PLANNING SUBMISSION

Engineering Infrastructure Report for 272 dwellings for Castle Rock Homes (Midleton) Ltd

At

Broomfield West, Midleton, Co Cork.

Date: 03.05.2023

Revision Record

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1. Introduction

This report is prepared in support of a planning application for the development of 272 houses and apartments on a site of net area 7.95 hectares at Broomfield West, Midleton, Co Cork. The report outlines the proposed means of servicing the development with roads, surface water sewers, foul water sewers, mains water supply, and storm water attenuation. The report also includes a Drainage Impact Assessment and a Flood Risk Assessment of the proposed development.
Separate technical reports for Traffic Management, Environmental Impact, Landscaping Design and Lighting Design have been prepared by other parties of the design team and are included separately with the planning application.
This report should be read in conjunction with the full set of engineering drawings submitted with the application, along with the design team documents.

2. Surface Water System - Design & Details

The surface water sewer system serving the development will consist of a network of surface water drains operated by gravity flow. The sewers will discharge westward towards the existing L-7360 public roadway. This roadway is currently being upgraded as part of the Park Hill View Estate Ltd development to the west of this roadway (PP Ref: 18/7236). The public road upgrade includes installing a new surface water sewer to serve the Park Hill View Estate Ltd housing development site. The surface water sewers serving the subject proposed development will connect into this newly-laid storm sewer. These sewers have been increased in size to accommodate the proposed extra discharge from the subject development.

SuDS measures have been incorporated on the surface water system to intercept water at source and reduce the run-off from the site (see section 3.0 below for separate Drainage Impact Assessment). A series of attenuation tanks will be installed to limit the run off from the site to the original greenfield run off level.

The sizing of the pipework collection system has been carried out using Causeway software. Design calculations and output sheets are attached in Appendix A. Details of the surface water sewer networks including connection points and discharge locations are shown on Drawings 22/6372-P-1321 + 1322 + 1324

2.1 Receiving Network

The surface water outfall pipe from the development will connect to an existing manhole at the junction of the L-7360 and the Broomfield Court spine road.

This manhole is part of an existing surface water network which runs from this connection point through the existing Brookdale and Avoncore estates, crossing the R626 public roadway and discharging into the Owenacurra River. The pipework is sized at 450mm Ø at the connection point and it increases as it runs downstream to 600mm Ø. The route of this receiving network and the discharge location to the Owenacurra River are shown on Drawing 22/6372-P-1324

It is noted that Avoncore is an older estate with a separate combined sewer system. There is no interconnection between this combined sewer and the surface water receiving network. The receiving network does not receive surface water from individual dwellings at this location.

The existing receiving network from the connection point to the river outfall has been CCTV surveyed in April 2019 as part of the Park Hill View Estate Ltd development permission. (PP Ref: 18/7236 - RFI submission). The CCTV survey shows the receiving network to be a modern concrete pipe and manhole network. It is in good condition and suitable for connecting into. Minor debris and pipe intrusions into the pipework were remedied post survey. A copy of this CCTV survey is attached in Appendix 'B'

An assessment of the capacity of the receiving network has been made. Catchment areas for the network have been calculated and sizes and invert levels of the pipes have been assessed. These capacity calculations are attached in Appendix 'C'. Contributing volumes from existing properties, public roads, the under-construction Park Hill View Estate Ltd Development and the Midleton Water Treatment Plant discharge volumes have been taken into account in these calculations. The catchment areas for this receiving network is shown in Figure 2.1

Figure 2.1 SW Receiving Network Catchment Area

The receiving network takes runoff from the Hollyridge, Broomfield Ridge, Holly Grove, Holly Court, Broomfield Court and Ivy Court areas east of the L-7360 roadway along with the Brookdale and Abbeylands developments west of the L-7360

Irish Water have indicated that the outflow from the Midleton waterworks is 107 m^3 per day. This is broken into 57 m^3 of sludge bleeds and 50 m^3 of backwash. The duration of the sludge bleeds is 1 min every 10 min or 2.4hrs (144 min) per day. Filter backwash is understood to be spread over the duration of a day. Taking a worst case scenario that the filter backwash also occurs over a 2.4 hrs duration then the calculated peak flow from the waterworks is 12.38 l/sec.

Added to this, is the calculated discharge from the Park Hill Development plus the run-off from the upgraded L-7360 public roadway of 4.77 l/sec. Hardstanding run-off from the catchments areas and the greenfield run off rate (see Section 2.2 hereunder) from the subject proposed development are also included.

The overall runoff volume from the existing and proposed development is 53 l/sec. This is taken for the receiving network calculations.

Causeway design printouts for the existing network capacity are attached in Appendix C. It will be seen that the flow capacity for the receiving network is at 57.3% capacity in the worst case scenario between manholes S3 to S4 for a 60 min duration winter event using a 5 year return period. Therefore, the receiving network has appropriate capacity to accept the additional surface water discharge from the proposed development.

2.2 Greenfield Run-off Rate

The greenfield runoff rate has been calculated using the HR Wallingford online Greenfield Runoff Estimation Tool. See report attached in Appendix D. The online tool has calculated a greenfield runoff rate of 24.35 l/sec.

Values input in the calculation are as follows:

Area of Site (ha) = 7.95
SAAR from Met Eireann published figures for this location (mm) = 1091
Soil type = 2
SPR = 0.3

The surface water design will limit runoff volumes by including a network of pipework with SuDS features and attenuation storage structures. This is designed to limit the effect of urbanisation and replicating the runoff characteristics of a greenfield site.

2.3 Attenuation details

Underground Storage Tanks are favoured over proprietary cellular structures on account of the high soil infiltration levels and down-slope existing housing development and infrastructure. The surface water drainage network is shown on Drawings 22/6372-P-1303 +,1321 + 1322. On account of the topography and the location of the Midleton Water Treatment Plant, the surface water network serving the site is divided up into separate segments with three separate attenuation tanks provided for adequate protection against downstream river flooding.

The tanks will be constructed of reinforced concrete cast in situ and fully sealed. Details of the attenuation tank design is shown on Drawings 22/6372-P-1323.

Attenuation tank volume calculations for the 3 attenuation tanks are shown in the Storm Network 1 and Storm Network 2 calculations in Appendix A

3.0 Foul Sewer System – Design & Details

The foul sewer system serving the development will operate by gravity flow. The sewers will discharge westward towards the existing L-7360 public roadway. This roadway is currently being upgraded as part of the Park Hill View Estate Ltd development to the west of this roadway (PP Ref:18/7236). This road upgrade includes installing new Surface and Foul Water sewers to serve the Park Hill View Estate Ltd development site. It is proposed to connect into these newly-laid sewers. These sewers have been upgraded to accommodate the proposed extra discharge from the subject development. Please see Drawings 22/6372-P-1301 + 1302

All sewers will be designed and installed in accordance with Irish Water Code of Practice for Wastewater infrastructure Rev July 2020.

3.1 Flow Rates

The development complies with Sewer Size/Gradients for multiple Properties. Based on this, flow rates are taken as 450l/house/day as per Irish Water guidelines for Housing Developments. The proposed development will produce the following volume:

$$\frac{272 \times 450}{24 \times 60 \times 60} = 1.41 \text{ l/s}$$

Population of 273 x 2.7 = 737 persons
Peaking factor for population of 737 = 6

6 x 1.41 l/s = 8.44 l/s design volume

Design Construction and output sheets from Causeway software for the foul sewer are included in Appendix 'F'

Design Settings	Value
Flow per dwelling per day (l/day)	450
Persons per House	2.7
Peaking Factor	6
Minimum backdrop height (m)	0.2
Min velocity (m/s)	0.75

Design Settings Used in the Causeway model

3.2 Pre Connection Query – Uisce Eireann

A COF from Uisce Eireann has been received and the Uisce Eireann response indicates that a wastewater connection is feasible subject to upgrades. A copy of the Irish Water response is included in Appendix 'G' of this report.

4.0 Water Supply – Design & Details

Irish water have an existing 12" Ductile Iron watermain running through the south-west corner of the site. It will be necessary to relocate this main to suit the proposed arrangement of roads and houses on the site, subject to agreement with Irish Water.

4.1Pre-Connection query

A pre-connection query was lodged with Irish Water. The Irish Water response confirms that a water connection is feasible without infrastructure upgrade by them.

The requirement to potentially divert the 12" Ductile Iron watermain is noted on the Irish Watermain is noted on the Irish Water Response. A copy of this confirmation of feasibility response is attached in Appendix G

4.2 Proposed Network

It is proposed to serve the development by an internal watermain network of 150Ø spine and 100Ø branch mains. All watermain installation details will be in accordance with Irish Water, Water Infrastructure Standard Details – July 2020.

Fire hydrants will be installed such that all dwellings are within 45.0m of a hydrant.

A bulk water meter will be installed at the principal watermain connection location. All dwellings will have individual meters.

Details of the water supply network are shown on Drawings 22/6372-P-1331 +1332

5.0 Drainage Impact Assessment

A Drainage Impact Assessment has been carried out in accordance with the requirements of County Development Plan, Advice Note No 1, Surface Water Management, (Dec 2022).
The Drainage Impact Assessment sets out how Sustainable Drainage Systems (SuDS) have been incorporated into the surface water design to manage surface water within and adjacent to the site.

5.1 SuDS Statement

The SuDS design for this development has been carried out with reference to:

- Cork County Development Plan 2022 objectives,
- The Greater Dublin Strategic Drainage Study Vol 2 (GDSDS) and
- The SuDS Manual CIRIA Report C753.

The surface water management plan for the site seeks to maximise the retention of surface water runoff from all hardstanding areas. Where feasible, SuDS measure have been incorporated into green spaces to intercept and minimise run-off.

The greenfield runoff rate from the development has been calculated (See section **2.2** above) and discharge to the public surface water sewer system has been kept below this figure.

The following individual SuDS measures have been considered appropriate for this particular development and will be incorporated:

	SuDS Measure	**To be used on site**	**Area of feature**	**Attenuation Volume of Feature**
1	**Drained Swale**	Yes	4 no locations: Overall length 480 lin m.	See Section 5.11.1
2	**Filter Drains**	Yes	4no locations: Overall length 230 lin m	See Section 5.11.2
3	**Permeable Paving**	Yes – permeable paving to be incorporated	2.38Ha	See Section 5.11.3

4	**Petrol, Oil Interceptor Grit Trap**	Yes – larger volume of water from estate roads will be diverted	All estate roads	Not applicable
5	**Attenuation Tank**	Yes – 2 no attenuation tanks provided to cater for separate areas of the site	Serves full development	

5.2 SuDS Selection Criteria

The SuDS design reflects the layout and topography of the development site:

- Permeable paving has been incorporated in the external hardstanding of all dwellings. Soakaways have also been incorporated to accommodate roof water run off – both of these measures will intercept surface water at source.
- Permeable paving has been incorporated into each of the 3 courtyard areas comprising 650 sqm each, being a total of 1950 sqm.
- Filter drains have been incorporated in select areas to address the potential for rainwater exceedance scenario. The East West retaining wall running across the centre of the site has a large filter drain at the rear of the wall with base level drainage incorporated. This addresses the risk of rainwater accumulation at the feature across the centre of the site.
- Swales have been incorporated where gradients allow. The swales will be appropriately planted to enhance biodiversity gains. The swales will serve specific areas of road water run off by drainage from road gullies. These areas will deliver a high level of water treatment.
- Due to the sloping nature of the site the incorporation of Detention Basins and/or Retention Basins is not feasible.

The infiltration capacity of the soils at the site is good. A series of soakaway tests were conducted on site to determine infiltration rates. These ranged from 2.8×10^5 m/s to 30.06×10^5 m/s indicative of moderate to high infiltration capacity.

Infiltration Rate Testing Results are attached in Appendix 'E'. These tests have been conducted as per the testing requirement laid down in BRE 365.

See Drawings 22/6372-P-1321 + 1322 for layout of SuDS measures incorporated into the development

5.3 SuDS Design Criteria

The key principles for consideration in SuDS design are:

1. Water Quality
2. Water Quantity
3. Amenity
4. Biodiversity

The following table shows how these criteria have been considered:

Criteria	Component	Description
Water Quantity	Collection of Run-off	Individual dwelling downpipes to soakaway. Individual Dwelling permeable paving hardstanding to intercept direct rainfall to common parking areas.
	Interception	Infiltration of >5mm for all surfaces Filter drains at specific locations
	Storage	Soakaway Pavement sub-base Swales Attenuation Tanks
	Exceedance	Raised road crossings and retaining walls allowing extra storage
Water Quality	Ground water discharge	Residential Parking and Roads: Swales and Filter drains to act as interception and treatment
Amenity	Swales	Water Supply to support vegetation and biodiversity habitat
Biodiversity	Landscaping + Swales	Enhance tree numbers – See Landscape Strategy Document

5.4 Layout of Proposed Network

The surface water network is laid out to provide gravity falls without the necessity for pumping. The network runs from East to West and discharges at two separate locations to the existing L-7360 public road which runs along the west and north boundaries of the development. See Drawings 22/6372-P-1321 + 1322 for the proposed layout. A new 300Ø S.W. sewer is currently being laid in the L-7360 public

roadway as part of a recently approved housing development (PP Ref: 18/7236) by Park Hill View Estate Ltd. This pipe was sized at 225Ø on the approved planning drawings and is being upgraded to a 300Ø pipe to cater for the additional run off from the subject development. The surface water design calculations for the development also confirm the sizing for this pipework

5.5 Interception Storage

River Water Quality Protection is assisted by interception of rainfall events to limit rapid run-off to receiving waters as per GDSDS objectives.

GDSDS lists an objective of no run-off to pass directly to the river for rainfall events of 5mm and up to 10mm if possible.

Infiltration techniques are incorporated in the subject development as follows:

i. Use of permeable paving to all individual properties.
ii. Use of permeable paving to courtyard common parking areas
iii. Use of swales and filter drains to receive run-off from elements of the estate roads.

Due to the site topography and subsequent workable estate layout, the use of Retention Ponds, Retention Basins, and Wetlands for infiltration and interception storage are not feasible at this development location however the significant use of the above referenced filtration systems offsets this.

5.6 Attenuation Storage

Underground Storage Tanks are favoured over proprietary cellular structures on account of high soil infiltration rates and down-slope existing housing development and infrastructure. On account of the topography and an area of sloping ground just north of the Midleton Water Treatment Plant, two separate attenuation tanks are required, to provide adequate protection against downstream river flooding. These are shown on Drawings 22/6372-P-1321 + 1322

In accordance with GDSDS the Greenfield run-off rate (QBAR) is used to calculate attenuation storage control. Attenuation tank capacity calculations for the two attenuation tanks are shown in the Storm Network 1 and Storm Network 2 calculations in Appendix 'A'

5.7 Climate Change

The SuDS design has been carried out taking into account climate change factors as outlined in the GDSDS document a follows:

Category	**Characteristics**
River Flows	20% Increase in flows for all return periods up to 100 years.
Rainfall	10% increase in depth

5.8 Existing Site Conditions

The development site is relatively flat at the higher northern end. It slopes from this high level in southern, south-western and south-eastern directions. Approx 25% of the site at the upper areas is relatively flat and has lesser falls of 1:15 (7%). The remaining 75% of the site has moderate falls of between 1:8 (12%) and 1:9 (11%).

The site is currently laid out in pasture with grazing sheep. The eastern boundary has a small mature ditch bordering further grasslands. The northern, north-western and western boundaries are a mature ditch bounding a public roadway - the L-7360. The southern boundary is adjoining a recently built housing development and has a palisade fence boundary. The site surrounds the Midleton Water Treatment Plant (WTP) on three sides. The WTP is accessed off the aforementioned public roadway. The boundary around the WTP is a mature ditch with mature trees. A small mature ditch and mound runs east-west across the site separating the lower and upper areas.

There are no existing drainage features evident on the lands. No water run-off channels are evident on any part of the lands. Rock is close to the surface at the upper flatter area with a couple of local rocky outcrops are visible.

Overland flow paths which run perpendicular to the contours are shown in Figure 5.1. – overlain on the proposed development. In most case these flow paths are intercepted by estate roads. Where estate roads run in the same direction as the flow paths, raised kerbing at the ends of these will prevent flooding of properties in an extreme rainfall event scenario. Where rainfall is at risk of entering a cul-de-sac area, a raised pedestrian crossing will be constructed at the entrance to this area to prevent flooding of the area. All potential collection areas of exceedance rainfall will be fitted with pairs of road gullies or filter drains to provide extra run-off capacity.

At the centre east-west roadway – where potential rainfall exceedance flow meets the east-west retaining wall there are no road routes downhill from here for exceedance flow to follow. The retaining wall will project 500mm above the ground level to prevent overflow above the wall and to act as a water retention area. The wall construction incorporates a 300mm wide filtration layer directly behind the wall face which extends the full heights of the wall and which has a perforated filter drain at its base, connected to the SW drainage system.

Figure 5.1 Overland Flow Paths

5.9 Existing Services

There are both overground and underground existing utilities on the site. A 38kV ESB overhead cable runs north-south to the east side of the development. This has been partly placed underground in ducting, with ESB approval, in the existing development to the south. It is proposed to continue this ducting this as far as the north east corner of the site where a new mast will be erected. This will minimise areas sterilised due to overhead lines. A 10kV line runs through the site providing power to the Water Treatment Plant (WTP). Here again the southern section of this overhead line has already been placed in ducting underground. It is intended continuing this ducting as far as the public roadway north of the WTP.

There is one existing watermain pipe running through the site directly south of the W.T.P. This has been shown diverted around the proposed new estate roads. Irish Water are aware of this diversion requirement and refer to same on their Confirmation of Feasibility letter.

These diversions are shown on Drawing Ref 22-6372-PL05- 1341 Existing Services.

5.10 Rainfall Event Stormwater Design

Computer modelling for a variety of rainfall events and return periods has been carried out using Causeway software to enable confirmation of pipework sizing, storage volumes and outfall discharge rates. This modelling outputs are attached in Appendix 'A'

5.11 Detailed design assessment

5.11.1. Swales

A series of dry swales will be formed to provide interception and filtration of run off from adjacent hard-landscape areas. To the north and south of the development site a series of interconnected swales take run off from adjacent internal road elements and provide a high-level of treatment of the runoff water. To the centre of the side a swale has been incorporated into the main green area (open space area 6) to intercept run-off from the green area itself. A further swale has been incorporated in the SW corner of the site – between the proposed southernmost estate road and the adjacent existing estates to the south.
The swales have a design filtration width of 2.0m – this may be narrowed locally to accommodate site constraints. The swales will be fitted with a

perforated underdrain as longitudinal falls exceed 1.5%. They are situated in green areas and in the case of the northern and southern swales are broken into interconnected elements to reflect individual green areas.
The swales will have maximum side slopes of 1:3 or shallower where space allows. The filter zone is covered with a planted filter bed of prepared soil to allow filtration to the filter medium and underdrain. A 600 mm depth of filter medium will be installed above the underdrain. See swale make-up detail on drawing P-1321.
The perforated underdrain will be re-connected to the surface water drainage system on the downstream end to accommodate peak-flow conveyance during a large volume event.
Site investigation shows no high level watertable and lining is not required.

Northern Swale (south of public road L-7360) – See drawing P-1322
This is made up of 3 interconnected sections. The swale is 160m long with a filter drain width of 2.0m - see drawing detail for typical make up. The swale drains an adjacent estate road area of 1,437 sqm. It has a longitudinal fall of 1:30 (0.033 or 3.3%fall)

Run Off Rates
Run off area = 1,437sqm
Runoff factor = 0.9 (impervious road and path areas)

Rainfall and runoff volumes:

Event	**Duration**	**Rainfall Intensity**	**Runoff Rates**
	min	**mm/hr**	**m^3/sec**
			(A x 0.9 x i)
1:1 year	15	28	0.012
1:10 year	15	57.2	0.020
1:30 year	15	78	0.028
1:100 year	15	107.2	0.040

Flow Rate from Swale to to Filter Drain

Permeability of Filter aggregate (k) = 0.0005m/s
Filter drain area (A) 2.0 x 160 = 320sqm
Capacity (Q) = Ak = 320 x 0.0005 = 0.16 m^3/sec
This is above the 1:100 year event run off volume which is acceptable

Check capacity of swale for 30 & 100 year events

Use Mannings equation *Q= A (R)^2/3 (S)^1/2 / n*

For high flows use average Manning's *n* = 0.15
A = Cross sectional area
R = hydraulic radius (A/P) P = wetted perimeter
S = slope of channel = 0.033

This gives the following depth:flow relationship results

d (mm)	**V (m/s)**	**Q (m^3/s)**
50	0.165	0.041
100	0.261	0.131
150	0.342	0.257
200	0.415	0.415
250	0.481	0.601
300	0.543	0.815
350	0.602	1.053
400	0.658	1.316
450	0.712	1.601
500	0.763	1.908
550	0.813	2.237

The 30 year flow rate has velocity below 1.5m/sec at a depth of approximately 100mm which is acceptable
The 100 year flow rate has a velocity below 1.5m/sec which is an acceptable non-erosive velocity.

Southern Swale – (Between lower east-west estate road and Blossomhill development to the south)
This is made up of 2 interconnected sections. The swale is 220m long with a filter drain width of 2.0m - see drawing detail for typical make up. The swale drains an adjacent estate road area of 2,180 sqm. It has a longitudinal fall of 1:40 (0.025 or 2.5% fall)

Run Off Rates
Run off area = 2,180sqm
Runoff factor = 0.9 (impervious road and path areas)

Rainfall and runoff volumes:

Event	Duration	Rainfall Intensity	Runoff Rates
	min	mm/hr	m^3/sec
			=A x 0.9 x i
1:1 year	15	28	0.015
1:10 year	15	57.2	0.031
1:30 year	15	78	0.042
1:100 year	15	107.2	0.058

Flow Rate to Filter Drain

Permeability of Filter aggregate (k) = 0.0005m/s
Filter drain area (A) 2.0 x 220 = 440sqm
Capacity (Q) = Ak = 440 x 0.0005 = 0.22 m^3/sec
This is greater than the 1:100 year event run off volume which is acceptable

Check capacity of swale for 30 & 100 year events

Use Manning's equation Q= A (R)^2/3 (S)^1/2 / *n*

For high flows use average Manning's *n* = 0.15
A = Cross sectional area
R = hydraulic radius (A/P) P = wetted perimeter
S = slope of channel = 0.025

This gives the following depth:flow relationship results

d (mm)	V (m/s)	Q (m^3/s)
50	0.143	0.036
100	0.227	0.114
150	0.298	0.223
200	0.361	0.361
250	0.419	0.523
300	0.473	0.709
350	0.524	0.917
400	0.573	1.145
450	0.619	1.393
500	0.664	1.661
550	0.708	1.947

The 30 year flow rate has velocity below 1.5m/sec at a depth of approximately 100mm which is acceptable
The 100 year flow rate has a velocity below 1.5m/sec which is an acceptable non erosive velocity.

