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MULTIDISCIPLINARY CONSULTING ENGINEERS

C1058: DISTILLERY WALK APARTMENTS - MIDLETON

DRAINAGE IMPACT ASSESSMENT REPORT

For

CORK COUNTY COUNCIL

3 May 2024

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1 INTRODUCTION

1.1. APPOINTMENT

O' Connor Sutton Cronin (OCSC) & Associates Ltd have been commissioned by the Cork County Council to prepare a Drainage Impact Assessment to inform the planning application for a proposed new multi-storey apartment block, at Distillery Walk, Midleton, Co Cork.
The objective of this Drainage Impact Assessment is to outline the methodologies relating to the management of surface water runoff for the proposed development.

Refer to Figure 1.1 for the site location.

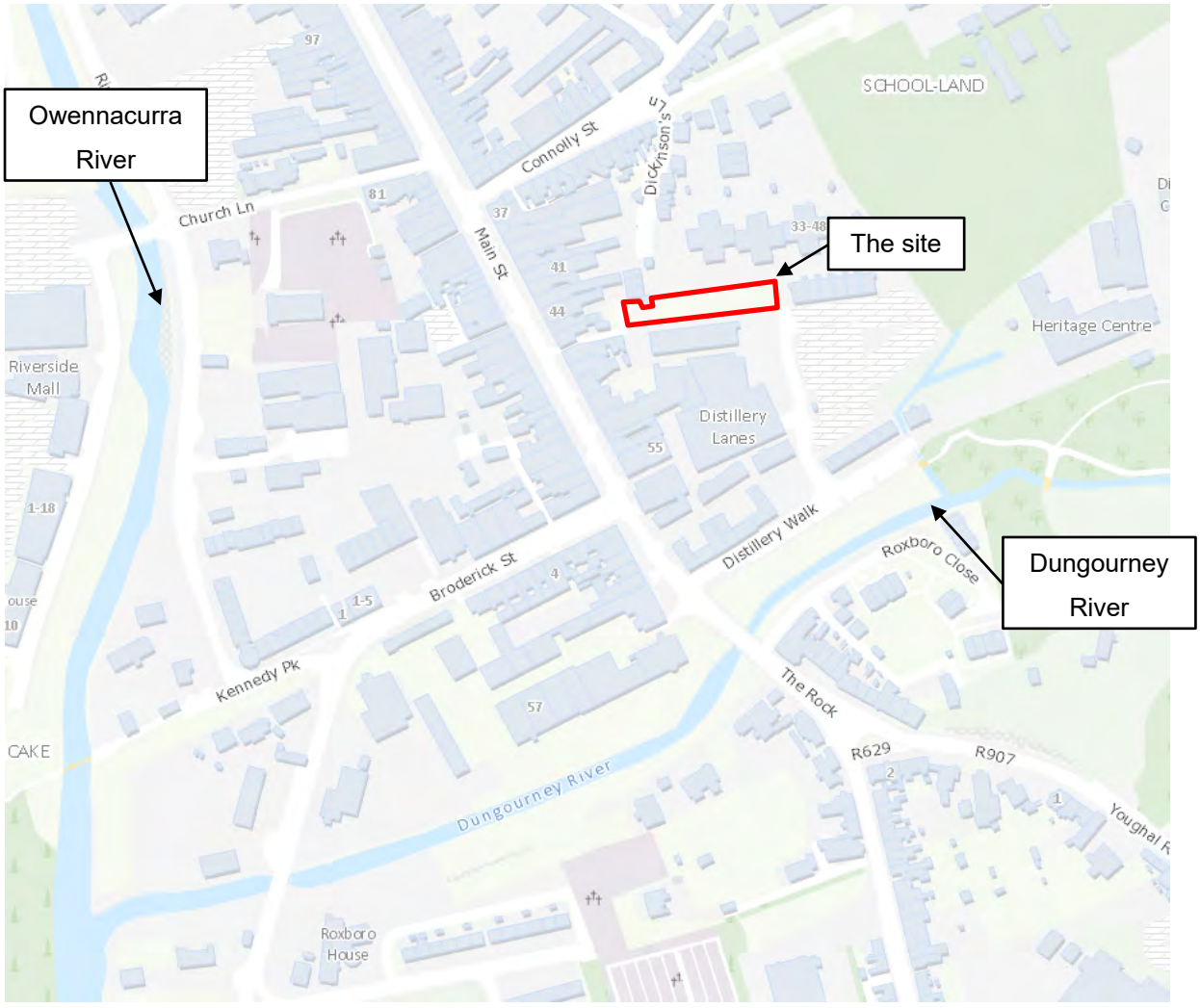


Figure 1.1: Site location

1.2. PROPOSED DEVELOPMENT

The project involves the construction of 16no. housing units and a community room on an existing walled garden site off Distillery Lane, in Midleton's town centre. The housing scheme has been designed as a 6no. storey apartment building with 3no. one bed units on each floor except the ground floor which contains a community room and a single one bed apartment. The development will have the capacity to cater for 2 ppl per unit, total 32 residents.

The intention is that this housing scheme would be allocated to accommodate elderly residents specifically. The remainder of the site is designed as a public garden space that also allows for management of storm water drainage on the site.

This subject site has been identified by Cork County Council's Housing Directorate as a key site within the town suitable for redevelopment. It is rectangular in shape and enclosed on all sites by a tall stone wall, approximately 6m. high. It measures 0.109Ha (0.27 acres) in area and is relatively flat. The subject site is in the ownership of Midleton Lions Club. It is bounded to the north by a private apartment development and by public lanes / access ways on the remaining 3no. sides.

1.3. TOPOGRAPHYCAL SURVEY

The site is relatively flat brownfield site at approximately 3.4m OD, typically varying from a lowest level of 3.29m OD in the middle of the eastern part of the site to 3.61m OD on the slightly higher western side of the site.

There is a 3.5-4m high wall surrounding the site. Distillery Walk runs south-west north-east to the south of the site, and continues from the site to the west, connecting to Main St. There is a lane parallel to the south of Distillery Walk and is approximately 500-600mm lower. There is a car park to the southeast of the site which gradually drops in elevation going south towards the Dungourney River. As Distillery Walk goes west from the site (3.6mOD) it also drops in elevation until it meets Main St (3.11mOD).

1.4. EXISTING SURFACE WATER DRAINAGE

Cork County Council were contacted to establish the existing storm water sewer network in the vicinity of the proposed development and a below ground utility survey was undertaken on the grounds of the site. The survey extents include a portion of Corabbey Court running along the northern and eastern boundaries and a portion of a lane running along the south boundary of the site. The found pipelines and the associated manholes/AJ's/gullies is marked in green in Figure 1.2 oveleaf.

The survey drawing indicates that there is an existing 100-225mm diameter PVC sewer serving the residential apartments to the north, running from west to east to the north of the site. This sewer then transitions to a 300mm diameter concrete pipe along the eastern boundary towards Distillery Walk to the south. Additionally, there is an existing manhole located outside at the southwest corner of the site and a 450mm diameter concrete pipe running from south to north across the western side of the site. Following a discussion with the Local Area Engineers, it has been suggested that the existing storm pipe crossing the site may be an old industrial line, necessitating further investigation before tying into it. A CCTV survey will be sought as part of the next stage to clarify its condition and viability for connection. Please refer to Appendix A for the below ground utility survey drawing.

Figure 1.2: Below ground utility survey drawing - Existing storm sewer (marked in green colour)

1.5. SITE INVESTIGATION

Ground investigation has been carried out as part of the initial design. IGSL Ltd. were appointed to complete a ground investigation and to determine the depths of the overburden and underlying strata and to provide all necessary information for design purposes including the infiltration capacity (percolation rate) of the existing ground.

The requested main works included 3 No. trial pits, 2 No of which are also to be used as soak pits. The soakaway tests were conducted in accordance with BRE Digest 365 guidance document. The results of that are discussed in Section 1.5.2 below. There are 4 No. exploratory boreholes requested across the site, to establish the depths of each strata, their strengths and permeability and the natural ground water levels.

1.5.1. EXISTING GEOLOGY AND GROUNDWATER VULNERABILITY

The Geological Survey of Ireland's (GSI) website provides information on the existing geology and groundwater condition and vulnerability via their public online mapping service.

- **Bedrock**

Figure 1.3 below indicates the bedrock geology of the subject site. The area is underlaid by massive, unbedded lime-mudstone with the formation of Waulsortian limestone.

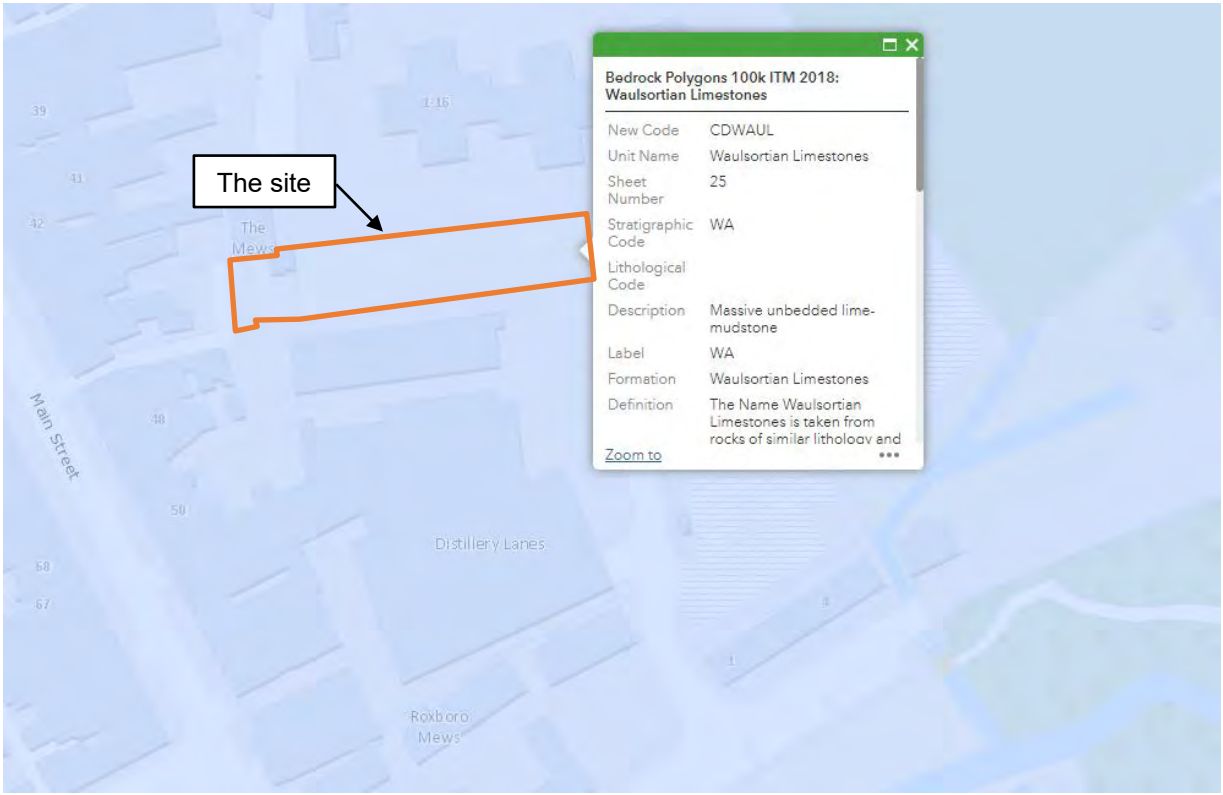


Figure 1.3: GSI bedrock mapping (Source: www.gsi.ie)

As part of the geotechnical ground investigation works, the boreholes findings were consistent with sandy gravel deposits noted below the superficial topsoil. The depth of the gravel strata varied, ranging from about 12 to 15 metres, with no bedrock encountered.

- **Groundwater**

The GSI (Geological Survey of Ireland) has devised a system for classifying the aquifers of Ireland. The aquifer classification depends on a number of parameters including, the aerial extent, well yield, specific capacity, aquifer transmissivity and groundwater flow. The aquifer categories are intended to describe both resource potential (Regionally or Locally important, or Poor) and groundwater flow type and attenuation potential (through fissures, karst conduits or intergranular). The aquifer code is made up of the aquifer resource value and how the groundwater flows in the bedrock or sand & gravel aquifer.

There is a regionally important karstified aquifer (Rkd) described in the area of the site. Refer to Figure 1.4 below. Rkd aquifers are those in which flow is more diffuse, storage is higher, there are many high yielding wells, and development of bored wells is less difficult. These areas also have caves and large springs, but the springs have a more regular flow.

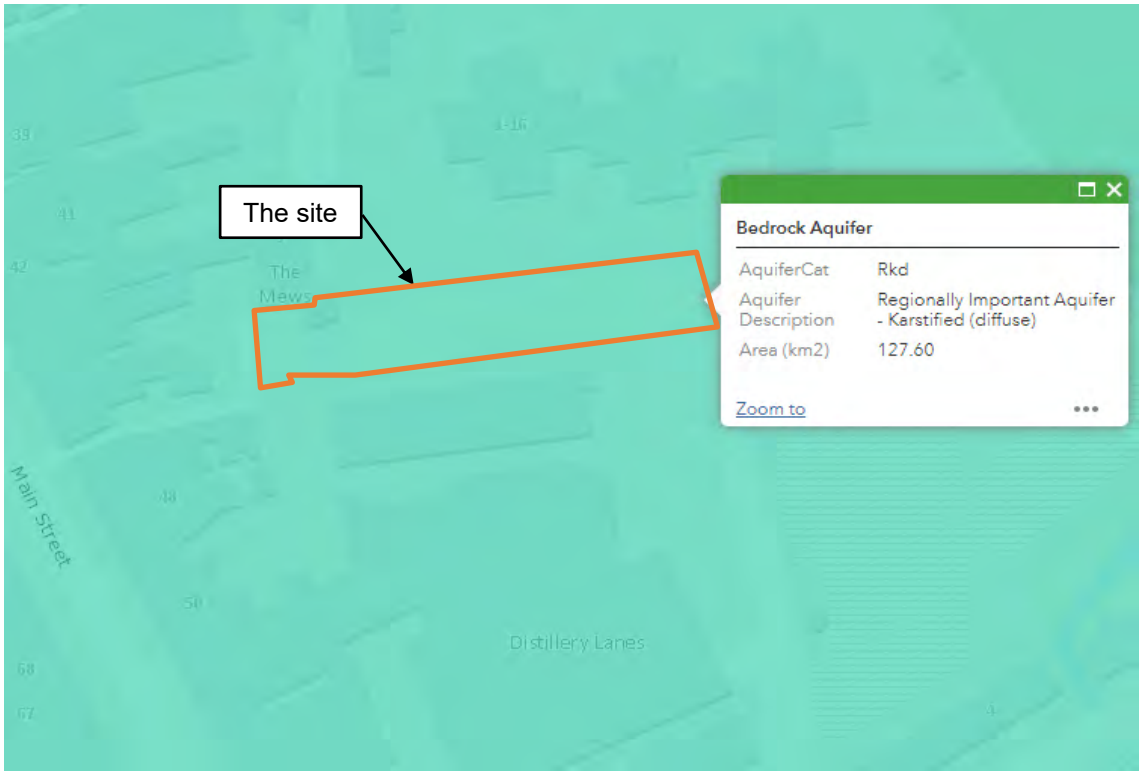


Figure 1.4: GSI groundwater resources map (Source: www.gsi.ie)

Groundwater vulnerability represents the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. The GSI maps assigns the vulnerability category to a site or an area is thus based on the relative ease with which infiltrating water and potential

contaminants may reach groundwater in a vertical or sub-vertical direction. As all groundwater is hydrologically connected to the land surface, it is the effectiveness of this connection that determines the relative vulnerability to contamination.

The website classifies the aquifer vulnerability in the region of the subject site as extreme with category 'E'. This category means that the depth of subsoil is 1.5m over locally important sand and gravel aquifer.

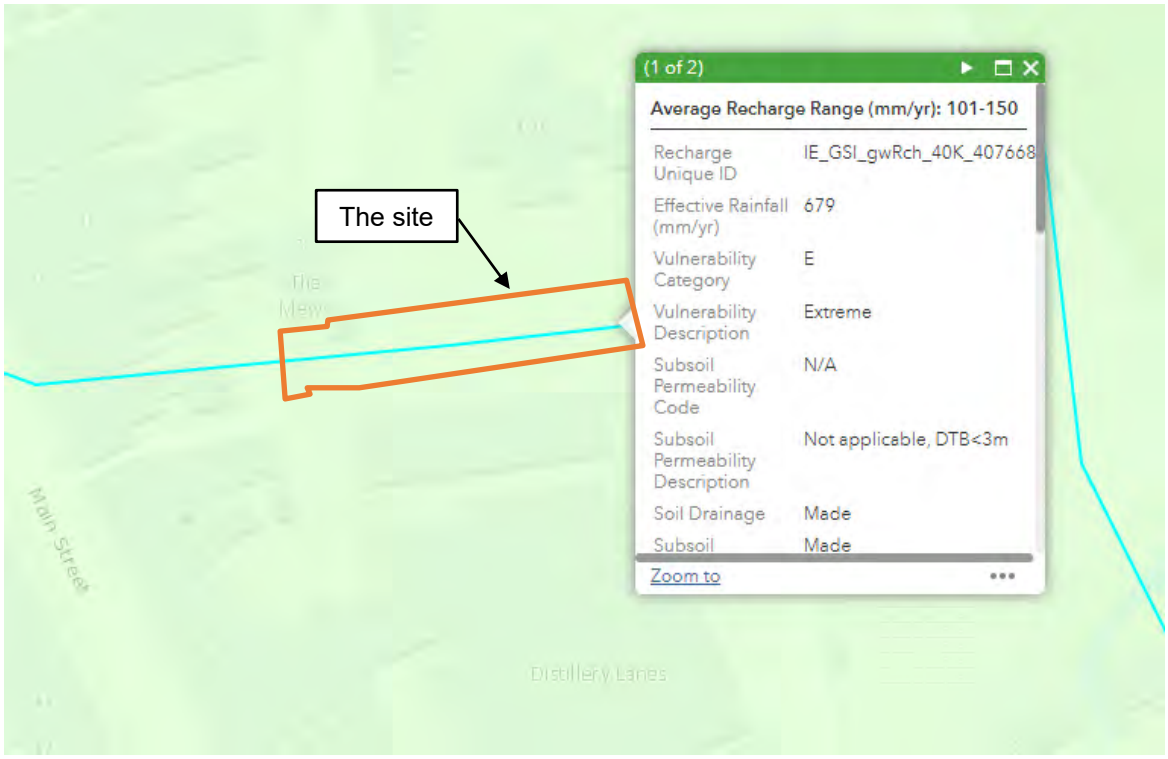


Figure 1.5: GSI groundwater recharge mapping (Source: www.gsi.ie)

1.5.2. INFILTRATION CAPACITY

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

The site investigation report noted that ground water ingress was observed in each borehole at about 3.00m BGL with a standing water level at 1.60-1.70m BGL recorded.

