Revision and Review

This report has been prepared for the sole benefit, use and information of the client. The liability of Tent Engineering with respect to the information contained in this report will not extend to any third party.

REVISION(S)

Rev.	Description	Date
P01	1st issue	04.11.2022

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Contents

1 Executive Summary

Tent Engineering has been appointed by Cavvies Limited to provide an infrastructure strategy for the site redevelopment located at Larkfield House, Coldcut Road. The development will consist of:

Retention permission for:

- alterations to the previously approved (Reg. Refs. SD16A/0269 and SD18A/0285) comprising an increase in the number of residential apartment units from 37 no. to 42 no. units now consisting of 2 no. one-bedroom units, 34 no. two-bedroom units, and 6 no. three-bedroom units, and;
- all associated site and engineering works necessary to facilitate the development.

Planning permission for:

- the amalgamation of unit nos. 22 and 23 and the amalgamation of unit nos. 34 and 33;
- internal alterations to provide for an increased quantum of storage space;
- alterations to private amenity spaces to provide for extension of ground floor private courtyards and balconies, of unit nos. 6-11, 17-20, 22-25, 27-30, 32-35, and 37-40 and the addition of private amenity spaces to unit nos. 12-16, 21, 26, 31, 36, and 41-42;
- the provision of fire escape stairs from the third floor to the fourth floor;
- revisions to the permitted site layout to now provide for 50 no. car parking spaces (inclusive of 3 no. disabled parking spaces and 5 no. electric vehicle charging spaces);
- the provision of 110 no. residential bicycle spaces (88 no. residential bicycle spaces and 22 no. visitor bicycle spaces);
- relocation of bin store from eastern boundary wall to northern boundary wall;
- landscaping, including communal public open space comprising 1 no. playground (583 sq.m total), and all associated boundary treatments, and;
- all associated site and engineering works necessary to facilitate the development.

The development is accessed via the main Coldcut Road. The development is located at Larkfield House, Coldcut Road, situated at approximately 250m West side of M50.

The impermeable area consist of the building footprint and hardstanding areas surrounding the building, all imperbeable area being approximately 52.5%. The remaining area consists of car parking permeable asphalt area of approx. 30.5% and landscaped area of aproximately 16%. Tree pits are added to the landscaped area to maximise SUDS measures on the site.

The project is considered a 'highly vulnerable development'. According to the OPW flood maps, the site is located within Flood Zone C, and therefore it does not require flood prevention measures. The justification test is not needed.

2 Introduction

Tent Engineering has been appointed by Cavvies Limited to provide an infrastructure strategy for the site redevelopment located at Larkfield House, Coldcut Road. This report describes the drainage strategy for the proposed residential extension. The existing building is a 4-storey apartment scheme which will increase by adding another 5no. residential apartment to the development.

2.1 General

The development is accessed via the main Coldcut Road. The development is located at Larkfield House, Coldcut Road, Clondalkin, situated at approximately 250m West side of M50. The subject site, which extends to approx. 0.44 hectares, is a scheme of a-4storey residential apartment block approved under previous planning permission (Reg. Refs. SD16A/0269 and SD18A/0285) and subsequently constructed.

Site Location

2.2 Scope of Civil Report

This report documents the proposed development Civil aspects required for this development. It contains information regarding the sewer infrastructure on site, and the connection to the existing public infrastructure serving the area. Most notably, the foul- and surface water drainage systems, the water supply system and flood risk aspects are covered.

2.3 Existing Services and Network

From available information, the area is served by an existing 100ø uPVC water distribution main running past the development along Coldcut Road.

There is a 225mm diameter foul sewer adjacent to the North side of our site, linking with the main foul line running from West to East, crossing Coldcut Road-Fonthill Road junction.

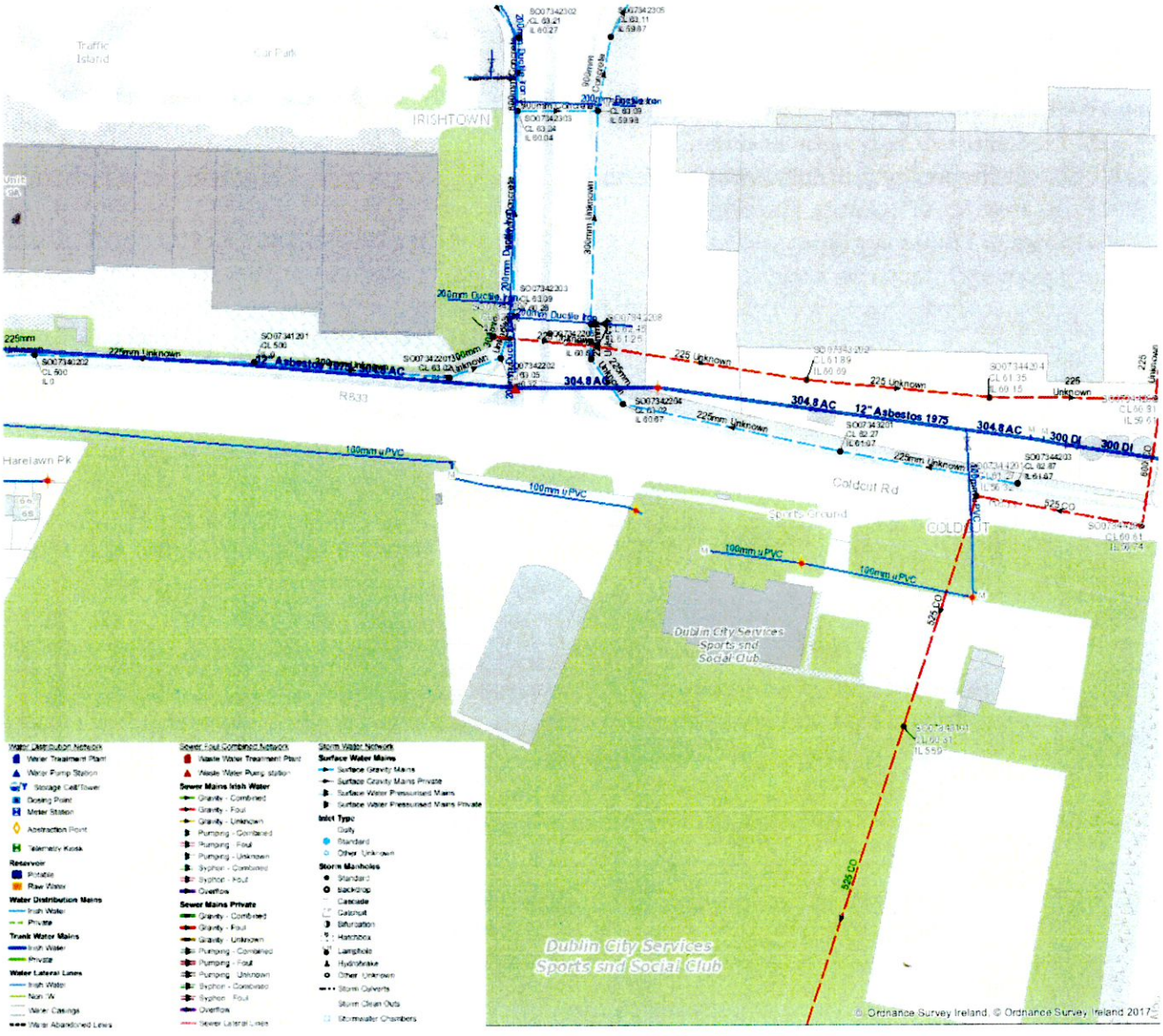
An existing connection for watermain and foul water are already installed on site, servicing the existing 37no. apartments scheme. The pipe location is to be confirmed through a CCTV survey. We propose to use the existing foul and watermain network for servicing the site and the additional 5no. apartments as part of the new proposal.

According to Irish Water maps, there is an existing storm water network across Coldcut Road, running North along both sides of Fonthill Road. The existing pipe diameters are 225ø and 300ø.
According to previous planning application drawings, the surface water on our site is discharged into the existing surface water manhole across Coldcut Road using a 150ø pipe diameter prior to be discharged into the existing 225ø surface water network running along righside of Fonhill Road.