South West Swale – See drawing P-1322
The swale is 80m long with a filter drain width of 2.0m - see drawing detail for typical make up. The swale drains an adjacent estate road area of 448 sqm. It has a longitudinal fall of 1:30 (0.033 or 3.3% fall)

Run Off Rates
Run off area = 448sqm
Runoff factor = 0.9 (impervious road and path areas)

Rainfall and runoff volumes:

Event	**Duration**	**Rainfall Intensity**	**Runoff Rates**
	min	**mm/hr**	**m^3/sec**
			=A x 0.9 x i
1:1 year	15	28	0.003
1:10 year	15	57.2	0.006
1:30 year	15	78	0.009
1:100 year	15	107.2	0.012

Flow Rate from Swale to Filter Drain

Permeability of Filter aggregate (k) = 0.0005m/s
Filter drain area (A) 2.0 x 80 = 160sqm
Capacity (Q) = Ak = 160 x 0.0005 = 0.08m^3/sec
This is greater than the 1:100 year event run off volume which is acceptable

Check capacity of swale for 30 & 100 year events

Use Manning's equation Q= A (R)^2/3 (S)^1/2 / *n*

For high flows use average Manning's *n* = 0.15
A = Cross sectional area
R = hydraulic radius (A/P) P = wetted perimeter
S = slope of channel = 0.033

This gives the following depth:flow relationship results

d (mm)	V (m/s)	Q (m^3/s)
50	0.165	0.041
100	0.261	0.131
150	0.342	0.257
200	0.415	0.415
250	0.481	0.601
300	0.543	0.815
350	0.602	1.053
400	0.658	1.316
450	0.712	1.601
500	0.763	1.908
550	0.813	2.237

The 30 year flow rate has velocity below 1.5m/sec at a depth of approximately 100mm which is acceptable
The 100 year flow rate has a velocity below 1.5m/sec which is an acceptable non erosive velocity.

Open space green area swale – (Open Space Area 6) See drawing P-1322
The swale is 20m long with a filter drain width of 2.0m - see drawing detail for typical make up. The swale drains an uphill grasses open space area of 630 sqm. It has a minimal longitudinal fall of 1:100 (0.01 or 1%fall)

Run Off Rates
Run off area = 630sqm
Runoff factor = 0.35 (conservative figure for sloping ground)

Rainfall and runoff volumes:

Event	Duration	Rainfall Intensity	Runoff Rates
	min	mm/hr	m^3/sec
			= A x 0.9 x i
1:1 year	15	28	0.002
1:10 year	15	57.2	0.004
1:30 year	15	78	0.005
1:100 year	15	107.2	0.007

Flow Rate from Swale to Filter Drain

Permeability of Filter aggregate (k) = 0.0005m/s
Filter drain area (A) 2.0 x 20 = 40sqm
Capacity (Q) = Ak = 40 x 0.0005 = 0.02 m^3/sec
This is greater than the 1:100 year event run off volume which is acceptable

Run off volumes are small and the swale make up coupled with high percolation rates for the subsoil will adequately handle run off.

5.11.2. Filter Drains

Filter drains have been incorporated to provide a backup measures for exceedance events and also to accommodate local run-off.
See filter drain detail on drawing P-1321

Filter drains are installed at the three courtyard areas which are fully served by permeable paving. They are located on the lower end of the courtyard areas and provide alternative drainage and to prevent any excess ponding which may affect the lower dwellings. These act as a failsafe mechanism in the event of lack of maintenance of the permeable paving areas.
The filter drains have perforated pipework with an overflow connection to the adjacent SW system to accommodate peak-flow conveyance during a large volume (exceedance) event. This is situated 1.0m above the invert of the drain invert to enable water entering the drain in a normal rainfall scenario to infiltrate to the surrounding ground.

The filter drains will be covered by a sacrificial layer of single-sized stone laid over geotextile wrapping the file aggregate. This layer will trap silt and can be replaced if required.

The main retaining wall running east-west across the centre of the site has a 300mm wide filter drain which is constructed integral with the wall facing - directly behind the wall face. See Type 4 retaining wall detail on drawing P-1110. This filter drain runs from the toe of this wall to the surface at the upper level. It has a 150mm diameter perforated drain pipe at the toe which allows infiltration into the surrounding subsoil and will also act as a conduit to the SW system in the event of an exceedance event.

5.11.2.1 Courtyard Filter Drains

The filter drains are 20m long each with a depth of 2.0m and a width of 1.0m see drawing detail for typical make up. The filter drain design will be checked to take drainage from the adjacent courtyard area of 650 sqm. It will be constructed with a longitudinal fall of 1:100 (0.01 or 1% fall)

Run Off Rates
Run off area = 650 sqm
Runoff factor = 0.75 (permeable paving courtyard areas – assume scenario where filter drain acts as failsafe for permeable paving)

Rainfall and runoff volumes:

Event	**Duration**	**Rainfall Intensity**	**Runoff Rates**
	min	**mm/hr**	**m³/sec**
			= A x 0.75 x i
1:1 year	15	28	0.004
1:10 year	15	57.2	0.008
1:30 year	15	78	0.011
1:100 year	15	107.2	0.015

Check rate of flow through filter media to base of filter drain using Darcy's Law formulae:

Q = Aki

Where: *Q* = flow capacity of filter media (m³/s)
A = horizontal area of filter drain x height (m²)
k = coefficient of permeability of filter media (m/s) Assume 0.0005
i = hydraulic gradient (generally taken as 1 for vertical flow over short distance)

Giving Q = 20 x 1 x 0.0005 x 1 = 0.01 m³/sec This capacity is similar to the 1:100 year event which is acceptable.

5.11.3. Permeable Paving

A permeable paving system is proposed for individual dwelling driveways. This system will also be used for the three courtyard areas. The proposed system is designed as an infiltration system with infiltration direct into the subsoils. The system has a 350mm thick graded sub-base layer which provides

high levels of storage capacity prior to subsoil percolation. The Roadstone Aquaflow system is shown in the figure 5.1 below – this system when used with the appropriate geotextile layers, where required, provides an excellent structural base for heavy loads, HGV's etc. The geotextile layers and the sub-base materials provide cleaning and filtering of the run-off water

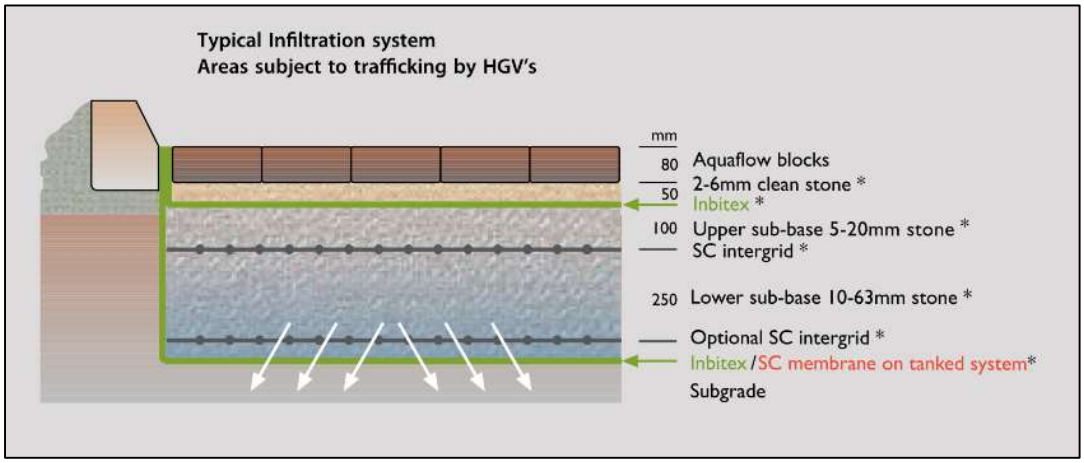


Figure 5.1 Infiltration permeable paving system

<u>Check design suitability for the courtyard areas:</u>

Check for maximum depth of water h_{max} for plane infiltration systems:

h_{max} = maximum head of water above base of infiltration component

$h_{max} = [D (Ri-q)] / n$ where

R = ratio of drained area to infiltration area = 650/650 = 1

q = infiltration coefficient form percolation test adjusted by appropriate factor of safety:
As per Table 25.2 of CIRIA SuDS manual <u>chose maximum factor of 10 as failure could lead to damage of building</u>. Thus q = (2.8 x 10^-5)/10 m/s
See percolation test results Appendix E (**note** lowest percolation test result obtained is being used for conservative design). Thus q = 0.01008m/hr

i, D = intensity and duration of rainfall events m/hr and hr. Chose a check on both 30 year and 100 year events where D = 15min (0.25 hr)

A_b = base area of filtration system = 650 sqm
A_d = area to be drained = 650 sqm

n = porosity of filter material. Use figure of 0.35 for uniform gravel

Then for 30 year return period with i = 0.078 m/hr

Then h_{max}
= [0.25(1 x 0.078 – 0.01008)]/0.35 = 0.048m or 48mm
This is satisfactory where we have a sub base filter layer of 350mm

For a 100 year return period with i = 0.107 m/hr

Then h_{max}
= [0.25(1 x 0.107 – 0.01008)]/0.35 = 0.069m or 69mm
This is satisfactory where we have a sub base filter layer of 350mm

Thus proposed infiltration system permeable paving system is appropriate for this location

5.12 SuDS Checklists

SuDS checklists in accordance with *Appendix B of the CIRIA SuDS Manual C753* have been provided and are attached in Appendix 'H' of this document

6.0 Flood Risk Assessment

A flood risk assessment has been carried out for the site. The assessment is based on The Planning System and Flood Risk Management (FRM) Guidelines for Planning Authorities (2009). The FRM Guidelines require the planning system and national and regional levels to:

- Avoid development in areas at risk of flooding.
- Avoid new developments increasing flood risk elsewhere including that which may arise from surface water run-off.
- Adopt a sequential approach based on "Avoid, Substitute, Justify, Mitigate & Proceed" principles.

STAGE 1 – Flood Risk Identification

6.1 Existing Topography

The development site is shown in Figure 6.1. It comprises 7.95Ha on lands that are sloping from 1:20 at the upper areas to lands that are sloping at 1:8 at the lower areas. The height of the site above ordnance datum ranges from 29.6m AOD at its lowest point to 67.7m AOD at the highest point.

No streams or watercourse exist around or within the development site. A walkover of the site shows no evidence of areas of water channels or run-off. There is no evidence of springs on the site and trial holes carried out in wet and dry weather conditions did not find any water table.

Figure 6.1 Location of proposed development

6.2 Local Risk Identifications

The height of the development above sea level (+30.0m to +67.0m AOD) and the non-proximity to either fluvial (river) or tidal zones rules out the risk of flooding from these sources.

Due to the sloping nature of the development site, overland pluvial flooding needs to be considered.

Source: Due to the sloping nature of the site overland pluvial flooding should be XX.

Pathway: Pluvial run-off within the development. Run-off from within the development onto the public roadway.

Receptor: Properties at the lower level of the proposed development. Existing properties downhill of the proposed development.

6.3 Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined for the purposes of these Guidelines:

Flood Zone A

Where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).

Flood Zone B

Where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding).

Flood Zone C

Where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.
Based on Initial Assessment above the site is in Flood Zone C

6.4 Vulnerability Class

In accordance with Table 3.1 of the FRM document the development, being a housing development, is classed as a Highly Vulnerable development

6.5 Justification Test

In accordance with Table 3.2 of the FRM document, the development is deemed Appropriate as it lies fully within a Flood Zone C area.

6.6 *STAGE 2* - Initial Flood Risk Assessment

6.6.1 Sources of flooding

Flooding Source	Comment	Risk
Tidal or Coastal	Not near coast	None
Fluvial	No nearby rivers or streams. Elevated site location	None
Surface Water	Overland water flow or overflow of drainage	Yes – Low risk

	infrastructure during significant rainfall events	
Ground Water	There is no evidence of springs at the site. Site investigation trial pits did not find any water table	Yes – Low risk

6.7 Sources of Flood Information

6.7.1 OPW Flood Maps Website (www.floodmaps.ie). This resource was consulted for evidence of flooding in the vicinity of the proposed development site.

The following flood maps are noted:

Figure 6.2 River Flood Extent, Medium and Low Probability

Figure 6.3 Indicative Fluvial Flooding High End Future Scenario Low & Medium Probability

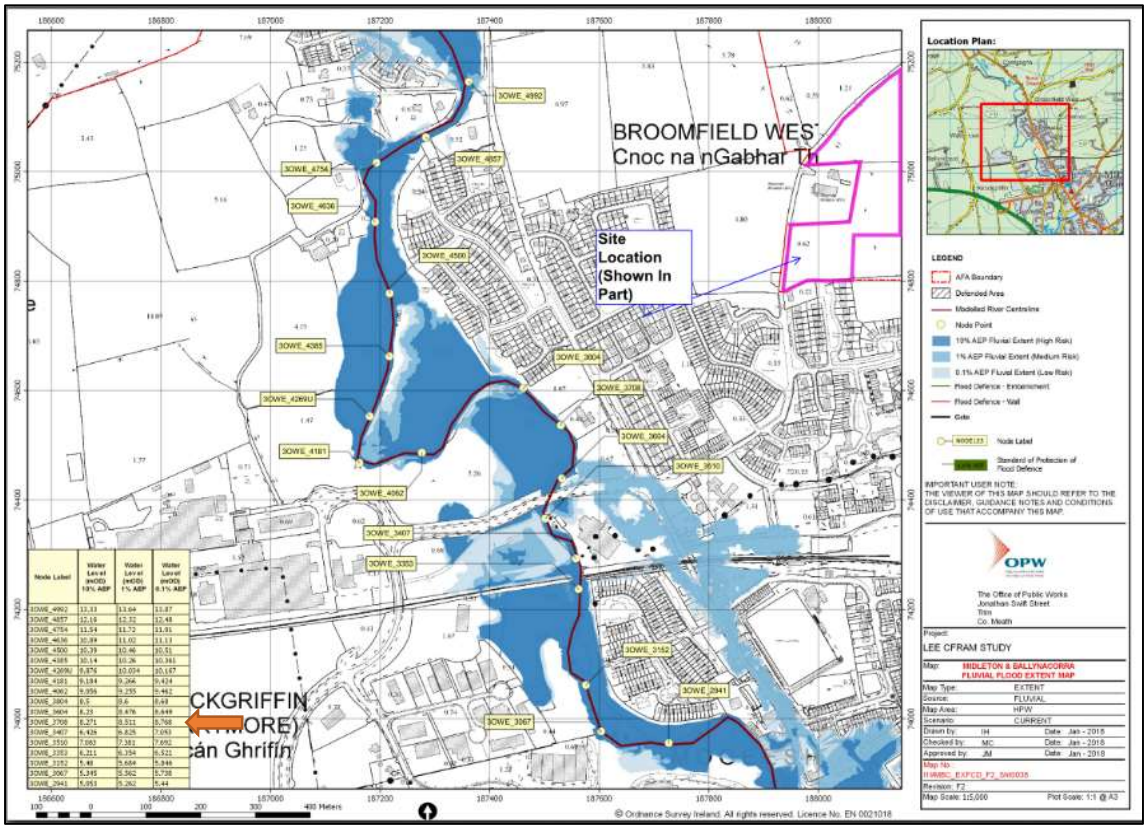


Figure 6.4 Current Fluvial Flood Extent Map

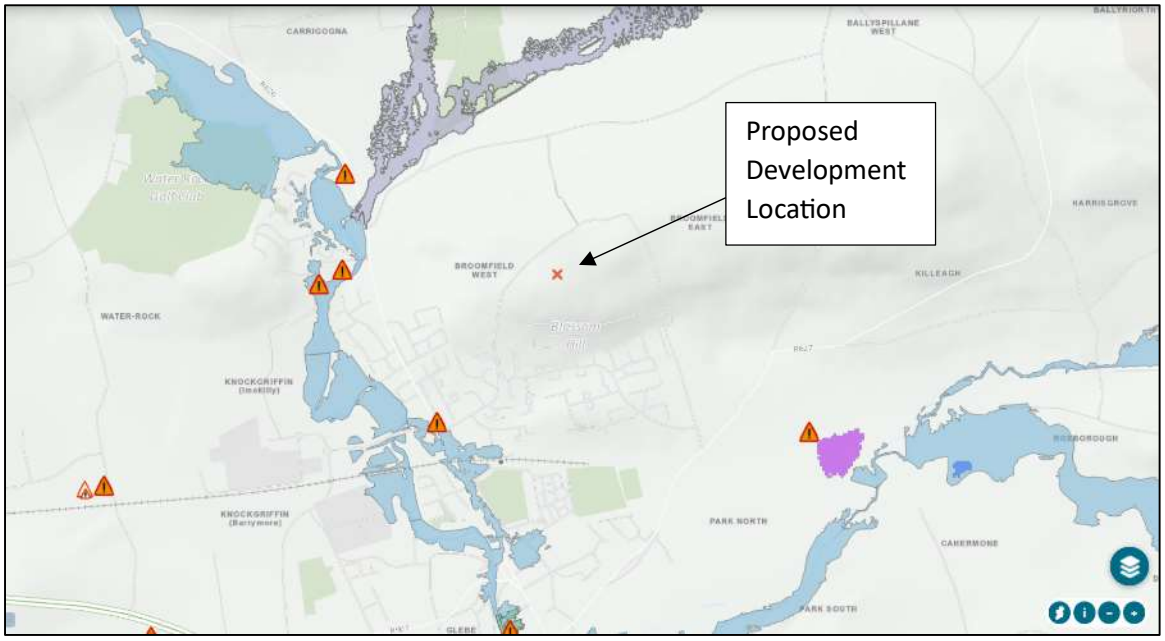


Figure 6.5 OPW National Flood Hazard Mapping

The OPW flood mapping does not predict any flooding at the proposed development site.
Figure 6.4 shows a 0.1% AEP (1:1000 chance of flooding in any given year) flood level risk of 8.770m AOD at the nearest Owenacurra river node point. As noted above the lowest point of the subject site is 29.60m AOD.

The Flood hazard mapping in Figure 6.5 shows one flood incident, associated with river flooding away from the site and well below the site level. This map also shown Geological Survey of Ireland Maximum Historic Groundwater Flooding. There is no record of ground water flooding at the subject site.

6.7.2 Geological Survey of Ireland (GSI)

GSI produce a series of maps on their interactive site GSI.ie. These show site soils and geology details along with Groundwater, Aquifer, Groundwater Vulnerability and Soils Permeability data. This data was consulted as part of the Flood Risk Assessment.

Soils data in Figure 6.6 shows that the site is primarily comprised of Till derived from Devonian sandstones. Figure 6.7 shows bedrock geology. This is classed as mudstone, sandstone and thin limestone.
Figure 6.8 shows the site to be at a location described as a locally important aquifer with bedrock which is moderately productive. The site is north of a regionally important karstified aquifer which runs from west of Cork city through Little Island and on towards Youghal.

The GSI mapping shows the underlying soils to be non-karst. There is no record of water associated with wells or springs at this locations

Figure 6.6 GSI – Quaternary Sediments map

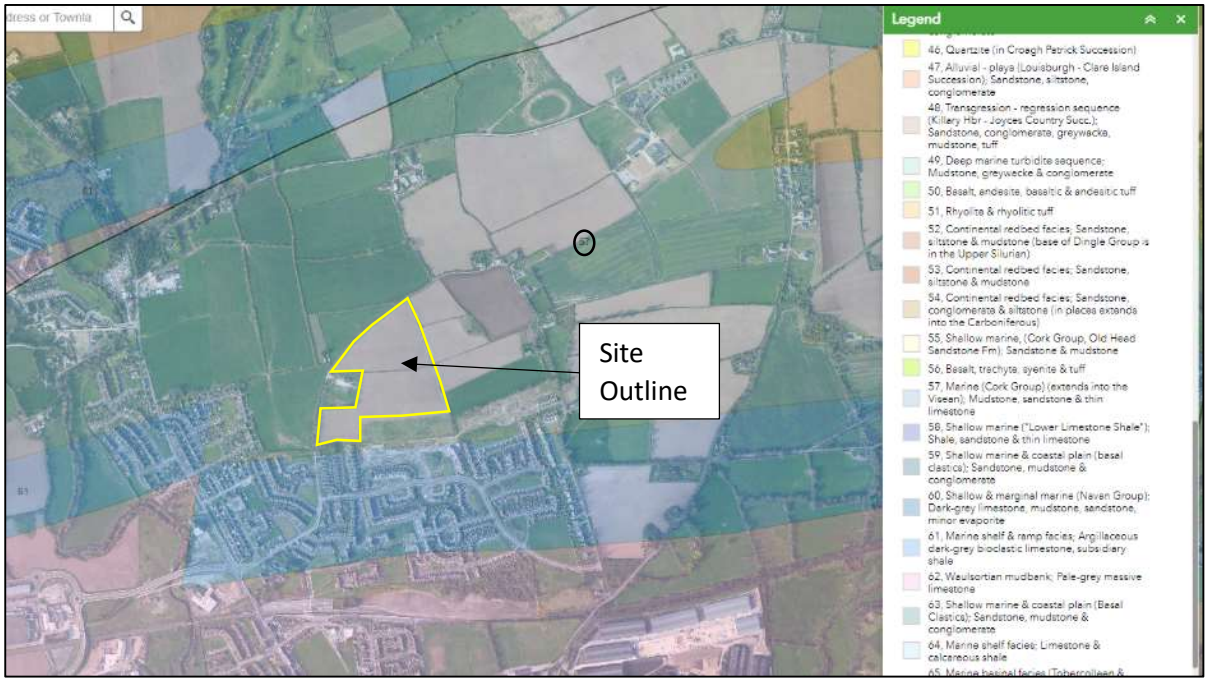


Figure 6.7 GSI – Bedrock Geology

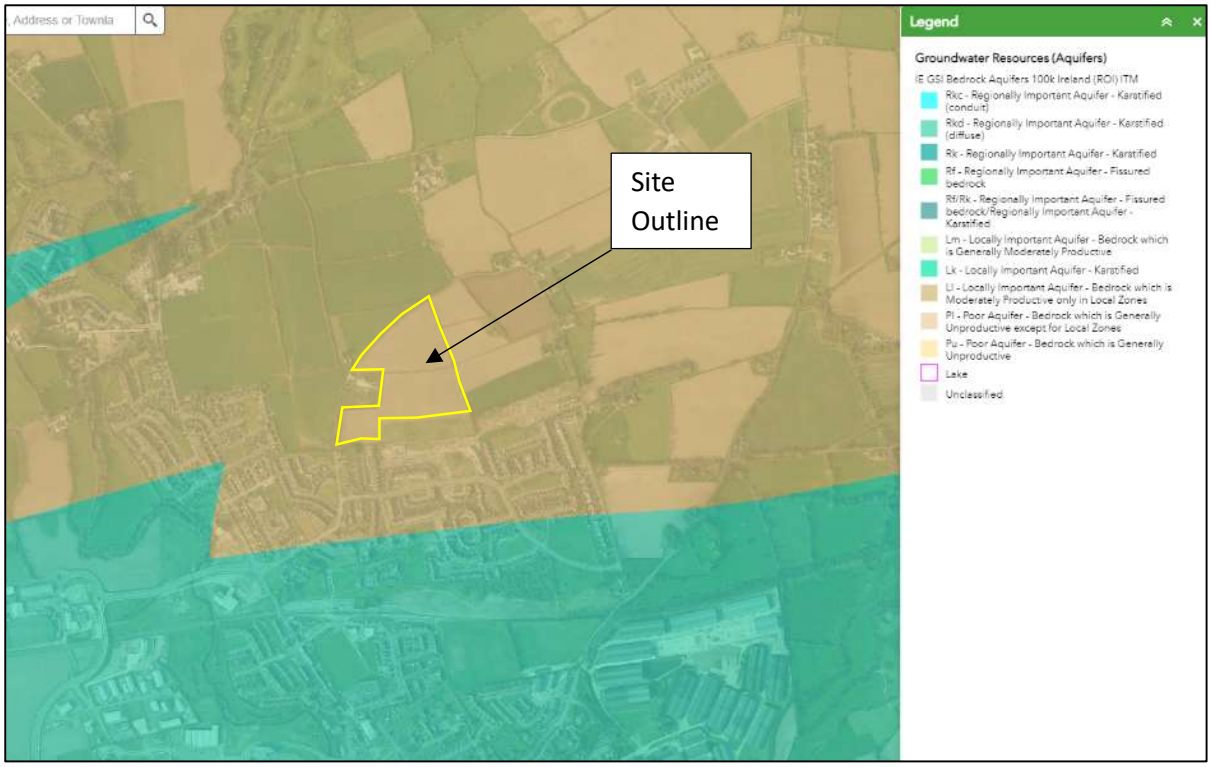


Figure 6.8 – GSI Groundwater Resources (Aquifers)