The BRE Digest 365 tests have confirmed a high infiltration rate indicating that the gravel stratum is suitable for dispersion of surface water. The results are contained in Table 1.1 overleaf.

Table 1.1: Site investigation - Percolation test results

Reference	Infiltration rate (m/min)
SA 01 (Trial pit 01)	0.00848
SA 02 (Trial pit 02)	0.01513

Please refer to Appendix A for the infiltration test results extracted from the site investigation report.

1.5.3. FLOOD RISK AND PREDICTIVE FLOOD EXTENT MAPPING

A separate Flood Risk Assessment report has been conducted for the proposed development in the planning application pack. Refer to document no. C1058-OCSC-XX-XX-RP-C-0001-S4-P01 Flood risk Assessment.

2 SURFACE WATER DRAINAGE STRATEGY

2.1. DESIGN CONSIDERATIONS

The surface water system for this development has been designed in accordance with the requirements of the following documents:

- CIRIA report C753 Sustainable Urban Drainage Strategy (SuDS) Manual
- Greater Dublin Strategic Drainage Strategy (GDSDS)
- Cork County Council Development Plan 2022-2028
- Cork County Council Advice Note 1 – Surface Water Management

2.1.1. METHOD OF DESIGN

Design of storm water drainage network is included in separate documentation included in this planning application. Refer to document no. C1058-OCSC-XX-XX-RP-C-0002-S4-P01 for the Engineering Services Report.

The proposed surface network is designed to cater for surface water runoff generated from the roof of the building and from the adjoining access ramp and ground floor terrace. The storm water drainage elements on the subject lands are designed in accordance with IS EN 752 & the Building Regulations Part H.

SuDS drainage design shall be developed as a first preference and in accordance with the SuDS hierarchy. Surface water generated from the paths in the landscaping area will be conveyed through a swale as part of the SuDS measures as outlined in this report and attenuated before being discharged at Q bar greenfield runoff rate to the existing storm sewer. SuDS design for the proposed development is discussed under Section 2.2 and 2.3 within this document.

2.2. PROPOSED SUDS STRATEGY

2.2.1. OVERVIEW OF STRATEGY

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

- **Water quantity**: maintaining flows and volumes to match the rainfall characteristics before development;

- **Water quality**: preventing and treating pollution to ensure that clean water is available to provide amenity and biodiversity, and also to protect natural watercourses;
- **Amenity**: enhancing people's quality of life through an integrated design;
- **Biodiversity**: maximising the potential for wildlife through design and management of SuDS.

The SuDS manual identifies a "management train" for an interconnected system design that describes the sequence of components to control the runoff, the flow rates and to reduce contaminants to acceptable levels. There are 6 specific functions, which includes:

- Rainwater harvesting systems;
- Pervious surfacing systems;
- Infiltration systems;
- Conveyance systems;
- Storage systems;
- Treatment systems.

The purpose of the above hierarchy is that all new developments must ensure that a comprehensive SuDS is incorporated into the development. SuDS requires that post development run-off rates are maintained at equivalent or lower levels than pre-development levels. The development must be able to retain, within its boundaries, storm water volumes from extreme storm events up to a probability of 1 in 100 years, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability). Any new development must have the physical capacity to retain storm water volumes and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate. A further component of the SuDS protocols is to increase the overall water quality of surface water runoff before it enters a natural water course or into a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of storm water quality and to prevent degradation of the water course resource by contamination.

Objective WM 11-10 of the Cork County Development Plan 2022 includes that the applied SuDS measures should mitigate flood risk, enhance biodiversity, protect, and enhance visual and recreational amenity. Nature-based solutions are preferred to be considered in the first instance in arriving at the preferred SuDS solution for any development.

2.3. PROPOSED SURFACE WATER DRAINAGE NETWORK

The main surface water drainage pipe from the building is proposed to discharge to the existing public drainage network. Surface water will be collected via a series of rainwater down pipes from the roof of the building, channel drains and gullies from the access ramp and from the terrace and will be discharging into the onsite underground attenuation tank. From here surface water will be released via a flow controlled hydro break to the public storm sewer. Outflow from the site will be restricted to green field runoff rate at 3.9 l/s. The proposed surface water network will consist of a new gravity fed sewer system designed in accordance with IS EN 752. The pipes of the main sewer will be uPVC and will vary from 150mm to 225mm in diameter.

In addition to the above, 150mm diameter PVC filter drains underlaying the permeable paved paths is proposed to discharge the stormwater into a wet swale channel in the middle landscaping area. Catchpits are proposed to be installed at each of the outlet into the swale from the filter drain to avoid sediments entering the swale. Refer to further details in section 3.2.3. of this document.

The Surface Water drainage layout is shown on drawing C1058-OCSC-XX-XX-DR-C-0100 in Appendix A with surface water design calculations provided in Appendix C.

2.3.1. COMPLIANCE WITH GDSDS SURFACE WATER DRAINAGE POLICY

The proposed drainage network was designed using the rational method for calculating peak storm water runoff. The value of Q is dependent on the intensity of the rainfall, which changes based on the intensity of the storm from which it came from.

Generally, drainage systems will be designed to handle the 5-year storm at a minimum, and the 100-year storm at the maximum. The 5 year-storm is a storm that has a 20% probability of occurring in a given year, for a given area, and the 100-year storm is a storm that has a 1% probability of occurring in a given year, for a given area. The 5-year and 100-year storms produce different Q values, generally denoted as Q5 and Q100 respectively, and these peak flows are used for the design of the systems that transport the runoff from these events.

The surface water pipe length, slopes including invert levels, pipe diameters were entered for the calculation. These parameters are also shown on the proposed drainage layout in Appendix C of this document.

The site's surface water management network has been designed in accordance with the GDSDS, Vol. 2, section 6.3.4 Table 6.3 requirements for the assessment of the design criteria.
Refer to Table 2.1 below for the assessment of the drainage proposal according to the design criteria.

Table 2.1: Assessment of drainage desing

Criteria	**Objective**	**Assessment for proposed development**
1 River water quality protection	Return Period <1-year 1.1 Interception storage of at least 5mm, and preferably 10mm, of rainfall where runoff to the receiving water can be prevented 1.2 Where initial runoff from at least 5mm of rainfall cannot be intercepted, treatment of runoff (treatment volume) is required. Retention pond (if used) to have minimum pool volume equivalent to 15mm rainfall.	Satisfied by providing stormwater attenuation and by SuDS features i.e. swale, attenuation tank at surface water discharge point
2. River regime protection	Return Period 1-year 2.1 Discharge rate equal to 1-year greenfield site peak runoff rate or 2l/s/ha, whichever is the greater. Site critical duration storm to be used to assess attenuation storage volume. Return Period 100-year 2.2 Discharge rate equal to 1 in 100-year greenfield site peak runoff rate. Site critical duration storm to be used to assess attenuation storage volume.	Satisfied by providing stormwater attenuation tank designed for 1 in 100-year event with 20% climate factor applied
3. Level of service (flooding) for the site	Return Period 30-year 3.1. No flooding on site except where specifically planned flooding is approved. Summer design storm of 15 or 30 minutes are normally critical. Return Period 100-year 3.2. No internal property flooding. Planned flood routing and temporary flood storage accommodated on site for short high intensity storms. Site critical duration events. Return Period 100-year	Satisfied by providing stormwater attenuation tank designed for 1 in 100-year event with 20% climate factor applied. Satisfied as the finished floor level has been set to be above the 1:100 year event with additional freeboard and climate change allowance (i.e.discussed under Flood Risk Assessment report from the proposed

	3.3. Floor levels at least 500mm above maximum river level and adjacent onsite storage retention. Return Period 100-year 3.4. No flooding of adjacent urban areas. Overland flooding managed within the development.	development issued separate to this document)
4. River flood protection (criterion 4.1, or 4.2 or 4.3 to be applied)	Return Period 100-year 4.1. "Long-term" floodwater accommodated on site for development runoff volume which is in excess of the greenfield runoff volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme events only. 100-year, 6 hour duration storm to be used for assessment of the additional volume of runoff. Return Period 100-year 4.2. Infiltration storage provided equal in volume to "long term" storage. Usually designed to operate for all events. 100year, 6 hour duration storm to be used for assessment of the additional volume of runoff. Return Period 100-year 4.3. Maximum discharge rate of QBAR or 2 l/s/ha, whichever is the greater, for all attenuation storage where separate "long term" storage cannot be provided.	Satisfied by providing stormwater attenuation tank designed for 1 in 100-year event with 20% climate factor applied. Also, satisfied by addressing flood risk associated with the 1 in 100-year storm

2.3.2. STORMWATER PIPE DESIGN

The proposed surface water drains have been designed in accordance with the GDSDS Section 6.5. The below inputs sourced mainly from Met Eireann and the from Volume 2 of the GDSDS are used in the development of the drainage design.

Table 2.2: Surface water design criteria

Parameter criteria	Surface water sewers	Assessment for proposed development
Minimum depth	1.2m under highways, 0.9m cover elsewhere	No vehicular traffic within site. Depth of cover varies. Where min depth of 0.9m cannot be achieved, pipe will be encased in min 150mm thick concrete according to IW standard details.

Maximum depth	Normally 5m	Max depth is not more than 1.3m
Minimum sewer size	225mm	Satisfied by providing 225mm storm water pipe
Runoff factors for pipe sizing	100% paved and roof structures, 0% off pervious surfaces	Satisfied by discharging the water from the roof and hard surfaces into the new sewer and discharging the surface water from pervious surface into the swale. Refer to proposed drainage drawing.
Rainfall for initial pipe sizing	50mm/hr rainfall intensity	Storm sewer has been designed for greater than 50mm/hr -refer to calculations in Appendix C
Minimum velocity (pipe full)	1.0m/s	The minimum full velocity in the proposed 225mm pipe is 1.30m/s
Flooding	Checks made for adequate protection * No flooding for return period less than 30 years except where explicitly planned. Simulation modelling is required for sites greater than 24ha**	Satisfied as the finished floor level has been set to be above the 1:100-year event with additional freeboard and climate change allowance (for assessment of flooding refer to Flood Risk Assessment report from the proposed development issued separate to this document)
Roughness factor (ks)	0.6	Satisfied within this design, refer to design calculation in Appendix C.

The proposed surface water drainage network was assessed for compliance with maximum and minimum velocities, pipe lengths, etc. The network was designed to ensure velocities in the network and pipe gradients did not exceed the maximum velocity of 3.0m/s.
The layout of the proposed storm water network is shown on drawing no. C1058-OCSC-XX-XX-DR-C-0100 in Appendix A.

2.3.3. PRE-DEVELOPMENT CONDITIONS

- River regime protection

One of the relevant design criteria for the protection of the river regime is that the rate of discharge to the receiving water must be retained to that of greenfield runoff for the site.
The calculation of the greenfield runoff rate of the area of the proposed development was conducted using the estimation method in the Institute of Hydrology Report No. 124: flood estimation for small catchments, as follows:

$$Qbar\ (m^3/s) = 0.00108 \times (0.01 \times AREA)^{0.89} \times SAAR^{1.17} \times SPR^{2.17}$$

where,

- AREA = sub catchment area (m2).
- SAAR = standard annual average rainfall (mm/yr).
- SPR = standard percentage runoff coefficient for the applicable SOIL category in the sub catchment area.

Where the area of the site is less than 50ha, the formula should be applied for a 50ha and the result factored based on the ratio of the actual site area and the applied area (50ha). The SOIL category is measure of winter rainfall acceptance potential, as a percent of rainfall. Soils are classified from S1 to S5 based on runoff potential. S1 has a low runoff value of 0.1 while S5 has a higher runoff potential, 0.53.

The hydrological characteristics of the region are:

Total site Area=0.109ha, of which the hardstanding area is 0.04ha

SAAR=1306mm/yr (based on rainfall data from Met Eireann, Roches Point SWS., see in Appendix D)

SOIL TYPE: 3 ->SPR=0.37

The greenfield runoff rate has been calculated as Qbar=5.96l/s/ha.

Allowable discharge rate is based on the total hardstanding area: Qallow=5.96l/s/ha*0.044ha=0.66l/s

The run-off rate calculated for the proposed development exceeds the allowable discharge rate, therefore SuDS design will need to include attenuation storage that will fill during rainfall events.

- Climate change

The GDSDS Climate Change policy document advises that rainfall event depths should be factored by minimum of 10%. Refer to Table 2.3 below for the advised climate change factors.

Table 2.3: Climate change factors

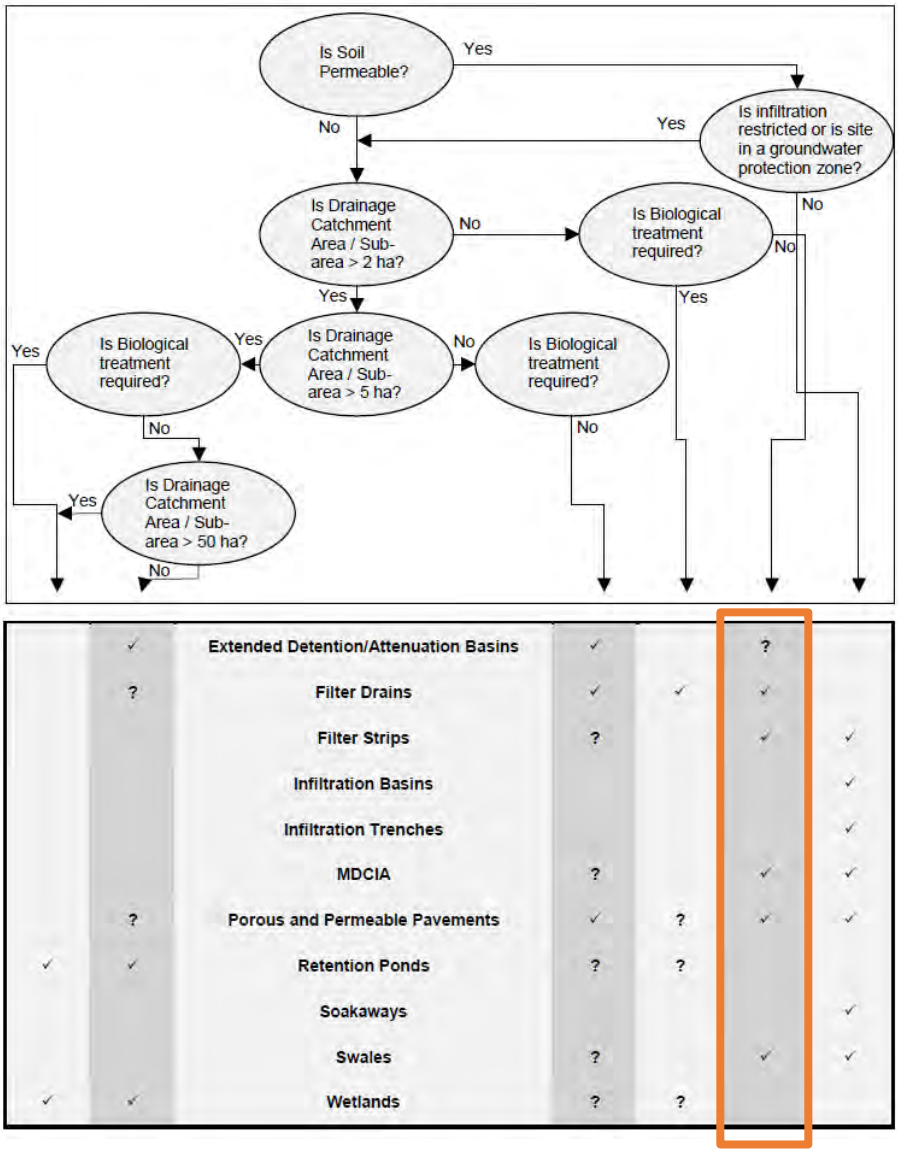
Climate change category	**Characteristics**
River flows	20% increase in flows for all return periods up to 100 years
Sea level	400+mm rise (see Climate Change policy document for sea levels as a function of return period)
Rainfall	10% increase in depth (factor all intensities by 1.1)
	Modify time series rainfall in accordance with the GDSDS climate change policy document

Using the above formula for the runoff rate for the subject site, the attenuation tank has been designed for a 100-year return period as well as an additional 20% climate change factor, satisfying the GDSDS hydraulic criterion 1-4 and the application of the climate change factor presented in Table 2.3 above, and also satisfying the County Development Plan 2022. Please refer to Appendix C for surface water sewer and to Appendix D for attenuation tank design calculations.

2.4. PROPOSED SUDS MEASURES

2.4.1. SUDS SELECTION

The SuDS selection process used for this site is in accordance with SuDS selection flow chart, Volume 3, Section 6.5, figure 48 of the GDSDS. The characteristics of the site are utilised to select the various SuDS technique that would be applicable are indicated in red outline below. Refer to Figure 2.1 below for the selection matrix applied for the proposed development.



	✓	Extended Detention/Attenuation Basins	✓		?	
	?	Filter Drains	✓	✓	✓	
		Filter Strips	?		✓	✓
		Infiltration Basins				✓
		Infiltration Trenches				✓
		MDCIA	?		✓	✓
	?	Porous and Permeable Pavements	✓	?	✓	✓
✓	✓	Retention Ponds	?	?		
		Soakaways				✓
		Swales	?		✓	✓
✓	✓	Wetlands	?	?		

Figure 2.1: Basic BMP control selection chart (Figure 48, Section 6.5, Volume 3 of GDSDS)

The SuDS selection process used for this site has been also carried out in accordance with the requirements Cork County Council Development Plan 2022 Advice Note 1 Surface Water Management December 2022.

Please refer to Figure 2.2 below for the site-specific SUDS selection hierarchy sheet. The completed sheet is also included in Appendix D of this document.

TABLE 4
CORK COUNTY COUNCIL SUDS SELECTION HIERARCHY SHEET FOR LARGE-SCALE DEVELOPMENT AND AGRICULTURAL DEVELOPMENT

SuDS Measures	Measures to be used on site	Rational for selecting / not selecting measure	Area of feature (m^2)	Attenuation volume of feature (m^3) (see No. 8)
Source Control Providing storage at source				
Swales	YES			
Integrated constructed tree pits	YES			
Rainwater Butts	NO			
Downpipe Planters	YES			
Rainwater Harvesting	NO			
Soakaways	NO			
Infiltration trenches	NO			
Permeable pavement (Grasscrete, Block Paving, Porous Asphalt etc)	YES			
Green Roofs	NO			
Green wall	NO			
Filter strips	YES			
Bio-retention systems/Raingardens	YES			
Blue Roofs	NO			
Filter Drain	YES			
Site Control				
Detention Basins	NO			
Retention basins	NO			
Regional Control				
Ponds	NO			
Wetlands	NO			
Other				
Petrol/Oil interceptor/Grit Trap	NO			
Attenuation tank – only as a last resort where other measures are not feasible	YES			
Oversized pipes– only as a last resort where other measures are not feasible	NO			
Other				

Figure 2.2: Completed table for selecting nature based solutions

2.4.2. PROPOSED SELECTED SUDS SYSTEMS

There are a number of systems available to address the SuDS requirements for the new developments according to the Cork County Development Plan 2022.