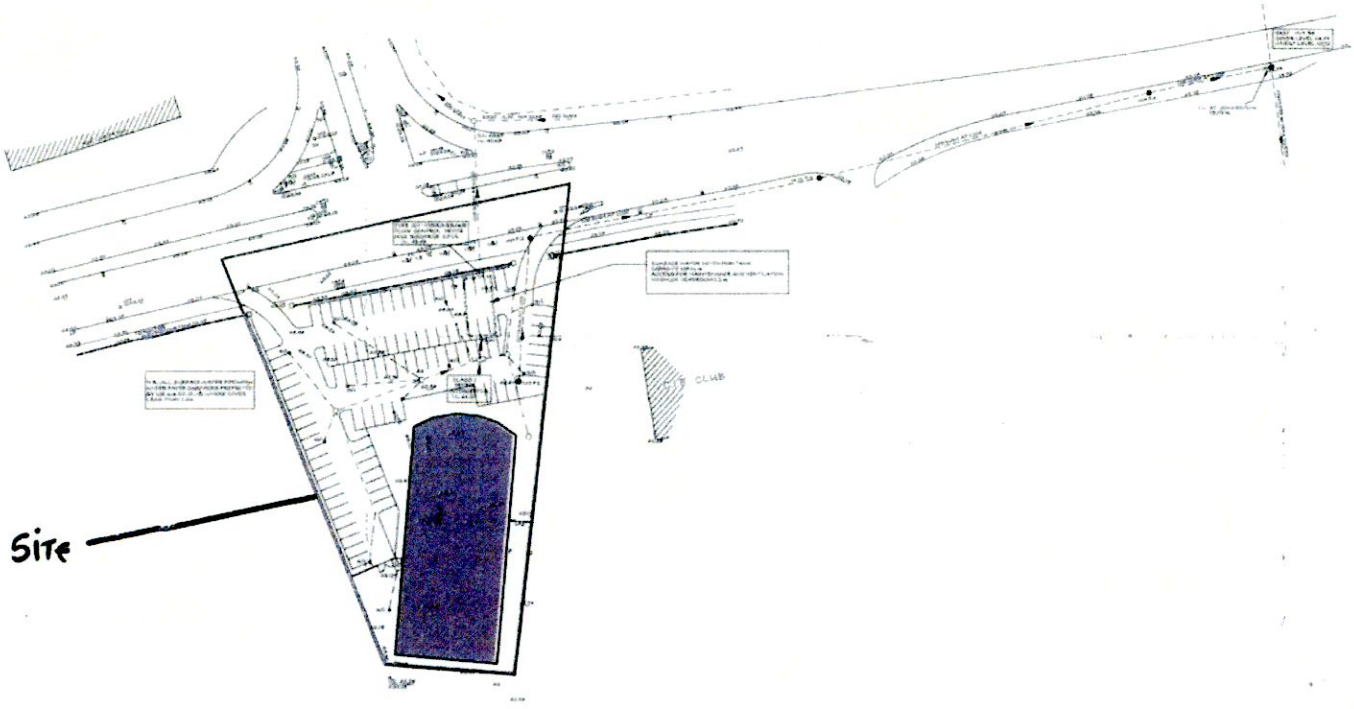
Further Ground Investigations are to satisfy the main contractor during the detailed design stage of the site present services (drainage, sewer, etc.).

Sewer manholes are to remain a minimum of 3m clear distance away from building structures. Exact placements of manholes and sewers are to be confirmed during detailed design.

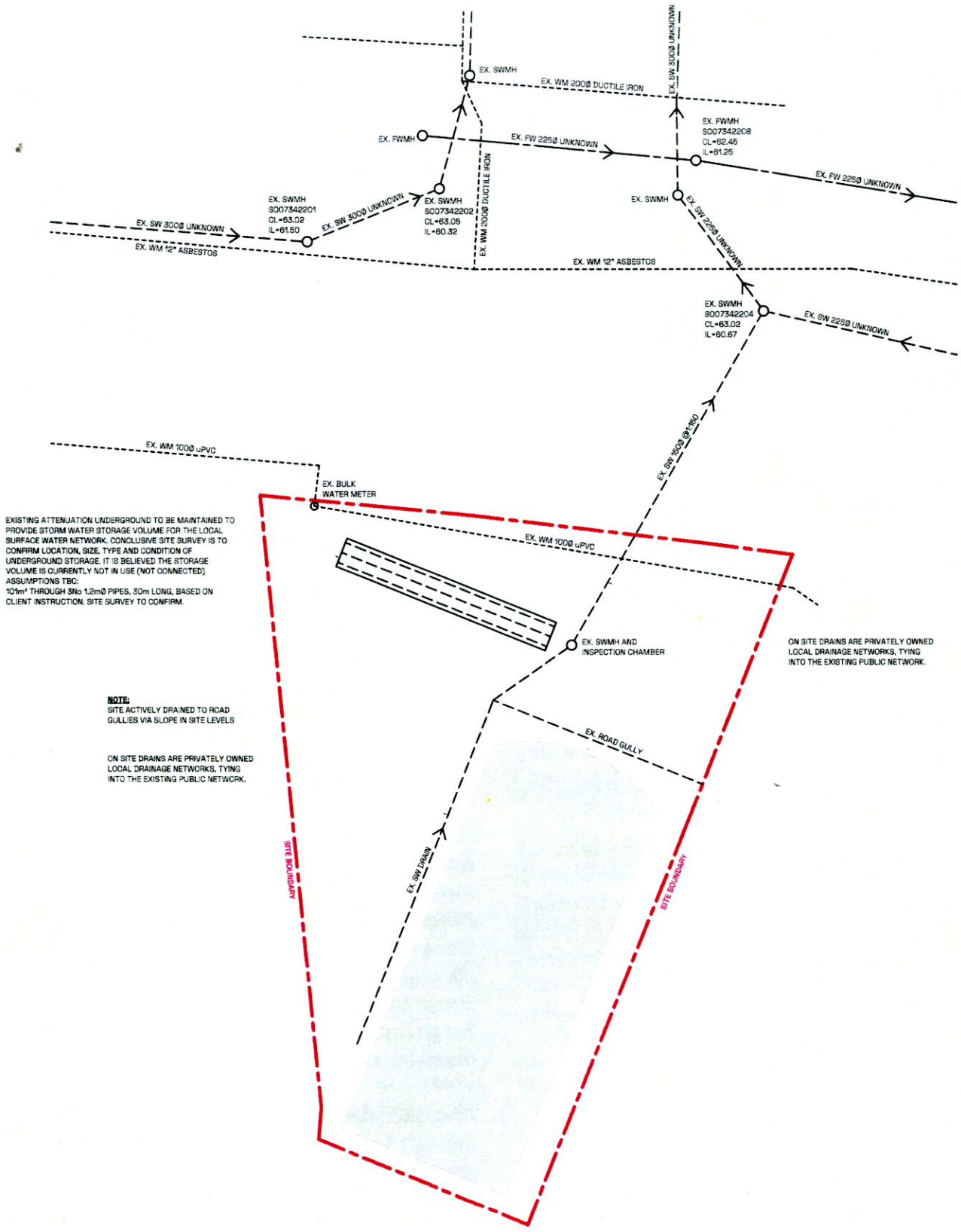
Irish Water Maps



Previous Planning Application drawings - Drainage layout



Existing on-site networks



EXISTING DRAINAGE INFRASTRUCTURE

1:300

3 Surface Water Drainage

3.1 General

The surface water drainage design philosophy has been prepared in accordance with the requirements from the following technical documents:

- The Greater Dublin Strategic Drainage Study
- Building Regulation Part H
- BS-EN 752-2019 - Gravity Drainage Systems outside Buildings
- Ciria Report C753 - The SuDS manual
- EPA Wastewater Treatment Manual 'Treatment Systems for Small Communities, Businesses, Leisure Centres and Hotels'

A fully separate sewer system is existing, and remains in-use unchanged. The separate surface water network and foul water network are not proposed to combine, either on- or of-site.

New precast manholes will be specifed with a minimum 150mm thickness of Concrete Class B.

The site is actively drained to road gullies and kerbs via slope in site levels and gets collected using existing surface water network on site which is privately owned by the client. Please refer to figure below which reflects the existing drainage infrastructure and existing underground Atenuation System.

A total of 101m^3 storage volume is believed to be currently provided, following client instruction. The size, location and condition of the existing storage system is to be confrmed prior to construction. It is proposed to re-use the existing storage, providing a sustainable solution for our local drainage network.

Prior to discharging the surface water from our site, a hydrobrake is to be placed, limiting the maximum fow rate (calculated via Q_{bar}).

No additional runoff requirement is included from sources outside the redline boundary.

Any hardstanding areas on site are to have conventional positive drainage systems with longitudinal and horizontal falls including of gradients sufficient to allow rainfall runoff to be collected using road gullies and kerbs.

The local network remains in ownership of our Client and a scheduled maintenance plan is required, covering the petrol interceptor and hydrobrake. This is to strictly follow supplier instructions and conditions of warranty. Maintenance and inspections are not to be disruptive to the day-to-day activities, and residents are to be informed in advance should their consideration be required.

3.2 Attenuation

Refer to Appendix B for the attenuation volume determination.

A total of 101m^3 storage volume is believed to be currently provided, following client instruction. The size, location and condition of the existing storage system is to be confrmed prior to construction. It is proposed to re-use the existing storage, providing a sustainable solution for our local drainage network.
Prior to discharging the surface water from our site, a hydrobrake is to be placed, limiting the maximum fow rate (calculated via Q_{bar}).

3.3 SUDs and Compliance

Several Sustainable Urban Drainage Systems (SUDs) have been incorporated in our designs. This includes an optimised area of cultivated landscaped, area with tree pits (in accordance with 'SDCC Sustainable Drainage Explanatory, Design and Evaluation Guide 2022'), providing 743m^2 self-draining open space with 16no. trees with tree pits. Trees to be planted, strictly following 'SDCC Sustainable Drainage Explanatory, Design and Evaluation Guide 2022' for acceptable tree pit details. We propose 1m diameter tree pits.

Approximately 1357m^2 site area with permeable asphalt further reduces site run-of and provides atenuation storage, with self draining high fltration rate soils below.

Hardstanding site run-of is actively drained via gravity towards road gullies and kerbs, ultimately reaching a petrol interceptor, underground atenuation tank and hydrobrake (limiting outfall fow rate to 2 L/s) prior to tying into the existing public network.

The SUDS efectively reduce the required site storage amount from approximately 372m³ (with no SuDS nor landscaping) to 174m³.

Refer to Appendix B for the Atenuation storage calculations and the total proposed volume. Refer to Appendix C for a summary of the proposed SuDS measures and their impacts.

The provided SUDS are low maintenance and mostly self-sustaining. The underground atenuation tank will have an inspection chamber and an access junction for rodding and CCTV.

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

- Interception storage (not adopted)
- Treatment storage (not required)
- Attenuation storage (adopted)
- Long term storage* (not required)

* Long term storage is not required when growth factors are applied to Q_{bar} when designing attenuation tank storage

Permeable paving (30% porosity) is proposed to reduce the surface water runoff from hardstanding areas. The volume required will be provided using pipes, soakaway and permeable paving which have a combined capacity sufficient to the attenuation requirement of the site.

