Project

White Pines Central Residential Development, Stocking Avenue, Dublin 16.

Report Title

Infrastructure Design Report

Client

Ardstone

INFRASTRUCTURE

DBFL CONSULTING ENGINEERS

May 2021

Document Control

Project Title: White Pines Central Residential Development, Stocking Avenue, Woodtown, Dublin 16.

Project Number: 190004

Report Ref: 190004-rep-001

Author: Seán Byrne

Reviewed By: Brendan Keogh

Approved By:

Date: May 2021

Distribution: An Bord Pleanala

DBFL Consulting Engineers

Dublin Office	**Waterford Office**	**Cork Office**
Ormond House Upper Ormond Quay Dublin 7	The Atrium Maritana Gate Canada Street Waterford	Phoenix House Monahan Road Cork
Tel 01 4004000 **Fax** 01 4004050 **Email** info@dbfl.ie **Web** www.dbfl.ie	**Tel** 051 309500 **Email** info@dbfl.ie **Web** www.dbfl.ie	**Tel** 021 2024538 **Email** info@dbfl.ie **Web** www.dbfl.ie

Revision	Issue Date	Description	Prepared	Reviewed	Approved
DRAFT	July 2020	Draft	SB	BK	-
DRAFT	Sep 2020	Draft	SB	BK	-
-	Nov 2020	Issued for ABP Pre-App	SB	BK	-
A	May 2021	SHD Application	SB	BK	-

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background

DBFL have been instructed to prepare an Infrastructure Design Report to accompany a planning application for a proposed residential development at lands south of Stocking Avenue, Dublin 16.

The proposed development ("the site") comprises of 114 No. residential dwellings on a 2.2 Ha (approx.) site.

1.2 Objectives

This report provides information regarding the existing site and addresses the infrastructural demands of the proposed development including the following:

- Site Access and Road Layout
- Surface Water Drainage
- Flood Risk
- Foul Drainage
- Water Supply

1.3 Topography

The site falls from its eastern boundary (+123.00) towards its western boundary (+103.50), following the grade along Stocking Avenue.

Existing surface gradients range from 1 (V) in 6 (H) to 1 (V) in 15 H). Existing steep surface gradients are an important factor in the design of the roads, setting of finished floor levels, foul drainage and surface water drainage.

Existing topographic survey information is shown in the background of the Proposed Roads Layout Plan (refer to DBFL Drawing No. 190004-DBFL-RD-SP-DR-C-1001).

1.4 Location

The site (known as the "White Pines Central") is located in the Woodtown area (approximately 10 km south of Dublin City Centre).

Stocking Avenue is located to the north of the site and the recently completed "White Pines South" development is located to the south of the site.

Ardstone has recently been granted permission for the development of “White Pines Retail” to the north-west of the site (Application Ref SD19A/0345).

Ardstone have also completed 177 Dwellings on the northern side of Stocking Avenue (known as “White Pines North”, Application Ref. SD14A/0222) and 106 dwellings on the southern side of Stocking Avenue (known as “White Pines South”, Application Reg. Ref. SD10A/0041).

Ardstone also recently submitted an SHD application for other lands north of Stocking Avenue (known as “White Pines East”), which comprises of 241 residential units, residential tenant amenity space and dedicated community space.

A full and comprehensive planning history for this and surrounding sites is included in Section 3 of the Planning Report, prepared by TPA, dated May 2021.

Figure 1.1 Extent of Ardstone Land Holdings (Site Boundary Indicative Only).

1.5 Ground Conditions

GII carried out ground investigations at the site in May 2020 (refer to Appendix A for extracts from GII's Site Investigation Report).

The site is overlaid by made ground comprising of sandy slightly gravelly CLAY with frequent cobles and boulders and occasional fragments of concrete / brick / glass / plastic. This material was recently spread (Q1 2020) from stockpiles of excavated material from the applicant's adjacent development (White Pines South). Cohesive deposits were observed below made ground comprising of sandy gravelly CLAY with occasional cobbles and boulders.

Two stockpiles of topsoil are located at the eastern end of the site (stripped from the applicant's adjacent development, White Pines South). The approximate volume of these stockpiles is 5,500 m3.

1.6 Proposed Development

The proposed development comprises of 114 No. residential dwellings on a 2.2 Ha site (approx.). Refer to Reddy Architecture + Urbanism's Schedule of Accommodation and Site Layout Plans for further detail.

The proposed development will also include the following associated engineering infrastructure:

- Provision of three access points from White Pines South (along the site's southern boundary) facilitating primary vehicle access via the existing roundabout on Stocking Avenue and existing road network within White Pines South.
- Provision of a secondary access point (normally bollarded) to Stocking Avenue in the north-east corner of the site (facilitating access for emergency services / residents should the primary access route become unpassable due to an accident). This access point will also facilitate permeability for pedestrians and cyclists.
- Provision of additional access points onto Stocking Avenue to accommodate pedestrian permeability.
- Provision of internal site roads including associated footpaths.
- Provision of surface water drainage, foul drainage and water supply infrastructure.

2. SITE ACCESS AND STREET LAYOUT

2.1 Site Access

The primary access route for motorised vehicles to the "White Pines Central" is via the existing roundabout on Stocking Avenue and the road network constructed to serve "White Pines South" under Application Reg. Ref. SD10A/0041.

The site layout facilitates high levels of cycle and pedestrian connectivity as noted below (also refer to Figure 2.1).

- Eastern corner of the site – principally intended to facilitate pedestrian and cyclist permeability between the proposed scheme and Stocking Avenue. This access point is designed as a 6.0m wide shared surface (grass-crete) and can also serve as an alternative access and egress point for Emergency Services and residents should the primary access route for motorised vehicles become blocked (e.g. road traffic accident).
- Along the site's northern boundary – facilitates pedestrian permeability between the proposed scheme and Stocking Avenue. This pedestrian access point also facilitates access to the bus stops immediately adjacent to the site.
- At the site's western boundary – facilitates direct pedestrian access to the site from existing pedestrian facilities at the roundabout on Stocking Avenue
- Along the site's southern boundary – pedestrian movement between "White Pines Central" and "White Pines South" is facilitated.

Refer to DBFL Drawing No. 190004-DBFL-RD-SP-DR-C-1001 for proposed site access' as described above.

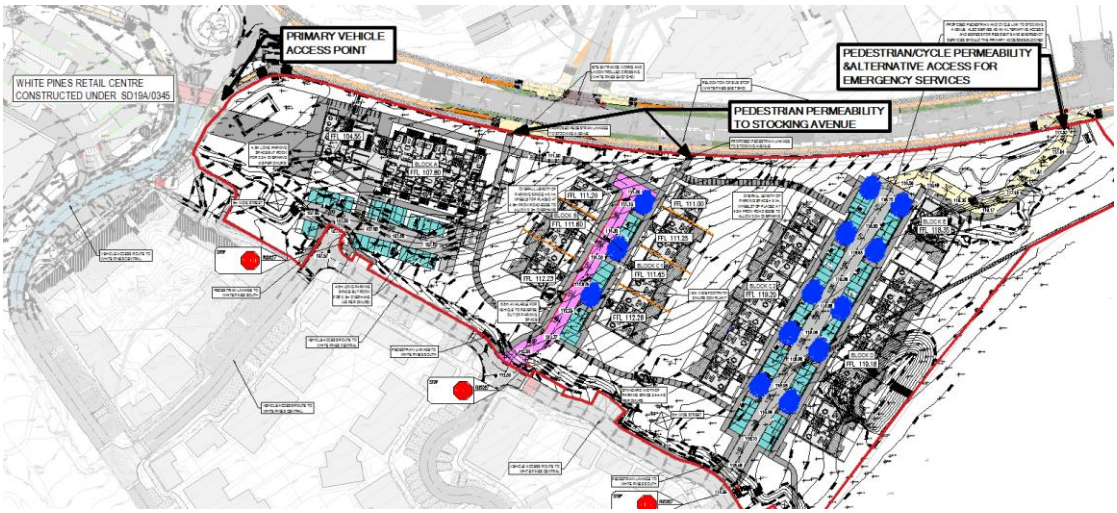


Figure 2.1 Proposed Access Points (Extract from Drawing 190004-DBFL-RD-SP-DR-C-1001***)***

2.2 Street Layout Design

The site's street layout is shown on DBFL Drawing 190004-DBFL-RD-SP-DR-C-1001

DMURS Street Design guidelines incorporated in the site's road layout are detailed in DBFL Technical Note – DMURS Compliance Statement (190004-TN-02).

A design speed limit of 30 km/hour has been applied throughout the development in accordance with the Design Manual for Urban Roads and Streets (function – local road, context – neighbourhood, pedestrian priority).

2.3 Vehicle Tracking

The proposed street layout has been tracked to demonstrate that the site's proposed corner radii and turning heads will accommodate large vehicles such as refuse trucks and fire engines (refer to DBFL Drawings No. 190004-DBFL-RD-SP-DR-C-1001).

2.4 Pavement Design Standards

Local streets within the site are to be designed in accordance with SDCC's *Taken In Charge Policy – Appendix 6 – Roads Minimum Standards*.

Proposed road construction materials and thicknesses are to be based on an existing minimum subsoil CBR of 2.0% at road formation level.

Actual CBR values are to be confirmed by site specific investigations prior to road construction.

2.5 Traffic & Transportation

A separate Traffic and Transportation Assessment has been prepared as part of this planning application (refer to DBFL Report No. 190004-rep-008).

3. SURFACE WATER DRAINAGE

3.1 Existing Surface Water Drainage

The existing surface water drainage network constructed to serve "White Pines South" has been designed to accommodate additional flow form the subject application site.

A spur has been left from the "White Pines South" surface water network adjacent to the site's western boundary (refer to Figure 3.1). As noted in Section 1.3, the site falls from its eastern boundary towards its western boundary.

The surface water network constructed to serve "White Pines South" outfalls via an existing surface water drain (225mm diameter) under Stocking Avenue.

This surface water drain under Stocking Avenue facilitates attenuated flows (38l/sec) from all "lands under the applicant's ownership" south of Stocking Avenue in accordance with previously granted planning permissions SD10A / 0041.

The surface water drain under Stocking Avenue outfalls to the surface water drainage network constructed by Ardstone under SD14A/0222 (which serves "White Pines North" and ultimately outfalls to an existing 600mm diameter surface water drain which crosses under the M50 motorway).

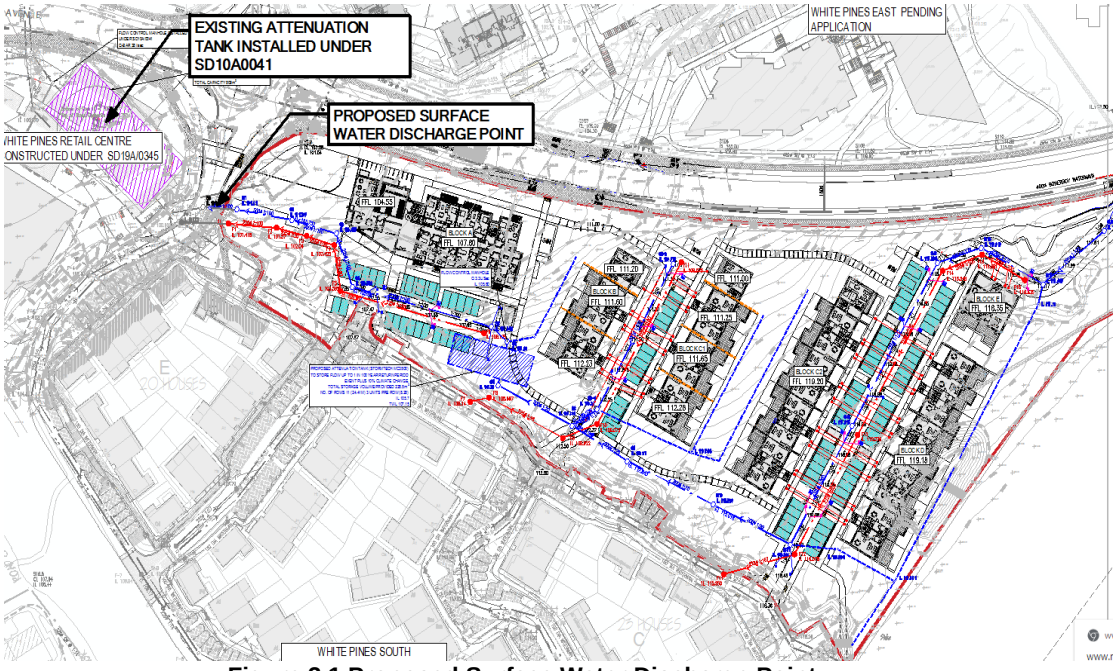


Figure 3.1 Proposed Surface Water Discharge Point.

3.2 Basis of Design

3.2.1 General Description of Surface Water Design

The surface water network (as described above in Section 3.1) is expected to provide a suitable surface water discharge point for the proposed development.

Refer to DBFL Drawing No. 190004-DBFL-CS-SP-DR-C-1002 for proposed surface water outfall location.

The site will be divided into two catchments and upper and a lower. The upper catchment will discharge into the lower catchment. The lower catchment will then discharge into the existing surface water network as describe in Section 3.1.

Surface water discharge rates from the proposed surface water drainage network will be controlled by a vortex flow control device (Hydrobrake or equivalent) and associated underground attenuation tanks (Stormtech Chambers).

Underground attenuation tanks are sized to attenuate the 1 in 100 year storm event.

Surface water discharge will also pass via a full retention fuel / oil separator (sized in accordance with permitted discharge from the site).

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the attenuation tank, flow control device and separator arrangement as noted above.

Surface water runoff from the site's road network will be directed to tree pits via conventional road gullies (with high level overflow to the piped surface water network).

Surface water runoff from in curtilage parking areas will be captured by permeable paving.

Surface water runoff from apartment roofs will be captured by green roofs (sedum blanket) prior to being routed to the piped surface water drainage network.

Surface water runoff from the roofs of duplexes will be routed to the proposed surface water pipe network via the porous aggregates beneath permeable paved driveways (providing an additional element of attenuation).

3.2.2 Compliance with Surface Water Drainage Policy

The site's surface water management infrastructure has been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS).

The GDSDS (Vol. 2, Chapter 6.3.4) requires that the following design criteria are applied to all sites:

- Criterion 1:

  River Water Quality Protection – Satisfied by providing interception storage and treatment of surface water run-off by SUDS features such as permeable paving of driveways, underground attenuation tanks and full retention fuel / oil separators at surface water discharge points.

- Criterion 2:

  River Regime Protection – Satisfied by attenuating surface water run-off in association with flow control devices prior to discharge off site at greenfield runoff rate. Site critical duration storm used to assess attenuation volume.

- Criterion 3:

  Level of Service (Flooding) for the Site – Satisfied by reviewing available flood hazard information (e.g. Eastern CFRAM Study) relating to the sites proximity to fluvial flood plains (up to 1 in 100-year flood event).

  Also refer to DBFL Report No. 190230-rep-002 (Site Specific Flood Risk Assessment).

- Criterion 4:

  River Flood Protection – Satisfied by attenuating surface water discharge to greenfield runoff rates, addressing pluvial flood risk associated with the 1 in 100 year storm and avoiding development in flood plains.

3.2.3 Proposed Runoff Coefficients & Factored Impermeable Areas

Noted below are the proposed reduction factors for the proposed development.

Proposed Runoff Coefficients and Factored Impermeable Areas are noted below in Table 3.1.

- Impermeable Roads Drained to Road Gullies – Runoff Coefficient 0.80

  Typically, road gullies discharge to tree pits (with high level overflow to the piped surface water network). Also takes account of run-off stored within the micro and macro texture of the surfacing (i.e. runoff not collected by piped network).

- Permeable Paved Areas Draining via SUDS – Runoff Coefficient 0.5

  Reduction of velocity as the aggregate/filter material used in the SuDS feature (permeable paving) slows the run-off at source ultimately reduce the peak inflow for attenuation calculations.

- Green Roof – Runoff Coefficient 0.75

  The proposed build-up will be an extensive type with 200mm minimum construction depth and sedum planting. The soil build-up will partially absorb some of the initial run-off and once saturated will reduce flow rates through the green roof medium to the outlets and final attenuation storage location.

- Duplex Roof Draining Via SuDS (permeable paving) – Runoff Coefficient 0.5

  Reduction of velocity as the aggregate/filter material used in the SuDS feature (permeable paving) slows the run-off at source ultimately reduce the peak inflow for attenuation calculations.

- Soft Landscaped / Grassed Areas – Runoff Coefficient 0.15

  Grassed / Landscaped areas slows the run-off at source ultimately reduce the peak inflow for attenuation calculations.

