drainage Systems (SuDS) in accordance with the guidelines of the GDSDS, SuDS CIRIA Manual C753 and the SDCC Sustainable Drainage Explanatory Design & Evaluation Guide 2022.

The aim of proposing sustainable drainage systems is to replicate the natural characteristics of the greenfield runoff minimising the environmental impact. SuDS are designed to manage water quantity reducing/preventing the likelihood of flooding from the proposed development and to maximise the opportunities and benefits from surface water management.

As per the *Policy GI4: Sustainable Urban Drainage Systems* (refer Figure 3-3 below), the importance of implementing SuDS systems on site are as follow:



Policy GI4: Sustainable Urban Drainage Systems

Require the provision of Sustainable Urban Drainage Systems (SUDS) in the County and maximise the amenity and biodiversity value of these systems.

GI4 Objective 1: To limit surface water run-off from new developments through the use of Sustainable Urban Drainage Systems (SuDS) using surface water and nature-based solutions and ensure that SuDS is integrated into all new development in the County and designed in accordance with South Dublin County Council's Sustainable Drainage Systems (SuDS) Explanatory, Design and Evaluation Guide.

GI4 Objective 2: To incorporate a SuDS management train during the design stage whereby surface water is managed locally in small sub-catchments rather than being conveyed to and managed in large systems further down the catchment.

GI4 Objective 3: To require multifunctional open space provision within new developments to include provision for ecology and sustainable water management.

GI4 Objective 4: To require that all SuDS measures are completed to a taking in charge standard.

GI4 Objective 5: To promote SuDS features as part of the greening of urban and rural streets to restrict or delay runoff from streets entering the storm drainage network.

GI4 Objective 6: To maintain and enhance existing surface water drainage systems in the County and promote and facilitate the development of Sustainable Urban Drainage Systems (SUDS), including integrated constructed wetlands, at a local, district and County level, to control surface water outfall and protect water quality.

Figure 3-3: Extract of Policy GI4 from the SDCC Sustainable Drainage Explanatory Design & Evaluation Guide 2022

The objectives indicate how SuDS features are important and therefore, AECOM have reviewed the potential systems that could have been proposed on site such as: integrated constructed wetlands, filter strips, swales and basins.

All these features have been considered for inclusion in the proposed development but have been found **incompatible** with the topography of the site and the nature of the proposed development. Integrated constructed wetlands, swales and basins are designed to slow the flow of the water, store and treat the runoff while draining through the site, encouraging biodiversity. Positioning these types of SuDS within the site layout is difficult to achieve for the following reasons:

- The ground falls from south to north at an average gradient of approximately 1:20 (gradients vary from 1:15 to 1:25). The majority of the SuDS systems require a longitudinal slope of less than 1:100 or a maximum velocity at full flow conditions of 2m/s;

- Excluding the footprint of the houses, the majority of the remaining site area is hardstanding (i.e covered by roads and footpaths) with the required percentage of public/communal open space. There is no room for verges along the proposed roads where swales could be proposed.
- For the wetlands/detention & basins to function they need to be relatively flat and sufficiently deep to accept runoff by gravity from the contributing impermeable areas. This would be particularly difficult to achieve considering that the inlets of the attenuation tank are very deep (i.e. the proposed invert level of the incoming pipe to the attenuation tank is 127.404m, with a cover level of 134.290m – circa 6.886m of manhole depth). If provided, the basins would be extremely deep and unsafe for children at play and the general health and safety of the public, and it would therefore be required to be fenced off, which would negate the use of the open space.

Based on these findings and the proposed Architectural layout, alternative SuDS measures have been provided to treat the surface water runoff, to replicate the natural characteristics of the greenfield runoff and minimise the environmental impact. The proposed SuDS are listed below:

- Permeable Paving;
- Porous Asphalt;
- Grasscrete;
- Rainwater Butts;
- Tree Pits;
- Filter Drains;
- Pond, and
- Petrol Interceptor.

3.4.1 Permeable Paving, Porous Asphalt & Grasscrete

Permeable paving is proposed at each private driveway location. Porous surfacing (paving block or open graded material) which can treat rainwater, at source, and allow infiltration through to an underlying porous subbase where water can be stored within the voids of the subbase before being slowly released to the drainage collection system through natural flow via the porous medium.

These systems will allow some form of storage for small rainfall events and can result in water evaporation and adsorption in small quantities, therefore there will be less run-off from these areas in small rainfall events thus mimicking the natural response for this catchment. As well as reducing the amount of run-off from the surface, permeable paving will slow down the rate of runoff from the pavement in extreme rainfall events contributing to attenuation of flows.

In addition, permeable paving will increase the quality of water which is intercepted by the system through filtration, biodegradation, pollutant adsorption and settlement and retention of solids, also the reduction in peak flows to the outfall will enhance settlement and biodegradation of pollutants.

It is also proposed to provide porous asphalt within the homezone area located to the south of the site. This porous asphalt will perform in the same manner as the permeable paving above with the allowance of infiltration through the material to an underlying subbase. The only difference between the two is the porous asphalt will contain a different build-up to the paving allowing for it to take more substantial loading under heavy goods vehicles such as refuse trucks.

It is proposed to provide grasscrete surfacing at the turning head of the roadway to the north-west corner of the site. As this will be reinforced grass surfacing it is suitable for the loading that will be placed on the surface from any heavy goods vehicles. This surface will also provide infiltration at source and helps to reduce the amount of impermeable area on site.

Refer to Figure 3-4 for typical permeable systems and drawing 60659192-ACM-01-00-DR-CE-10-520 & 521 for the proposed SuDS layout & details respectively.

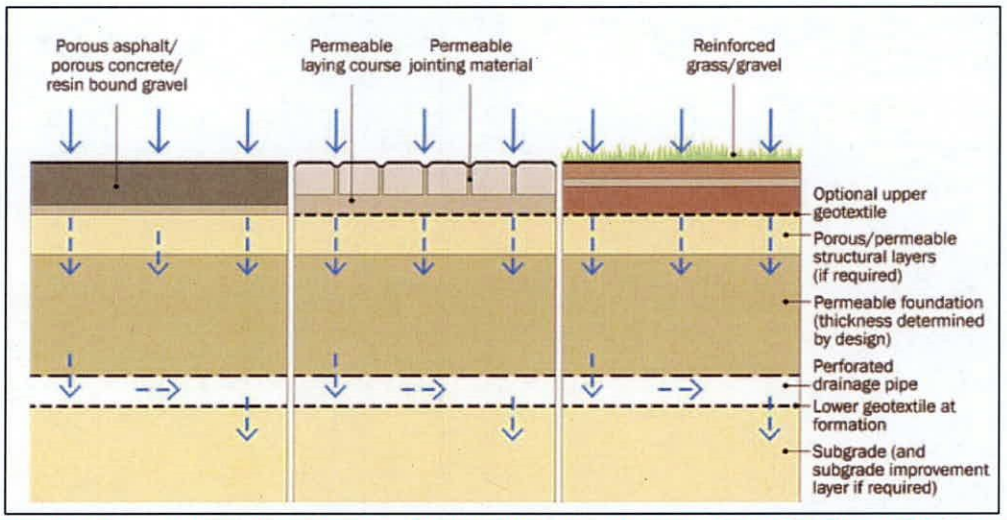


Figure 3-4: Permeable Paving System – Partial Infiltration (Source: Ciria C753 The SuDS Manual)

3.4.2 Rainwater Butts

The introduction of rainwater butts within the development will provide peak flow reduction and also a reduction in pollutants by capturing suspended solids, nutrients and heavy metals. It is envisaged that surface water captured within the rainwater butt will be used for tasks such as garden and plant watering. The use of this water will also reduce the demand on mains water supply.

A rainwater butt with 225 litre capacity is provided at the rear garden of each dwelling. The rainwater butt should be tapped to roof drain downpipe in order to store rainwater for domestic garden use. Refer to Figure 3-5 below for a typical Rainwater Butt.

Figure 3-5: Typical 225 Litre Rainwater Butt

3.4.3 Tree Pits

Trees help protecting and enhancing the urban environment in several ways, such as pollutant filter from the air, effective surface water management and landscaping. The surface water management they provide is listed below:

- Transpiration;
- Interception;
- Increase infiltration; and

- Phytoremediation (the process of drawing water from the soil, including chemicals, pollutants, metals. Trees are able to transform pollutants into less harmful substances, converting into nutrients).

As trees provide surface water management, tree pits and planters can be designed to collect and attenuate runoff, providing additional storage within the underlying structure. In addition, the soil around the trees can also be used as a filter for pollutant from surface water runoff. Refer to Figure 3-6 below for a typical tree pit detail.

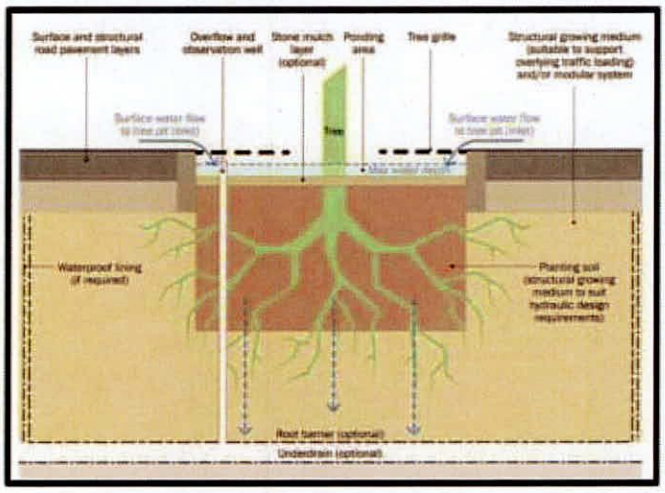


Figure 3-6: Detail of Tree Pits (Extract from Ciria C753 SuDS Manual)

3.4.4 Filter Drains

Filter drains are shallow trenches filled with stone/gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. The stone may be contained in a simple trench lined with a geotextile, geomembrane or other impermeable liner, or within a more structural facility such as a concrete trough. Filter drains can help to reduce pollutant levels in runoff by filtering out fine sediments, metals, hydrocarbons and other pollutants.

It is currently proposed to provide filter drains along the road edge of the homezone area to the south of the site. These filter drains are designed to capture the flows from the overland catchment.

Surface water will flow from the hill, located to the south and sloping towards the development. Please see Figure 3-7 showing the full extent of the catchment area that has been considered.

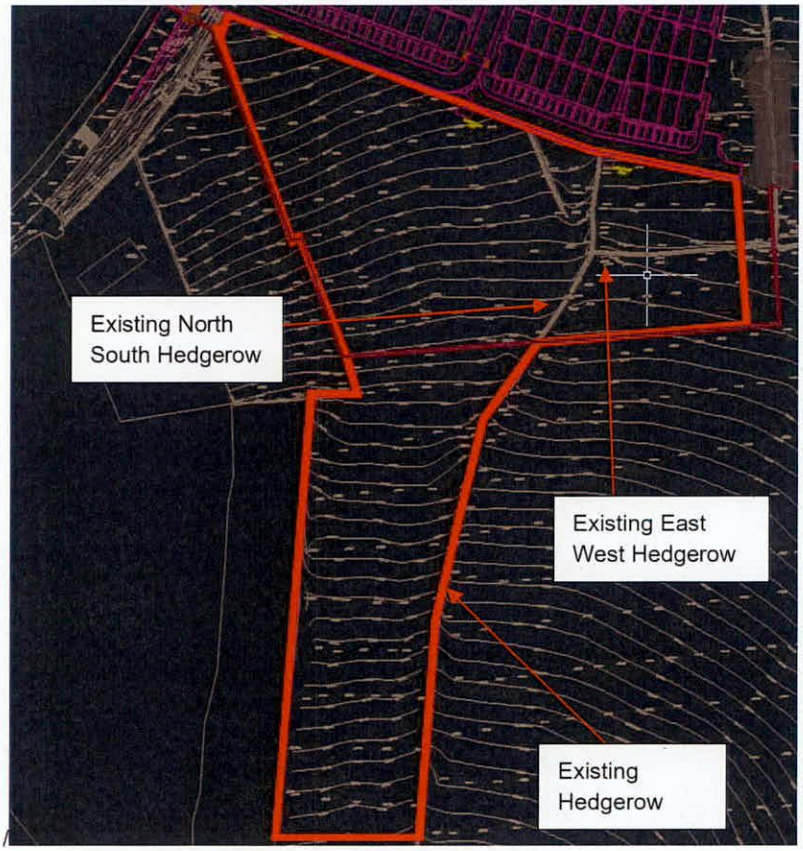


Figure 3-7: Extent of Overland Catchment Area

The extent of the catchment area has been estimated based on the existing topography on site. As shown in the figure above, the ground is falling with a north/north-east direction. It is also noted that there are existing hedgerows (running from south to north and from east to west). The catchment area that has been considered for the overland catchment analysis is shown within the red line.

The area to the east of the identified red line, is noted to be sloping mainly with a north-east direction and it is bound by the existing hedgerows. The surface water runoff in this area flows north easterly towards the east west hedgerow where it then drains east away from the contributing upstream catchment, and is therefore excluded from the upstream catchment area.

Filter drains are generally 1-2m deep, with a minimum depth of filter beneath any inflow distribution pipework and outfall connection system of 0.5m to ensure reasonable levels of pollutant removal. A typical filter drain detail is provided in Figure 3.8.

It should be noted that 2no. of these drains are provided with a gully grated manhole on the heads of their runs. This is to ensure that the minimum 750mm filter drain depth is provided at the downstream end of the run with a 1:100 gradient along the filter drain before it connects to the main site drainage network. Catchpit manholes will be provided at the outfall of each filter drain to prevent a build-up of sediment in the main network.

The design of these filter drains has been included within the Surface Water Drainage Calculations and can be found in Appendix H.

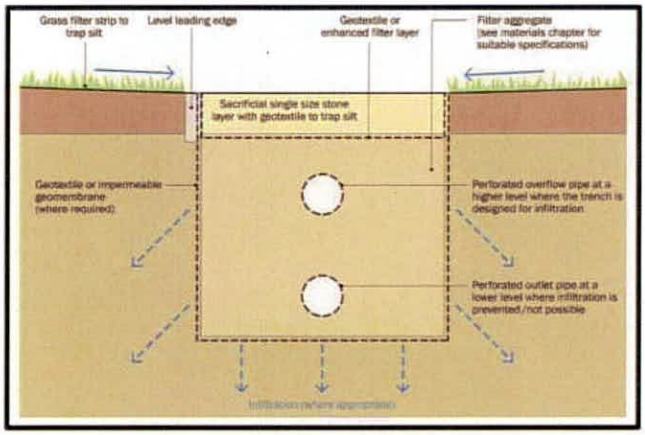


Figure 3-8: Details of Filter Drain (Extract from Ciria C753 SuDS Manual)

3.4.5 Pond

As can be seen in Figure 3.9 below, the overland flow catchment will follow the existing gradient lines with the green arrows indicating the area draining towards the filter drains and the red arrows indicating the catchment that will drain towards the proposed pond. It is noted that the estimated catchment area is circa 2ha and extends beyond the red boundary line.

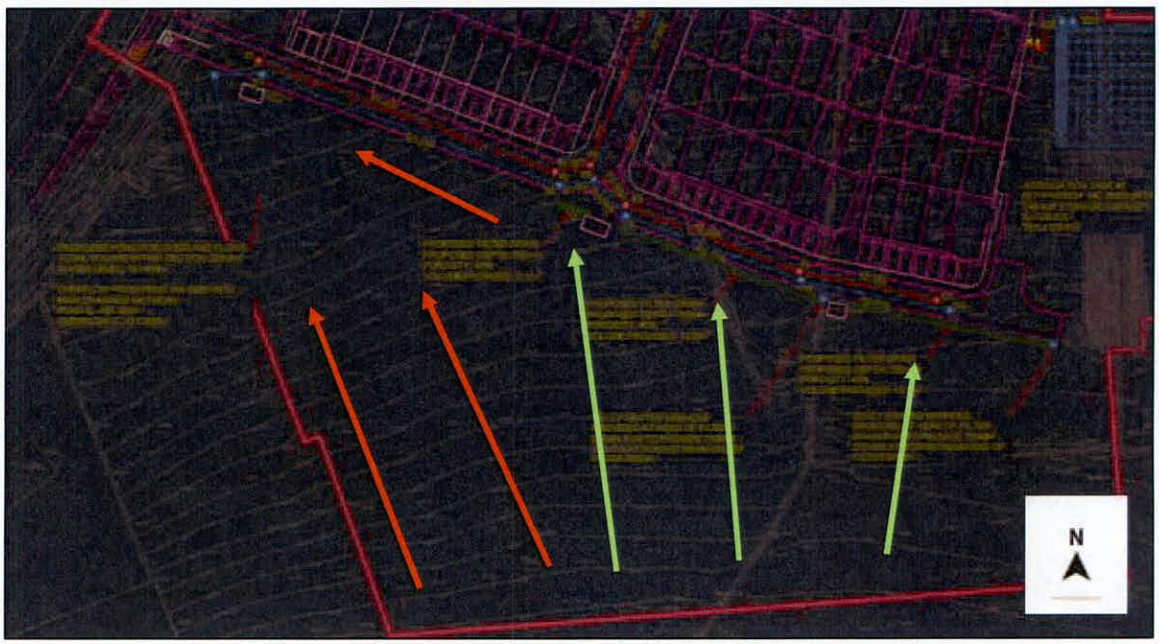


Figure 3-9: Snip of AECOM Dwg. 0501

The stormwater flows that do not infiltrate and pond in this area will follow the gradients and ultimately discharge towards the proposed pond. This pond will attenuate the overland flows from this catchment with the flows controlled via a overflow weir that ultimately discharges into the site drainage network, limiting the flow to the estimate Qbar for the overland catchment area (4.57l/s).

Details of the proposed pond and how it is integrated within the existing topography will be further developed at detailed design stage. Please refer to AECOM Drawing 60659192-ACM-01-00-DR-CE-10-0520 for further details on the filter drains and proposed pond area.

3.4.6 Petrol Interceptor

Petrol Interceptors are widely used to avoid and prevent hazardous chemical and petroleum products from entering watercourses or public sewers. They should be installed close to the potential pollution source to minimise emulsification of oils and their coating of sediments. There are 2no classes of systems"

- Class 1 device means that the resultant effluent should contain 5mg/l of hydrocarbon content or less under standard test conditions;
- Class 2 can contain up to 100mg/l in their discharge and are appropriate where drainage is to a foul sewer.

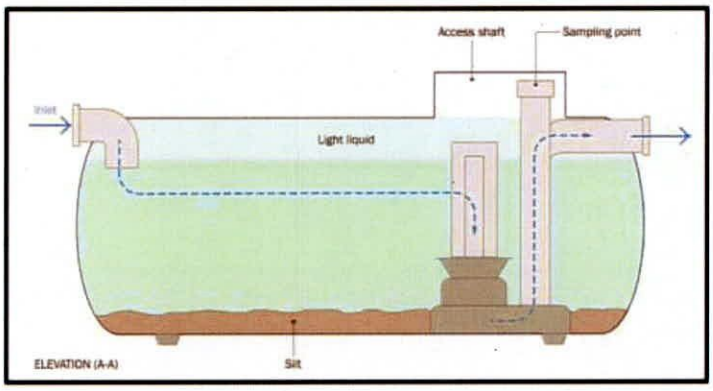


Figure 3-10 : Typical Petrol Interceptor detail (Extract from Ciria C753 SuDS Manual)

The proposed Petrol Interceptor is Class 1 NSBP006 or similar approved.

3.5 Attenuation Storage Proposal

South Dublin City Council is moving towards a tankless approach, which means that the generated surface water runoff should be treated and stored within the proposed SuDS systems. However, geocellular storage systems (Stormtech) are not considered SuDS measures.

As mentioned in Section 3.4, AECOM have considered the provision of wetlands, swales or basins but due to the topography of the site and the depth of the proposed network, it has been considered that these options are not suitable for the subject site.

As a result, an attenuation tank Stormtech has been proposed in order to provide the required storage volume.

It is also noted that the proposed tank is located where Infiltration Test IT06 was carried out (2.02608e-06 infiltration rate). IT06 shows that the soil has a good permeability to allow water infiltrating to the ground and the established infiltration rate has been used in the drainage model and design.

It should be noted that as part of calculating the infiltration capacity of the proposed attenuation tank within the model the tank base area contributing to infiltration was reduced to 50%. The base area was reduced to account for any construction inefficiencies that may impact the resulting infiltration rate from the attenuation tank.

Please refer to Appendix H for the Surface Water drainage calculations and Appendix I for the Attenuation Tank Details.

3.6 Water Quality Protection – Interception & Treatment

A review has been undertaken in accordance with the GDSDS and the SDCC SuDS Guidelines, to verify the required 5mm interception storage is being provided as per Sub-Criterion 1.1 from Table 6.2 GDSDS Volume 2 New Development. The provided interception volumes for the site is provided below in Table 2.

Where possible SuDS and interception storage will be provided at source through the permeable paving and the porous asphalt. The positioning of the attenuation tank and via the isolator row within the tank and the quantity of interception storage provided in the tank sub-base will ensure that the interception storage presented below will capture runoff from all of the impermeable areas within the site prior to entering the proposed petrol interceptor and discharging off site.

Table 2: Proposed Interception Volume

Feature	Area (m2)	Interception Storage Required (m3) *	Interception Storage provided (m3)
Roof Area	3066	12.3	-
Road Area (including footways)	2565	10.3	-
Permeable Paving **	1008	4.0	8.0
Filter Drain	87	0.3	29.4
Porous Asphalt ***	800	3.2	66.0
Grasscrete ****	52	0.2	4.7
Attenuation Tank *****	620	-	99.2
Interception Provision		**30.3**	**229.5**

** Based on the first 5mm of rainfall over 80% of the total impermeable area, as per GDSDS Volume 2, New Development, Appendix E, Section E1.1.5.*

*** Based on 350mm depth of porous sub-base below the pavement with a porosity of 30%.*

**** Based on 275mm depth of porous sub-base below the surface and binder course with a porosity of 30%.*

***** Based on 300mm depth of porous sub-base with a porosity of 30%*

****** Based on 400mm depth of porous sub-base below the tank outlet which will capture and infiltrate runoff. Sub-base porosity of 40%.*

Please note that permeable paving interception storage volume provided has been further reduced to take into account the steepness of the road (1:25 and 1:18).

As set out in the GDSDS Table 6.3 Criterion 1 with the successful provision of 5mm of interception storage, treatment storage is not required.

3.7 Drainage Maintenance Inspection Checklist

Please refer to Appendix J for a typical SuDS Maintenance Inspection Checklist which includes the typical operation and maintenance requirements for the proposed SuDS measures discussed above, this is sourced from the CIRIA SuDS Manual C753.

4. Foul Water Drainage

4.1 Existing Foul Water Drainage

Record drawings provided by SDCC (refer to Figure 4-1 and Appendix D) indicate that there is an existing 225mm diameter surface water sewer running in a northerly direction along Stoney Hill Road, within the northern boundary of the proposed site. This foul asset then drains in a north westerly direction through the Stoney Hill Road roundabout and along Stoney Hill and ultimately discharges to the Tay Lane Pumping Station.

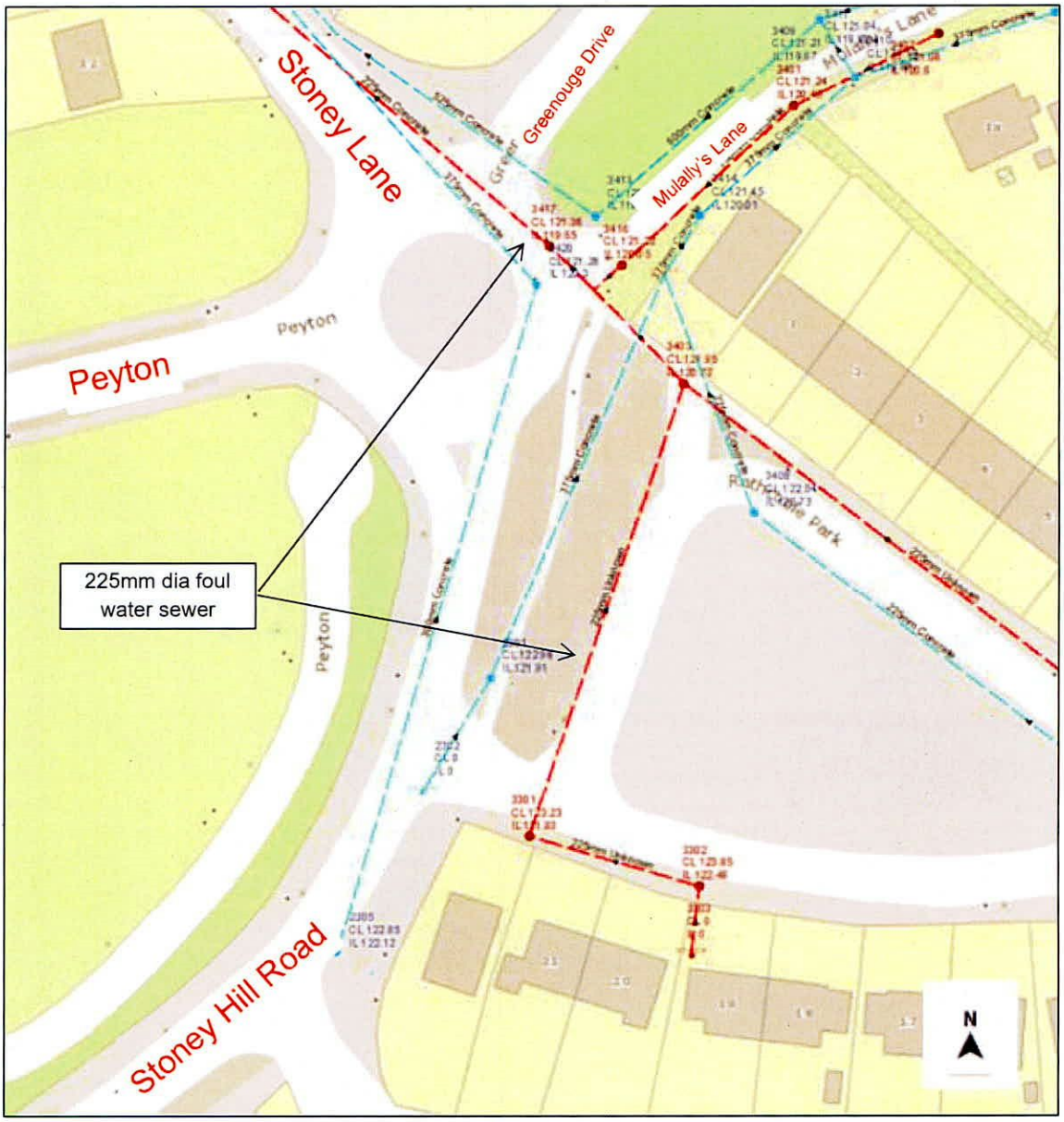


Figure 4-1: SDCC Foul Water Record Drawing

4.2 Proposed Foul Water Drainage

It is proposed to discharge the foul water runoff from the proposed development by gravity via a new 225mm diameter foul water outfall discharging into the existing 225mm diameter foul water sewer (I.D 3417 in Figure 4-1) located in the Stoney Hill Road roundabout running in a north westerly direction along Stoney Lane. The proposed outfall location / connection is located approximately 230m north of the Phase 1 development. Refer to Figure 4-2 for the proposed foul water outfall location.