SUDs are applied to reduce pressure on the proposed surface water drainage network and may decrease the underground attenuation volume.

3.4 Basis of Surface Water

Below are assumptions outlined, considered in the surface water design.

- The proposed surface water drainage to be discharged into the proposed soakaway.
- The surface water pipe network has been designed with the aid of computer software and validated design spreadsheets
- Local rainfall data has been used for this model
- The pipe network has been sized to accommodate a 1 in 2 year return period storm event in compliance with the requirements of EN 752.
- Time of entry 4 minutes
- A pipe roughness co-efficient of (ks) 0.6 is applied for surface water drainage pipes
- Maximum flow velocity 3 m/s
- Pipe gradients not to be flatter than the pipe diameter itself. i.e. min 1:dia. mm
- A climate change factor of 20% is applied for surface water design
- The system is checked in order to ensure that the network does not flood during the 1 in 100 year event
- Drainage infrastructure is developed with the latest architectural data at time of writing. For further information, refer to Architectural drawings
- At internal bends, junctions and extraordinarily long runs of surface water pipes an inclusion for Access Joints (AJs) are made. External bends and long runs require manholes.
- Manholes to be >3m removed from building structures.

3.5 Validation

The surface water contribution to the total discharge into the existing surface water sewer network, discharge rate, flow and system capacities are deemed acceptable in the proposed drainage system layout.

4 Foul Drainage

4.1 General

The foul drainage design philosophy has been developed in accordance with the requirements from the following technical documents:

- BS-EN 752-2019 - Gravity Drainage Systems Outside Buildings
- BS-EN 12056-2 2000 - Gravity Drainage Systems Inside Buildings
- Building Regulations Part H
- EPA Wastewater Treatment Manual - Treatment Systems for Small Communities, Businesses, Leisure Centres and Hotels

4.2 Proposed Foul Drainage

A fully separate sewer system is existing, servicing the existing development at Larkfield House and remains in-use unchanged. The foul water network is not proposed to be combined with the surface water network either on- or of-site. Foul drainage from the development is generated by toilets, wash hand basins, showers/baths, sinks and floor drains. The additional peak wastewater discharged for the 5no. apartments extension is determined to be 0.155 L/s based on Irish Water requirements. The additional average daily discharge is determined to be 0.026 L/s. This represents an additional 12% added strain on the existing network on site and therefore on the public network.

4.3 Basis of Foul Water

Below are assumptions outlined, considered in the foul water design.

- An existing and compliant foul network is existing, servicing the development located at Larfield House and remains in-use unchanged.
- The foulwater network has been designed with computer software and validated design spreadsheets.
- Maximum flow velocity 3 m/s
- Drainage infrastructure is developed with the latest architectural layouts at time of writing. For further information, refer to Architectural drawings
- Pipe gradients comply with best practise
- At internal bends, junctions and extraordinarily long runs of surface water pipes an inclusion for Access Joints (AJs) are made. External bends and long runs require manholes.
- Manholes to be >3m removed from building structures.

No. dwellings	Minimum pipe gradient
1	ø100mm at 1:40-60 fall
2-9	ø150mm at 1:40-60 fall
10-20	ø225mm at 1:60-150 fall
21-210	ø225mm at 1:80-200 fall

4.4 Validation

The foul water contribution to the total discharge into the existing sewer network, discharge rate, flow and system capacities are deemed acceptable in the proposed drainage system layout, and are to be confirmed during detailed design.

The existing scheme located at Abington Wood have an approximated peak daily foul water discharge of 1.145 L/s. An additional peak daily foul discharge on the existing sewer system of 0.155 L/s has been found and validated for the additional 5no. apartments.
The total foul water discharge (proposed and existing) is approximately 1.144 L/s.

5 Water Supply

5.1 Existing Water Supply

Review of Irish Water records and previous planning application drawings indicates that the site is served by a 100mm uPVC watermain running West-East along Coldcut Road, North side of our development.

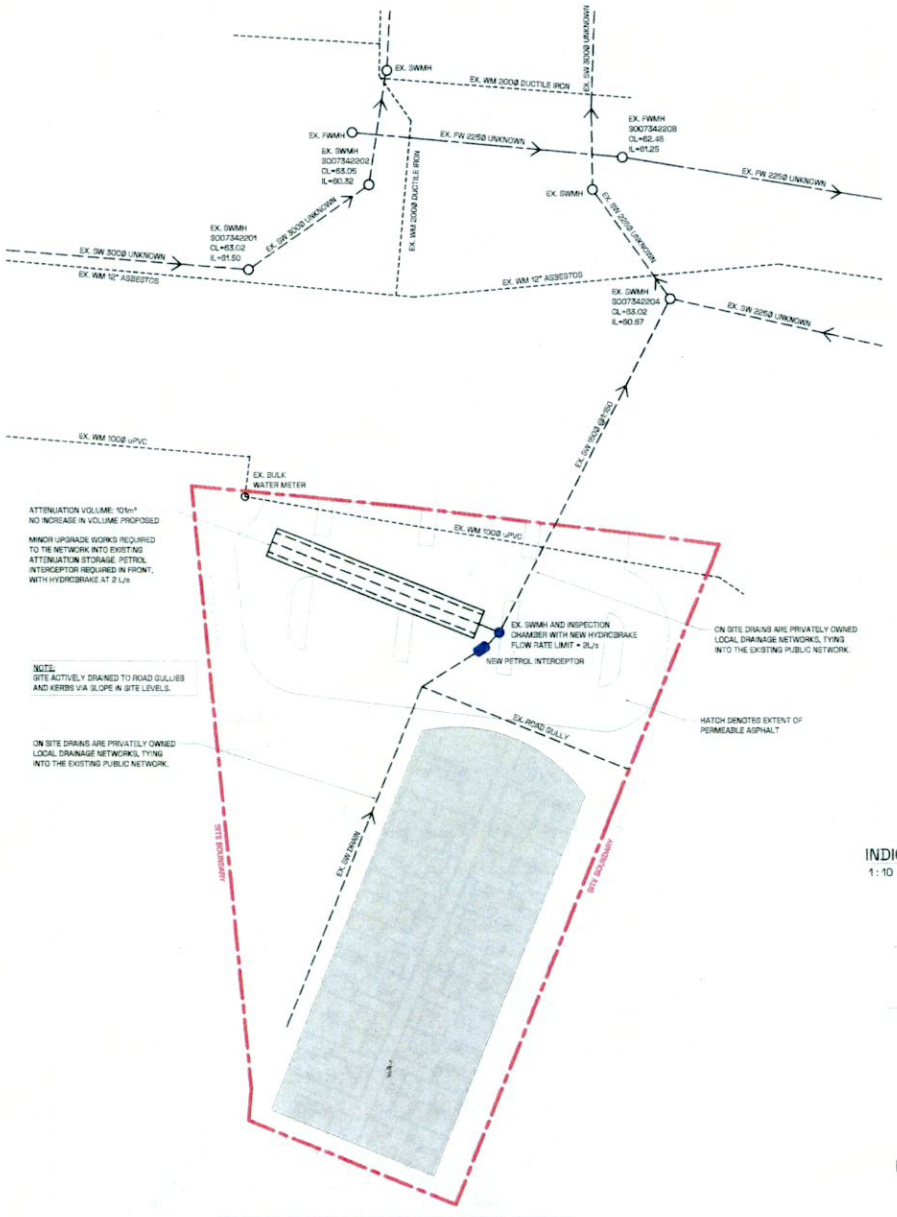
The local area is served by a 12" Asbestos watermain located across Coldcut Road, running West to East.

5.2 Proposed Water Supply

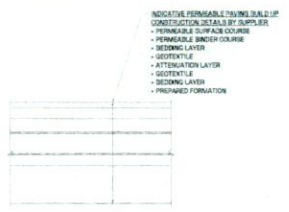
The existing water main on site will be used to service the proposed extension of 5no. apartments. Please find attached in Appendix A of this report the latest layout of the proposed drainage system at Larkfield House

The existing peak water demand for the development considered to be approximately 1.084 L/s. The additional peak daily water demand due to the extension of the building is identified to be 0.146 L/s. This results in an added water demand on the existing distribution system of total peak daily water demand for the whole development of 1.230 L/s. The average daily demand is 0.246 L/s.

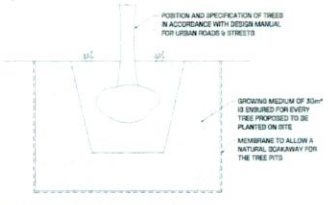
Proposed Drainage layout



PROPOSED DRAINAGE INFRASTRUCTURE
1 : 300



INDICATIVE PERMEABLE ASPHALT SECTION
1 : 10



INDICATIVE TREE PIT DETAIL
1 : 25

6 Flood Risk Assessment

6.1 General

A Stage 1 Flood Risk Identification has been carried out for the site. The proposed development lies within an area classified as Flood Zone C "lowest risk". This task was undertaken taking cognisance of the guidance given in the Office of Public Works (OPW) and Department of Environment, Heritage and Local Government (DEHLG) document titled 'The Planning System and Flood Risk Management' (2009).

6.2 Potential Flood Sources

A review of all potential sources of flooding at the subject site concludes the following:

Flood Source	Risk of Flood after development
On-site drainage system	Low (designed with adequate capacity)
Local Authority drainage system	Low
Sea and Rivers	Low
Groundwater	Low

FloodMaps Data

6.3 Catchment

The OPW provides records for predictive and historic flood maps. These land maps have been consulted and interrogated regarding documented flood events in the vicinity of the subject site.

According to the OPW flood maps, the area where the site is located can be considered within Flood Zone C, which is defined as an area with the lowest risk of flooding from rivers and the sea.