		Catchment C1		Catchment C2		Total (m2)	
	Runoff Coefficients	Gross Areas (m2)	Factored Areas (m2)	Gross Areas (m2)	Factored Areas (m2)	Gross Area (m2)	Factored Areas (m2)
Duplex Roof -Draining to SUDs	0.50	-	-	2,118	1,059	2,118	1,059
Apartment - Green Roof	0.75	1,699	1,274	-	-	1,699	1,274
Paved Areas - Draining to Gullies	0.80	366	293	2,004	1,603	2,370	1,896
Paved Areas- Draining to SUDS (Permeable Parking)	0.50	348	174	1,263	631	1,611	805
Soft Landscaping	0.15	3,035	455	10,062	1,509	13,098	1,965
		5,448	2,196	15,447	4,803	20,895	6,999

Table 3.1 Proposed Runoff Coefficients and Factored Impermeable Areas
Note: Refer to DBFL Drawing 190004-DBFL-SW-SP-DR-C-1001 for the location of Catchment C1 and Catchment C2

3.2.4 Allowable Greenfield Runoff Rate

Q-bar has been assessed based on GDSDS requirements (Institute of Hydrology Report No. 124, Flood Estimation for Small Catchments)

i.e. Q-bar (m^3/s)=0.00108x(Area)0.89(SAAR)1.17(SOIL)2.17

- Area – 6.19 Ha i.e. “lands under the applicant’s ownership” south of Stocking Avenue.
- SAAR – 1,005 mm (based on local information from Met Eireann), also refer to GDSDS Section 6.7.3 “*South Dublin is differentiated as the mountains make rainfall characteristics for the region slightly different*”.
- SOIL – Soil Type 4 / SPR Value 0.47 (see Table 3.2 below for assessment of Soil Type, also refer to GDSDS Section 6.7.3 “*although much of Dublin is categorised as SOIL type 2, in practice some areas might be closer to SOIL type 4*”)
- Q-bar = 41.6 l/sec (equivalent to 6.7 l/sec/Ha).

Under SD10A / 0041, an allowable outflow of 38 l/sec was permitted “lands under the applicant’s ownership” south of Stocking Avenue. It is proposed to use this figure as Q-bar for the “lands under the applicant’s ownership” south of Stocking Avenue (it compares well to the Q-bar calculated above although slightly more conservative).

Assessment of Soil Type (also refer to Table 3.2)

- Drainage Group 2 (poorly drained, subsoil material comprises of gravelly clays, also refer to Section 1.5 of this report)
- Depth to Impermeable Layer 3 (< 40cm) i.e. topsoil depth 200mm to 300mm
- Slope 1 (2 – 8 deg), existing surface gradients are as steep as 1 in 6, also refer to GDSDS Section 6.7.3 "*the rate and amount of runoff from the greenfield site is going to be influenced to some degree by slope*"
- Permeability Group 3 (Slow), percolation testing was carried out at several locations on the site and Infiltration was not observed at any of the test locations

Table 4.4 Classification of soil factors.

Property		Classes
A Drainage group	1	Rarely waterlogged within 60 cm at any time (well and moderately well drained)
	(2)	Commonly waterlogged within 60 cm during winter (imperfect and poor)
	3	Commonly waterlogged within 60 cm during winter and summer (very poorly drained)
B Depth to 'impermeable' layers	1	>80 cm
	2	80–40 cm
	(3)	<40 cm
C Permeability group (above 'impermeable' layers or to 80 cm)	1	Rapid
	2	Medium
	(3)	Slow
D Slope	1	0–2°
	(2)	2–8°
	3	>8°

Having decided all four parameters, Table 4.5 was used to reach the index of 'winter rain acceptance'.

Table 4.5 The classification of soils by winter rain acceptance rate from soil survey data.

Drainage ~~class~~ Group	Depth to impermeable layer (cm)	Slope classes								
		0 - 2°			2 - 8°			>8°		
		Permeability rates above impermeable layers								
		Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)
1	>80	1			1			1	2	3
	40 - 80				2			3		4
	<40	—	—	—	—	—	—	—	—	—
(2)	>80	2		3			4	—		
	40 - 80									
	<40	3								
3	>80				5			—		
	40 - 80							—		
	<40									

Table 3.2 Classification of Soils Type (by winter rain acceptance rate from soil survey data)

3.2.5 Design Standards

Proposed surface water drains have been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS), the Department of the Environment's Recommendations for Site Development Works for Housing Areas, the Department of the Environment's Building Regulations "Technical Guidance Document Part H Drainage and Waste Water Disposal" and BS EN 752: 2008 Drain and Sewer Systems Outside Buildings.

Design Criteria:

- Return period for pipe work design 5 years
- Return period for attenuation design 100 years
- Soil Type 4
- Allowable Outflow 6.1 l/sec/ha

  (Based on allowable outflow of 38 l/sec from "lands Under the applicant's ownership" south of Stocking Avenue as permitted under SD10A/0441)
- Time of entry 4 minutes
- M5 - 60 17.0 mm
- Ratio "r" 0.30
- Pipe Friction (Ks) 0.6 mm
- Minimum Velocity (based on pipe flowing full) 1.0 m/s
- Rainfall Depth Factored for Climate Change (as per GDSDS) 10%

  (in accordance with GDSDS Volume 2, Chapter 6, Table 6.2 – see below)

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

Table 6.2 Climate Change Factors to be Applied to Drainage Design

Refer to Appendix B for Attenuation Design Calculations

Refer to Appendix E for Surface Water Network Design Calculations.

Surface water calculations have been carried out using Microdrainage WinDes analysis software.

3.2.6 SuDS

The following methodologies are being implemented as part of a SuDS treatment train approach:

- Permeable paving in parking spaces / in curtilage areas.
- Typically, road gullies discharge to tree pits (with high level overflow to the piped surface water network)
- Surface water runoff from duplex roofs will be routed to the proposed surface water pipe network via the stone reservoir beneath permeable paved parking. Note, this detail does not rely on infiltration, the stone reservoir is intended to provide an additional element of attenuation storage.
- Surface water runoff from apartment roofs will be captured by green roofs (sedum blanket) prior to being routed to piped surface water drainage network.
- Attenuation of the 1 in 100 year return period storms in underground attenuation chambers (Stormtech). Provision of above ground storage for the 100 year less the 30 year storm volume is not feasible due to steep site gradients. Note: Our calculation has not allowed for any infiltration when calculating the attenuation volume.
- Installation of a vortex flow control device (Hydrobrake or equivalent).
- Surface water discharge will also pass via a Class 1 full retention fuel / oil separator (sized in accordance with permitted discharge as set out in SD10A/0041).

3.2.7 Attenuation Calculation

Attenuation volumes have been calculated based on an allowable outflow rate of 3.3 l/sec for Catchment C2 (catchment C2 is a sub catchment of C and is only used for internal management and ultimately discharges into catchment C1) and a combined allowable outflow of 38 l/sec for catchments A, B and C1 (refer to Section 3.2.4 above).

Refer to DBFL Drawing 190004-DBFL-SW-SP-DR-C-1001 for the location of Catchment C1 and Catchment C2.

Run-off from the proposed development will be controlled / attenuated using vortex type flow control devices (Hydrobrake or equivalent).

The resultant storage system types, discharge limits and storage volumes are detailed in Table 3.3.

Catchment Summary "All Lands Under Applicants Ownership" South of Stocking Ave.	**Catchment Area**	**Impermeable Area**	**Allowable Outflow (L/Sec)**	**Required Storage Volume**	**Underground Storage Volume Provided**
A "White Pines South" (SD10A / 0041)	3.355Ha	1.526Ha	38.0 (i.e. allowable outflow from Lands Under Applicants Ownership South of Stocking Ave, SD10A / 0041.	535m^3 Catchment A	809 m^3 Attenuation Provided for Catchment A,B & C1 **EXISTING**
B "White Pines Retail" (SD19A/0345)	0.746Ha	0.497Ha		130m^3 Catchment B	
C1 "Subject Application" (Lower Catchment)	0.545Ha	0.219		128m^3 Catchment C1	
C2 "Subject Application" (Upper Catchment)	1.544Ha	0.480	3.3	210 m^3 Catchment C2	228.5 m^3
Total:	**6.190Ha**	**2.659Ha**	-	**1003 m^3**	**1037.5 m^3**

Table 3.3 – Surface Water Attenuation Storage and Discharge Limits

Refer to Appendix B for Preliminary Attenuation Design Calculations.

Attenuation volumes have been calculated using Microdrainage WinDes analysis software taking account of the depth and type of attenuation system.

In total 1037.5m^3 of storm-water storage is provided is provided below ground.

Supplementing this storage volume is a further approx. 370m^3 of additional storage in SUDS measures (i.e. voids in aggregates beneath permeable paving).

The location of proposed attenuation systems is shown on DBFL Drawing 190004-DBFL-CS-SP-DR-C-1002.

3.2.8 Interception Volume

The GDSDS (Vol. 2, Table 6.3) requires interception storage to be incorporated into surface water drainage design in order to limit discharge of sediment and pollutants into the downstream surface water drainage network and receiving water courses.

This interception storage is designed to capture surface water run-off from rainfall depths of 5mm (and up to 10mm if possible).

The SuDS features included in the development (refer to Section 3.2.6) will provide the necessary interception volume required by the GDSDS (within stone reservoirs beneath permeable paved driveways and within the Stormtech Attenuation Chambers).

3.3 Flood Risk

A separate Site Specific Flood Risk Assessment has been prepared as part of this planning application (refer to DBFL Report No. 190004-rep-002).

This flood risk assessment has been undertaken by reviewing information from the Office of Public Works (OPW) National Flood Hazard Mapping (www.floods.ie) and the Eastern CFRAM Study and has been carried out in accordance with the OPW's Guidelines for Planning Authorities – The Planning System and Flood Risk Management (November 2009).

3.4 Surface Water Quality Impact

Run-off rates from the site are controlled by flow control devices.

Surface water management proposals for the development also incorporate the following impact reduction measures;

- Surface water network designed in accordance with GDSDS requirements
- Incorporates SUDS features e.g. permeable paving in the higher risk parking areas at the front of houses (i.e. treatment / filtration provided within the stone reservoir beneath permeable paved driveways)
- Surface water attenuation (i.e. treatment / filtration provided within the granular surround of the Stormtech Chambers) in conjunction with a final Class 1 fuel / oil separator prior to discharge to the downstream surface water network.

4. FOUL DRAINAGE

4.1 Foul Drainage Strategy

The existing foul drainage network constructed to serve “White Pines South” has been designed to accommodate additional flow form the subject application site.

A spur has been left from the “White Pines South” foul drainage network adjacent to the site’s western boundary (refer to Figure 4.1). As noted in Section 1.3, the site falls from its eastern boundary towards its western boundary facilitating a gravity drainage solution.

The foul drainage network constructed to serve “White Pines South” outfalls via an existing surface water drain (225mm diameter) under Stocking Avenue which in turn outfalls northwards via the foul drainage network constructed by Ardstone under SD14A/0222 (which serves “White Pines North” and ultimately discharging to an existing 450mm diameter foul drain which crosses under the M50 motorway).

The proposed foul drainage network within the site comprises of a series of 225mm diameter pipes discharging by gravity via the foul drainage network described above (refer to DBFL Drawing 190004-DBFL-CS-SP-DR-C-1002 for the proposed foul drainage layout). Duplex units located will be services by individual 100mm diameter connections. A Statement of Design Acceptance has been received from Irish Water (included in Appendix C of this report).

Foul drainage network design has been carried out using Microstation WinDes analysis software (refer to Appendix F for foul drainage network calculations).

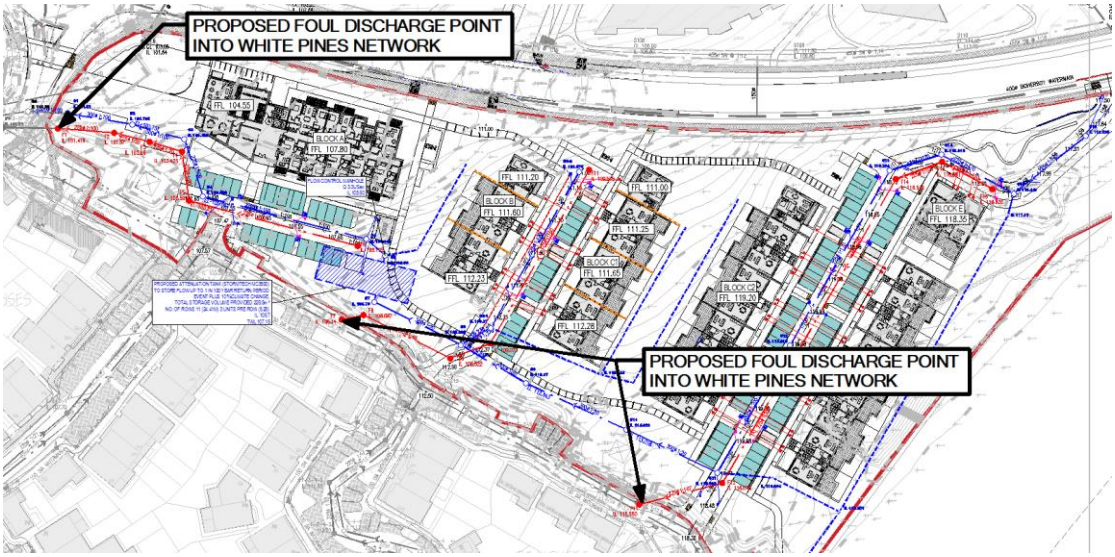


Figure 4.1 Proposed Foul Discharge Point.

4.2 Pre-Connection Feedback from Irish Water

Pre-connection enquiry feedback has been received from Irish Water (included in Appendix C). Irish Water have advised as follows:

- Subject to a valid connection agreement being put in place, the proposed connection to the Irish Water's foul drainage network can be facilitated.
- To accommodate the proposed connection, upgrade works are required to increase capacity of the Irish Water Network.

The upgrade works noted above are the Scholarstown Brach Sewer LNRP. The applicant has been engaged with Irish Water regarding the Scholarstown Brach Sewer LNRP as it partly traverses another of their development sites at Scholarstown Road (this development received a grant of planning from ABP via the SHD process in March 2020).

The Scholarstown Brach Sewer LNRP works are to be completed in Q4 2021. Ardstone have completed the portion of the LNRP works (approx. 300 linear meters) which traverses their lands at Scholarstown Road under a Technical Services Agreement with Irish Water.

4.3 Design Calculations

The foul drainage network for the proposed development has been designed in accordance with the following guidelines:

- Irish Water Code of Practice for Wastewater Infrastructure
- Department of the Environment's Building Regulations "Technical Guidance Document Part H Drainage and Waste Water Disposal"
- BS EN 752: 2008 Drain and Sewer Systems Outside Buildings
- IS EN 12056: Part 2 (2000) Gravity Drainage Systems Inside Buildings

Design Criteria:

Demand	446 l/dwelling/day
Discharge units	14 units per house (as BS8301)
Pipe Friction (Ks)	1.5 mm
Minimum Velocity	0.75 m/s (self-cleansing velocity)
Maximum Velocity	3.0 m/s (1:18 maximum pipe gradient)
Frequency Factor	0.5 for domestic use
Manhole Depths	< 4.0m

4.4 Foul Drainage – Environmental Impacts

Waste Water Discharge Calculation

(as outlined in Irish Water's Pre-Connection Enquiry Application Form)

No. of Housing Units	114
Post Development Average Discharge	0.59 l/sec
Post Development Peak Discharge	3.54 l/sec
Daily Foul Discharge Volume (446l per dwelling)	50,844 l/Day

5. WATER SUPPLY AND DISTRIBUTION

5.1 Existing Public Watermains

An existing 500mm Watermain watermains running along the southern side of Stocking Avenue, adjacent to the site's northern boundary.

An existing 150mm water main network is also located to the south of the site within "White Pines South".