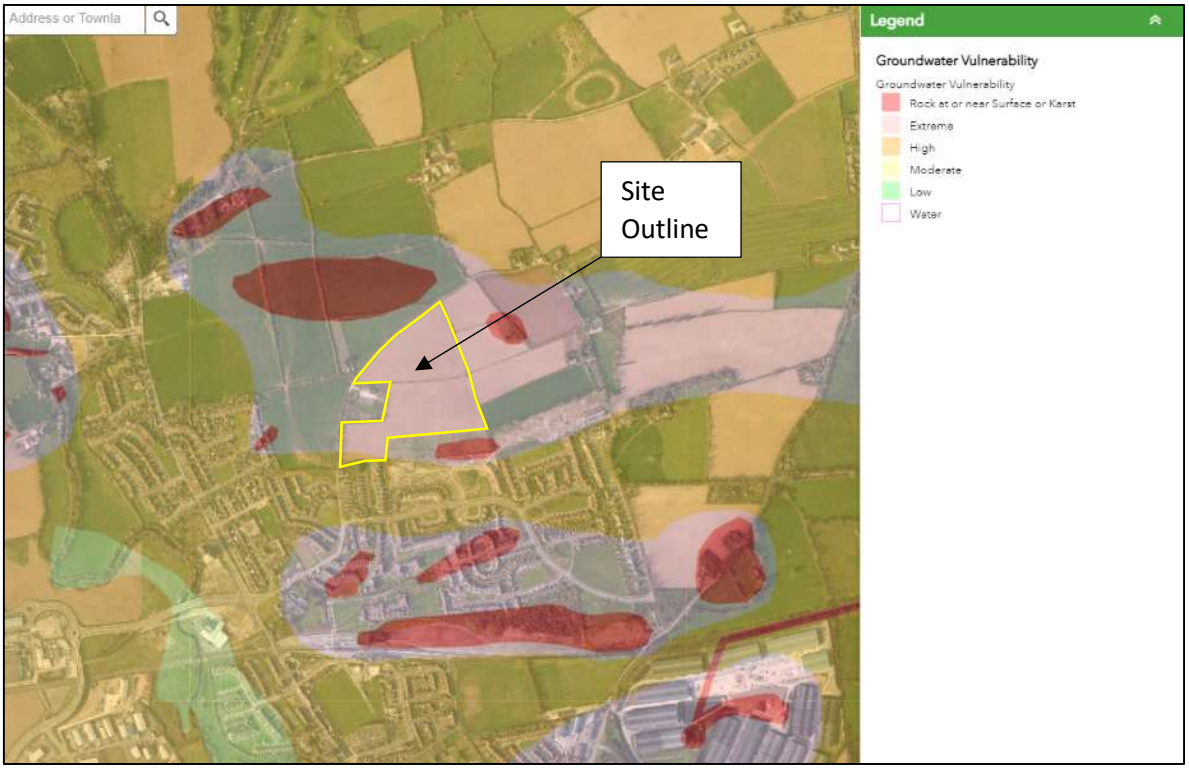


Figure 6.9 – GSI Groundwater Vulnerability

6.7.3 Historic Mapping

Both 6" and 25" historic mapping was consulted in relation to the proposed development site. No record relating to flooding, springs or watercourses are noted on this mapping.

6.8 Initial Flood Risk Assessment Summary

From the information reviewed no risk is considered associated with fluvial flooding events. It is also considered that there is no risk associated with the geology of the site and potential groundwater issues. It is further considered that sufficient data in relation to both these potential sources is available, and has been reviewed, to enable this assessment.
It is considered from the Initial Flood Risk Assessment that a flood risk exists at the proposed development location in relation to overland water flow or overflow of drainage infrastructure during significant rainfall events. A detailed Flood Risk Assessment in relation to this aspect thus follows.

6.9 *STAGE 3* - Detailed Flood Risk Assessment

An assessment of overland water flow and overflow or exceedance of drainage infrastructure is deemed necessary for the proposed development. The proposed site has moderately steep topography which will be modified as part of the design to accommodate regulation-compliant circulation routes and to provide level areas for infrastructure, but will nevertheless potentially provide downhill run-off routes for excess water associated with extreme rainfall events. To mitigate against this the following measures have been adopted.

6.9.1 Mitigation Measures

The design incorporates various mitigation measures to prevent or limit overland run-off.

- The development is divided into discrete sections for drainage and access. Internal roads run across contours – primarily falling towards the public roadway to the east. There are limited sections of roadway running directly downhill. This limits the gathering of surface water run-off in one area and limits the consequences of excessive build-up and discharge overtopping and surcharging an adjacent area
- The development has four separate exits onto the public roadway and will have separate connections of both the surface and foul water systems into new drainage pipework being laid in the public roadway to the bottom of the sloping public road. The separate sections of sewers including separate discharge points, limits cumulative effects in the drainage systems.
- A detailed SuDS design has been adopted for the surface water system in accordance with the Cork County Development Plan the Greater Dublin Strategic Drainage Study and Code of Practice and SuDS manual CIRIA 753. Interception and treatment at

source has been incorporated to minimise run off into the drainage system. Permeable paving discharging to filter drains and soakaways has been incorporated to each property and to common parking areas.

- Two separate attenuation chambers have been incorporated to attenuate water runoff to greenfield site rates. These chambers are buried sealed concrete structures with lockable and sealed covers.
- Double gullies with individual connections to the drainage system are incorporated at appropriate surface water collection locations
- Raised kerbing or ramps are incorporated at specific locations to prevent excess surface water run-off entering lower areas.
- Raised kerbing is incorporated along all road edges on the downhill side of the roads running across the site.

6.9.2 Hydrological and Hydraulic calculations

- The drainage systems for the development have been designed using Causeway 3D modelling software incorporating hard-surface areas and falls, pipe sizes, materials and gradients to provide an appropriate receiving system for both surface and foul water volumes.
- The drain system modelling has been designed with reference to the Cork County Development Plan and the Greater Dublin Strategic Drainage Study and Code of Practice requirements.
- Appropriate climate change requirements have been incorporated into the design
- Site infiltration testing has been carried out to enable accurate design
- 30 year and 100 year return periods for a variety of event durations have been used for design calculations
- The receiving surface water network downstream has been separately modelled to confirm capacity for receipt of runoff. See Surface Water design section

6.9.3 Supporting Information

- A drawing showing the relevant mitigation measures incorporated into the development is attached with this report. Drawings 22/6372-P-1321 +1322.
- Full surface and foul water modelling design calculation are included as part of the Surface and Foul design in Appendix A & Appendix F
- A full set of design drawings for the proposed development is attached with this report

6.10 Pluvial Exceedance

The surface water drainage strategy has been assessed for a pluvial exceedance event. Exceedance routes have been reviewed for all roads. Typically an exceedance event will be triggered by a short high intensity rainfall period.
Roads throughout have 150mm high kerbing which will direct overflow waters downhill and away from properties. There are a number of locations where ponding of excess runoff is possible with a potential risk to properties. These vulnerable locations within the development are shown below are assessed individually hereunder.

Figure 6.10 **Plan of site showing potential vulnerable locations during a pluvial exceedance event**

Location 'A'

The north-western courtyard housing has a fall from the high point of the development to the eastern boundary of the courtyard. The area of estate roadway passing the courtyard entrance where exceedance may occur is shown highlighted. A raised table entry is incorporated at the entrance to ensure surface water from the estate road does not enter the courtyard area. Within the courtyard itself any surface water exceedance that is not drained by the permeable paving will pass to the filter drain at the lower end.

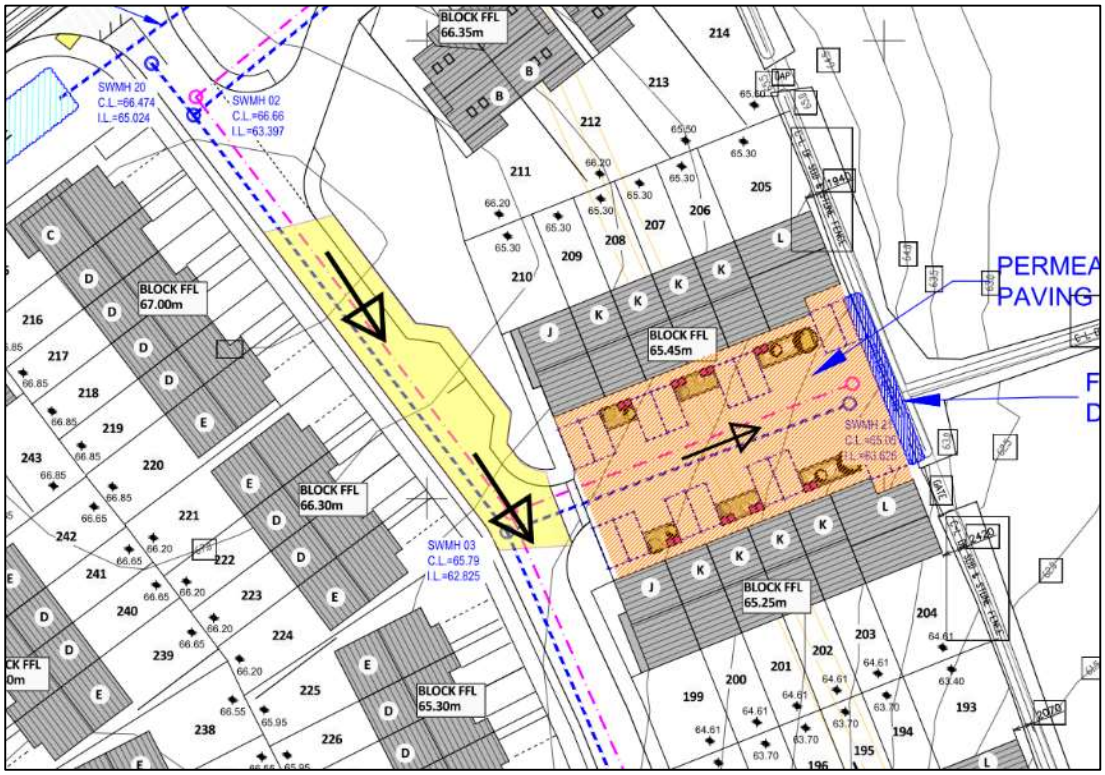


Figure 6.11 **Location A - detail**

Location 'B'

The courtyard housing at this location has a fall from the high point of the development to the eastern boundary of the courtyard. The estate roadway falls from two directions towards the entry point of the courtyard. A raised table entry is incorporated at the entrance of the courtyard to ensure surface water from the estate road does not enter the courtyard area. The SWMH04 manhole at this location will be fitted with D400 round grating cover and two gullys will be situated at the lower corner. The kerb at the lower road edge will be kept full height as far as the driveway point of House No 186. The top of the raised table is 290mm below the FFL of this house. Within the courtyard any surface water exceedance that is not drained by the permeable paving will pass to the filter drain at the lower end.
The filter drain capacity is outlined in section 5.11.2 above.

Figure 6.12 **Location B - detail**

Location 'C'

Location C is a hammerhead cul-de-sac situated above the main east-west retaining wall.
The roadway south of dwellings 159 to 175, shown coloured yellow below, contribute to the lowest collection point.
The lowest road level is at 59.45 AOD at MH SWMH61. This manhole has been added at this location and will be fitted with a round grating cover to allow maximum collection of storm water runoff. A double gully system will also be installed at this location.
The hammerhead is just north of the east-west retaining wall. This wall is constructed with a vertical filter drain 300mm wide over its full height, see drawing P-1110, which will take exceedance overflow. The retaining wall has a 500mm high upstand which will act as a retention location for exceedance ponding. The top of retaining wall level at this location is 60.10 allowing a ponding depth of up to 650mm depth. This is below the FFL of the block of houses to the north and thus these dwellings are protected.
The retained water area as may occur in an exceedance event is shaded in blue on the below location 'C' detail.
This has a 667sqm area at average depth of 0.325m giving a retained volume of 217m³. The contributing area of roadway is 710sqm
Referring to Section 5.11 above a 1:100 year storm for 15min duration gives a 107.2mm rainfall event. This contributes a volume of 76 m³ for the storm event which is less than retention volume. Therefore there is no risk to property.

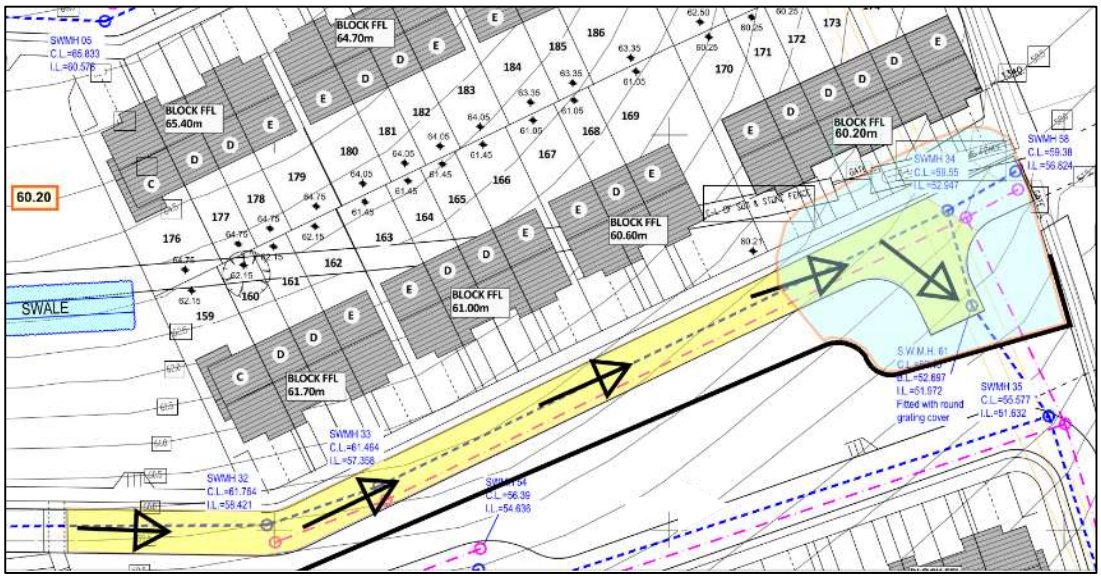


Figure 6.13 **Location C – detail**

Location 'D'

This location is at a pedestrian crossing below the main east west retaining wall.
The roadway will have a raised table at the pedestrian crossing to prevent exceedance run off continuing westward to the end of this cul de sac roadway. Any surcharge of exceedance rainwater at this location will be directed south along the pedestrian pathway away from the adjacent dwellings, by ensuring the south side kerbing is at a lower level than the top of the raised table crossing. Road gullys will also be incorporated at this location.

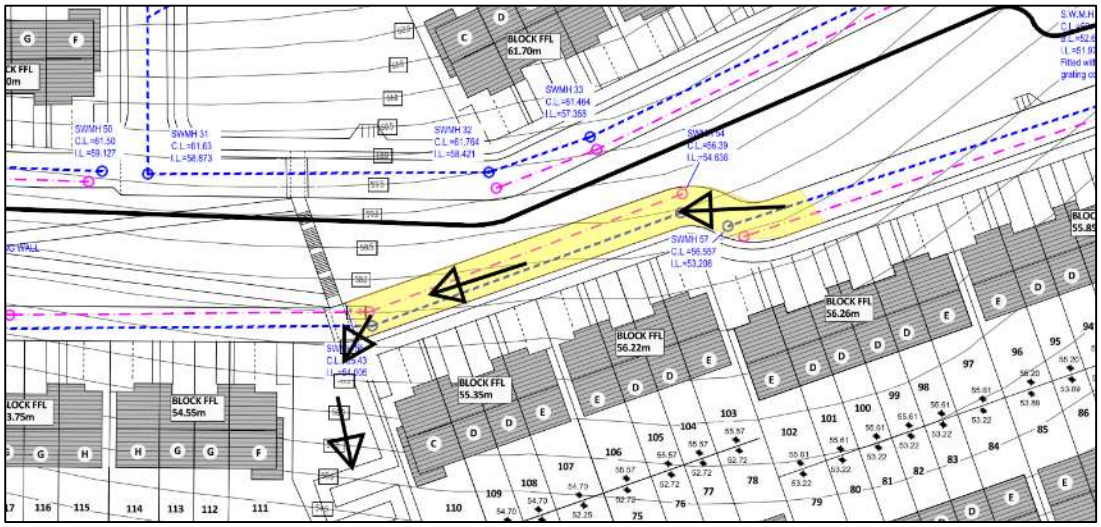


Figure 6.14 **Location D detail**

Location 'E'

Location E is a hammerhead cul-de-sac situated above the main east-west retaining wall.
The estate roads shown coloured yellow below, contribute to the lowest collection point.
The lowest road level is at 59.38m AOD at MH SWMH62. This manhole has been added at this location and will be fitted with a round grating cover to allow maximum collection of storm water runoff. A double gully system will also be installed at this location.
The hammerhead is just north of the east-west retaining wall. This wall is constructed with a vertical filter drain 300mm wide over its full height, see drawing P-1110, which will take exceedance overflow. The retaining wall has a 500mm high upstand which will act as a retention location for exceedance ponding. The top of retaining wall level at this location is 60.00m AOD allowing a ponding depth of up to 650mm depth. This is below the FFL of the block of houses to the north and thus these dwellings are protected.
The retained water area as may occur in an exceedance event is shaded in blue on the below section E detail.
This has a 399 sqm area at average depth of 0.325m giving a retained volume of 130m³.
The contributing area of roadway is 925sqm
Referring to Section 5.11 above 1:100 year storm for 15min duration gives a 107.2mm rainfall event. This contributes a volume of 99m³ for the storm event which is less than retention volume. Therefore there is no risk to property.

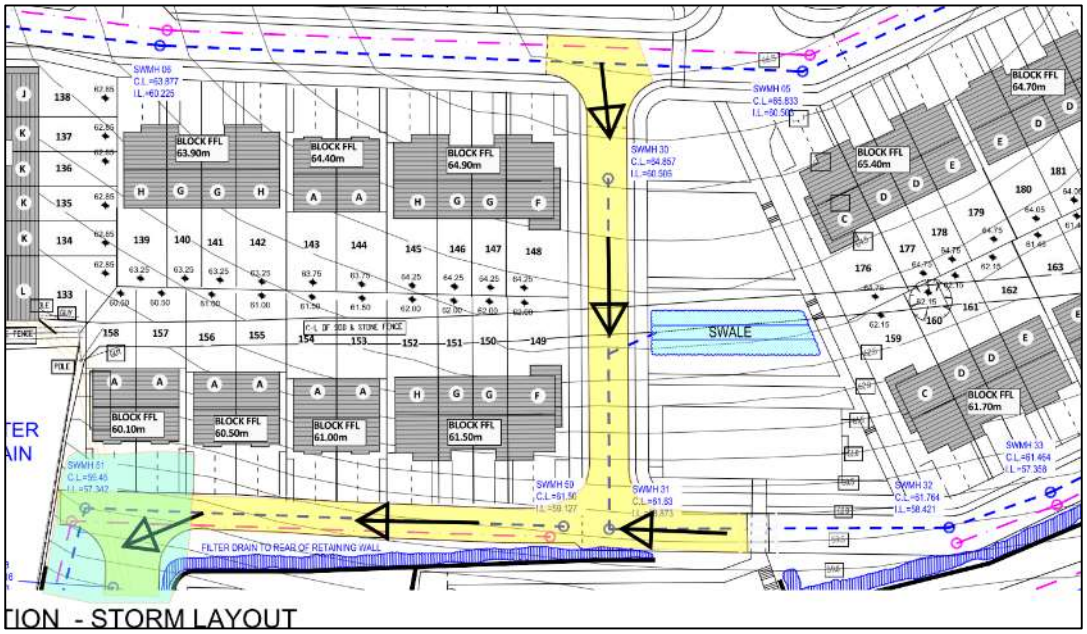


Figure 6.15 **Location E detail**

Location 'F'

Location E is a hammerhead cul-de-sac situated below the main east-west retaining wall.
The estate roads shown coloured yellow below, contribute to the lowest collection point.
The lowest road level is at 52.38m AOD at MH SWMH52. This manhole will be fitted with a round grating cover to allow maximum collection of storm water runoff. A double gully system will also be installed at this location.
The drainage pipework from manholes SWMH 51 to 52 to 53 to 41 has been upsized from 225mm dia to 300mm dia.
The contributing road area is 605 sqm
The above referenced drainage pipework also partly serves the upper roadway as outlined in location E above, being an area of 925 sqm
If we conservatively take the two areas being fully served by this element of the SW network
Total area served is 1530sqm

Taking a 1:100 year event giving 107.2mm of rainfall
Runoff $Q = Aki$ = 1,530 x 0.9 x 0.1072 = 147m³/hr or 41L/s
300dia pipe capacity at installed falls of 1:5.5 = 500L/s
Installed pipework has adequate capacity to cater for a 1:100 year event

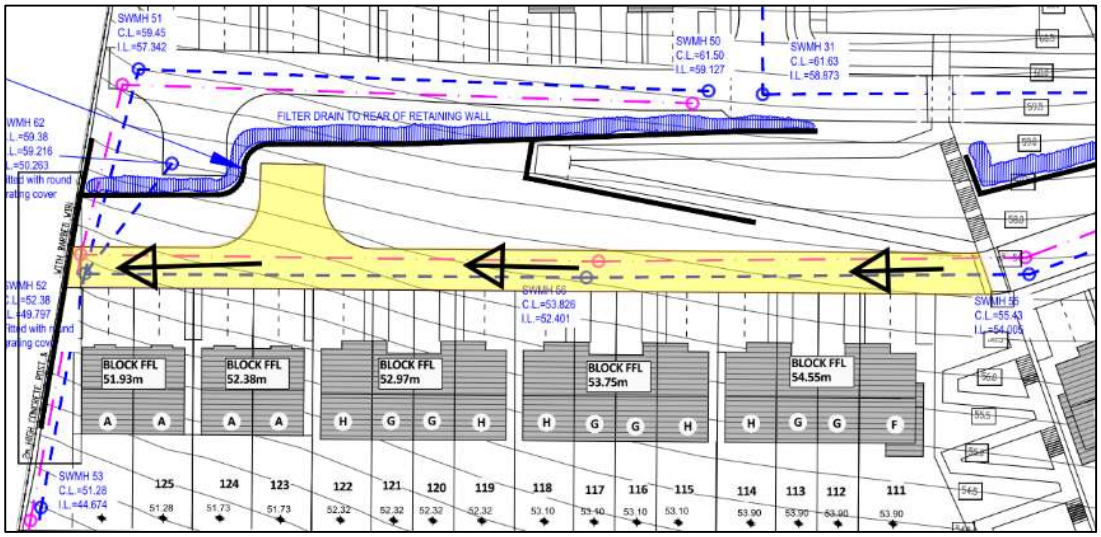


Figure 6.16 **Location F detail**

6.11 Conclusion

The proposed development is within a Flood Zone 'C' and is considered appropriate for this site location.
The risk of overland water flow or exceedance of the proposed infrastructure has been considered and appropriate measures are incorporated into the design to mitigate against this risk.