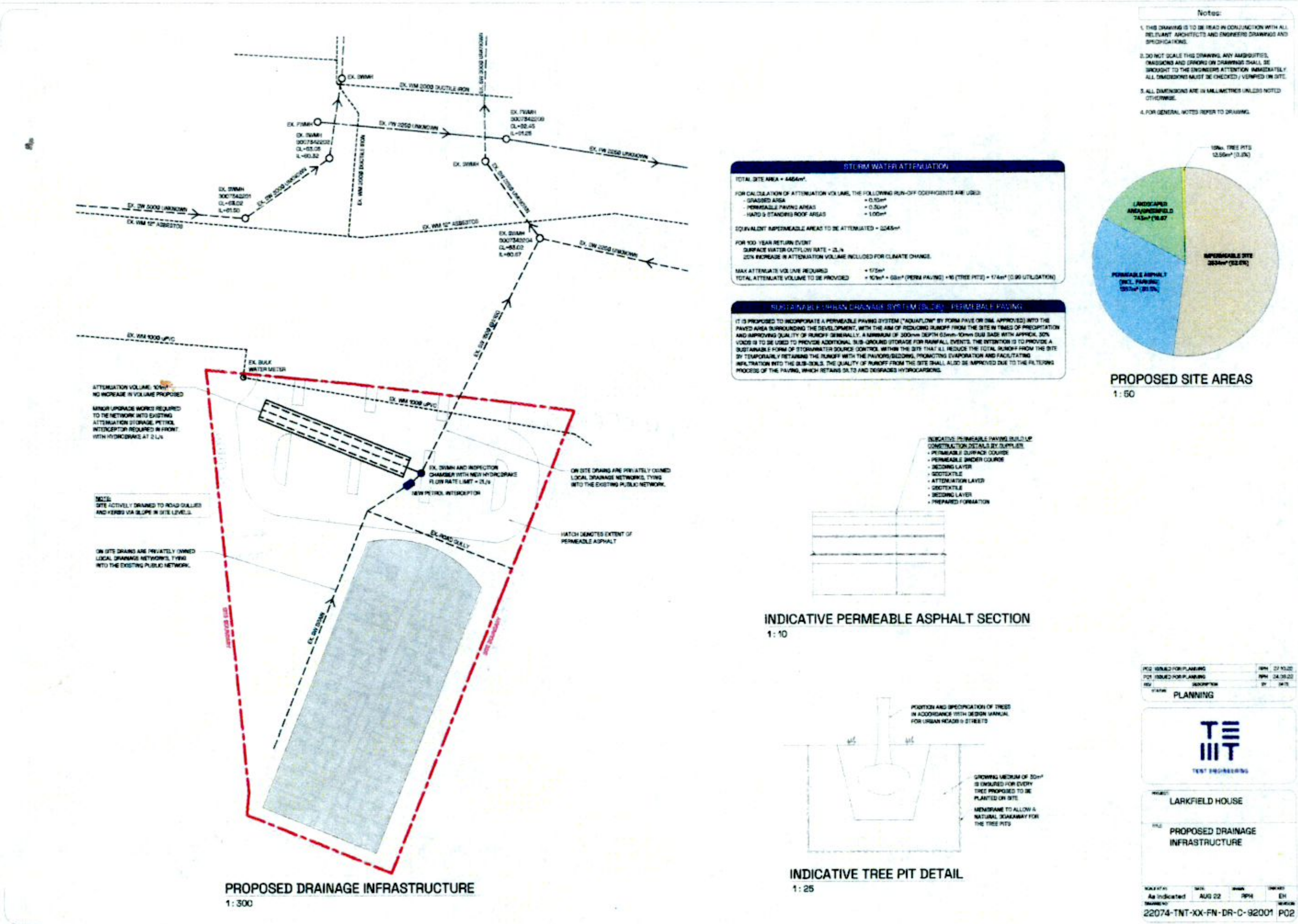
No historical flood events have been identified, after interrogation of the OPW website.

6.4 Validation

The flood risk assessment has concluded the following:

- The site is located in Flood Zone C
- There is low risk of flooding from any source
- A satisfactory degree of confidence exists that the subject site is not prone to potential flood issues.
- The proposed drainage network is not to cause or increase flood risk to the public network and adjacent buildings.
- A stage 2 Flood Assessment is not required

7 Appendix A - Proposed Drainage Infrastructure



8 Appendix B - Calculations of Attenuation Storage

EXISTING SITE APPROXIMATION

HR Wallingford
Working with water

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Edward Heukers
Site name:	22074 - Larkfield House
Site location:	Coldcut Road

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.34717° N
Longitude:	6.39018° W
Reference:	1714545755
Date:	Aug 23 2022 14:30

Site characteristics

Total site area (ha):	0.4467
Significant public open space (ha):	0
Area positively drained (ha):	0.4467
Impermeable area (ha):	0.4467
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0.027
Return period for infiltration system design (year):	100
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.45
Net impermable area for storage volume design (ha):	0.42
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
SPR:	0.3	0.3

Hydrological characteristics	Default	Edited
Rainfall 100 yrs 6 hrs:	--	71.2
Rainfall 100 yrs 12 hrs:	--	88
FEH / FSR conversion factor:	1	1.21
SAAR (mm):	969	969
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.72	1.72
Growth curve factor 30 year:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Q_{BAR} for total site area (l/s):	1.19	1.19
Q_{BAR} for net site area (l/s):	1.19	1.19

Design criteria

Climate change allowance factor:	1.2
Urban creep allowance factor:	1.1
Volume control approach	Flow control to max of 2 l/s/ha or
Interception rainfall depth (mm):	Qbar 5
Minimum flow rate (l/s):	2

Site discharge rates	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes	Default	Edited
Attenuation storage 1/100 years (m^3):	285	372
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	285	372

PROPOSED SITE REQUIREMENT

Print Close Report

HR Wallingford

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Cristina Peslari
Site name:	22074 Larkfield House
Site location:	Coldcut Road

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.34729° N
Longitude:	6.39016° W
Reference:	4056938497
Date:	Oct 27 2022 14:12

Site characteristics

Total site area (ha):	0.4467
Significant public open space (ha):	0.0743
Area positively drained (ha):	0.372399999999999
Impermeable area (ha):	0.2815
Percentage of drained area that is impermeable (%):	76
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.37
Net impermable area for storage volume design (ha):	0.29
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
SPR:	0.3	0.3

Hydrological characteristics	Default	Edited
Rainfall 100 yrs 6 hrs:	--	61
Rainfall 100 yrs 12 hrs:	--	73
FEH / FSR conversion factor:	1	1
SAAR (mm):	969	969
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.72	1.72
Growth curve factor 30 year:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Q_{BAR} for total site area (l/s):	1.19	1.19
Q_{BAR} for net site area (l/s):	0.99	0.99

Design criteria

Climate change allowance factor:	1.2
Urban creep allowance factor:	1.1
Volume control approach	Flow control to max of 2 l/s/ha or Qbar
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Site discharge rates	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes	Default	Edited
Attenuation storage 1/100 years (m^3):	173	173
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	173	173

This report was produced using the storage estimation tool developed by HRWallingford 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 http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. 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 these data in the design or operational characteristics of any drainage scheme.

9 Appendix C - Proposed SuDS

Site areas	Area [m^2]
Total site	4464
Impermeable	2334
Permeable asphalt	1357
Landscape	743
... of which tree pits	12.56

Impermeable area:

Rain water on the impermeable areas of our site will find its way into the actively drained surface water network. This network is guided through a petrol interceptor an existing attenuation tank and ultimately discharged via hydrobrake limiting the flow rate at 2 L/s.

Permeable paving:

According to 'SDCC Sustainable Drainage Explanatory, Design and Evaluation Guide 2022' , $1m^2$ of permeable paving is providing a conservative $0.05m^3$ of attenuation storage, therefore a total storage volume of $68m^3$ is provided by the permeable area on our proposed site.
30% of the permeable paving area will drain into the attenuation storage via run-off.

Tree pits:

According to 'SDCC Sustainable Drainage Explanatory, Design and Evaluation Guide 2022' $1m^2$ of tree pit is providing $0.4m^3$ of attenuation storage, therefore a total volume of $5m^3$ is provided by tree pits. We propose tree pits of 1m diameter.

Landscaped area:

We propose green area on our site to be $743m^2$, reducing the strain on the attenuation tank as less area is to be catched and site run-off is reduced, the landscaped area will provide natural soil infiltration/soakaway properties for surface water. 10% of the landscaped area will drain into the attenuation storage via run-off.

As shown in Appendix A, the total volume of attenuation necessary for our site is $173m^3$ (using SuDS).

This is calculated with the equivalent impermeable area (as noted below) and site specific rainfall and soil data.

Total impermeable area = $2334m^2$

30% of permeable paving area = $407m^2$

10% of landscaped area = $74m^2$

$2334m^2 + 407m^2 + 74m^2 = 2815m^2$ to be actively drained as impermeable equivalent area.

$101m^3$ (ex. storage) + $68m^3$ (perm. paving) + $5m^3$ (tree pits) = $174m^3$ provided storage volume.