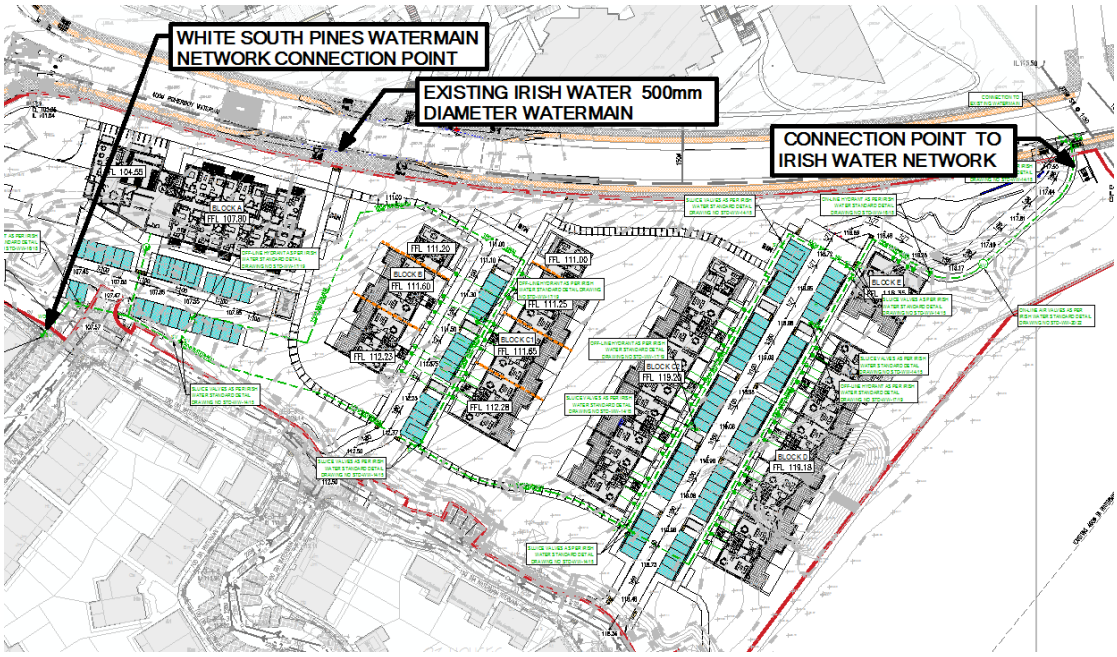


Figure 5.1 Existing Watermain layout.

5.2 Proposed Watermain Layout

The site's proposed water main layout is shown on DBFL Drawing 190004-DBFL-WM-SP-DR-C-1001. The proposed development's water supply is to be taken from the 500mm diameter water main on Stocking Avenue and connected back into the 150mm diameter network located within White Pines South.

A 150mm diameter looped water main will be provided within the development.

The proposed water main layout and connections to existing public water mains have been designed in accordance with Irish Water Standard Detail STD-W-02. A Statement of Design Acceptance has been received from Irish Water (included in Appendix C of this report).

Duplex units will have their own connections (25mm O.D. PE pipe) to distribution water mains via service connections and meter / boundary boxes. Individual connections are to be installed in accordance with Irish Water Standard Detail STD-W-03. Block A (apartments building) is to be serviced via an individual metered connection.

5.3 Pre-Connection Feedback from Irish Water

Pre-connection enquiry feedback has been received from Irish Water (included in Appendix C). Irish Water have advised as follows:

- Subject to a valid connection agreement being put in place, the proposed connection to the Irish Water's water supply network can be facilitated.
- New connection to the existing network is feasible without upgrade

5.4 Hydrants

The proposed water main layout is arranged such that all buildings are a maximum of 46.0m from a hydrant in accordance with the Department of the Environment's Building Regulations "Technical Guidance Document Part B Fire Safety".

Hydrants shall comply with the requirements of BS 750:2012 and shall be installed in accordance with Irish Water's Code of Practice and Standard Details.

5.5 Materials

Proposed water mains are to be HDPE 100 SDR17.

5.6 Proposed Watermain Layout

Water Demand has been calculated in accordance with the guidelines outlined in Irish Water's Pre-Connection Enquiry Application Form:

- No. of Housing Units 114
- Average Occupancy Ration (Persons Per Dwelling) 2.7
- Per-Capita Consumption (l/person/day) 150
- Average Domestic Daily Demand (l/sec) 0.53
- Post Development Average Hour Water Demand (l/sec) 0.67

  (1.25 x Average Domestic Daily Demand)
- Post Development Peak Hour Water Demand (l/sec) 3.35

  (5.0 x Post Development Average Hour Water Demand)

APPENDIX A – EXTRACTS FROM GII SITE INVESTIGATION REPORT

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP01
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.90x0.70x3.10	**Ground Level (mOD)** 105.85	**Client** DBFL	**Job Number** 9481-02-20
	Location 712457.9 E 726037.3 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.00)	MADE GROUND: Brown slightly andy gravelly Clay with some cobbles and PVC fragments		
1.00	B			104.85	1.00			
					(0.30)	MADE GROUND: Grey clayey sandy angular fine to coarse Gravel with many angular cobbles (Old haul road)		
				104.55	1.30			
					(0.70)	Soft to firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
2.00	B			103.85	2.00			
			Slow seepage(1) at 2.60m.		(1.10)	Firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		▽1
3.00	B			102.75	3.10			
						Complete at 3.10m		

Plan

Remarks

Trial Pit stable
Groundwater encountered at 2.60m BGL as slow seepage
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP01

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP02
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.80x0.70x3.00	**Ground Level (mOD)** 105.36	**Client** DBFL	**Job Number** 9481-02-20
	Location 712481.2 E 726055.4 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.90)	MADE GROUND: Brown slightly andy gravelly Clay with some cobbles and PVC fragments		
				104.46	0.90			
1.00	B				(0.70)	Soft to firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
				103.76	1.60			
2.00	B				(1.00)	Firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
				102.76	2.60			
					(0.40)	Possible WEATHERED ROCK: Green/grey/brown slightly clayey sandy angular fine to coarse GRAVEL with angular cobbles of Schist		
				102.36	3.00			
3.00	B					Complete at 3.00m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP02

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP03
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 4.40x0.70x4.00	**Ground Level (mOD)** 107.20	**Client** DBFL	**Job Number** 9481-02-20
	Location 712487.2 E 726027.9 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.80)	MADE GROUND: Brown/grey slightly andy gravelly Clay with some cobbles and PVC fragments		
				106.40	0.80			
					(0.20)	MADE GROUND: Grey clayey sandy angular fine to coarse Gravel with many angular cobbles		
1.00	B			106.20	1.00			
					(0.80)	MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional cobbles (PVC Land drain in Gravel trench on North side of pit)		
				105.40	1.80			
2.00	B					Soft to firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
					(0.90)			
				104.50	2.70			
3.00	B		Slow seepage(1) at 3.00m.			Firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		▽1
					(1.00)			
				103.50	3.70			
					(0.30)	WEATHERED ROCK: Green/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
4.00	B			103.20	4.00			

Plan

Remarks

Trial Pit spalling from surface
Groundwater encountered at 3.00m BGL as slow seepage
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP03

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP04
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.20x0.70x3.20	**Ground Level (mOD)** 106.98	**Client** DBFL	**Job Number** 9481-02-20
	Location 712519.7 E 726043.4 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	MADE GROUND: Brown/grey slightly sandy gravelly Clay with some cobbles and PVC fragments		
				106.38	0.60			
1.00	B				(1.00)	Firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
				105.38	1.60			
2.00	B				(0.90)	VERY WEATHERED ROCK: Green/grey clayey sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
				104.48	2.50			
3.00	B				(0.70)	WEATHERED ROCK: Green/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
				103.78	3.20			
						Complete at 3.20m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP04

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP05
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 5.10x0.70x3.70	**Ground Level (mOD)** 112.64	**Client** DBFL	**Job Number** 9481-02-20
	Location 712530.5 E 726000.1 N	**Dates** 26/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	B				(2.10)	MADE GROUND: Brown/grey slightly sandy gravelly Clay with some cobbles and timber fragments		
2.00	B			110.54	2.10	Firm to stiff brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
3.00	B				(1.40)			
				109.14	3.50	WEATHERED ROCK: Green/grey silty sandy angular fine to coarse GRAVEL with occasional cobbles of Schist		
				108.94	(0.20) 3.70	Complete at 3.70m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP10

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP06
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.80x0.70x3.70	**Ground Level (mOD)** 108.01	**Client** DBFL	**Job Number** 9481-02-20
	Location 712537.3 E 726042 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.00)	MADE GROUND: Brown/black slightly sandy gravelly Clay with some cobbles and metal fragments		
1.00	B			107.01	1.00	Soft to firm brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
					(0.70)			
				106.31	1.70	VERY WEATHERED ROCK: Green/grey clayey sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
2.00	B							
					(1.60)			
3.00	B							
				104.71	3.30	WEATHERED ROCK: Green/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
			Slow seepage(1) at 3.50m.		(0.40)			▽1
				104.31	3.70	Complete at 3.70m		

Plan

Remarks

Trial Pit spalling from surface
Groundwater encountered at 3.50m BGL as slow seepage
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP06

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP07
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.80x0.70x3.50	**Ground Level (mOD)** 112.69	**Client** DBFL	**Job Number** 9481-02-20
	Location 712595.9 E 726036.4 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.80)	MADE GROUND: Brown slightly sandy gravelly Clay with some cobbles and metal fragments		
				111.89	0.80	VERY WEATHERED ROCK: Green/grey clayey sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
1.00	B							
2.00	B				(2.20)			
3.00	B			109.69	3.00	WEATHERED ROCK: Green/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
					(0.50)			
				109.19	3.50	Complete at 3.50m		

Plan

Remarks

Trial Pit spalling from surface
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP07

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP08
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 4.60x0.70x3.50	**Ground Level (mOD)** 115.21	**Client** DBFL	**Job Number** 9481-02-20
	Location 712586.1 E 726006.9 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.20)	MADE GROUND: Brown slightly sandy gravelly Clay with some cobbles and concrete blocks, scrap metal and plastic fragments		
1.00	B			114.01	1.20			
					(0.20)	Dark brown slightly sandy slightly gravelly Clay (Old Topsoil)		
				113.81	1.40			
					(1.10)	Soft to firm brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
2.00	B							
				112.71	2.50			
					(0.20)	WEATHERED ROCK: Green/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
				112.51	2.70			
						Complete at 3.50m		
3.00	B							

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP08

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP09
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 4.00x0.70x4.50	**Ground Level (mOD)** 118.99	**Client** DBFL	**Job Number** 9481-02-20
	Location 712586.6 E 725967.4 N	**Dates** 26/05/2020	**Engineer** DBFL	**Sheet** 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND: Brown/grey slightly sandy gravelly Clay with some cobbles and timber fragments		
				118.69	0.30	Dark brown slightly sandy slightly gravelly Clay (Old Topsoil)		
					(0.50)			
				118.19	0.80	Soft to firm brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
1.00	B				(1.00)			
				117.19	1.80	Firm brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
2.00	B				(1.20)			
3.00	B		Slow seepage(1) at 3.00m.	115.99	3.00	Soft to firm brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		▽1
					(1.50)			

Plan

Remarks

Trial Pit collapsing
Groundwater encountered at 3.00m BGL as slow seepage
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP09

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP09
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 4.00x0.70x4.50	**Ground Level (mOD)** 118.99	**Client** DBFL	**Job Number** 9481-02-20
	Location 712586.6 E 725967.4 N	**Dates** 26/05/2020	**Engineer** DBFL	**Sheet** 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				114.49	4.50	Obstruction: presumed bedrock Complete at 4.50m		

Plan

Remarks

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP09

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP10
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.10x0.70x3.00	**Ground Level (mOD)** 118.11	**Client** DBFL	**Job Number** 9481-02-20
	Location 712610.3 E 725998.1 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	MADE GROUND: Brown/grey slightly sandy gravelly Clay with some cobbles and timber fragments		
0.50	B			117.51	0.60	MADE GROUND: Brown slightly sandy gravelly Clay with occasional cobbles		
1.00	B				(1.40)			
2.00	B			116.11	2.00	POSSIBLE MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional subangular to subrounded cobbles and organic pockets		
					(0.50)			
				115.61	2.50	WEATHERED ROCK: Green/grey silty sandy angular fine to coarse GRAVEL with occasional cobbles of Schist		
					(0.50)			
3.00	B			115.11	3.00	Complete at 3.00m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP10

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP11
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 4.60x0.70x3.40	**Ground Level (mOD)** 121.10	**Client** DBFL	**Job Number** 9481-02-20
	Location 712607.4 E 725953.1 N	**Dates** 26/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	MADE GROUND: Brown/grey slightly sandy gravelly Clay with some cobbles and glass fragments		
0.50	B			120.50	0.60			
					(0.50)	Soft to firm brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
1.00	B			120.00	1.10			
					(0.40)	Firm brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
				119.60	1.50			
2.00	B					Firm to stiff brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
					(1.90)			
3.00	B							
						Obstruction: presumed bedrock		
				117.70	3.40	Complete at 3.40m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP11

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP12
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 4.40x0.70x2.40	**Ground Level (mOD)** 122.17	**Client** DBFL	**Job Number** 9481-02-20
	Location 712656.2 E 725972.4 N	**Dates** 26/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Brown slightly gravelly TOPSOIL		
				121.87	0.30	Soft to firm brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
					(0.40)			
				121.47	0.70	Firm brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
1.00	B				(0.70)			
				120.77	1.40	VERY WEATHERED ROCK: Grey/brown very clayey sandy angular to subangular fine to coarse GRAVEL of Schist with a large granite boulder		
					(0.50)			
				120.27	1.90	WEATHERED ROCK: Grey/brown very clayey sandy angular fine to coarse GRAVEL of Schist		
2.00	B				(0.50)			
				119.77	2.40	Complete at 2.40m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP12

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP13
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 4.80x0.70x2.30	**Ground Level (mOD)** 119.79	**Client** DBFL	**Job Number** 9481-02-20
	Location 712628.6 E 725988.8 N	**Dates** 26/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.70)	MADE GROUND: Brown/grey slightly sandy gravelly Clay with some cobbles and timber fragments		
0.50	B			119.09	0.70			
1.00	B				(1.60)	Soft brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles		
2.00	B					Obstruction: presumed bedrock		
				117.49	2.30	Complete at 2.30m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP13

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP14
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.00x0.70x1.80	**Ground Level (mOD)** 119.24	**Client** DBFL	**Job Number** 9481-02-20
	Location 712652.3 E 726019.6 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	MADE GROUND: Brown slightly sandy gravelly Clay with some cobbles and metal fragments		
				118.74	0.50			
					(0.60)	Soft to firm brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
1.00	B			118.14	1.10			
					(0.70)	WEATHERED ROCK: Green/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
1.80	B			117.44	1.80			
						Complete at 1.80m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP14

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP15
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 4.70x0.70x1.60	**Ground Level (mOD)** 119.46	**Client** DBFL	**Job Number** 9481-02-20
	Location 712676.7 E 726041.6 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B				(0.80)	MADE GROUND: Brown slightly sandy gravelly Clay with some cobbles and metal fragments		
1.00	B			118.66	0.80	Soft to firm brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
				118.06	(0.60) 1.40			
				117.86	(0.20) 1.60	WEATHERED ROCK: Green/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of Schist		
						Complete at 1.60m		

Plan

Remarks

Trial Pit stable
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP15

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines Central			**Trial Pit Number** TP16
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.30x0.70x2.40	**Ground Level (mOD)** 121.40	**Client** DBFL	**Job Number** 9481-02-20
	Location 712692.8 E 726026.2 N	**Dates** 25/05/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND: Brown slightly sandy gravelly Clay with some cobbles and glass fragments		
				121.10	0.30	Soft to firm brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
					(0.70)			
0.90	B			120.40	1.00	WEATHERED ROCK: Green/grey silty sandy gravelly angular COBBLES and BOULDERS of Schist		
					(1.40)			
2.00	B							
				119.00	2.40	Complete at 2.40m		

Plan

Remarks

Trial Pit spalling from surface
No groundwater encountered
Trial Pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9481-02-20.TP16

APPENDIX B – ATTENUATION CALCULATION

Cascade Summary of Results for Catchment A+B+C (100yr).srcx

	Upstream Structures	Outflow To	Overflow To
Catchment C2 - Upper (100yr).srcx		(None)	(None)