The proposed surface water network will include a storm drainage pipe network, attenuation storage and nature-based SuDS features which will aid the reduction of runoff volumes by slowing surface water flows, providing the opportunity for evapotranspiration, and providing the opportunity for infiltration to ground.

It is proposed that, as a minimum, the following mechanisms have been considered and incorporated into the SuDS surface water management regime:

- **Tree Pits**

Tree pits provide a nature-based solution for the treatment and disposal of surface water for low flow events. It is proposed that a number of tree pits will be designed to act as bioretention mechanisms, providing additional storage within their subbase. The soils arounds the trees will aid in filtering pollutants while also reducing the volume of surface water discharged to the attenuation tank. Tree pits are proposed in the green spaces adjacent to car parking, simultaneously providing amenity value to the development.

- **Attenuated Storage**

Attenuation storage tank is proposed to be provided in the form of a reinforced concrete underground storage tank for events up to and including the 1.0% AEP rainfall with a climate change allowance of 20%. The minimum storage capacity of the tank is 25m3. As a result of a consultation with the Local Area Engineer, concrete attenuation tanks are preferred in the East Cork area due to the karst limestone nature of the ground conditions, as opposed to the plastic attenuation tanks, as they have been known to puncture and drain into the soft limestone sub strata causing eventual subsidence.

- **Hydro-brake**

It is proposed to provide a hydro-brake at the outfall of the surface water network before connecting to the existing sewer to restrict the outflow of water from the site. The hydro-brake will be fitted with a pull cord bypass and a penstock valve installed on the inlet to the manhole for maintenance purposes.

- **Permeable paving**

Pervious pavement will be provided for the eastern, southern and western paths around the swale.

- **Downpipe planter**

There is an approx. 700mm wide, 1.1m high raised planter proposed at the southern boundary along the entrance ramp as an astatic solution to manage the flow of rainwater from the roof through the downpipe.

- **Swale**

A vegetated swale (conveyance channel) is proposed to be constructed running in the middle part of the landscaping area. Refer to Figure 2.3 overleaf for the proposed site layout. The swale will be a shallow landscaped depression (approx. 0.6m deep) and will be utilised to convey surface water flows.

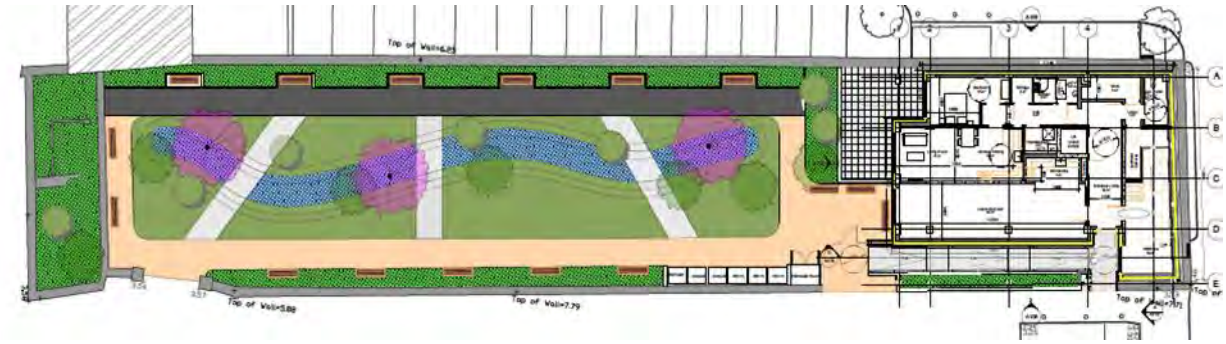


Figure 2.3: Proposed site layout

It is proposed that the swale will receive runoff from the hard surface areas to the north with filter strip being constructed along the path for pre-treatment and it will receive rainwater via filter drains laid under the permeable paved paths along the southern boundary. The wetland planting including trees and shrubs are proposed around that will enhance the biodiversity of the area and will provide a visual experience to the amenity space for the community.

- **Filter strips**

Filter strip is a linear feature that is designed to treat runoff from path with impervious pavement proposed to the north of the swale along the northern boundary used as pre-treatment component before the swale. Filter strips can be effectively incorporated into the landscaping and will support biodiversity.

- **Catch pits**

Catch pits in the form of small chambers will also be provided upstream of all filter drain inlets to the swale to prevent silt and debris entering to the swale causing buildup and blockages in the channel.

- **Landscape/Green Areas**

Green areas have been provided wherever possible which will reduce the overall quantity of surface water runoff from the site.

2.4.3. HYDRAULIC DESIGN OF SUDS MEASURES

- **Swale**

To meet the CIRIA SuDS manual 2015, a trapezoidal cross section with a bottom width of 0.5m and a depth of 0.6m with side slopes of 1:3 proposed to resist erosion and has been considered for hydraulic design.
The swale to be designed for a maximum velocity of 1.0 m/s. The hydraulic flow velocity has been calculated by using the Manning's equation:

$$V = \frac{R^{\frac{2}{3}} * \sqrt{S}}{n} \text{ [m/s]}$$

The hydraulic radius (R) has been calculated as the cross-sectional area of the swale divided by the wetted perimeter. The cross-sectional area is taken as 0.85m^2, and the wetted perimeter is 3.61m. It is important to note that a freeboard of 100mm at the top and a 150mm constant water level at the bottom was taken into account and was conservatively omitted from the calculation of the cross-sectional area.
The hydraulic radius is calculated as R=0.238. The average longitudinal gradient or slope (S) of the swale is considered 1.5% (0.015). The Manning's roughness coefficient (n) is taken as 0.3 for grassed channel. Grass/ vegetation has greater resistance when compared with hard standing surfaces, therefore it generates lower flow velocities and flow rates in the channel. Attenuation of peak flows is better achieved in grassed/ vegetated surface water channels and consequently the rate of discharge of runoff into the receiving sewer/watercourse is significantly slowed down.

The hydraulic capacity of the swale has been calculated 0.157m/s which is less than the maximum allowable velocity of 1.0m/s, therefore the proposed swale with its parameters is adequate.
A 225mm outlet is proposed at the lowest point of the swale, situated above the consistent water level, to facilitate the discharge of any excess water into the attenuation tank. This overflow therefore mitigating the risk of flooding in heavy rainfall events.

- **Filter drain**

Permeable pavement with porous surface materials is considered for a section of the paths around the inner landscape area. A perforated drain is proposed to be laid under the permeable pavement that will collect the water and discharge it into the swale. Six intermediate inlets indicated that are proposed to discharge surface water from the permeable paved path into the swale.
The approximately area of the permeable surface is 0.02ha. Dividing that area by the 6no. of inlets, the area for an inlet is 0.003ha. It is proposed to install 150mm diameter PVD filter drains. Based on the rainfall data and the granular soil properties under the permeable pavement, the allowable outflow is 0.014l/s/inlet. The flow into the swale is less than the flow capacity in the swale therefore the proposed inlets are adequate. A filter drain laid in a 0.5m deep, 1.5m wide, 50m long pervious filter strip area has a storage capacity of 2.2m3. It's important to note that the attenuation tank was conservatively designed to store water from all hardstanding areas (roof and tarmac path) including the permeable paved area as well as if it has no storage volume.

- **Attenuated Storage**

An underground concrete attenuation storage tank is proposed at the lowest point of the site before the discharge point to the existing storm sewer. The tank is sized to cater for events up to and including the 1.0% AEP rainfall (100-years) with a climate change allowance of 20%, while assuming a discharge rate of Qbar=5.96l/s. The allowable outflow is Qallow=0.66l/s. The attenuation tank was conservatively designed to store water from all hardstanding areas, not just from the roof and tarmac path, but including the permeable

paved area as well as if it has no storage volume. Therefore, the minimum storage capacity of the tank is proposed to be 26m^3.
As a result of a consultation with the Local Area Engineer, concrete attenuation tanks are preferred in the East Cork area due to the karst limestone nature of the ground conditions, as opposed to the plastic attenuation tanks, as they have been known to puncture and drain into the soft limestone sub strata causing eventual subsidence.

A sketch of the proposed SuDS systems with the initial calculations can be found in Appendix D to the rear of this report.

3 MAINTENANCE REGIME

The proposed development does not involve construction of a new access road, or car park, etc. The following maintenance regime is recommended to be included in the project safety file at handover stage.

- **Filter strips**

Maintenance of the filter strips is relatively straight forward for landscape contractors. Providing landscape management is required at the site, including the filter strip maintenance. Refer to Figure 3.1 below for the typical maintenance requirements for filter strips according to Table 15.1 of the SuDS manual.

TABLE 15.1 Operation and maintenance requirements for filter strips

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation and contamination (eg oils)	Monthly (at start, then half yearly)
	Check flow spreader and filter strip surface for even gradients	Monthly (at start, then half yearly)
	Inspect gravel flow spreader upstream of filter strip for clogging	Monthly (at start, then half yearly)
	Inspect silt accumulation rates and establish appropriate removal frequencies	Monthly (at start, then half yearly)
Occasional maintenance	Reseed areas of poor vegetation growth; alter plant types to better suit conditions, if required	As required or if bare soil is exposed over > 10% of the filter strip area.
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Figure 3.1: Guidance on the maintenance requirements for filter strips

- **Tree Pits & Trees**

Regular inspection of tree pits and tree condition including inlets/outlets is to be undertaken by the client. Maintenance requirements for the trees will be greatest during the first five years, when tree is becoming

established. Any invasive or excessive vegetation is to be removed and trees are to receive additional irrigation during prolonged dry periods. Landscape architect to advise regarding appropriate irrigation schedules. Maintenance responsibility for a tree pit or planter should always be placed with an appropriate organisation. Refer to Figure 3.2 below for the typical maintenance requirements for filter strips according to Table 19.3 of the SuDS manual.

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

Figure 3.2: Guidance on the maintenance requirements for trees

- **Filter drains**

Regular inspection and maintenance is important for the effective operation of filter drains. Maintenance responsibility for a filter drain should always be placed with an appropriate organisation. Litter and debris removal should be undertaken as part of the general landscape maintenance. Sediments collected in catchpits from upstream discharge should be removed and appropriately disposed. Refer to Figure 3.3 below for the typical maintenance requirements for filter strips according to Table 16.1 of the SuDS manual.

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

Figure 3.3: Guidance on the maintenance requirements for filter drains

- **Swale**

Regular inspection and maintenance is important for the effective operation of the swale. Maintenance responsibility for a swale should always be placed with an appropriate organisation. Litter and debris removal should be undertaken as part of the general landscape maintenance. Mowing of grass should retain grass length of 75-150mm across the slopes, to assist in filtering the pollutants and retaining sediments and to reduce the risk of flattening during runoff events. For wet swale, as what is proposed for this development, mowing of wetland vegetation is not required. However, harvesting of very dense vegetation may be desirable in the autumn after plant die-back, to prevent the discharge of excess organic material into receiving waters. Refer to Figure 3.4 below for the typical maintenance requirements for swales according to Table 17.1 of the SuDS manual.

TABLE 17.1 Operation and maintenance requirements for swales

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Figure 3.4: Guidance on the maintenance requirements for swale

- **Attenuated Storage**

All attenuation tanks are to be inspected and maintained in accordance with the manufacturer's requirements. At a minimum the tank is to be inspected monthly for the first 3 months following commissioning. There after inspections are to be undertaken annually. Debris should be removed monthly

for the relevant catchment area and silt traps are to be inspected monthly and sediment build up cleaned as required. The inside of the tank should be surveyed as per the manufacturer's requirements and sediment build up washed out as required.

- **Hydro break**

The hydro break manhole is to be inspected monthly for the first 3 months of operation and bi-annually thereafter. Any blockages or debris build ups are to be removed.

- **Pervious pavement**

Regular inspection and maintenance is important for the effective operation of filter drains. Maintenance responsibility for a filter drain should always be placed with an appropriate organisation. Before handover to the client, it should be inspected for clogging, litter, weeds, and water ponding. After handover, it should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding. Refer to Figure 3.5 below for the typical maintenance requirements for pervious pavement according to Table 20.15 of the SuDS manual.

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

Figure 3.5: Guidance on the maintenance requirements for pervious pavement

Pervious pavements need to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. Sweeping once per year should be sufficient for most sites, however inspection report should inform on the frequency to suit the site. A brush or suction cleaner should be used for regular sweeping; however, care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced.

Maintenance Plan and schedules should be developed for all of the above-mentioned SuDS measures and landscaping areas on the site. Specific maintenance needs should be monitored and maintenance schedule to be adjusted to suit requirements.

4 FLOODING

With reference to Distillery Walk Apartments, Midleton - Flood Risk Assessment Report – O1058-OCSC-XX-XX-RP-C-0001-S4-P01 - Issued 13 February 2024, OCSC Consulting Engineers investigated the publicly available information in relation to flooding in the Midleton area. Following review of the Arup Flood Maps developed for the Midleton Flood Relief Scheme and the Midleton flooding event of October 18th, 2023, it is proposed to set the finished floor level at 4.22m, to ensure it remains above the current 1:1000-year fluvial flood level with additional climate change and freeboarding allowance at the site. Please refer to Flood Risk Assessment report as a separate document within the planning package for full details.

5 CONCLUSION AND RECOMMENDATION

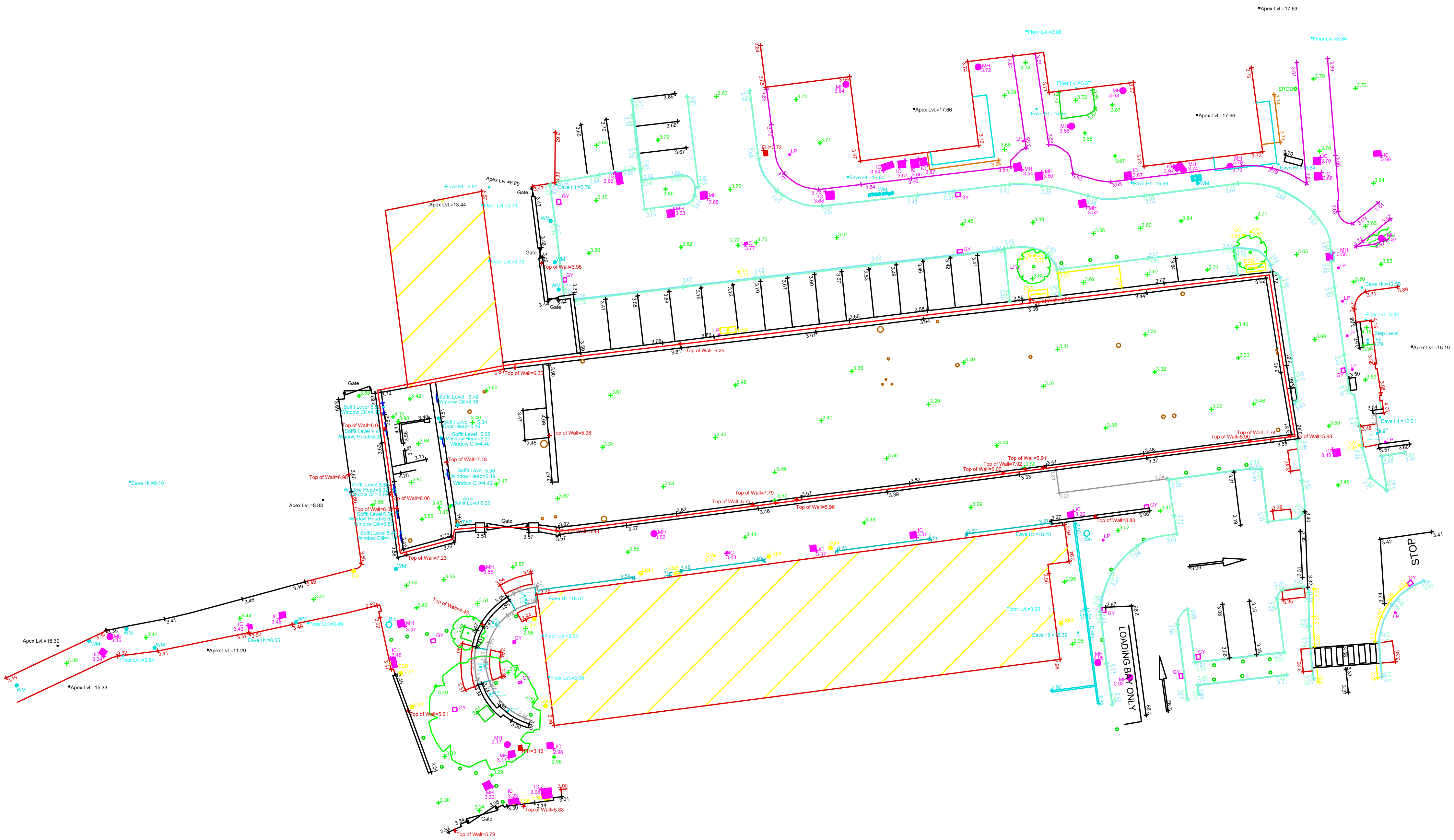
A Drainage Impact Assessment of the proposed development has been carried out. Apart from the new storm water sewer design, the proposed SuDS measures include a swale, filter strip, filter drain under permeable pavement, tree pits, landscaping areas with raised planter, as well as an underground attenuation tank with hydro-brake as outflow control structure. The maximum storm water outflow from the proposed network is 5.96l/s.

6 VERIFICATION

This report was compiled and verified by:

Anett Bognar-Nemeth BSc (Hons), MEng (Hons)
Civil & Structural Project Engineer
O'Connor Sutton Cronin & Associates

Appendix A TOPOGRAPHICAL SURVEY



METROSCAN UTILITY LOCATING

Address: Rathjarney
Piercestown
Co. Wexford
Tel (086) 8522298
(086) 1935847

Email: john@metroscan.ie
ciaran@metroscan.ie

Website: www.metroscan.ie

Legend

- Bottom of Bank
- Building Line
- Carriageway Edge
- Edge of Trees
- ESB Lines
- Fenceline
- Hard Shoulder
- Hedgeline
- Kerb Line
- Road Edge
- Road Centre Line
- Solid White Line
- Top of Bank
- Track
- Wall Line

Date	Rev. No.	Description	Drawn by	Checked by	Approved by
25/03/21	01	Extra Survey Detail	KON	JM	KON

Client

Cork Co Co

NOTES:

1. ITM Co-ordinates.
2. All levels relative to Malin Head Datum.
3. Contour interval 0.50 metres.
4. Although every effort has been made to survey all features, some may be missing due to obstructions.
5. Every effort has been made to survey features at 10m intervals and retain their integrity.