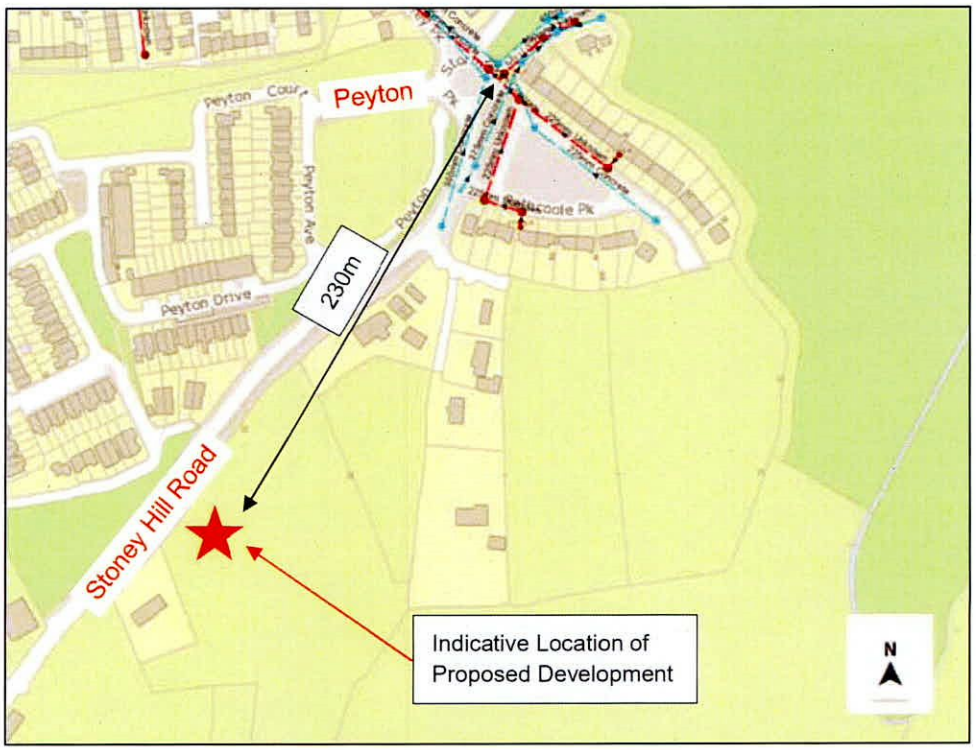


Figure 4-2:Proposed Foul Water Outfall Location

Please refer to the AECOM Drawing 60659192-ACM-01-00-DR-CE-10-0501 for more information on the foul water network layout.

Foul water drainage has been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS) using Innovyze MicroDrainage software (refer to Appendix K for detailed design calculations). The dry weather flow (DWF) was calculated as 0.218 l/s with a peak flow of 1.308 l/s (6DWF) as outlined Table 3 below.

The following design standards and guidelines have been used in the design of the wastewater drainage network for the site:

- Irish Water Code of Practice for Wastewater Infrastructure,
- BS EN 752 – Drains and sewer systems outside buildings,
- Sewers for Adoption, 6th Edition,
- Part H Building Regulations;

Please refer to Appendix L for the confirmation of feasibility (CDS22001396) received from Irish Water on the 9th of March 2022 for the proposed development works.

4.3 Proposed Foul Loading

The estimated wastewater discharge associated with the proposed development has been based on Irish Water's Code of Practice for Wastewater Infrastructure. The design foul loading is outlined in Table 3 below.

Table 3: Estimated Foul Water Loading

Use	No. of Units	Population Equivalent *	Flow (l/d) **	Peaking Factor ***	Dry Weather Flow (DWF) (l/s)	Peak Flow (l/s)
Residential	42	114	18,810	6.0	0.218	1.308

* Based on a national average of 2.7 persons/house (Irish Water Code of Practice)

** Based on foul loading 150 l/p/d, allowing 10% infiltration, as per Irish Water requirements

*** Based on peak factor of 6 as per Irish Water requirements (population between 0 - 750)

5. Water Supply

5.1 Existing Water Supply

Record drawings provided by SDCC (refer to Figure 5-1 and Appendix D) indicate the site of the proposed development is bounded by an existing 300mm diameter PVC-A watermain dated 2009 running along Stoney Hill Road.

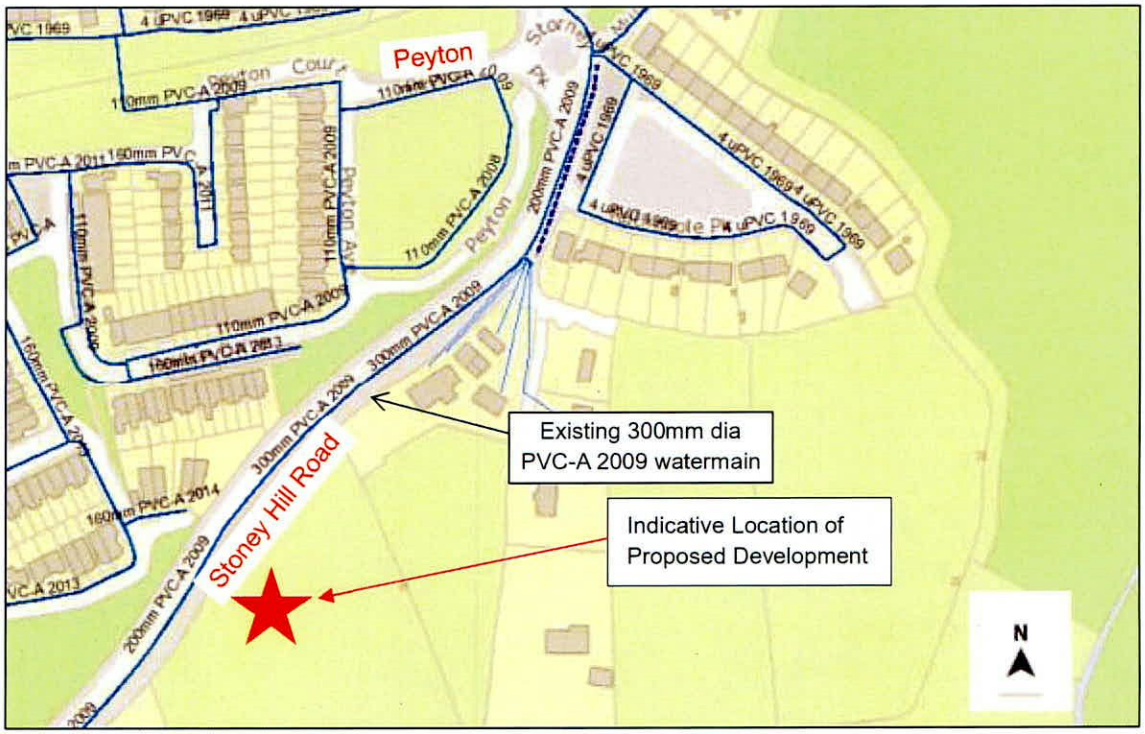


Figure 5-1: SDCC Watermain Record Drawing

5.2 Proposed Water Supply

It is proposed to service the proposed development via a new 150mm diameter watermain connection off the 300mm diameter PVC-A watermain running along Stoney Hill Road to the west of the site. Refer to AECOM Drawing No. 60659192-ACM-01-00-DR-CE-10-2701.

The internal water supply network is based on the Department of the Environment 'Recommendation for Site Development Works', the requirements of Irish Water and the Technical Guidance Document – Part B of the Building Regulations 2006:

- The development shall have a bulk water meter (exact location to be agreed with Irish Water) in accordance with Irish Water Code of Practice for Water Infrastructure Section 3.15.4.
- Hydrants are positioned within 46m from all the proposed buildings
- Sluice valves are positioned to isolate the watermain
- An air valve is proposed at the high point within the internal water supply network
- A scour valve is proposed the low point within the internal water supply network

It is shown on Table 4 below that for the proposed development an average water demand of 0.272 l/s is required and a peak demand of 1.360 l/s.

Please refer to Appendix L for the confirmation of feasibility (CDS22001396) received from Irish Water on the 9th of March 2022 for the proposed development works.

5.3 Proposed Water Demand

The estimated water demand associated with the proposed development was based on Irish Water's Code of Practice for Water Infrastructure. The design demand is outlined in Table 4 below.

Table 4: Estimated Water Supply Loading

Use	No. Units	Population Equivalent *	Flow (l/d) **	Average Water Demand (l/s)	Peak Water Demand (l/s) ***
Residential	42	114	18,810	0.272	1.360

* Based on a national average of 2.7 persons/house (Irish Water Code of Practice)

** Based on per-capita consumption of 150 l/p/d, as per Irish Water requirements

**** Peak Demand is 5 times the average peek demand (1.25 x Average demand), for sizing of the pipe network, as per Irish Water requirements

Appendix A – Stage 1 Pre-Planning Meeting Record

SOUTH DUBLIN COUNTY COUNCIL
PLANNING DEPARTMENT

PRE-APPLICATION CONSULTATION

Pre-Planning Ref. No. SHD1SPP014/19

Date: 21/05/19

Proposal: 'Proposed residential development of circa 172 no. residential units, in a mix of apartments and dwellings, a creche and all associated and ancillary development.'

SDCC attendance: Fiona Redmond, Fergus Browne, Eoin Burke, Rosaleen Dwyer, Suzanne Furlong, Willie Purcell, Robert Roche, Ronan Toft.

Attendance: Colin Stanley, Gareth Stanley, Robert Keran, Paul Urwin, Linda Doyle, Matteo Iannucci, Michael Dunne, Shaun Grima.

Please note that advice or opinions offered at consultations is given in good faith and cannot prejudice the determination of a subsequent planning application in accordance with Section 247 of the Planning and Development Act, 2000 and in accordance with the provisions of the recently adopted Strategic Housing Legislation.

General Guidance
The Planning Authority will use the provisions of the ***South Dublin County Council Development Plan 2016-2022*** when assessing the application.

The application should also adhere to and include details in terms of:

- Adherence to National Standards & specifically the ***Urban Design Manual: A Best Practice Guide*** 2009, ***Sustainable Residential Development in Urban Areas, 2009*** (or any superseding document), ***Design Manual for Urban Roads and Streets*** (2013) and the 2018 Apartment Guidelines.
- Adherence with 2016-2022 CDP in terms of certain information required to facilitate the comprehensive assessment of any subsequent planning applications such as:
    - Comprehensive Urban Design Statement
    - Framework Plan
    - Housing Quality Assessment
    - Climate Change & Adaptation Statement
    - SUDS
    - Public Realm
    - Car parking standards
    - Bike parking standards
    - Part V agreement
    - Clear delineation of areas to be Taken-in-Charge
    - Landscape Masterplan
    - Hedgerow Plan
    - Bat survey
    - Information relating to Appropriate Assessment

General Comment:

A SHD pre-planning meeting was held, SHD1SPP008/18, in the offices of South Dublin County Council on 7th June 2018 in relation to a similar development on the said lands. Two applications were subsequently lodged to South Dublin County Council for the said development comprised of two phases, SD18A/0364 and SD18A/0413. Following requests for additional information, the two applications were subsequently withdrawn.

The current pre-planning proposal on the subject lands is a similar development to that subject to previous pre-planning guidance and planning assessments.

Planning Comments:

- Applicant advised to liaise with Forward Planning in relation to the preparation of an Area Plan.
- The applicant was advised to take into consideration all the issues raised in the two planning applications as part of any future proposals for the lands, particularly as the principle of the current development is similar in layout.
- The Planning Authority expressed strong concerns relating to the proposal for an access road to the south of the south, adjacent to the RU lands, and at the highest point of the site.
- A transition between the RU and future residential lands would be required.
- The applicant was advised to fully address the site-specific constraints on the site, address how the site would link to further lands to the east, and devise a movement framework/hierarchy that complies with best practice urban design and DMURS.
- Street hierarchy and movement framework should take account of the development of lands to the east.
- Applicant was advised that the retention of hedgerows throughout the site was important. In particular the loss of considerable lengths of north-south hedgerows would be problematic for bat populations and would also constitute a loss of biodiversity corridors and loss of green infrastructure. Advised that replacement should not be the first solution. Justification for the loss of hedgerows was not considered to be strong.
- Serious concerns were raised that retaining walls would be utilised throughout the site, due to the site topography. This was strongly discouraged. Advised that a bespoke housing typology should be considered, which addresses the topography to obviate the use of retaining walls.
- Detailed sections would be required throughout the site, to enable a full assessment to be made.
- Full topographical survey should be provided.
- Quantum and usability of open space was questioned and sufficient details should be provided for this.
- Sustainable Urban Drainage and the use of green infrastructure should be used as starting point to development strategy. Flood Risk assessment would be required.
- The design of units should address the corners and dual frontage incorporated.
- Rationale for the location of typologies and the overall urban structure should be given, to avoid an arbitrary layout.

Appendix B – SDCC Internal Reports Water Services

Water Services Planning Report

Register Reference No.:	*SHD2ABP-305677-19*
Development:	Demolition of 3 no. existing houses on the site. Construction of 197 no. residential units, a creche facility and all associated and ancillary works, including site services, landscaping and boundary treatment, and new internal road and circulation network.
Location:	Lands at Stoney Hill Road, Rathcoole, Co.Dublin
Report Date :	30th October 2019

Surface Water Report: Comments:

1.1 The applicant has not submitted a detailed breakdown of each surface area type within each catchment and their corresponding run off coefficients. The applicant shall submit a report that shows a detailed breakdown of each surface area type (in m^2) such as roads, paths, building roofs, green roofs, permeable paving and grassed area for each catchment area. The report shall include the equivalent run off coefficients for each area type. Once this information is submitted, South Dublin County Council can then assess the surface water attenuation volumes provided for each catchment.

1.2 In the submitted infrastructure design report, the applicant states that the total site area is 6.4 Ha, however the applicant also states that the total area drained from the site is 5.92 Ha. The applicant shall include an explanation in the infrastructure design report as to why these two figures do not correlate.

1.3 All proposed surface water attenuation systems shall be located a minimum distance of 5m away from all building structures.

Water Services Planning Report

Flood Risk Report: **Comments:**

2.1. The Flood Risk Assessment report submitted does not correlate with either surface water drawing no. (PR305837-ACM-00-DR-CE-10-0501) or Infrastructure design report no. (PR-305837-ACM-01-00-RP-CE-10-0001) in terms of locations and capacities of proposed attenuation systems. The applicant shall submit a revised site flood risk assessment report which fully correlates with surface water layout drawings and infrastructure design report in terms of locations and capacities of proposed attenuation systems.

- The Developer shall ensure that there is complete separation of the foul and surface water drainage systems within the site, both in respect of installation and use.
- All new precast surface water manholes shall have a minimum thickness surround of 150mm Concrete Class B.
- All works for this development shall comply with the requirements of the Greater Dublin Regional Code of Practice for Drainage Works which can be viewed /downloaded from the South Dublin County Council website at the following link http://www.sdcc.ie/sites/default/files/publications/greater-dublin-regional-code-of-practice-for-drainage-works.pdf

---

Signed: _____ Date: _____
Ronan Toft AE

Endorsed: _____ Date: _____
Brian Harkin SEE

SOUTH DUBLIN COUNTY COUNCIL

Comhairle Contae
Átha Cliath Theas
South Dublin County Council

INTERNAL MEMORANDUM

Department: **Parks & Landscape Services / Public Realm** Date: **07/11/2019**

Area Planner
Planning Department

Development: Demolition of 3 existing houses on the site. Construction of 197 residential units, comprising 148 houses and 49 apartments. The houses comprise of 6 no. 2-bed units in duplex typologies, 130 no. 3-bed units (including 14 in duplex typologies) and 12 no. 4-bed units. Included in this mix are 20 duplex units, the apartments comprise of 11 no. 1-bed, 25 2-bed and 13 3- bed. The apartments are accommodated in a single four storey building to the north-west of the site adjacent to Stoney Hill Road. A new vehicular entrance from Stoney Hill Road, and a pedestrian and cyclist entrance to the north of the site to link to an unnamed road off Stoney Hill Road. Provision is made for future vehicular/pedestrian/cyclist linkages to the east to undeveloped lands and pedestrian/cyclist links to the north to Rathcoole Park. Public open space which in total provides circa 15% of the total site area. in addition, a significant linear park is provided for passive amenity to the south of the site. A creche facility located adjacent to the primary site, on undeveloped lands within the Peyton Residential Estate. The development also provides 314 car parking spaces and 105 bicycle parking spaces. The development includes all associated and ancillary works, including site services, landscaping and boundary treatment, and new internal road and circulation network.

Location: Lands at Stoney Hill Road, Rathcoole, Co.Dublin

Applicant: Romeville Developments Ltd.

Reg. Ref: SHD2ABP-305677-19

Main Concerns:

- **Loss of hedgerows/ fragmentation of green infrastructure**
- **Lack of street trees throughout the development**
- **Lack of SUDS features**
- **Landscape Plan / Maintenance of proposed landscape**
- **Poor Play provision**

1. **Existing Trees and Hedgerows**

- The applicant has proposed removing 40% of the existing hedgerows and 86% of the existing individually tagged trees on site to facilitate the proposed development.

- The tree and hedgerow loss breakdown for the development site will be:

    - Category U – Tree Nos. 0851, 0861 & 0862.
    - Category B – Tree Nos.0852, 0855 & 0860.
    - Category C – Tree Nos. 0853, 0854, 0856, 0857, 0858, 0859 & 0863
    - Hedge No.1 - C.55m of hedge No.1A plus c.21m of hedge No.1B
    - Hedge No.2 – c.95m of hedge No.2B
    - Hedge No.4 – c.79m of hedge No.4A plus all (c.20m) of hedge No.4B plus all (c.30m) hedge No.4C.
    - Hedge No.5 – c.30m hedge No.5A.
    - Hedge No.6 – all (c.103m) of this hedge.
    - Hedge No.7 – all (c.107m) of this hedge.

- The proposed development layout fails to sufficiently adapt the design of dwellings and streets to the existing physical attributes of the site resulting in the proposed removal of 551 meters of existing hedgerows and 13 trees.
- The proposed development if granted will fragment or remove green infrastructural elements that support bat species, biodiversity in general, and which help to mitigate against climate change.

- This is contrary to SDCC CDP 2016-2022.
    - **G2 Objective 1:** To reduce fragmentation of the Green Infrastructure network and strengthen ecological links between urban areas, Natura 2000 sites, proposed Natural Heritage Areas, parks and open spaces and the wider regional Green Infrastructure network.
    - **G2 Objective 2:** To protect and enhance the biodiversity value and ecological function of the Green Infrastructure network.
    - **G2 Objective 9:** To preserve, protect and augment trees, groups of trees, woodlands and hedgerows within the County
    - **G2 Objective 13:** To seek to prevent the loss of woodlands, hedgerows, aquatic habitats and wetlands wherever possible including requiring a programme to monitor and restrict the spread of invasive species
    - **G6 Objective 1:** To protect and enhance existing ecological features including tree stands, woodlands, hedgerows and watercourses in all new developments as an essential part of the design process.

- **HCL15 Objective 3:** To protect existing trees, hedgerows, and woodlands which are of amenity or biodiversity value and/ or contribute to landscape character and ensure that proper provision is made for their protection and management in accordance with Living with Trees: South Dublin County Council's Tree Management Policy 2015-2020.

- The scheme should be redesigned to retain more of the existing hedgerows thereby mitigating the proposed significant habitat and green infrastructure loss. The applicant has not provided a bat survey.

2. <u>Street Trees</u>

- Insufficient numbers of street trees have been proposed. The proposed scheme presents a very stark streetscape without any trees or vegetation for vast areas. Combined with the lack of front gardens and dominated by car parking spaces it is a very bleak proposal and unacceptable in terms of street design. It is also totally unacceptable from a landscaping, aesthetic and biodiversity point of view.
- This is contrary to the SDCC CDP 2016-2022, 6.4.3 ROAD AND STREET DESIGN (i) Design of Urban Roads and Streets, *"harsh measures such as bare concrete walls will not be permitted, and alternative landscape measures such as street trees, screen planting and planted verges should be provided"*.

- No more than 60% of residential car parking spaces shall be provided as private in-curtilage parking spaces in any development area.
- On street car parking shall be combined with regular tree planting and a high standard of kerbing and paving. It is a general objective that not more than five perpendicular or two parallel car parking spaces be allowed between trees
- In the proposed residential car parking areas trees should be provided every 5/6 car parking spaces to reduce the hard-urban impact of the proposed development.
- SDCC require street trees to be planted in public open space with suitable tree pit that incorporates SuDS features.
- The landscape plan doesn't detail where lighting columns will be located, all lighting columns should be located a minimum of 5m away from any tree. A revised tree planting schedule is required.

3. <u>SUDS</u>

. The applicant has failed to comply with the objectives of the development plan regarding SUDS.

- The provision of SUDs is a requirement for all new developments and cannot be omitted because they can be difficult to achieve on site.
- There are inconsistencies between the SUDs Strategy document and the landscape plan. Measures listed in the SUDS strategy such as use of filter drains do not appear on the drainage drawings. The tree pits proposed in the SUDs Strategy differ from the tree pit design on the landscape plans

- The proposed drainage solution does not meet the requirements of the development plan as it does nothing to improve amenity or promote biodiversity. On the contrary, areas of open space have been used for underground attenuation tanks thus prohibiting the planting of trees, reducing the amenity value of the open space and its potential to support biodiversity.

Along with hedgerows and water courses SUDs should be designed as a key component of Green Infrastructure provision. The Green Infrastructure network supports native plant and animal species and provides corridors for their movement, maintains natural ecological processes and biodiversity, sustains air and water quality and provides vital amenity and recreational spaces for communities, thereby contributing to the health and quality of life of residents and visitors to the County.

- **IE2 Objective 3:** "To maintain and enhance existing surface water drainage systems in the County and promote and facilitate the development of Sustainable Urban Drainage Systems (SUDS), including integrated constructed wetlands, at a local, district and County level, to control surface water outfall and protect water quality."
- **IE2 Objective 5:** To limit surface water run-off from new developments through the use of Sustainable Urban Drainage Systems (SUDS) and **avoid the use of underground attenuation and storage tanks.**
- **IE2 Objective 6:** To promote and support the retrofitting of Sustainable Urban Drainage Systems (SUDS) in established urban areas, including integrated constructed wetlands.
- **G5 Objective 1:** To promote and support the development of Sustainable Urban Drainage Systems (SUDS) at a local, district and county level and to **maximise the amenity and biodiversity value of these systems.**
- **G5 Objective 2:** To promote the provision of Green Roofs and/or Living Walls in developments where expansive roofs are proposed such as industrial, retail and civic developments.
- **11.6.1 WATER MANAGEMENT (iii)** Sustainable Urban Drainage System (SUDS) In general, all new developments will be required to incorporate Sustainable Urban Drainage Systems (SUDS). SUDS include devices such as swales, permeable pavements, filter drains, storage ponds, constructed wetlands, soakways and green roofs.
- **.1.0 G2 Objective 2:** To protect and enhance the biodiversity value and ecological function of the Green Infrastructure network.
- **8.1.0 G2 Objective 5**: To integrate Green Infrastructure as an essential component of all new developments.
- A key function of **open space provision** is to provide habitats for ecological processes, to provide amenity and recreation and to mitigate the impacts of climate change. The open spaces provided in this development do not provide these functions
- 8.3.0 **G4 Objective 1:** To support and facilitate the provision of a network of high quality, well located and multifunctional public parks and open spaces throughout the County and to protect and enhance the environmental capacity and ecological function of these spaces.
- **G4 Objective 2:** To connect parks and areas of open space with ecological and recreational corridors to aid the movement of biodiversity and people and to strengthen the overall Green Infrastructure network.
- **G4 Objective 3:** To enhance and diversify the outdoor recreational potential of public open spaces and parks, subject to the protection of the natural environment.
-

4. Landscape Plan

- The applicant hasn't provided a taking in charge drawing that clearly outlines what's proposed to be taking in charge by SDCC.
- All proposed landscaping intended to be taken in charge shall be to a taking in charge standard that ensures ease of maintenance. This included soft landscaping details.

Appendix C – SDCC Consultation

From: Ronan Toft <rtoft@SDUBLINCOCO.ie>
Sent: 03 April 2020 14:58
To: Budal, Thamara <thamara.budal@aecom.com>
Cc: Brian Harkin <bharkin@SDUBLINCOCO.ie>; Dunne, Michael <michael.dunne@aecom.com>; Iannucci, Matteo <matteo.iannucci@aecom.com>
Subject: [EXTERNAL] Re: SHD Application for Stoney Hill Road (Reg. Ref. No. SHD2ABP-305677-19)

Hi Thamara,

In principle there are no objections however I cannot give you a definitive answer regarding the final assessment at this time. Please highlight the additional attenuation storage available within all proposed suds features when making your submission and it will be assessed when the application is made. Can you also submit this email correspondence with your application also for reference when assessing the application.

Please note that pre planning guidance is given in good faith and the final assessment will be made when the application is submitted.

Kind regards,
Ronan

From: Budal, Thamara <thamara.budal@aecom.com>
Sent: Friday, April 3, 2020 2:46 PM
To: Ronan Toft <rtoft@SDUBLINCOCO.ie>
Cc: Brian Harkin <bharkin@SDUBLINCOCO.ie>; Dunne, Michael <michael.dunne@aecom.com>; Iannucci, Matteo <matteo.iannucci@aecom.com>
Subject: RE: SHD Application for Stoney Hill Road (Reg. Ref. No. SHD2ABP-305677-19)

Hi Ronan

Thanks for your prompt response.

Considering the total attenuation volume of 1422m3, a 15% extra volume would be a volume of 213.3m3. The proposed permeable paving total area is 2980m2 as per the table attached. Considering a depth of stone of 500mm and a stone porosity of 45%, the total storage volume provided under the permeable paving is 670.5m3 which is more three times the extra volume required. Taking this into consideration, would you be satisfied with the drainage design?

Kind regards,
Thamara Budal, BEng, MIEI
Consulting Engineer, Development Engineering
M +353-87-664-0603
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Imagine it. Delivered.
LinkedIn Twitter Facebook Instagram

From: Ronan Toft <rtoft@SDUBLINCOCO.ie>
Sent: 02 April 2020 16:40
To: Budal, Thamara <thamara.budal@aecom.com>
Cc: Brian Harkin <bharkin@SDUBLINCOCO.ie>; Dunne, Michael <michael.dunne@aecom.com>
Subject: [EXTERNAL] Re: SHD Application for Stoney Hill Road (Reg. Ref. No. SHD2ABP-305677-19)

Hi Thamara,

Apologies I have recalculated the surface areas and they add up.

Based on initial calculations it would appear that the current attenuation provision for catchments 1, 2 and 4 (1,421.76 cu.m via arch type systems) is undersized by approximately 15%. Note I have added a run off factor of around 0.15 for green areas as this would allow for a small percentage of run off from grassed areas in time of soil saturation which may enter the drainage network and given the site is at a gradient this may occur.

This allowance for extra attenuation must be made clear in your submission on the drawings provided and in your infrastructure design report. The other comments you made in your previous email are noted.

PLEASE NOTE: Advice or opinions offered at pre-planning consultation stage is given in good faith and cannot prejudice the determination of a subsequent planning application in accordance with Section 247 of the Planning and Development Act, 2000, as amended

Kind regards,
Ronan Toft
Assistant Engineer
Water Services

From: Budal, Thamara <thamara.budal@aecom.com>
Sent: Thursday, April 2, 2020 4:03 PM
To: Ronan Toft <rtoft@SDUBLINCOCO.ie>
Cc: Brian Harkin <bharkin@SDUBLINCOCO.ie>; Dunne, Michael <michael.dunne@aecom.com>
Subject: RE: SHD Application for Stoney Hill Road (Reg. Ref. No. SHD2ABP-305677-19)

Hi Ronan

Thanks for the feedback. Please see responses below in blue.

Kind regards,
Thamara Budal, BEng, MIEI
Consulting Engineer, Development Engineering
M +353-87-664-0603
thamara.budal@aecom.com
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From: Ronan Toft <rtoft@SDUBLINCOCO.ie>
Sent: 02 April 2020 15:29
To: Budal, Thamara <thamara.budal@aecom.com>
Cc: Brian Harkin <bharkin@SDUBLINCOCO.ie>; Dunne, Michael <michael.dunne@aecom.com>
Subject: [EXTERNAL] Re: SHD Application for Stoney Hill Road (Reg. Ref. No. SHD2ABP-305677-19)

Hi Thamara,

In principle the proposed attenuation and discharged outflow for catchment 3 is satisfactory.

Noted.