Half Drain Time : 180 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	100.476	0.476	0.0	38.0	38.0	323.8	O K
30 min Summer	100.641	0.641	0.0	38.0	38.0	436.1	O K
60 min Summer	100.809	0.809	0.0	38.0	38.0	550.4	O K
120 min Summer	100.952	0.952	0.0	38.0	38.0	648.1	O K
180 min Summer	101.004	1.004	0.0	38.0	38.0	683.6	O K
240 min Summer	101.018	1.018	0.0	38.0	38.0	692.8	O K
360 min Summer	101.005	1.005	0.0	38.0	38.0	684.0	O K
480 min Summer	100.976	0.976	0.0	38.0	38.0	663.9	O K
600 min Summer	100.937	0.937	0.0	38.0	38.0	637.6	O K
720 min Summer	100.895	0.895	0.0	38.0	38.0	609.0	O K
960 min Summer	100.808	0.808	0.0	38.0	38.0	550.2	O K
1440 min Summer	100.646	0.646	0.0	38.0	38.0	440.0	O K
2160 min Summer	100.456	0.456	0.0	38.0	38.0	310.2	O K
2880 min Summer	100.335	0.335	0.0	37.4	37.4	228.0	O K
4320 min Summer	100.235	0.235	0.0	33.7	33.7	160.1	O K
5760 min Summer	100.201	0.201	0.0	28.3	28.3	136.9	O K
7200 min Summer	100.181	0.181	0.0	24.6	24.6	123.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	82.007	0.0	418.0	22
30 min Summer	56.717	0.0	577.9	36
60 min Summer	37.574	0.0	766.6	66
120 min Summer	24.105	0.0	983.6	124
180 min Summer	18.324	0.0	1121.6	180
240 min Summer	14.972	0.0	1222.1	208
360 min Summer	11.156	0.0	1365.9	272
480 min Summer	9.057	0.0	1478.6	336
600 min Summer	7.697	0.0	1571.0	402
720 min Summer	6.735	0.0	1649.3	468
960 min Summer	5.449	0.0	1779.3	602
1440 min Summer	4.033	0.0	1974.6	856
2160 min Summer	2.976	0.0	2186.9	1212
2880 min Summer	2.395	0.0	2346.6	1536
4320 min Summer	1.760	0.0	2585.9	2212
5760 min Summer	1.411	0.0	2765.6	2936
7200 min Summer	1.191	0.0	2917.7	3672

Cascade Summary of Results for Catchment A+B+C (100yr).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	100.166	0.166	0.0	21.8	21.8	113.1	O K
10080 min Summer	100.155	0.155	0.0	19.7	19.7	105.5	O K
15 min Winter	100.535	0.535	0.0	38.0	38.0	364.4	O K
30 min Winter	100.723	0.723	0.0	38.0	38.0	492.4	O K
60 min Winter	100.918	0.918	0.0	38.0	38.0	624.6	O K
120 min Winter	101.094	1.094	0.0	38.0	38.0	744.4	O K
180 min Winter	101.154	1.154	0.0	38.0	38.0	785.3	O K
240 min Winter	101.165	1.165	0.0	38.0	38.0	793.0	O K
360 min Winter	101.143	1.143	0.0	38.0	38.0	777.6	O K
480 min Winter	101.104	1.104	0.0	38.0	38.0	751.2	O K
600 min Winter	101.049	1.049	0.0	38.0	38.0	714.2	O K
720 min Winter	100.980	0.980	0.0	38.0	38.0	666.9	O K
960 min Winter	100.832	0.832	0.0	38.0	38.0	566.2	O K
1440 min Winter	100.577	0.577	0.0	38.0	38.0	392.6	O K
2160 min Winter	100.329	0.329	0.0	37.3	37.3	224.1	O K
2880 min Winter	100.238	0.238	0.0	34.1	34.1	162.1	O K
4320 min Winter	100.190	0.190	0.0	26.3	26.3	129.0	O K
5760 min Winter	100.165	0.165	0.0	21.6	21.6	112.4	O K
7200 min Winter	100.149	0.149	0.0	18.6	18.6	101.6	O K
8640 min Winter	100.138	0.138	0.0	16.4	16.4	93.7	O K
10080 min Winter	100.129	0.129	0.0	14.8	14.8	87.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.037	0.0	3048.6	4408
10080 min Summer	0.923	0.0	3164.3	5136
15 min Winter	82.007	0.0	468.3	22
30 min Winter	56.717	0.0	646.9	36
60 min Winter	37.574	0.0	858.5	64
120 min Winter	24.105	0.0	1101.6	122
180 min Winter	18.324	0.0	1256.4	178
240 min Winter	14.972	0.0	1368.7	230
360 min Winter	11.156	0.0	1530.3	286
480 min Winter	9.057	0.0	1656.6	364
600 min Winter	7.697	0.0	1759.8	444
720 min Winter	6.735	0.0	1847.5	518
960 min Winter	5.449	0.0	1992.7	650
1440 min Winter	4.033	0.0	2209.9	898
2160 min Winter	2.976	0.0	2450.0	1216
2880 min Winter	2.395	0.0	2628.2	1504
4320 min Winter	1.760	0.0	2896.2	2212
5760 min Winter	1.411	0.0	3097.2	2944
7200 min Winter	1.191	0.0	3268.0	3672
8640 min Winter	1.037	0.0	3414.7	4408
10080 min Winter	0.923	0.0	3543.9	5136

Cascade Rainfall Details for Catchment A+B+C (100yr).srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.000	Shortest Storm (mins)	15
Ratio R	0.300	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 2.242

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000	4	8	2.242

Cascade Model Details for Catchment A+B+C (100yr).srcx

Storage is Online Cover Level (m) 103.205

Cellular Storage Structure

Invert Level (m) 100.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	716.4	0.0	1.450	0.0	0.0
1.440	716.4	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0256-3800-1450-3800
Design Head (m)	1.450
Design Flow (l/s)	38.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	256
Invert Level (m)	99.990
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	38.0
Flush-Flo™	0.469	38.0
Kick-Flo®	1.013	32.0
Mean Flow over Head Range	-	32.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.3	1.200	34.7	3.000	53.9	7.000	81.4
0.200	26.3	1.400	37.4	3.500	58.1	7.500	84.1
0.300	36.7	1.600	39.8	4.000	62.0	8.000	86.8
0.400	37.8	1.800	42.2	4.500	65.6	8.500	89.4
0.500	37.9	2.000	44.3	5.000	69.1	9.000	92.0
0.600	37.6	2.200	46.4	5.500	72.4	9.500	94.4
0.800	36.3	2.400	48.4	6.000	75.5		
1.000	32.5	2.600	50.3	6.500	78.5		

Cascade Summary of Results for Catchment C2 - Upper (100yr).srcx

Upstream Structures	Outflow To	Overflow To
(None)	Catchment A+B+C (100yr).srcx	(None)

Half Drain Time : 541 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	105.901	0.201	0.0	3.3	3.3	70.5	O K
30 min Summer	105.973	0.273	0.0	3.3	3.3	96.0	O K
60 min Summer	106.052	0.352	0.0	3.3	3.3	123.7	O K
120 min Summer	106.130	0.430	0.0	3.3	3.3	151.1	O K
180 min Summer	106.169	0.469	0.0	3.3	3.3	164.8	O K
240 min Summer	106.189	0.489	0.0	3.3	3.3	171.8	O K
360 min Summer	106.201	0.501	0.0	3.3	3.3	176.1	O K
480 min Summer	106.198	0.498	0.0	3.3	3.3	175.2	O K
600 min Summer	106.191	0.491	0.0	3.3	3.3	172.6	O K
720 min Summer	106.183	0.483	0.0	3.3	3.3	169.8	O K
960 min Summer	106.168	0.468	0.0	3.3	3.3	164.5	O K
1440 min Summer	106.138	0.438	0.0	3.3	3.3	153.9	O K
2160 min Summer	106.089	0.389	0.0	3.3	3.3	136.8	O K
2880 min Summer	106.040	0.340	0.0	3.3	3.3	119.6	O K
4320 min Summer	105.951	0.251	0.0	3.3	3.3	88.2	O K
5760 min Summer	105.879	0.179	0.0	3.3	3.3	62.9	O K
7200 min Summer	105.826	0.126	0.0	3.2	3.2	44.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	82.007	0.0	73.6	23
30 min Summer	56.717	0.0	101.9	37
60 min Summer	37.574	0.0	135.2	66
120 min Summer	24.105	0.0	173.3	126
180 min Summer	18.324	0.0	197.6	186
240 min Summer	14.972	0.0	215.4	246
360 min Summer	11.156	0.0	240.7	364
480 min Summer	9.057	0.0	260.5	462
600 min Summer	7.697	0.0	277.1	516
720 min Summer	6.735	0.0	290.7	576
960 min Summer	5.449	0.0	313.7	704
1440 min Summer	4.033	0.0	348.4	972
2160 min Summer	2.976	0.0	385.5	1384
2880 min Summer	2.395	0.0	413.6	1768
4320 min Summer	1.760	0.0	456.0	2552
5760 min Summer	1.411	0.0	487.7	3232
7200 min Summer	1.191	0.0	514.3	3960

Cascade Summary of Results for Catchment C2 - Upper (100yr).srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	105.786	0.086	0.0	3.1	3.1	30.3	O K
10080 min Summer	105.757	0.057	0.0	2.9	2.9	20.0	O K
15 min Winter	105.926	0.226	0.0	3.3	3.3	79.4	O K
30 min Winter	106.008	0.308	0.0	3.3	3.3	108.4	O K
60 min Winter	106.099	0.399	0.0	3.3	3.3	140.1	O K
120 min Winter	106.191	0.491	0.0	3.3	3.3	172.5	O K
180 min Winter	106.239	0.539	0.0	3.3	3.3	189.4	O K
240 min Winter	106.266	0.566	0.0	3.3	3.3	199.0	O K
360 min Winter	106.290	0.590	0.0	3.3	3.3	207.4	O K
480 min Winter	106.298	0.598	0.0	3.3	3.3	210.0	O K
600 min Winter	106.294	0.594	0.0	3.3	3.3	208.8	O K
720 min Winter	106.284	0.584	0.0	3.3	3.3	205.2	O K
960 min Winter	106.256	0.556	0.0	3.3	3.3	195.6	O K
1440 min Winter	106.208	0.508	0.0	3.3	3.3	178.7	O K
2160 min Winter	106.129	0.429	0.0	3.3	3.3	150.9	O K
2880 min Winter	106.051	0.351	0.0	3.3	3.3	123.3	O K
4320 min Winter	105.917	0.217	0.0	3.3	3.3	76.1	O K
5760 min Winter	105.822	0.122	0.0	3.2	3.2	42.9	O K
7200 min Winter	105.762	0.062	0.0	3.0	3.0	21.7	O K
8640 min Winter	105.724	0.024	0.0	2.8	2.8	8.4	O K
10080 min Winter	105.704	0.004	0.0	2.6	2.6	1.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.037	0.0	537.4	4664
10080 min Summer	0.923	0.0	558.0	5344
15 min Winter	82.007	0.0	82.5	22
30 min Winter	56.717	0.0	114.1	37
60 min Winter	37.574	0.0	151.3	66
120 min Winter	24.105	0.0	194.0	124
180 min Winter	18.324	0.0	221.5	182
240 min Winter	14.972	0.0	241.2	240
360 min Winter	11.156	0.0	269.7	356
480 min Winter	9.057	0.0	292.0	468
600 min Winter	7.697	0.0	310.1	578
720 min Winter	6.735	0.0	325.8	682
960 min Winter	5.449	0.0	351.3	772
1440 min Winter	4.033	0.0	390.1	1070
2160 min Winter	2.976	0.0	432.0	1500
2880 min Winter	2.395	0.0	463.2	1908
4320 min Winter	1.760	0.0	510.7	2680
5760 min Winter	1.411	0.0	545.9	3352
7200 min Winter	1.191	0.0	576.1	4032
8640 min Winter	1.037	0.0	602.1	4664
10080 min Winter	0.923	0.0	624.8	5240

Cascade Rainfall Details for Catchment C2 - Upper (100yr).srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.000	Shortest Storm (mins)	15
Ratio R	0.300	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 0.480

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.480

Cascade Model Details for Catchment C2 - Upper (100yr).srcx

Storage is Online Cover Level (m) 109.000

Cellular Storage Structure

Invert Level (m) 105.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	370.0	0.0	1.445	0.0	0.0
1.440	370.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0083-3300-1200-3300
Design Head (m)	1.200
Design Flow (l/s)	3.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	83
Invert Level (m)	105.600
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.3
Flush-Flo™	0.363	3.3
Kick-Flo®	0.741	2.6
Mean Flow over Head Range	-	2.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.5	1.200	3.3	3.000	5.0	7.000	7.5
0.200	3.1	1.400	3.5	3.500	5.4	7.500	7.8
0.300	3.3	1.600	3.8	4.000	5.8	8.000	8.0
0.400	3.3	1.800	4.0	4.500	6.1	8.500	8.3
0.500	3.2	2.000	4.2	5.000	6.4	9.000	8.5
0.600	3.1	2.200	4.4	5.500	6.7	9.500	8.7
0.800	2.7	2.400	4.5	6.000	7.0		
1.000	3.0	2.600	4.7	6.500	7.3		

APPENDIX C – CORRESPONDENCE WITH IRISH WATER

DBFL Consulting Eng C/o Sean Byrne
Ormond House
Upper Ormond Quay
Dublin 7

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
Éire

Irish Water
PO Box 6000
Dublin 1
Ireland

T: +353 1 89 25000
F: +353 1 89 25001
www.water.ie

08 May 2020

Dear Sir/Madam,

Re: Customer Reference No 1000859447 pre-connection enquiry - Subject to contract | Contract denied
[Connection for Strategic Housing Development of 195 no. domestic units]

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connections at Stocking Avenue, Woodtown, Dublin 16 . Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the network(s), as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network(s) can be facilitated.

In the case of wastewater connections this assessment does not confirm that a gravity connection is achievable. Therefore a suitably sized pumping station may be required to be installed on your site. All infrastructure should be designed and installed in accordance with the Irish Water Code of Practice.

Water:
New connection to the existing network is feasible without upgrade.
This Confirmation of Feasibility to connect to the Irish Water infrastructure also does not extend to your fire flow requirements. Please note that Irish Water can not guarantee a flow rate to meet fire flow requirements and in order to guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development.

Wastewater:
In order to accommodate the proposed connection at the Premises, upgrade works are required to increase the capacity of the Irish Water network. Irish Water currently has a project on our current investment plan which will provide the necessary upgrade and capacity. This upgrade project is scheduled to be completed by 2022 (this may be subject to change). Separately, network extension (approx. 520m) will be required from the upgraded wastewater network up to the Premises. The extension works is currently not on Irish Water investment plan.

Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. Therefore in advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services. The design has to be in accordance with published Irish Water Code of Practice and Standard Details for water and wastewater.

A connection agreement can be applied for by completing the connection application form available at **www.water.ie/connections**. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities.

If you have any further questions, please contact Marina Byrne from the design team on 018925991 or email mzbyrne@water.ie. For further information, visit **www.water.ie/connections**

Yours sincerely,

Maria O'Dwyer
Connections and Developer Services

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
Éire

Irish Water
PO Box 6000
Dublin 1
Ireland

T: +353 1 89 25000
F: +353 1 89 25001
www.water.ie

Your Ref: ABP- 308642-20
Our Ref: 1000859447

An Bord Pleanála,
64 Marlborough Street,
Dublin 1

17th December 2020

Dear Sir/ Madam,

Re: Strategic Housing Development – Construction of 137 no. residential units (29 no. houses and 108 no. apartments), and all other associated site works at Lands North of Stocking Avenue, Stocking Avenue, Woodstown, Dublin 16.

A confirmation of Feasibility for 195 units was issued to the applicant in 2019 which confirmed feasibility of connections subject to the following;

Water:
New connection to the existing network is feasible without upgrade(s) however, the assessment does not extend to the applicant's fire flow requirements for which they are required to provide adequate fire storage capacity within the development.

The connection from the trunk main should include installation of an offtake with a PRV controller and a bulk/DMA meter with associated telemetry system. The offtake design should take into account other potential developments in the area. Full details of this will be agreed at a connection application stage.

Wastewater:
In order to accommodate the proposed connection at the Premises, upgrade works are required to increase the capacity of the Irish Water network. Irish Water currently has a project on our current Capital Investment Plan which will provide the necessary upgrade and capacity. This upgrade project is scheduled to be completed by 2022 (subject to change). In addition to these capital works, a separate network extension of approximately 520m will be required from the upgraded wastewater network to the development site and proposed premises. These extension works are not currently on Irish Water investment plan therefore, the applicant will be required to fund these local

upgrades. The applicant will also be responsible for any 3rd party consents required to facilitate this extension.

General observations;

The applicant is required to submit design proposals ahead of any SHD application, to IW, for which they will be issued a Statement of Design Acceptance for the development proposal subject to meeting IW Standards & Codes of Practice.

All development is to be carried out in compliance with Irish Waters Standards Codes and Practices and that design layouts for the development proposal have been submitted to Irish Water and that a Statement of Design Acceptance has been issued to the applicant by Irish Water ahead of any SHD Application.