N

Project Title:

Site Survey at Midleton,Co.Cork.

Drawing Title:

2D Topographical Survey ITM

Approved by KON	Y
Checked by KON	Y
Drawn by: KON	Y

Scale: 1:200

Date: March 25th 2021

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

Contract: Distillery Lane Midleton Contract No. 25097
Test No. SA01 (at TP01)
Client Cork County Council
Date: 06/12/2023

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	Topsoil	Test pit dry to 1.4m (rapid water ingress in adjacent trial pit TP1 at 1.5m)
0.30	1.00	Grey brown slightly clayey fine to coarse GRAVEL	
1.00	1.40	Grey sandy fine to coarse GRAVEL	

Notes:

Field Data

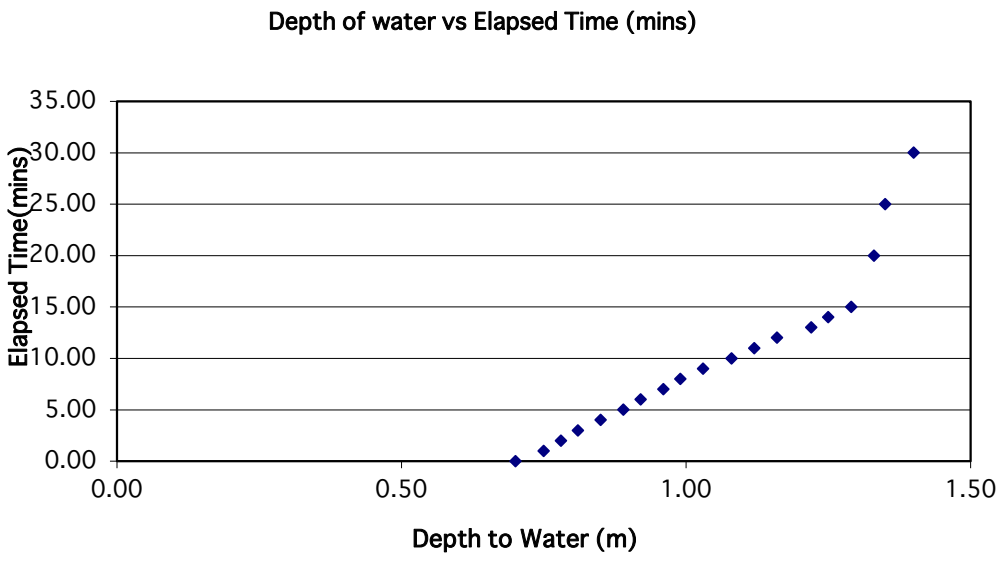
Depth to Water (m)	Elapsed Time (min)
0.70	0.00
0.75	1.00
0.78	2.00
0.81	3.00
0.85	4.00
0.89	5.00
0.92	6.00
0.96	7.00
0.99	8.00
1.03	9.00
1.08	10.00
1.12	11.00
1.16	12.00
1.22	13.00
1.25	14.00
1.29	15.00
1.33	20.00
1.35	25.00
1.40	30.00

Field Test

Depth of Pit (D)	1.40	m
Width of Pit (B)	0.50	m
Length of Pit (L)	2.00	m
Initial depth to Water =	0.70	m
Final depth to water =	1.40	m
Elapsed time (mins)=	30.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	1	m2
*Av. side area of permeable stratum over test perio	1.75	m2
Total Exposed area =	2.75	m2

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

f= 0.00848 m/min or 0.0001414 m/sec



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

Contract: Distillery Lane Midleton Contract No. 25097
Test No. SA02 (at TP02)
Client Cork County Council
Date: 06/12/2023

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	Topsoil	Test pit dry to 1.2m (rapid water ingress in adjacent trial pit TP2 at 1.5m)
0.30	1.00	Grey brown fine to coarse slightly clayey GRAVEL	
1.00	1.20	Grey fine to coarse sandy GRAVEL	

Notes:

Field Data

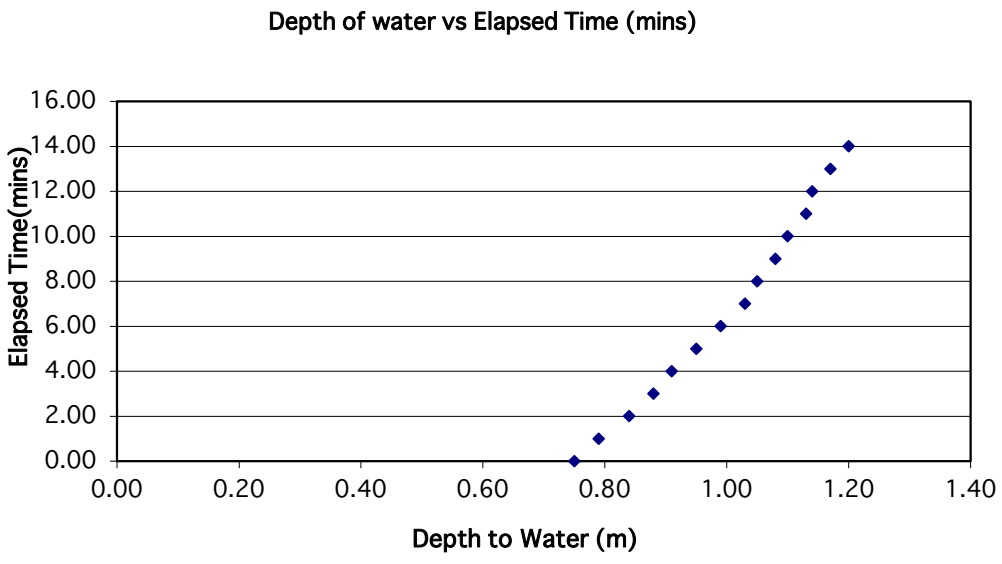
Depth to Water (m)	Elapsed Time (min)
0.75	0.00
0.79	1.00
0.84	2.00
0.88	3.00
0.91	4.00
0.95	5.00
0.99	6.00
1.03	7.00
1.05	8.00
1.08	9.00
1.10	10.00
1.13	11.00
1.14	12.00
1.17	13.00
1.20	14.00

Field Test

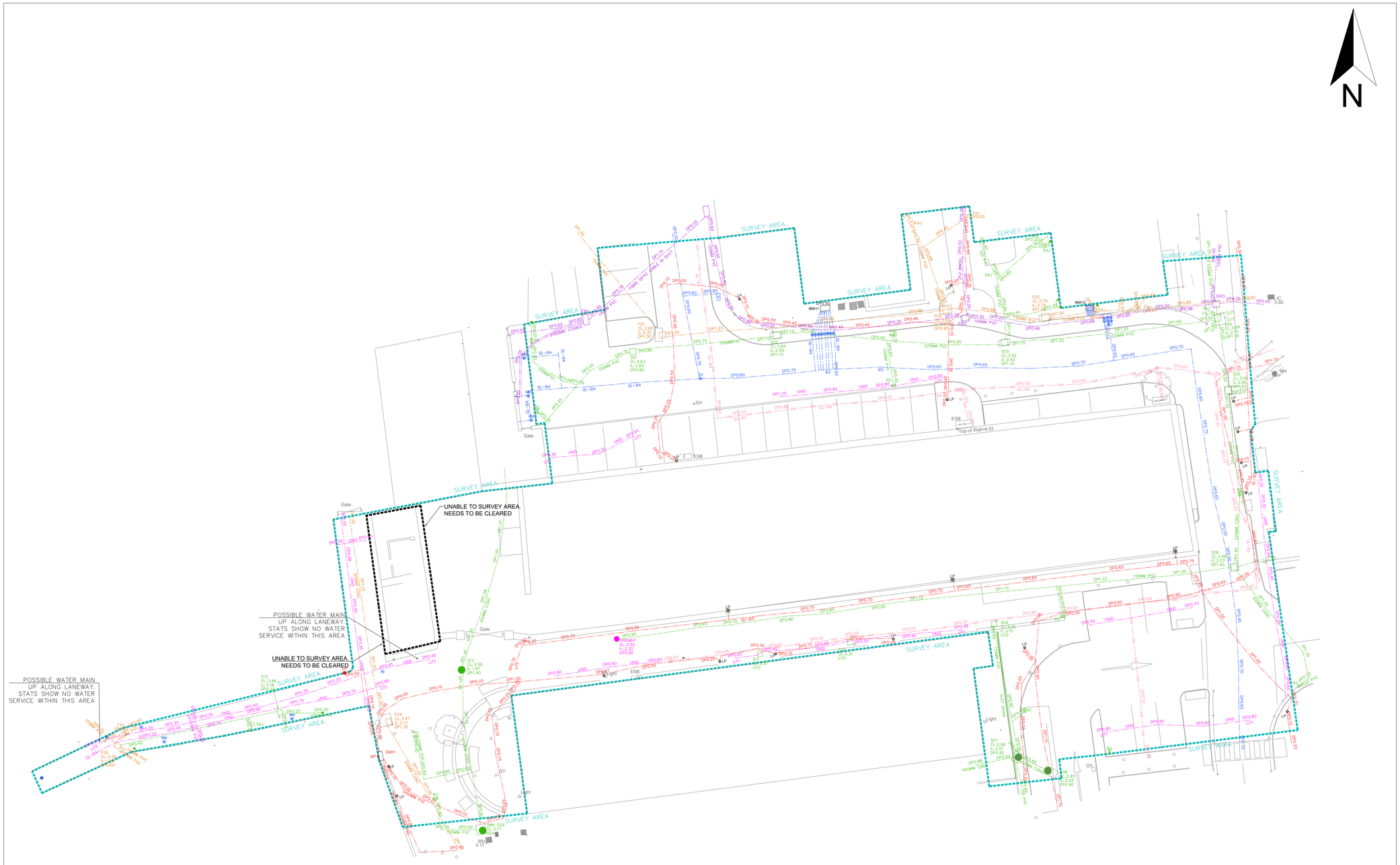
Depth of Pit (D)	1.20	m
Width of Pit (B)	0.50	m
Length of Pit (L)	2.00	m
Initial depth to Water =	0.75	m
Final depth to water =	1.20	m
Elapsed time (mins)=	14.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	1	m2
*Av. side area of permeable stratum over test perio	1.125	m2
Total Exposed area =	2.125	m2

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

f= 0.01513 m/min or 0.0002521 m/sec



Appendix B BELOW GROUND UTILITY SURVEY



Sheet No. 1

SERVICES LEGEND

- UNDERGROUND ELECTRICITY LINE
- ELECTRICAL MANHOLE
- OVERHEAD LINE WITH POLE
- OVERHEAD ELECTRIC
- UNDERGROUND HV ELECTRICITY LINE
- 6M HIGH STREET LIGHT
- MINI PILLAR
- EIR
- EIR CHAMBER
- OVERHEAD LINE WITH POLE
- ENET
- ENET CHAMBER
- COMMS
- COMMS CHAMBER
- VIRGIN
- VIRGIN CHAMBER
- FIBRE
- FIBRE CHAMBER
- AURORA TELECOM
- AURORA TELECOM CHAMBER
- CATV
- CATV CHAMBER
- BT
- BT CHAMBER
- ESAT
- ESAT CHAMBER
- SIRO FIBRE
- SIRO CHAMBER
- UNIDENTIFIED SERVICE
- UNIDENTIFIED CHAMBER
- EARTH LINE AND RODS
- TRAFFIC SENSORS
- CCTV POLE
- UTILITIES CABINET
- FOUL DRAINAGE
- FOUL MANHOLE
- STORM DRAINAGE
- STORM DRAINAGE MANHOLE
- COMBINED DRAINAGE
- COMBINED DRAINAGE MANHOLE
- PRODUCT DRAINAGE
- PRODUCT DRAINAGE MANHOLE
- CHEMICAL LINE
- CHEMICAL MANHOLE
- ROAD GULLY
- GULLY TRAP
- WATER MAIN
- SLUICE VALVE
- FIRE HYDRANT
- WATER METER
- SCOUR VALVE
- PRESSURE RELEASE VALVE
- AIR VALVE
- NON-RETURN VALVE
- FUEL LINE/TANK
- GAS SV
- GAS LINE
- GAS HIGH PRESSURE LINE
- GL 00.00 GROUND LEVEL (METRES - OS DATUM)
- CL 10.00 COVER LEVEL (METRES - OS DATUM)
- IL 10.00 INVERT LEVEL (METRES - OS DATUM)
- DP1.50 DEPTH TO TOP OF SERVICE DUCT OR CABLE
- DP ON MANHOLES = INVERT LEVEL OF CHAMBER
- DP ON DRAINAGE = INVERT LEVEL OF PIPE
- UTO UNABLE TO OPEN
- OSA OUTSIDE SURVEY AREA
- UTT UNABLE TO TRACE
- SURVEYED AREA

Please note that the absence of services on this drawing is not solid proof that these services are not present in the ground.
While every method of underground utility locating has been adhered to in this survey, some services may lie outside the range of the GPR and electro-magnetic locator signal. Poor ground conditions and or services situated underneath other services can also prove impossible to locate. Due to the fact that not all Utility Service Plans were provided to Metroscan by the contractor,Metroscan cannot be held responsible for any services that have not been identified. The contractor should not assume that all services have been identified and must exercise a duty of care when excavating.
Hand / vacuum excavation is advised to determine exact depth and position of service prior to excavation commencing.
Please note that the drawing provided is valid for 60 days from date stated below.
Drawing is intended solely for use of the contractor named below.

Accuracy Levels

In ideal conditions the accuracy levels of the EML is +\-5% whilst the GPR outputs accuracy levels of 10% up to 2.5m depth.
These accuracy levels can vary depending on ground conditions, depths of services, congestion of services (may cause signal to bleed on to other services).
Depths noted on drawings should be taken as indicative and hand / vacuum excavation is advised where exact depth are required.
Diameter of services will be given where direct access is available through visual inspection, eg manhole.

Survey Limitations

Non-conductible services pose a difficult task to identify. Direct buried fibre optic cables are difficult to identify with GPR.
They can easily be traced when placed in a conduit by the means of a sonde or cobra reel.
PE gas mains can also prove difficult to identify.

If Metroscan cannot get an accurate signal from a service, it will be noted on the drawing that the service is 'Taken from records QL-B4'.
If manholes cannot be opened on site, they with be marked on the drawing as UTO (unable to open).
Excluded from the survey unless otherwise stated:
Domestic services, Services above ground, Disconnected services where no signal can be obtained.

Notes

1. GPR scanning frequency 250 and 700 mhz
   Depth of investigation 2.5m, self calibrating.
2. Radio detection equipment:
   Vivax Metrotech VproLoc2 / RD7000
3. GPR scanning limited to smooth surfaces only no obstruction.
   Survey area marked on drawing
4. All depths stated are an indication of depth
   caution required when excavating.
5. All Utilities are classified QL- B2 unless noted otherwise.

PAS 128

	Survey Type	Quality Level	Location Accuracy: Horizonal	Location Accuracy: vertical	Supporting Data
D	Desktop utility record search	QL-D	Undefined	Undefined	
C	Site Reconnaissance	QL-C	Undefined	Undefined	A segment of utility whose location is demonstrated by visual reference to street furniture, topographical features or evidence of previous street works.
B	Detection	QL-B4	Undefined	Undefined	A utility segment which is suspected to exist but has not been detected and is therefor shown as an assumed route
		QL-B3 plus QL-B2B	plus/minus 500mm	Undefined (no reliable depth)	Horizontal location only of the utility detected by one of the geophysical techniques used
		QL-B2 plus QL-B2P	plus/minus 250mm of the detected depth	Plus/minus 40% of the detected depth	Horizontal and vertical location of the utility detected by one of the geophysical techniques used
		QL-B1 plus QL-B1P	plus/minus 150mm of the detected depth	plus/minus 15% of the detected depth	Horizontal and vertical location of the utility detected by multiple geophysical techniques used
A	Verification	QL-A	plus/minus 50mm	plus/minus 15mm	Horizontal and vertical location of the top and/or bottom of the utility through trial holes/slit trench method

Client : Priority

Site Address : Distillery Walk, Midleton, Co. Cork

Drawing Title: MUL762_ Distillery Walk_Midleton		**Drwg No:** 1
Date: 04/03/2021		**Sheet No:** 1
Scale: 1:250 @ A1	**Coordinates:** ITM	**Revision No:**