Appendix A:
Surface Water Drainage - Design Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	60.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
30	0.017	60.00	64.857	1200	588101.671	575099.415	4.351
31	0.073	60.00	61.630	1200	588101.801	575050.376	2.757
32	0.033	60.00	61.764	1200	588149.382	575050.602	3.343
33	0.029	60.00	61.464	1200	588163.548	575055.533	4.106
34	0.135	60.00	59.550	1200	588235.554	575090.402	2.785
35	0.098	60.00	55.577	1200	588248.389	575064.396	4.063
36	0.049	60.00	53.610	1200	588267.833	575001.849	4.012
37	0.104	60.00	52.070	1350	588198.656	574977.047	2.997
38	0.011	60.00	51.857	1350	588188.632	574979.552	3.780
39	0.074	60.00	50.934	1350	588146.453	574965.064	4.970
40	0.119	60.00	48.320	1350	588056.458	574965.966	3.664
41	0.065	60.00	46.700	1350	588011.360	574964.831	3.533
42	0.034	60.00	45.000	1350	587982.683	574961.150	1.904
43	0.119	60.00	40.740	1350	587909.442	574950.451	1.575
44	0.053	60.00	35.422	1500	587908.172	574915.301	2.816
45	0.096	60.00	35.614	1500	587926.221	574904.484	5.141
46	0.139	60.00	33.640	1500	587922.873	574869.360	3.594
47	0.036	60.00	33.300	1800	587912.593	574865.443	3.632
48			31.300	1200	587897.007	574866.909	2.843
49			30.200	1500	587886.418	574863.818	1.766
58		60.00	59.380	1200	588244.174	575095.362	2.556
57	0.010	60.00	56.557	1200	588182.752	575043.109	3.349
50		60.00	61.500	1200	588095.446	575050.761	2.373
51	0.088	60.00	59.450	1200	588028.495	575053.328	2.108
52	0.072	60.00	52.380	1200	588022.269	575029.250	2.583
53			51.280	1200	588017.024	575001.813	6.606
54		60.00	56.391	1200	588176.197	575044.968	1.755
55	0.073	60.00	55.430	1200	588133.117	575029.230	1.425
56	0.056	60.00	53.826	1200	588081.077	575028.853	1.425
59		60.00	39.710	1200	588002.490	574913.929	5.848
60		60.00	36.750	1200	588003.372	574879.543	4.023
61			58.078	1200	588237.755	575078.327	5.194
62		60.00	40.720	1200	587993.647	574925.998	1.300

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	30	31	49.039	0.600	60.506	58.873	1.633	30.0	225	30.00	50.0
1.001	31	32	47.582	0.600	58.873	58.421	0.452	105.3	225	30.00	50.0
1.002	32	33	15.000	0.600	58.421	57.358	1.063	14.1	225	30.00	50.0
1.003	33	34	80.004	0.600	57.358	56.765	0.593	135.0	225	30.00	50.0
1.004	34	61	12.274	0.600	56.765	52.884	3.881	3.2	225	30.00	50.0
1.006	35	36	65.500	0.600	51.514	49.673	1.841	35.6	225	30.00	50.0
1.007	36	37	73.489	0.600	49.598	49.073	0.525	140.0	300	30.00	50.0
1.008	37	38	10.332	0.600	49.073	48.077	0.996	10.4	300	30.00	50.0
1.009	38	39	44.598	0.600	48.077	45.964	2.113	21.1	300	30.00	50.0
1.010	39	40	90.000	0.600	45.964	44.731	1.232	73.0	300	30.00	50.0
1.011	40	41	45.112	0.600	44.656	44.517	0.139	324.5	375	30.00	50.0
1.012	41	42	28.912	0.600	43.167	43.096	0.071	407.2	450	30.00	50.0
1.013	42	43	74.018	0.600	43.096	39.165	3.931	18.8	375	30.00	50.0
1.014	43	44	35.173	0.600	39.165	32.606	6.559	5.4	375	30.00	50.0
1.015	44	45	21.042	0.600	32.606	30.473	2.133	9.9	375	30.00	50.0
1.016	45	46	35.283	0.600	30.473	30.046	0.427	82.7	375	30.00	50.0
1.017	46	47	11.001	0.600	30.046	29.668	0.378	29.1	375	30.00	50.0
1.018	47	48	15.655	0.600	29.668	28.607	1.062	14.7	375	30.00	50.0
1.019	48	49	11.031	0.600	28.457	28.434	0.023	479.6	525	30.00	50.0
2.000	58	34	9.945	0.600	56.824	56.765	0.059	168.6	225	30.00	50.0
3.000	57	35	69.003	0.600	53.208	52.801	0.407	169.5	225	30.00	50.0
5.000	50	51	67.000	0.600	59.127	57.417	1.710	39.2	225	30.00	50.0
5.001	51	52	24.870	0.600	57.342	49.797	7.545	3.3	300	30.00	50.0
4.003	52	53	27.934	0.600	49.797	44.674	5.122	5.5	300	30.00	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.396	95.3	2.3	4.126	2.532	0.017	0.0	24	1.017
1.001	1.273	50.6	12.2	2.532	3.118	0.090	0.0	75	1.053
1.002	3.501	139.2	16.6	3.118	3.881	0.123	0.0	52	2.380
1.003	1.123	44.7	20.5	3.881	2.560	0.151	0.0	107	1.099
1.004	7.411	294.7	38.8	2.560	4.969	0.286	0.0	55	5.184
1.006	2.200	87.5	53.5	3.838	3.712	0.395	0.0	127	2.305
1.007	1.327	93.8	60.2	3.712	2.697	0.444	0.0	175	1.405
1.008	4.908	346.9	74.3	2.697	3.480	0.548	0.0	94	3.940
1.009	3.437	242.9	75.8	3.480	4.670	0.559	0.0	115	3.047
1.010	1.842	130.2	85.9	4.670	3.289	0.634	0.0	178	1.963
1.011	1.000	110.4	102.0	3.289	1.808	0.752	0.0	286	1.129
1.012	1.001	159.2	150.0	3.083	1.454	1.107	0.0	349	1.131
1.013	4.191	462.9	154.6	1.529	1.200	1.141	0.0	149	3.790
1.014	7.866	868.8	170.7	1.200	2.441	1.260	0.0	112	6.159
1.015	5.797	640.2	177.9	2.441	4.766	1.313	0.0	134	4.987
1.016	1.993	220.1	191.0	4.766	3.219	1.409	0.0	271	2.232
1.017	3.370	372.2	209.9	3.219	3.257	1.548	0.0	202	3.467
1.018	4.738	523.3	214.8	3.257	2.318	1.585	0.0	167	4.517
1.019	1.016	219.9	214.8	2.318	1.241	1.585	0.0	423	1.150
2.000	1.004	39.9	0.0	2.331	2.560	0.000	0.0	0	0.000
3.000	1.001	39.8	1.4	3.124	2.551	0.010	0.0	29	0.469
5.000	2.096	83.3	0.0	2.148	1.808	0.000	0.0	0	0.000
5.001	8.717	616.2	11.9	1.808	2.283	0.088	0.0	28	3.465
4.003	6.774	478.8	39.2	2.283	6.306	0.289	0.0	58	4.149

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.004	53	41	37.413	0.600	44.674	43.317	1.358	27.6	300	30.00	50.0
4.000	54	55	45.865	0.600	54.636	54.005	0.631	72.7	225	30.00	50.0
4.001	55	56	52.041	0.600	54.005	52.401	1.604	32.4	225	30.00	50.0
4.002	56	52	58.809	0.600	52.401	50.955	1.446	40.7	225	30.00	50.0
7.000	59	45	76.852	0.600	33.862	33.409	0.453	169.7	225	30.00	50.0
8.000	60	46	81.141	0.600	32.727	32.215	0.512	158.5	225	30.00	50.0
1.005	61	35	17.526	0.600	52.884	51.514	1.369	12.8	225	30.00	50.0
6.000	62	44	86.142	0.600	39.420	32.881	6.539	13.2	100	30.00	50.0

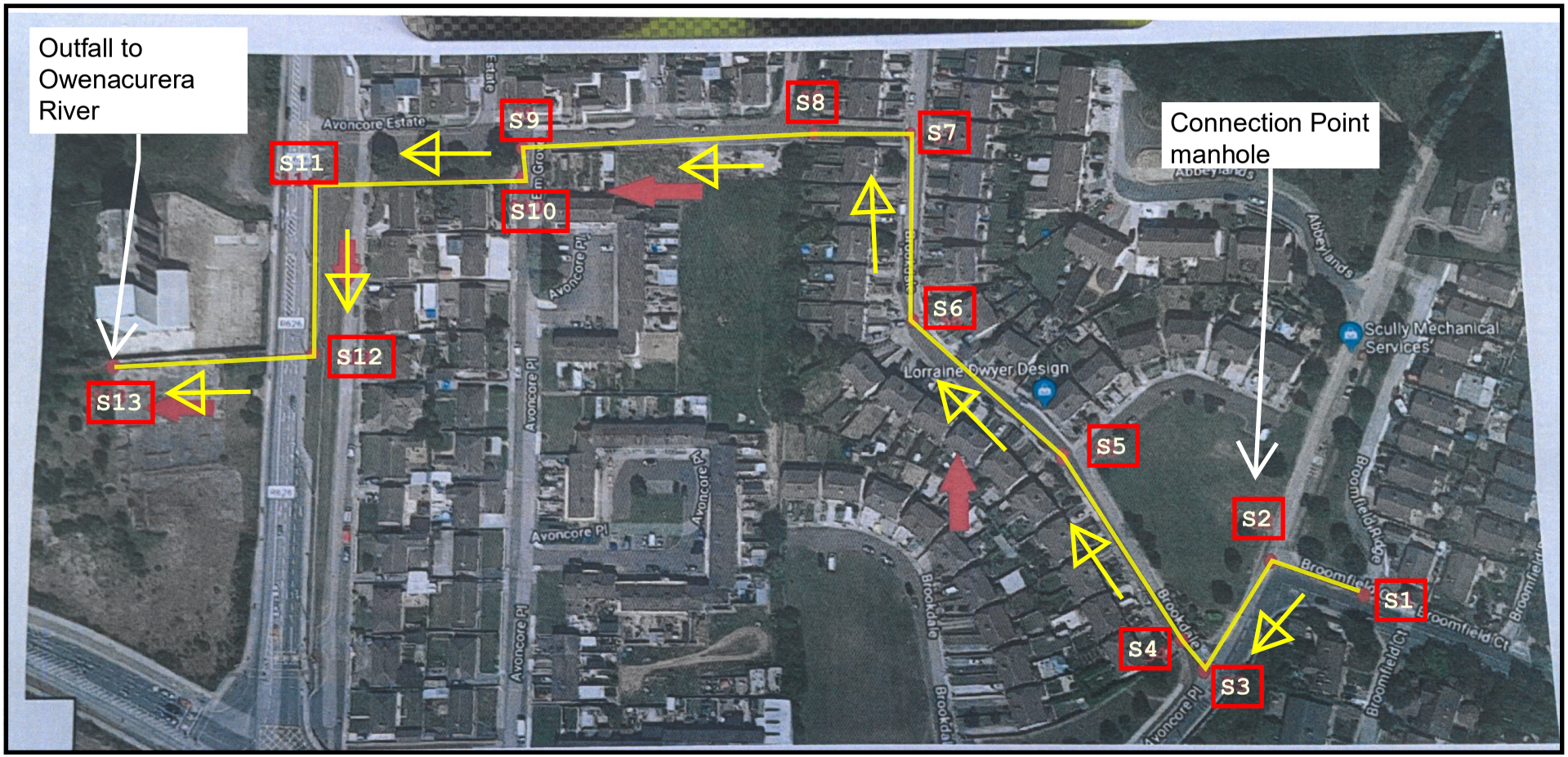
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.004	3.006	212.5	39.2	6.306	3.083	0.289	0.0	87	2.315
4.000	1.535	61.0	0.0	1.530	1.200	0.000	0.0	0	0.000
4.001	2.305	91.6	9.9	1.200	1.200	0.073	0.0	50	1.519
4.002	2.057	81.8	17.5	1.200	1.200	0.129	0.0	71	1.649
7.000	1.001	39.8	0.0	5.623	1.980	0.000	0.0	0	0.000
8.000	1.036	41.2	0.0	3.798	1.200	0.000	0.0	0	0.000
1.005	3.677	146.2	38.8	4.969	3.838	0.286	0.0	79	3.116
6.000	2.140	16.8	0.0	1.200	2.441	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	49.039	30.0	225	Circular	64.857	60.506	4.126	61.630	58.873	2.532
1.001	47.582	105.3	225	Circular	61.630	58.873	2.532	61.764	58.421	3.118
1.002	15.000	14.1	225	Circular	61.764	58.421	3.118	61.464	57.358	3.881
1.003	80.004	135.0	225	Circular	61.464	57.358	3.881	59.550	56.765	2.560
1.004	12.274	3.2	225	Circular	59.550	56.765	2.560	58.078	52.884	4.969
1.006	65.500	35.6	225	Circular	55.577	51.514	3.838	53.610	49.673	3.712
1.007	73.489	140.0	300	Circular	53.610	49.598	3.712	52.070	49.073	2.697
1.008	10.332	10.4	300	Circular	52.070	49.073	2.697	51.857	48.077	3.480
1.009	44.598	21.1	300	Circular	51.857	48.077	3.480	50.934	45.964	4.670
1.010	90.000	73.0	300	Circular	50.934	45.964	4.670	48.320	44.731	3.289
1.011	45.112	324.5	375	Circular	48.320	44.656	3.289	46.700	44.517	1.808
1.012	28.912	407.2	450	Circular	46.700	43.167	3.083	45.000	43.096	1.454

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	30	1200	Manhole	Adoptable	31	1200	Manhole	Adoptable
1.001	31	1200	Manhole	Adoptable	32	1200	Manhole	Adoptable
1.002	32	1200	Manhole	Adoptable	33	1200	Manhole	Adoptable
1.003	33	1200	Manhole	Adoptable	34	1200	Manhole	Adoptable
1.004	34	1200	Manhole	Adoptable	61	1200	Manhole	Adoptable
1.006	35	1200	Manhole	Adoptable	36	1200	Manhole	Adoptable
1.007	36	1200	Manhole	Adoptable	37	1350	Manhole	Adoptable
1.008	37	1350	Manhole	Adoptable	38	1350	Manhole	Adoptable
1.009	38	1350	Manhole	Adoptable	39	1350	Manhole	Adoptable
1.010	39	1350	Manhole	Adoptable	40	1350	Manhole	Adoptable
1.011	40	1350	Manhole	Adoptable	41	1350	Manhole	Adoptable
1.012	41	1350	Manhole	Adoptable	42	1350	Manhole	Adoptable

Appendix B:
Surface Water Receiving Network – CCTV Survey



Surface Water Receiving Network - Munster Drain Survey Manhole Schedule

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wrc

Project

Project Name:	Broomfield Court, Midleton
Project Description:	Surface Water CCTV Survey
Project Number:	KM.04.19.67
Project Date:	05/04/2019
Project Standard:	MSCC4 Sewers & Drainage GB (SRM4 Scoring)

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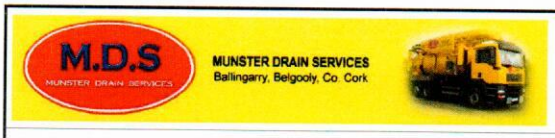

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Project Information

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

Client

Company: M.H.L Consulting Engineers
Contact: Shane Moriarty

Contractor

Company: Munster Drain Services
Contact: Office
Phone: 021 - 4770797
Email: info@munsterdrain.com

MUNSTER DRAIN SERVICES
Ballingarry, Belgooly, Co. Cork

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Scoring Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

Structural Defects

Grade 3: Best practice suggests consideration should be given to repairs in the medium term.

Grade 4: Best practice suggests consideration should be given to repairs to avoid a potential collapse.

Grade 5: Best practice suggests that this pipe is at risk of collapse at any time. Urgent consideration should be given to repairs to avoid total failure.

Section	PLR	Grade	Description
9	S7X	4	Fracture spiral from 9 o'clock to 3 o'clock

Service / Operational Condition

Grade 3: Best practice suggests consideration should be given to maintenance activities in the medium term.

Grade 4: Best practice suggests consideration should be given to maintenance activity to avoid potential blockages.

Grade 5: Best practice suggests that this pipe is at a high risk of backing up or causing flooding.

Section	PLR	Grade	Description
6	S5X	5	Connection intruding at 1 o'clock, diameter: 100mm, intrusion: 95%
7	S6X	5	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 80%
8	S5X	5	Connection intruding at 11 o'clock, diameter: 100mm, intrusion: 95%

Abandoned Surveys

Section	PLR	Description
6	S5X	Survey abandoned
8	S5X	Survey abandoned
10	S8X	Survey abandoned
11	S8X	Survey abandoned

Information

These scoring summaries are based on the SRM grading from the WRc.

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Section Profile

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

Circular, 450 mm

Section	Upstream Node	Downstream Node	Date	Road	Pipe Material	Total Length	Inspected Length
2	S1	S2	05/04/2019	Broomfield	Polyvinyl chloride	13.36 m	13.36 m
3	S2	S3	05/04/2019	Avoncore Place	Polyvinyl chloride	34.89 m	34.89 m
4	S4	S5	05/04/2019	Brookdale	Concrete	65.17 m	65.17 m
5	S3	S4	05/04/2019	Brookdale	Polyvinyl chloride	14.68 m	14.68 m

Total: 4 Inspections x Circular 450 mm = 128.10 m Total Length and 128.10 m Inspected Length

Circular, 600 mm

Section	Upstream Node	Downstream Node	Date	Road	Pipe Material	Total Length	Inspected Length
1	S11	S12	05/04/2019	R626	Concrete	55.46 m	55.46 m
7	S6	S7	05/04/2019	Brookdale	Concrete	61.18 m	61.18 m
9	S7	S8	05/04/2019	Avoncore Estate	Concrete	31.38 m	31.38 m
12	S9	S10	05/04/2019	Elm Grove	Concrete	9.92 m	9.92 m
13	S10	S11	05/04/2019	Avoncore Estate	Concrete	67.57 m	67.57 m
14	S12	S13	05/04/2019	R626	Concrete	68.87 m	68.87 m

Total: 6 Inspections x Circular 600 mm = 294.38 m Total Length and 294.38 m Inspected Length

Total: 10 Inspections = 422.48 m Total Length and 422.48 m Inspected Length

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

Number of sections	14
Total length of sewer network	588.62 m
Total length of inspections	588.62 m
Total length of abandoned inspections	0.00 m
Total abandoned inspections	4
Number of section inspection photos	96
Number of section inspection videos	14
Number of section inspection scans	0
Number of section inclination measurements	0

PLR:	S1X	**Upstream Node:**	S1
Inspection Direction:	Upstream	**Downstream Node:**	S2
Inspected Length:	13.36 m	**Dia/Height:**	450 mm
Total Length:	13.36 m	**Pipe Material:**	Polyvinyl chloride

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S2
2	13.36	MHF	Finish node type, manhole, reference number: S1

PLR:	S2X	**Upstream Node:**	S2
Inspection Direction:	Downstream	**Downstream Node:**	S3
Inspected Length:	34.89 m	**Dia/Height:**	450 mm
Total Length:	34.89 m	**Pipe Material:**	Polyvinyl chloride

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S2
2	14.35	WL	Water level, 5% of the vertical dimension
3	34.89	MHF	Finish node type, manhole, reference number: S3

PLR:	S3X	**Upstream Node:**	S3
Inspection Direction:	Upstream	**Downstream Node:**	S4
Inspected Length:	14.68 m	**Dia/Height:**	450 mm
Total Length:	14.68 m	**Pipe Material:**	Polyvinyl chloride

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S4
2	1.98	WL	Water level, 20% of the vertical dimension
3	12.99	GP	General photograph taken at this point
4	14.68	MHF	Finish node type, manhole, reference number: S3

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

PLR:	S4X	**Upstream Node:**	S4
Inspection Direction:	Upstream	**Downstream Node:**	S5
Inspected Length:	65.17 m	**Dia/Height:**	450 mm
Total Length:	65.17 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S5
2	0.59	CN	Connection other than junction at 12 o'clock, diameter: 100mm
3	4.16	CN	Connection other than junction at 12 o'clock, diameter: 150mm
4	8.54	CN	Connection other than junction at 12 o'clock, diameter: 100mm
5	16.53	CN	Connection other than junction at 12 o'clock, diameter: 100mm
6	22.05	CN	Connection other than junction at 12 o'clock, diameter: 150mm
7	24.68	CN	Connection other than junction at 12 o'clock, diameter: 100mm
8	32.38	CN	Connection other than junction at 12 o'clock, diameter: 100mm
9	36.31	CN	Connection other than junction at 12 o'clock, diameter: 150mm
10	38.59	CN	Connection other than junction at 12 o'clock, diameter: 100mm
11	46.36	CN	Connection other than junction at 12 o'clock, diameter: 100mm
12	49.34	CN	Connection other than junction at 12 o'clock, diameter: 100mm
13	58.93	CN	Connection other than junction at 12 o'clock, diameter: 100mm
14	61.19	CN	Connection other than junction at 12 o'clock, diameter: 150mm
15	64.09	CN	Connection other than junction at 12 o'clock, diameter: 100mm
16	65.17	MHF	Finish node type, manhole, reference number: S4

PLR:	S5X	**Upstream Node:**	S5
Inspection Direction:	Downstream	**Downstream Node:**	S6
Inspected Length:	51.90 m	**Dia/Height:**	450 mm
Total Length:	51.90 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S5
2	4.83	CN	Connection other than junction at 12 o'clock, diameter: 100mm
3	17.03	CN	Connection other than junction at 12 o'clock, diameter: 100mm
4	21.52	CN	Connection other than junction at 12 o'clock, diameter: 100mm
5	27.37	CN	Connection other than junction at 12 o'clock, diameter: 100mm
6	34.29	CN	Connection other than junction at 12 o'clock, diameter: 100mm
7	36.11	CN	Connection other than junction at 12 o'clock, diameter: 100mm
8	41.03	CN	Connection other than junction at 12 o'clock, diameter: 100mm
9	49.28	CN	Connection other than junction at 11 o'clock, diameter: 100mm
10	51.22	CXI	Connection intruding at 1 o'clock, diameter: 100mm, intrusion: 95%
11	51.90	SA	Survey abandoned

PLR:	S5X	**Upstream Node:**	S5
Inspection Direction:	Upstream	**Downstream Node:**	S6
Inspected Length:	14.70 m	**Dia/Height:**	450 mm
Total Length:	14.70 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S6

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

No.	m+	Code	Observation
2	0.42	CN	Connection other than junction at 2 o'clock, diameter: 100mm
3	0.84	CXI	Connection intruding at 2 o'clock, diameter: 100mm, intrusion: 20%
4	1.73	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 25%
5	4.75	CN	Connection other than junction at 1 o'clock, diameter: 100mm
6	8.40	CN	Connection other than junction at 2 o'clock, diameter: 100mm
7	14.23	CXI	Connection intruding at 11 o'clock, diameter: 100mm, intrusion: 95%
8	14.70	SA	Survey abandoned