Where any proposals by the applicant to build over or divert existing water or wastewater services the applicant is required to submit details to Irish Water for assessment of feasibility and have written confirmation of feasibility of diversion(s) from Irish Water ahead of any SHD Application to the board.

Queries relating to the observations above should be sent to planning@water.ie

PP. Ali Robinson

Yvonne Harris
Connections and Developer Services

Sean Byrne
Ormond House
Upper Ormond Quay
Dublin 7
D07 W704

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

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

www.water.ie

13 May 2021

Re: Design Submission for White Pines central residential development (the "Development") (the "Design Submission") / 190004.

Dear Sean Byrne,

Many thanks for your recent Design Submission.

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

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

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

If you have any further questions, please contact your Irish Water Representative

Name: Alvaro Garcia
Email: agarcia@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations

Appendix A

Document Title & Revision

190004-DBFL-CS-SP-DR-C-1001 Proposed Site Services
190004-DBFL-CS-SP-DR-C-3002 Foul Sewer Longsections
190004-DBFL-WM-SP-DR-C-1001 Proposed Watermain Layout

*For further information, visit **www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

WHITE PINES NORTH
CONSTRUCTED UNDER SD14A/0222

WHITE PINES EAST PENDING APPLICATION

WHITE PINES RETAIL CENTRE
CONSTRUCTED UNDER SD19A/0345

WHITE PINES SOUTH
CONSTRUCTED UNDER SD10A/0041

G AVENUE

FLOW CONTROL MANHOLE INSTALLED UNDER SD10A/0041
Q-BAR 38 l/sec

ATTENUATION TANK INSTALLED UNDER SD10A/0041 TO SERVE ALL LANDS SOUTH OF STOCKING AVENUE
TOTAL CAPACITY 809m³

400ø BOHERBOY WATERMAIN

BLOCK A
FFL 104.55
FFL 107.80

BLOCK B
FFL 111.60
FFL 111.20

FFL 111.00
FFL 111.25
BLOCK C1
FFL 111.65
FFL 112.23
FFL 112.28

BLOCK C2
FFL 119.20

BLOCK D
FFL 119.18

BLOCK E
FFL 118.35

FLOW CONTROL MANHOLE
Q 3.3L/Sec
IL 105.60

PROPOSED ATTENUATION TANK (STORMTECH MC3500)
TO STORE FLOW UP TO 1 IN 100 YEAR RETURN PERIOD
EVENT PLUS 10% CLIMATE CHANGE.
TOTAL STORAGE VOLUME PROVIDED 228.5m³
NO. OF ROWS 11 (24.41M) 3 UNITS PRE ROW (8.28)
IL 105.7
TWL 107.15

E
20 HOUSES

D
63 HOUSES

C
23 HOUSES

ON ORIGINAL
0 5 10 15 20 30 40 50mm

NOTES;

1. ALL WORKS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE WORKS REQUIREMENTS.
2. ALL DIMENSIONS IN METRES UNLESS SPECIFIED OTHERWISE.
3. ALL CO-ORDINATES ARE TO IRISH TRANSVERSE MERCATOR.
4. ALL LEVELS ARE TO ORDINANCE DATUM (MALIN HEAD).
5. ALL TEMPORARY TRAFFIC & OPERATIONS MANAGEMENT SHALL COMPLY FULLY WITH THE WORKS REQUIREMENTS
6. THE CONTRACTOR MUST LIAISE DIRECTLY WITH LOCAL AUTHORITY DEPARTMENTS AS DIRECTED IN THE WORKS REQUIREMENTS.
7. ALL VEHICULAR & PEDESTRIAN, CYCLE & PRIVATE ACCESS ROUTES WITHIN AND SURROUNDING THE WORKS EXTENTS MUST BE MAINTAINED THROUGHOUT THE WORKS IN ACCORDANCE WITH THE CONTRACTORS APPROVED TEMPORARY TRAFFIC & OPERATIONS MANAGEMENT PLAN.

DRAWING SPECIFIC NOTES

1. ALL DRAWINGS TO BE CHECKED BY CONTRACTOR ON SITE AND ENGINEER INFORMED OF DISCREPANCIES BEFORE WORK COMMENCES.
2. CONTRACTOR SHALL SATISFY HIMSELF AS TO THE ACCURACY OF EXISTING DRAINAGE LEVELS & THE LOCATION OF EXISTING SERVICES ON SITE PRIOR TO COMMENCEMENT OF WORKS ON SITE
3. ALL WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH THE NRA SPECIFICATION FOR ROAD WORKS UNLESS NOTED OTHERWISE
4. MANHOLE COVER LEVELS ARE TO CONFORM WITH FINISHED ROAD AND PATH LEVELS
5. ALL SURFACE WATER DRAINAGE WORKS TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL AUTHORITY'S CODE OF PRACTICE FOR DRAINAGE AND THE GSDS
6. ALL FOUL DRAINAGE WORKS TO BE IN ACCORDANCE WITH IRISH WATERS' CODE OF PRACTICE FOR WASTEWATER SUPPLY AND WASTEWATER INFRASTRUCTURE STANDARD DETAILS.
7. FOUL SEWERS TO BE CONCRETE PIPES (SPIGOT AND SOCKET JOINTS AND RUBBER RING FITTINGS COMPLYING WITH IS EN 1916) OR THERMOPLASTIC STRUCTURED WALL PIPES (COMPLYING WITH THE PROVISION OF IS EN 13476 AND WIS 4-35-01 2000) AND COMPLY WITH THE REQUIREMENTS OF THE IRISH WATER CODE OF PRACTICE
10. ALL SURFACE WATER SEWERS TO BE CLASS H CONCRETE TO EN1916 & IS 6 2004.
11. SURFACE WATER COLLECTOR DRAINS 150mm DIA.
12. FOUL HOUSE CONNECTIONS TO BE 100mm DIA.
13. THIS DRAWING IS BASED ON TOPO SURVEY BY J&L SURVEY Ltd. DATED 06/2016
14. CONTRACTOR SHALL INSPECT THE ROUTE & CONFIRM LOCATIONS OF ALL TREES, FEATURES, ENTRANCES & ASPECTS IMPACTING CONSTRUCTION OF THE WORKS
15. NOTE THAT THE CONTRACTOR AND/OR ARCHITECT ARE RESPONSIBLE FOR CONNECTIONS INTO THE BUILDING

LEGEND:

- SITE BOUNDARY
- 1:999 PROPOSED ROAD GRADIENT
- 99.99 EXISTING LEVELS
- 99.99 PROPOSED LEVELS
- FFL 99.999 FINISHED FLOOR LEVEL
- PROPOSED STORMWATER PIPE
- PROPOSED FILTER DRAIN
- G PROPOSED SURFACE WATER GULLY
- G PROPOSED GULLY SURFACE WATER GULLY DISCHARGING VIA TREE PIT
- PROPOSED TREE PIT
- PROPOSED FOUL WATER PIPE
- EXISTING FOUL WATER PIPE
- EXISTING STORM WATER PIPE
- S9 CL 100.00 IL 99.00 PROPOSED STORMWATER MANHOLE
- S9 CL 100.00 IL 99.00 PROPOSED STORMWATER INSPECTION CHAMBER
- F9 CL 100.00 IL 99.99 PROPOSED FOUL WATER MANHOLE
- F9 CL 100.00 IL 99.00 PROPOSED 600mm FOUL INSPECTION CHAMBER
- ExMH CL 100.00 IL 99.00 EXISTING FOUL WATER MANHOLE
- ExMH CL 11.494 IL TBC EXISTING STORMWATER MANHOLE
- PROPOSED PERMEABLE PAVING
- EXISTING ATTENUATION TANK
- STORMTECH ATTENUATION SYSTEM

rev	date	description	by	chkd.
P01	07-05-21	ABP APPLICATION	JVS	BK

client approval
- A - Approved
- B - Approved with comments
- C - Do not use

suitability: S0 - WORK IN PROGRESS
issue purpose: PLANNING

DBFL Consulting Engineers
Civil, Structural & Transportation Engineering
www.dbfl.ie

DUBLIN OFFICE: Ormond House, Upper Ormond Quay, Dublin 7. D07 W704
PHONE +353 1 400 4000

CORK OFFICE: 14 South Mall, Cork. T12 CT91
PHONE +353 21 2424538

WATERFORD OFFICE: Suite 8b The Atrium, Maritana Gate, Canada Street, Waterford. X91 W028
PHONE +353 51 309 500

project ref.
WHITE PINES CENTRAL
RESIDENTIAL DEVELOPMENT

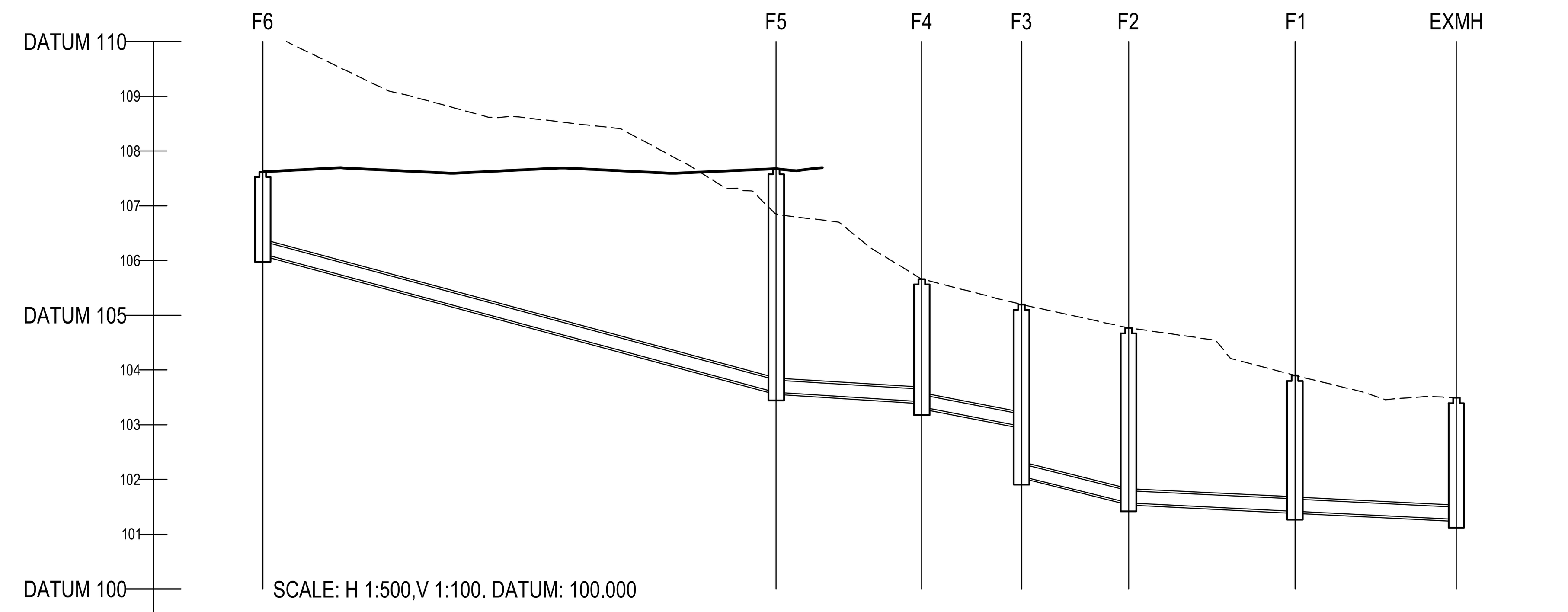
drawing title
PROPOSED SITE SERVICES

client
ARDSTONE HOMES

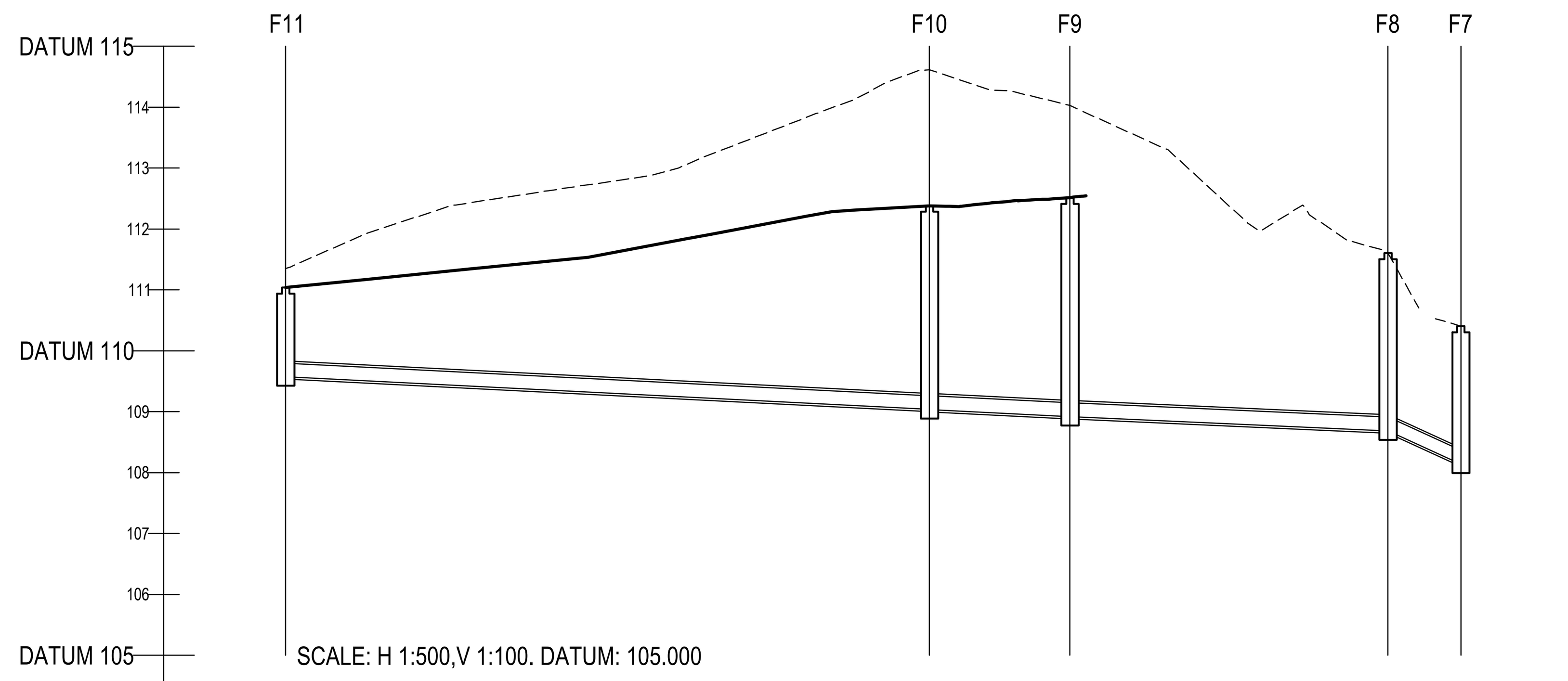
designed by	author	scale	sheet size
SPB	JJB	1:500	A1

drawing no.: 190004-DBFL-CS-SP-DR-C-1001
revision: P01

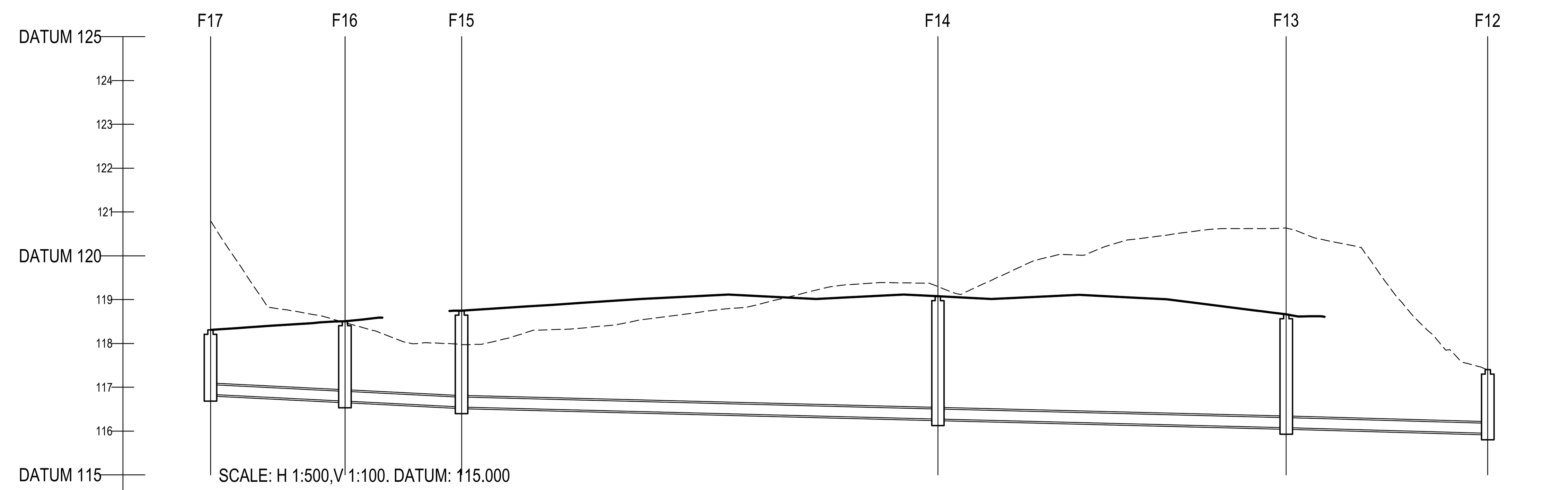
DBFL CONSULTING ENGINEERS LTD
DRAFT
ORMOND HOUSE, UPPER ORMOND QUAY, DUBLIN 7



	F6		F5		F4		F3		F2		F1		EXMH
COVER LEVEL	107.624		107.677		105.662		105.198		104.769		103.902		103.494
INVERT LEVEL	106.125	Pipe369	103.592 / 103.592	Pipe370	103.425 / 103.325	Pipe384	102.970 / 102.060	Pipe372	101.570 / 101.570	Pipe373	101.418 / 101.418	Pipe374	101.270
DEPTH (m)	1.499		4.085		2.337		3.138		3.199		2.484		2.224
DISTANCE (m)		46.91		13.30		9.12		9.78		15.21		14.75	
PIPE SLOPE		1:19		1:80		1:26		1:20		1:100		1:100	
PIPE SIZE		225mm		225mm		225mm		225mm		225mm		225mm	