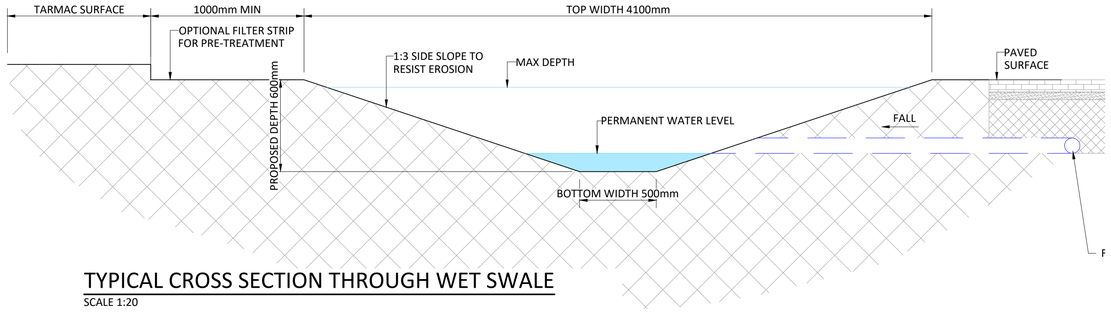
METROSCAN UTILITY LOCATING

Address: Rathjarney
Piercestown
Co. Wexford
Tel (086) 8522298
(086) 1935847

Email: john@metroscan.ie
ciaran@metroscan.ie

Website: www.metroscan.ie

Appendix C SURFACE WATER DESIGN CALCULATIONS



TYPICAL CROSS SECTION THROUGH WET SWALE

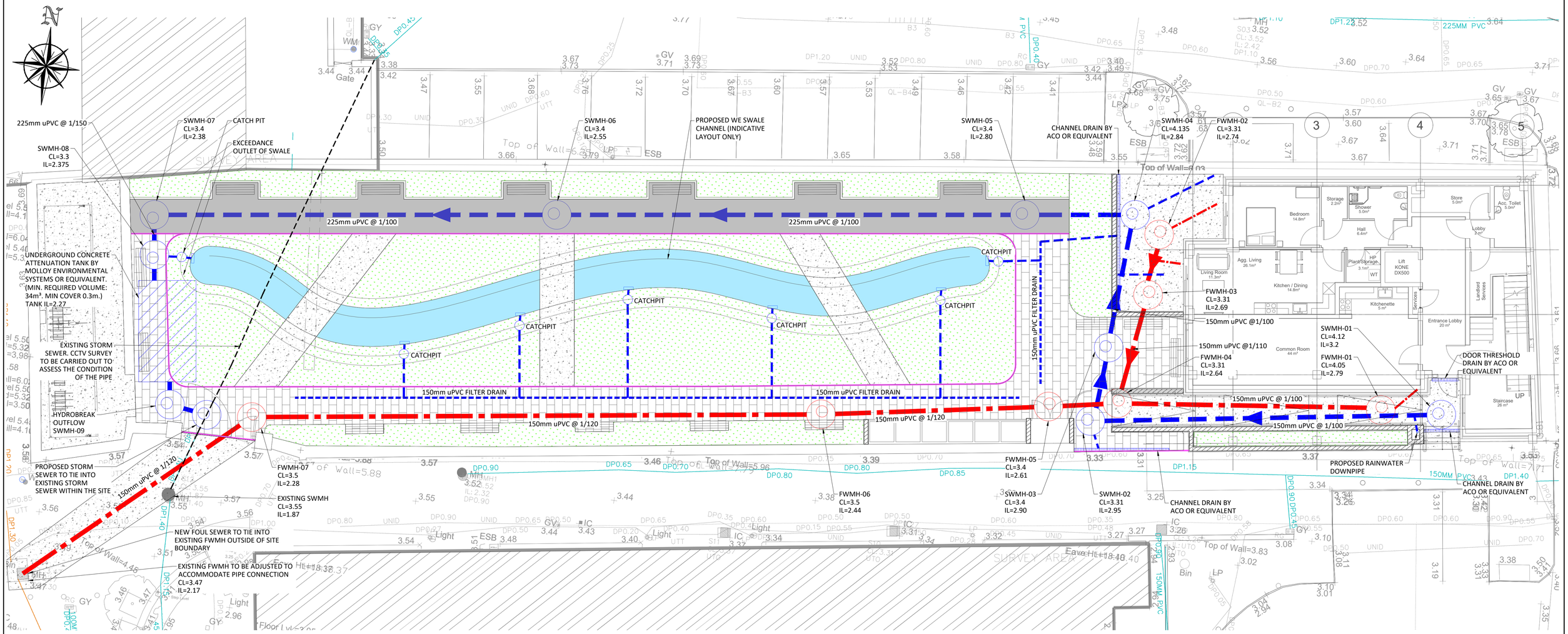
SCALE 1:20

FOUL & SURFACE WATER NOTES:

1. FOR SETTING OUT REFER TO ARCHITECT'S DRAWINGS.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER ARCHITECTURAL AND ENGINEERING DRAWINGS AND ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
3. FOR UNDER FLOOR DRAINAGE ARRANGEMENT PLEASE REFER TO ARCHITECT'S DRAWINGS.
4. DO NOT SCALE THIS DRAWING. USE FIGURE DIMENSIONS ONLY.
5. ALL SURFACE WATER SEWERS SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH THE RECOMMENDATIONS CONTAINED IN "RECOMMENDATIONS FOR SITE DEVELOPMENT WORKS FOR HOUSING AREAS" AS PUBLISHED BY DEPARTMENT OF ENVIRONMENT AND LOCAL GOVERNMENT AND IRISH WATER STANDARD DETAILS FOR WASTE WATER INFRASTRUCTURE.
6. ALL FOWL SEWER WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE IRISH WATER CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE & IRISH WATERS WASTE WATER INFRASTRUCTURE STANDARD DETAILS
7. GROUND LEVELS, COVER LEVELS AND INVERT LEVELS ARE APPROXIMATE ONLY. EXACT LEVELS TO BE CONFIRMED ON SITE.
8. THE DEVELOPMENT SHALL BE CONNECTED TO THE PUBLIC SEWER TO THE SATISFACTION OF THE LOCAL AUTHORITY AND IRISH WATER. THE MINIMUM COVER TO ANY SEWER PIPE SHALL BE 1.2m IN ROAD AND 0.9m IN OPEN SPACES AND FOOTPATHS NOT ADJACENT TO CARRIAGEWAYS. WHERE IT IS NOT POSSIBLE TO ACHIEVE THESE MINIMUM COVERS, PIPES SHALL BE BEDDED AND SURROUNDED IN CONCRETE 150thk.
9. THE SEWERS AND MANHOLES SHALL BE LAID AND TESTED TO THE SATISFACTION OF IRISH WATER AND THE LOCAL AUTHORITY. LAYING, BEDDING AND BACK FILLING OF SEWERS SHALL BE IN ACCORDANCE WITH THE IRISH WATER STANDARD DETAILS.
10. ALL SERVICE TRENCHES IN ROADS SHALL BE BACK FILLED AND PROPERLY COMPACTED WITH GRANULAR MATERIAL IN ACCORDANCE WITH IRISH WATER STANDARD DETAILS FOR WASTEWATER INFRASTRUCTURE.
11. GULLIES A) ALL GULLIES AND MANHOLES LOCATED IN THE PUBLIC ROAD SHALL BE LOCKING TYPE. GULLIES TO BE LOACTED EVERY 45m OR 200m2 OF HARD STANDING. B) DOUBLE GULLIES TO BE PROVIDED AT ALL ROAD SAG CURVES AND CUL DE SACS WHERE INDICATED. SEPARATE CONNECTIONS SHALL BE PROVIDED FOR EACH GULLY.
12. MAIN DRAINGE INDICATED ONLY. ALL SECONDARY DRAINAGE INCLUDING GULLIES, DOOR THRESHOLD DRAINS, BIGTs, RWPs, AJs ETC. OMITTED FOR CLARITY AT THIS STAGE.
13. ALL MANHOLE COVERS TO BE D400
14. ALL MANHOLE COVERS IN PAVEMENT AREAS TO BE RECESSED
15. ALL INTERNAL MANHOLES ARE TO HAVE DOUBLE SEALED, RECESSED MANHOLE COVERS
16. ALL BELOW GROUND FLOOR SLAB FOUL AND SURFACE WATER PIPEWORK TO BE MIN 150Ø U.N.O.
17. REFER TO TYPICAL BELOW GROUND FLOOR SLAB DRAINAGE DETAILS FOR INTERNAL DRAINAGE SUPPORT DETAIL
18. FLOOR GULLIES TO BE CAST INTO CONCRETE SLAB/SCREED. MIN B125 RATED COVER. FINISH TO ARCHITECT'S SPECIFICATION

LEGEND:

- DENOTES NEW uPVC STORM WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE/IC/AI/MH REF & INVERT LEVEL TO IRISH WATER CODE OF PRACTICE
- DENOTES NEW uPVC FOUL WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE/IC/AI/MH REF & INVERT LEVEL TO IRISH WATER CODE OF PRACTICE
- DENOTES FILTER DRAIN UNDER PERMEABLE PAVEMENT
- DENOTES NEW VEGETATED WET SWALE
- DENOTES CHANNEL DRAIN BY ACO OR EQUIVALENT
- DENOTES EXISTING STORM SEWER
- DENOTES EXISTING FOUL SEWER
- SUDS INLET BY ACO OR EQUIVALENT



- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DESIGN TEAM DRAWINGS AND SPECIFICATIONS.
- FOR SETTING OUT REFER TO ARCHITECT'S DRAWINGS. DO NOT SCALE THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
-

Rev No.	Date	Revision Note	Drn by	Chkd by
P01	26/02/24	ISSUED FOR PLANNING	MA	ABN
P02	03/05/24	ISSUED FOR PLANNING	MA	ABN

Rev No.	Date	Revision Note	Drn by	Chkd by

OCSC
O'CONNOR SUTTON CRONIN
MULTIDISCIPLINARY CONSULTING ENGINEERS
Civil / Structural / Environmental / Mechanical /Electrical / Sustainability
Cork Office: North Point House, North Point Business Park, New Mallow Road, Cork.
Tel: +353 (0)21 2355816 Web: www.ocsc.ie
Dublin · London · Belfast · Galway · Cork · Birmingham

Client: CORK COUNTY COUNCIL
Project: 16No. APARTMENTS AT DISTILLERY LANE, MIDLETON CO.CORK
Title: DRAINAGE LAYOUT

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
C1058	OCSC	XX	XX	DR	C	0001	S3	P02

Date:02/24 Scale @ A1: 1/100 Drn by:CW Chkd by:ANB Aprvd by:JMcB

JOB NAME:	JOB NO:	DATE:	Pipe Ks:	0.6 mm
Distillery Lane Apartments, Midleton, Co. Cork	C1058	23/11/21		
			Te:	4 mins
TITLE:	CALCS BY:	CHECK'D:		
	ABN	CM	Design Storm:	5 years
STORM SEWER CAPACITY CALCS				

Pipe Section			U/S Level (m)	D/S Level (m)	Length (m)	Slope (1:X)	Pipe Diameter (mm)	Pipe Capacity (l/s)	Full Velocity (m/s)	T_{pipe} (mins)	Tc (mins)	Rainfall Intensity, i (mm/hr)	Imp Area (Ha)	Cum. Imp Area (Ha)	Flow (Q = 2.71Ai) (l/s)	Adequate Capacity?
SWMH 01	to	SWMH 02	3.12	2.95	17	100	225	51.93	1.31	0.22	4.22	93.04	0.02	0.02	3.78	✓
SWMH 02	to	SWMH 03	2.95	2.90	5	100	225	51.93	1.31	0.06	4.28	91.95	0.0005	0.02	3.86	✓
SWMH 03	to	SWMH 04	2.9	2.84	6	100	225	51.93	1.31	0.08	4.36	90.69	0.0005	0.016	3.93	✓
SWMH 04	to	SWMH 05	2.84	2.8	4	100	225	51.93	1.31	0.05	4.41	89.87	0.03	0.044	10.72	✓
SWMH 05	to	SWMH 06	2.8	2.55	25	100	225	51.93	1.31	0.32	4.73	85.15	0.00	0.044	10.15	✓
SWMH 06	to	SWMH 07	2.55	2.38	17	100	225	51.93	1.31	0.22	4.94	82.29	0.00	0.044	9.81	✓
SWMH 07	to	SWMH 08	2.38	2.375	0.5	100	225	51.93	1.31	0.01	4.95	82.21	0.00	0.044	9.80	✓
SWMH 08	to	ATT. TANK	2.375	2.37	0.5	100	225	51.93	1.31	0.01	4.96	82.13	0.00	0.044	9.79	✓
ATT. TANK	to	EXISTING MH	1.92	1.90	2	100	225	51.93	1.31	0.03	4.98	81.81	0.00	0.044	9.76	✓

JOB NAME: Distillery Lane Apartments, Midleton, Co. Cork	**JOB NO:** C1058	**DATE:** 22/01/24	**Pipe Ks:** 0.6 mm	O'CONNOR SUTTON CRONIN NORTH POINT HOUSE NORTH POINT BUSINESS PARK NEW MALLOW ROAD CORK. Tel: 021 2355816
TITLE: SWALE - OUTFLOW PIPE CAPACITY CHECK	**CALCS BY:** ABN	**CHECK'D:** CM	**Te:** 4 mins **Design Storm:** 5 years	

Pipe Section	U/S Level (m)	D/S Level (m)	Length (m)	Slope (1:X)	Pipe Diameter (mm)	Pipe Capacity (l/s)	Full Velocity (m/s)	T_{pipe} (mins)	Tc (mins)	Rainfall Intensity, i (mm/hr)	Imp Area (Ha)	Cum. Imp Area (Ha)	Flow (Q = 2.71Ai) (l/s)	Adequate Capacity?
Swale outflow to SWMH-08	2.85	2.375	2	4	225	255.32	6.42	0.01	4.01	96.90	0.02	0.02	13.40	✓

Project:	Distillery Lane Apartments
Project No.:	C1058
Calculation:	Attenuation 100-year
Calcs By:	ABN
Checked By:	JMcB
Date:	22/01/2024

O'CONNOR SUTTON CRONIN
NORTH POINT HOUSE
NORTH POINT BUSINESS PARK
NEW MALLOW ROAD
CORK.
Tel: 021 2355816

Site Location:	Midleton	
Design Storm Return Period:	100 years	
Climate Change Factor:	20 %	
Total Area of pervious pavement:	0.02 ha	
Hardstand Area:	0.02 ha	……@ 100% pervious
Effective Impermeable Area A_D:	0.02 ha	

Soakaway Design - To BRE Digest 365				
Infiltration Coefficient from Percolation Test		0.011805	m/min	average value from SI report
Soil Infiltration Rate	f	1.97E-04	m/s	Infitration Coefficeint / F
Length	L	50	m	length of filter drain
Effective Depth	D_e	0.5	m	
Porosity of Fill Material	n	0.95		
Width	W	1.5	m	width of paved path
Internal Surface Area @ 50% Depth	$a_{s50\%}$	25.75	m	

REQUIRED STORAGE: **2.176 m^3**

DIMENSIONS (L x W x H): **50.000m x 2.000m x 0.50m**

Duration (min)	Rainfall 100-Year (mm)	Rainfall 100-Year with CCF (mm)	Inflow I (m^3)	Outflow O (m^3)	Required Storage S (m^3)	Volume Provided P	Optimum (Size to ensure P>S) = P - S	Time of emptying half storage volume $t_{s50\%}$ (hrs)
2	0.0	0.0	0.000	0.608	-0.608	35.625	36.233	-0.02
5	15.4	18.5	3.696	1.520	**2.176**	35.625	33.449	0.06
10	21.5	25.8	5.160	3.040	2.120	35.625	33.505	0.06
15	25.3	30.4	6.072	4.560	1.512	35.625	34.113	0.04
30	31.6	37.9	7.584	9.119	-1.535	35.625	37.160	-0.04
60	39.4	47.3	9.456	18.239	-8.783	35.625	44.408	-0.24
120	49.2	59.0	11.808	36.477	-24.669	35.625	60.294	-0.68
180	56.0	67.2	13.440	54.716	-41.276	35.625	76.901	-1.13
240	61.3	73.6	14.712	72.955	-58.243	35.625	93.868	-1.60
360	69.8	83.8	16.752	109.432	-92.680	35.625	128.305	-2.54
540	79.5	95.4	19.080	164.149	-145.069	35.625	180.694	-3.98
720	87.2	104.6	20.928	218.865	-197.937	35.625	233.562	-5.43
1080	99.2	119.0	23.808	328.297	-304.489	35.625	340.114	-8.35
1440	108.8	130.6	26.112	437.729	-411.617	35.625	447.242	-11.28
2880	124.8	149.8	29.952	875.459	-845.507	35.625	881.132	-23.18
4320	138.3	166.0	33.192	1313.188	-1279.996	35.625	1315.621	-35.09
5760	150.1	180.1	36.024	1750.918	-1714.894	35.625	1750.519	-47.01
8640	170.9	205.1	41.016	2626.376	-2585.360	35.625	2620.985	-70.88
11520	189.3	227.2	45.432	3501.835	-3456.403	35.625	3492.028	-94.75
14400	206.0	247.2	49.440	4377.294	-4327.854	35.625	4363.479	-118.64
17280	221.5	265.8	53.160	5252.753	-5199.593	35.625	5235.218	-142.54
23040	250.1	300.1	60.024	7003.670	-6943.646	35.625	6979.271	-190.35
28800	276.4	331.7	66.336	8754.588	-8688.252	35.625	8723.877	-238.18
36000	306.9	368.3	73.656	10943.235	-10869.579	35.625	10905.204	-297.98

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 188295, Northing: 73497,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	3.0,	4.2,	4.8,	5.7,	6.4,	6.8,	8.4,	10.2,	11.3,	12.9,	14.3,	15.4,	17.1,	18.4,	19.5,	N/A ,
10 mins	4.2,	5.8,	6.7,	8.0,	8.9,	9.5,	11.7,	14.1,	15.8,	18.0,	20.0,	21.5,	23.9,	25.7,	27.2,	N/A ,
15 mins	4.9,	6.9,	7.9,	9.4,	10.4,	11.2,	13.8,	16.6,	18.5,	21.2,	23.5,	25.3,	28.1,	30.2,	32.0,	N/A ,
30 mins	6.5,	9.0,	10.3,	12.1,	13.4,	14.4,	17.6,	21.1,	23.4,	26.6,	29.4,	31.6,	34.9,	37.5,	39.6,	N/A ,
1 hours	8.7,	11.7,	13.3,	15.7,	17.3,	18.5,	22.4,	26.7,	29.5,	33.4,	36.8,	39.4,	43.4,	46.4,	49.0,	N/A ,
2 hours	11.5,	15.4,	17.4,	20.3,	22.3,	23.8,	28.6,	33.8,	37.2,	41.9,	46.0,	49.2,	53.9,	57.6,	60.6,	N/A ,
3 hours	13.5,	18.0,	20.3,	23.6,	25.8,	27.5,	32.9,	38.9,	42.7,	47.9,	52.5,	56.0,	61.2,	65.3,	68.6,	N/A ,
4 hours	15.2,	20.1,	22.6,	26.3,	28.7,	30.6,	36.4,	42.9,	47.0,	52.7,	57.6,	61.3,	67.0,	71.4,	74.9,	N/A ,
6 hours	17.9,	23.5,	26.4,	30.6,	33.3,	35.4,	42.0,	49.2,	53.8,	60.2,	65.7,	69.8,	76.1,	80.9,	84.9,	N/A ,
9 hours	21.1,	27.5,	30.8,	35.5,	38.6,	41.0,	48.5,	56.6,	61.7,	68.8,	74.9,	79.5,	86.5,	91.8,	96.1,	N/A ,
12 hours	23.7,	30.8,	34.4,	39.6,	42.9,	45.5,	53.6,	62.4,	68.0,	75.6,	82.2,	87.2,	94.7,	100.4,	105.0,	N/A ,
18 hours	28.0,	36.0,	40.1,	46.0,	49.8,	52.7,	61.9,	71.7,	77.9,	86.4,	93.7,	99.2,	107.6,	113.9,	119.0,	N/A ,
24 hours	31.4,	40.3,	44.8,	51.2,	55.4,	58.5,	68.5,	79.1,	85.8,	95.0,	102.9,	108.8,	117.7,	124.5,	130.0,	148.7,
2 days	40.3,	50.6,	55.7,	62.9,	67.5,	71.0,	81.9,	93.4,	100.6,	110.3,	118.6,	124.8,	134.1,	141.1,	146.8,	165.9,
3 days	47.7,	59.0,	64.6,	72.5,	77.5,	81.3,	93.0,	105.2,	112.8,	123.1,	131.8,	138.3,	147.9,	155.2,	161.1,	180.7,
4 days	54.3,	66.5,	72.5,	80.9,	86.3,	90.3,	102.7,	115.6,	123.6,	134.3,	143.4,	150.1,	160.2,	167.7,	173.7,	193.9,
6 days	66.0,	79.8,	86.6,	95.9,	101.8,	106.3,	119.8,	133.9,	142.5,	154.0,	163.7,	170.9,	181.6,	189.5,	195.9,	217.2,
8 days	76.5,	91.8,	99.1,	109.2,	115.7,	120.4,	135.0,	150.0,	159.2,	171.4,	181.7,	189.3,	200.5,	208.8,	215.5,	237.7,
10 days	86.4,	102.8,	110.7,	121.5,	128.4,	133.5,	148.9,	164.8,	174.5,	187.3,	198.0,	206.0,	217.7,	226.4,	233.3,	256.3,
12 days	95.7,	113.2,	121.5,	133.1,	140.3,	145.7,	161.9,	178.6,	188.7,	202.1,	213.3,	221.5,	233.7,	242.7,	249.9,	273.6,
16 days	113.2,	132.7,	141.9,	154.5,	162.5,	168.3,	186.1,	204.0,	215.0,	229.3,	241.3,	250.1,	263.1,	272.6,	280.3,	305.4,
20 days	129.6,	150.9,	160.9,	174.5,	183.1,	189.4,	208.4,	227.6,	239.2,	254.4,	267.1,	276.4,	290.0,	300.1,	308.1,	334.4,
25 days	149.2,	172.4,	183.3,	198.1,	207.3,	214.1,	234.5,	255.0,	267.4,	283.6,	297.0,	306.9,	321.3,	331.9,	340.3,	367.9,