$173m^3 / 174m^3$ = 0.98% utilisation of our provided storage (including SuDS)

10 Appendix D - Rainfall Data and Calculations

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 307247, Northing: 234181,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3,	3.5,	4.1,	5.0,	5.7,	6.2,	7.9,	10.0,	11.3,	13.3,	15.0,	16.4,	18.6,	20.3,	21.7,	N/A ,
10 mins	3.3,	4.8,	5.7,	7.0,	7.9,	8.7,	11.1,	13.9,	15.8,	18.5,	20.9,	22.9,	25.9,	28.2,	30.2,	N/A ,
15 mins	3.9,	5.7,	6.7,	8.3,	9.3,	10.2,	13.0,	16.3,	18.6,	21.7,	24.6,	26.9,	30.4,	33.2,	35.6,	N/A ,
30 mins	5.1,	7.4,	8.7,	10.6,	12.0,	13.0,	16.5,	20.5,	23.2,	27.1,	30.5,	33.3,	37.5,	40.8,	43.5,	N/A ,
1 hours	6.7,	9.7,	11.3,	13.7,	15.4,	16.7,	20.9,	25.8,	29.1,	33.7,	37.9,	41.1,	46.1,	50.1,	53.3,	N/A ,
2 hours	8.9,	12.6,	14.6,	17.6,	19.7,	21.3,	26.5,	32.5,	36.4,	42.0,	47.0,	50.8,	56.8,	61.4,	65.3,	N/A ,
3 hours	10.5,	14.7,	17.0,	20.5,	22.8,	24.6,	30.5,	37.2,	41.6,	47.8,	53.3,	57.6,	64.1,	69.3,	73.5,	N/A ,
4 hours	11.8,	16.4,	19.0,	22.7,	25.3,	27.2,	33.6,	40.9,	45.6,	52.3,	58.3,	62.9,	69.9,	75.4,	79.9,	N/A ,
6 hours	13.8,	19.2,	22.1,	26.3,	29.2,	31.4,	38.6,	46.7,	52.0,	59.5,	66.1,	71.2,	79.0,	85.0,	90.0,	N/A ,
9 hours	16.3,	22.4,	25.7,	30.5,	33.8,	36.3,	44.4,	53.4,	59.4,	67.6,	74.9,	80.6,	89.2,	95.8,	101.3,	N/A ,
12 hours	18.3,	25.1,	28.6,	33.9,	37.4,	40.2,	49.0,	58.8,	65.2,	74.1,	81.9,	88.0,	97.2,	104.3,	110.2,	N/A ,
18 hours	21.5,	29.3,	33.3,	39.3,	43.3,	46.4,	56.3,	67.2,	74.3,	84.2,	92.9,	99.6,	109.8,	117.6,	124.1,	N/A ,
24 hours	24.2,	32.7,	37.1,	43.7,	48.0,	51.3,	62.1,	73.9,	81.6,	92.3,	101.6,	108.8,	119.7,	128.1,	135.0,	158.8,
2 days	30.1,	39.7,	44.6,	51.8,	56.5,	60.2,	71.7,	84.2,	92.2,	103.3,	112.9,	120.2,	131.2,	139.7,	146.6,	170.3,
3 days	34.8,	45.3,	50.7,	58.4,	63.5,	67.3,	79.5,	92.6,	101.0,	112.5,	122.4,	129.9,	141.2,	149.9,	156.9,	180.9,
4 days	39.0,	50.2,	55.9,	64.1,	69.5,	73.5,	86.3,	100.0,	108.7,	120.5,	130.8,	138.5,	150.1,	158.9,	166.1,	190.5,
6 days	46.3,	58.8,	65.1,	74.1,	79.9,	84.3,	98.1,	112.8,	122.0,	134.6,	145.3,	153.4,	165.6,	174.8,	182.3,	207.5,
8 days	52.7,	66.4,	73.1,	82.8,	89.0,	93.7,	108.4,	123.9,	133.6,	146.8,	158.0,	166.5,	179.1,	188.6,	196.4,	222.4,
10 days	58.6,	73.2,	80.5,	90.7,	97.3,	102.3,	117.7,	134.0,	144.1,	157.8,	169.5,	178.2,	191.3,	201.1,	209.1,	235.8,
12 days	64.1,	79.6,	87.3,	98.1,	105.0,	110.2,	126.3,	143.2,	153.8,	168.0,	180.1,	189.1,	202.6,	212.7,	220.8,	248.2,
16 days	74.3,	91.4,	99.8,	111.6,	119.1,	124.7,	142.0,	160.2,	171.4,	186.5,	199.3,	208.8,	223.0,	233.6,	242.1,	270.8,
20 days	83.8,	102.3,	111.3,	123.9,	131.9,	137.9,	156.4,	175.5,	187.4,	203.2,	216.6,	226.6,	241.4,	252.5,	261.4,	291.1,
25 days	94.9,	114.9,	124.7,	138.2,	146.8,	153.2,	172.9,	193.2,	205.8,	222.5,	236.6,	247.0,	262.5,	274.1,	283.4,	314.3,

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

Additional Units

Residential Units		New	
WATER DEMAND			
No. of units		5	
Occupancy	2.7	14	
Average usage (resi)	150	2025	Resi dry weather flow V
Avg daily discharge l/s	1.25	0.0293	
Peak daily discharge l/s	5	0.146	

Residential Units		New	
WASTE WATER DISCHARGE			
No. of units		5	
Occupancy	2.7	14	
Average usage (resi)	150	2025	Unit Consumption [1.1]
Resi dry weather flow V	1.1	2228	
Avg daily discharge l/s		0.026	
Peak daily discharge l/s	6	0.155	

Water
Total proposed demand 0.15

Foul
Total proposed discharge 0.15 Required pipe diameter (on site) at 50% capacity

Total Units

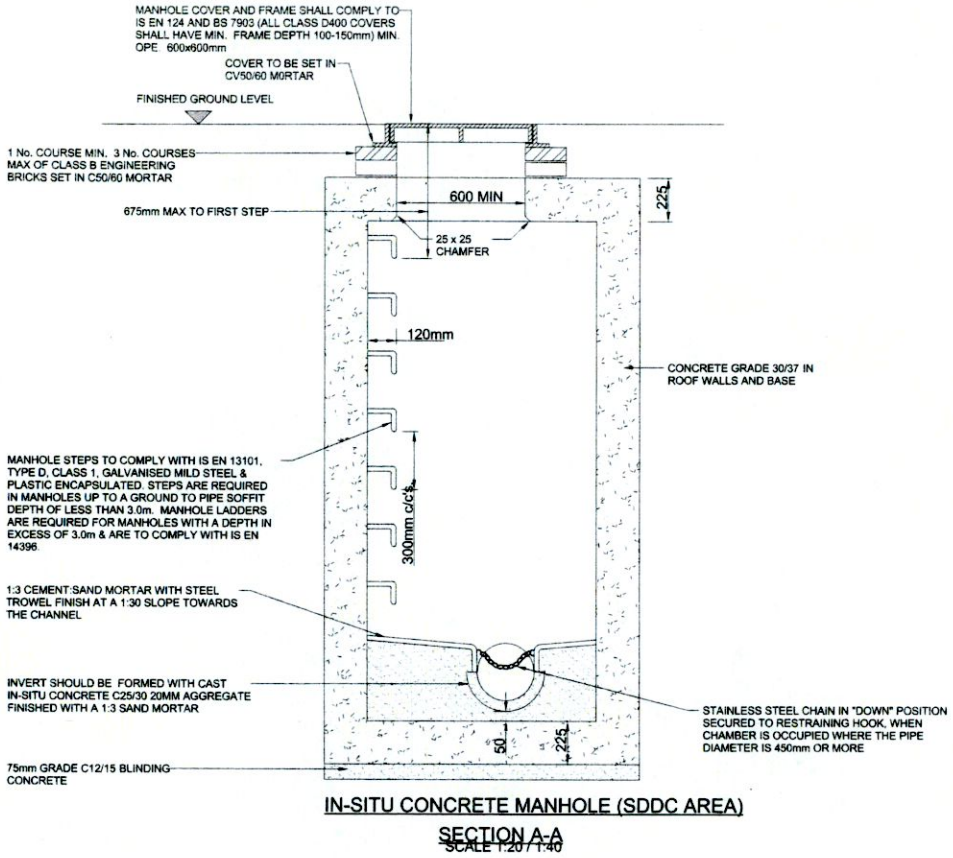
Residential Units		New	
WATER DEMAND			
No. of units		42	
Occupancy	2.7	113	
Average usage (resi)	150	17010	Resi dry weather flow V
Avg daily discharge l/s	1.25	0.2461	
Peak daily discharge l/s	5	1.230	

Residential Units		New	
WASTE WATER DISCHARGE			
No. of units		42	
Occupancy	2.7	113	
Average usage (resi)	150	17010	Unit Consumption [1.1]
Resi dry weather flow V	1.1	18711	
Avg daily discharge l/s		0.217	
Peak daily discharge l/s	6	1.299	

Water
Total proposed demand 1.23

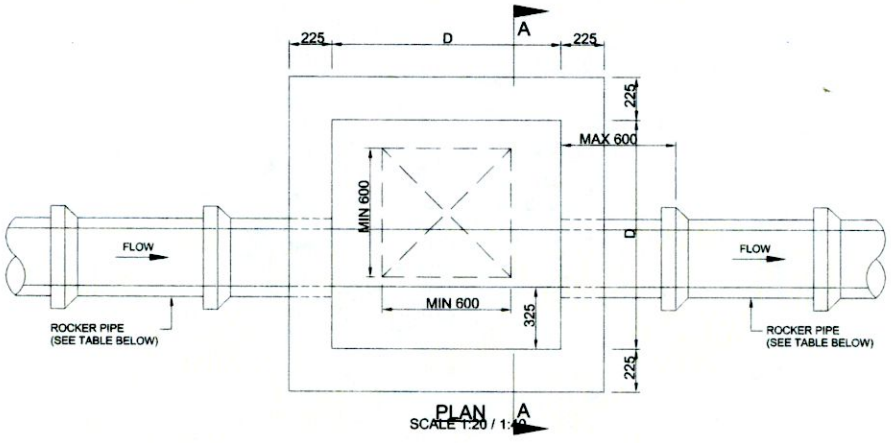
Foul
Total proposed discharge 1.30 Required pipe diameter (on site) at 50% capacity