	F11		F10		F9		F8		F7
COVER LEVEL	111.042		112.383		112.515		111.606		110.403
INVERT LEVEL	109.575	Pipe380	109.037 / 109.037	Pipe381	108.922 / 108.922	Pipe382	108.687 / 108.687	Pipe383	108.140
DEPTH (m)	1.467		3.346		3.593		2.919		2.263
DISTANCE (m)		52.83		11.51		26.10		5.99	
PIPE SLOPE		1:98		1:100		1:111		1:11	
PIPE SIZE		225mm		225mm		225mm		225mm	



	F17		F16		F15		F14		F13		F12
COVER LEVEL	118.307		118.502		118.743		119.074		118.664		117.401
INVERT LEVEL	116.835	Pipe375	116.681 / 116.681	Pipe376	116.549 / 116.549	Pipe377	116.276 / 116.276	Pipe378	116.078 / 116.078	Pipe379	115.950
DEPTH (m)	1.472		1.821		2.194		2.798		2.586		1.451
DISTANCE (m)		15.33		13.30		54.33		39.73		22.98	
PIPE SLOPE		1:100		1:101		1:199		1:201		1:180	
PIPE SIZE		225mm		225mm		225mm		225mm		225mm	

ON ORIGINAL

0 5 10 15 20 25 30 40 50mm

NOTES:

1. ALL DRAWINGS TO BE CHECKED BY CONTRACTOR ON SITE AND ENGINEER INFORMED OF DISCREPANCIES BEFORE WORK COMMENCES
2. ALL LEVELS ARE IN METRES AND ARE RELATED TO ORDNANCE DATUM
3. CONTRACTOR SHALL SATISFY HIMSELF AS TO THE ACCURACY OF PAVEMENT LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORKS ON SITE
4. ALL WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH THE NRA SPECIFICATION FOR ROAD WORKS UNLESS NOTED OTHERWISE
5. THIS DRAWING IS FOR PLANNING PURPOSES ONLY
6. MANHOLE COVER LEVELS ARE TO CONFORM WITH FINISHED ROAD AND PATH LEVELS
7. WHERE COVER TO PIPE IS LESS THAN 1200mm (ROAD/PATH/VERGE) OR 900mm (OPEN SPACE) SURROUND PIPE IN MINIMUM 150mm CONCRETE

KEY

EXISTING GROUND PROFILE

PROPOSED GROUND PROFILE

DBFL CONSULTING ENGINEERS LTD

DRAFT

ORMOND HOUSE, UPPER ORMOND QUAY, DUBLIN 7

rev	date	description	by	chkd.
client approval		A - Approved		
		B - Approved with comments		
		C - Do not use		

suitability: S0 - WORK IN PROGRESS

issue purpose: PLANNING

DBFL Consulting Engineers
Civil, Structural & Transportation Engineering
www.dbfl.ie

DUBLIN OFFICE: Ormond House, Upper Ormond Quay, Dublin 7. D07 W704
PHONE +353 1 400 4000

CORK OFFICE: 14 South Mall, Cork. T12 CT91
PHONE +353 21 2024538

WATERFORD OFFICE: Suite 8b The Atrium, Maritana Gate, Canada Street, Waterford. X91 W028
PHONE +353 51 309 500

project ref.

WHITE PINES CENTRAL
RESIDENTIAL DEVELOPMENT

drawing title

FOUL SEWER LONGSECTIONS

client

ARDSTONE HOMES

designed by	author	scale	sheet size
SPB	###	AS SHOWN	A1

drawing no.	revision
190004-DBFL-CS-SP-DR-C-3002	P0

WHITE PINES NORTH
CONSTRUCTED UNDER SD14A/0222

WHITE PINES RETAIL CENTRE
CONSTRUCTED UNDER SD19A/0345

WHITE PINES EAST PENDING APPLICATION

WHITE PINES SOUTH
CONSTRUCTED UNDER SD10A/0041

BLOCK A FFL 107.80
BLOCK B FFL 111.60
BLOCK C1 FFL 111.65
BLOCK C2 FFL 119.20
BLOCK D FFL 119.18
BLOCK E FFL 118.35
FFL 104.55
FFL 111.20
FFL 112.23
FFL 111.25
FFL 112.28
FFL 111.00

400ø BOHERBOY WATERMAIN
150ø WATERMAIN
200ø
225ø PVC
150 DIA WATERMAIN
225ø HDPE

CONNECTION TO EXISTING WATERMAIN
SLUICE VALVES AS PER IRISH WATER STANDARD DETAIL DRAWING NO STD-WW-14/15
ON-LINE HYDRANT AS PER IRISH WATER STANDARD DETAIL DRAWING NO STD-WW-16/18
OFF-LINE HYDRANT AS PER IRISH WATER STANDARD DETAIL DRAWING NO STD-WW-17/19
WASHOUT HYDRANT AS PER IRISH WATER STANDARD DETAIL DRAWING NO STD-WW-30A
ON-LINE AIR VALVES AS PER IRISH WATER STANDARD DETAIL DRAWING NO STD-WW-20/22
CASTLE OF IL.116 CIL.119.5
EXISTING 400ø DI WATERMAIN

ON ORIGINAL
0 5 10 15 20 25 30 40 50mm

NOTES:
ALL WORKS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE WORKS REQUIREMENTS.
1. ALL DIMENSIONS IN METRES UNLESS SPECIFIED OTHERWISE.
2. ALL CO-ORDINATES ARE TO IRISH TRANSVERSE MERCATOR.
3. ALL LEVELS ARE TO ORDNANCE DATUM (MALIN HEAD).
4. ALL TEMPORARY TRAFFIC & OPERATIONS MANAGEMENT SHALL COMPLY FULLY WITH THE WORKS REQUIREMENTS
5. THE CONTRACTOR MUST LIAISE DIRECTLY WITH LOCAL AUTHORITY DEPARTMENTS AS DIRECTED IN THE WORKS REQUIREMENTS.
6. ALL VEHICULAR & PEDESTRIAN, CYCLE & PRIVATE ACCESS ROUTES WITHIN AND SURROUNDING THE WORKS EXTENTS MUST BE MAINTAINED THROUGHOUT THE WORKS IN ACCORDANCE WITH THE CONTRACTORS APPROVED TEMPORARY TRAFFIC & OPERATIONS MANAGEMENT PLAN.

DRAWING SPECIFIC NOTES
1. WATERMAIN INSTALLATION AND ALL WATER SUPPLY WORKS TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF IRISH WATER'S CODE OF PRACTICE FOR WATER SUPPLY AND WATER INFRASTRUCTURE STANDARD DETAILS
2. WATERMAIN (AND SERVICE CONNECTIONS) TO BE PE-100 SDR 17 AND CONFORM TO IS EN 12201 (PART 1, PART 2 & PART 3)
3. AT 90 DEG. TURNS USE 2 No. 45 DEG. BENDS.
4. COVER TO WATERMAIN TO BE 900mm.
5. CONNECTION BETWEEN EXISTING AND PROPOSED WATERMAINS TO BE CARRIED OUT IN ACCORDANCE WITH IRISH WATER STANDARD DETAILS STD-W-03 TO STD-W-10.
6. ANCHOR BLOCKS TO BE POSITIONED AT DEAD ENDS, TEES, BENDS AND AT EACH SIDE OF HYDRANTS AND VALVES IN ACCORDANCE WITH THE REQUIREMENTS OF IRISH WATER STANDARD DETAIL STD-W-28 (WATER MAIN THRUST AND SUPPORT BLOCKS.
7. HYDRANT OUTLET TO BE 200mm BELOW GROUND LEVEL UNLESS REQUESTED OTHERWISE.
8. WHERE COVER TO PIPE IS LESS THAN 900mm IN GREEN AREAS AND 1200mm IN TRAFFICKED AREAS, ENCASE PIPE IN NEW 150mm CONCRETE WITH MOVEMENT JOINTS.
9. NOTE THAT THE CONTRACTOR IS RESPONSIBLE FOR CONNECTIONS INTO THE BUILDING.
10. CONNECTION TO INDIVIDUAL HOUSES IN ACCORDANCE WITH IRISH WATER STD-W-03.
11. CONTRACTOR SHALL SATISFY THEMSELVES AS TO THE ACCURACY OF EXISTING SERVICES INFORMATION AND THE LOCATION OF EXISTING SERVICES ON SITE PRIOR TO COMMENCING INSTALLATION OF WATERMAINS.
12. INSTALLATION OF SLUICE VALVES AND HYDRANTS SHALL BE IN ACCORDANCE WITH IRISH WATER'S STANDARD DETAILS STD-W-14 TO STD-W-19.
13. MARKER POSTS AND PLATES ARE TO BE PROVIDED IN ACCORDANCE WITH IRISH WATER STANDARD DETAIL STD-W-27.
14. CONNECTION TO EXISTING WATERMAINS TO BE COORDINATED BY THE CONTRACTOR WITH IRISH WATER AND/OR THE LOCAL AUTHORITY.
15. CONTRACTOR TO LIASE WITH IRISH WATER AND / OR THE LOCAL AUTHORITY AS REQUIRED REGARDING CLEANSING AND STERILISATION OF WATERMAINS

LEGEND:
- SITE BOUNDARY
- LANDS UNDER APPLICANTS OWNERSHIP
- WATERMAIN — SV — EXISTING WATERMAIN
- SV — SLUICE VALVE AS PER IRISH WATER STD-W-15
- H — HYDRANT AS PER IRISH WATER STD-W-18
- 150mm WATERMAIN — WATERMAIN
- 25mm SERVICE CONNECTION
- AV — AIR VALVE AS PER IRISH WATER STD-W-22
- M — WATER METER AS PER IRISH WATER STD-W-26
- K — WATER KIOSK
- WOH — WASHOUT HYDRANT AS PER I.W. STD-W-30A
- ScV — SCOUR VALVE AS PER I.W. STD-W-30
- BOUNDARY BOX

DBFL CONSULTING ENGINEERS LTD
DRAFT
ORMOND HOUSE, UPPER ORMOND QUAY, DUBLIN 7

rev	date	description	by	chkd.
P01	07-05-21	ABP APPLICATION	JVS	BK

client approval: A - Approved; B - Approved with comments; C - Do not use

suitability: S0 - WORK IN PROGRESS
issue purpose: PLANNING

DBFL Consulting Engineers
Civil, Structural & Transportation Engineering
www.dbfl.ie

DUBLIN OFFICE: Ormond House, Upper Ormond Quay, Dublin 7. D07 W704
PHONE +353 1 400 4000

CORK OFFICE: 14 South Mall, Cork. T12 CT91
PHONE +353 21 2024538

WATERFORD OFFICE: Suite 8b The Atrium, Maritana Gate, Canada Street, Waterford. X91 W028
PHONE +353 51 309 500