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

Appendix D ATTENUATION SYSTEM DETAILS

Project: Distillery Lane Apartments
Project No.: C1058
Calculation: Attenuation 100-year
Calcs By: ABN
Checked By: JMcB
Date: 22/01/2024

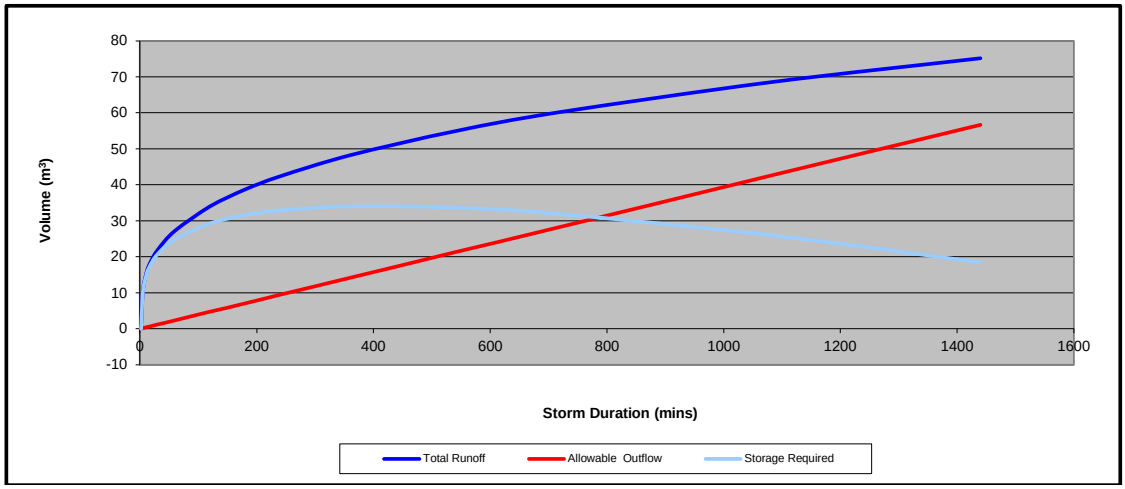
Site Location:	Midleton		
Design Storm Return Period:	100 years		
Climate Change Factor:	20 %		
Soil Type:	3		
Total Site Area:	0.110 ha		
Hardstand Area:	0.059 ha	……@	100% Impervious
Softstand Area:	0.05 ha	……@	0% pervious
Effective Impermeable Area:	0.059 ha		

Allowable Outflow	**Calculate**
IH124: QBAR = 0.00108 x $AREA^{0.89}$ x $SAAR^{1.17}$ x $SOIL^{2.17}$	
AREA:	0.0006 km^2
SAAR:	1306.5 mm
SOIL:	0.37
QBAR/ha	5.96 l/s/ha
Allowable Outflow	**0.66 l/s**

Storage required =	**34 m^3**	

Duration (min)	Rainfall 100-Year (mm)	Rainfall 100-Year with CCF (mm)	Intensity (mm/hr)	Discharge (Q = 2.71iA) (l/s)	Proposed Runoff (m^3)	Contiguous Land Runoff (m^3)	Total Runoff (m^3)	Allowable Outflow (m^3)	Storage Required (m^3)
2	0.0	0.0	0.0	0	0	0	0	0	0
5	15.4	18.5	221.8	35	11	0	11	0	10
10	21.5	25.8	154.8	25	15	0	15	0	14
15	25.3	30.4	121.4	19	17	0	17	1	17
30	31.6	37.9	75.8	12	22	0	22	1	21
60	39.4	47.3	47.3	8	27	0	27	2	25
120	49.2	59.0	29.5	5	34	0	34	5	29
180	56.0	67.2	22.4	4	39	0	39	7	32
240	61.3	73.6	18.4	3	42	0	42	9	33
360	69.8	83.8	14.0	2	48	0	48	14	34
540	79.5	95.4	10.6	2	55	0	55	21	34
720	87.2	104.6	8.7	1	60	0	60	28	32
1080	99.2	119.0	6.6	1	69	0	69	42	26
1440	108.8	130.6	5.4	1	75	0	75	57	18
2880	124.8	149.8	3.1	0	86	0	86	113	-27
4320	138.3	166.0	2.3	0	96	0	96	170	-74
5760	150.1	180.1	1.9	0	104	0	104	227	-123
8640	170.9	205.1	1.4	0	118	0	118	340	-222
11520	189.3	227.2	1.2	0	131	0	131	453	-323
14400	206.0	247.2	1.0	0	142	0	142	567	-424
17280	221.5	265.8	0.9	0	153	0	153	680	-527
23040	250.1	300.1	0.8	0	173	0	173	907	-734
28800	276.4	331.7	0.7	0	191	0	191	1133	-942
36000	306.9	368.3	0.6	0	212	0	212	1417	-1205

Project:	Distillery Lane Apartments
Project No.:	C1058
Calculation:	Attenuation 100-year
Calcs By:	ABN
Checked By:	JMcB
Date:	22/01/2024



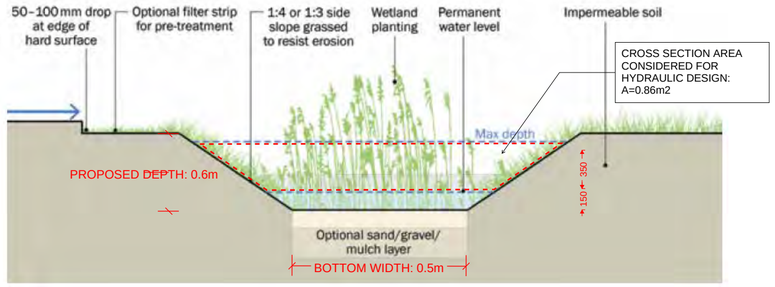
Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 188295, Northing: 73497,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	3.0,	4.2,	4.8,	5.7,	6.4,	6.8,	8.4,	10.2,	11.3,	12.9,	14.3,	15.4,	17.1,	18.4,	19.5,	N/A ,
10 mins	4.2,	5.8,	6.7,	8.0,	8.9,	9.5,	11.7,	14.1,	15.8,	18.0,	20.0,	21.5,	23.9,	25.7,	27.2,	N/A ,
15 mins	4.9,	6.9,	7.9,	9.4,	10.4,	11.2,	13.8,	16.6,	18.5,	21.2,	23.5,	25.3,	28.1,	30.2,	32.0,	N/A ,
30 mins	6.5,	9.0,	10.3,	12.1,	13.4,	14.4,	17.6,	21.1,	23.4,	26.6,	29.4,	31.6,	34.9,	37.5,	39.6,	N/A ,
1 hours	8.7,	11.7,	13.3,	15.7,	17.3,	18.5,	22.4,	26.7,	29.5,	33.4,	36.8,	39.4,	43.4,	46.4,	49.0,	N/A ,
2 hours	11.5,	15.4,	17.4,	20.3,	22.3,	23.8,	28.6,	33.8,	37.2,	41.9,	46.0,	49.2,	53.9,	57.6,	60.6,	N/A ,
3 hours	13.5,	18.0,	20.3,	23.6,	25.8,	27.5,	32.9,	38.9,	42.7,	47.9,	52.5,	56.0,	61.2,	65.3,	68.6,	N/A ,
4 hours	15.2,	20.1,	22.6,	26.3,	28.7,	30.6,	36.4,	42.9,	47.0,	52.7,	57.6,	61.3,	67.0,	71.4,	74.9,	N/A ,
6 hours	17.9,	23.5,	26.4,	30.6,	33.3,	35.4,	42.0,	49.2,	53.8,	60.2,	65.7,	69.8,	76.1,	80.9,	84.9,	N/A ,
9 hours	21.1,	27.5,	30.8,	35.5,	38.6,	41.0,	48.5,	56.6,	61.7,	68.8,	74.9,	79.5,	86.5,	91.8,	96.1,	N/A ,
12 hours	23.7,	30.8,	34.4,	39.6,	42.9,	45.5,	53.6,	62.4,	68.0,	75.6,	82.2,	87.2,	94.7,	100.4,	105.0,	N/A ,
18 hours	28.0,	36.0,	40.1,	46.0,	49.8,	52.7,	61.9,	71.7,	77.9,	86.4,	93.7,	99.2,	107.6,	113.9,	119.0,	N/A ,
24 hours	31.4,	40.3,	44.8,	51.2,	55.4,	58.5,	68.5,	79.1,	85.8,	95.0,	102.9,	108.8,	117.7,	124.5,	130.0,	148.7,
2 days	40.3,	50.6,	55.7,	62.9,	67.5,	71.0,	81.9,	93.4,	100.6,	110.3,	118.6,	124.8,	134.1,	141.1,	146.8,	165.9,
3 days	47.7,	59.0,	64.6,	72.5,	77.5,	81.3,	93.0,	105.2,	112.8,	123.1,	131.8,	138.3,	147.9,	155.2,	161.1,	180.7,
4 days	54.3,	66.5,	72.5,	80.9,	86.3,	90.3,	102.7,	115.6,	123.6,	134.3,	143.4,	150.1,	160.2,	167.7,	173.7,	193.9,
6 days	66.0,	79.8,	86.6,	95.9,	101.8,	106.3,	119.8,	133.9,	142.5,	154.0,	163.7,	170.9,	181.6,	189.5,	195.9,	217.2,
8 days	76.5,	91.8,	99.1,	109.2,	115.7,	120.4,	135.0,	150.0,	159.2,	171.4,	181.7,	189.3,	200.5,	208.8,	215.5,	237.7,
10 days	86.4,	102.8,	110.7,	121.5,	128.4,	133.5,	148.9,	164.8,	174.5,	187.3,	198.0,	206.0,	217.7,	226.4,	233.3,	256.3,
12 days	95.7,	113.2,	121.5,	133.1,	140.3,	145.7,	161.9,	178.6,	188.7,	202.1,	213.3,	221.5,	233.7,	242.7,	249.9,	273.6,
16 days	113.2,	132.7,	141.9,	154.5,	162.5,	168.3,	186.1,	204.0,	215.0,	229.3,	241.3,	250.1,	263.1,	272.6,	280.3,	305.4,
20 days	129.6,	150.9,	160.9,	174.5,	183.1,	189.4,	208.4,	227.6,	239.2,	254.4,	267.1,	276.4,	290.0,	300.1,	308.1,	334.4,
25 days	149.2,	172.4,	183.3,	198.1,	207.3,	214.1,	234.5,	255.0,	267.4,	283.6,	297.0,	306.9,	321.3,	331.9,	340.3,	367.9,

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

PROPOSED SUDS MEASURES ACCORDING TO STRATEGIC FLOOD RISK ASSESSMENT (SFRA) AS PART OF CORK COUTY DEVELOPMENT PLAN 2022:

- RAISED GROUND FLOOR LEVEL
- SWALE COLLECT RUNOFF FROM HARD SURFACE WITH FILTER STRIP FOR PRE-TREATMENT (NO NEED FOR KERBS AND GULLIES) + DRAIN PATHS VIA FILTER DRAIN
- PROVISION OF VEGETATED SWALES (CONVEYANCE CHANNEL) IN ACCORDANCE WITH CIRIA SUDS MANUAL 2015
- ATTENUATION TANK TO CONTROL RAINWATER DISCHARGE INTO THE EXISTING STORM SEWER AND DECREASE RISK OF FLOODING FROM THE SWALE



TYPICAL CROSS SECTION OF A WET SWALE AS PER FIGURE 17.3 IN CIRIA SuDS MANUAL 2015

SWALE TO BE DESIGNED FOR MAX VELOCITY 1.0m/s

HYDRAULIC DESIGN CHECK:
HYDRAULIC FLOW VELOCITY CALCULATION USING MANNING'S EQUATION: v=(R^2/3*S^1/2)/n
HYDRAULIC RADIUS: CROSS SECTION/WETTED PERIMETER
R=A/P =0.86m2/3.61m=0.238
S: AVERAGE LONGITUDINAL SLOPE 1.5%->0.015
n: MANNING'S NUMBER: 0.3 TAKEN FOR GRASSED CHANNEL
v=0.157m/s <1.0m/s -> adequate

Outflow pipe capacity check: 225mm dia pipe proposed
Q(l/s)=A*v ->Q=0.0134 m3/s=13.4 l/s ->adequate capacity

Pipe Section	U/S Level (m)	D/S Level (m)	Length (m)	Slope (1:X)	Pipe Diameter (mm)	Pipe Capacity (l/s)	Full Velocity (m/s)	Flow (Q = 2.71Ai) (l/s)	Adequate Capacity?
Swale to outflow	2.894	2.877	1.7	100	225	51.93	1.31	13.40	✓

Inlet to swale:
total permeable area 0.02ha / 6 inlet: 0.003ha

Allowable Outflow	Calculate
IH124: QBAR = 0.00108 x AREA$^{0.89}$ x SAAR$^{1.17}$ x SOIL$^{2.17}$	
AREA:	0.0000 km^2
SAAR:	1091 mm
SOIL:	0.37
QBAR/ha	4.83 l/s/ha
Allowable Outflow	**0.014 l/s**

Flow into the swale is less than the flow capacity in the swale --> inlet is adequate