Regarding the attenuation for catchments 1, 2 and 4 the breakdown of areas don't quite add up to the total area of 5.73 Ha. When I add up the sub areas for these catchments I am getting 4.853ha. Can you explain how there is a discrepancy or else if it is an error can you resubmit a revised breakdown for these catchments (1, 2 and 4)?

Apologies, but I can't seem to get the 4.853Ha figure you have mentioned in sub-catchments #1, #2 and #4. Would you please highlight which figures you are adding up from table 1?

Regarding the location of the porous asphalt- Can you consult with the roads department on this and ensure that they are in agreement with the location of the porous asphalt if it is located in areas to be taken in charge by the Roads department.

Noted. We will contact John Joe Hegarty to get confirmation that the proposed porous asphalt locations are going to be taken in charge by the Roads department.

The proposed filter drain to the east of the site is acceptable in principle from a Sustainable Drainage System point of view. Can filter drains/swales etc be further incorporated as a SuDS measure throughout the site to drain roads and paths? There may be scope to incorporate further SuDS measures.

We have tried to include swales and filter drains throughout the site during the design stage, however we have found that they are incompatible with the subject development due to the topography of the site. The ground falls from south to north at an average gradient of approximately 1:20 (gradients vary between 1:15 and 1:25). These SuDS systems require a longitudinal slope of less than 1:100 or a maximum velocity at full flow conditions of 2m/s. Please see proposed Road Levels drawing attached to this e-mail for clarification on levels.

PLEASE NOTE: Advice or opinions offered at pre-planning consultation stage is given in good faith and cannot prejudice the determination of a subsequent planning application in accordance with Section 247 of the Planning and Development Act, 2000, as amended

Kind Regards,

Ronan Toft
Assistant Engineer
Water Services

From: Budal, Thamara <thamara.budal@aecom.com>
Sent: Thursday, April 2, 2020 12:51 PM
To: Ronan Toft <rtoft@SDUBLINCOCO.ie>
Cc: Brian Harkin <bharkin@SDUBLINCOCO.ie>; Dunne, Michael <michael.dunne@aecom.com>
Subject: RE: SHD Application for Stoney Hill Road (Reg. Ref. No. SHD2ABP-305677-19)

Hi Ronan

Thank you for the prompt response. Please see response to your comments below.

We have designed the allowable flow rate (Qbar) for the whole residential development area, including the 4No catchments, thus a total of 6.57Ha. The Qbar for the subject site is 16.69L/s which is the outflow we are allowing to enter the existing surface water network. Since attenuation tanks #1, #2 and #4 are in series and attenuation tank #3 is acting separately, the final outflow is dictated by attenuation tanks #3 and #4. Attenuation tank #3 has been designed with an outflow of 2.4L/s and attenuation tank #4 with an outflow of 14.3L/s, this means the sum of this two outflows matches the required Qbar of the site.

Please find supportive information attached to this e-mail:

- Qbar calculations
- Catchment areas
- Table showing surface areas and run-off coefficients within each catchment
- Revised Surface Water Drainage drawing
- Proposed SuDS details

Please note a few areas will not match the information sent previously on 26 March 2020, due to the fact the green roof area has been reduced slightly to allow for PV panels and the landscape drawings have been amended in the meantime.

Let me know if you have any further comments or queries on this.

Kind regards,
Thamara Budal, BEng, MIEI
Consulting Engineer, Development Engineering
M +353-87-664-0603
thamara.budal@aecom.com
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From: Ronan Toft <rtoft@SDUBLINCOCO.ie>
Sent: 31 March 2020 11:34
To: Budal, Thamara <thamara.budal@aecom.com>
Cc: Brian Harkin <bharkin@SDUBLINCOCO.ie>
Subject: Fw: SHD Application for Stoney Hill Road (Reg. Ref. No. SHD2ABP-305677-19)

Thamara,

Having reviewed your attached draft technical note submission, please see below comments:

1.1 Please provide a breakdown of surface types, areas and run off coefficients for **each** of the 4 catchments as well as a breakdown of the permissible outflow calculations for **each** of the four catchments.
1.2 Noted
1.3 Noted
2.1 Noted

Can you also provide a drawing showing section views of all proposed SUDS features with your application and please also show all SuDS features on the surface water drainage layout including green roofs, permeable surfacing, rainwater butts, filter drain as proposed.

PLEASE NOTE: Advice or opinions offered at pre-planning consultation stage is given in good faith and cannot prejudice the determination of a subsequent planning application in accordance with Section 247 of the Planning and Development Act, 2000, as amended.

Regards,
Ronan Toft
Assistant Engineer
Water Services

From: Budal, Thamara <thamara.budal@aecom.com>
Sent: Thursday, March 26, 2020 7:10 PM
To: Ronan Toft <rtoft@SDUBLINCOCO.ie>
Cc: Dunne, Michael <michael.dunne@aecom.com>; Iannucci, Matteo <matteo.iannucci@aecom.com>
Subject: SHD Application for Stoney Hill Road (Reg. Ref. No. SHD2ABP-305677-19)

Hi Ronan

Following the conversations between yourself and Matteo Iannucci of our Development Team, we would like to formalise a response to the queries raised by the Water Services department within Planning Report Reg. Ref. No. SHD2ABP-305677-19. Please find a Technical Note regarding these matters attached to this e-mail. If you could please review the information provided and confirm that you are now satisfied with the infrastructure design it would be highly appreciated.

Feel free to call me if you would like to discuss any of the items.

Kind regards,
Thamara Budal, BEng, MIEI
Consulting Engineer, Development Engineering
M +353-87-664-0603
thamara.budal@aecom.com

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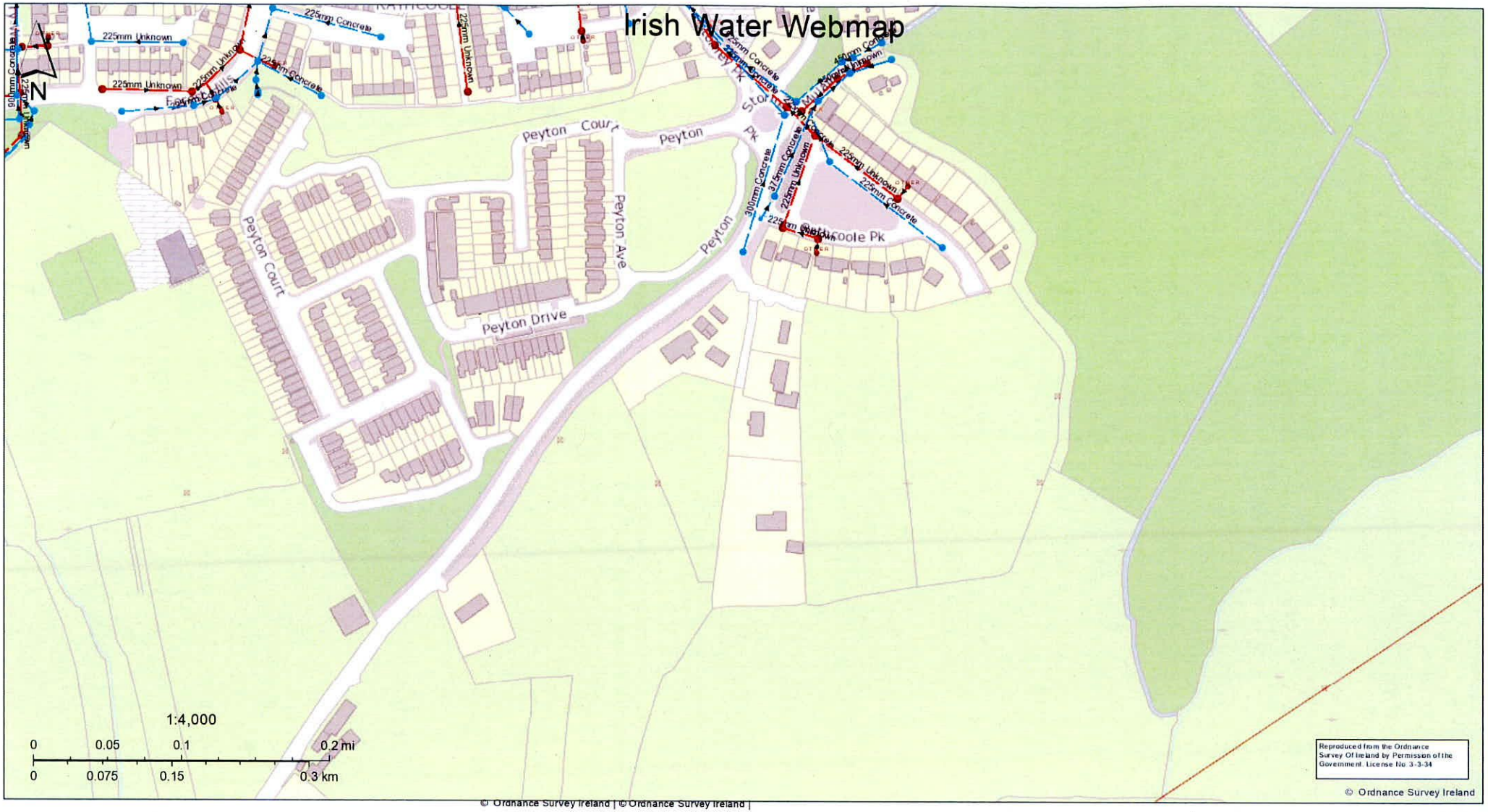
Appendix D – Existing Record Drawings



7/10/2018 11:02:38 AM

Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Storm Culverts

Storm Clean Outs

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

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. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated. © Irish Water

UISCE EIREANN : IRISH WATER

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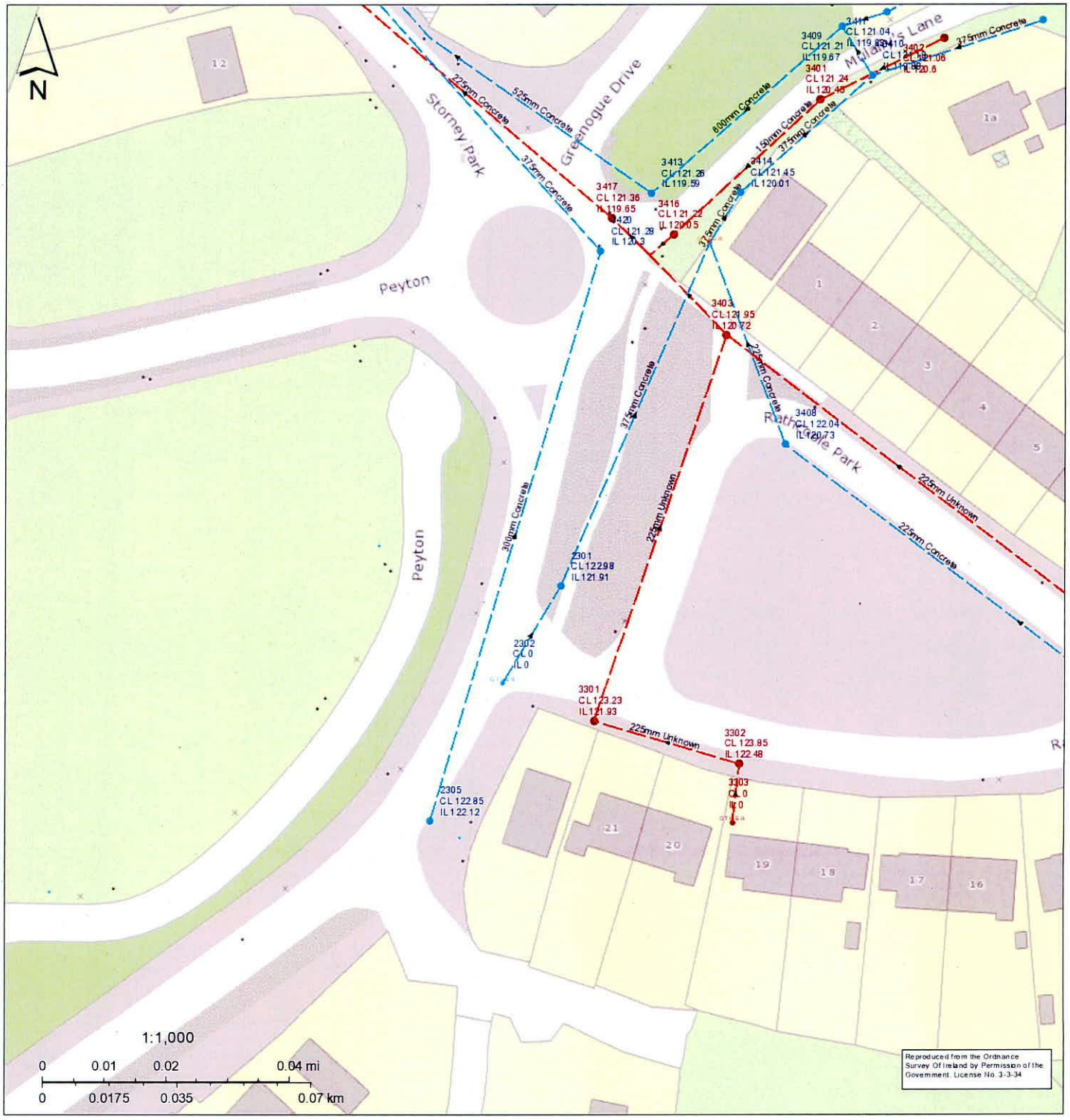
Irish Water Webmap



7/10/2018 11:05:33 AM

Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)
- Surface

Storm Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

Storm Discharge Points
- Outfall
- Overflow
- Soakaway
- Other; Unknown
- Storm Culverts
- Storm Clean Outs

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Pressurized Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Pressurized Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

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. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated.

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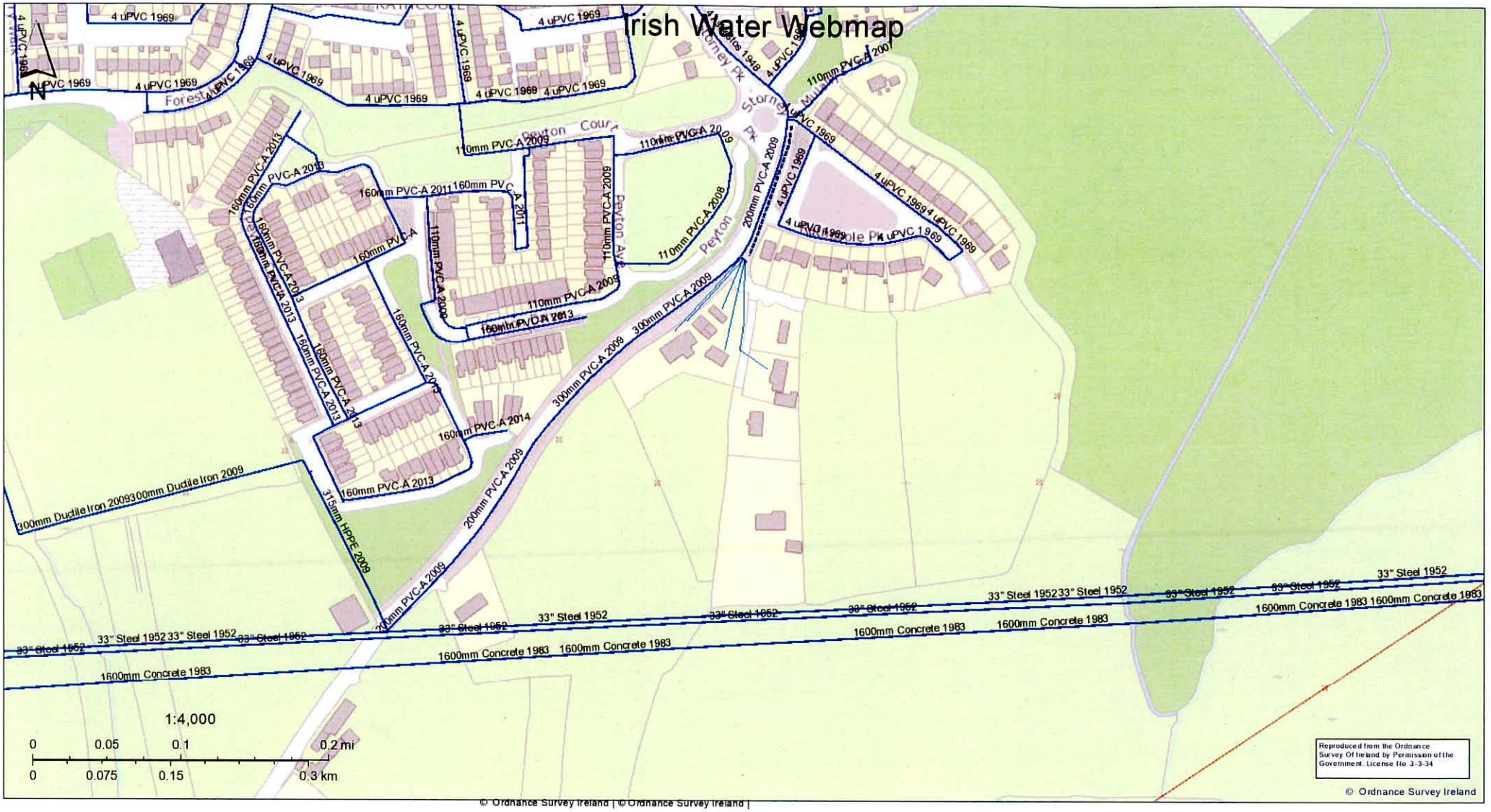


7/10/2018 10:54:10 AM

Legend

Flow Control Valves
- Non-return
- Hydro
- Orifice Plate
- PRV
- PSV
- Other

Boundary Valves
- Open
- Closed
- Part Closed

Boundary Meter
- District (Boundary Meter)

- Treatment Plant

Reservoir
- Potable
- Raw Water
- Pump Stations

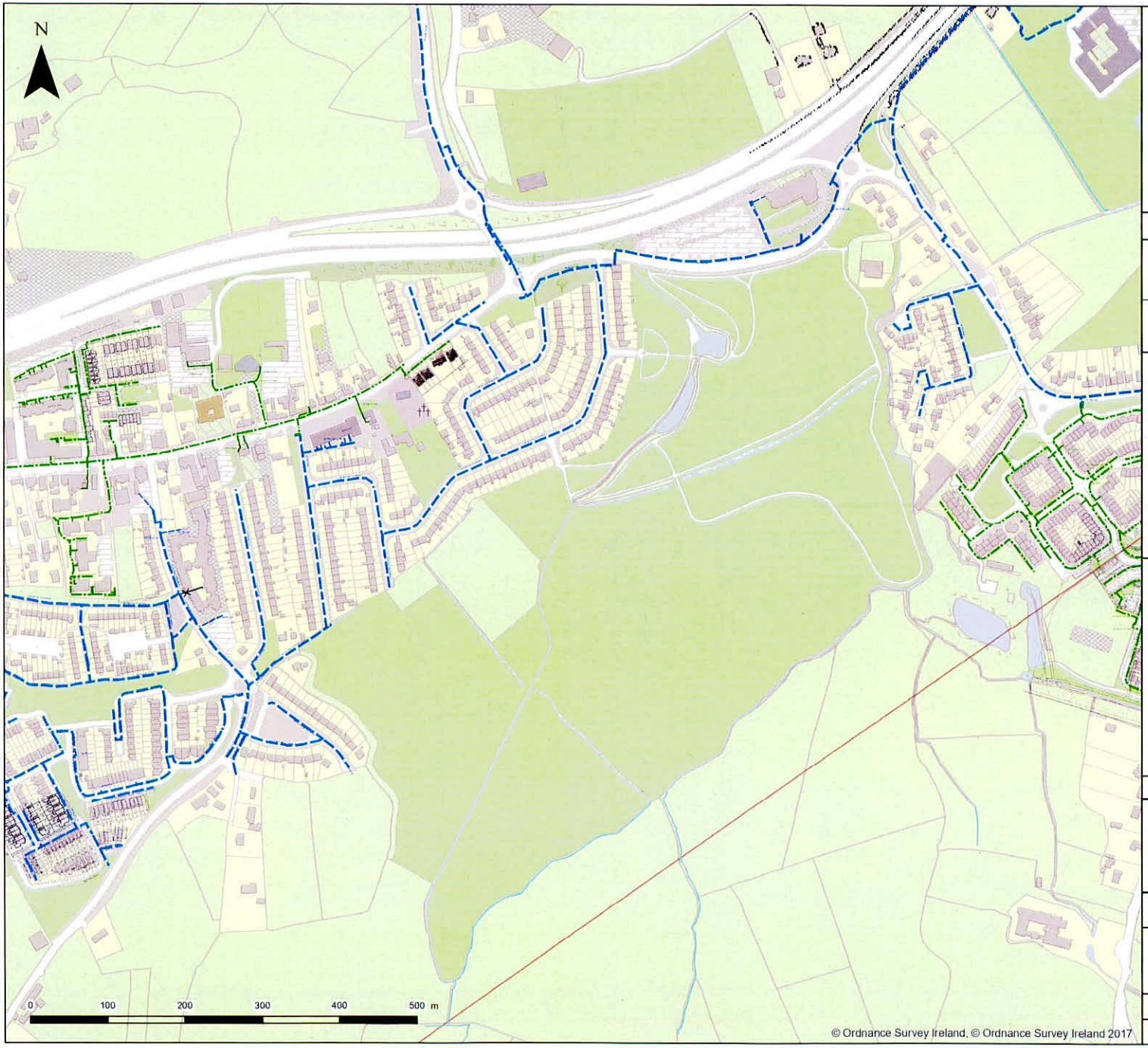
Water Mains(Irish Water Owned)
- Untreated

- Potable Water

Water Mains(Non Irish Water Owned)
- Untreated
- Potable Water

Water Lateral Lines
- Irish Water
- Non IW

- Water Abandoned Lines
- Water Casings



Important Safety Notice: Damage to gas pipelines can result in serious injury or death. Gas network information is provided as a general guide. The exact location and depth of medium or low pressure distribution gas pipes must be verified on site by carrying out necessary investigations, including, for example, hand digging trial holes along the route of the pipe. Service pipes are not generally shown but their presence should always be anticipated.

High pressure transmission pipelines are shown in red. If a transmission pipeline is identified within 10m of any intended excavations then work must not proceed before GNI has been consulted. The true location and depth of a transmission pipeline must be verified on site by a representative of GNI. Contact can be made through 1800 427 747.

All work in the vicinity of the gas network must be completed in accordance with the current edition of the Health and Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 289 389) or can be downloaded at www.hsa.ie

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- Aurora Telecom Duct
- Aurora Telecom Sub Duct
- Aurora Telecom Inserted Gas Pipe

Aurora TELECOM

Aurora Telecom Queries - 01-8926166 (Office Hours)
Aurora_Network_Queries@gasnetworks.ie
Aurora Telecom Emergency Only 1800 427399 / 01 2030120

- Transmission Pipe (High Pressure)
- Transmission Pipe (Construction Issue)
- Distribution Pipe (Medium Pressure)
- Distribution Pipe (Low Pressure)
- Service Pipe (Medium Pressure)
- Service Pipe (Low Pressure)
- Strategic Pipe (Medium Pressure)
- Strategic Pipe (Low Pressure)
- Inserted
- Abandoned Pipe

C=?	Cover (depth in metres)		Pressure Monitor
CP	CP Test Point		Protection (Slabbing)
	End Cap		Protection (Sleeve)
	Hot Tap		Reducer
	Installation		Service Terminator
	Valve		Tee
	Mains Verification**		Transition

** Please contact GNI on 1800-427747 for specific information

DIAL BEFORE YOU DIG 1800 42 77 47
In Emergency call 1800 20 50 50 Gas Networks Ireland

Gas Networks Ireland

GAS NETWORK INFORMATION

Description: Stoneyhill

Location: 702644,726679

Plot Date: 26/04/2022 14:44	Scale: 5000 @ A3
Plotted By: 2991	Ref ID: *2991_26042022144426*

A3

open eir Civil Engineering Infrastructure Service	Scale: 1:1500	Irish National Grid Co-Ordinates Centre XY: 302192 m, 226280 m
	Date 27/07/2022	Smallworld Powered by GE

ESB Networks

TITLE: 20220428-008_A3

COLOUR CODE:
- BLACK - 38KV & HIGHER VOLTAGE OVERHEAD LINES
- GREEN - MV(10KV/20KV) OVERHEAD LINES
- BLUE - LV (400V/230V) OVERHEAD LINES
- CYAN - 38KV & HIGHER VOLTAGE UNDERGROUND CABLE ROUTES
- RED - MV/LV (10KV/20KV/400V/230V) UNDERGROUND CABLE ROUTES

DATE: 28-Apr-2022

** SCALE: 1:2500

** SCALE WHEN PRINTED ON AN A3 PAGE
XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

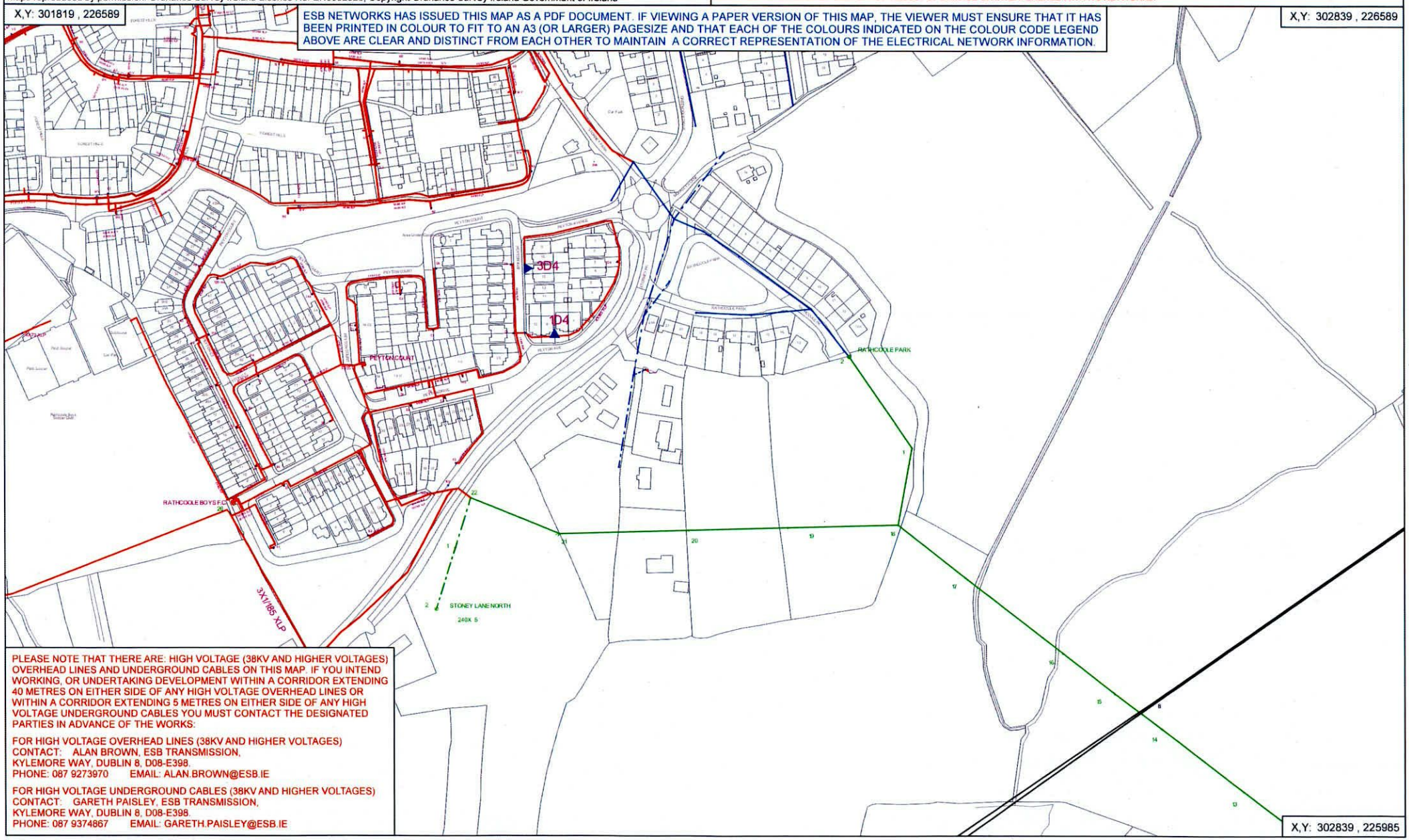
WARNING

THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (400KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE ASSUMED. ADDITIONAL MORE DETAILED INFORMATION IS AVAILABLE FOR HIGH VOLTAGE TRANSMISSION UNDERGROUND CABLES (38KV, 110KV, 220KV, 400KV) FROM THE LOCAL ESB NETWORKS TRANSMISSION REPRESENTATIVE - SEE ATTACHED LIST FOR CONTACT DETAILS OR CALL 1800 372 757. NO WORK SHOULD BE CARRIED OUT IN THE VICINITY OF 38KV OR HIGHER VOLTAGE UNDERGROUND CABLES WITHOUT PRIOR CONSULTATION WITH ESB NETWORKS. BEFORE ANY MECHANICAL EXCAVATION IS UNDERTAKEN, THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING: (A) UP-TO-DATE MAP RECORDS, (B) CABLE LOCATER EQUIPMENT OPERATED IN BOTH POWER AND RADIO MODES; (C) CAREFUL HAND DIGGING OF TRIAL HOLES USING 'SAFE DIGGING PRACTICE'. REFER ALSO TO 'HSA CODE OF PRACTICE FOR AVOIDING DANGER FROM UNDERGROUND SERVICES'. ESB TAKES NO RESPONSIBILITY FOR AND SHALL BEAR NO LIABILITY, HOWSOEVER ARISING, IN RELATION TO ANY DAMAGE, INJURY/DEATH OR LOSS OF SUPPLY AS A RESULT OF DAMAGE OR INTERFERENCE WITH ITS NETWORKS.