project ref.
WHITE PINES CENTRAL
RESIDENTIAL DEVELOPMENT

drawing title
PROPOSED WATERMAIN LAYOUT

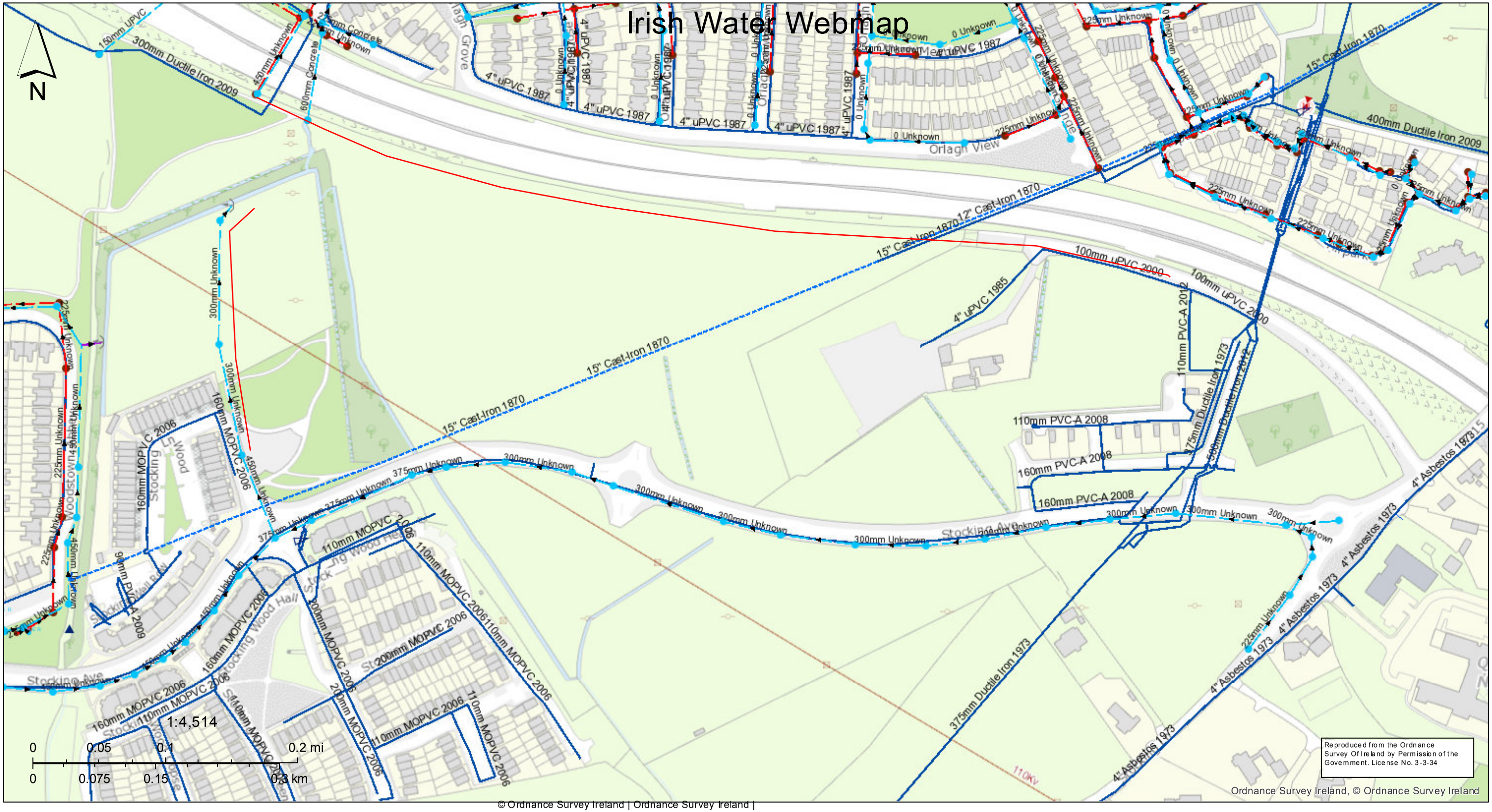
client
ARDSTONE HOMES

designed by	author	scale	sheet size
SPB	JJB	1:500	A1

drawing no.: 190004-DBFL-WM-SP-DR-C-1001
revision: P01

APPENDIX D – IRISH WATER RECORD DRAWINGS

Irish Water Webmap



April 19, 2017

Legend

Stormwater Gravity Mains (Irish Water Owned)
- Surface

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

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

Storm Inlets
- Gully
- Standard
- Other; Unknown

Storm Fittings
- Vent/Col
- Other; Unknown

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

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

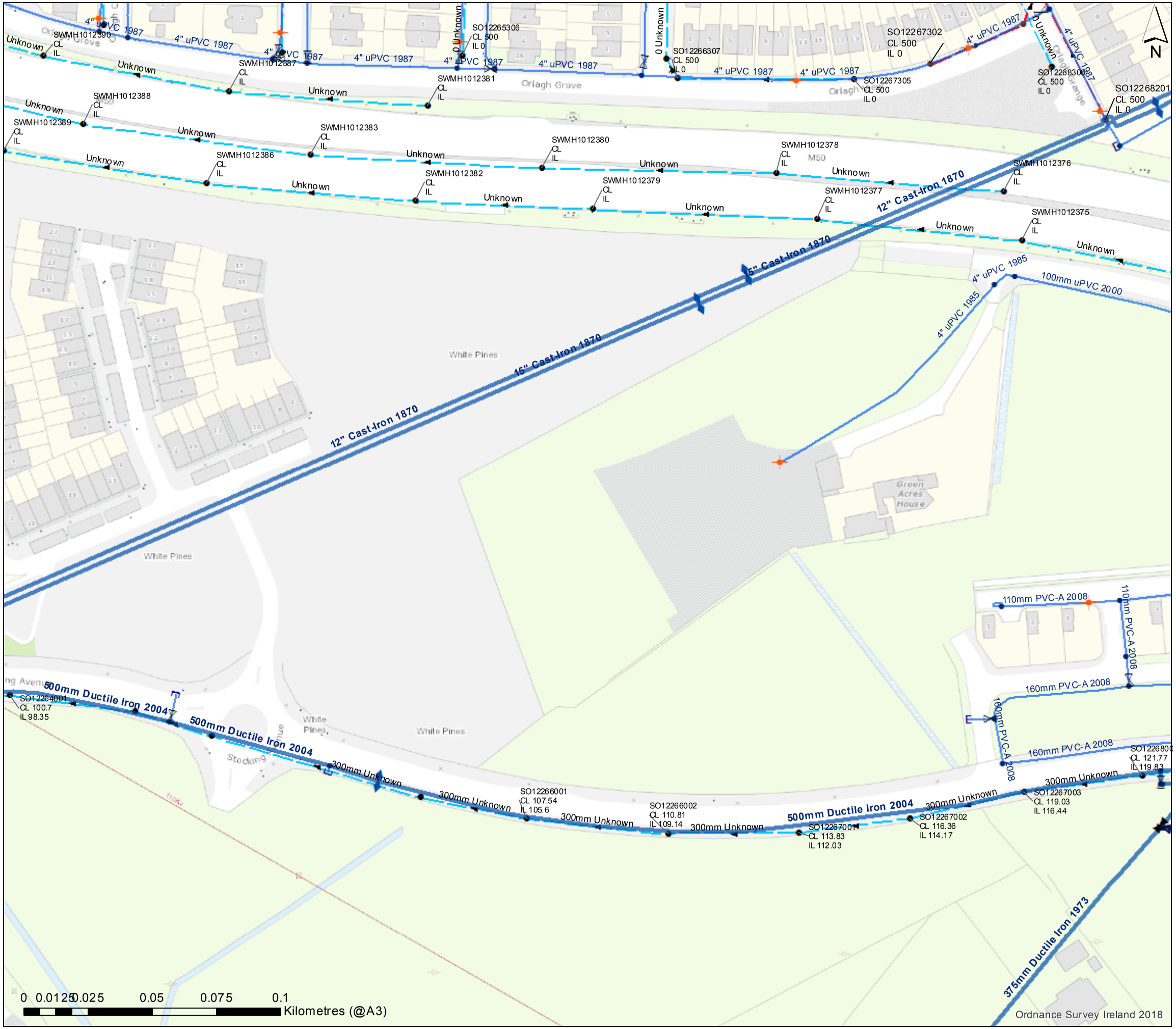
Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

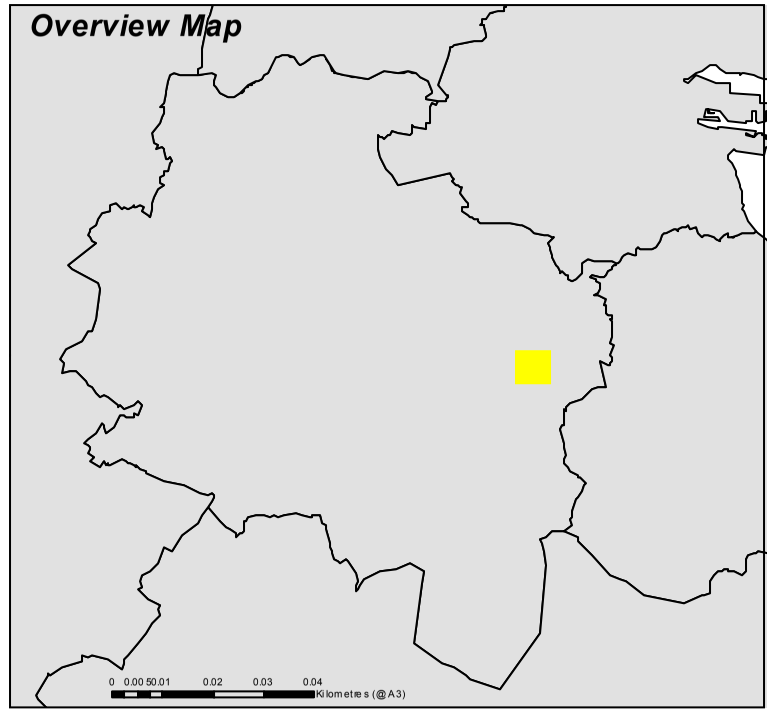
Sewer Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated. © Irish Water

"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the Information (including maps or mapping data). NOTE: DIAL BEFORE YOU DIG Phone 1850 427 747 or e-mail dig@gasnetworks.ie – The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of the gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

IWGIS Water Utilities Network





Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Hydrant (FH, WO)

Water Fittings
- Cap
- Other Fitting

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

UISCE ÉIREANN : IRISH WATER

Print Date: 27/03/2020

Printed by: cbolger

APPENDIX E – SURFACE WATER NETWORK CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	17.000	Add Flow / Climate Change (%)	10
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	24.306	0.146	166.5	0.022	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	21.769	0.130	167.5	0.019	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	14.449	0.085	170.0	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	54.141	0.319	169.7	0.101	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	39.369	0.232	169.7	0.092	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	27.192	1.445	18.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	29.597	1.395	21.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	20.343	1.017	20.0	0.014	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	48.299	0.285	169.5	0.094	4.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	9.277	0.054	171.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.40	116.595	0.022	0.0	0.0	0.3	1.01	40.2	3.3
1.001	50.00	4.76	116.449	0.041	0.0	0.0	0.6	1.01	40.1	6.1
1.002	50.00	5.00	116.319	0.050	0.0	0.0	0.7	1.00	39.8	7.4
1.003	50.00	5.90	116.234	0.151	0.0	0.0	2.0	1.00	39.8	22.5
1.004	50.00	6.45	115.915	0.243	0.0	0.0	3.3	1.20	85.1	36.2
1.005	50.00	6.57	115.683	0.243	0.0	0.0	3.3	3.64	257.4	36.2
1.006	50.00	6.72	114.238	0.243	0.0	0.0	3.3	3.43	242.3	36.2
1.007	50.00	6.81	110.270	0.257	0.0	0.0	3.5	3.53	249.6	38.3
2.000	50.00	4.80	109.575	0.094	0.0	0.0	1.3	1.00	39.8	14.0
2.001	50.00	4.96	109.290	0.094	0.0	0.0	1.3	0.99	39.5	14.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.008	26.116	0.605	43.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.009	12.811	0.100	128.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.010	6.613	0.059	112.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.011	45.415	0.454	100.0	0.082	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.012	16.228	0.163	99.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.013	14.651	0.146	100.3	0.050	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.014	17.436	0.175	99.6	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.008	50.00	6.99	106.305	0.351	0.0	0.0	4.8	2.40	169.6	52.3
1.009	50.00	7.15	105.700	0.351	0.0	0.0	4.8	1.39	98.1	52.3
1.010	50.00	7.24	105.600	0.351	0.0	0.0	4.8	1.23	49.1«	52.3
1.011	50.00	7.82	105.541	0.433	0.0	0.0	5.9	1.31	52.0«	64.5
1.012	50.00	8.02	103.588	0.433	0.0	0.0	5.9	1.31	52.1«	64.5
1.013	50.00	8.21	103.425	0.483	0.0	0.0	6.5	1.31	51.9«	71.9
1.014	50.00	8.43	101.785	0.496	0.0	0.0	6.7	1.31	52.1«	73.9

Flow shown at on these lines not reflective of flow after hydrobrake, see last page for summary of results

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
16	117.755	1.160	Open Manhole	1200	1.000	116.595	225				
15	118.181	1.732	Open Manhole	1200	1.001	116.449	225	1.000	116.449	225	
14	118.544	2.225	Open Manhole	1200	1.002	116.319	225	1.001	116.319	225	
13	118.730	2.496	Open Manhole	1200	1.003	116.234	225	1.002	116.234	225	
12	119.090	3.175	Open Manhole	1200	1.004	115.915	300	1.003	115.915	225	
11	118.722	3.039	Open Manhole	1200	1.005	115.683	300	1.004	115.683	300	
10	118.715	4.477	Open Manhole	1200	1.006	114.238	300	1.005	114.238	300	
9	115.511	5.241	Open Manhole	1200	1.007	110.270	300	1.006	112.843	300	2573
8-2	111.042	1.467	Open Manhole	1200	2.000	109.575	225				
8-1	112.315	3.025	Open Manhole	1200	2.001	109.290	225	2.000	109.290	225	
8	112.400	6.095	Open Manhole	1200	1.008	106.305	300	1.007	109.253	300	2948
								2.001	109.236	225	2856
7	112.020	6.320	Open Manhole	1200	1.009	105.700	300	1.008	105.700	300	
6	110.893	5.293	Open Manhole	1200	1.010	105.600	225	1.009	105.600	300	
5	107.575	2.034	Open Manhole	1200	1.011	105.541	225	1.010	105.541	225	
4	107.614	4.026	Open Manhole	1200	1.012	103.588	225	1.011	105.087	225	1499
3	104.550	1.125	Open Manhole	1200	1.013	103.425	225	1.012	103.425	225	
2	104.600	2.815	Open Manhole	1200	1.014	101.785	225	1.013	103.279	225	1494
	103.600	1.990	Open Manhole	0		OUTFALL		1.014	101.610	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	16	117.755	116.595	0.935	Open Manhole	1200
1.001	o	225	15	118.181	116.449	1.507	Open Manhole	1200
1.002	o	225	14	118.544	116.319	2.000	Open Manhole	1200
1.003	o	225	13	118.730	116.234	2.271	Open Manhole	1200
1.004	o	300	12	119.090	115.915	2.875	Open Manhole	1200
1.005	o	300	11	118.722	115.683	2.739	Open Manhole	1200
1.006	o	300	10	118.715	114.238	4.177	Open Manhole	1200
1.007	o	300	9	115.511	110.270	4.941	Open Manhole	1200
2.000	o	225	8-2	111.042	109.575	1.242	Open Manhole	1200
2.001	o	225	8-1	112.315	109.290	2.800	Open Manhole	1200
1.008	o	300	8	112.400	106.305	5.795	Open Manhole	1200
1.009	o	300	7	112.020	105.700	6.020	Open Manhole	1200
1.010	o	225	6	110.893	105.600	5.068	Open Manhole	1200
1.011	o	225	5	107.575	105.541	1.809	Open Manhole	1200
1.012	o	225	4	107.614	103.588	3.801	Open Manhole	1200
1.013	o	225	3	104.550	103.425	0.900	Open Manhole	1200
1.014	o	225	2	104.600	101.785	2.590	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	24.306	166.5	15	118.181	116.449	1.507	Open Manhole	1200
1.001	21.769	167.5	14	118.544	116.319	2.000	Open Manhole	1200
1.002	14.449	170.0	13	118.730	116.234	2.271	Open Manhole	1200
1.003	54.141	169.7	12	119.090	115.915	2.950	Open Manhole	1200
1.004	39.369	169.7	11	118.722	115.683	2.739	Open Manhole	1200
1.005	27.192	18.8	10	118.715	114.238	4.177	Open Manhole	1200
1.006	29.597	21.2	9	115.511	112.843	2.368	Open Manhole	1200
1.007	20.343	20.0	8	112.400	109.253	2.847	Open Manhole	1200
2.000	48.299	169.5	8-1	112.315	109.290	2.800	Open Manhole	1200
2.001	9.277	171.8	8	112.400	109.236	2.939	Open Manhole	1200
1.008	26.116	43.2	7	112.020	105.700	6.020	Open Manhole	1200
1.009	12.811	128.1	6	110.893	105.600	4.993	Open Manhole	1200
1.010	6.613	112.1	5	107.575	105.541	1.809	Open Manhole	1200
1.011	45.415	100.0	4	107.614	105.087	2.302	Open Manhole	1200
1.012	16.228	99.6	3	104.550	103.425	0.900	Open Manhole	1200
1.013	14.651	100.3	2	104.600	103.279	1.096	Open Manhole	1200
1.014	17.436	99.6		103.600	101.610	1.765	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.014		103.600	101.610	0.000	0	0

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.000	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6, DS/PN: 1.010, Volume (m³): 6.8

Unit Reference	MD-SHE-0080-3300-1450-3300
Design Head (m)	1.450
Design Flow (l/s)	3.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	105.600
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	3.3
Flush-Flo™	0.350	3.0
Kick-Flo®	0.713	2.4
Mean Flow over Head Range	-	2.7

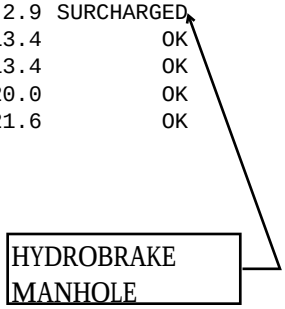
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.200	3.0	3.000	4.6	7.000	6.9
0.200	2.8	1.400	3.2	3.500	5.0	7.500	7.1
0.300	2.9	1.600	3.5	4.000	5.3	8.000	7.3
0.400	2.9	1.800	3.6	4.500	5.6	8.500	7.5
0.500	2.9	2.000	3.8	5.000	5.9	9.000	7.8
0.600	2.7	2.200	4.0	5.500	6.1	9.500	8.0
0.800	2.5	2.400	4.2	6.000	6.4		
1.000	2.8	2.600	4.3	6.500	6.6		

Summary of Results for 30 minute 5 year Summer (Storm)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	16	116.643	-0.177	0.000	0.10		3.7	OK
1.001	15	116.512	-0.162	0.000	0.17		6.3	OK
1.002	14	116.393	-0.151	0.000	0.22		7.5	OK
1.003	13	116.355	-0.104	0.000	0.54		20.7	OK
1.004	12	116.050	-0.165	0.000	0.41		32.3	OK
1.005	11	115.758	-0.225	0.000	0.14		32.5	OK
1.006	10	114.315	-0.223	0.000	0.15		32.5	OK
1.007	9	110.349	-0.221	0.000	0.16		34.2	OK
2.000	8-2	109.677	-0.123	0.000	0.41		15.5	OK
2.001	8-1	109.399	-0.116	0.000	0.47		15.4	OK
1.008	8	106.421	-0.184	0.000	0.32		48.0	OK
1.009	7	105.838	-0.162	0.000	0.05		4.0	OK
1.010	6	105.835	0.010	0.000	0.08		2.9	SURCHARGED
1.011	5	105.621	-0.145	0.000	0.27		13.4	OK
1.012	4	103.670	-0.143	0.000	0.29		13.4	OK
1.013	3	103.529	-0.121	0.000	0.44		20.0	OK
1.014	2	101.893	-0.117	0.000	0.47		21.6	OK