PLR:	S6X	**Upstream Node:**	S6
Inspection Direction:	Downstream	**Downstream Node:**	S7
Inspected Length:	61.18 m	**Dia/Height:**	600 mm
Total Length:	61.18 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S6
2	4.14	CN	Connection other than junction at 12 o'clock, diameter: 100mm
3	4.39	CN	Connection other than junction at 12 o'clock, diameter: 100mm
4	14.22	CN	Connection other than junction at 12 o'clock, diameter: 100mm
5	14.77	CN	Connection other than junction at 12 o'clock, diameter: 100mm
6	18.16	CN	Connection other than junction at 11 o'clock, diameter: 100mm
7	18.17	CN	Connection other than junction at 12 o'clock, diameter: 100mm
8	27.51	CN	Connection other than junction at 12 o'clock, diameter: 100mm
9	27.62	CN	Connection other than junction at 12 o'clock, diameter: 100mm
10	32.56	CN	Connection other than junction at 12 o'clock, diameter: 100mm
11	34.61	CN	Connection other than junction at 12 o'clock, diameter: 100mm
12	41.57	CN	Connection other than junction at 12 o'clock, diameter: 100mm
13	42.14	CN	Connection other than junction at 12 o'clock, diameter: 100mm
14	48.17	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 20%
15	52.98	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 80%
16	53.79	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 50%
17	58.07	CN	Connection other than junction at 12 o'clock, diameter: 100mm
18	61.18	MHF	Finish node type, manhole, reference number: S7

PLR:	S7X	**Upstream Node:**	S7
Inspection Direction:	Downstream	**Downstream Node:**	S8
Inspected Length:	31.38 m	**Dia/Height:**	600 mm
Total Length:	31.38 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S7
2	0.00	GP	General photograph taken at this point
3	0.00	CM	Cracks, multiple from 4 o'clock to 6 o'clock
4	0.00	FS	Fracture spiral from 9 o'clock to 3 o'clock
5	0.07	GP	General photograph taken at this point
6	0.07	SRB	Sealing ring broken from 3 o'clock to 9 o'clock
7	0.37	CS	Cracks, spiral from 12 o'clock to 12 o'clock

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

No.	m+	Code	Observation
8	1.34	CN	Connection other than junction at 12 o'clock, diameter: 100mm
9	3.48	GP	General photograph taken at this point
10	5.72	CN	Connection other than junction at 1 o'clock, diameter: 100mm
11	21.87	CN	Connection other than junction at 12 o'clock, diameter: 100mm
12	31.38	MHF	Finish node type, manhole, reference number: S8

PLR:	S8X	**Upstream Node:**	S8
Inspection Direction:	Downstream	**Downstream Node:**	S9
Inspected Length:	78.81 m	**Dia/Height:**	600 mm
Total Length:	78.81 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S8
2	78.81	SA	Survey abandoned

PLR:	S8X	**Upstream Node:**	S8
Inspection Direction:	Upstream	**Downstream Node:**	S9
Inspected Length:	20.73 m	**Dia/Height:**	600 mm
Total Length:	20.73 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S9
2	20.73	SA	Survey abandoned

PLR:	S9X	**Upstream Node:**	S9
Inspection Direction:	Downstream	**Downstream Node:**	S10
Inspected Length:	9.92 m	**Dia/Height:**	600 mm
Total Length:	9.92 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S9
2	9.92	MHF	Finish node type, manhole, reference number: S10

PLR:	S10X	**Upstream Node:**	S10
Inspection Direction:	Downstream	**Downstream Node:**	S11
Inspected Length:	67.57 m	**Dia/Height:**	600 mm
Total Length:	67.57 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S10
2	61.26	WL	Water level, 10% of the vertical dimension
3	67.57	MHF	Finish node type, manhole, reference number: S11

PLR:	S11X	**Upstream Node:**	S11
Inspection Direction:	Downstream	**Downstream Node:**	S12
Inspected Length:	55.46 m	**Dia/Height:**	600 mm
Total Length:	55.46 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S11
2	7.22	CN	Connection other than junction at 1 o'clock, diameter: 150mm
3	30.65	CN	Connection other than junction at 1 o'clock, diameter: 150mm

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

No.	m+	Code	Observation
4	30.84	CN	Connection other than junction at 1 o'clock, diameter: 150mm
5	53.11	CN	Connection other than junction at 1 o'clock, diameter: 150mm
6	53.16	CN	Connection other than junction at 1 o'clock, diameter: 150mm
7	55.46	MHF	Finish node type, manhole, reference number: S12

PLR:	S12X	**Upstream Node:**	S12
Inspection Direction:	Downstream	**Downstream Node:**	S13
Inspected Length:	68.87 m	**Dia/Height:**	600 mm
Total Length:	68.87 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S12
2	1.65	WL	Water level, 10% of the vertical dimension
3	2.84	CN	Connection other than junction at 12 o'clock, diameter: 150mm
4	12.36	CN	Connection other than junction at 12 o'clock, diameter: 150mm
5	27.79	CN	Connection other than junction at 12 o'clock, diameter: 100mm
6	68.87	MHF	Finish node type, manhole, reference number: S13

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Section Inspection - 05/04/2019 - S1X

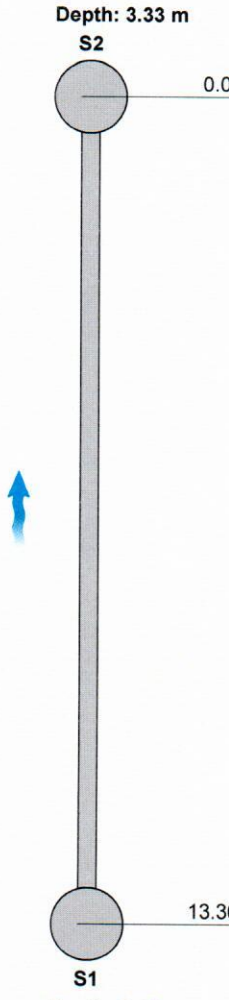
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
2	1	05/04/19	7:05	KM.04.19.67	No Rain Or Snow	Yes	S1X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S1
Road:	Broomfield	**Inspected Length:**	13.36 m	**Upstream Pipe Depth:**	3.150 m
Location:	Road	**Total Length:**	13.36 m	**Downstream Node:**	S2
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	3.330 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	450 mm
Year Constructed:				**Pipe Material:**	Polyvinyl chloride
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:117



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S2	00:00:00		
13.36	MHF	Finish node type, manhole, reference number: S1	00:01:26		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S1X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
2	Upstream	S1X	KM.04.19.67	

S1X_fb6e0b6d-9bc2-4073-a808-d941a78430c0_20190405_072359_148.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S2

S1X_ca35267c-2005-4aaa-a9e6-63c0758e75ec_20190405_072534_741.jpg, 00:01:26, 13.36 m
Finish node type, manhole, reference number: S1

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Section Inspection - 05/04/2019 - S2X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
3	1	05/04/19	7:28	KM.04.19.67	No Rain Or Snow	Yes	S2X
Operator		**Vehicle**		**Camera**	**Preset Length**	**Legal Status**	**Alternative ID**
Kenneth Murray		141		Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S2
Road:	Avoncore Place	**Inspected Length:**	34.89 m	**Upstream Pipe Depth:**	3.330 m
Location:	Road	**Total Length:**	34.89 m	**Downstream Node:**	S3
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.565 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	450 mm
Year Constructed:				**Pipe Material:**	Polyvinyl chloride
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:304	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 3.33 m						
S2						
	0.00	MH	Start node type, manhole, reference number: S2	00:00:00		
	14.35	WL	Water level, 5% of the vertical dimension	00:01:20		
	34.89	MHF	Finish node type, manhole, reference number: S3	00:03:29		
S3						
Depth: 2.57 m						

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S2X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
3	Downstream	S2X	KM.04.19.67	

S2X_2608f175-6544-4e1c-a755-5bcd4680625b_20190405_072911_710.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S2

S2X_3c24dd86-e9c2-4854-a02e-26cc4f794fcc_20190405_073041_501.jpg, 00:01:20, 14.35 m
Water level, 5% of the vertical dimension

S2X_145dd4f1-9c8c-4397-98e5-7cbd74295ccd_20190405_073325_858.jpg, 00:03:29, 34.89 m
Finish node type, manhole, reference number: S3

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Section Inspection - 05/04/2019 - S3X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
5	1	05/04/19	8:14	KM.04.19.67	No Rain Or Snow	Yes	S3X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S3
Road:	Brookdale	**Inspected Length:**	14.68 m	**Upstream Pipe Depth:**	2.565 m
Location:	Road	**Total Length:**	14.68 m	**Downstream Node:**	S4
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.050 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	450 mm
Year Constructed:				**Pipe Material:**	Polyvinyl chloride
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:128	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 2.05 m						
S4						
	0.00	MH	Start node type, manhole, reference number: S4	00:00:00		
	1.98	WL	Water level, 20% of the vertical dimension: due to concrete at joint	00:00:51		
	12.99	GP	General photograph taken at this point: Resin liner	00:05:56		
	14.68	MHF	Finish node type, manhole, reference number: S3	00:06:46		
S3						
Depth: 2.57 m						

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S3X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
5	Upstream	S3X	KM.04.19.67	

S3X_9e923133-f59a-4261-918a-f2247a8f9391_20190405_081548_768.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S4

S3X_51ac9785-3074-40fa-9406-ab5ca25e2d2c_20190405_081701_604.jpg, 00:00:51, 1.98 m
Water level, 20% of the vertical dimension

S3X_e1f5476d-f88c-4819-a01c-ac833c89ea8f_20190405_082226_733.jpg, 00:05:56, 12.99 m
General photograph taken at this point

S3X_3154a530-4788-4cb9-9b2f-c8e0ef97cbe9_20190405_082323_160.jpg, 00:06:46, 14.68 m
Finish node type, manhole, reference number: S3

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Section Inspection - 05/04/2019 - S4X

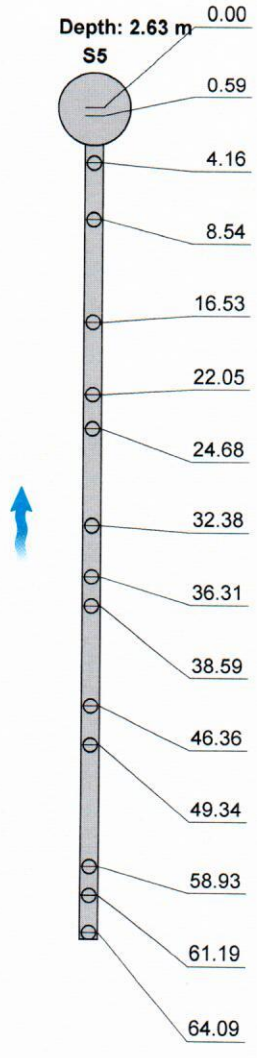
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
4	1	05/04/19	8:01	KM.04.19.67	No Rain Or Snow	Yes	S4X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S4
Road:	Brookdale	**Inspected Length:**	65.17 m	**Upstream Pipe Depth:**	2.050 m
Location:	Road	**Total Length:**	65.17 m	**Downstream Node:**	S5
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.630 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	450 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:562



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S5	00:00:00		
0.59	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:00:11		
4.16	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:00:38		
8.54	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:01:12		
16.53	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:02:01		
22.05	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:02:52		
24.68	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:25		
32.38	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:12		
36.31	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:04:43		
38.59	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:11		
46.36	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:59		
49.34	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:06:25		
58.93	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:07:39		
61.19	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:08:11		
64.09	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:08:39		

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Section Inspection - 05/04/2019 - S4X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
4	1	05/04/19	8:01	KM.04.19.67	No Rain Or Snow	Yes	S4X
Operator		**Vehicle**		**Camera**	**Preset Length**	**Legal Status**	**Alternative ID**
Kenneth Murray		141		Mini-Cam	Not Specified	Not Specified	Not Specified

Scale:	Position [m]	Code	Observation	MPEG	Photo	Grade
	65.17	MHF	Finish node type, manhole, reference number: S4	00:08:55		

S4

Depth: 2.05 m

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S4X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Upstream	S4X	KM.04.19.67	

S4X_6b0fc3f3-69d8-4222-817c-d3ec9f1d921d_20190405_080239_607.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S5

S4X_a5e9ed2b-8f8f-494b-b06d-fe2155b6fd24_20190405_080304_982.jpg, 00:00:11, 0.59 m
Connection other than junction at 12 o'clock, diameter:

S4X_6021ae2c-959a-4f2c-99e0-d2c84a075fe2_20190405_080341_009.jpg, 00:00:38, 4.16 m
Connection other than junction at 12 o'clock, diameter:

S4X_802735c8-86e0-42c0-8b8c-a67a50e5e5f3_20190405_080501_375.jpg, 00:01:12, 8.54 m
Connection other than junction at 12 o'clock, diameter:

S4X_0a309ee2-7cfd-4233-bd52-868781fad4a2_20190405_080558_786.jpg, 00:02:01, 16.53 m
Connection other than junction at 12 o'clock, diameter:

S4X_054fcaef-7066-4d99-b900-6afa1e02cb72_20190405_080704_434.jpg, 00:02:52, 22.05 m
Connection other than junction at 12 o'clock, diameter:

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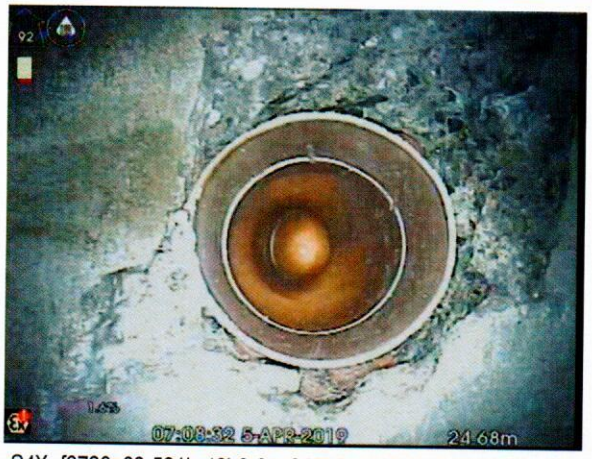
Section Pictures - 05/04/2019 - S4X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Upstream	S4X	KM.04.19.67	



S4X_f6729a63-531b-46b9-9aaf-873fb425f930_20190405_080740_702.jpg, 00:03:25, 24.68 m
Connection other than junction at 12 o'clock, diameter:

S4X_4dd6337d-9aba-4882-aa9d-5cf20b35e773_20190405_080834_359.jpg, 00:04:12, 32.38 m
Connection other than junction at 12 o'clock, diameter:

S4X_8113a11a-517e-4edd-8ac4-bde4a3698e20_20190405_080913_677.jpg, 00:04:43, 36.31 m
Connection other than junction at 12 o'clock, diameter:

S4X_b34d13cd-a11f-4f5a-83bd-292a71613fec_20190405_080949_148.jpg, 00:05:11, 38.59 m
Connection other than junction at 12 o'clock, diameter:

S4X_1c539c1b-af17-430a-a122-eb39745caf70_20190405_081045_894.jpg, 00:05:59, 46.36 m
Connection other than junction at 12 o'clock, diameter:

S4X_70a28ef5-6797-4dd6-b806-d4c54aea946f_20190405_081119_111.jpg, 00:06:25, 49.34 m
Connection other than junction at 12 o'clock, diameter:

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Section Pictures - 05/04/2019 - S4X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Upstream	S4X	KM.04.19.67	

S4X_0e1e6e37-3caa-43e9-b2cf-042f1139d628_20190405_081240_534.jpg, 00:07:39, 58.93 m
Connection other than junction at 12 o'clock, diameter:

S4X_0a9403e3-fb40-4f72-b1bf-ef6ebd8fc1bf_20190405_081320_079.jpg, 00:08:11, 61.19 m
Connection other than junction at 12 o'clock, diameter:

S4X_a38e43f0-4d8b-475b-90dc-9483a57644e7_20190405_081355_262.jpg, 00:08:39, 64.09 m
Connection other than junction at 12 o'clock, diameter:

S4X_bb89ef55-97ee-4461-8fa9-05e0bdeb471d_20190405_081415_982.jpg, 00:08:55, 65.17 m
Finish node type, manhole, reference number: S4

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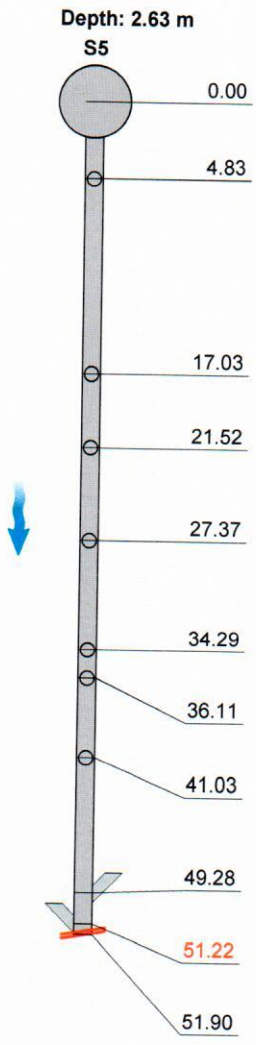
Section Inspection - 05/04/2019 - S5X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
6	1	05/04/19	8:31	KM.04.19.67	No Rain Or Snow	Yes	S5X
Operator		**Vehicle**		**Camera**	**Preset Length**	**Legal Status**	**Alternative ID**
Kenneth Murray		141		Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S5
Road:	Brookdale	**Inspected Length:**	51.90 m	**Upstream Pipe Depth:**	2.630 m
Location:	Road	**Total Length:**	51.90 m	**Downstream Node:**	S6
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.330 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	450 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:452



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S5	00:00:00		
4.83	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:00:30		
17.03	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:01		
21.52	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:30		
27.37	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:08		
34.29	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:51		
36.11	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:12		
41.03	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:45		
49.28	CN	Connection other than junction at 11 o'clock, diameter: 100mm	00:06:34		
51.22	CXI	Connection intruding at 1 o'clock, diameter: 100mm, intrusion: 95%	00:06:56		5
51.90	SA	Survey abandoned: can not pass intrusion	00:07:24		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	10.0	0.2	10.0	5.0

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Section Pictures - 05/04/2019 - S5X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
6	Downstream	S5X	KM.04.19.67	

S5X_3a8da4cf-5542-444f-a34e-e58f58df49c0_20190405_090223_838.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S5

S5X_693240fd-ed56-427d-b066-fe6b68a06725_20190405_090306_660.jpg, 00:00:30, 4.83 m
Connection other than junction at 12 o'clock, diameter:

S5X_bd0ee04a-35e7-4a44-b67f-3794dc58536d_20190405_090545_028.jpg, 00:03:01, 17.03 m
Connection other than junction at 12 o'clock, diameter:

S5X_4b0726a5-1b8e-4719-8026-5574e0baccf4_20190405_090622_341.jpg, 00:03:30, 21.52 m
Connection other than junction at 12 o'clock, diameter:

S5X_e997d85e-513a-4c9e-a330-d3a995be0e1e_20190405_090707_939.jpg, 00:04:08, 27.37 m
Connection other than junction at 12 o'clock, diameter:

S5X_dc88f43e-10f2-439f-90a0-45b58179b8de_20190405_090759_213.jpg, 00:04:51, 34.29 m
Connection other than junction at 12 o'clock, diameter:

Section Pictures - 05/04/2019 - S5X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
6	Downstream	S5X	KM.04.19.67	

S5X_b30b547f-62c6-437a-8a7e-d78a072d496e_20190405_090834_506.jpg, 00:05:12, 36.11 m
Connection other than junction at 12 o'clock, diameter:

S5X_a2af812d-00a0-49d5-82f5-9c2578d3b00a_20190405_090914_929.jpg, 00:05:45, 41.03 m
Connection other than junction at 12 o'clock, diameter:

S5X_5188388e-7b81-4df1-9aaa-194757a45e84_20190405_091014_963.jpg, 00:06:34, 49.28 m
Connection other than junction at 11 o'clock, diameter:

S5X_d9c04386-cfdb-4432-a2e0-6620da3a2084_20190405_091108_192.jpg, 00:06:56, 51.22 m
Connection intruding at 1 o'clock, diameter: 100mm, intrusion:

S5X_56b9a2bb-9e90-4269-8e9d-ab53078964d4_20190405_091158_715.jpg, 00:07:24, 51.90 m
Survey abandoned

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Section Inspection - 05/04/2019 - S5X

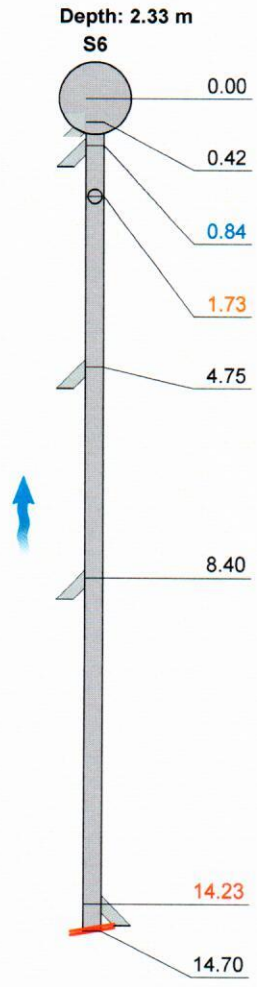
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
8	1	05/04/19	9:38	KM.04.19.67	No Rain Or Snow	Yes	S5X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S5
Road:	Brookdale	**Inspected Length:**	14.70 m	**Upstream Pipe Depth:**	2.630 m
Location:	Road	**Total Length:**	14.70 m	**Downstream Node:**	S6
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.330 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	450 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:128



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S6	00:00:00		
0.42	CN	Connection other than junction at 2 o'clock, diameter: 100mm	00:00:14		
0.84	CXI	Connection intruding at 2 o'clock, diameter: 100mm, intrusion: 20%	00:00:28		3
1.73	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 25%	00:00:43		4
4.75	CN	Connection other than junction at 1 o'clock, diameter: 100mm	00:01:18		
8.40	CN	Connection other than junction at 2 o'clock, diameter: 100mm	00:01:52		
14.23	CXI	Connection intruding at 11 o'clock, diameter: 100mm, intrusion: 95%	00:02:36		5
14.70	SA	Survey abandoned: Survey Complete	00:02:45		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	3	10.0	1.2	17.0	5.0

Section Pictures - 05/04/2019 - S5X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S5X	KM.04.19.67	

S5X_104bc7a0-720a-47f0-9d37-14bde05d9d88_20190405_093909_790.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S6

S5X_03b0457f-bb8e-468f-9713-1786b92e3fda_20190405_093935_556.jpg, 00:00:14, 0.42 m
Connection other than junction at 2 o'clock, diameter: 100mm

S5X_b7966323-76b6-459a-b1e1-98e9956461e4_20190405_094005_065.jpg, 00:00:28, 0.84 m
Connection intruding at 2 o'clock, diameter: 100mm, intrusion:

S5X_62aa0cc2-107c-47cd-adfc-3f77a6d3f8cb_20190405_094031_971.jpg, 00:00:43, 1.73 m
Connection intruding at 12 o'clock, diameter: 100mm,

S5X_370e06e4-84f4-4c8a-a3a3-c44a2989c107_20190405_094118_654.jpg, 00:01:18, 4.75 m
Connection other than junction at 1 o'clock, diameter: 100mm

S5X_acceb949-f9b9-48f2-85ef-1e599e766fc5_20190405_094202_125.jpg, 00:01:52, 8.40 m
Connection other than junction at 2 o'clock, diameter: 100mm