11 Appendix E - Drainage details



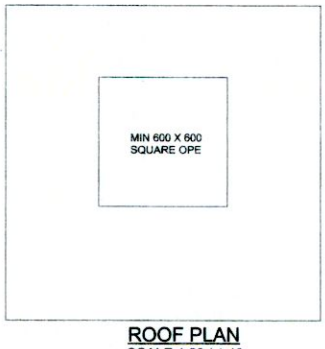
IN-SITU CONCRETE MANHOLE (SDDC AREA)

SECTION A-A
SCALE 1:20 / 1:40



PLAN A
SCALE 1:20 / 1:40

TRENCH WIDTHS-RIGID PIPES



ROOF PLAN
SCALE 1:20 / 1:40

MINIMUM MANHOLE DIAMETER "D"	
DIAMETER OF LARGEST PIPE IN IN MANHOLE (mm)	INTERNAL DIAMETER OF MANHOLE (mm)
LESS THAN 375	1200
375 TO 450	1350
500 TO 750	1500

ROCKER PIPE LENGTH	
PIPE DIAMETER (mm)	ROCKER PIPE LENGTH (mm)
150 TO 600	600
GREATER THAN 600 TO 750	1000
GREATER THAN 750	1250

NORMAL PIPE DIAMETER (mm)	100	150	225	300	375	450	525	600	750	900	1050	1200	1350
TRENCH WIDTH MIN (mm) (W)	450	500	600	700	950	1050	1150	1250	1400	1950	2100	2300	2450
TRENCH WIDTH MAX (mm) (W)	650	700	800	900	1150	1250	1350	1450	1600	2150	2300	2500	2650

TRENCH WIDTHS-FLEXIBLE PIPES

NOMINAL PIPE DIAMETER (mm)	100	150	200	250	300
TRENCH WIDTH MIN (mm) (W)	450	450	600	700	700
TRENCH WIDTH MAX (mm) (W)	600	600	700	700	850

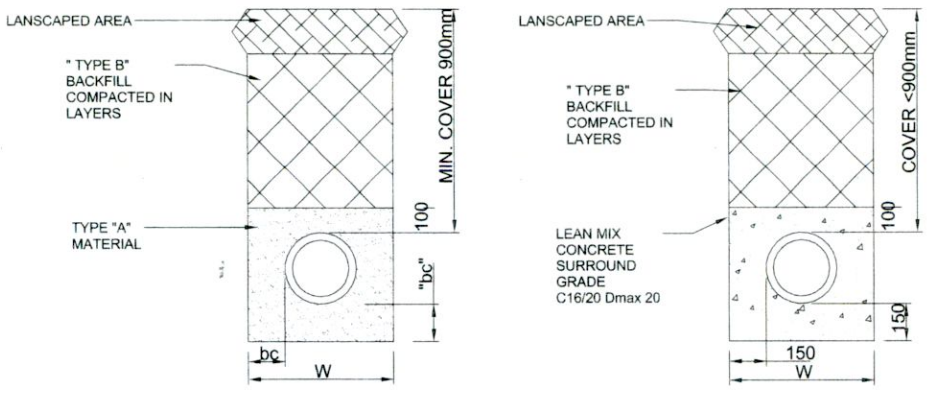
DIMENSIONS-"bc"

NOMINAL PIPE DIAMETER (mm)	100-450 incl.	525-600 incl.	750	900	1050	1200
bc (mm)	100	150	200	225	250	300

DIMENSION-"b"	PIPES UP TO AND INC. 600mm DIA	PIPES GREATER THAN 600mm DIA
UNIFORM SOIL	100mm	200mm
ROCK	200mm	300mm

TYPE "A" MATERIAL:
BROKEN STONE OR GRAVEL, GRADING AS FOLLOWS:-
1) RIGID PIPES - PIPE DIAMETER UP TO AND INCLUDING 600mm
:SIEVE SIZE GREATER THAN 5mm AND LESS THAN 12mm
- PIPE DIAMETER GREATER THAN 600mm DIA
:SIEVE SIZE GREATER THAN 5mm AND LESS THAN 19mm
2) FLEXIBLE PIPES : SIEVE SIZE GREATER THAN 5mm
AND LESS THAN 10mm

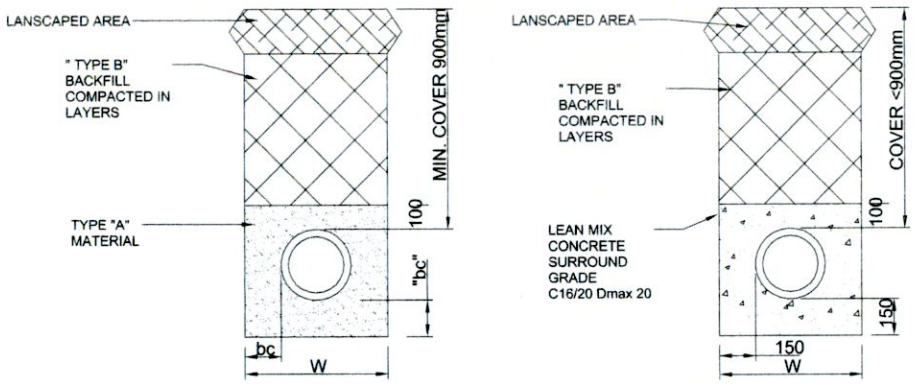
TYPE "B" MATERIAL:
SELECTED FILL UNIFORM READILY COMPACTABLE MATERIAL.
FREE FROM : CLAY LUMPS RETAINED ON 75mm SIEVE,STONES RETAINED ON 25mm. SIEVE, TREE ROOTS,VEGETABLE MATTER, BUILDING RUBBISH AND FROZEN SOIL.