X,Y: 301819 , 226589

ESB NETWORKS HAS ISSUED THIS MAP AS A PDF DOCUMENT. IF VIEWING A PAPER VERSION OF THIS MAP, THE VIEWER MUST ENSURE THAT IT HAS BEEN PRINTED IN COLOUR TO FIT TO AN A3 (OR LARGER) PAGESIZE AND THAT EACH OF THE COLOURS INDICATED ON THE COLOUR CODE LEGEND ABOVE ARE CLEAR AND DISTINCT FROM EACH OTHER TO MAINTAIN A CORRECT REPRESENTATION OF THE ELECTRICAL NETWORK INFORMATION.

X,Y: 302839 , 226589



X,Y: 302839 , 225985

PLEASE NOTE THAT THERE ARE: HIGH VOLTAGE (38KV AND HIGHER VOLTAGES) OVERHEAD LINES AND UNDERGROUND CABLES ON THIS MAP. IF YOU INTEND WORKING, OR UNDERTAKING DEVELOPMENT WITHIN A CORRIDOR EXTENDING 40 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE OVERHEAD LINES OR WITHIN A CORRIDOR EXTENDING 5 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE UNDERGROUND CABLES YOU MUST CONTACT THE DESIGNATED PARTIES IN ADVANCE OF THE WORKS:

FOR HIGH VOLTAGE OVERHEAD LINES (38KV AND HIGHER VOLTAGES)
CONTACT: ALAN BROWN, ESB TRANSMISSION,
KYLEMORE WAY, DUBLIN 8, D08-E398.
PHONE: 087 9273970 EMAIL: ALAN.BROWN@ESB.IE

FOR HIGH VOLTAGE UNDERGROUND CABLES (38KV AND HIGHER VOLTAGES)
CONTACT: GARETH PAISLEY, ESB TRANSMISSION,
KYLEMORE WAY, DUBLIN 8, D08-E398.
PHONE: 087 9374867 EMAIL: GARETH.PAISLEY@ESB.IE

Appendix E – Met Eireann Rainfall Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 302192, Northing: 226168,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.9,	4.3,	5.1,	6.4,	7.2,	7.9,	10.1,	12.7,	14.5,	17.1,	19.4,	21.2,	24.1,	26.3,	28.2,	N/A ,
10 mins	4.1,	6.0,	7.1,	8.9,	10.0,	11.0,	14.1,	17.7,	20.2,	23.8,	27.0,	29.5,	33.5,	36.6,	39.3,	N/A ,
15 mins	4.8,	7.1,	8.4,	10.4,	11.8,	12.9,	16.6,	20.9,	23.8,	28.0,	31.8,	34.8,	39.4,	43.1,	46.2,	N/A ,
30 mins	6.3,	9.3,	10.9,	13.4,	15.2,	16.6,	21.2,	26.5,	30.1,	35.3,	40.0,	43.7,	49.4,	53.9,	57.7,	N/A ,
1 hours	8.2,	12.0,	14.1,	17.4,	19.6,	21.3,	27.0,	33.7,	38.2,	44.6,	50.3,	54.8,	61.9,	67.4,	72.0,	N/A ,
2 hours	10.8,	15.7,	18.3,	22.4,	25.2,	27.3,	34.5,	42.8,	48.4,	56.3,	63.3,	68.9,	77.5,	84.2,	89.8,	N/A ,
3 hours	12.7,	18.3,	21.4,	26.0,	29.2,	31.7,	39.9,	49.3,	55.6,	64.5,	72.5,	78.7,	88.4,	96.0,	102.3,	N/A ,
4 hours	14.2,	20.4,	23.8,	28.9,	32.4,	35.1,	44.1,	54.4,	61.3,	71.0,	79.7,	86.5,	97.1,	105.3,	112.1,	N/A ,
6 hours	16.7,	23.8,	27.7,	33.6,	37.5,	40.7,	50.9,	62.6,	70.4,	81.4,	91.2,	98.9,	110.7,	120.0,	127.7,	N/A ,
9 hours	19.6,	27.8,	32.2,	39.0,	43.5,	47.1,	58.7,	72.0,	80.8,	93.3,	104.4,	113.0,	126.3,	136.7,	145.3,	N/A ,
12 hours	21.9,	31.0,	35.9,	43.3,	48.3,	52.2,	65.0,	79.5,	89.2,	102.7,	114.8,	124.2,	138.7,	150.0,	159.4,	N/A ,
18 hours	25.7,	36.2,	41.8,	50.3,	56.0,	60.5,	75.0,	91.5,	102.4,	117.7,	131.4,	141.9,	158.3,	170.9,	181.4,	N/A ,
24 hours	28.8,	40.4,	46.6,	55.9,	62.2,	67.1,	83.0,	101.1,	113.0,	129.7,	144.5,	156.0,	173.8,	187.5,	198.9,	238.8,
2 days	36.3,	49.4,	56.4,	66.6,	73.4,	78.6,	95.5,	114.3,	126.6,	143.5,	158.5,	170.0,	187.5,	201.0,	212.1,	250.7,
3 days	42.5,	56.9,	64.4,	75.4,	82.6,	88.2,	106.0,	125.6,	138.2,	155.7,	170.9,	182.6,	200.4,	213.9,	225.1,	263.5,
4 days	48.0,	63.5,	71.5,	83.1,	90.7,	96.6,	115.2,	135.5,	148.6,	166.5,	182.1,	194.0,	212.1,	225.8,	237.1,	275.8,
6 days	57.8,	75.1,	83.9,	96.7,	105.0,	111.4,	131.4,	153.0,	166.8,	185.6,	201.9,	214.3,	232.9,	247.0,	258.6,	298.0,
8 days	66.5,	85.4,	95.0,	108.7,	117.6,	124.4,	145.6,	168.4,	182.8,	202.5,	219.4,	232.1,	251.3,	265.9,	277.7,	317.9,
10 days	74.6,	95.0,	105.1,	119.7,	129.1,	136.3,	158.6,	182.4,	197.4,	217.8,	235.2,	248.4,	268.1,	283.0,	295.2,	336.2,
12 days	82.3,	103.9,	114.7,	130.0,	139.9,	147.4,	170.7,	195.4,	210.9,	232.0,	249.9,	263.5,	283.7,	299.0,	311.3,	353.1,
16 days	96.6,	120.5,	132.3,	149.0,	159.8,	167.8,	192.9,	219.3,	235.8,	258.0,	276.9,	291.0,	312.2,	328.1,	340.9,	384.1,
20 days	110.0,	136.0,	148.7,	166.6,	178.1,	186.7,	213.3,	241.1,	258.4,	281.7,	301.4,	316.2,	338.1,	354.6,	367.9,	412.3,
25 days	126.0,	154.1,	167.9,	187.2,	199.5,	208.7,	237.0,	266.4,	284.7,	309.1,	329.7,	345.1,	368.0,	385.1,	398.9,	444.8,

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

M5-50 = 21.3
M5-2Day = 78.6
Ratio R=> 21.3/78.6 = 0.271
SAAR = 863mm

Appendix F – Qbar Calculations

Print | Close Report

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Jamie Cullen
Site name:	Stoney Hill SHD
Site location:	Rathcoole

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

Site Details

Latitude:	53.27646° N
Longitude:	6.46869° W
Reference:	925566478
Date:	Jul 18 2022 11:55

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 2.6

Methodology

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

Soil characteristics	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics	Default	Edited
SAAR (mm):	930	863
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

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):	6.61	6.05
1 in 1 year (l/s):	5.62	5.15
1 in 30 years (l/s):	14.07	12.89
1 in 100 year (l/s):	17.24	15.8
1 in 200 years (l/s):	18.9	17.31

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix G – Site Investigations Report

IGSL Limited

AECOM

Rathcoole Residential

Geotechnical Report

Report No. 24101

June 2022

Report

M7 Business Park
Naas
Co. Kildare
Ireland

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E: info @igsl.ie
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Project: Rathcoole Residential

Project No. 24101

Revision	Date	Title		
Rev 0	06/2022	Ground Investigation Report		
	Copies	Document Format	Prepared By	Reviewed By
		PDF	Brian Green Chartered Engineer	David Green Chartered Engineer
	To	Aecom		
Revision	**Date**	**Title**		
Rev 1				
	Copies	Document Format	Prepared By	Reviewed By
	To			
Revision	**Date**	**Title**		
	Copies	Document Format	Prepared By	Reviewed By
	To			
Revision	**Date**	**Title**		
	Copies	Document Format	Prepared By	Reviewed By
	To			

TABLE OF CONTENTS

FOREWORD

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

Standards

The ground investigation works for this project have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (1999), BS 1377 (Parts 1 to 9) and Engineers Ireland Specification & Related Documents for Ground Investigation in Ireland (2006). A new National Annex for use in the Republic of Ireland is currently in circulation for comment and will be adopted in the near future. In the meantime, the following Irish (IS) and European Standards or Norms are referenced:

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

Reporting

Recommendations made and opinions expressed in this report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations.

The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points.

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

In-Situ Testing

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

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

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

Retention of Samples
Samples shall be retained for a period of 60 days following approval of the final factual report, as detailed in the Scope of Works.

1.0 Introduction

Prior to the commencement of the Stoney Hill Phase 1 Residential Scheme, information was required regarding the general sub-soil conditions and, more specifically, factors relating to pavement design and soil infiltration. This report contains the results of the fieldworks as specified by the consulting engineers. No interpretation of this information was required.

The fieldworks entailed the following elements.

* Trial pits were excavated in six locations to ascertain the sub-soil stratification at the infiltration test locations.

* Infiltration tests were performed at the selected locations.

* Plate Bearing Tests were performed at an additional six locational

2.0 Ground Conditions

2.1 Trial Pits

Trial pits were excavated in six locations as shown on the site plan enclosed in Appendix 4 while the descriptions and depths of the various soils encountered are shown on the trial pit records enclosed in Appendix 1.

TP01, TP02 and TP03 were excavated to a depth of 0.5 metres to provide an indication of the sub-soil conditions in areas where the use of permeable pavement is being considered. These pits revealed made ground overlying firm brown sandy gravelly clay in which the pits were terminated.

TP04, TP05 and TP06 were excavated to the proposed soakaway depth of 2.0 metres.

TP04 revealed firm to stiff brown gravelly clay, becoming stiff from 1.10 metres to the terminal depth of 2.0 metres.

TP05 and TP06 encountered firm white/grey friable clay from 1.2 metres to 2.0 metres.

All pits remained dry during the course of excavation operations.

2.2 Infiltration Tests

The infiltration tests were performed in accordance with BRE Digest 365 'Soakaway Design'.

To obtain a measure of the infiltration rate of the sub-soils, water is poured into the test pit, and records taken of the fall in water level against time. This procedure is repeated twice more to ensure saturation of the sub-soils. Normally the results for the final stage of testing, following the saturation periods, are used for soakaway design purposes. The

infiltration rate is the volume of water dispersed per unit exposed area per unit of time, and is generally expressed as metres/minute or metres/second.

The records for the monitored stages, following the initial saturation stages, are enclosed in Appendix 2. The results are summarised in Table1. The infiltration rates are very low, with no measurable infiltration in IFT02.

Location	Infiltration f-value (m/min)
IFT01	0.00022
IFT02	0.000000
IFT03	0.00008
IFT04	0.000091
IFT05	0.00015
IFT06	0.00012

Table 1

2.3 Plate Bearing Tests

Plate bearing tests were performed in six locations to obtain a measure of the CBR values. A 450 mm diameter plate was used, and the test was performed at a depth of 0.35 metres below existing ground level. The test was performed in accordance with BS 1377 Part 9: 1990. "In-situ Tests". The incremental loading test (4.1.6.4.2) was used.

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

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

The test records from the initial and reload stages are presented in Table 2

Location	Depth (m bgl)	CBR %	
		First Cycle	Second Cycle
PT01	0.35	3.0	5.1
PT02	0.35	2.9	6.2
PT03	0.35	8.0	13.9
PT04	0.35	0.7	0.7
PT05	0.35	2.0	3.5
PT06	0.35	2.4	3.3

Table 2

Appendix 1 Trial Pit Records

TRIAL PIT RECORD

REPORT NUMBER 24101

CONTRACT	Rathcoole housing scheme	**TRIAL PIT NO.**	**TP01**
		SHEET	Sheet 1 of 1
LOGGED BY	S.Hannon	**CO-ORDINATES**	
		DATE STARTED	28/05/2022
		DATE COMPLETED	28/05/2022
CLIENT	Stanley Developments	**GROUND LEVEL (m)**	
ENGINEER	Aecom	**EXCAVATION METHOD**	JCB

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND - Firm to stiff brown gravelly clay with abundant waster material									
Firm to stiff brown gravelly CLAY.		0.40							
End of Trial Pit at 0.50m		0.50							

1.0

2.0

3.0

4.0

Groundwater Conditions
DRY

Stability
Stable

General Remarks
CAT Scanned location for services.

IGSL TP LOG 24101.GPJ IGSL.GDT 1/6/22

TRIAL PIT RECORD

REPORT NUMBER 24101

CONTRACT	Rathcoole housing scheme	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	S.Hannon	**CO-ORDINATES**	
		DATE STARTED	28/05/2022
CLIENT	Stanley Developments	**GROUND LEVEL (m)**	**DATE COMPLETED** 28/05/2022
ENGINEER	Aecom	**EXCAVATION METHOD**	JCB

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.20							
Firm brown slightly sandy gravelly CLAY with low cobble content.		0.60							
End of Trial Pit at 0.60m									

1.0 2.0 3.0 4.0

Groundwater Conditions
DRY

Stability
Stable

General Remarks
CAT Scanned location for services.

IGSL TP LOG 24101.GPJ IGSL.GDT 1/6/22

TRIAL PIT RECORD

REPORT NUMBER 24101

CONTRACT	Rathcoole housing scheme	**TRIAL PIT NO.**	**TP03**
		SHEET	Sheet 1 of 1
LOGGED BY	S.Hannon	**CO-ORDINATES**	
		DATE STARTED	28/05/2022
CLIENT	Stanley Developments	**GROUND LEVEL (m)**	**DATE COMPLETED** 28/05/2022
ENGINEER	Aecom	**EXCAVATION METHOD**	JCB

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL									
Firm brown slightly sandy gravelly CLAY with low cobble content.		0.20							
End of Trial Pit at 0.50m		0.50							
1.0									
2.0									
3.0									
4.0									

Groundwater Conditions
DRY

Stability
Stable

General Remarks
CAT Scanned location for services.

TRIAL PIT RECORD

REPORT NUMBER 24101

CONTRACT	Rathcoole housing scheme	**TRIAL PIT NO.**	**TP04**
		SHEET	Sheet 1 of 1
LOGGED BY	S.Hannon	**CO-ORDINATES**	
		DATE STARTED	28/05/2022
		DATE COMPLETED	28/05/2022
CLIENT	Stanley Developments	**GROUND LEVEL (m)**	
ENGINEER	Aecom	**EXCAVATION METHOD**	JCB

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.10							
Firm brown slightly sandy gravelly CLAY		0.40							
Firm to stiff brown gravelly CLAY with low cobble content.		1.10							
1.0 Stiff brown very gravelly CLAY with medium cobble content.		2.00							
2.0 End of Trial Pit at 2.00m									
3.0									
4.0									

Groundwater Conditions
DRY

Stability
Stable

General Remarks
CAT Scanned location for services.

IGSL TP LOG 24101.GPJ IGSL.GDT 1/6/22

TRIAL PIT RECORD

REPORT NUMBER 24101

CONTRACT	Rathcoole housing scheme	**TRIAL PIT NO.**	**TP05**
		SHEET	Sheet 1 of 1
LOGGED BY	S.Hannon	**CO-ORDINATES**	
		DATE STARTED	28/05/2022
		DATE COMPLETED	28/05/2022
CLIENT	Stanley Developments	**GROUND LEVEL (m)**	
ENGINEER	Aecom	**EXCAVATION METHOD**	JCB

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.10							
Firm brown slightly sandy gravelly CLAY with low cobble content.		0.60							
Firm to stiff brown gravelly CLAY with low cobble content.		1.20							
Firm whiteish grey CLAY.		1.90							
End of Trial Pit at 1.90m									

1.0
2.0
3.0
4.0

Groundwater Conditions
DRY

Stability
Stable

General Remarks
CAT Scanned location for services.

IGSL TP LOG 24101.GPJ IGSL.GDT 1/6/22

TRIAL PIT RECORD

REPORT NUMBER 24101

CONTRACT	Rathcoole housing scheme	**TRIAL PIT NO.**	**TP06**
		SHEET	Sheet 1 of 1
LOGGED BY	S.Hannon	**CO-ORDINATES**	
		DATE STARTED	28/05/2022
CLIENT	Stanley Developments	**GROUND LEVEL (m)**	**DATE COMPLETED** 28/05/2022
ENGINEER	Aecom	**EXCAVATION METHOD**	JCB

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.10							
Firm brown slightly sandy gravelly CLAY with low cobble content.		0.60							
Firm to stiff brown gravelly CLAY with low cobble content.		1.20							
Firm whiteish grey slightly gravelly CLAY (crumbles into white powder)					AA118026	B	1.50-2.00		
2.0 End of Trial Pit at 2.00m		2.00							
3.0									
4.0									

Groundwater Conditions
DRY

Stability
Stable

General Remarks
CAT Scanned location for services.

IGSL TP LOG 24101.GPJ IGSL.GDT 1/6/22

Appendix 2 Infiltration Test Results

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

Contract: Rathcoole Housing Contract No. 24101
Test No. IFT1
Client Stanley Developments
Date: 28/05/2022

Summary of ground conditions

from	to	Description	Ground water
0.00	0.40	MADE GROUND - Firm to stiff brown gravelly clay with abundant waster material	None encountered
		(timber, rope, metal and plastic).	
0.40	0.50	Firm to stiff brown gravelly CLAY.	

Notes:

Field Data

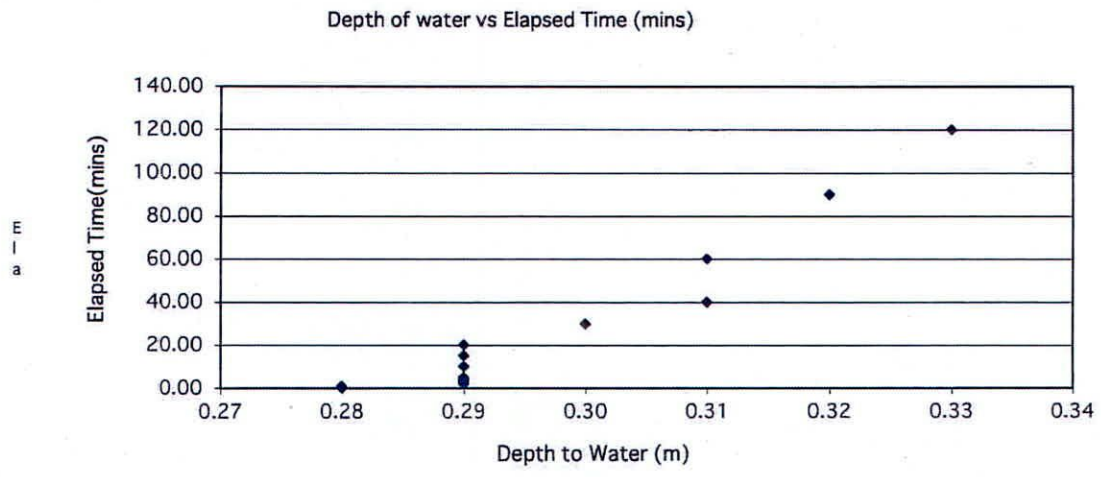
Depth to Water (m)	Elapsed Time (min)
0.28	0.00
0.28	1.00
0.29	2.00
0.29	3.00
0.29	4.00
0.29	5.00
0.29	10.00
0.29	15.00
0.29	20.00
0.30	30.00
0.31	40.00
0.31	60.00
0.32	90.00
0.33	120.00

Field Test

Depth of Pit (D)	0.50	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.50	m
Initial depth to Water =	0.28	m
Final depth to water =	0.33	m
Elapsed time (mins)=	120.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.9	m2
*Av. side area of permeable stratum over test period=	0.819	m2
Total Exposed area =	1.719	m2

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

f= 0.00022 m/min or 3.63583E-06 m/sec



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

Contract: Rathcoole Housing Contract No. 24101
Test No. IFT2
Client Stanley Developments
Date: 28/05/2022

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	None encountered
0.20	0.60	Firm brown slightly sandy gravelly CLAY with low cobble content.	

Notes:

Field Data

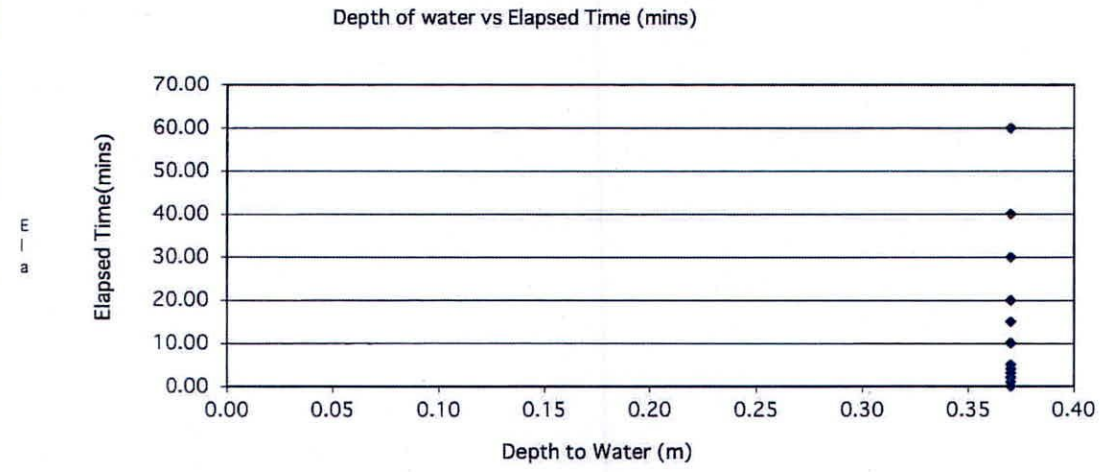
Depth to Water (m)	Elapsed Time (min)
0.37	0.00
0.37	1.00
0.37	2.00
0.37	3.00
0.37	4.00
0.37	5.00
0.37	10.00
0.37	15.00
0.37	20.00
0.37	30.00
0.37	40.00
0.37	60.00

Field Test

Depth of Pit (D)	0.60	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.80	m
Initial depth to Water =	0.37	m
Final depth to water =	0.37	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.72	m2
*Av. side area of permeable stratum over test period=	1.012	m2
Total Exposed area =	1.732	m2

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

f= 0 m/min or 0 m/sec



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

Contract: Rathcoole Housing Contract No. 24101
Test No. IFT3
Client Stanley Developments
Date: 28/05/2022

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	None encountered
0.20	0.50	Firm brown slightly sandy gravelly CLAY with low cobble content.	

Notes:

Field Data

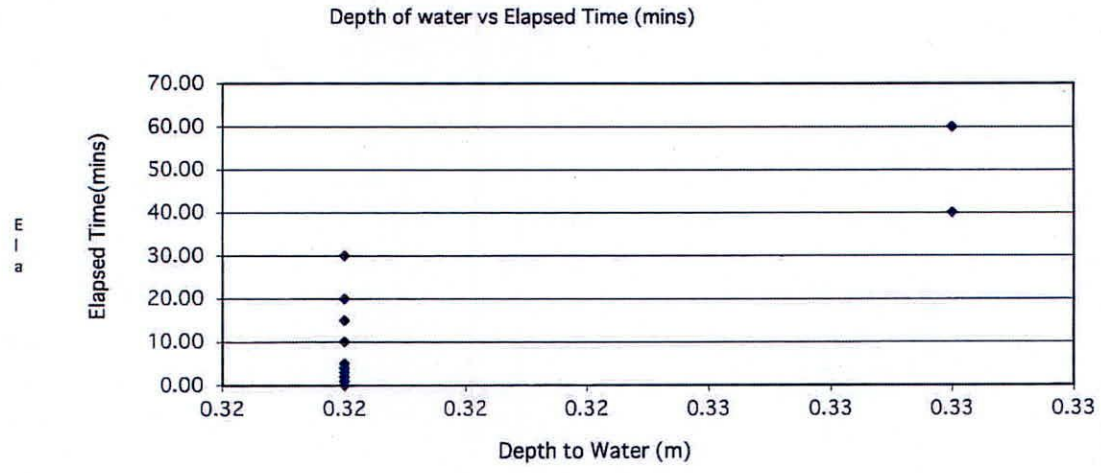
Depth to Water (m)	Elapsed Time (min)
0.32	0.00
0.32	1.00
0.32	2.00
0.32	3.00
0.32	4.00
0.32	5.00
0.32	10.00
0.32	15.00
0.32	20.00
0.32	30.00
0.33	40.00
0.33	60.00

Field Test

Depth of Pit (D)	0.50	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.70	m
Initial depth to Water =	0.32	m
Final depth to water =	0.33	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.68	m2
*Av. side area of permeable stratum over test period=	0.735	m2
Total Exposed area =	1.415	m2

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

f= 8E-05 m/min or 1.3349E-06 m/sec



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

Contract: Rathcoole Housing
Contract No. 24101
Test No. IFT4
Client Stanley Developments
Date: 28/05/2022

Summary of ground conditions

from	to	Description	Ground water
0.00	0.10	TOPSOIL	None encountered
0.10	0.40	Firm brown slightly sandy gravelly CLAY	
0.40	1.10	Firm to stiff brown gravelly CLAY. (slightly unstable)	
1.10	2.00	Stiff brown very gravelly CLAY with medium cobble content	

Notes:

Field Data

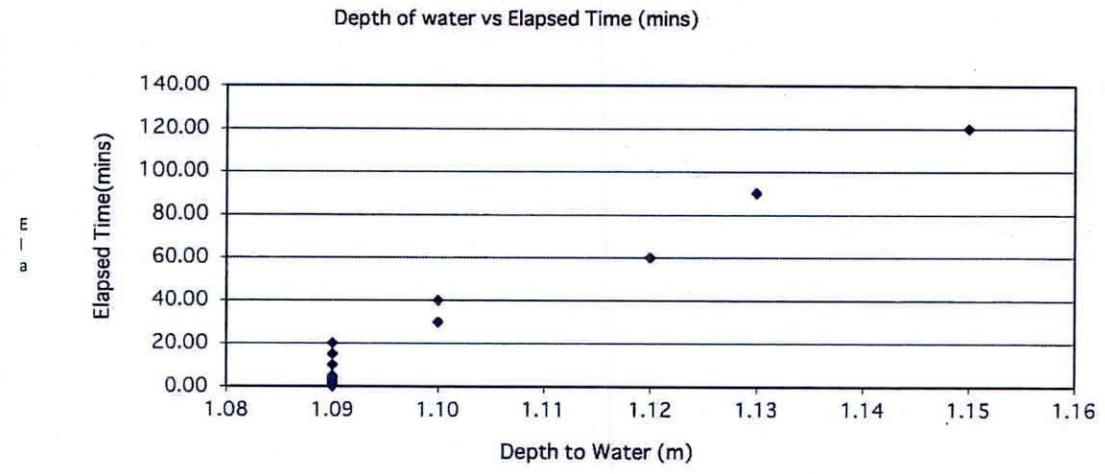
Depth to Water (m)	Elapsed Time (min)
1.09	0.00
1.09	1.00
1.09	2.00
1.09	3.00
1.09	4.00
1.09	5.00
1.09	10.00
1.09	15.00
1.09	20.00
1.10	30.00
1.10	40.00
1.12	60.00
1.13	90.00
1.15	120.00

Field Test

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.50	m
Length of Pit (L)	1.80	m
Initial depth to Water =	1.09	m
Final depth to water =	1.15	m
Elapsed time (mins)=	120.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.9	m2
*Av. side area of permeable stratum over test period=	4.048	m2
Total Exposed area =	4.948	m2

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

f= 9.1E-05 m/min or 1.51576E-06 m/sec



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

Contract: Rathcoole Housing Contract No. 24101
Test No. IFT5
Client Stanley Developments
Date: 28/05/2022

Summary of ground conditions

from	to	Description	Ground water
0.00	0.10	TOPSOIL	None encountered
0.10	0.60	Firm brown slightly sandy gravelly CLAY with low cobble content.	
0.60	1.20	Firm to stiff brown gravelly CLAY with low cobble content.	
1.20	1.90	Firm whiteish grey CLAY.	