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Section Pictures - 05/04/2019 - S5X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S5X	KM.04.19.67	

S5X_1b0d48cc-b4e9-416a-a0f1-9fd0bb0d32b9_20190405_094303_328.jpg, 00:02:36, 14.23 m
Connection intruding at 11 o'clock, diameter: 100mm,

S5X_1d400da9-4a1b-4c68-8818-be19158c9803_20190405_094328_528.jpg, 00:02:45, 14.70 m
Survey abandoned

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Section Inspection - 05/04/2019 - S6X

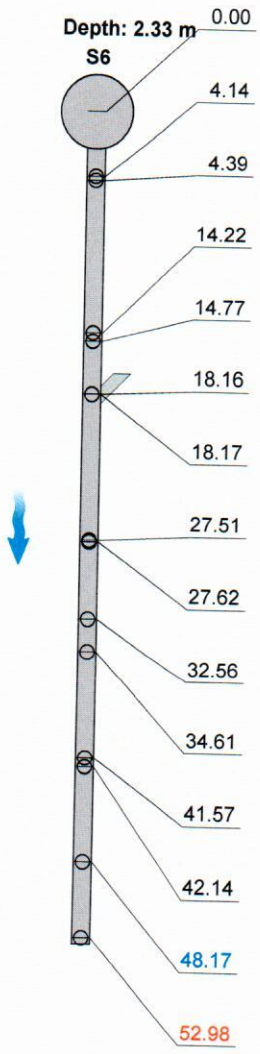
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
7	1	05/04/19	9:24	KM.04.19.67	No Rain Or Snow	Yes	S6X
Operator		**Vehicle**		**Camera**	**Preset Length**	**Legal Status**	**Alternative ID**
Kenneth Murray		141		Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S6
Road:	Brookdale	**Inspected Length:**	61.18 m	**Upstream Pipe Depth:**	2.330 m
Location:	Road	**Total Length:**	61.18 m	**Downstream Node:**	S7
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.800 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	600 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:

Recommendations:

Scale: 1:465



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S6	00:00:00		
4.14	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:00:39		
4.39	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:00:46		
14.22	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:01:54		
14.77	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:02:07		
18.16	CN	Connection other than junction at 11 o'clock, diameter: 100mm	00:02:37		
18.17	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:02:43		
27.51	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:41		
27.62	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:47		
32.56	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:20		
34.61	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:39		
41.57	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:23		
42.14	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:35		
48.17	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 20%	00:06:23		3
52.98	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 80%	00:07:02		5

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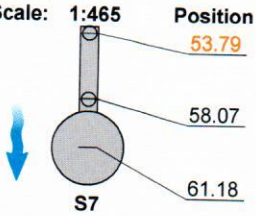
Section Inspection - 05/04/2019 - S6X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
7	1	05/04/19	9:24	KM.04.19.67	No Rain Or Snow	Yes	S6X
Operator		**Vehicle**		**Camera**	**Preset Length**	**Legal Status**	**Alternative ID**
Kenneth Murray		141		Mini-Cam	Not Specified	Not Specified	Not Specified

Scale: 1:465



Depth: 2.80 m

Position [m]	Code	Observation	MPEG	Photo	Grade
53.79	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 50%	00:07:32		4
58.07	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:08:05		
61.18	MHF	Finish node type, manhole, reference number: S7	00:08:30		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	3	10.0	0.3	17.0	5.0

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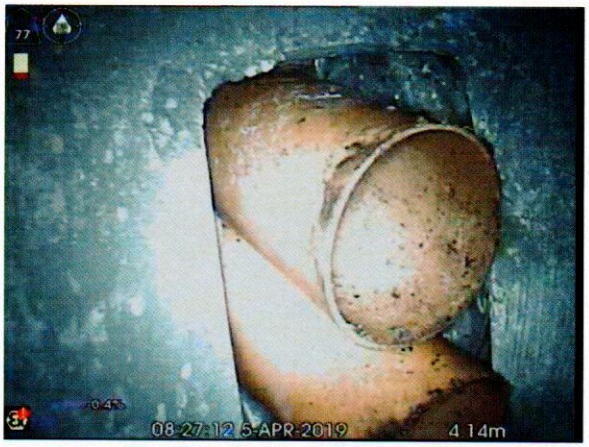
Section Pictures - 05/04/2019 - S6X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S6X	KM.04.19.67	

S6X_8127d366-a7dc-4957-9b17-592a26f26520_20190405_092527_372.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S6



S6X_91b31115-cf97-4745-8a43-0827462e78b0_20190405_092621_053.jpg, 00:00:39, 4.14 m
Connection other than junction at 12 o'clock, diameter:

S6X_a4098aa4-0653-4636-a51a-36339279b92e_20190405_092636_205.jpg, 00:00:46, 4.39 m
Connection other than junction at 12 o'clock, diameter:

S6X_c9ec7afd-1a4f-4ea7-9098-e3660764c0f2_20190405_092750_886.jpg, 00:01:54, 14.22 m
Connection other than junction at 12 o'clock, diameter:

S6X_81383c55-9e7a-4746-8099-ef1c849ac6b8_20190405_092812_269.jpg, 00:02:07, 14.77 m
Connection other than junction at 12 o'clock, diameter:

S6X_a74c1424-4840-47fc-b6ea-f90ae8ef89d6_20190405_092853_457.jpg, 00:02:37, 18.16 m
Connection other than junction at 11 o'clock, diameter:

Section Pictures - 05/04/2019 - S6X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S6X	KM.04.19.67	

S6X_bdf240ab-03ce-4839-a13b-4a7ff26210f2_20190405_092906_364.jpg, 00:02:43, 18.17 m
Connection other than junction at 12 o'clock, diameter:

S6X_906c9892-9f70-4388-9326-8bfcfe449905_20190405_093015_084.jpg, 00:03:41, 27.51 m
Connection other than junction at 12 o'clock, diameter:

S6X_d6038f54-fdae-433f-a67f-0de6ba9aa6ba_20190405_093028_351.jpg, 00:03:47, 27.62 m
Connection other than junction at 12 o'clock, diameter:

S6X_3f5f0a68-e51d-4e08-a22b-9b6fb0ced204_20190405_093108_985.jpg, 00:04:20, 32.56 m
Connection other than junction at 12 o'clock, diameter:

S6X_ddbe4989-b184-447f-9b4f-07cca075102e_20190405_093136_478.jpg, 00:04:39, 34.61 m
Connection other than junction at 12 o'clock, diameter:

S6X_1735cf16-efdb-4b0a-88ca-38dbbd134ab1_20190405_093229_036.jpg, 00:05:23, 41.57 m
Connection other than junction at 12 o'clock, diameter:

Section Pictures - 05/04/2019 - S6X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S6X	KM.04.19.67	

S6X_28decd9d-07d9-44c7-92b2-5de24c9dc43b_20190405_093250_338.jpg, 00:05:35, 42.14 m
Connection other than junction at 12 o'clock, diameter:

S6X_0d19f72f-ee95-4bcb-a8f3-93b19fae9762_20190405_093350_333.jpg, 00:06:23, 48.17 m
Connection intruding at 12 o'clock, diameter: 100mm,

S6X_884f3d3d-f874-4854-8418-3b70886c52c6_20190405_093453_196.jpg, 00:07:02, 52.98 m
Connection intruding at 12 o'clock, diameter: 100mm,

S6X_db2ccba5-02ab-4808-a2f3-f6fb28bc5a34_20190405_093553_252.jpg, 00:07:32, 53.79 m
Connection intruding at 12 o'clock, diameter: 100mm,

S6X_c5a221d9-8216-4a70-82c9-317fa8dbc8cf_20190405_093635_123.jpg, 00:08:05, 58.07 m
Connection other than junction at 12 o'clock, diameter:

S6X_2600c881-53cf-4c40-b02b-ee08dc7ae9b1_20190405_093705_399.jpg, 00:08:30, 61.18 m
Finish node type, manhole, reference number: S7

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Section Inspection - 05/04/2019 - S7X

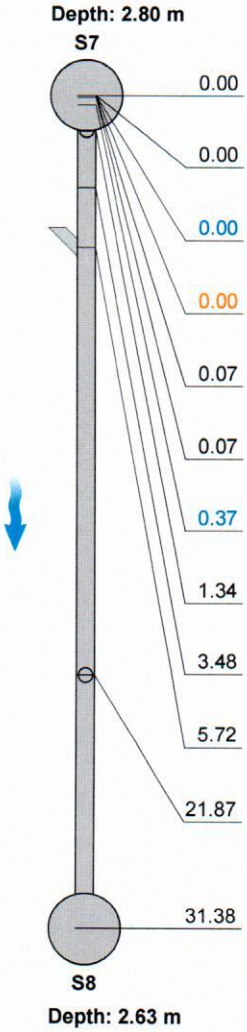
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
9	1	05/04/19	9:49	KM.04.19.67	No Rain Or Snow	Yes	S7X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S7
Road:	Avoncore Estate	**Inspected Length:**	31.38 m	**Upstream Pipe Depth:**	2.800 m
Location:	Road	**Total Length:**	31.38 m	**Downstream Node:**	S8
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.630 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	600 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:273



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S7	00:00:00		
0.00	GP	General photograph taken at this point: Concrete in line	00:00:07		
0.00	CM	Cracks, multiple from 4 o'clock to 6 o'clock	00:00:24		3
0.00	FS	Fracture spiral from 9 o'clock to 3 o'clock	00:00:40		4
0.07	GP	General photograph taken at this point: Pipe layed through surveying pipe	00:00:54		
0.07	SRB	Sealing ring broken from 3 o'clock to 9 o'clock	00:01:01		1
0.37	CS	Cracks, spiral from 12 o'clock to 12 o'clock	00:01:21		3
1.34	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:01:38		
3.48	GP	General photograph taken at this point: Concrete in line	00:01:58		
5.72	CN	Connection other than junction at 1 o'clock, diameter: 100mm	00:02:16		
21.87	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:30		
31.38	MHF	Finish node type, manhole, reference number: S8	00:04:26		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
4	165.0	5.3	165.0	4.0	0	0.0	0.0	0.0	1.0

Section Pictures - 05/04/2019 - S7X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
9	Downstream	S7X	KM.04.19.67	

S7X_61b2b2d6-a4dc-436d-b3c1-1745fe7a4a02_20190405_095008_174.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S7

S7X_975bed17-9008-4230-9468-a5f4fb99637b_20190405_095036_538.jpg, 00:00:07, 0.00 m
General photograph taken at this point

S7X_e95e40db-f421-4224-9e8c-5d1c64228623_20190405_095114_099.jpg, 00:00:24, 0.00 m
Cracks, multiple from 4 o'clock to 6 o'clock

S7X_ca062aaf-6af5-4bed-ad91-987a9282a6d7_20190405_095147_073.jpg, 00:00:40, 0.00 m
Fracture spiral from 9 o'clock to 3 o'clock

S7X_d006f887-6511-4b65-b4da-cfa26ba72726_20190405_095217_150.jpg, 00:00:54, 0.07 m
General photograph taken at this point

S7X_507b6eab-e483-4ccb-9798-b9840ae9fe90_20190405_095241_489.jpg, 00:01:01, 0.07 m
Sealing ring broken from 3 o'clock to 9 o'clock

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Section Pictures - 05/04/2019 - S7X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
9	Downstream	S7X	KM.04.19.67	

S7X_7668e268-54dd-4054-bff4-0173f5f9763b_20190405_095314_961.jpg, 00:01:21, 0.37 m
Cracks, spiral from 12 o'clock to 12 o'clock

S7X_5389aa5f-4fe3-4cf8-b377-cfb7861908ba_20190405_095338_868.jpg, 00:01:38, 1.34 m
Connection other than junction at 12 o'clock, diameter:

S7X_45db0c5d-8ed2-4482-a9ef-89be9f78f5ff_20190405_095410_824.jpg, 00:01:58, 3.48 m
General photograph taken at this point

S7X_ff2f0039-0154-4204-b1e9-e659e7926ade_20190405_095439_124.jpg, 00:02:16, 5.72 m
Connection other than junction at 1 o'clock, diameter: 100mm

S7X_31436574-988a-4e7e-9a63-8803c35111fa_20190405_095559_947.jpg, 00:03:30, 21.87 m
Connection other than junction at 12 o'clock, diameter:

S7X_a6d2ef8d-17e9-4708-9152-e0ca7997194e_20190405_095701_470.jpg, 00:04:26, 31.38 m
Finish node type, manhole, reference number: S8

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Section Inspection - 05/04/2019 - S8X

Section	Inspection	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
10	1	05/04/19	11:25	KM.04.19.67	No Rain Or Snow	Yes	S8X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S8
Road:	Avoncore Estate	**Inspected Length:**	78.81 m	**Upstream Pipe Depth:**	2.630 m
Location:	Road	**Total Length:**	78.81 m	**Downstream Node:**	S9
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.180 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	600 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:686	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 2.63 m S8						
	0.00	MH	Start node type, manhole, reference number: S8	00:00:00		
	78.81	SA	Survey abandoned: Survey will continue from other end	00:14:34		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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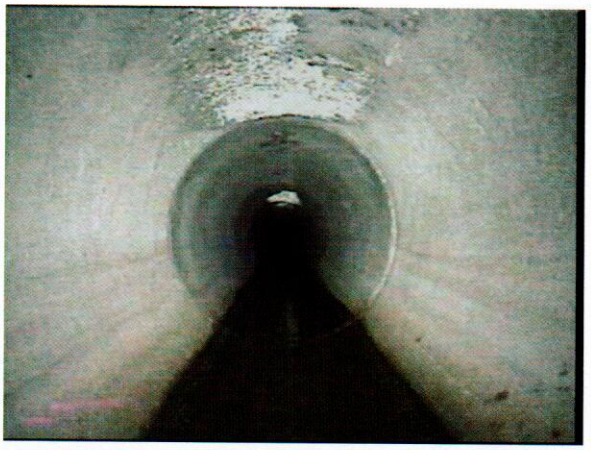
Section Pictures - 05/04/2019 - S8X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
10	Downstream	S8X	KM.04.19.67	

S8X_416171ae-cd8c-4dee-a7c8-081971adace7_20190405_112732_811.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S8



S8X_f3ae3c52-c9e2-435d-85d9-ce996e3978a7_20190405_114838_269.jpg, 00:14:34, 78.81 m
Survey abandoned

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Section Inspection - 05/04/2019 - S8X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
11	1	05/04/19	12:00	KM.04.19.67	No Rain Or Snow	Yes	S8X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S8
Road:	Avoncore Estate	**Inspected Length:**	20.73 m	**Upstream Pipe Depth:**	2.630 m
Location:	Road	**Total Length:**	20.73 m	**Downstream Node:**	S9
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.180 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	600 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:181

Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 2.18 m **S9**					
0.00	MH	Start node type, manhole, reference number: S9	00:00:00		
20.73	SA	Survey abandoned: Survey Complete	00:01:52		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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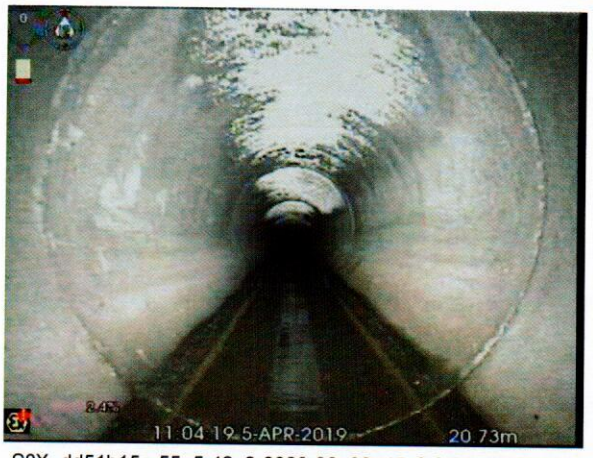
Section Pictures - 05/04/2019 - S8X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
11	Upstream	S8X	KM.04.19.67	

S8X_7e3b0df1-74e1-44e9-b001-48fa4edb2e65_20190405_120112_208.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S9



S8X_dd51b15e-55e5-42e3-8028-90a36a45cfef_20190405_120328_014.jpg, 00:01:52, 20.73 m
Survey abandoned

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Section Inspection - 05/04/2019 - S9X

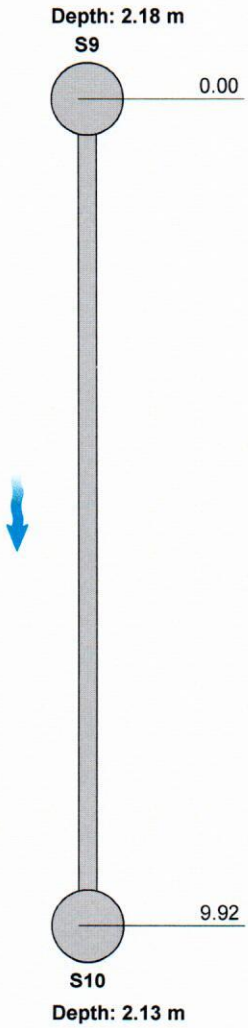
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
12	1	05/04/19	12:05	KM.04.19.67	No Rain Or Snow	Yes	S9X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S9
Road:	Elm Grove	**Inspected Length:**	9.92 m	**Upstream Pipe Depth:**	2.180 m
Location:	Road	**Total Length:**	9.92 m	**Downstream Node:**	S10
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.130 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	600 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:87



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S9	00:00:00		
9.92	MHF	Finish node type, manhole, reference number: S10	00:00:49		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S9X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
12	Downstream	S9X	KM.04.19.67	

S9X_144cd6f6-0f76-4b04-90bd-f1f8add8c847_20190405_120737_601.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S9

S9X_ea66e2f4-6960-4c58-b4e6-be7f4ad17f91_20190405_120835_240.jpg, 00:00:49, 9.92 m
Finish node type, manhole, reference number: S10

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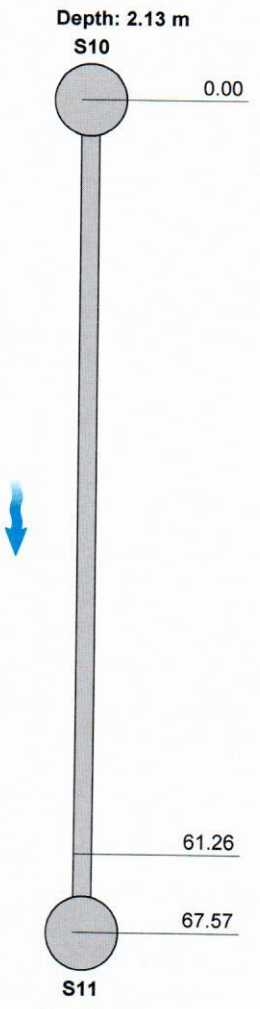
Section Inspection - 05/04/2019 - S10X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
13	1	05/04/19	12:42	KM.04.19.67	No Rain Or Snow	Yes	S10X
Operator		**Vehicle**		**Camera**	**Preset Length**	**Legal Status**	**Alternative ID**
Kenneth Murray		141		Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S10
Road:	Avoncore Estate	**Inspected Length:**	67.57 m	**Upstream Pipe Depth:**	2.130 m
Location:	Road	**Total Length:**	67.57 m	**Downstream Node:**	S11
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	1.250 m
Use:	Surface water	**Pipe Shape:**	Circular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm		
Year Constructed:		**Pipe Material:**	Concrete		
Flow Control:	No flow control	**Lining Type:**	No Lining		
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining		

Comments:
Recommendations:

Scale: 1:588



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S10	00:00:00		
61.26	WL	Water level, 10% of the vertical dimension	00:05:21		
67.57	MHF	Finish node type, manhole, reference number: S11	00:06:41		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S10X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
13	Downstream	S10X	KM.04.19.67	

S10X_fc02f629-fa01-4181-91fa-71543718d68d_20190405_133713_174.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S10

S10X_f3b594ef-ef55-4d79-baf5-181129d52886_20190405_134246_959.jpg, 00:05:21, 61.26 m
Water level, 10% of the vertical dimension

S10X_a69e2a28-feaf-4cff-85c4-7a83b30f4b02_20190405_134412_733.jpg, 00:06:41, 67.57 m
Finish node type, manhole, reference number: S11

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Section Inspection - 05/04/2019 - S11X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
1	1	05/04/19	15:47	KM.04.19.67	No Rain Or Snow	Yes	S11X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S11
Road:	R626	**Inspected Length:**	55.46 m	**Upstream Pipe Depth:**	1.250 m
Location:	Road	**Total Length:**	55.46 m	**Downstream Node:**	S12
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	1.970 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	600 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:483

Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 1.25 m					
S11					
0.00	MH	Start node type, manhole, reference number: S11	00:00:00		
7.22	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:00:53		
30.65	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:03:15		
30.84	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:03:25		
53.11	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:07:57		
53.16	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:08:06		
S12					
55.46	MHF	Finish node type, manhole, reference number: S12	00:08:50		
Depth: 1.97 m					

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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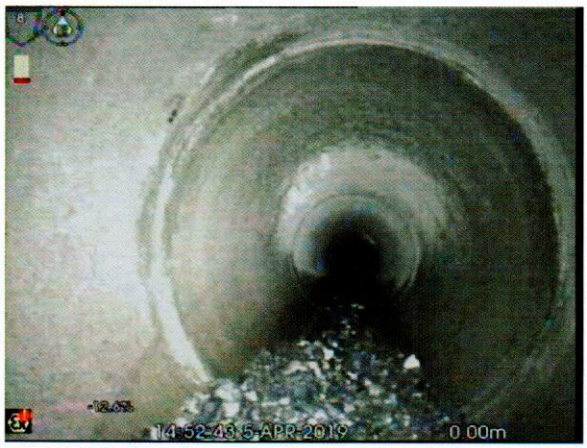
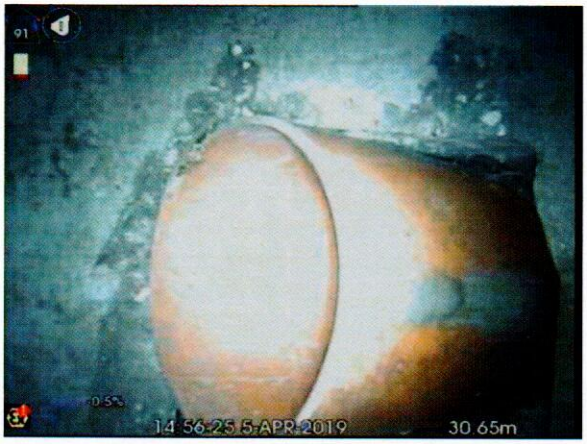
Section Pictures - 05/04/2019 - S11X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Downstream	S11X	KM.04.19.67	



S11X_0f7f2399-5c83-4708-94ca-2adb86d599b4_20190405_155152_771.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S11

S11X_8c26414c-5570-4c5c-9c45-72a3d62b1144_20190405_155300_478.jpg, 00:00:53, 7.22 m
Connection other than junction at 1 o'clock, diameter: 150mm



S11X_97e89ff1-cece-4ded-a60d-67b0788aebb6_20190405_155533_720.jpg, 00:03:15, 30.65 m
Connection other than junction at 1 o'clock, diameter: 150mm

S11X_b51732fa-f87c-498b-98f5-c59dd0c10ad3_20190405_155550_998.jpg, 00:03:25, 30.84 m
Connection other than junction at 1 o'clock, diameter: 150mm