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.000	Add Flow / Climate Change (%)	10
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	24.306	0.146	166.5	0.022	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	21.769	0.130	167.5	0.019	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	14.449	0.085	170.0	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	54.141	0.319	169.7	0.101	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	39.369	0.232	169.7	0.092	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	27.192	1.445	18.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	29.597	1.395	21.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	20.343	1.017	20.0	0.014	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	48.299	0.285	169.5	0.094	4.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	9.277	0.054	171.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.40	116.595	0.022	0.0	0.0	0.3	1.01	40.2	3.3
1.001	50.00	4.76	116.449	0.041	0.0	0.0	0.6	1.01	40.1	6.1
1.002	50.00	5.00	116.319	0.050	0.0	0.0	0.7	1.00	39.8	7.4
1.003	50.00	5.90	116.234	0.151	0.0	0.0	2.0	1.00	39.8	22.5
1.004	50.00	6.45	115.915	0.243	0.0	0.0	3.3	1.20	85.1	36.2
1.005	50.00	6.57	115.683	0.243	0.0	0.0	3.3	3.64	257.4	36.2
1.006	50.00	6.72	114.238	0.243	0.0	0.0	3.3	3.43	242.3	36.2
1.007	50.00	6.81	110.270	0.257	0.0	0.0	3.5	3.53	249.6	38.3
2.000	50.00	4.80	109.575	0.094	0.0	0.0	1.3	1.00	39.8	14.0
2.001	50.00	4.96	109.290	0.094	0.0	0.0	1.3	0.99	39.5	14.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.008	26.116	0.605	43.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.009	12.811	0.100	128.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.010	6.613	0.059	112.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.011	45.415	0.454	100.0	0.082	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.012	16.228	0.163	99.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.013	14.651	0.146	100.3	0.050	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.014	17.436	0.175	99.6	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.008	50.00	6.99	106.305	0.351	0.0	0.0	4.8	2.40	169.6	52.3
1.009	50.00	7.15	105.700	0.351	0.0	0.0	4.8	1.39	98.1	52.3
1.010	50.00	7.24	105.600	0.351	0.0	0.0	4.8	1.23	49.1«	52.3
1.011	50.00	7.82	105.541	0.433	0.0	0.0	5.9	1.31	52.0«	64.5
1.012	50.00	8.02	103.588	0.433	0.0	0.0	5.9	1.31	52.1«	64.5
1.013	50.00	8.21	103.425	0.483	0.0	0.0	6.5	1.31	51.9«	71.9
1.014	50.00	8.43	101.785	0.496	0.0	0.0	6.7	1.31	52.1«	73.9

Flow shown at on these lines not reflective of flow after hydrobrake, see last page for summary of results

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
16	117.755	1.160	Open Manhole	1200	1.000	116.595	225				
15	118.181	1.732	Open Manhole	1200	1.001	116.449	225	1.000	116.449	225	
14	118.544	2.225	Open Manhole	1200	1.002	116.319	225	1.001	116.319	225	
13	118.730	2.496	Open Manhole	1200	1.003	116.234	225	1.002	116.234	225	
12	119.090	3.175	Open Manhole	1200	1.004	115.915	300	1.003	115.915	225	
11	118.722	3.039	Open Manhole	1200	1.005	115.683	300	1.004	115.683	300	
10	118.715	4.477	Open Manhole	1200	1.006	114.238	300	1.005	114.238	300	
9	115.511	5.241	Open Manhole	1200	1.007	110.270	300	1.006	112.843	300	2573
8-2	111.042	1.467	Open Manhole	1200	2.000	109.575	225				
8-1	112.315	3.025	Open Manhole	1200	2.001	109.290	225	2.000	109.290	225	
8	112.400	6.095	Open Manhole	1200	1.008	106.305	300	1.007	109.253	300	2948
								2.001	109.236	225	2856
7	112.020	6.320	Open Manhole	1200	1.009	105.700	300	1.008	105.700	300	
6	110.893	5.293	Open Manhole	1200	1.010	105.600	225	1.009	105.600	300	
5	107.575	2.034	Open Manhole	1200	1.011	105.541	225	1.010	105.541	225	
4	107.614	4.026	Open Manhole	1200	1.012	103.588	225	1.011	105.087	225	1499
3	104.550	1.125	Open Manhole	1200	1.013	103.425	225	1.012	103.425	225	
2	104.600	2.815	Open Manhole	1200	1.014	101.785	225	1.013	103.279	225	1494
	103.600	1.990	Open Manhole	0		OUTFALL		1.014	101.610	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	16	117.755	116.595	0.935	Open Manhole	1200
1.001	o	225	15	118.181	116.449	1.507	Open Manhole	1200
1.002	o	225	14	118.544	116.319	2.000	Open Manhole	1200
1.003	o	225	13	118.730	116.234	2.271	Open Manhole	1200
1.004	o	300	12	119.090	115.915	2.875	Open Manhole	1200
1.005	o	300	11	118.722	115.683	2.739	Open Manhole	1200
1.006	o	300	10	118.715	114.238	4.177	Open Manhole	1200
1.007	o	300	9	115.511	110.270	4.941	Open Manhole	1200
2.000	o	225	8-2	111.042	109.575	1.242	Open Manhole	1200
2.001	o	225	8-1	112.315	109.290	2.800	Open Manhole	1200
1.008	o	300	8	112.400	106.305	5.795	Open Manhole	1200
1.009	o	300	7	112.020	105.700	6.020	Open Manhole	1200
1.010	o	225	6	110.893	105.600	5.068	Open Manhole	1200
1.011	o	225	5	107.575	105.541	1.809	Open Manhole	1200
1.012	o	225	4	107.614	103.588	3.801	Open Manhole	1200
1.013	o	225	3	104.550	103.425	0.900	Open Manhole	1200
1.014	o	225	2	104.600	101.785	2.590	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	24.306	166.5	15	118.181	116.449	1.507	Open Manhole	1200
1.001	21.769	167.5	14	118.544	116.319	2.000	Open Manhole	1200
1.002	14.449	170.0	13	118.730	116.234	2.271	Open Manhole	1200
1.003	54.141	169.7	12	119.090	115.915	2.950	Open Manhole	1200
1.004	39.369	169.7	11	118.722	115.683	2.739	Open Manhole	1200
1.005	27.192	18.8	10	118.715	114.238	4.177	Open Manhole	1200
1.006	29.597	21.2	9	115.511	112.843	2.368	Open Manhole	1200
1.007	20.343	20.0	8	112.400	109.253	2.847	Open Manhole	1200
2.000	48.299	169.5	8-1	112.315	109.290	2.800	Open Manhole	1200
2.001	9.277	171.8	8	112.400	109.236	2.939	Open Manhole	1200
1.008	26.116	43.2	7	112.020	105.700	6.020	Open Manhole	1200
1.009	12.811	128.1	6	110.893	105.600	4.993	Open Manhole	1200
1.010	6.613	112.1	5	107.575	105.541	1.809	Open Manhole	1200
1.011	45.415	100.0	4	107.614	105.087	2.302	Open Manhole	1200
1.012	16.228	99.6	3	104.550	103.425	0.900	Open Manhole	1200
1.013	14.651	100.3	2	104.600	103.279	1.096	Open Manhole	1200
1.014	17.436	99.6		103.600	101.610	1.765	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.014		103.600	101.610	0.000	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6, DS/PN: 1.010, Volume (m³): 6.8

Unit Reference	MD-SHE-0080-3300-1450-3300
Design Head (m)	1.450
Design Flow (l/s)	3.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	105.600
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	3.3
Flush-Flo™	0.350	3.0
Kick-Flo®	0.713	2.4
Mean Flow over Head Range	-	2.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.200	3.0	3.000	4.6	7.000	6.9
0.200	2.8	1.400	3.2	3.500	5.0	7.500	7.1
0.300	2.9	1.600	3.5	4.000	5.3	8.000	7.3
0.400	2.9	1.800	3.6	4.500	5.6	8.500	7.5
0.500	2.9	2.000	3.8	5.000	5.9	9.000	7.8
0.600	2.7	2.200	4.0	5.500	6.1	9.500	8.0
0.800	2.5	2.400	4.2	6.000	6.4		
1.000	2.8	2.600	4.3	6.500	6.6		

Summary of Results for 360 minute 100 year Summer (Storm)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	16	116.625	-0.195	0.000	0.04		1.6	OK
1.001	15	116.493	-0.181	0.000	0.08		3.1	OK
1.002	14	116.368	-0.176	0.000	0.11		3.7	OK
1.003	13	116.317	-0.142	0.000	0.30		11.3	OK
1.004	12	116.012	-0.203	0.000	0.23		18.2	OK
1.005	11	115.739	-0.244	0.000	0.08		18.2	OK
1.006	10	114.296	-0.242	0.000	0.08		18.2	OK
1.007	9	110.330	-0.240	0.000	0.09		19.3	OK
2.000	8-2	109.640	-0.160	0.000	0.18		7.0	OK
2.001	8-1	109.361	-0.154	0.000	0.22		7.0	OK
1.008	8	107.131	0.526	0.000	0.17		26.3	SURCHARGED
1.009	7	107.129	1.129	0.000	0.10		8.0	SURCHARGED
1.010	6	108.858	3.033	0.000	0.10		3.3	SURCHARGED
1.011	5	105.606	-0.160	0.000	0.18		9.0	OK
1.012	4	103.655	-0.158	0.000	0.19		8.9	OK
1.013	3	103.506	-0.144	0.000	0.28		12.6	OK
1.014	2	101.868	-0.142	0.000	0.29		13.7	OK

APPENDIX F – FOUL DRAINAGE NETWORK CALCULATIONS

FOUL SEWERAGE DESIGN

Design Criteria for Foul NET 1 - Unit

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Calculation Method	EN 752	Maximum Backdrop Height (m)	1.500
Frequency Factor	0.50	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul NET 1 - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	15.322	0.154	99.5	0.000	56.0	0.0	1.500	o	225	Pipe/Conduit	
F1.001	13.271	0.132	100.5	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F1.002	54.345	0.273	199.1	0.000	266.0	0.0	1.500	o	225	Pipe/Conduit	
F1.003	39.729	0.198	200.7	0.000	252.0	0.0	1.500	o	225	Pipe/Conduit	
F1.004	22.908	0.128	179.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F2.000	52.900	0.538	98.3	0.000	364.0	0.0	1.500	o	225	Pipe/Conduit	
F2.001	11.507	0.115	100.1	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F2.002	26.104	0.235	111.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F2.003	5.952	0.547	10.9	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F3.000	46.867	2.232	21.0	0.000	336.0	0.0	1.500	o	225	Pipe/Conduit	
F3.001	13.308	0.568	23.4	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F3.002	9.140	0.355	25.7	0.000	322.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	116.835	0.000	0.0	56.0	0.0	44	0.69	1.15	45.8	3.7
F1.001	116.681	0.000	0.0	56.0	0.0	44	0.69	1.14	45.5	3.7
F1.002	116.549	0.000	0.0	322.0	0.0	81	0.70	0.81	32.3	9.0
F1.003	116.276	0.000	0.0	574.0	0.0	95	0.75	0.81	32.2	12.0
F1.004	116.078	0.000	0.0	574.0	0.0	92	0.78	0.86	34.1	12.0
F2.000	109.575	0.000	0.0	364.0	0.0	70	0.91	1.16	46.0	9.5
F2.001	109.037	0.000	0.0	364.0	0.0	70	0.91	1.15	45.6	9.5
F2.002	108.922	0.000	0.0	364.0	0.0	72	0.87	1.09	43.3	9.5
F2.003	108.687	0.000	0.0	364.0	0.0	40	2.00	3.49	138.8	9.5
F3.000	106.125	0.000	0.0	336.0	0.0	46	1.56	2.51	99.8	9.2
F3.001	103.893	0.000	0.0	336.0	0.0	47	1.51	2.38	94.5	9.2
F3.002	103.325	0.000	0.0	658.0	0.0	57	1.61	2.27	90.2	12.8

Network Design Table for Foul NET 1 - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F3.003	9.797	0.490	20.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F3.004	15.161	0.152	99.7	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F3.003	102.060	0.000	0.0	658.0	0.0	54	1.76	2.57	102.3	12.8
F3.004	101.570	0.000	0.0	658.0	0.0	82	0.99	1.15	45.7	12.8

Manhole Schedules for Foul NET 1 - Unit

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F1	118.307	1.472	Open Manhole	1200	F1.000	116.835	225				
F2	118.502	1.821	Open Manhole	1200	F1.001	116.681	225	F1.000	116.681	225	
F3	118.743	2.194	Open Manhole	1200	F1.002	116.549	225	F1.001	116.549	225	
F4	119.074	2.798	Open Manhole	1200	F1.003	116.276	225	F1.002	116.276	225	
F5	118.664	2.586	Open Manhole	1200	F1.004	116.078	225	F1.003	116.078	225	
F	117.401	1.451	Open Manhole	0		OUTFALL		F1.004	115.950	225	
F6	111.042	1.467	Open Manhole	1200	F2.000	109.575	225				
F7	112.383	3.346	Open Manhole	1200	F2.001	109.037	225	F2.000	109.037	225	
F8	112.515	3.593	Open Manhole	1200	F2.002	108.922	225	F2.001	108.922	225	
F9	111.606	2.919	Open Manhole	1200	F2.003	108.687	225	F2.002	108.687	225	
F	110.403	2.263	Open Manhole	0		OUTFALL		F2.003	108.140	225	
F10	107.624	1.499	Open Manhole	1200	F3.000	106.125	225				
F11	107.677	3.784	Open Manhole	1200	F3.001	103.893	225	F3.000	103.893	225	
F12	105.662	2.337	Open Manhole	1200	F3.002	103.325	225	F3.001	103.325	225	
F13	105.198	3.138	Open Manhole	1200	F3.003	102.060	225	F3.002	102.970	225	910
F14	104.769	3.199	Open Manhole	1200	F3.004	101.570	225	F3.003	101.570	225	
F	103.902	2.484	Open Manhole	0		OUTFALL		F3.004	101.418	225	

PIPELINE SCHEDULES for Foul NET 1 - Unit

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	225	F1	118.307	116.835	1.247	Open Manhole	1200
F1.001	o	225	F2	118.502	116.681	1.596	Open Manhole	1200
F1.002	o	225	F3	118.743	116.549	1.969	Open Manhole	1200
F1.003	o	225	F4	119.074	116.276	2.573	Open Manhole	1200
F1.004	o	225	F5	118.664	116.078	2.361	Open Manhole	1200
F2.000	o	225	F6	111.042	109.575	1.242	Open Manhole	1200
F2.001	o	225	F7	112.383	109.037	3.121	Open Manhole	1200
F2.002	o	225	F8	112.515	108.922	3.368	Open Manhole	1200
F2.003	o	225	F9	111.606	108.687	2.694	Open Manhole	1200
F3.000	o	225	F10	107.624	106.125	1.274	Open Manhole	1200
F3.001	o	225	F11	107.677	103.893	3.559	Open Manhole	1200
F3.002	o	225	F12	105.662	103.325	2.112	Open Manhole	1200
F3.003	o	225	F13	105.198	102.060	2.913	Open Manhole	1200
F3.004	o	225	F14	104.769	101.570	2.974	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	15.322	99.5	F2	118.502	116.681	1.596	Open Manhole	1200
F1.001	13.271	100.5	F3	118.743	116.549	1.969	Open Manhole	1200
F1.002	54.345	199.1	F4	119.074	116.276	2.573	Open Manhole	1200
F1.003	39.729	200.7	F5	118.664	116.078	2.361	Open Manhole	1200
F1.004	22.908	179.0	F	117.401	115.950	1.226	Open Manhole	0
F2.000	52.900	98.3	F7	112.383	109.037	3.121	Open Manhole	1200
F2.001	11.507	100.1	F8	112.515	108.922	3.368	Open Manhole	1200
F2.002	26.104	111.0	F9	111.606	108.687	2.694	Open Manhole	1200
F2.003	5.952	10.9	F	110.403	108.140	2.038	Open Manhole	0
F3.000	46.867	21.0	F11	107.677	103.893	3.559	Open Manhole	1200
F3.001	13.308	23.4	F12	105.662	103.325	2.112	Open Manhole	1200
F3.002	9.140	25.7	F13	105.198	102.970	2.003	Open Manhole	1200
F3.003	9.797	20.0	F14	104.769	101.570	2.974	Open Manhole	1200
F3.004	15.161	99.7	F	103.902	101.418	2.259	Open Manhole	0

Free Flowing Outfall Details for Foul NET 1 - Unit

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.004	F	117.401	115.950	0.000	0	0

Free Flowing Outfall Details for Foul NET 1 - Unit

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F2.003	F	110.403	108.140	0.000	0	0

Free Flowing Outfall Details for Foul NET 1 - Unit

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F3.004	F	103.902	101.418	0.000	0	0