Notes:

Field Data

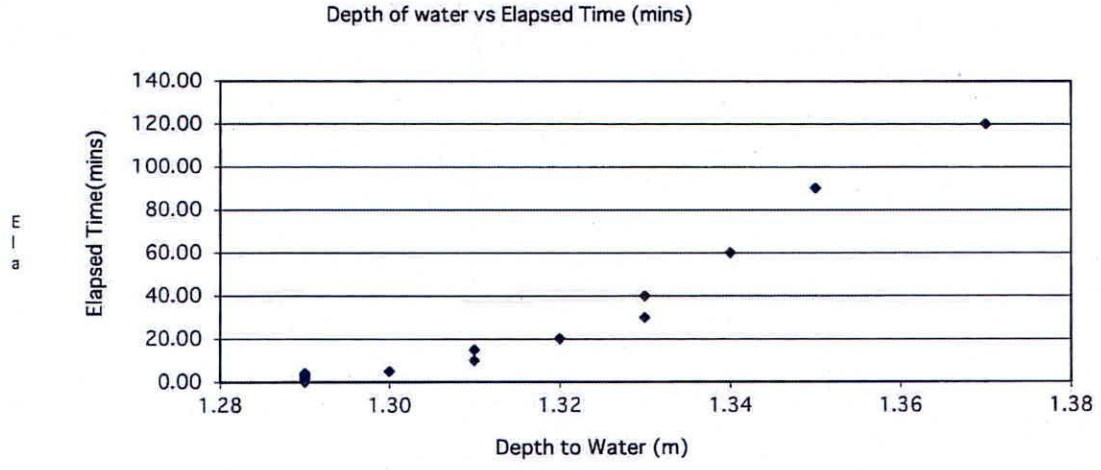
Depth to Water (m)	Elapsed Time (min)
1.29	0.00
1.29	1.00
1.29	2.00
1.29	3.00
1.29	4.00
1.30	5.00
1.31	10.00
1.31	15.00
1.32	20.00
1.33	30.00
1.33	40.00
1.34	60.00
1.35	90.00
1.37	120.00

Field Test

Depth of Pit (D)	1.90	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.70	m
Initial depth to Water =	1.29	m
Final depth to water =	1.37	m
Elapsed time (mins)=	120.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.68	m2
*Av. side area of permeable stratum over test period=	2.394	m2
Total Exposed area =	3.074	m2

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

f= 0.00015 m/min or 2.45789E-06 m/sec



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

Contract: Rathcoole Housing Contract No. 24101
Test No. IFT6
Client Stanley Developments
Date: 28/05/2022

Summary of ground conditions

from	to	Description	Ground water
0.00	0.10	TOPSOIL	None encountered
0.10	0.60	Firm brown slightly sandy gravelly CLAY with low cobble content.	
0.60	1.20	Firm to stiff brown gravelly CLAY with low cobble content.	
1.20	2.00	Firm whiteish grey CLAY (crumbles into white powder, sample at 1.5-2 m AA118026)	

Notes:

Field Data

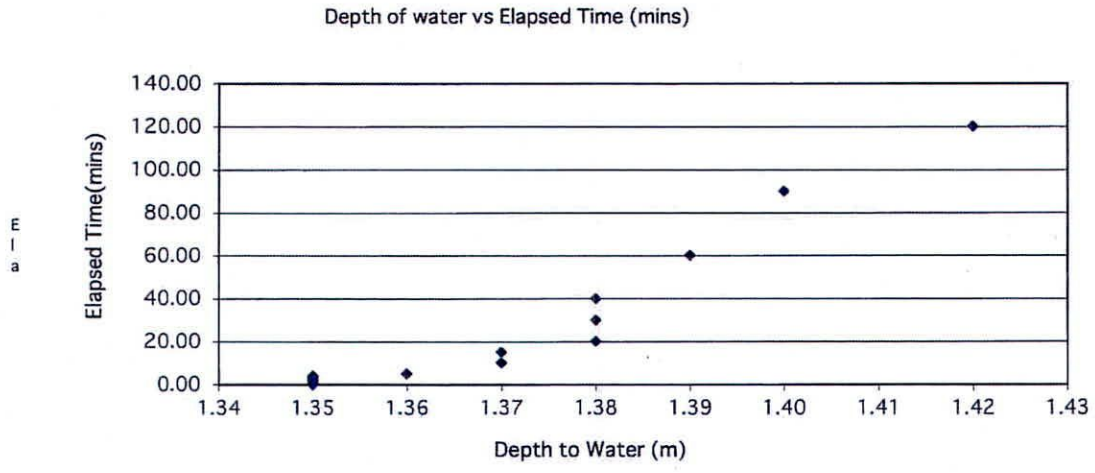
Depth to Water (m)	Elapsed Time (min)
1.35	0.00
1.35	1.00
1.35	2.00
1.35	3.00
1.35	4.00
1.36	5.00
1.37	10.00
1.37	15.00
1.38	20.00
1.38	30.00
1.38	40.00
1.39	60.00
1.40	90.00
1.42	120.00

Field Test

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.70	m
Initial depth to Water =	1.35	m
Final depth to water =	1.42	m
Elapsed time (mins)=	120.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.68	m2
*Av. side area of permeable stratum over test period=	2.583	m2
Total Exposed area =	3.263	m2

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

f= 0.00012 m/min or 2.02608E-06 m/sec



Appendix 3 Plate Bearing Test Results

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

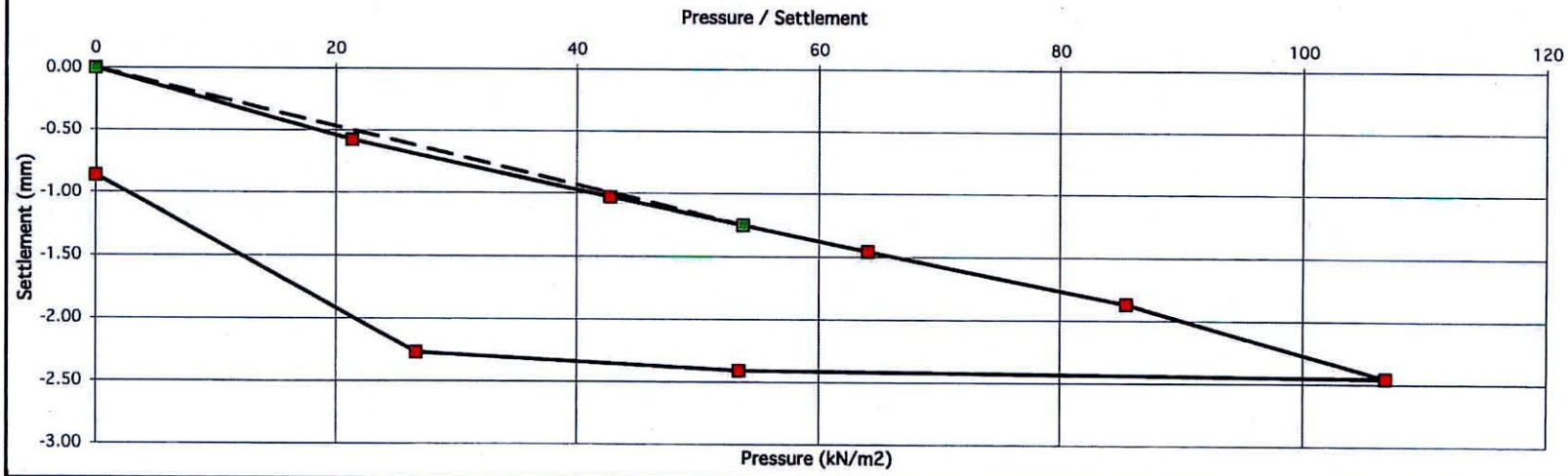
Reference No.	R134809
Contract	Rathcoole housing scheme
Test No.	PT1 Load
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 43

Modulus of subgrade reaction = 28 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 3.0 %

PLATE TEST REPORT SHEET (F3.1)

Reference No.	R134809
Contract	Rathcoole housing scheme
Test No.	PT1 Reload
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

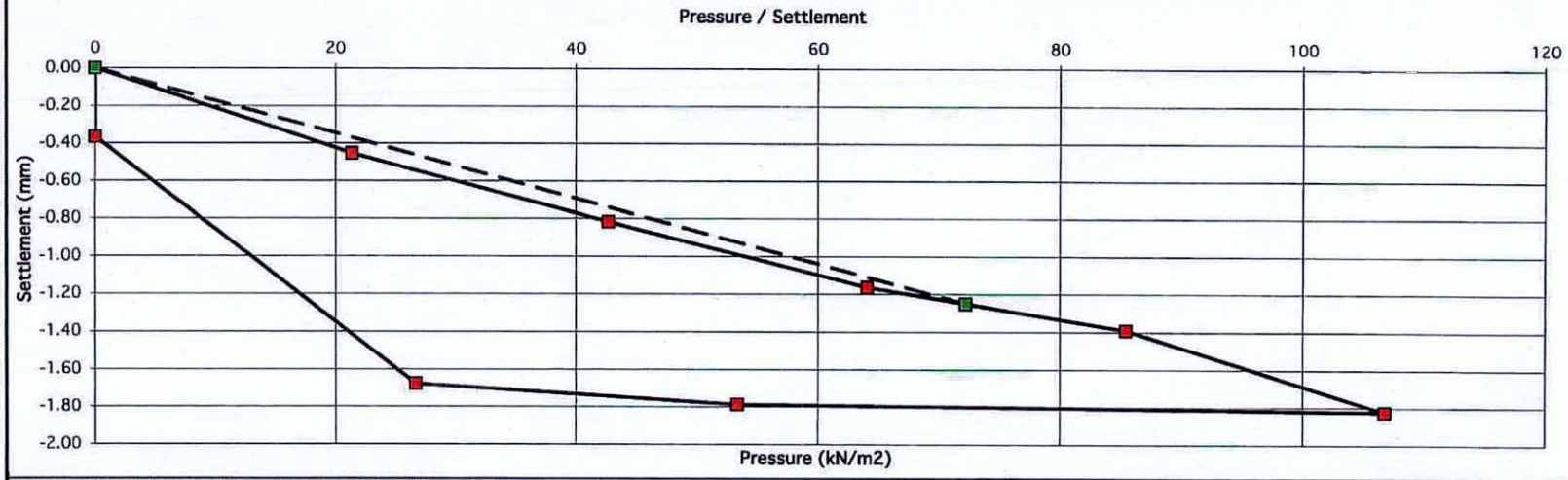
Applied Pressure/Settlement Curve

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 58

Modulus of subgrade reaction = 37 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 5.1 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

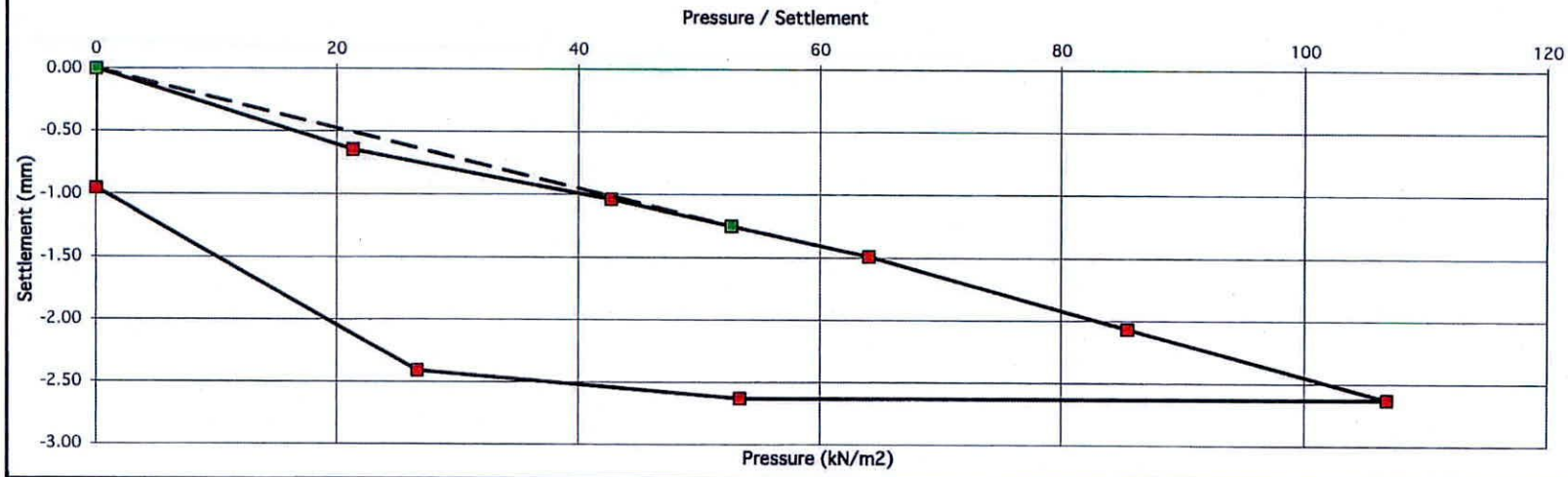
Reference No.	R134810
Contract	Rathcoole housing scheme
Test No.	PT2 Load
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 42

Modulus of subgrade reaction = 27 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.9 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

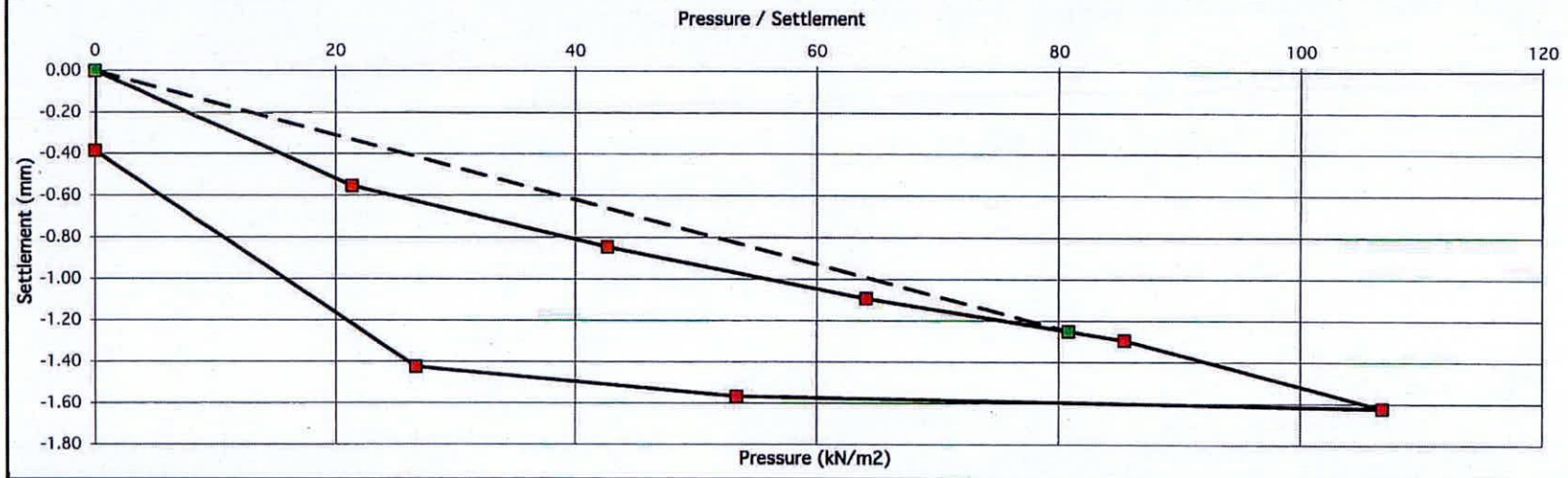
Reference No.	R134810
Contract	Rathcoole housing scheme
Test No.	PT2 Reload
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 65

Modulus of subgrade reaction = 42 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 6.2 %

PLATE TEST REPORT SHEET (F3.1)

Reference No.	R134811
Contract	Rathcoole housing scheme
Test No.	PT3 Load
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

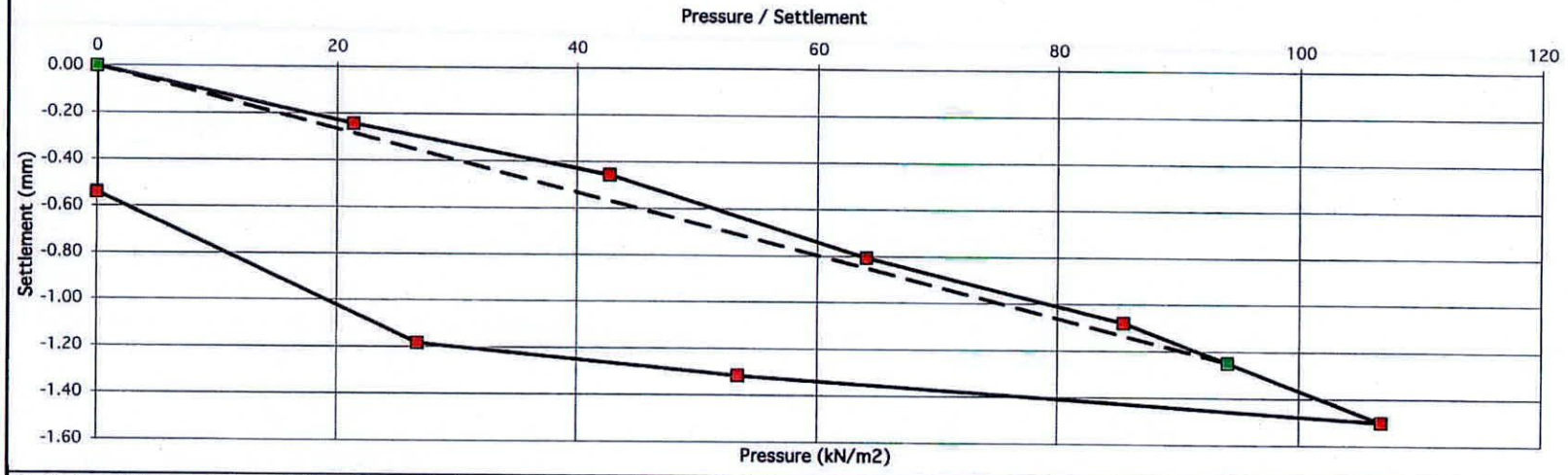
Applied Pressure/Settlement Curve

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 75

Modulus of subgrade reaction = 48 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 8.0 %

PLATE TEST REPORT SHEET (F3.1)

Reference No.	R134811
Contract	Rathcoole housing scheme
Test No.	PT3 Reload
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

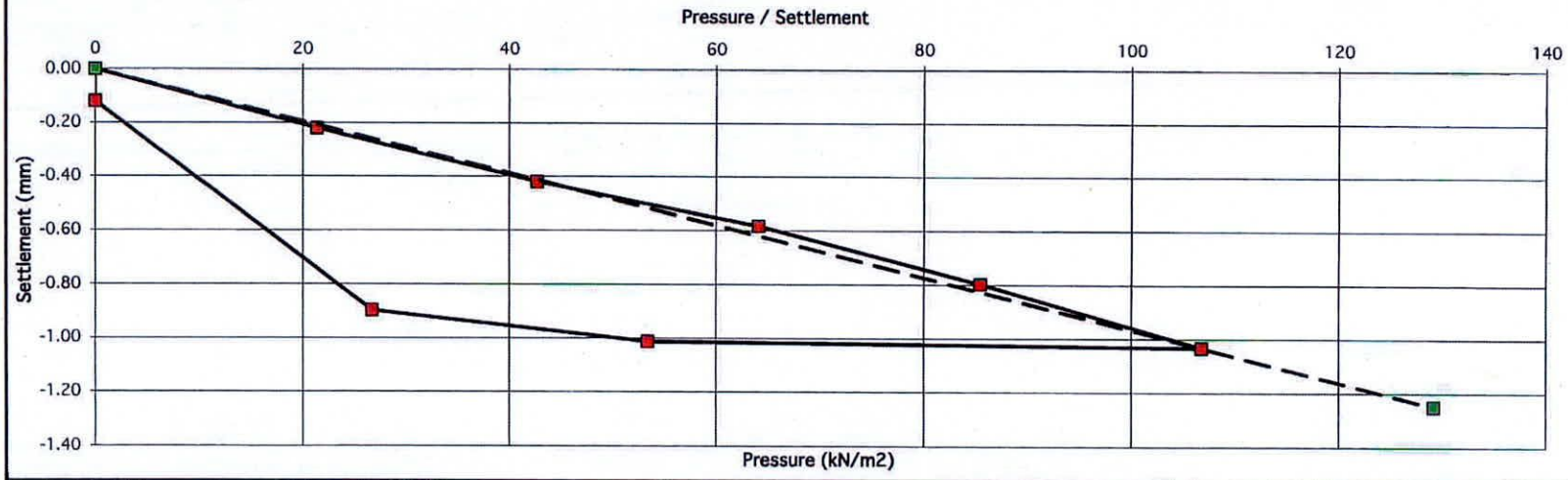
Applied Pressure/Settlement Curve

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 103

Modulus of subgrade reaction = 66 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 13.9 %

PLATE TEST REPORT SHEET (F3.1)

Reference No.	R134812
Contract	Rathcoole housing scheme
Test No.	PT4 Load
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

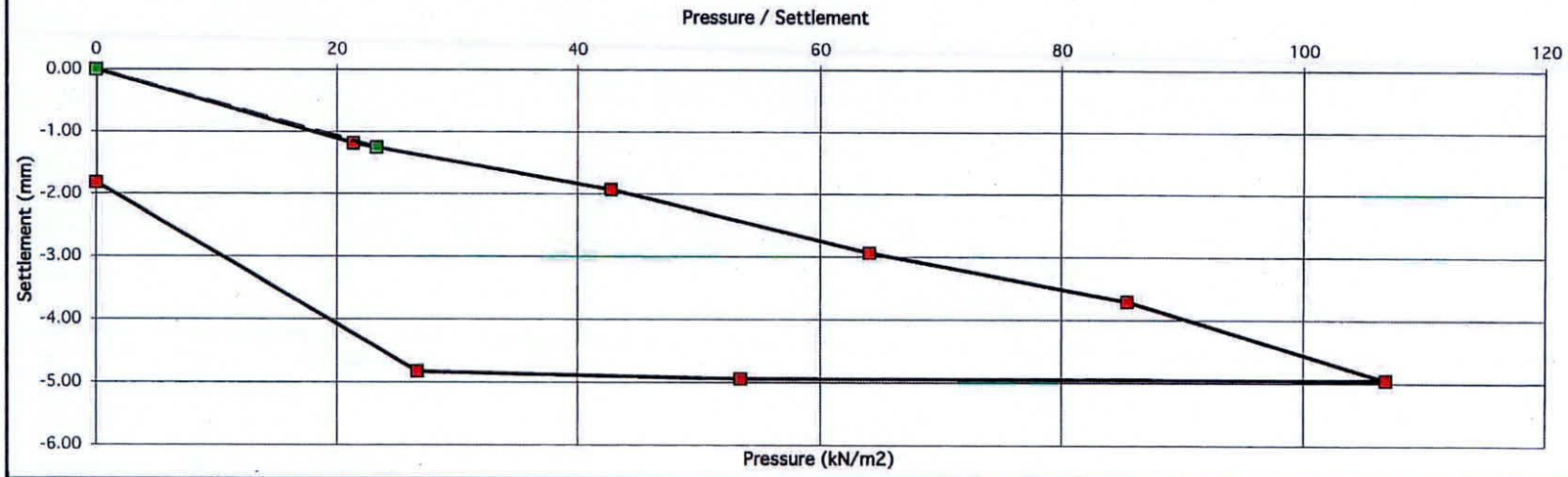
Applied Pressure/Settlement Curve

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 19

Modulus of subgrade reaction = 12 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.7 %

PLATE TEST REPORT SHEET (F3.1)

Reference No.	R134812
Contract	Rathcoole housing scheme
Test No.	PT4 Reload
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

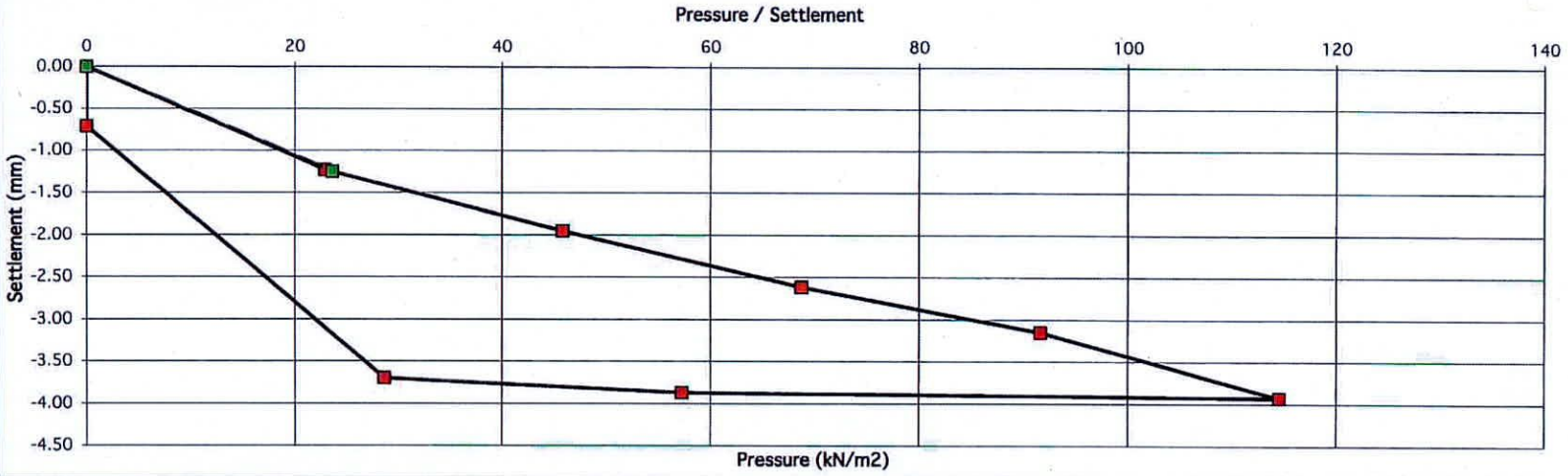
Applied Pressure/Settlement Curve

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 19

Modulus of subgrade reaction = 12 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.7 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