S11X_bced69d4-79c0-4d55-a302-6040b96b55cc_20190405_160032_561.jpg, 00:07:57, 53.11 m
Connection other than junction at 1 o'clock, diameter: 150mm

S11X_4159b65c-b355-45a4-92e8-229edce50242_20190405_160051_701.jpg, 00:08:06, 53.16 m
Connection other than junction at 1 o'clock, diameter: 150mm

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Section Pictures - 05/04/2019 - S11X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Downstream	S11X	KM.04.19.67	

S11X_0c83f958-bcf9-481f-9fee-3e27b1badafb_20190405_160142_182.jpg, 00:08:50, 55.46 m
Finish node type, manhole, reference number: S12

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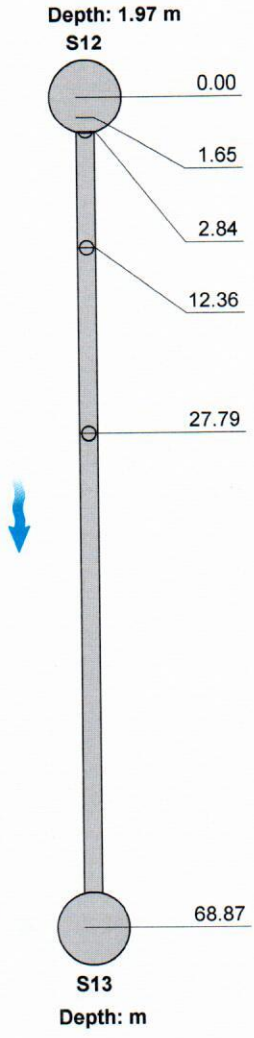
Section Inspection - 05/04/2019 - S12X

Section	Inspection	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
14	1	05/04/19	14:45	KM.04.19.67	No Rain Or Snow	Yes	S12X
Operator		**Vehicle**		**Camera**	**Preset Length**	**Legal Status**	**Alternative ID**
Kenneth Murray		141		Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S12
Road:	R626	**Inspected Length:**	68.87 m	**Upstream Pipe Depth:**	1.970 m
Location:	Road	**Total Length:**	68.87 m	**Downstream Node:**	S13
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	600 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining
Comments:	No access to S13 for invert level				
Recommendations:					

Scale: 1:599



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S12	00:00:00		
1.65	WL	Water level, 10% of the vertical dimension	00:00:12		
2.84	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:00:28		
12.36	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:04:18		
27.79	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:06:39		
68.87	MHF	Finish node type, manhole, reference number: S13: Cover in manhole	00:11:35		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S12X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
14	Downstream	S12X	KM.04.19.67	

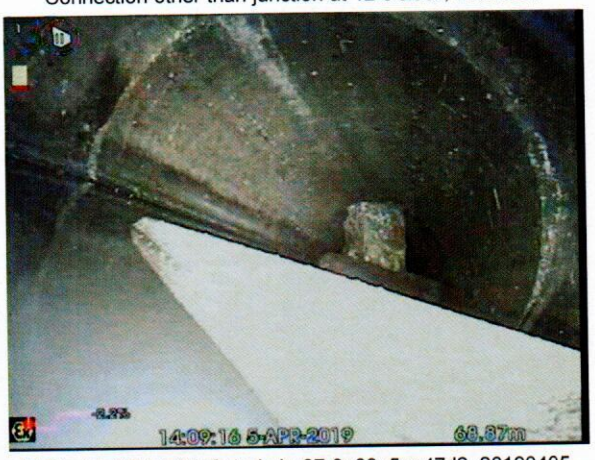
S12X_530986e0-6df5-4e9a-9f86-33bcdb7ea806_20190405_145505_405.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S12

S12X_a4c78e13-8fa1-48da-99c7-0acaecf3be4c_20190405_145527_027.jpg, 00:00:12, 1.65 m
Water level, 10% of the vertical dimension

S12X_c8a29280-971f-4478-a52d-44cf951e9945_20190405_145551_027.jpg, 00:00:28, 2.84 m
Connection other than junction at 12 o'clock, diameter:

S12X_1bd62a68-ad66-4de4-b315-8e019f14ab10_20190405_145952_710.jpg, 00:04:18, 12.36 m
Connection other than junction at 12 o'clock, diameter:

S12X_7c569883-7420-47af-be2e-602fc3a58e52_20190405_150225_562.jpg, 00:06:39, 27.79 m
Connection other than junction at 12 o'clock, diameter:



S12X_14a235e1-3da0-4edc-ba07-3a80a5ae47d2_20190405_150825_482.jpg, 00:11:35, 68.87 m
Finish node type, manhole, reference number: S13

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WinCan

Notes:

Thank you for choosing to use Munster Drain Services to carry out your drainage investigation works.

The results and views carried in this report are those of the engineer(s) appointed to carry out the investigation and are considered relevant on the day of the survey. Drain and sewer performance is known to alter over time, so liability cannot be accepted for differences between the recorded data and the actual data at a time after this report was generated.

This survey has been created in accordance with the drainage standard used in the country and language settings for this PC.

If a DVD has been supplied with this report, please note that it can only be used in a Windows based PC. Please browse the DVD and navigate to the PDF folder to find project-based documents such as drawings, engineer's site notes and survey specifications amongst others.

CCTV subsidence investigations do not account for the water tightness of the pipes and are merely a visual inspection of inside of the drains. CCTV drainage engineers are generally not qualified to comment on the causes of subsidence, and can only suggest required remedial actions for the pipes, and not the affected buildings.

Subsidence is a building structural failure, which can occur for many reasons. Although drainage failures can contribute to subsidence problems, other causes should always be investigated as part of a considered approach. In order to eliminate drains from suspicion, it is suggested that all pipes within at least 10m of the subsidence area be pressure tested over and above a CCTV inspection, and remedial suggestions considered based on the findings.

Unless otherwise specified in an associated task order (or similar), the data gathered in this report may not be suitable for use as a pre-lining investigation. Munster Drain are happy to carry out such surveys, but this must be agreed prior to the commencement of the works, and a the client must specify the data they wish to capture and the acceptable tolerances.

Where GPS coordinates and heights have been issued within this report, they are to 1m accuracy, and 2m accuracy for heights. Greater accuracy can be provided on request.

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wrc

Project

Project Name:	Broomfield Court, Midleton
Project Description:	Surface Water CCTV Survey
Project Number:	KM.04.19.67
Project Date:	05/04/2019
Project Standard:	MSCC4 Sewers & Drainage GB (SRM4 Scoring)

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Project Information

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

Client

Company: M.H.L Consulting Engineers
Contact: Shane Moriarty

Contractor

Company: Munster Drain Services
Contact: Office
Phone: 021 - 4770797
Email: info@munsterdrain.com

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Scoring Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

Structural Defects

Grade 3: Best practice suggests consideration should be given to repairs in the medium term.

Grade 4: Best practice suggests consideration should be given to repairs to avoid a potential collapse.

Grade 5: Best practice suggests that this pipe is at risk of collapse at any time. Urgent consideration should be given to repairs to avoid total failure.

Section	PLR	Grade	Description
9	S7X	4	Fracture spiral from 9 o'clock to 3 o'clock

Service / Operational Condition

Grade 3: Best practice suggests consideration should be given to maintenance activities in the medium term.

Grade 4: Best practice suggests consideration should be given to maintenance activity to avoid potential blockages.

Grade 5: Best practice suggests that this pipe is at a high risk of backing up or causing flooding.

Section	PLR	Grade	Description
6	S5X	5	Connection intruding at 1 o'clock, diameter: 100mm, intrusion: 95%
7	S6X	5	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 80%
8	S5X	5	Connection intruding at 11 o'clock, diameter: 100mm, intrusion: 95%

Abandoned Surveys

Section	PLR	Description
6	S5X	Survey abandoned
8	S5X	Survey abandoned
10	S8X	Survey abandoned
11	S8X	Survey abandoned

Information

These scoring summaries are based on the SRM grading from the WRc.

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Section Profile

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

Circular, 450 mm

Section	Upstream Node	Downstream Node	Date	Road	Pipe Material	Total Length	Inspected Length
2	S1	S2	05/04/2019	Broomfield	Polyvinyl chloride	13.36 m	13.36 m
3	S2	S3	05/04/2019	Avoncore Place	Polyvinyl chloride	34.89 m	34.89 m
4	S4	S5	05/04/2019	Brookdale	Concrete	65.17 m	65.17 m
5	S3	S4	05/04/2019	Brookdale	Polyvinyl chloride	14.68 m	14.68 m

Total: 4 Inspections x Circular 450 mm = 128.10 m Total Length and 128.10 m Inspected Length

Circular, 600 mm

Section	Upstream Node	Downstream Node	Date	Road	Pipe Material	Total Length	Inspected Length
1	S11	S12	05/04/2019	R626	Concrete	55.46 m	55.46 m
7	S6	S7	05/04/2019	Brookdale	Concrete	61.18 m	61.18 m
9	S7	S8	05/04/2019	Avoncore Estate	Concrete	31.38 m	31.38 m
12	S9	S10	05/04/2019	Elm Grove	Concrete	9.92 m	9.92 m
13	S10	S11	05/04/2019	Avoncore Estate	Concrete	67.57 m	67.57 m
14	S12	S13	05/04/2019	R626	Concrete	68.87 m	68.87 m

Total: 6 Inspections x Circular 600 mm = 294.38 m Total Length and 294.38 m Inspected Length

Total: 10 Inspections = 422.48 m Total Length and 422.48 m Inspected Length

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

Number of sections	14
Total length of sewer network	588.62 m
Total length of inspections	588.62 m
Total length of abandoned inspections	0.00 m
Total abandoned inspections	4
Number of section inspection photos	96
Number of section inspection videos	14
Number of section inspection scans	0
Number of section inclination measurements	0

PLR:	S1X	**Upstream Node:**	S1
Inspection Direction:	Upstream	**Downstream Node:**	S2
Inspected Length:	13.36 m	**Dia/Height:**	450 mm
Total Length:	13.36 m	**Pipe Material:**	Polyvinyl chloride

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S2
2	13.36	MHF	Finish node type, manhole, reference number: S1

PLR:	S2X	**Upstream Node:**	S2
Inspection Direction:	Downstream	**Downstream Node:**	S3
Inspected Length:	34.89 m	**Dia/Height:**	450 mm
Total Length:	34.89 m	**Pipe Material:**	Polyvinyl chloride

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S2
2	14.35	WL	Water level, 5% of the vertical dimension
3	34.89	MHF	Finish node type, manhole, reference number: S3

PLR:	S3X	**Upstream Node:**	S3
Inspection Direction:	Upstream	**Downstream Node:**	S4
Inspected Length:	14.68 m	**Dia/Height:**	450 mm
Total Length:	14.68 m	**Pipe Material:**	Polyvinyl chloride

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S4
2	1.98	WL	Water level, 20% of the vertical dimension
3	12.99	GP	General photograph taken at this point
4	14.68	MHF	Finish node type, manhole, reference number: S3

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

PLR:	S4X	**Upstream Node:**	S4
Inspection Direction:	Upstream	**Downstream Node:**	S5
Inspected Length:	65.17 m	**Dia/Height:**	450 mm
Total Length:	65.17 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S5
2	0.59	CN	Connection other than junction at 12 o'clock, diameter: 100mm
3	4.16	CN	Connection other than junction at 12 o'clock, diameter: 150mm
4	8.54	CN	Connection other than junction at 12 o'clock, diameter: 100mm
5	16.53	CN	Connection other than junction at 12 o'clock, diameter: 100mm
6	22.05	CN	Connection other than junction at 12 o'clock, diameter: 150mm
7	24.68	CN	Connection other than junction at 12 o'clock, diameter: 100mm
8	32.38	CN	Connection other than junction at 12 o'clock, diameter: 100mm
9	36.31	CN	Connection other than junction at 12 o'clock, diameter: 150mm
10	38.59	CN	Connection other than junction at 12 o'clock, diameter: 100mm
11	46.36	CN	Connection other than junction at 12 o'clock, diameter: 100mm
12	49.34	CN	Connection other than junction at 12 o'clock, diameter: 100mm
13	58.93	CN	Connection other than junction at 12 o'clock, diameter: 100mm
14	61.19	CN	Connection other than junction at 12 o'clock, diameter: 150mm
15	64.09	CN	Connection other than junction at 12 o'clock, diameter: 100mm
16	65.17	MHF	Finish node type, manhole, reference number: S4

PLR:	S5X	**Upstream Node:**	S5
Inspection Direction:	Downstream	**Downstream Node:**	S6
Inspected Length:	51.90 m	**Dia/Height:**	450 mm
Total Length:	51.90 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S5
2	4.83	CN	Connection other than junction at 12 o'clock, diameter: 100mm
3	17.03	CN	Connection other than junction at 12 o'clock, diameter: 100mm
4	21.52	CN	Connection other than junction at 12 o'clock, diameter: 100mm
5	27.37	CN	Connection other than junction at 12 o'clock, diameter: 100mm
6	34.29	CN	Connection other than junction at 12 o'clock, diameter: 100mm
7	36.11	CN	Connection other than junction at 12 o'clock, diameter: 100mm
8	41.03	CN	Connection other than junction at 12 o'clock, diameter: 100mm
9	49.28	CN	Connection other than junction at 11 o'clock, diameter: 100mm
10	51.22	CXI	Connection intruding at 1 o'clock, diameter: 100mm, intrusion: 95%
11	51.90	SA	Survey abandoned

PLR:	S5X	**Upstream Node:**	S5
Inspection Direction:	Upstream	**Downstream Node:**	S6
Inspected Length:	14.70 m	**Dia/Height:**	450 mm
Total Length:	14.70 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S6

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

No.	m+	Code	Observation
2	0.42	CN	Connection other than junction at 2 o'clock, diameter: 100mm
3	0.84	CXI	Connection intruding at 2 o'clock, diameter: 100mm, intrusion: 20%
4	1.73	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 25%
5	4.75	CN	Connection other than junction at 1 o'clock, diameter: 100mm
6	8.40	CN	Connection other than junction at 2 o'clock, diameter: 100mm
7	14.23	CXI	Connection intruding at 11 o'clock, diameter: 100mm, intrusion: 95%
8	14.70	SA	Survey abandoned

PLR:	S6X	**Upstream Node:**	S6
Inspection Direction:	Downstream	**Downstream Node:**	S7
Inspected Length:	61.18 m	**Dia/Height:**	600 mm
Total Length:	61.18 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S6
2	4.14	CN	Connection other than junction at 12 o'clock, diameter: 100mm
3	4.39	CN	Connection other than junction at 12 o'clock, diameter: 100mm
4	14.22	CN	Connection other than junction at 12 o'clock, diameter: 100mm
5	14.77	CN	Connection other than junction at 12 o'clock, diameter: 100mm
6	18.16	CN	Connection other than junction at 11 o'clock, diameter: 100mm
7	18.17	CN	Connection other than junction at 12 o'clock, diameter: 100mm
8	27.51	CN	Connection other than junction at 12 o'clock, diameter: 100mm
9	27.62	CN	Connection other than junction at 12 o'clock, diameter: 100mm
10	32.56	CN	Connection other than junction at 12 o'clock, diameter: 100mm
11	34.61	CN	Connection other than junction at 12 o'clock, diameter: 100mm
12	41.57	CN	Connection other than junction at 12 o'clock, diameter: 100mm
13	42.14	CN	Connection other than junction at 12 o'clock, diameter: 100mm
14	48.17	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 20%
15	52.98	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 80%
16	53.79	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 50%
17	58.07	CN	Connection other than junction at 12 o'clock, diameter: 100mm
18	61.18	MHF	Finish node type, manhole, reference number: S7

PLR:	S7X	**Upstream Node:**	S7
Inspection Direction:	Downstream	**Downstream Node:**	S8
Inspected Length:	31.38 m	**Dia/Height:**	600 mm
Total Length:	31.38 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S7
2	0.00	GP	General photograph taken at this point
3	0.00	CM	Cracks, multiple from 4 o'clock to 6 o'clock
4	0.00	FS	Fracture spiral from 9 o'clock to 3 o'clock
5	0.07	GP	General photograph taken at this point
6	0.07	SRB	Sealing ring broken from 3 o'clock to 9 o'clock
7	0.37	CS	Cracks, spiral from 12 o'clock to 12 o'clock

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

No.	m+	Code	Observation
8	1.34	CN	Connection other than junction at 12 o'clock, diameter: 100mm
9	3.48	GP	General photograph taken at this point
10	5.72	CN	Connection other than junction at 1 o'clock, diameter: 100mm
11	21.87	CN	Connection other than junction at 12 o'clock, diameter: 100mm
12	31.38	MHF	Finish node type, manhole, reference number: S8

PLR:	S8X	**Upstream Node:**	S8
Inspection Direction:	Downstream	**Downstream Node:**	S9
Inspected Length:	78.81 m	**Dia/Height:**	600 mm
Total Length:	78.81 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S8
2	78.81	SA	Survey abandoned

PLR:	S8X	**Upstream Node:**	S8
Inspection Direction:	Upstream	**Downstream Node:**	S9
Inspected Length:	20.73 m	**Dia/Height:**	600 mm
Total Length:	20.73 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S9
2	20.73	SA	Survey abandoned

PLR:	S9X	**Upstream Node:**	
Inspection Direction:	Downstream	**Downstream Node:**	
Inspected Length:	9.92 m	**Dia/Height:**	
Total Length:	9.92 m	**Pipe Material:**	

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S9
2	9.92	MHF	Finish node type, manhole, reference number: S10

PLR:	S10X	**Upstream Node:**	
Inspection Direction:	Downstream	**Downstream Node:**	
Inspected Length:	67.57 m	**Dia/Height:**	
Total Length:	67.57 m	**Pipe Material:**	

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S10
2	61.26	WL	Water level, 10% of the vertical dimension
3	67.57	MHF	Finish node type, manhole, reference number: S11

PLR:	S11X	**Upstream Node:**	S11
Inspection Direction:	Downstream	**Downstream Node:**	S12
Inspected Length:	55.46 m	**Dia/Height:**	600 mm
Total Length:	55.46 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S11
2	7.22	CN	Connection other than junction at 1 o'clock, diameter: 150mm
3	30.65	CN	Connection other than junction at 1 o'clock, diameter: 150mm

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Section Summary

Project Name	Project Number	Project Date
Broomfield Court, Midleton	KM.04.19.67	05/04/2019

No.	m+	Code	Observation
4	30.84	CN	Connection other than junction at 1 o'clock, diameter: 150mm
5	53.11	CN	Connection other than junction at 1 o'clock, diameter: 150mm
6	53.16	CN	Connection other than junction at 1 o'clock, diameter: 150mm
7	55.46	MHF	Finish node type, manhole, reference number: S12

PLR:	S12X	**Upstream Node:**	S12
Inspection Direction:	Downstream	**Downstream Node:**	S13
Inspected Length:	68.87 m	**Dia/Height:**	600 mm
Total Length:	68.87 m	**Pipe Material:**	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node type, manhole, reference number: S12
2	1.65	WL	Water level, 10% of the vertical dimension
3	2.84	CN	Connection other than junction at 12 o'clock, diameter: 150mm
4	12.36	CN	Connection other than junction at 12 o'clock, diameter: 150mm
5	27.79	CN	Connection other than junction at 12 o'clock, diameter: 100mm
6	68.87	MHF	Finish node type, manhole, reference number: S13

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Section Inspection - 05/04/2019 - S1X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
2	1	05/04/19	7:05	KM.04.19.67	No Rain Or Snow	Yes	S1X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S1
Road:	Broomfield	**Inspected Length:**	13.36 m	**Upstream Pipe Depth:**	3.150 m
Location:	Road	**Total Length:**	13.36 m	**Downstream Node:**	S2
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	3.330 m

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm
Year Constructed:		**Pipe Material:**	Polyvinyl chloride
Flow Control:	No flow control	**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:117

Position [m]	Code	Observation	MPEG	Photo	Grade
		Depth: 3.33 m			
		S2			
0.00	MH	Start node type, manhole, reference number: S2	00:00:00		
13.36	MHF	Finish node type, manhole, reference number: S1	00:01:26		
		S1			
		Depth: 3.15 m			

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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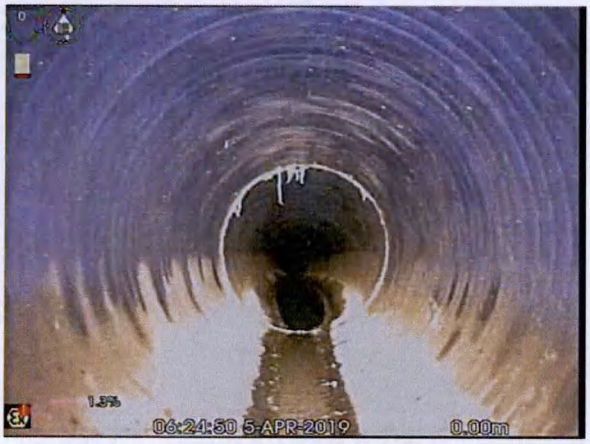
Section Pictures - 05/04/2019 - S1X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
2	Upstream	S1X	KM.04.19.67	



S1X_fb6e0b6d-9bc2-4073-a808-d941a78430c0_20190405_072359_148.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S2

S1X_ca35267c-2005-4aaa-a9e6-63c0758e75ec_20190405_072534_741.jpg, 00:01:26, 13.36 m
Finish node type, manhole, reference number: S1

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Section Inspection - 05/04/2019 - S2X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
3	1	05/04/19	7:28	KM.04.19.67	No Rain Or Snow	Yes	S2X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S2
Road:	Avoncore Place	**Inspected Length:**	34.89 m	**Upstream Pipe Depth:**	3.330 m
Location:	Road	**Total Length:**	34.89 m	**Downstream Node:**	S3
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.565 m
Use:	Surface water	**Pipe Shape:**	Circular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm		
Year Constructed:		**Pipe Material:**	Polyvinyl chloride		
Flow Control:	No flow control	**Lining Type:**	No Lining		
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining		
Comments:					
Recommendations:					

Scale: 1:304	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 3.33 m						
S2						
	0.00	MH	Start node type, manhole, reference number: S2	00:00:00		
	14.35	WL	Water level, 5% of the vertical dimensi			
	34.89	MHF	Finish node type, manhole, reference r			
S3						
Depth: 2.57 m						

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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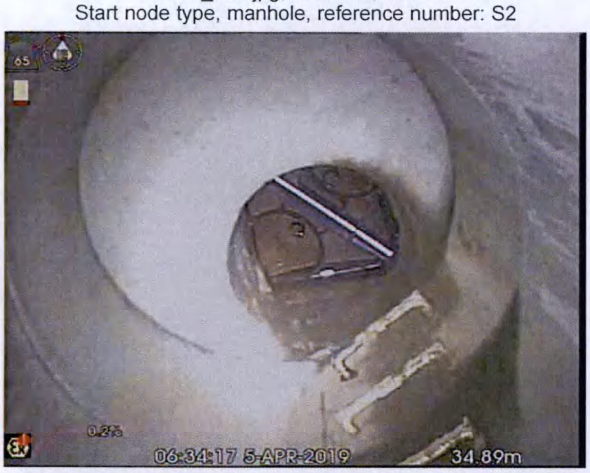
Section Pictures - 05/04/2019 - S2X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
3	Downstream	S2X	KM.04.19.67	

S2X_2608f175-6544-4e1c-a755-5bcd4680625b_20190405_072911_710.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S2

S2X_3c24dd86-e9c2-4854-a02e-26cc4f794fcc_20190405_073041_501.jpg, 00:01:20, 14.35 m
Water level, 5% of the vertical dimension