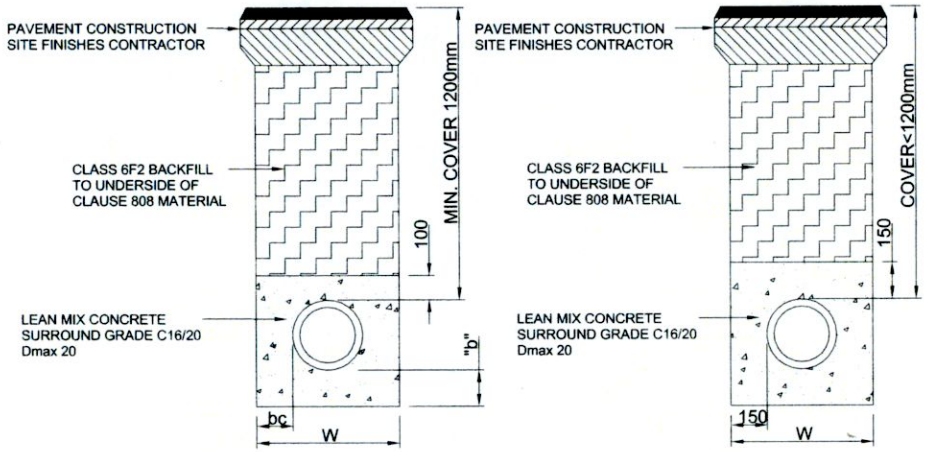
UNPAVED AREAS

PIPE TRENCH DETAILS

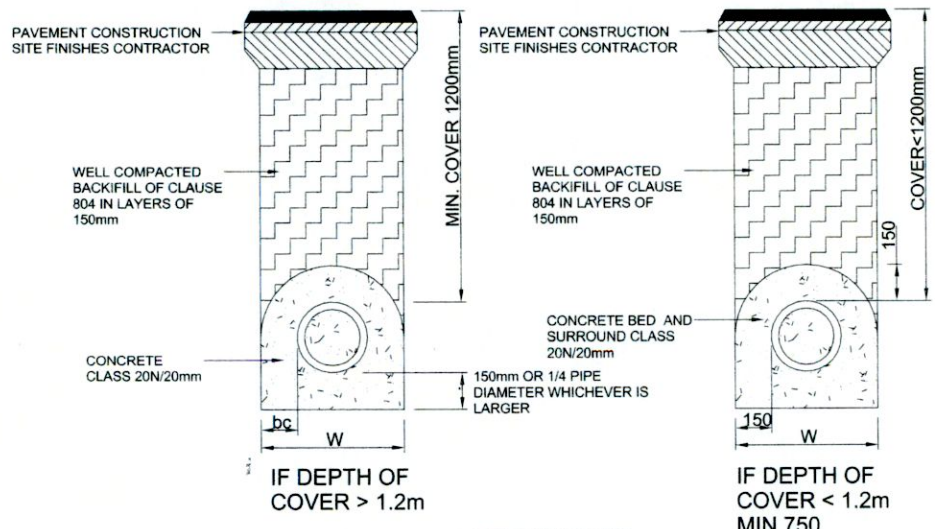
SCALE 1:20



UNPAVED AREAS



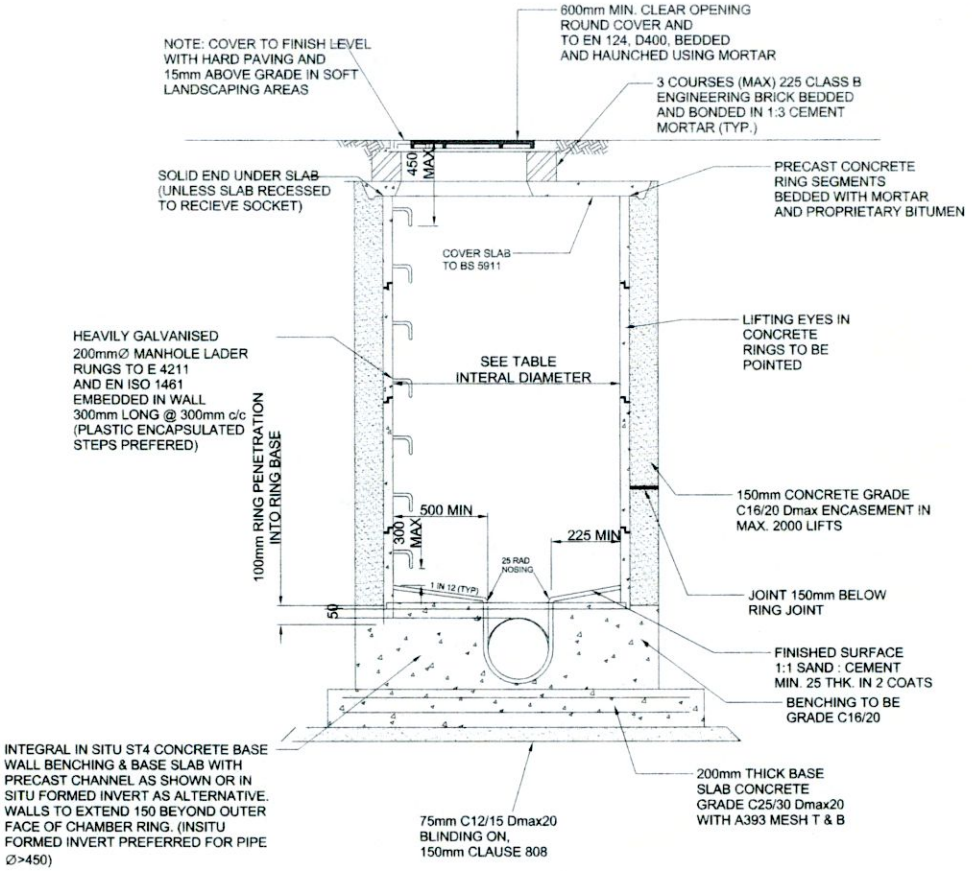
PAVED AREAS



PAVED AREAS

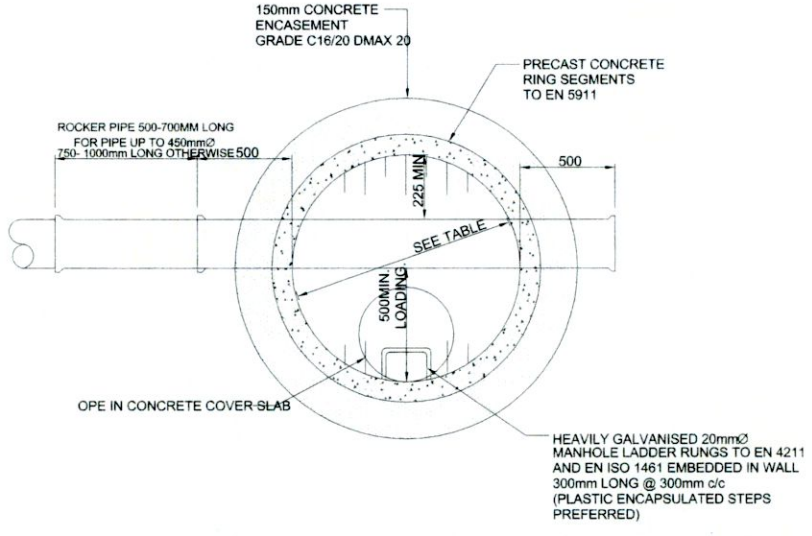
PIPE TRENCH DETAILS (SDDC AREA)

SCALE 1:20



PRECAST CONCRETE MANHOLE<3000mm DEEP, <525mm PIPES DIAMETER

SCALE 1:20

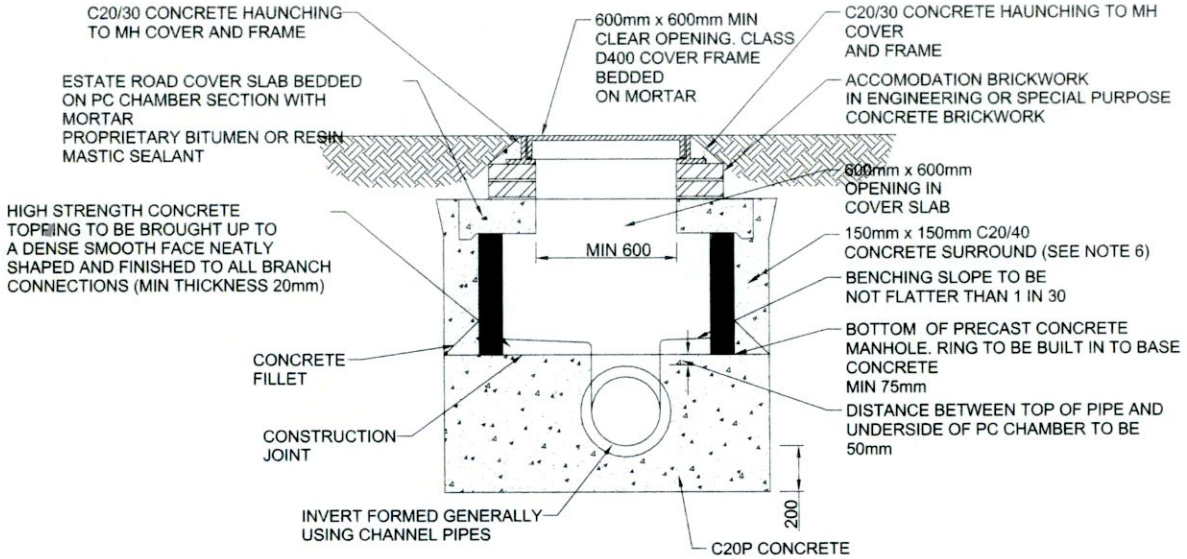


TYPICAL STRAIGHT THROUGH PRECAST CONCRETE MANHOLE

SCALE 1:20

CIRCULAR MANHOLES			MATERIAL (DEPTH)	
OUTLET DIAMETER	INTERNAL DIMENSIONS	EXTERNAL DIMENSIONS INCL CONC SURROUND	<3m	>3m
UP TO 375mmØ	1200mmØ RING	1680mm	RC & PCC	PCC
450mmØ	1350mmØ RING	1840mm	RC & PCC	PCC
525mmØ	1500mmØ RING	2010mm	RC & PCC	PCC
600mmØ	1500mmØ RING	2010mm	PCC	PCC
750mmØ	1500mmØ RING	2010mm	PCC	PCC
900mmØ	1800mmØ RING	2330mm	PCC	PCC
1050mmØ	2100mmØ RING	2650mm	PCC	PCC

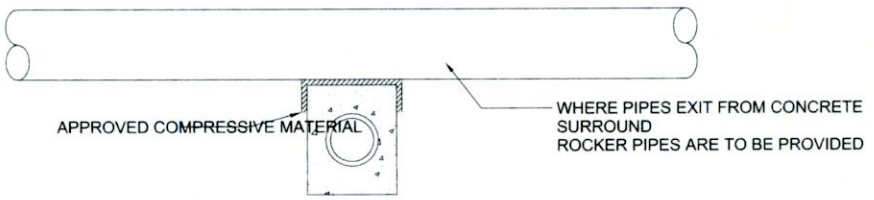
RECTANGULAR MANHOLES (MINIMUM STRAIGHT THROUGH DIMENSIONS)		
OUTLET DIAMETER	DEPTH	INTERNAL DIMENSIONS
150≤ D ≤ 375	ALL	1200 x 910
150≤ D ≤ 375	< 1.5M	1200 x 1135
	> 1.5M	1200 x 1360
	< 1.5M	1500 x 1660
	> 1.5M	1500 x 1885