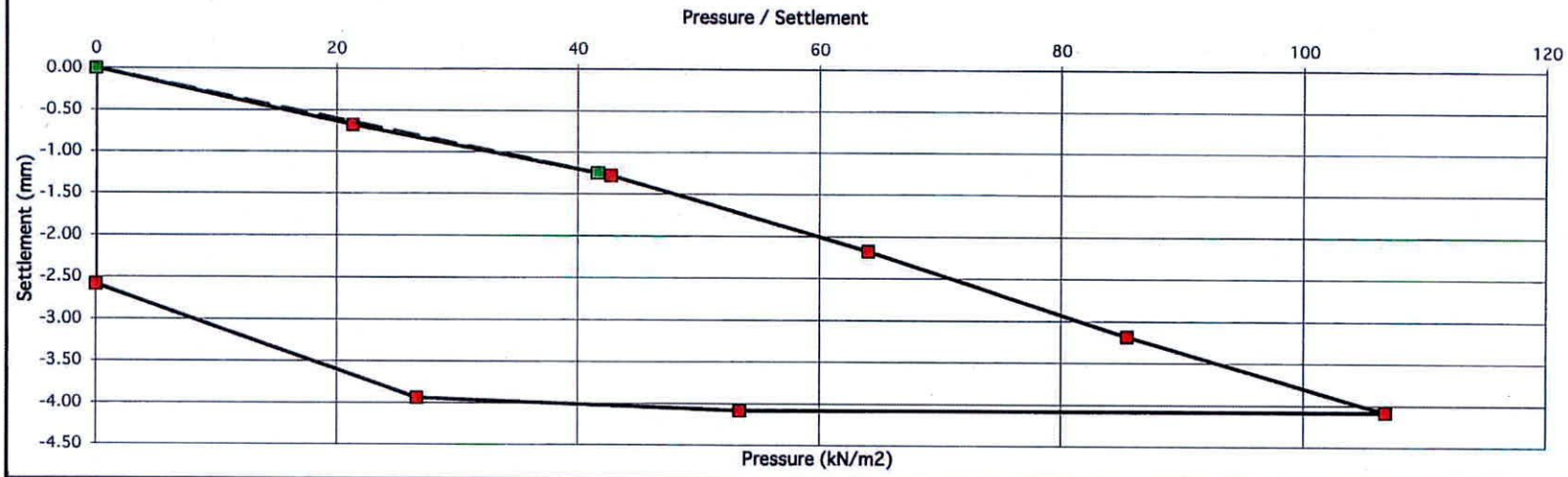
Reference No.	R134813
Contract	Rathcoole housing scheme
Test No.	PT5 Load
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 33

Modulus of subgrade reaction = 21 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.0 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

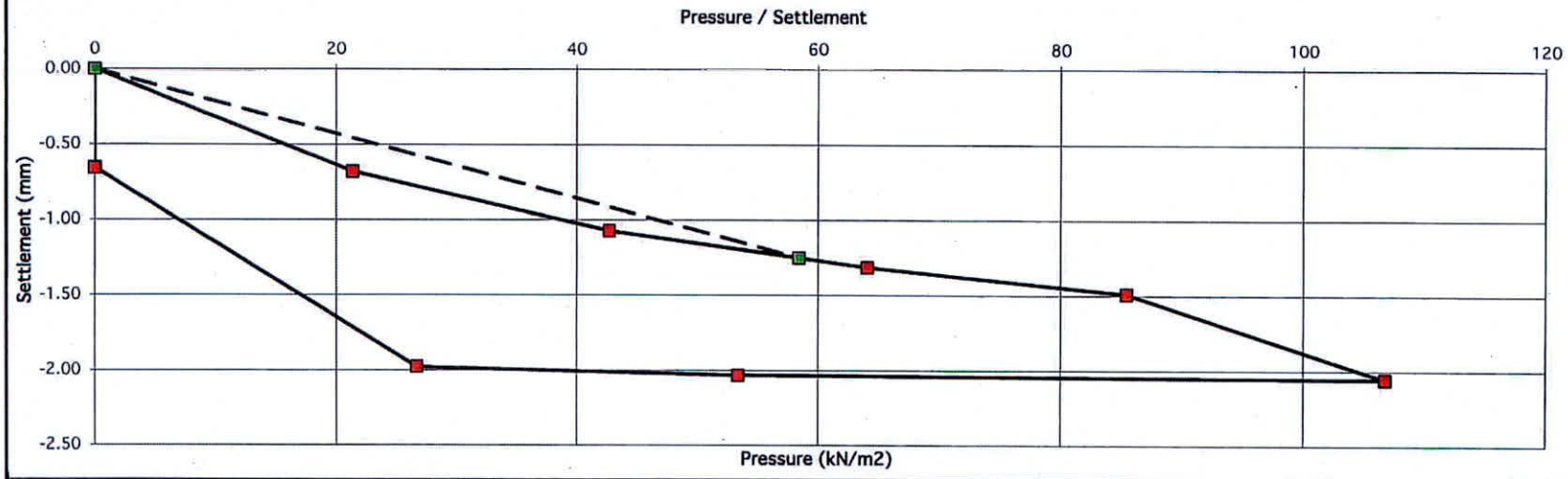
Reference No.	R134814
Contract	Rathcoole housing scheme
Test No.	PT5 Reload
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 47

Modulus of subgrade reaction = 30 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 3.5 %

PLATE TEST REPORT SHEET (F3.1)

Reference No.	R134814
Contract	Rathcoole housing scheme
Test No.	PT6 Load
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

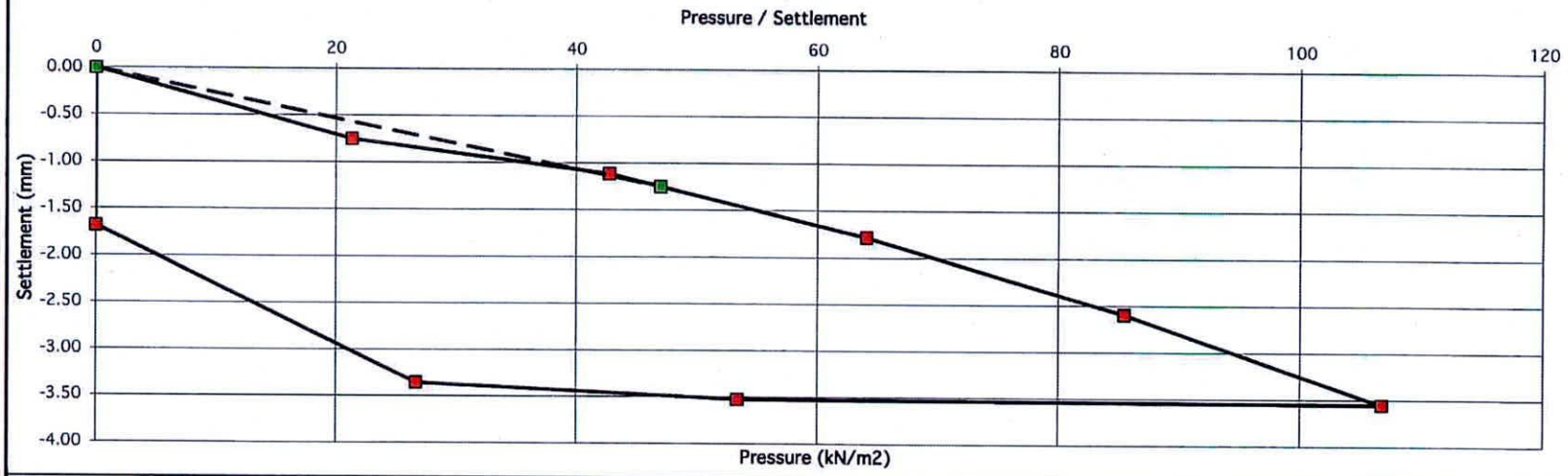
Applied Pressure/Settlement Curve

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 38

Modulus of subgrade reaction = 24 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.4 %

PLATE TEST REPORT SHEET (F3.1)

Reference No.	R134814
Contract	Rathcoole housing scheme
Test No.	PT6 Reload
Location	See site Map
Depth	350 mm
Client	Aecom
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	S.Hannon
Authorised by	H. Byrne
Date	27/05/2022

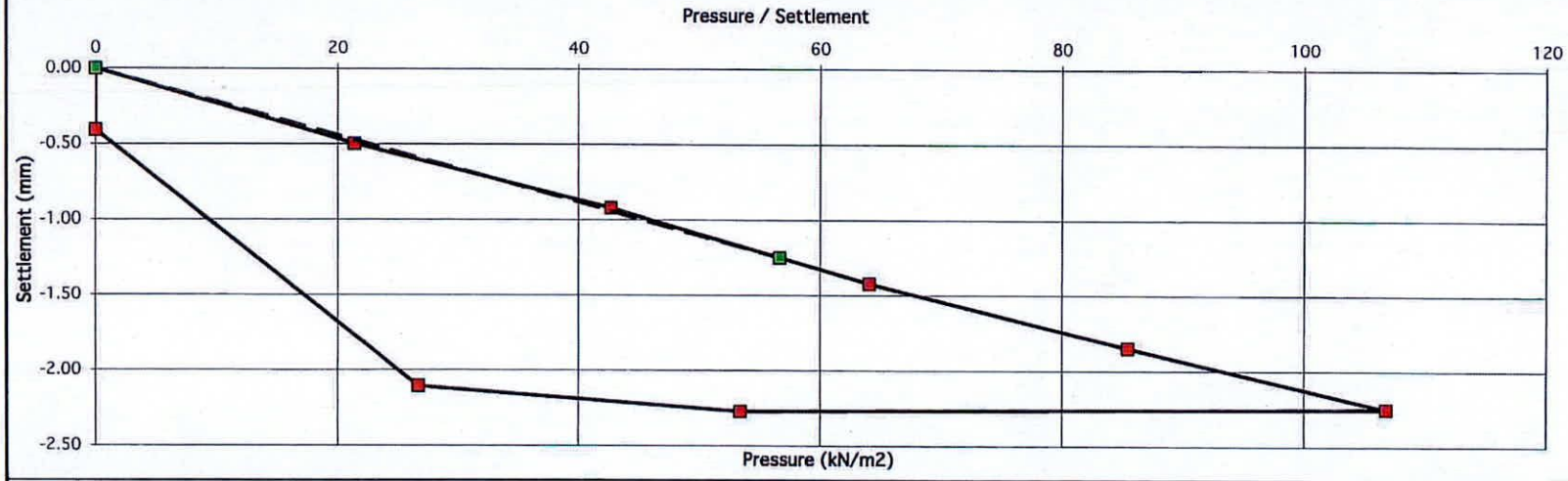
Applied Pressure/Settlement Curve

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

Brown gravelly clay

Sample Ref No. N/A

Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 45

Modulus of subgrade reaction = 29 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 3.3 %

Appendix 4 Site Plan

Test	Coordinates	
	North	East
IFT 1	226245	302231
IFT 2	226239	302155
IFT 3	226199	302221
IFT 4	226221	302200
IFT 5	226194	302277
IFT 6	226213	302293
CBR 1	226260	302179
CBR 2	226237	302226
CBR 3	226218	302293
CBR 4	226208	302131
CBR 5	226182	302206
CBR 6	226159	302276

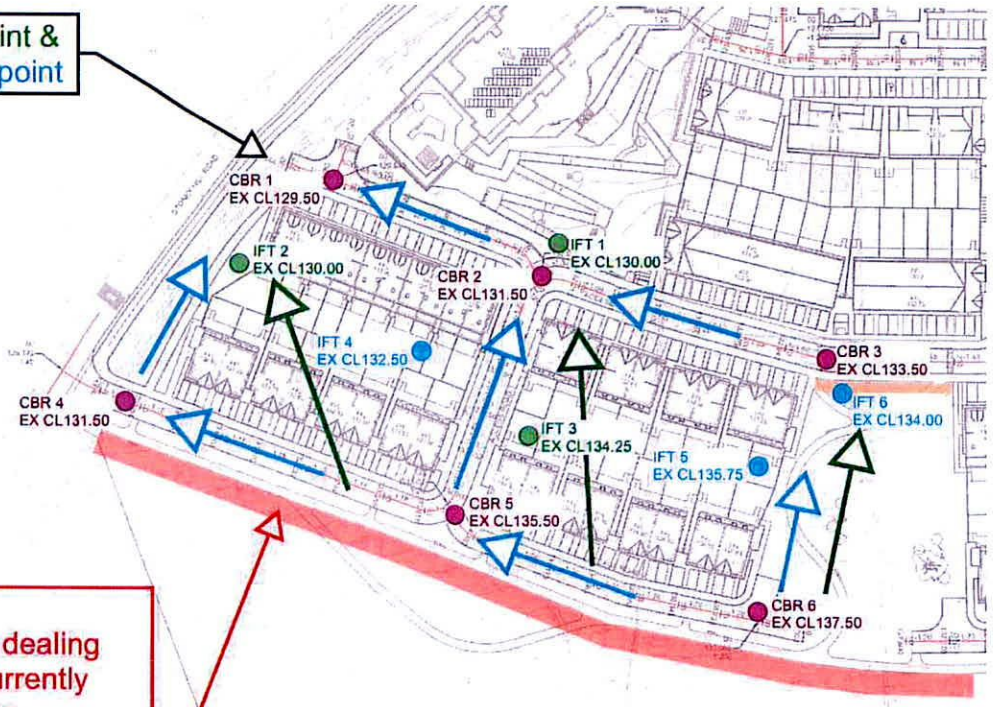
Natural low point &
Proposed low point

Natural overland flow direction

Proposed flow exceedance route

Potential Storage Swale

Upstream Overland
Flow Storage Swale



Key Item to Note
The SHD application did not proposed a strategy for dealing with the overland flow coming from the south, that currently drains across the land and likely infiltrates to a degree.

We have seen on a few recent projects, particularly with Wicklow County Council, the requirement to provide an upstream catchment analysis and overland flow strategy that includes attenuation, to deal with these flows to ensure that the development does not create issues elsewhere. For example, in the case, the flows ending up out on Stoney Hill Road.

INFILTRATION TEST
AT 0.5m BGL (3 no.)

INFILTRATION TEST
AT 2m BGL (3 no.)

CBR TEST (6 no.)

Project:	Stoney Hill Phase 1 Residential Scheme, Rathcoole
Code:	60659192
Title:	MU-CE-0001 - Infiltration and CBR Test Locations [01]
Date:	09/03/2022
Scale:	Not to Scale
Drawn:	LShaughnessy
Status:	For Information
File Path:	L:\Legacy\ledbl2fp001\DATA\DCS\Projects\CI\60659192_Stoneyhill\I\300_Communications\330_External\302_OUT\11_PDF Mark-ups

AECOM

Appendix H – MicroDrainage Surface Water 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)	5	PIMP (%)	100
M5-60 (mm)	21.300	Add Flow / Climate Change (%)	0
Ratio R	0.271	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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	6.035	0.302	20.0	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	11.354	0.568	20.0	0.225	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	9.208	0.460	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	61.541	0.308	200.0	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	5.750	0.058	100.0	0.022	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	3.280	0.164	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	6.723	0.022	300.0	0.150	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	29.420	0.785	37.5	0.031	4.00	0.0	0.600	o	375	Pipe/Conduit	
S4.000	39.766	0.398	100.0	0.068	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	10.902	0.545	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	36.009	0.960	37.5	0.064	0.00	0.0	0.600	o	375	Pipe/Conduit	
S5.000	41.203	0.412	100.0	0.090	4.00	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)
S1.000	50.00	4.03	132.000	0.000	0.0	0.0	0.0	2.94	116.9	0.0
S1.001	50.00	4.06	130.125	0.000	4.5	0.0	0.0	2.94	116.9	4.5
S1.002	50.00	4.12	129.557	0.000	4.5	0.0	0.0	2.94	116.8	4.5
S1.003	50.00	5.23	129.097	0.015	4.5	0.0	0.0	0.92	36.6	6.5
S2.000	50.00	4.07	133.025	0.022	0.0	0.0	0.0	1.31	52.0	3.0
S2.001	50.00	4.09	132.968	0.022	0.0	0.0	0.0	2.94	116.9	3.0
S1.004	50.00	5.35	128.714	0.188	4.5	0.0	0.0	0.90	63.8	29.9
S3.000	50.00	4.17	135.025	0.031	0.0	0.0	0.0	2.97	327.8	4.2
S4.000	50.00	4.51	135.673	0.068	0.0	0.0	0.0	1.31	52.0	9.2
S4.001	50.00	4.57	135.275	0.068	0.0	0.0	0.0	2.94	116.9	9.2
S3.001	50.00	4.77	133.794	0.163	0.0	0.0	0.0	2.97	327.7	22.1
S5.000	50.00	4.53	133.970	0.090	0.0	0.0	0.0	1.31	52.0	12.2

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
S5.001	2.092	0.105	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	9.572	0.255	37.5	0.086	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	57.424	0.144	400.0	0.011	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.006	6.538	0.016	400.0	0.054	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.000	50.075	0.250	200.0	0.016	4.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	12.911	0.065	200.0	0.125	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	25.483	0.064	400.0	0.012	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.008	37.882	0.095	400.0	0.088	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.009	8.306	0.021	400.0	0.096	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.010	2.108	0.005	400.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.011	10.295	0.051	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	26.956	0.225	120.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.013	43.556	0.218	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	13.043	0.065	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.015	51.444	1.513	34.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.016	12.390	0.620	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.017	37.684	1.256	30.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.018	72.222	1.111	65.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.019	22.321	0.149	150.0	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)
S5.001	50.00	4.54	133.558	0.090	0.0	0.0	0.0	2.94	116.9	12.2
S3.002	50.00	4.82	132.715	0.340	0.0	0.0	0.0	2.97	327.5	46.0
S1.005	50.00	6.21	128.467	0.539	4.5	0.0	0.0	1.11	241.1	77.4
S1.006	50.00	6.30	128.248	0.593	4.5	0.0	0.0	1.21	342.5	84.8
S6.000	50.00	4.91	128.278	0.016	0.0	0.0	0.0	0.92	36.6	2.1
S6.001	50.00	5.14	128.028	0.141	0.0	0.0	0.0	0.92	36.6	19.0
S1.007	50.00	6.65	127.588	0.745	4.5	0.0	0.0	1.21	342.5	105.4
S1.008	50.00	7.18	127.524	0.833	4.5	0.0	0.0	1.21	342.5	117.3
S1.009	50.00	7.29	127.430	0.930	4.5	0.0	0.0	1.21	342.5	130.4
S1.010	50.00	7.32	127.409	0.930	4.5	0.0	0.0	1.21	342.5	130.4
S1.011	50.00	4.19	127.404	0.000	6.0	0.0	0.0	0.92	36.6	6.0
S1.012	50.00	4.56	127.352	0.000	6.0	0.0	0.0	1.19	47.4	6.0
S1.013	50.00	5.35	127.128	0.000	6.0	0.0	0.0	0.92	36.6	6.0
S1.014	50.00	5.59	126.910	0.000	6.0	0.0	0.0	0.92	36.6	6.0
S1.015	50.00	5.97	126.845	0.000	6.0	0.0	0.0	2.25	89.5	6.0
S1.016	50.00	6.04	125.331	0.000	6.0	0.0	0.0	2.94	116.9	6.0
S1.017	50.00	6.30	124.712	0.000	6.0	0.0	0.0	2.40	95.3	6.0
S1.018	50.00	7.04	123.456	0.000	6.0	0.0	0.0	1.62	64.6	6.0
S1.019	50.00	7.39	122.345	0.000	6.0	0.0	0.0	1.07	42.4	6.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	133.500	1.500	Open Manhole	1200	S1.000	132.000	225				
SPond	132.500	2.375	Open Manhole	1200	S1.001	130.125	225	S1.000	131.698	225	1573
S2	130.532	0.975	Open Manhole	1200	S1.002	129.557	225	S1.001	129.557	225	
S3	130.417	1.320	Open Manhole	1500	S1.003	129.097	225	S1.002	129.097	225	
S4	134.250	1.225	Open Manhole	1200	S2.000	133.025	225				
S5	133.943	0.976	Open Manhole	1200	S2.001	132.968	225	S2.000	132.968	225	
S6	133.818	5.104	Open Manhole	1200	S1.004	128.714	300	S1.003	128.789	225	
								S2.001	132.804	225	4014
S7	136.973	1.948	Open Manhole	1200	S3.000	135.025	375				
S8	137.868	2.195	Open Manhole	1200	S4.000	135.673	225				
S9	136.250	0.975	Open Manhole	1200	S4.001	135.275	225	S4.000	135.275	225	
S10	135.815	2.021	Open Manhole	1200	S3.001	133.794	375	S3.000	134.240	375	446
								S4.001	134.730	225	786
S11	135.935	1.965	Open Manhole	1200	S5.000	133.970	225				
S12	134.534	0.976	Open Manhole	1200	S5.001	133.558	225	S5.000	133.558	225	
S13	134.409	1.694	Open Manhole	1200	S3.002	132.715	375	S3.001	132.834	375	119
								S5.001	133.453	225	588
S14	134.035	5.568	Open Manhole	1200	S1.005	128.467	525	S1.004	128.692	300	
								S3.002	132.460	375	3843
S15	132.194	3.946	Open Manhole	1200	S1.006	128.248	600	S1.005	128.323	525	
S16	129.703	1.425	Open Manhole	1200	S6.000	128.278	225				
S17	131.692	3.664	Open Manhole	1200	S6.001	128.028	225	S6.000	128.028	225	
S18	132.156	4.568	Open Manhole	1200	S1.007	127.588	600	S1.006	128.232	600	644
								S6.001	127.963	225	
S19	132.582	5.058	Open Manhole	1200	S1.008	127.524	600	S1.007	127.524	600	
S20	133.122	5.692	Open Manhole	1200	S1.009	127.430	600	S1.008	127.430	600	
S21	134.943	7.534	Open Manhole	1200	S1.010	127.409	600	S1.009	127.409	600	
S22	134.290	6.886	Open Manhole	1200	S1.011	127.404	225	S1.010	127.404	600	
S23	133.150	5.798	Open Manhole	1200	S1.012	127.352	225	S1.011	127.352	225	
S24	132.843	5.715	Open Manhole	1200	S1.013	127.128	225	S1.012	127.128	225	
S25	132.148	5.238	Open Manhole	1200	S1.014	126.910	225	S1.013	126.910	225	
S26	131.620	4.775	Open Manhole	1200	S1.015	126.845	225	S1.014	126.845	225	
S27	129.599	4.268	Open Manhole	1200	S1.016	125.331	225	S1.015	125.331	225	
S28	126.140	1.428	Open Manhole	1200	S1.017	124.712	225	S1.016	124.712	225	
S29	125.240	1.784	Open Manhole	1200	S1.018	123.456	225	S1.017	123.456	225	
S30	123.730	1.385	Open Manhole	1200	S1.019	122.345	225	S1.018	122.345	225	
SSurface	123.500	1.304	Open Manhole	0		OUTFALL		S1.019	122.196	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	702080.257	726212.480	702080.257	726212.480	Required	
SPond	702077.216	726217.693	702077.216	726217.693	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S2	702075.008	726228.830	702075.008	726228.830	Required	
S3	702084.214	726229.035	702084.214	726229.035	Required	
S4	702146.952	726202.230	702146.952	726202.230	Required	
S5	702141.549	726204.195	702141.549	726204.195	Required	
S6	702141.849	726207.461	702141.849	726207.461	Required	
S7	702217.456	726183.330	702217.456	726183.330	Required	
S8	702237.485	726176.586	702237.485	726176.586	Required	
S9	702198.540	726184.622	702198.540	726184.622	Required	
S10	702188.613	726189.129	702188.613	726189.129	Required	
S11	702192.970	726185.468	702192.970	726185.468	Required	
S12	702154.256	726199.572	702154.256	726199.572	Required	
S13	702154.827	726201.585	702154.827	726201.585	Required	
S14	702148.452	726208.726	702148.452	726208.726	Required	
S15	702169.245	726262.253	702169.245	726262.253	Required	
S16	702117.737	726289.840	702117.737	726289.840	Required	
S17	702164.723	726272.525	702164.723	726272.525	Required	
S18	702175.192	726264.969	702175.192	726264.969	Required	
S19	702199.431	726257.106	702199.431	726257.106	Required	
S20	702235.851	726246.683	702235.851	726246.683	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S21	702239.017	726239.004	702239.017	726239.004	Required	
S22	702241.125	726238.988	702241.125	726238.988	Required	
S23	702243.436	726249.021	702243.436	726249.021	Required	
S24	702217.191	726255.171	702217.191	726255.171	Required	
S25	702175.736	726268.536	702175.736	726268.536	Required	
S26	702164.723	726275.525	702164.723	726275.525	Required	
S27	702116.561	726293.606	702116.561	726293.606	Required	
S28	702105.837	726299.811	702105.837	726299.811	Required	
S29	702132.483	726326.457	702132.483	726326.457	Required	
S30	702190.131	726369.962	702190.131	726369.962	Required	
SSurface	702208.161	726383.122			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S1	133.500	132.000	1.275	Open Manhole	1200
S1.001	o	225	SPond	132.500	130.125	2.150	Open Manhole	1200
S1.002	o	225	S2	130.532	129.557	0.750	Open Manhole	1200
S1.003	o	225	S3	130.417	129.097	1.095	Open Manhole	1500
S2.000	o	225	S4	134.250	133.025	1.000	Open Manhole	1200
S2.001	o	225	S5	133.943	132.968	0.751	Open Manhole	1200
S1.004	o	300	S6	133.818	128.714	4.804	Open Manhole	1200
S3.000	o	375	S7	136.973	135.025	1.573	Open Manhole	1200
S4.000	o	225	S8	137.868	135.673	1.970	Open Manhole	1200
S4.001	o	225	S9	136.250	135.275	0.750	Open Manhole	1200
S3.001	o	375	S10	135.815	133.794	1.646	Open Manhole	1200
S5.000	o	225	S11	135.935	133.970	1.740	Open Manhole	1200
S5.001	o	225	S12	134.534	133.558	0.751	Open Manhole	1200
S3.002	o	375	S13	134.409	132.715	1.319	Open Manhole	1200
S1.005	o	525	S14	134.035	128.467	5.043	Open Manhole	1200
S1.006	o	600	S15	132.194	128.248	3.346	Open Manhole	1200
S6.000	o	225	S16	129.703	128.278	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	6.035	20.0	SPond	132.500	131.698	0.577	Open Manhole	1200
S1.001	11.354	20.0	S2	130.532	129.557	0.750	Open Manhole	1200
S1.002	9.208	20.0	S3	130.417	129.097	1.095	Open Manhole	1500
S1.003	61.541	200.0	S6	133.818	128.789	4.804	Open Manhole	1200
S2.000	5.750	100.0	S5	133.943	132.968	0.751	Open Manhole	1200
S2.001	3.280	20.0	S6	133.818	132.804	0.789	Open Manhole	1200
S1.004	6.723	300.0	S14	134.035	128.692	5.043	Open Manhole	1200
S3.000	29.420	37.5	S10	135.815	134.240	1.200	Open Manhole	1200
S4.000	39.766	100.0	S9	136.250	135.275	0.750	Open Manhole	1200
S4.001	10.902	20.0	S10	135.815	134.730	0.860	Open Manhole	1200
S3.001	36.009	37.5	S13	134.409	132.834	1.200	Open Manhole	1200
S5.000	41.203	100.0	S12	134.534	133.558	0.751	Open Manhole	1200
S5.001	2.092	20.0	S13	134.409	133.453	0.731	Open Manhole	1200
S3.002	9.572	37.5	S14	134.035	132.460	1.200	Open Manhole	1200
S1.005	57.424	400.0	S15	132.194	128.323	3.346	Open Manhole	1200
S1.006	6.538	400.0	S18	132.156	128.232	3.324	Open Manhole	1200
S6.000	50.075	200.0	S17	131.692	128.028	3.439	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.001	o	225	S17	131.692	128.028	3.439	Open Manhole	1200
S1.007	o	600	S18	132.156	127.588	3.968	Open Manhole	1200
S1.008	o	600	S19	132.582	127.524	4.458	Open Manhole	1200
S1.009	o	600	S20	133.122	127.430	5.092	Open Manhole	1200
S1.010	o	600	S21	134.943	127.409	6.934	Open Manhole	1200
S1.011	o	225	S22	134.290	127.404	6.661	Open Manhole	1200
S1.012	o	225	S23	133.150	127.352	5.573	Open Manhole	1200
S1.013	o	225	S24	132.843	127.128	5.490	Open Manhole	1200
S1.014	o	225	S25	132.148	126.910	5.013	Open Manhole	1200
S1.015	o	225	S26	131.620	126.845	4.550	Open Manhole	1200
S1.016	o	225	S27	129.599	125.331	4.043	Open Manhole	1200
S1.017	o	225	S28	126.140	124.712	1.203	Open Manhole	1200
S1.018	o	225	S29	125.240	123.456	1.559	Open Manhole	1200
S1.019	o	225	S30	123.730	122.345	1.160	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.001	12.911	200.0	S18	132.156	127.963	3.968	Open Manhole	1200
S1.007	25.483	400.0	S19	132.582	127.524	4.458	Open Manhole	1200
S1.008	37.882	400.0	S20	133.122	127.430	5.092	Open Manhole	1200
S1.009	8.306	400.0	S21	134.943	127.409	6.934	Open Manhole	1200
S1.010	2.108	400.0	S22	134.290	127.404	6.286	Open Manhole	1200
S1.011	10.295	200.0	S23	133.150	127.352	5.573	Open Manhole	1200
S1.012	26.956	120.0	S24	132.843	127.128	5.490	Open Manhole	1200
S1.013	43.556	200.0	S25	132.148	126.910	5.013	Open Manhole	1200
S1.014	13.043	200.0	S26	131.620	126.845	4.550	Open Manhole	1200
S1.015	51.444	34.0	S27	129.599	125.331	4.043	Open Manhole	1200
S1.016	12.390	20.0	S28	126.140	124.712	1.203	Open Manhole	1200
S1.017	37.684	30.0	S29	125.240	123.456	1.559	Open Manhole	1200
S1.018	72.222	65.0	S30	123.730	122.345	1.160	Open Manhole	1200
S1.019	22.321	150.0	SSurface	123.500	122.196	1.079	Open Manhole	0