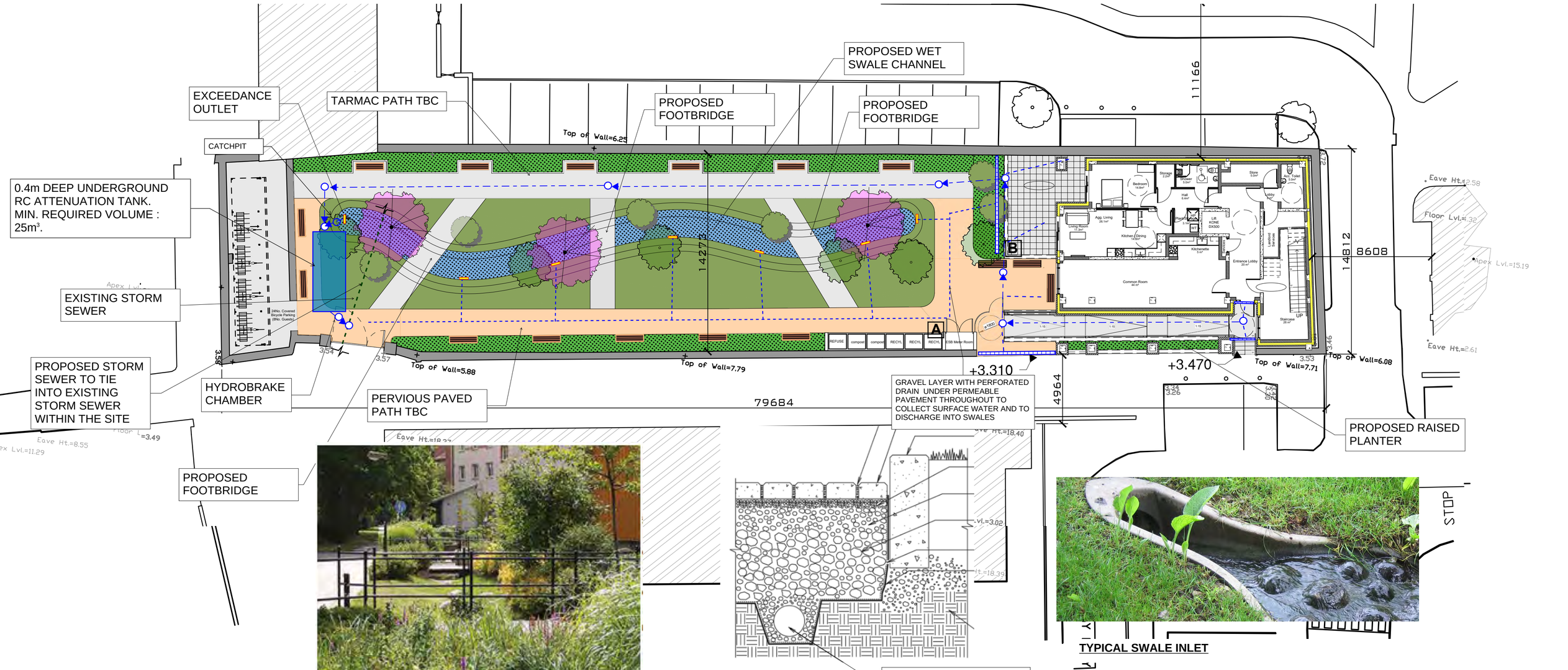


IMAGE OF TYPICAL FOOTBRIDGE OVER SWALE CHANNEL WITH HANDRAIL

TYPICAL SECTION THROUGH PERMEABLE PAVEMENT WITH DRAINAGE

TYPICAL SWALE INLET

OCSC
O'CONNOR · SUTTON · CRONIN
MULTIDISCIPLINARY CONSULTING ENGINEERS

C1058-OCSC-XX-XX-SK-C-0002-P03-S3
PROPOSED SUDS MEASURES

REV: P03	BY: ABN	DATE: 03/05/24

TABLE 4
CORK COUNTY COUNCIL SUDS SELECTION HIERARCHY SHEET FOR LARGE-SCALE DEVELOPMENT AND AGRICULTURAL DEVELOPMENT

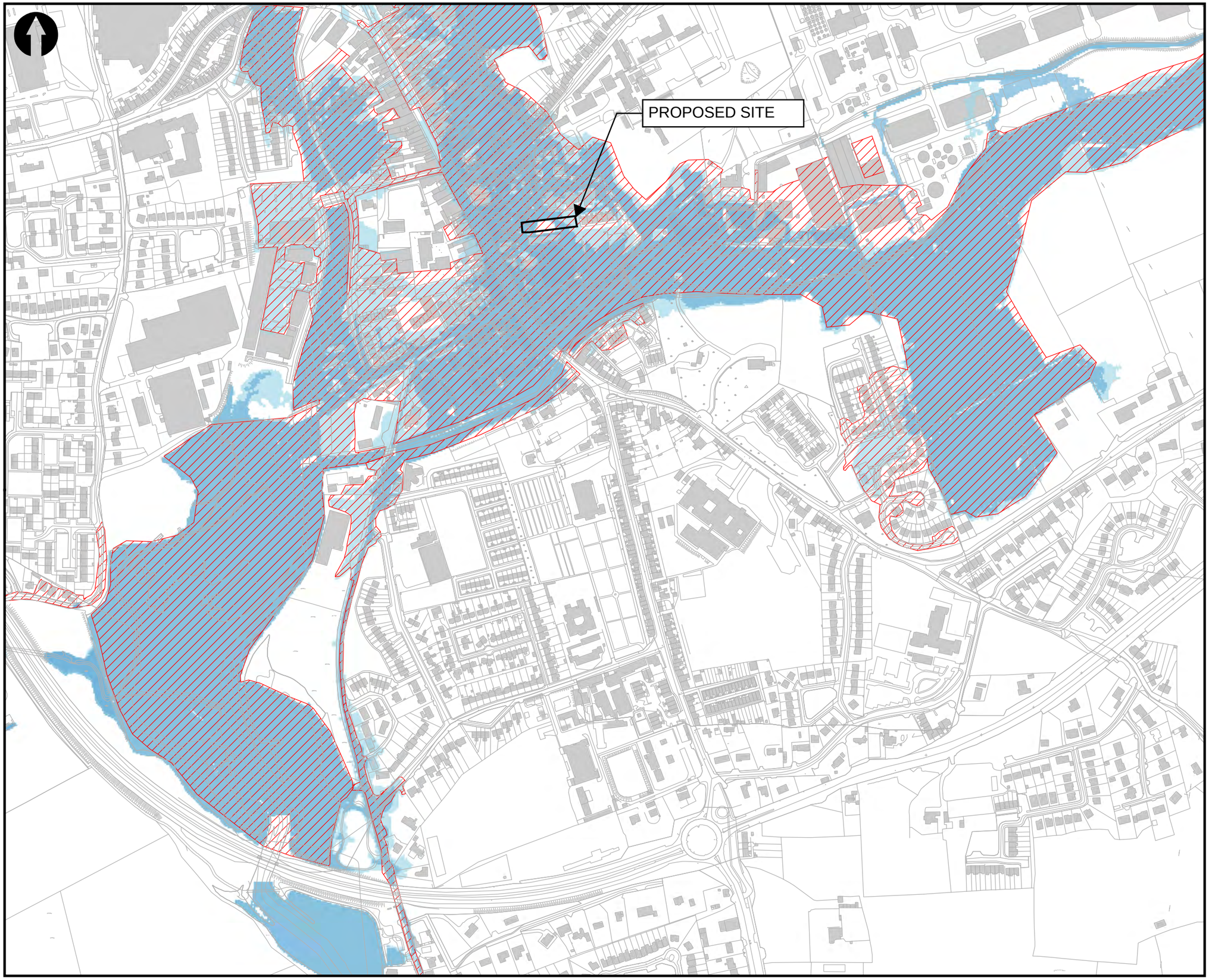
SuDS Measures	Measures to be used on site	Rational for selecting / not selecting measure	Area of feature (m^2)	Attenuation volume of feature (m^3) (see No. 8)
Source Control Providing storage at source				
Swales	YES	SUFFICIENT SPACE AVAILABLE	APPROX. 172m^2	APPROX. 42m^3
Integrated constructed tree pits	YES	MITIGATE SURFACE WATER RUNOFF AND INCREASE TRANSPIRATION		
Rainwater Butts	NO	INSUFFICIENT SPACE AVAILABLE AS BUILDING IS CLOSE TO BOUNDARY WALLS		
Downpipe Planters	YES	SUFFICIENT SPACE AVAILABLE AT ONE DOWNPIPE LOCATION ALONG THE RAMP		
Rainwater Harvesting	NO	NOT VIABLE DUE TO SMALL AREA OF ROOF		
Soakaways	NO	INSUFFICIENT DUE TO VULERABILITY OF GROUNDWATER TABLE AND KARSTIC BEDROCK		
Infiltration trenches	NO	INSUFFICIENT DUE TO VULERABILITY OF GROUNDWATER TABLE AND KARSTIC BEDROCK		
Permeable pavement (Grasscrete, Block Paving, Porous Asphalt etc)	YES	SUFFICIENT WITH SWALE AS A COMBINATION OF SUDS FEATURES. SURFACE WATER CAN BE DISCHARGED INTO SWALES FROM PERVIOUS PAVEMENT VIA FILTER DRAINS		
Green Roofs	NO	NOT VIABLE DUE TO SMALL AREA OF ROOF		
Green wall	NO	NOT FEASIBLE DUE TO PROXIMITY TO BOUNDARY WALLS		
Filter strips	YES	REQUIRED AS PRE-TREATMENT OF RUNOFF FROM HARD SURFACE INTO SWALE		
Bio-retention systems/Raingardens	YES	BIO RETENTION TREE PITS INCLUDED		
Blue Roofs	NO	NOT VIABLE DUE TO SMALL AREA OF ROOF		
Filter Drain	YES	SUFFICIENT FOR WATER TO BE DISCHARGED INTO SWALES FROM PERVIOUS PAVEMENT		
Site Control				
Detention Basins	NO	PROPOSED SWALE FUNCTIONS AS DETENTION BASIN		
Retention basins	NO	NOT SUFFICIENT DUE TO GROUNDWATER TABLE VULNERABILITY		
Regional Control				
Ponds	NO	NOT FEASIBLE		
Wetlands	NO	NOT FEASIBLE		
Other				
Petrol/Oil interceptor/Grit Trap	NO	NOT REQUIRED AS THERE WILL BE NO VEHICULAR TRAFFIC WITHIN THE SITE BOUNDARIES		
Attenuation tank – only as a last resort where other measures are not feasible	YES	REDUCE OUTFLOW TO GREEN FIELD RUNOFF RATE FOR 100-YEAR RETURN PERIOD AS OUTLINED IN DRAINAGE IMPACT ASSESSMENT REPORT		
Oversized pipes– only as a last resort where other measures are not feasible	NO	ATTENUATION TANK UTILISED AS ALTERNATIVE MEASURE		
Other				

Notes:

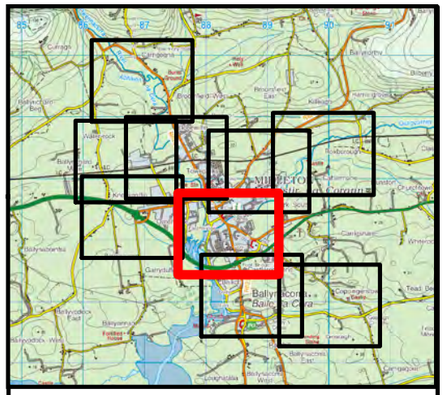
Cork County Council is seeking above-ground solutions rather than tanks or oversized pipes. Above ground flows through swales, basins etc. are encouraged.

1. Demonstrate SuDS system will have sufficient Pollutant removal efficiency in accordance with CIRIA Suds Manual C753.
2. Basins and swale sides should be no steeper than 1:4 and no deeper than 1.2m in the 1%AEP.
3. Culverting should be avoided.
4. De-culverting is encouraged.
5. Please submit evidence of infiltration rates.
6. To account for climate change in the design of the drainage system rainfall intensities should be factored up by 20%.
7. The applicant must provide SuDS checklists in accordance with the Appendix B of the CIRIA Suds manual C753.
8. The applicant must provide discharge rate applied with supporting calculations.

Appendix E FLOOD MAPS



0 50 100 200 300 400 500 Meters



Legend:

- 1% Fluvial AEP
- 0.1% Fluvial AEP
- Storm Babet Estimated Flood Extent

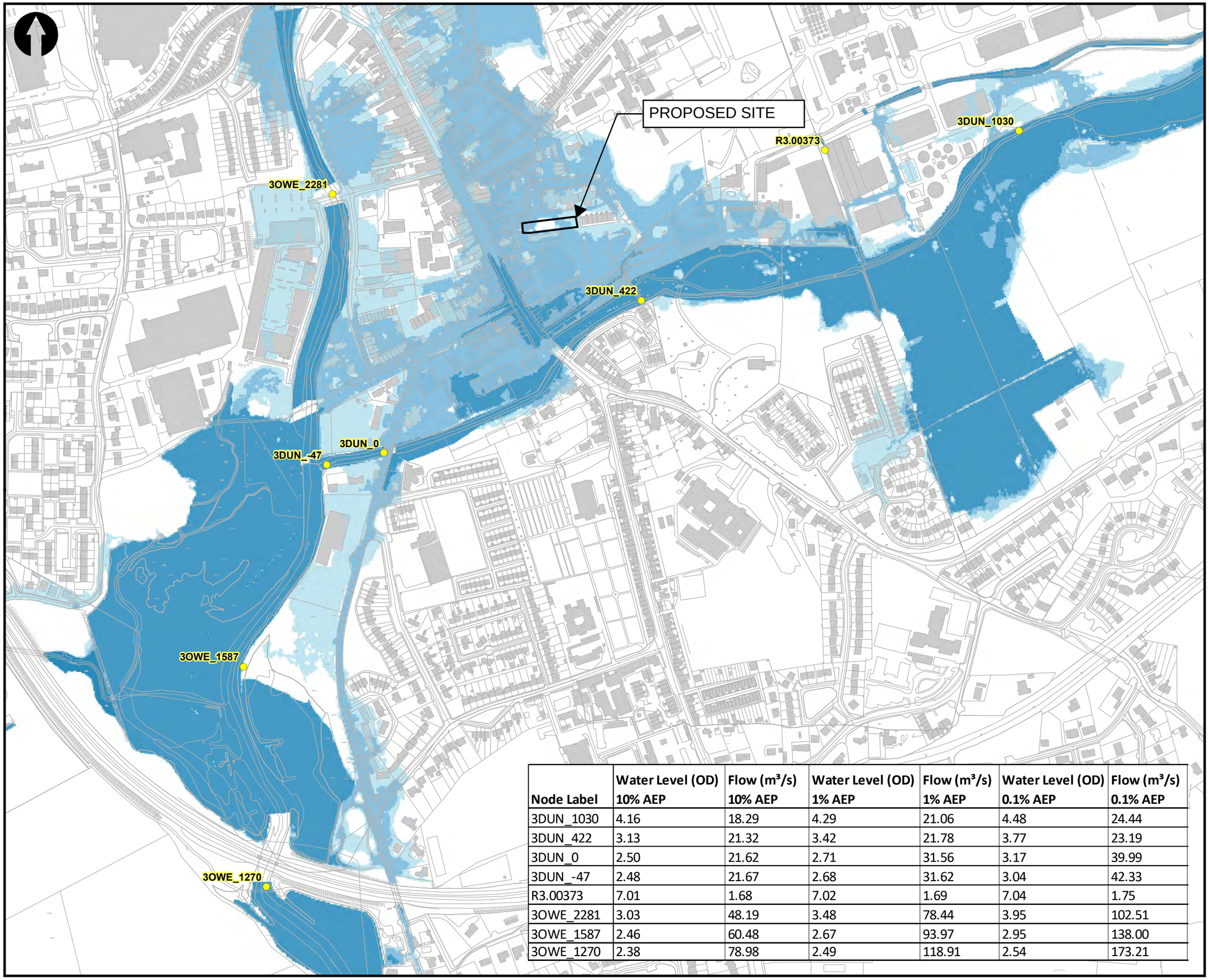
WORKING DRAFT

Rev:	Note:	Date:

ARUP

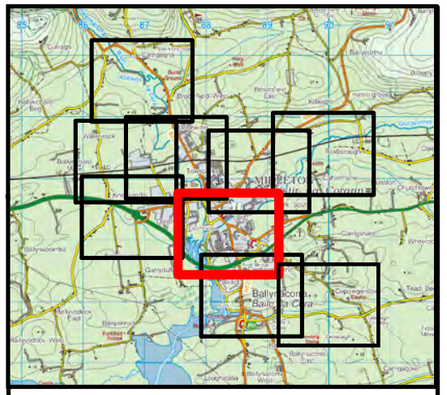
Map:
Midleton Storm Babet (18/10/2023)
Estimated Flood Extents

Map type:	Fluvial Flood Extents	
Source:	Midleton Flood Relief Scheme	
Scenario:	Storm Babet	
Drawn By:	CB	Date: 20/12/2023
Checked By:	KB	Date: 20/12/2023
Approved By:	BO'B	Date: 20/12/2023
Drawing No:	1	
Map Series:	Page 3 of 9	
Drawing Scale:	1:5,000 @ A3	



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
3DUN_1030	4.16	18.29	4.29	21.06	4.48	24.44
3DUN_422	3.13	21.32	3.42	21.78	3.77	23.19
3DUN_0	2.50	21.62	2.71	31.56	3.17	39.99
3DUN_-47	2.48	21.67	2.68	31.62	3.04	42.33
R3.00373	7.01	1.68	7.02	1.69	7.04	1.75
3OWE_2281	3.03	48.19	3.48	78.44	3.95	102.51
3OWE_1587	2.46	60.48	2.67	93.97	2.95	138.00
3OWE_1270	2.38	78.98	2.49	118.91	2.54	173.21

0 50 100 200 300 400 500 Meters



Legend:

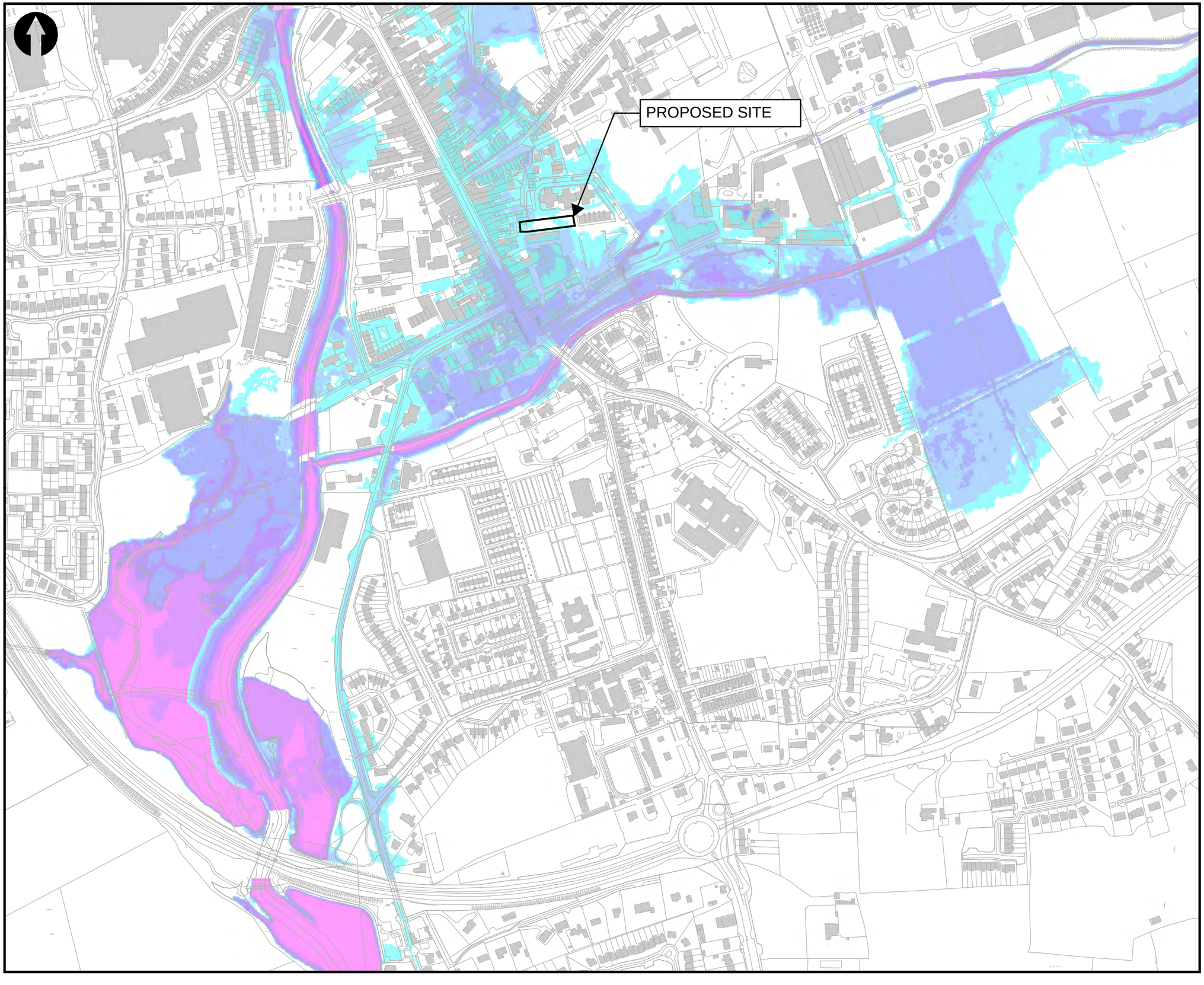
- 10% Fluvial AEP
- 1% Fluvial AEP
- 0.1% Fluvial AEP

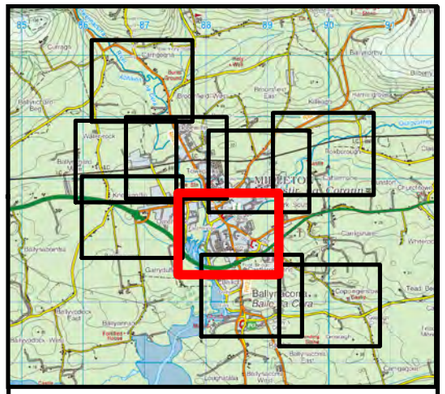
Rev:	Note:	Date:

ARUP

Map:
Midleton Fluvial Flood Extents

Map type:	Fluvial Flood Depth	
Source:	Midleton Flood Relief Scheme	
Scenario:	Current	
Drawn By:	CB	Date: 21/09/2022
Checked By:	KB	Date: 21/09/2022
Approved By:	BO'B	Date: 21/09/2022
Drawing No:	1	
Map Series:	Page 3 of 9	
Drawing Scale:	1:5,000 @ A3	





Legend:

1% Fluvial AEP Flood Depth (m)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2

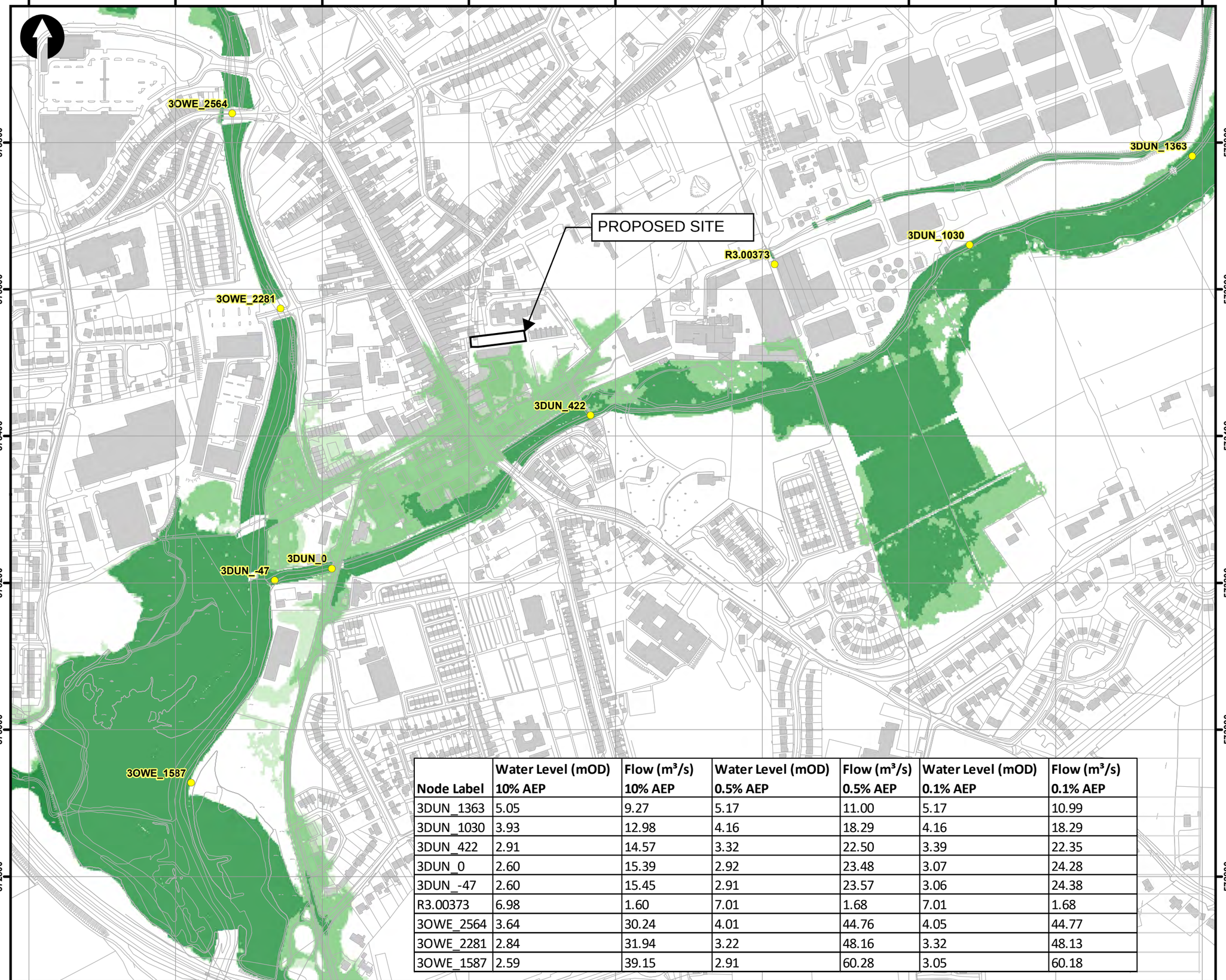
0 50 100 200 300 400 500 Meters

Rev:	Note:	Date:

ARUP

Map:
Midleton Fluvial Flood Depths

Map type:	Fluvial Flood Depth	
Source:	Midleton Flood Relief Scheme	
Scenario:	Current	
Drawn By:	CB	Date: 22/09/2022
Checked By:	KB	Date: 22/09/2022
Approved By:	BO'B	Date: 22/09/2022
Drawing No:	1	
Map Series:	Page 3 of 9	
Drawing Scale:	1:5,000 @ A3	



Legend:

- 10% Tidal AEP
- 0.5% Tidal AEP
- 0.1% Tidal AEP

Node Label	Water Level (mOD) 10% AEP	Flow (m^3/s) 10% AEP	Water Level (mOD) 0.5% AEP	Flow (m^3/s) 0.5% AEP	Water Level (mOD) 0.1% AEP	Flow (m^3/s) 0.1% AEP
3DUN_1363	5.05	9.27	5.17	11.00	5.17	10.99
3DUN_1030	3.93	12.98	4.16	18.29	4.16	18.29
3DUN_422	2.91	14.57	3.32	22.50	3.39	22.35
3DUN_0	2.60	15.39	2.92	23.48	3.07	24.28
3DUN_-47	2.60	15.45	2.91	23.57	3.06	24.38
R3.00373	6.98	1.60	7.01	1.68	7.01	1.68
3OWE_2564	3.64	30.24	4.01	44.76	4.05	44.77
3OWE_2281	2.84	31.94	3.22	48.16	3.32	48.13
3OWE_1587	2.59	39.15	2.91	60.28	3.05	60.18

Rev:	Note:	Date:

ARUP

Map:
Midleton Tidal Flood Extents

Map type:	Tidal Flood Extent	
Source:	Midleton Flood Relief Scheme	
Scenario:	Current	
Drawn By:	CB	Date: 04/09/2020
Checked By:	KB	Date: 04/09/2020
Approved By:	BO'B	Date: 04/09/2020
Drawing No:	1	
Map Series:	Page 3 of 3	
Drawing Scale:	1:5,000 @ A3	

587600 587800 588000 588200 588400 588600 588800 589000 589200

573800 573600 573400 573200 573000 572800

PROPOSED SITE

Legend:

0.5% Tidal AEP Flood Depth (m)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2

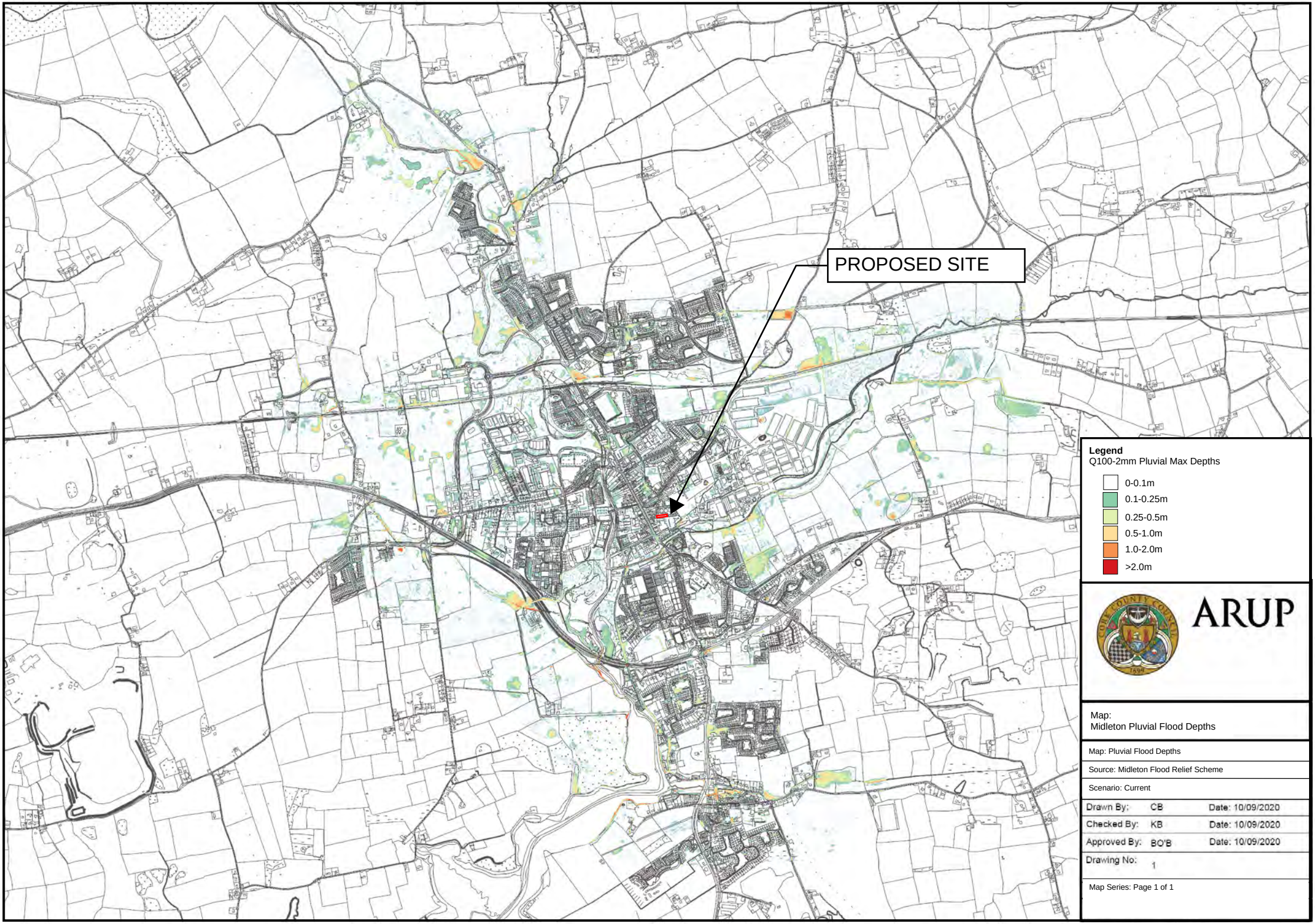
Rev:	Note:	Date:

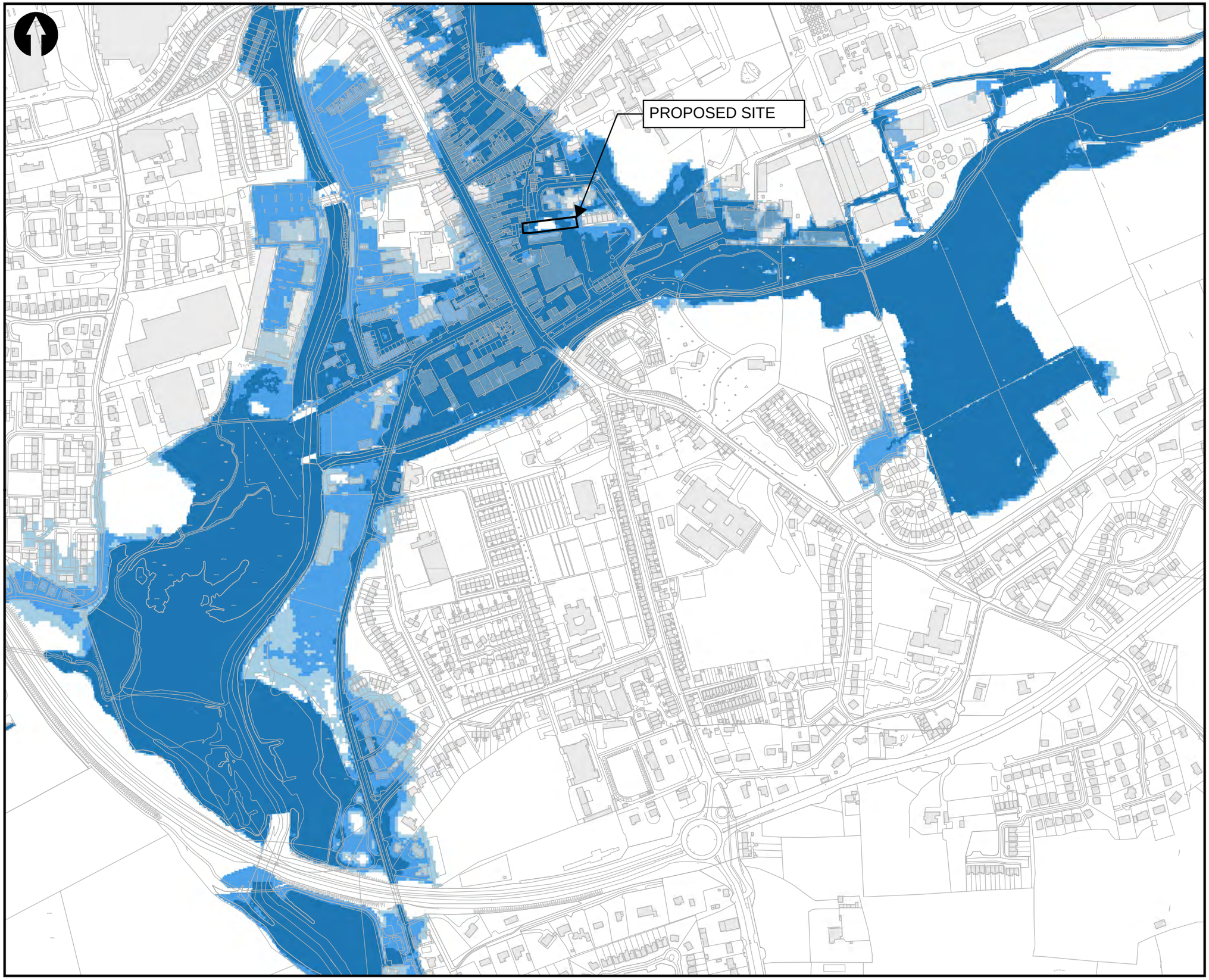
ARUP

Map:
Midleton Tidal Flood Depths

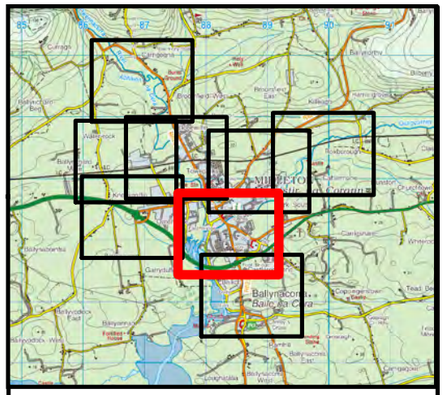
Map type:	Tidal Flood Depth	
Source:	Midleton Flood Relief Scheme	
Scenario:	Current	
Drawn By:	CB	Date: 04/09/2020
Checked By:	KB	Date: 04/09/2020
Approved By:	BO'B	Date: 04/09/2020
Drawing No:	1	
Map Series:	Page 2 of 3	
Drawing Scale:	1:5,000 @ A3	

0 50 100 200 300 400 500 Meters


PROPOSED SITE
Legend
Q100-2mm Pluvial Max Depths
0-0.1m
0.1-0.25m
0.25-0.5m
0.5-1.0m
1.0-2.0m
>2.0m
ARUP
Map:
Midleton Pluvial Flood Depths
Map: Pluvial Flood Depths
Source: Midleton Flood Relief Scheme
Scenario: Current
Drawn By: CB Date: 10/09/2020
Checked By: KB Date: 10/09/2020
Approved By: BO'B Date: 10/09/2020
Drawing No: 1
Map Series: Page 1 of 1



0 50 100 200 300 400 500 Meters



Legend:

- Current 1% Fluvial AEP
- MRFS Fluvial 1% AEP
- HEFS Fluvial 1% AEP

Rev:	Note:	Date:

ARUP

Map:
Midleton Fluvial Flood Extents (Undefended)

Map type:	Fluvial Flood Depth	
Source:	Midleton Flood Relief Scheme	
Scenario:	Current, MRFS & HEFS	
Drawn By:	CB	Date: 03/03/2022
Checked By:	KB	Date: 03/03/2022
Approved By:	BO'B	Date: 03/03/2022
Drawing No:	1	
Map Series:	Page 3 of 8	
Drawing Scale:	1:5,000 @ A3	

PROPOSED SITE

Legend:

- Current Tidal 0.5% AEP
- MRFS Tidal 0.5% AEP
- HEFS Tidal 0.5% AEP

Rev:	Note:	Date:

ARUP

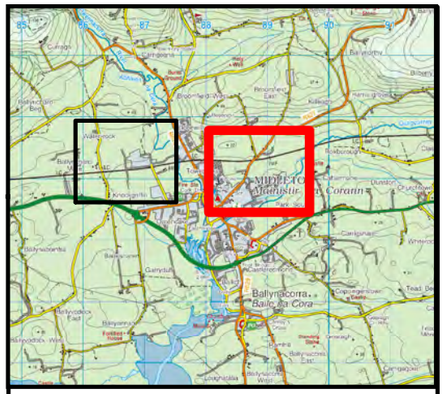
Map:
Midleton Tidal Flood Extents (Undefended)

Map type:	Tidal Flood Extent	
Source:	Midleton Flood Relief Scheme	
Scenario:	Current, MRFS & HEFS	
Drawn By:	CB	Date: 03/03/2022
Checked By:	KB	Date: 03/03/2022
Approved By:	BO'B	Date: 03/03/2022
Drawing No:	1	
Map Series:	Page 3 of 3	
Drawing Scale:	1:5,000 @ A3	

0 50 100 200 300 400 500 Meters

PROPOSED SITE

0 50 100 200 300 400 500 Meters



Legend:

Design Groundwater Flood Extent

Rev:	Note:	Date:

ARUP

Map:
Midleton Groundwater Flood Extent

Map type:	Groundwater Flood Extent	
Source:	Midleton Flood Relief Scheme	
Scenario:	Current	
Drawn By:	AP	Date: 07/09/2020
Checked By:	KB	Date: 07/09/2020
Approved By:	BO'B	Date: 07/09/2020
Drawing No:	1	
Map Series:	Page 1 of 2	
Drawing Scale:	1:5,000 @ A3	

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O'CONNOR · SUTTON · CRONIN

MULTIDISCIPLINARY CONSULTING ENGINEERS

Cork Office

North Point House
North Point Business Park
New Mallow Road
Cork
T23 AT2P
T: +353 21 235 5816
E: cork@ocsc.ie | W: www.ocsc.ie

Civil | Structural | Mechanical | Electrical | Sustainability | Environmental