LOCATION OF THIS TYPE OF MANHOLE RESTRICTED TO AREAS WHERE GRADE B CLASS 1 COVERS ARE USED

TYPICAL PRECAST SHALLOW MANHOLE DETAIL

SCALE 1:20/1:40



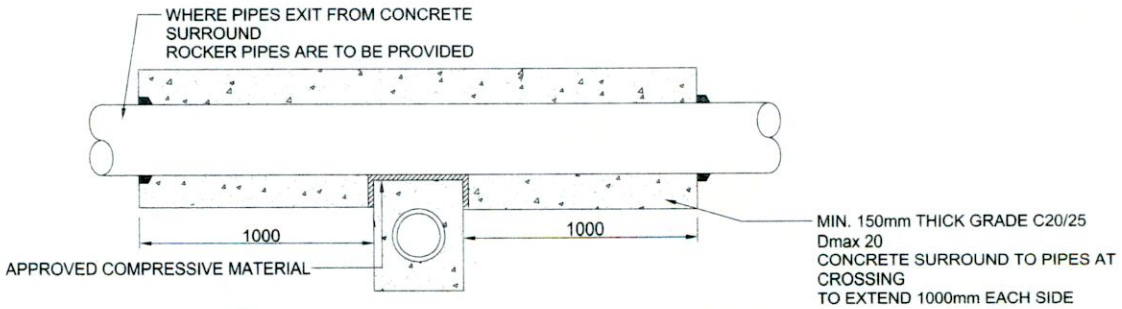
TYPICAL DETAIL AT PIPE CROSSING WITH ADEQUATE COVER

<1200mm COVER IN PAVED AREAS

<900mm COVER IN LANDSCAPED AREAS

(FOR GAPS BETWEEN PIPES OF LESS THAN 300mm

SCALE 1:20 /1:40



TYPICAL DETAIL AT PIPE CROSSING WITH SHALLOW COVER

<1200mm COVER IN PAVED AREAS

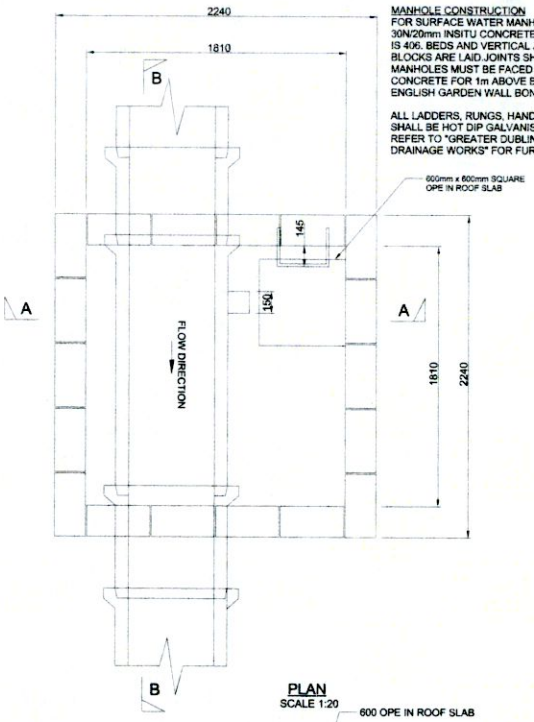
<900mm COVER IN LANDSCAPED AREAS

(FOR GAPS BETWEEN PIPES OF LESS THAN 300mm

SCALE 1:20 / 1:40

MANHOLES DETAILS - TYPE D MANHOLE (SURFACE WATER OUTFALL MANHOLE)

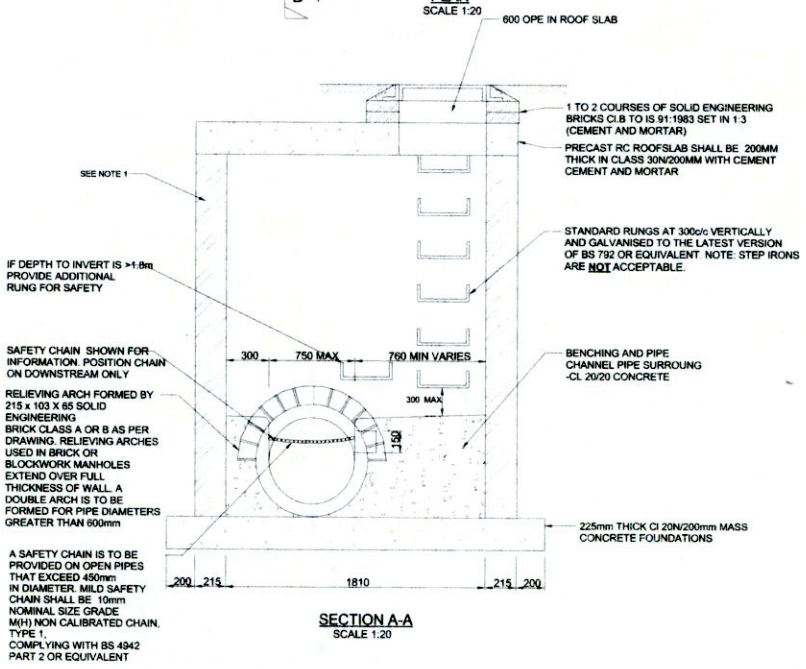
SCALE 1:20



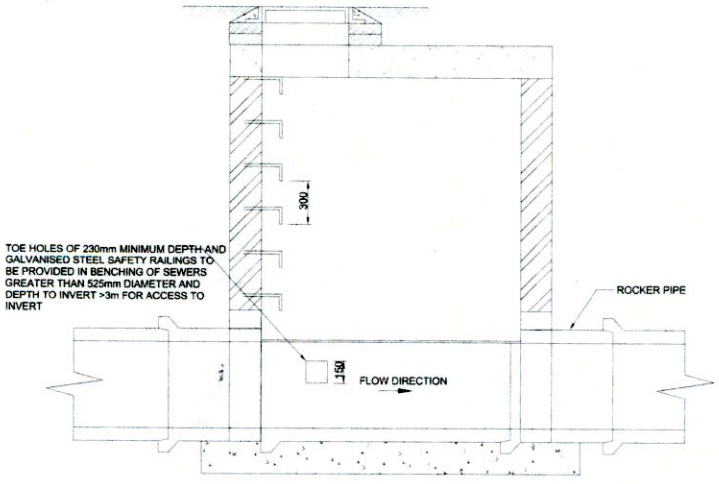
PLAN
SCALE 1:20

MANHOLE CONSTRUCTION
FOR SURFACE WATER MANHOLES HIGH DENSITY BLOCKS TO CL S10 OF IS:20 PART 1:1967 OR CL. 30N/20mm INSITU CONCRETE. BLOCKWORK SHALL BE BEDDED AND JOINTED USING MORTAR TO IS 406. BEDS AND VERTICAL JOINTS SHALL BE COMPLETELY FILLED WITH MORTAR AS THE BLOCKS ARE LAID JOINTS SHALL BE FLUSH POINTED AS THE WORK PROCEEDS. ALL FOUL MANHOLES MUST BE FACED IN SOLID ENGINEERING BRICK (min CLASS A OR B) OR INSITU CONCRETE FOR 1m ABOVE BENCHING LEVEL. BRICK TO BE BONDED TO BLOCKWORK USING ENGLISH GARDEN WALL BOND.

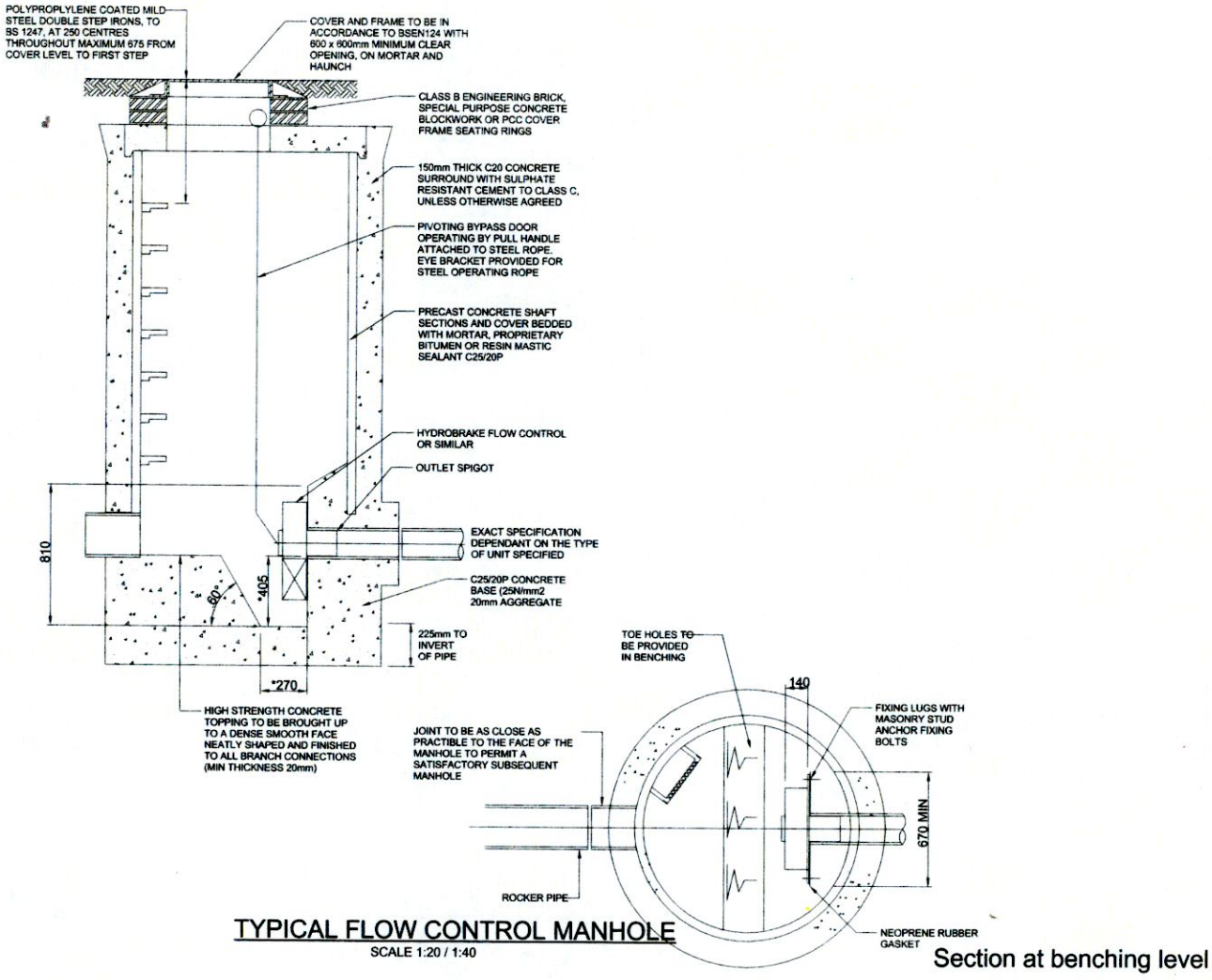
ALL LADDERS, RUNGS, HANDRAILS AND SAFETY CHAINS ETC SHALL BE HOT DIP GALVANISED TO BS 729 OR EQUIVALENT REFER TO "GREATER DUBLIN REGIONAL CODE OF PRACTICE FOR DRAINAGE WORKS" FOR FURTHER DETAILS.



SECTION A-A
SCALE 1:20



SECTION B-B
SCALE 1:20



TYPICAL FLOW CONTROL MANHOLE

SCALE 1:20 / 1:40