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)
S1.019	SSurface	123.500	122.196	122.100	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	0.900	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Simulation Criteria for Storm

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	21.300	Storm Duration (mins)	30
Ratio R	0.271		

Online Controls for Storm

Weir Manhole: SPond, DS/PN: S1.001, Volume (m³): 2.9

Discharge Coef 0.544 Width (m) 0.100 Invert Level (m) 131.350

Hydro-Brake® Optimum Manhole: S22, DS/PN: S1.011, Volume (m³): 8.0

Unit Reference	MD-SHE-0101-6000-2000-6000
Design Head (m)	2.000
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	127.404
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	6.0	Kick-Flo®	0.900	4.1
Flush-Flo™	0.438	5.2	Mean Flow over Head Range	-	4.8

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	3.3	0.800	4.7	2.000	6.0	4.000	8.3	7.000	10.8
0.200	4.7	1.000	4.3	2.200	6.3	4.500	8.8	7.500	11.2
0.300	5.1	1.200	4.7	2.400	6.5	5.000	9.2	8.000	11.5
0.400	5.2	1.400	5.1	2.600	6.8	5.500	9.7	8.500	11.9
0.500	5.2	1.600	5.4	3.000	7.3	6.000	10.1	9.000	12.2
0.600	5.1	1.800	5.7	3.500	7.8	6.500	10.5	9.500	12.5

Storage Structures for Storm

Tank or Pond Manhole: SPond, DS/PN: S1.001

Invert Level (m) 130.125

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	225.0	1.000	225.0	1.001	0.0

Filter Drain Manhole: S4, DS/PN: S2.000

Infiltration Coefficient Base (m/hr)	0.00481	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.00481	Pipe Depth above Invert (m)	0.450
Safety Factor	2.0	Number of Pipes	1
Porosity	0.45	Slope (1:X)	100.0
Invert Level (m)	133.025	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	5.8		

Filter Drain Manhole: S8, DS/PN: S4.000

Infiltration Coefficient Base (m/hr)	0.00885	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.00885	Pipe Depth above Invert (m)	0.450
Safety Factor	2.0	Number of Pipes	1
Porosity	0.45	Slope (1:X)	100.0
Invert Level (m)	135.673	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	39.7		

Filter Drain Manhole: S11, DS/PN: S5.000

Infiltration Coefficient Base (m/hr)	0.00481	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.00481	Pipe Depth above Invert (m)	0.450
Safety Factor	2.0	Number of Pipes	1
Porosity	0.45	Slope (1:X)	100.0
Invert Level (m)	133.970	Cap Volume Depth (m)	0.000
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	41.2		

Cellular Storage Manhole: S22, DS/PN: S1.011

Invert Level (m)	127.404	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00729	Porosity	0.60
Infiltration Coefficient Side (m/hr)	0.00729		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	610.0	305.0	2.000	610.0	532.2	2.001	0.0	532.2

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

Simulation Criteria

Areal Reduction Factor 0.900 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 2 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 21.300 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.271 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 0.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Summer	1	+0%					132.000	-0.225	0.000
S1.001	SPond	2880 Summer	100	+20%	1/240 Summer				131.439	1.089	0.000
S1.002	S2	2880 Summer	100	+20%					129.587	-0.195	0.000
S1.003	S3	15 Summer	100	+20%	100/15 Summer				129.453	0.131	0.000
S2.000	S4	15 Summer	100	+20%					133.128	-0.122	0.000
S2.001	S5	15 Summer	100	+20%					133.045	-0.148	0.000
S1.004	S6	15 Summer	100	+20%	30/15 Summer				129.436	0.422	0.000
S3.000	S7	15 Summer	100	+20%					135.090	-0.310	0.000
S4.000	S8	15 Summer	100	+20%					135.839	-0.059	0.000
S4.001	S9	15 Summer	100	+20%					135.380	-0.120	0.000
S3.001	S10	15 Summer	100	+20%					133.949	-0.220	0.000
S5.000	S11	15 Summer	100	+20%	100/15 Summer				134.230	0.035	0.000
S5.001	S12	15 Summer	100	+20%	100/15 Summer				133.796	0.013	0.000
S3.002	S13	15 Summer	100	+20%	100/15 Summer				133.106	0.016	0.000
S1.005	S14	15 Summer	100	+20%	100/15 Summer				129.225	0.233	0.000
S1.006	S15	1440 Winter	100	+20%	100/15 Summer				129.210	0.361	0.000
S6.000	S16	1440 Winter	100	+20%	100/15 Summer				129.211	0.708	0.000
S6.001	S17	1440 Winter	100	+20%	30/15 Summer				129.211	0.958	0.000
S1.007	S18	1440 Winter	100	+20%	30/30 Summer				129.209	1.021	0.000
S1.008	S19	1440 Winter	100	+20%	30/15 Summer				129.208	1.084	0.000
S1.009	S20	1440 Winter	100	+20%	30/15 Summer				129.207	1.177	0.000
S1.010	S21	1440 Winter	100	+20%	30/15 Summer				129.206	1.197	0.000
S1.011	S22	1440 Winter	100	+20%	1/30 Summer				129.206	1.577	0.000
S1.012	S23	1440 Winter	100	+20%					127.406	-0.171	0.000
S1.013	S24	1440 Winter	100	+20%					127.188	-0.164	0.000
S1.014	S25	1440 Winter	100	+20%					126.974	-0.161	0.000
S1.015	S26	1440 Winter	100	+20%					126.882	-0.187	0.000
S1.016	S27	1440 Winter	100	+20%					125.366	-0.191	0.000
S1.017	S28	1440 Winter	100	+20%					124.749	-0.188	0.000
S1.018	S29	1440 Winter	100	+20%					123.501	-0.179	0.000
S1.019	S30	1440 Winter	100	+20%					122.402	-0.168	0.000

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.00			0.0	OK	
S1.001	SPond	0.04			3.7	SURCHARGED	
S1.002	S2	0.04			3.7	OK	
S1.003	S3	0.31			11.0	SURCHARGED	
S2.000	S4	0.43		5	14.6	OK	
S2.001	S5	0.26			14.6	OK	
S1.004	S6	2.47			112.9	SURCHARGED	
S3.000	S7	0.07			20.4	OK	
S4.000	S8	0.87		3	42.7	OK	
S4.001	S9	0.43			42.8	OK	
S3.001	S10	0.35			103.1	OK	
S5.000	S11	1.02		3	50.5	SURCHARGED	
S5.001	S12	1.10			50.3	SURCHARGED	
S3.002	S13	1.02			201.2	SURCHARGED	
S1.005	S14	1.40			305.3	SURCHARGED	
S1.006	S15	0.10			20.2	SURCHARGED	
S6.000	S16	0.01			0.5	SURCHARGED	
S6.001	S17	0.14			4.5	SURCHARGED	
S1.007	S18	0.09			24.5	SURCHARGED	
S1.008	S19	0.09			27.4	SURCHARGED	
S1.009	S20	0.17			30.5	SURCHARGED	
S1.010	S21	0.13			30.5	SURCHARGED	
S1.011	S22	0.19		1200	5.7	SURCHARGED	
S1.012	S23	0.13			5.7	OK	
S1.013	S24	0.16			5.7	OK	
S1.014	S25	0.18			5.7	OK	
S1.015	S26	0.07			5.7	OK	
S1.016	S27	0.06			5.7	OK	
S1.017	S28	0.06			5.7	OK	
S1.018	S29	0.09			5.7	OK	
S1.019	S30	0.15			5.7	OK	

Appendix I – Attenuation Tank Details

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
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STONEY HILL

RATHCOOLE, CO. DUBLIN

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS, AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED, AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER, 2) MAXIMUM PERMANENT (75-YR) COVER LOAD, AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND, b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLOURS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUB-GRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm).
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUB-SURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILISED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

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

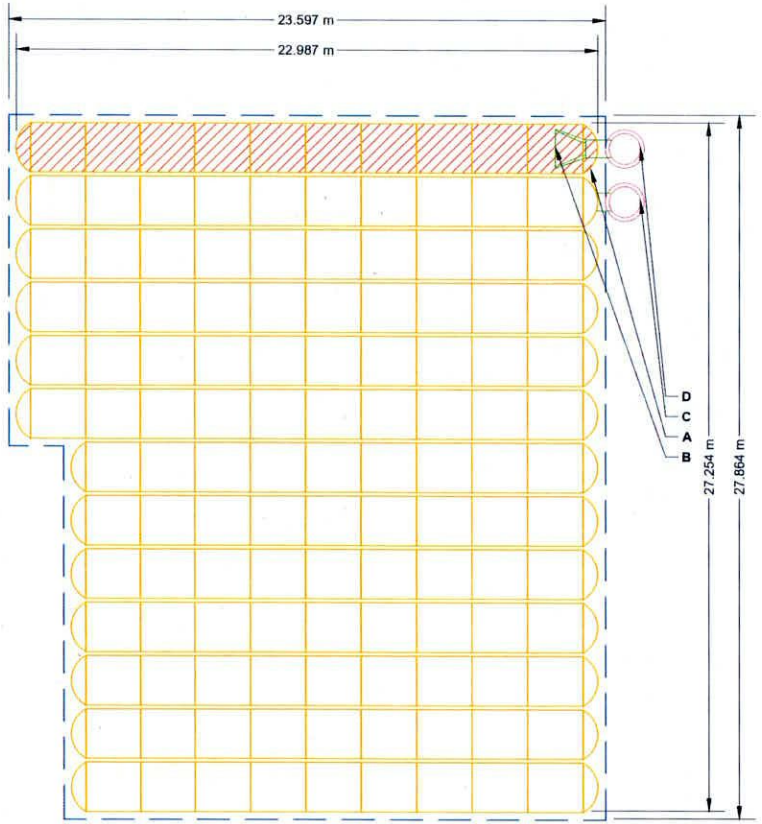
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

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

PROPOSED LAYOUT		PROPOSED ELEVATIONS	
123	STORMTECH MC-3500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	131.385
26	STORMTECH MC-3500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	129.557
460	STONE ABOVE (mm)	TOP OF STONE:	129.407
400	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	129.404
40	STONE VOID	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	129.404
738.2	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	129.404
		TOP OF MC-3500 CHAMBER:	128.947
		600 mm ISOLATOR ROW PLUS INVERT:	127.856
		600 mm BOTTOM CONNECTION INVERT:	127.856
625.3	SYSTEM AREA (m^2)	BOTTOM OF MC-3500 CHAMBER:	127.804
102.9	SYSTEM PERIMETER (m)	BOTTOM OF STONE:	127.404

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	600 mm BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	52 mm	
FLAMP	B	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: MC350024RAMP		
CONCRETE STRUCTURE	C	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		198 L/s OUT
CONCRETE STRUCTURE	D	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		



ISOLATOR ROW PLUS (SEE DETAIL)

NO WOVEN GEOTEXTILE

BED LIMITS

NOTES

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

STONEY HILL
RATHCOOLE, CO. DUBLIN

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

DATE	DRW	CHK	DESCRIPTION

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

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

StormTech® Chamber System

888-892-2694 | WWW.STORMTECH.COM

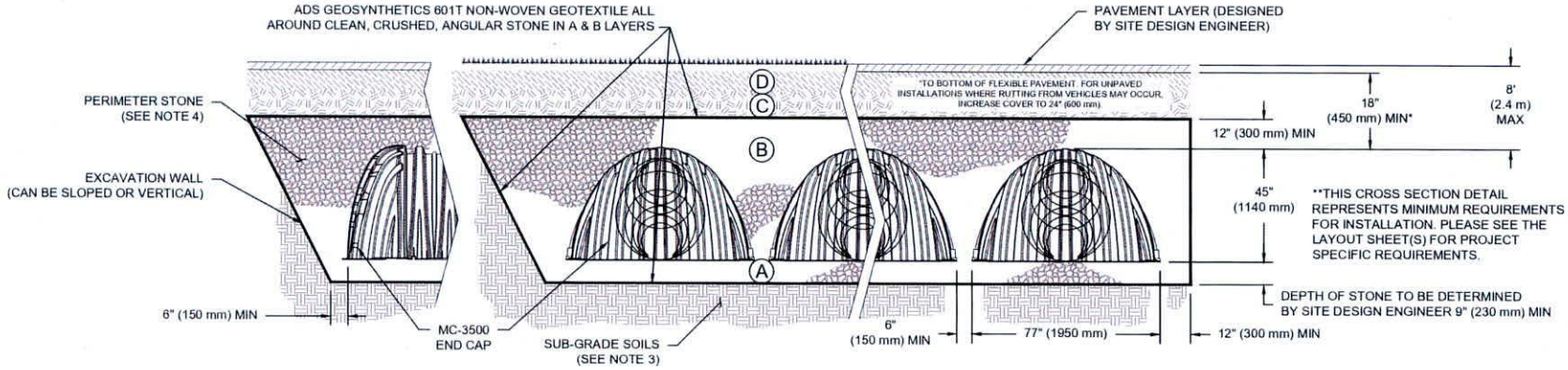
SCALE = 1 : 200

SHEET
2 OF 5

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

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

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



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUB-GRADE SOILS, AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23°, AND C) CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLOURS.

STONEY HILL
RATHCOOLE, CO. DUBLIN
DATE: DRAWN: JC
PROJECT #: CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

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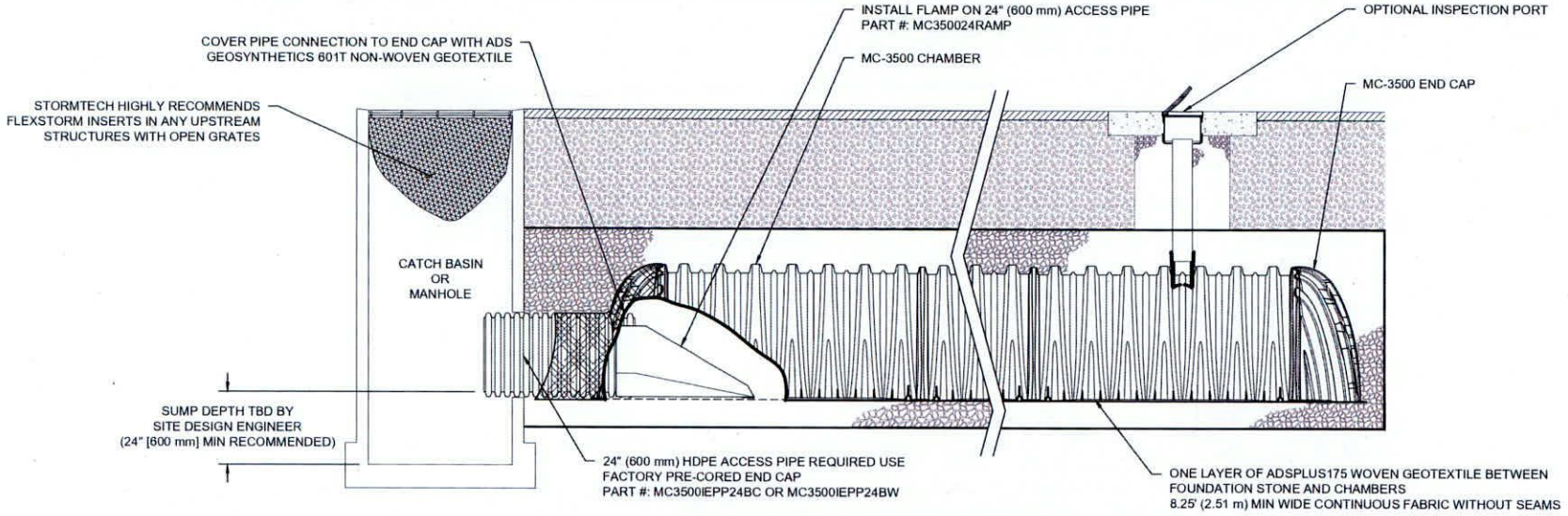

MC-3500 ISOLATOR ROW PLUS DETAIL

NTS

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

INSPECTION & MAINTENANCE

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

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

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

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

NOTES

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

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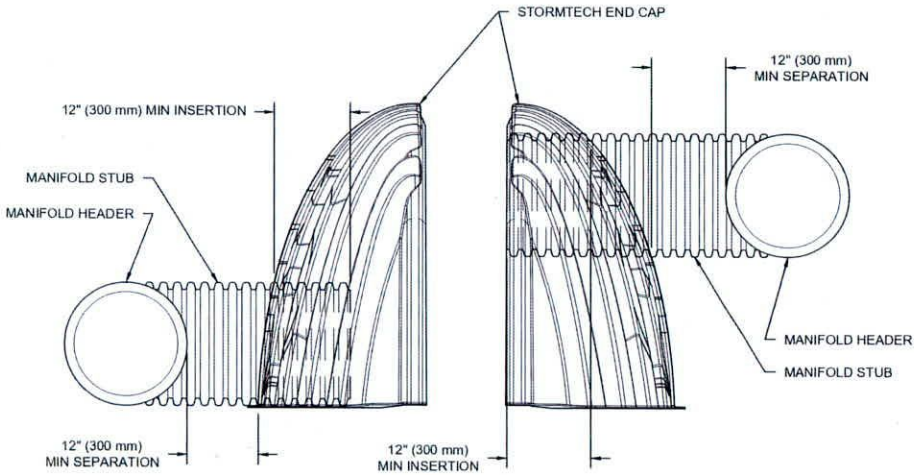
SHEET
4 OF 5

MC-SERIES END CAP INSERTION DETAIL

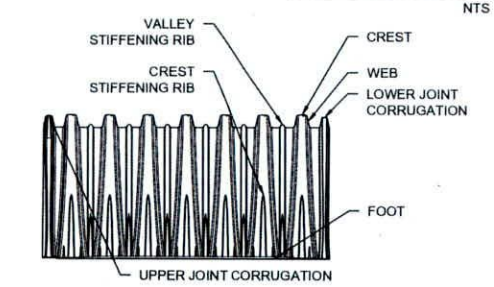
NTS

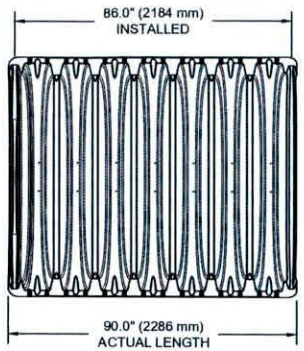


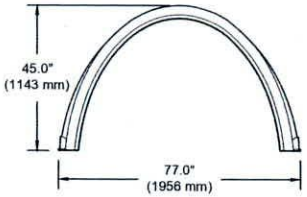
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

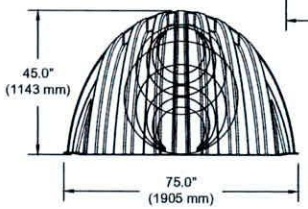
MC-3500 TECHNICAL SPECIFICATION

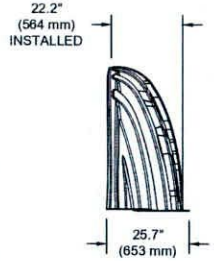
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

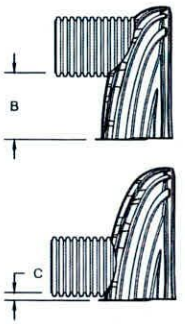
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

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Appendix J – Maintenance Checklist

- a plan clearly showing the extent of the adopted area along with easements and rights of way for access to carry out maintenance. If other parties are responsible for different parts of a scheme, this should be clearly shown on the plan.
- the access that is required to each surface water management component for maintenance purposes and a plan for the safe and sustainable removal and disposal of waste periodically arising from the drainage system
- a review of the work to be undertaken, based on regular day-to-day maintenance, occasional tasks and remedial work. Details of the likely maintenance requirements for each SuDS element are provided in this Manual. Maintenance requirements for proprietary systems should be provided by the manufacturer or supplier.
- the maintenance specification – detailing the materials to be used and the standard of work required. A specification should describe how the work should be carried out and should contain clauses giving general instructions to the maintenance contractor.
- the maintenance schedule of work – itemising the tasks to be undertaken and the frequency at which they should be performed so that an acceptable long-term performance standard is secured. This schedule can then be priced and checked on site, and it can form the basis of an inspection log where appropriate. The schedule should be a living document because it may change, where inspections advise changes to the scheme maintenance requirements.
- contact sheet and any extra guidance notes – eg action plan for dealing with accidental spillages
- photographic records of the inspections. This can pick up long-term changes that might not be apparent on a single visit, especially where inspections are carried out by different members of staff.

Note: An example of a Maintenance Plan is available in Box B.2.

B.8.3 Maintenance inspection checklist

This checklist is a generic list that can be added to, or have items removed from it, to suit a particular site. The exact content of the checklist will depend on the combination of different SuDS components used in a scheme. Checklists should be selected based on the combination of elements in the drainage system to provide a bespoke inspection report.

The objective of this checklist is to:

- confirm that appropriate routine maintenance of the system is being undertaken
- confirm that the system is continuing to operate effectively
- identify any remedial works required
- provide a consistent record of the condition and performance of the system.

It is not a checklist of maintenance items, which is covered in Chapters 11 to 23 of this manual (Table B.24). It is a checklist to facilitate consistent inspection of the condition of the system. It can be used by any organisation responsible for the long-term maintenance of the SuDS system as a recording process, or by a subcontracted organisation as part of their client reporting procedures.

Inspections should comply with all relevant health and safety legislation (The Management of Health and Safety at Work Regulations 1999) including the development of risk assessments for working close to or in water.

Inspections should ideally be carried out monthly (and no less than three-monthly), at the same time as other routine maintenance activities.

TABLE B.24 Where to find information on maintenance activities and frequencies

Component	Ref (within this manual)
Green roofs	Section 12.12
Infiltration systems	Section 13.12
Proprietary systems	Section 14.12
Filter strips	Section 15.12
Filter drains	Section 16.12
Swales	Section 17.12
Bioretention systems	Section 18.12
Trees	Section 19.12
Pervious pavements	Section 20.14
Attenuation storage tanks	Section 21.13
Detention basins	Section 22.12
Ponds and wetlands	Section 23.12

TABLE B.25 SuDS maintenance inspection checklist

General information			
Site ID			
Site location and co-ordinates (GIS if appropriate)			
Elements forming the SuDS scheme		Approved drawing reference(s)	
Inspection frequency		Approved specification reference	
Type of development		Specific purpose of any parts of the scheme (eg biodiversity, wildlife and visual aspects)	

Inspection date								
	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date Completed
General inspection items								
Is there any evidence of erosion, channelling, ponding (where not desirable) or other poor hydraulic performance?								
Is there any evidence of accidental spillages, oils, poor water quality, odours or nuisance insects?								
Have any health and safety risks been identified to either the public or maintenance operatives?								
Is there any deterioration in the surface of permeable or porous surfaces (eg rutting, spreading of blocks or signs of ponding water)?								
Silt/sediment accumulation								
Is there any sediment accumulation at inlets (or other defined accumulation zones such as the surface of filter drains or infiltration basins and within proprietary devices)? If yes, state depth (mm) and extent. Is removal required? If yes, state waste disposal requirements and confirm that all waste management requirements have been complied with (consult environmental regulator)								

continued...

continued from...

TABLE B.25 SuDS maintenance inspection checklist

Inspection date								
	Details	**Y/N**	**Action required**	**Date completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
Is surface clogging visible (potentially problematic where water has to soak into the underlying construction or ground (eg underdrained swale or infiltration basin)?								
Does permeable or porous surfacing require sweeping to remove silt?								
System blockages and litter build-up								
Is there evidence of litter accumulation in the system? If yes, is this a blockage risk?								
Is there any evidence of any other clogging or blockage of outlets or drainage paths?								
Vegetation								
Is the vegetation condition satisfactory (density, weed growth, coverage etc)? (Check against approved planting regime.)								
Does any part of the system require weeding, pruning or mowing? (Check against maintenance frequency stated in approved design.)								
Is there any evidence of invasive species becoming established? If yes, state action required								
Infrastructure								
Are any check dams or weirs in good condition?								
Is there evidence of any accidental damage to the system (eg wheel ruts?)								
Is there any evidence of cross connections or other unauthorised inflows?								
Is there any evidence of tampering with the flow controls?								

continued...

continued from...

TABLE B.25 SuDS maintenance inspection checklist

Inspection date								
	Details	**Y/N**	**Action required**	**Date completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
Are there any other matters that could affect the performance of the system in relation to the design objectives for hydraulic, water quality, biodiversity and visual aspects? (Specify.)								
Other observations								
Information appended (eg photos)								
Suitability of current maintenance regime								
Continue as current Increase maintenance Decrease maintenance								
Next inspection								
Proposed date for next inspection								

16.11 CONSTRUCTION REQUIREMENTS

Filter drains should be protected before completion and stabilisation of the upstream development areas. They should not be used for drainage of construction sites, where untreated runoff is likely to contain large amounts of silt, debris and other pollutants, as this will cause rapid clogging of the systems.

All trench excavations should follow construction best practice and be supported, if required. No personnel should be allowed to enter an unsupported trench deeper than 1.2 m. Trench supports should be designed to guarantee the safety of those working in the trench. Support may also be needed for shallower trenches in weak ground.

Filter drain formations should be flat or to a shallow grade to reduce the risk of ponding and negative filter gradients. Geotextile and stone fill should be clean before construction. Backfill should be placed in 100–150 mm layers and lightly compacted as required.

All geotextiles should be wrapped and secured to prevent gravel or stone from clogging with sediments.

The drain-down time after a storm should be observed after completion or modification of the facility to confirm that the desired drain time has been obtained (BRE, 1991).

▶ Further detail on construction activities and the programming of construction activities is provided in Chapter 31.

A construction phase health and safety plan is required under the Construction (Design and Management) Regulations (CDM) 2015. This should ensure that all construction risks have been identified, eliminated, reduced and/or controlled where appropriate.

▶ Generic health and safety guidance is presented in Chapter 36.

16.12 OPERATION AND MAINTENANCE REQUIREMENTS

Filter drains will require regular maintenance to ensure continuing operation to design performance standards, and all designers should provide detailed specifications and frequencies for the required maintenance activities along with likely machinery requirements and typical annual costs – within the Maintenance Plan. The treatment performance of filter drains is dependent on maintenance, and robust management plans will be required to ensure that maintenance is carried out in the long term. Different designs will have different operation and maintenance requirements, but this section gives some generic guidance.

Regular inspection and maintenance is important for the effective operation of filter drains as designed. Maintenance responsibility for a filter drain should always be placed with an appropriate organisation. Adequate access should always be provided to the filter drain for inspection and maintenance. If filter drains are implemented within private property, owners should be educated on their routine maintenance needs, and should understand the long-term Maintenance Plan and any legally binding maintenance agreement.

Litter (including leaf litter) and debris removal should be undertaken as part of general landscape maintenance for the site and before any other SuDS management task. All litter should be removed from site.

Table 16.1 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

TABLE 16.1 Operation and maintenance requirements for filter drains

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Sediments excavated from upstream pre-treatment devices that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate waste management protocols and compliance with legislation. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on site, if there is an appropriate safe and acceptable location to do so. Any damage due to sediment removal or erosion should be repaired and immediately reseeded or planted.

► Further detail on waste management is provided in **Chapter 32**.

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the filter drain should be monitored and maintenance schedules adjusted to suit requirements.

► Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 32**.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

► Generic health and safety guidance is presented in **Chapter 36**.

▶ Further detail on construction activities and the programming of construction activities is provided in Chapter 31.

A construction phase health and safety plan is required under the Construction (Design and Management) Regulations 2015. This should ensure that all construction risks have been identified, eliminated, reduced and/or controlled where appropriate.

▶ Generic health and safety guidance is provided in Chapter 36.

19.12 OPERATION AND MAINTENANCE REQUIREMENTS

Maintenance requirements of trees will be greatest during the first few years, when the tree is becoming established. Early maintenance should involve regular inspection, removal of invasive vegetation and possibly irrigation during long dry periods, particularly in soils with high void ratios. Tree roots need to establish good root–soil contact before they can efficiently extract water from the soil. The expertise of a arboriculturist/landscape architect with local knowledge should be sought regarding appropriate irrigation schedules. Maintenance responsibility for a tree pit or planter should always be placed with an appropriate organisation.

Table 19.3 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

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

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

Sediments excavated from a tree pit or planter that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For runoff, from busy streets with high vehicle traffic sediment testing will be essential.

▶ Further detail on waste management is provided in Chapter 33.

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the tree pits/planters should be monitored and maintenance schedules adjusted to suit requirements.

▶ Further detail on the preparation of maintenance specifications and schedules of work is given in Chapter 31.

Many of the specific maintenance activities for trees can be undertaken as part of a general landscaping or specific tree maintenance contracts.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

▶ Generic health and safety guidance is provided in **Chapter 36**.

19.13 REFERENCES

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20.14 OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is important for the effective operation of pervious pavements. Maintenance responsibility for a pervious pavement and its surrounding area should be placed with an appropriate responsible organisation. Before handing over the pavement to the client, it should be inspected for clogging, litter, weeds and water ponding, and all failures should be rectified. After handover, the pavement should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious pavements need to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. Extensive experience suggests that sweeping once per year should be sufficient to maintain an acceptable infiltration rate on most sites. However, in some instances, more or less sweeping may be required and the frequency should be adjusted to suit site-specific circumstances and should be informed by inspection reports.

A brush and suction cleaner (which can be a lorry-mounted device or a smaller precinct sweeper) should be used for regular sweeping. Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced. It is also possible to clean the surface using lightweight rotating brush cleaners combined with power spraying using hot water, as shown in **Figure 20.30**. This is done every two years at the site shown.

If the surface has clogged then a more specialist sweeper with water jetting and oscillating and rotating brushes may be required, especially for porous asphalt surfaces, to restore the surface infiltration rate to an acceptable level. The specialist equipment should be adjusted so that it does not strip binder from the aggregate in the asphalt.

Figure 20.30 Deep cleaning a supermarket car park, Dundee (courtesy Abertay University)

The likely design life of grass reinforcement will be dictated by trafficking and is likely to be about 20 years if designed correctly. For concrete block permeable paving the design life should be no different from standard paving, assuming that an effective maintenance regime is in place to minimise risks of infiltration clogging. Porous asphalt will lose strength and begin to fatigue due to oxidation of the binder. This is likely to occur slightly faster in porous asphalt than normal asphalt, so the design life will be reduced slightly. Porous concrete should have a similar design life to a normal concrete slab.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

▶ Guidance on waste management is provided in **Chapter 33**.

Table 20.15 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

Maintenance Plans and schedules should be prepared during the design phase. Specific maintenance needs of the pervious pavement should be monitored, and maintenance schedules adjusted to suit requirements.

▶ Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 32**.

TABLE 20.15 Operation and maintenance requirements for pervious pavements

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

Many of the specific maintenance activities for pervious pavements can be undertaken as part of a general site cleaning contract (many car parks or roads are swept to remove litter and for visual reasons to keep them tidy) and therefore, if litter management is already required at site, this should have marginal cost implications.

Generally, pervious pavements require less frequent gritting in winter to prevent ice formation. There is also less risk of ice formation after snow melt, as the melt water drains directly into the underlying sub-base and does not have chance to refreeze. A slight frost may occur more frequently on the surface of pervious pavements compared to adjacent impermeable surfaces, but this is only likely to last for a few hours. It does not happen in all installations and, if necessary, this can be dealt with by application of salt. It is not likely to pose a hazard to vehicle movements.

▶ Generic health and safety guidance is presented in **Chapter 36**.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

Heavy vibrating rollers are definitely not recommended around plastic pipes or tanks due to the high pressures that they can generate. Thin layers with smaller plant are recommended. DfT (2009) should be referred to for guidance for plant and methods for achieving compaction. The manufacturers' recommendations usually limit plant size above geocellular units to no more than 2300 kg/m width. However, the loading resulting from this will still need to be checked in the design. If such plant is to be used adjacent to the units, the resulting compaction pressures need to be checked.

Any arch or flexible pipe structures depend on the even resistance provided from soil or aggregate on both sides of the arch/pipe for their structural capacity. Even slight differences in the level of filling on each side of the arch/pipe as it progresses could potentially cause uneven deflections and increase the stress within the structure above design values. Close supervision during backfilling is therefore vital. The backfill around geocellular tanks should also be brought up evenly around all sides.

Bedding directly below a concrete pipe should have minimal compaction. The fill at the side of the pipe should be well compacted to a level 300 mm above the crown of the pipe. Only light compaction should be applied to the backfill directly over the crown of the pipe to a point 300 mm above it. With reasonable workmanship and supervision, the bedding factors used in the design should be relatively conservative.

21.12.6 Wrapping

All storage tanks should be watertight in accordance with the relevant standards. Geocellular and similar structures using geomembranes to hold water should be sealed in accordance with waterproofing standards (ie welded joints rather than adhesive taped) and the integrity of the seal checked on site through the use of non-destructive testing, to ensure that it is leak-proof. Advice on appropriate integrity and seam tests for geomembranes, that could be adapted for testing membranes around storage tanks, is provided in Mallett *et al* (2014). Care needs to be taken during installation to protect against damage of both the tank structure and the geotextile and the geomembrane wrapping. Follow-on trades can also cause damage and put the integrity and performance of the structure at risk.

21.13 OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is required to ensure the effective long-term operation of below-ground storage systems. Maintenance responsibility for systems should be placed with a responsible organisation. **Table 21.3** provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

Maintenance Plans and schedules should be developed during the design phase, and will be specific to the type of tank that is adopted. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements. Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 32**.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

- Generic health and safety guidance is provided in **Chapter 36**.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

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

21.14 REFERENCES

BARNES, G E (2010) *Soil mechanics: principles and practice, third edition*, Palgrave Macmillan, Hampshire, UK (ISBN: 978-0-23057-980-4)

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DfT (2001) *Manual of contract documents for highway works. Volume 1: Series 2500 Special structures*, HMSO, London, UK. Go to: **http://tinyurl.com/l3tap4z**

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23.11 CONSTRUCTION REQUIREMENTS

The bottom and side slopes of the pond, including any benches, should be carefully prepared to ensure that they are structurally sound. Any embankments should be checked to ensure that they meet their design criteria. The preparation should also ensure that the basin will satisfactorily retain the surface water runoff without significant erosion damage.

Backfilling against inlet and outlet structures needs to be controlled so as to minimise settlement and erosion. The soils used to finish the side slopes of the pond above the retained level need to be suitably fertile, porous and of sufficient depth to ensure healthy vegetation growth. If an impermeable liner is used, care should be taken to ensure that it is not damaged during construction.

There are various materials available to help prevent erosion while allowing plants to establish (Section 29.4.3). Ideally, planting would be planned over a number of years so that the rate of establishment can be monitored and densities adjusted accordingly.

Ponds can only be used to manage construction runoff where there is provision made for their complete rehabilitation to original design formation levels before handover. Planting schemes should be delayed until full rehabilitation has been undertaken.

Further detail on construction activities and the programming of construction activities is provided in Chapter 31. Generic health and safety guidance is provided in Chapter 36. A construction phase health and safety plan is required under CDM 2015. This should ensure that all construction risks have been identified, eliminated, reduced and/or controlled where appropriate.

23.12 OPERATION AND MAINTENANCE REQUIREMENTS

Ponds and wetlands will require regular maintenance to ensure continuing operation to design performance standards, and all designers should provide detailed specifications and frequencies for the required maintenance activities, along with likely machinery requirements and typical annual costs – within the Maintenance Plan. The treatment performance of ponds and wetlands is dependent on maintenance, and robust management plans will be required to ensure maintenance is carried out in the long term. Different designs will have different operation and maintenance requirements, but this section gives some generic guidance.

Maintenance of ponds is relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work required for a SuDS pond or wetland feature over and above what is necessary for standard public open space.

Regular inspection and maintenance is important for the effective operation of ponds as designed. Maintenance responsibility for a pond and its surrounding area should always be placed with a responsible organisation. Litter and debris removal should be undertaken as part of general landscape maintenance for the site and before any other SuDS management task. All litter should be removed from site.

Any invasive maintenance work such as silt or vegetation removal is only required intermittently, but it should be planned to be sympathetic to the requirements of wildlife in a pond. Care should be taken to avoid disturbance to nesting birds during the breeding season and habitats of target species (eg great crested newt and water voles) at critical times. The window for carrying out maintenance to achieve this is usually towards the end of the growing season (typically September/October), although this will vary with species). Invasive silt and vegetation removal should only be carried out to limited areas at any one time (25–30% of the pond area on one occasion each year to minimise the impact on biodiversity. Plant management, to achieve particular desired habitat effects, should be clearly specified in a maintenance schedule.

Site vegetation should be trimmed as necessary to keep the pond free of leaves and to maintain the aesthetic appearance of the site. Slope areas that have become bare should be re-vegetated and any eroded areas should be regraded before replanting.

Maintenance access (or "easement") should be provided to the pond from a public or private road. An assessment should be made at the planning stage regarding the maintenance and associated access requirements. Ideally, access should be at least 3.5 m wide, have a maximum cross fall of 1 in 7, and be sufficiently robust to withstand maintenance equipment and vehicles. However, temporary access routes for infrequent operations could be considered where permanent routes are not appropriate. The access should extend to any forebay, safety and aquatic benches, inlet and outlet infrastructure. Consideration should be given as to whether maintenance vehicles will need to turn around. Wherever possible SuDS ponds and wetlands should be designed so that special machinery is not required to undertake maintenance.

Table 23.1 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required. Consideration should be given to the need to control risks to biosecurity during maintenance operations and guidance is provided in Chapter 29.

Sediments excavated from ponds or forebays that receive runoff from residential or standard road and roof areas should be safely disposed of in accordance with current waste management legislation. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Chemical testing of the sediment may be required, before sediment excavation, to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases on low-risk sites with source control and a Management Train, it will be acceptable to distribute the sediment on site, if there is an appropriate safe and acceptable location to do so. Further detail on waste management is provided in Chapter 33. If ponds are to be drawn down, care should be taken to prevent downstream discharge of sediments and anoxic water. The environmental regulator should be notified before such activities.

New ponds may become rapidly dominated by invasive native plants, particularly common bulrush (Typha latifolia). As it is not desirable for all new ponds to be bulrush dominated, it should be ensured that in the first five years, while vegetation is establishing, certain plant growth is controlled. After this time, ponds can usually be allowed to develop naturally recognising that, unless the margins are occasionally managed, they are likely to become dominated by trees and shrubs.

Eutrophication of SuDS ponds can occur during the summer months. This is best alleviated by controlling the nutrient source or providing a continuous baseflow to the pond. Unless eutrophication is severe, aeration can be used as a stop-gap measure to save aquatic animal species and reduce risks to receiving waters. However, the addition of barley straw bales, dredging or rendering the nutrients inactive by chemical means can also be successful.

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the pond should be monitored, and maintenance schedules adjusted to suit requirements. Further detail on the preparation of maintenance specifications and schedules of work is given in Chapter 32.

Generic health and safety guidance is provided in Chapter 36. CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

TABLE 23.1 Operation and maintenance requirements for ponds and wetlands

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices, eg penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1 m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay.	Every 1–5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, eg every 25–50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets and overflows.	As required

Appendix K – MicroDrainage Foul Water Calculations

FOUL SEWERAGE DESIGN

Design Criteria for Foul

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)	0.000
Flow Per Person (l/per/day)	165.00	Maximum Backdrop Height (m)	0.000
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)	1.00
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul

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	61.380	0.409	150.0	0.000	10	0.0	1.500	o	150	Pipe/Conduit	
F1.001	6.903	0.046	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.000	27.157	1.086	25.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F2.001	35.856	1.793	20.0	0.000	7	0.0	1.500	o	150	Pipe/Conduit	
F2.002	10.410	0.069	150.9	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.002	59.198	0.296	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.003	6.725	0.042	161.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F3.000	33.615	0.560	60.0	0.000	7	0.0	1.500	o	150	Pipe/Conduit	
F3.001	28.860	0.491	58.8	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F3.002	5.812	0.291	20.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.004	53.812	0.359	150.0	0.000	10	0.0	1.500	o	225	Pipe/Conduit	
F1.005	16.568	0.753	22.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.006	41.515	1.887	22.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.007	73.033	0.730	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.008	40.491	1.841	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)
F1.000	129.434	0.000	0.0	10	0.0	17	0.29	0.71	12.6	0.3
F1.001	129.025	0.000	0.0	10	0.0	17	0.29	0.71	12.6	0.3
F2.000	135.507	0.000	0.0	4	0.0	7	0.40	1.76	31.0	0.1
F2.001	134.421	0.000	0.0	11	0.0	11	0.60	1.97	34.7	0.3
F2.002	132.628	0.000	0.0	11	0.0	17	0.30	0.71	12.6	0.3
F1.002	128.904	0.000	0.0	21	0.0	22	0.32	0.81	32.2	0.6
F1.003	128.608	0.000	0.0	21	0.0	21	0.34	0.90	35.9	0.6
F3.000	131.705	0.000	0.0	7	0.0	11	0.36	1.13	20.0	0.2
F3.001	131.145	0.000	0.0	11	0.0	14	0.42	1.14	20.2	0.3
F3.002	130.654	0.000	0.0	11	0.0	11	0.60	1.96	34.7	0.3
F1.004	128.566	0.000	0.0	42	0.0	29	0.43	0.94	37.2	1.3
F1.005	125.958	0.000	0.0	42	0.0	18	0.84	2.45	97.5	1.3
F1.006	125.205	0.000	0.0	42	0.0	18	0.84	2.45	97.5	1.3
F1.007	123.318	0.000	0.0	42	0.0	26	0.50	1.15	45.6	1.3
F1.008	122.588	0.000	0.0	42	0.0	18	0.84	2.45	97.5	1.3

Network Design Table for Foul

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
F1.009	11.311	0.514	22.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.010	42.634	0.284	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.011	20.420	0.227	90.1	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)
F1.009	120.747	0.000	0.0	42	0.0	18	0.84	2.45	97.5	1.3
F1.010	120.233	0.000	0.0	42	0.0	29	0.43	0.94	37.2	1.3
F1.011	119.949	0.000	0.0	42	0.0	26	0.52	1.21	48.1	1.3

Manhole Schedules for Foul

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F1	130.334	0.900	Open Manhole	1200	F1.000	129.434	150				
F2	133.785	4.760	Open Manhole	1200	F1.001	129.025	150	F1.000	129.025	150	
F3	136.857	1.350	Open Manhole	1200	F2.000	135.507	150				
F4	135.783	1.362	Open Manhole	1200	F2.001	134.421	150	F2.000	134.421	150	
F5	134.397	1.769	Open Manhole	1200	F2.002	132.628	150	F2.001	132.628	150	
F6	133.644	4.740	Open Manhole	1200	F1.002	128.904	225	F1.001	128.979	150	
								F2.002	132.559	150	3580
F7	132.342	3.734	Open Manhole	1200	F1.003	128.608	225	F1.002	128.608	225	
F8	133.055	1.350	Open Manhole	1200	F3.000	131.705	150				
F9	132.567	1.422	Open Manhole	1200	F3.001	131.145	150	F3.000	131.145	150	
F10	132.034	1.380	Open Manhole	1200	F3.002	130.654	150	F3.001	130.654	150	
F11	131.724	3.158	Open Manhole	1200	F1.004	128.566	225	F1.003	128.566	225	
								F3.002	130.363	150	1722
F12	129.675	3.717	Open Manhole	1200	F1.005	125.958	225	F1.004	128.207	225	2249
F13	126.180	0.975	Open Manhole	1200	F1.006	125.205	225	F1.005	125.205	225	
F14	125.200	1.882	Open Manhole	1200	F1.007	123.318	225	F1.006	123.318	225	
F15	123.610	1.022	Open Manhole	1200	F1.008	122.588	225	F1.007	122.588	225	
F16	122.310	1.563	Open Manhole	1200	F1.009	120.747	225	F1.008	120.747	225	
F17	121.835	1.602	Open Manhole	1200	F1.010	120.233	225	F1.009	120.233	225	
F18	121.598	1.649	Open Manhole	1200	F1.011	119.949	225	F1.010	119.949	225	
FFoul	121.360	1.638	Open Manhole	0		OUTFALL		F1.011	119.722	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F1	702083.581	726231.681	702083.581	726231.681	Required	
F2	702141.061	726210.152	702141.061	726210.152	Required	
F3	702214.831	726185.325	702214.831	726185.325	Required	
F4	702188.221	726190.749	702188.221	726190.749	Required	
F5	702154.752	726203.612	702154.752	726203.612	Required	
F6	702147.849	726211.404	702147.849	726211.404	Required	
F7	702169.292	726266.583	702169.292	726266.583	Required	
F8	702230.705	726249.975	702230.705	726249.975	Required	

Manhole Schedules for Foul

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F9	702198.281	726258.841	702198.281	726258.841	Required	
F10	702171.333	726269.171	702171.333	726269.171	Required	
F11	702166.824	726272.839	702166.824	726272.839	Required	
F12	702116.327	726291.433	702116.327	726291.433	Required	
F13	702102.110	726299.940	702102.110	726299.940	Required	
F14	702131.914	726328.841	702131.914	726328.841	Required	
F15	702190.646	726372.249	702190.646	726372.249	Required	
F16	702211.710	726406.830	702211.710	726406.830	Required	
F17	702219.005	726415.475	702219.005	726415.475	Required	
F18	702224.455	726457.759	702224.455	726457.759	Required	
FFoul	702233.764	726475.934			No Entry	

PIPELINE SCHEDULES for Foul

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	150	F1	130.334	129.434	0.750	Open Manhole	1200
F1.001	o	150	F2	133.785	129.025	4.610	Open Manhole	1200
F2.000	o	150	F3	136.857	135.507	1.200	Open Manhole	1200
F2.001	o	150	F4	135.783	134.421	1.212	Open Manhole	1200
F2.002	o	150	F5	134.397	132.628	1.619	Open Manhole	1200
F1.002	o	225	F6	133.644	128.904	4.515	Open Manhole	1200
F1.003	o	225	F7	132.342	128.608	3.509	Open Manhole	1200
F3.000	o	150	F8	133.055	131.705	1.200	Open Manhole	1200
F3.001	o	150	F9	132.567	131.145	1.272	Open Manhole	1200
F3.002	o	150	F10	132.034	130.654	1.230	Open Manhole	1200
F1.004	o	225	F11	131.724	128.566	2.933	Open Manhole	1200
F1.005	o	225	F12	129.675	125.958	3.492	Open Manhole	1200
F1.006	o	225	F13	126.180	125.205	0.750	Open Manhole	1200
F1.007	o	225	F14	125.200	123.318	1.657	Open Manhole	1200
F1.008	o	225	F15	123.610	122.588	0.797	Open Manhole	1200
F1.009	o	225	F16	122.310	120.747	1.338	Open Manhole	1200
F1.010	o	225	F17	121.835	120.233	1.377	Open Manhole	1200
F1.011	o	225	F18	121.598	119.949	1.424	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	61.380	150.0	F2	133.785	129.025	4.610	Open Manhole	1200
F1.001	6.903	150.0	F6	133.644	128.979	4.515	Open Manhole	1200
F2.000	27.157	25.0	F4	135.783	134.421	1.212	Open Manhole	1200
F2.001	35.856	20.0	F5	134.397	132.628	1.619	Open Manhole	1200
F2.002	10.410	150.9	F6	133.644	132.559	0.935	Open Manhole	1200
F1.002	59.198	200.0	F7	132.342	128.608	3.509	Open Manhole	1200
F1.003	6.725	161.0	F11	131.724	128.566	2.933	Open Manhole	1200
F3.000	33.615	60.0	F9	132.567	131.145	1.272	Open Manhole	1200
F3.001	28.860	58.8	F10	132.034	130.654	1.230	Open Manhole	1200
F3.002	5.812	20.0	F11	131.724	130.363	1.211	Open Manhole	1200
F1.004	53.812	150.0	F12	129.675	128.207	1.243	Open Manhole	1200
F1.005	16.568	22.0	F13	126.180	125.205	0.750	Open Manhole	1200
F1.006	41.515	22.0	F14	125.200	123.318	1.657	Open Manhole	1200
F1.007	73.033	100.0	F15	123.610	122.588	0.797	Open Manhole	1200
F1.008	40.491	22.0	F16	122.310	120.747	1.338	Open Manhole	1200
F1.009	11.311	22.0	F17	121.835	120.233	1.377	Open Manhole	1200
F1.010	42.634	150.0	F18	121.598	119.949	1.424	Open Manhole	1200
F1.011	20.420	90.1	FFoul	121.360	119.722	1.413	Open Manhole	0

Free Flowing Outfall Details for Foul

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.011	FFoul	121.360	119.722	119.330	0	0

Appendix L – Confirmation of Feasibility (COF)

Nicholas Orr

4th Floor
Adelphi Plaza George's Street Upper
Dun Laoghaire
Co. Dublin
A96T927

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 March 2022

Re: CDS22001396 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 55 domestic units and Creche at Stoney Hill, Rathcoole, Dublin

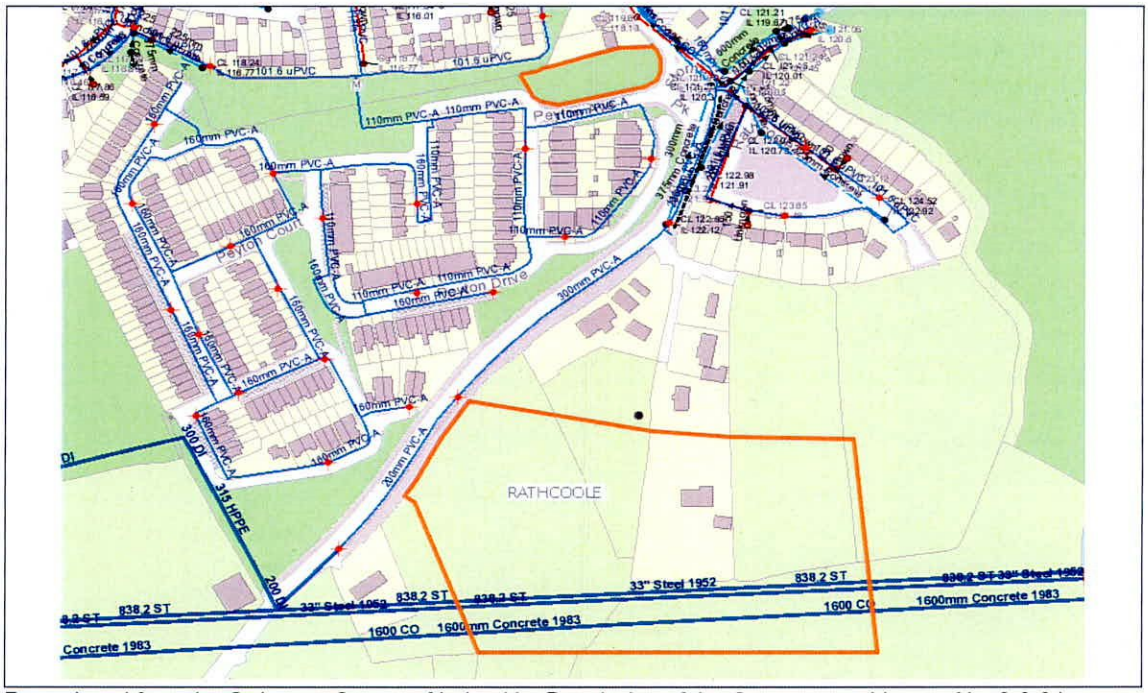
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Stoney Hill, Rathcoole, Dublin (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 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	The connection points to the network are to be determined at connection application stage. This Confirmation of Feasibility to connect to the Irish Water infrastructure does not extend to your fire flow requirements. Please note that Irish Water cannot guarantee a flow rate to meet fire flow requirements and in order to guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development. The proposed Development indicates that Irish Water assets are present on the site. The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the assets during and after the works. Drawings (showing clearance distances, changing to ground levels) and Method

	Statements should be included in the Detailed Design of the Development. A wayleave in favour of Irish Water will be required over the assets that are not located within the Public Space. For design submissions and queries related to diversion/build near or over, please contact IW Diversion Team via email address diversions@water.ie
Wastewater Connection	Approximately 210m of network extension will be required for the connection to the wastewater network to the North of the site. These extension works are not currently on Irish Water investment plan therefore, the applicant will be required to fund these local network upgrades. The fee will be calculated at a connection application stage. It is the responsibility of the applicant to verify that a gravity connection is feasible. There are known constraints in Tay Lane Pumping Station. Irish Water currently has a project underway which will provide the necessary upgrades. This upgrade project is scheduled to be completed in Q1/2026 (this may be subject to change) and the proposed connection for the full development could be completed as soon as possibly practicable after this date. Some number of units may be permitted to connect prior the completion of the upgrade project, subject to other IW new connection agreements within the PS contributing area at the time. At connection application stage, it will be reviewed and the number of units which can be connected (if any) will be advised.
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:



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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 Kevin McManmon from the design team at kmcmanmon@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations

aecom.com

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