S2X_145dd4f1-9c8c-4397-98e5-7cbd74295ccd_20190405_073325_858.jpg, 00:03:29, 34.89 m
Finish node type, manhole, reference number: S3

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Section Inspection - 05/04/2019 - S3X

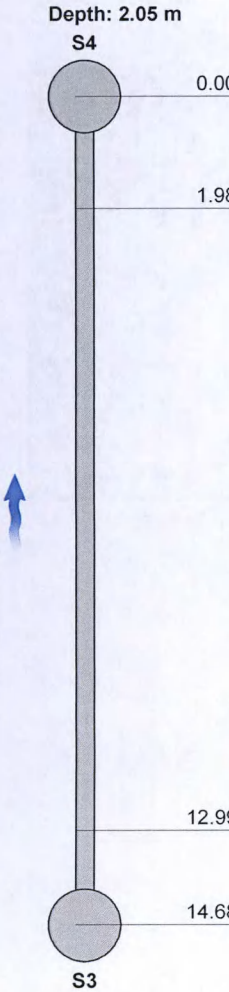
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
5	1	05/04/19	8:14	KM.04.19.67	No Rain Or Snow	Yes	S3X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S3
Road:	Brookdale	**Inspected Length:**	14.68 m	**Upstream Pipe Depth:**	2.565 m
Location:	Road	**Total Length:**	14.68 m	**Downstream Node:**	S4
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.050 m
Use:	Surface water	**Pipe Shape:**	Circular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm		
Year Constructed:		**Pipe Material:**	Polyvinyl chloride		
Flow Control:	No flow control	**Lining Type:**	No Lining		
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining		

Comments:
Recommendations:

Scale: 1:128



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S4	00:00:00		
1.98	WL	Water level, 20% of the vertical dimension: due to concrete at joint	00:00:51		
12.99	GP	General photograph taken at this point: F			
14.68	MHF	Finish node type, manhole, reference nu			

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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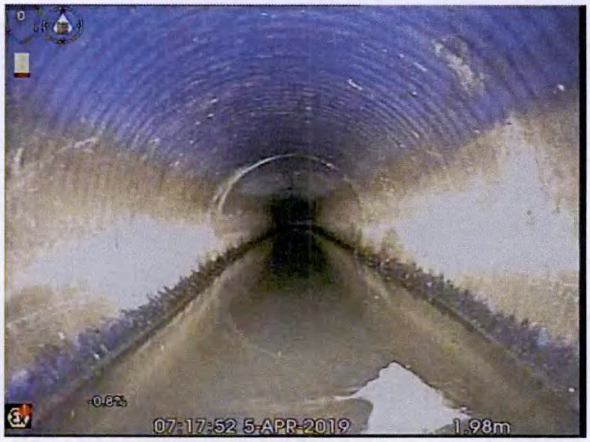
Section Pictures - 05/04/2019 - S3X

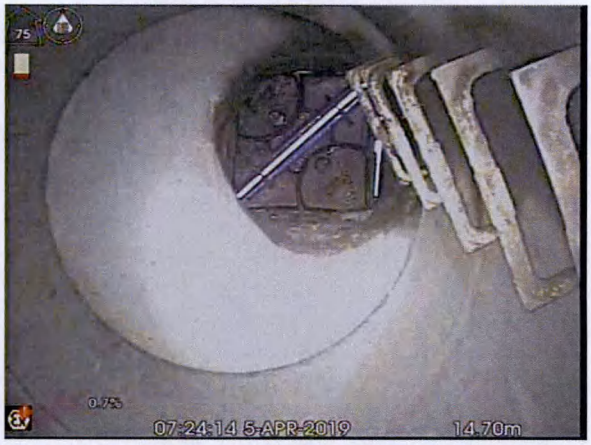
Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
5	Upstream	S3X	KM.04.19.67	

S3X_9e923133-f59a-4261-918a-f2247a8f9391_20190405_081548_768.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S4



S3X_51ac9785-3074-40fa-9406-ab5ca25e2d2c_20190405_081701_604.jpg, 00:00:51, 1.98 m
Water level, 20% of the vertical dimension

S3X_e1f5476d-f88c-4819-a01c-ac833c89ea8f_20190405_082226_733.jpg, 00:05:56, 12.99 m
General photograph taken at this point



S3X_3154a530-4788-4cb9-9b2f-c8e0ef97cbe9_20190405_082323_160.jpg, 00:06:46, 14.68 m
Finish node type, manhole, reference number: S3

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Section Inspection - 05/04/2019 - S4X

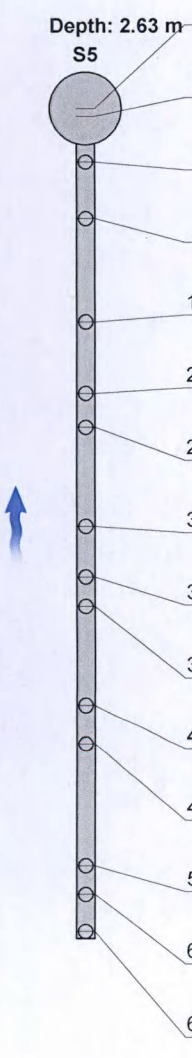
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
4	1	05/04/19	8:01	KM.04.19.67	No Rain Or Snow	Yes	S4X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S4
Road:	Brookdale	**Inspected Length:**	65.17 m	**Upstream Pipe Depth:**	2.050 m
Location:	Road	**Total Length:**	65.17 m	**Downstream Node:**	S5
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.630 m
Use:	Surface water	**Pipe Shape:**	Circular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm		
Year Constructed:		**Pipe Material:**	Concrete		
Flow Control:	No flow control	**Lining Type:**	No Lining		
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining		

Comments:
Recommendations:

Scale: 1:562



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S5	00:00:00		
0.59	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:00:11		
4.16	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:00:38		
8.54	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:01:12		
16.53	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:02:01		
22.05	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:02:52		
24.68	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:25		
32.38	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:12		
36.31	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:04:43		
38.59	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:11		
46.36	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:59		
49.34	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:06:25		
58.93	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:07:39		
61.19	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:08:11		
64.09	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:08:39		

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Section Inspection - 05/04/2019 - S4X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
4	1	05/04/19	8:01	KM.04.19.67	No Rain Or Snow	Yes	S4X
Operator		**Vehicle**		**Camera**	**Preset Length**	**Legal Status**	**Alternative ID**
Kenneth Murray		141		Mini-Cam	Not Specified	Not Specified	Not Specified

Scale:	Position [m]	Code	Observation	MPEG	Photo	Grade
	65.17	MHF	Finish node type, manhole, reference number: S4	00:08:55		

S4

Depth: 2.05 m

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S4X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Upstream	S4X	KM.04.19.67	

S4X_6b0fc3f3-69d8-4222-817c-d3ec9f1d921d_20190405_080239_607.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S5

S4X_a5e9ed2b-8f8f-494b-b06d-fe2155b6fd24_20190405_080304_982.jpg, 00:00:11, 0.59 m
Connection other than junction at 12 o'clock, diameter:

S4X_6021ae2c-959a-4f2c-99e0-d2c84a075fe2_20190405_080341_009.jpg, 00:00:38, 4.16 m
Connection other than junction at 12 o'clock, diameter:

S4X_802735c8-86e0-42c0-8b8c-a67a50e5e5f3_20190405_080501_375.jpg, 00:01:12, 8.54 m
Connection other than junction at 12 o'clock, diameter:

S4X_0a309ee2-7cfd-4233-bd52-868781fad4a2_20190405_080558_786.jpg, 00:02:01, 16.53 m
Connection other than junction at 12 o'clock, diameter:

S4X_054fcaef-7066-4d99-b900-6afa1e02cb72_20190405_080704_434.jpg, 00:02:52, 22.05 m
Connection other than junction at 12 o'clock, diameter:

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Section Pictures - 05/04/2019 - S4X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Upstream	S4X	KM.04.19.67	

S4X_f6729a63-531b-46b9-9aaf-873fb425f930_20190405_080740_702.jpg, 00:03:25, 24.68 m
Connection other than junction at 12 o'clock, diameter:

S4X_4dd6337d-9aba-4882-aa9d-5cf20b35e773_20190405_080834_359.jpg, 00:04:12, 32.38 m
Connection other than junction at 12 o'clock, diameter:

S4X_8113a11a-517e-4edd-8ac4-bde4a3698e20_20190405_080913_677.jpg, 00:04:43, 36.31 m
Connection other than junction at 12 o'clock, diameter:

S4X_b34d13cd-a11f-4f5a-83bd-292a71613fec_20190405_080949_148.jpg, 00:05:11, 38.59 m
Connection other than junction at 12 o'clock, diameter:

S4X_1c539c1b-af17-430a-a122-eb39745caf70_20190405_081045_894.jpg, 00:05:59, 46.36 m
Connection other than junction at 12 o'clock, diameter:

S4X_70a28ef5-6797-4dd6-b806-d4c54aea946f_20190405_081119_111.jpg, 00:06:25, 49.34 m
Connection other than junction at 12 o'clock, diameter:

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Section Pictures - 05/04/2019 - S4X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Upstream	S4X	KM.04.19.67	

S4X_0e1e6e37-3caa-43e9-b2cf-042f1139d628_20190405_081240_534.jpg, 00:07:39, 58.93 m
Connection other than junction at 12 o'clock, diameter:

S4X_0a9403e3-fb40-4f72-b1bf-ef6ebd8fc1bf_20190405_081320_079.jpg, 00:08:11, 61.19 m
Connection other than junction at 12 o'clock, diameter:

S4X_a38e43f0-4d8b-475b-90dc-9483a57644e7_20190405_081355_262.jpg, 00:08:39, 64.09 m
Connection other than junction at 12 o'clock, diameter:

S4X_bb89ef55-97ee-4461-8fa9-05e0bdeb471d_20190405_081415_982.jpg, 00:08:55, 65.17 m
Finish node type, manhole, reference number: S4

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Section Inspection - 05/04/2019 - S5X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
6	1	05/04/19	8:31	KM.04.19.67	No Rain Or Snow	Yes	S5X

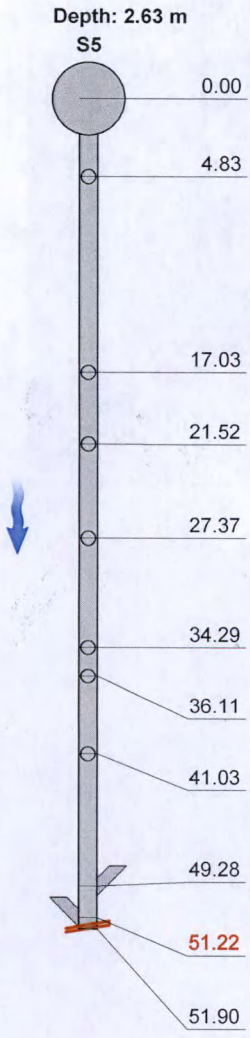
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S5
Road:	Brookdale	**Inspected Length:**	51.90 m	**Upstream Pipe Depth:**	2.630 m
Location:	Road	**Total Length:**	51.90 m	**Downstream Node:**	S6
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.330 m

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm
Year Constructed:		**Pipe Material:**	Concrete
Flow Control:	No flow control	**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:452



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S5	00:00:00		
4.83	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:00:30		
17.03	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:01		
21.52	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:30		
27.37	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:08		
34.29	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:51		
36.11	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:12		
41.03	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:45		
49.28	CN	Connection other than junction at 11 o'clock, diameter: 100mm	00:06:34		
51.22	CXI	Connection intruding at 1 o'clock, diameter: 100mm, intrusion: 95%	00:06:56		5
51.90	SA	Survey abandoned: can not pass intrusion	00:07:24		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	10.0	0.2	10.0	5.0

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Section Pictures - 05/04/2019 - S5X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
6	Downstream	S5X	KM.04.19.67	

S5X_3a8da4cf-5542-444f-a34e-e58f58df49c0_20190405_090223_838.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S5

S5X_693240fd-ed56-427d-b066-fe6b68a06725_20190405_090306_660.jpg, 00:00:30, 4.83 m
Connection other than junction at 12 o'clock, diameter:

S5X_bd0ee04a-35e7-4a44-b67f-3794dc58536d_20190405_090545_028.jpg, 00:03:01, 17.03 m
Connection other than junction at 12 o'clock, diameter:

S5X_4b0726a5-1b8e-4719-8026-5574e0baccf4_20190405_090622_341.jpg, 00:03:30, 21.52 m
Connection other than junction at 12 o'clock, diameter:

S5X_e997d85e-513a-4c9e-a330-d3a995be0e1e_20190405_090707_939.jpg, 00:04:08, 27.37 m
Connection other than junction at 12 o'clock, diameter:

S5X_dc88f43e-10f2-439f-90a0-45b58179b8de_20190405_090759_213.jpg, 00:04:51, 34.29 m
Connection other than junction at 12 o'clock, diameter:

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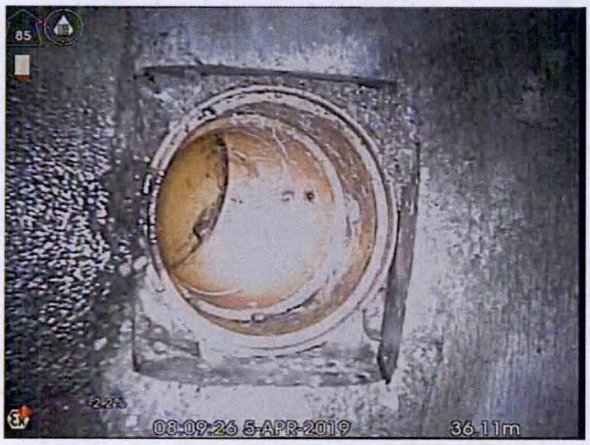
Section Pictures - 05/04/2019 - S5X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
6	Downstream	S5X	KM.04.19.67	



S5X_b30b547f-62c6-437a-8a7e-d78a072d496e_20190405_090834_506.jpg, 00:05:12, 36.11 m
Connection other than junction at 12 o'clock, diameter:

S5X_a2af812d-00a0-49d5-82f5-9c2578d3b00a_20190405_090914_929.jpg, 00:05:45, 41.03 m
Connection other than junction at 12 o'clock, diameter:

S5X_5188388e-7b81-4df1-9aaa-194757a45e84_20190405_091014_963.jpg, 00:06:34, 49.28 m
Connection other than junction at 11 o'clock, diameter:

S5X_d9c04386-cfdb-4432-a2e0-6620da3a2084_20190405_091108_192.jpg, 00:06:56, 51.22 m
Connection intruding at 1 o'clock, diameter: 100mm, intrusion:

S5X_56b9a2bb-9e90-4269-8e9d-ab53078964d4_20190405_091158_715.jpg, 00:07:24, 51.90 m
Survey abandoned

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Section Inspection - 05/04/2019 - S5X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
8	1	05/04/19	9:38	KM.04.19.67	No Rain Or Snow	Yes	S5X

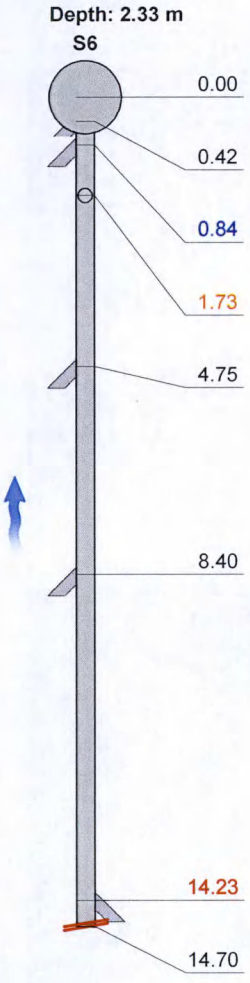
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S5
Road:	Brookdale	**Inspected Length:**	14.70 m	**Upstream Pipe Depth:**	2.630 m
Location:	Road	**Total Length:**	14.70 m	**Downstream Node:**	S6
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.330 m

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm
Year Constructed:		**Pipe Material:**	Concrete
Flow Control:	No flow control	**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:128



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S6	00:00:00		
0.42	CN	Connection other than junction at 2 o'clock, diameter: 100mm	00:00:14		
0.84	CXI	Connection intruding at 2 o'clock, diameter: 100mm, intrusion: 20%	00:00:28		3
1.73	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 25%	00:00:43		4
4.75	CN	Connection other than junction at 1 o'clock, diameter: 100mm	00:01:18		
8.40	CN	Connection other than junction at 2 o'clock, diameter: 100mm	00:01:52		
14.23	CXI	Connection intruding at 11 o'clock, diameter: 100mm, intrusion: 95%	00:02:36		5
14.70	SA	Survey abandoned: Survey Complete	00:02:45		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	3	10.0	1.2	17.0	5.0

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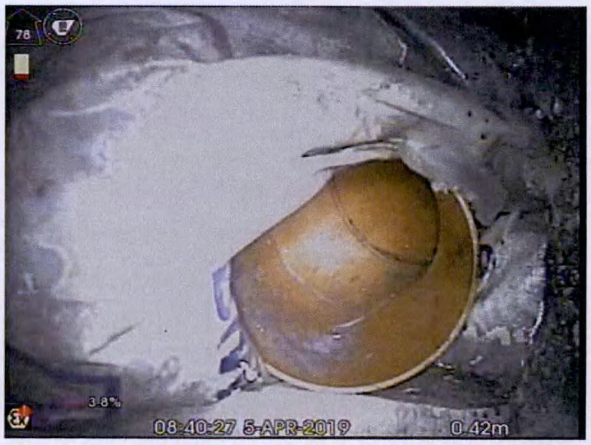
Section Pictures - 05/04/2019 - S5X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S5X	KM.04.19.67	

S5X_104bc7a0-720a-47f0-9d37-14bde05d9d88_20190405_093909_790.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S6



S5X_03b0457f-bb8e-468f-9713-1786b92e3fda_20190405_093935_556.jpg, 00:00:14, 0.42 m
Connection other than junction at 2 o'clock, diameter: 100mm

S5X_b7966323-76b6-459a-b1e1-98e9956461e4_20190405_094005_065.jpg, 00:00:28, 0.84 m
Connection intruding at 2 o'clock, diameter: 100mm, intrusion:

S5X_62aa0cc2-107c-47cd-adfc-3f77a6d3f8cb_20190405_094031_971.jpg, 00:00:43, 1.73 m
Connection intruding at 12 o'clock, diameter: 100mm,

S5X_370e06e4-84f4-4c8a-a3a3-c44a2989c107_20190405_094118_654.jpg, 00:01:18, 4.75 m
Connection other than junction at 1 o'clock, diameter: 100mm

S5X_acceb949-f9b9-48f2-85ef-1e599e766fc5_20190405_094202_125.jpg, 00:01:52, 8.40 m
Connection other than junction at 2 o'clock, diameter: 100mm

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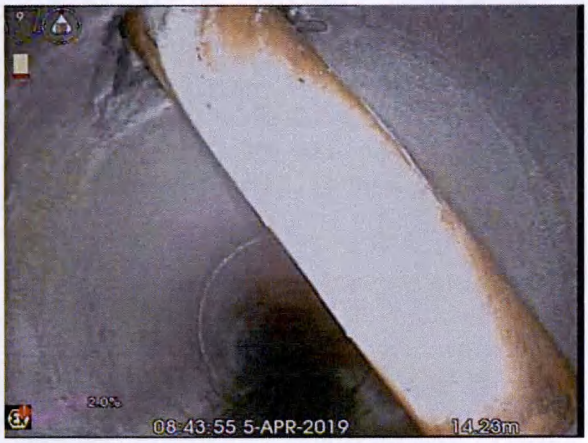
Section Pictures - 05/04/2019 - S5X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
8	Upstream	S5X	KM.04.19.67	



S5X_1b0d48cc-b4e9-416a-a0f1-9fd0bb0d32b9_20190405_094303_328.jpg, 00:02:36, 14.23 m
Connection intruding at 11 o'clock, diameter: 100mm,

S5X_1d400da9-4a1b-4c68-8818-be19158c9803_20190405_094328_528.jpg, 00:02:45, 14.70 m
Survey abandoned

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Section Inspection - 05/04/2019 - S6X

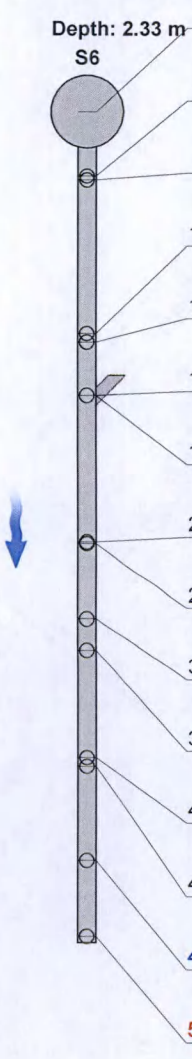
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
7	1	05/04/19	9:24	KM.04.19.67	No Rain Or Snow	Yes	S6X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S6
Road:	Brookdale	**Inspected Length:**	61.18 m	**Upstream Pipe Depth:**	2.330 m
Location:	Road	**Total Length:**	61.18 m	**Downstream Node:**	S7
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.800 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	600 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:465



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S6	00:00:00		
4.14	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:00:39		
4.39	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:00:46		
14.22	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:01:54		
14.77	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:02:07		
18.16	CN	Connection other than junction at 11 o'clock, diameter: 100mm	00:02:37		
18.17	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:02:43		
27.51	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:41		
27.62	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:47		
32.56	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:20		
34.61	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:04:39		
41.57	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:23		
42.14	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:05:35		
48.17	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 20%	00:06:23		3
52.98	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 80%	00:07:02		5

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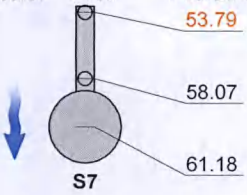
Section Inspection - 05/04/2019 - S6X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
7	1	05/04/19	9:24	KM.04.19.67	No Rain Or Snow	Yes	S6X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Scale: 1:465



Depth: 2.80 m

Position [m]	Code	Observation	MPEG	Photo	Grade
53.79	CXI	Connection intruding at 12 o'clock, diameter: 100mm, intrusion: 50%	00:07:32		4
58.07	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:08:05		
61.18	MHF	Finish node type, manhole, reference number: S7	00:08:30		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	3	10.0	0.3	17.0	5.0

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Section Pictures - 05/04/2019 - S6X

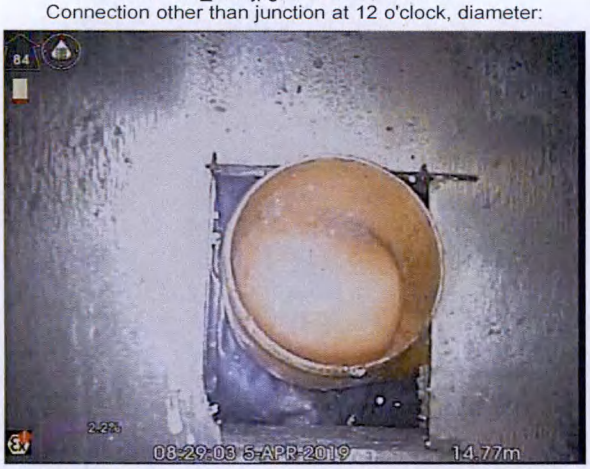
Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S6X	KM.04.19.67	

S6X_8127d366-a7dc-4957-9b17-592a26f26520_20190405_092527_372.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S6

S6X_91b31115-cf97-4745-8a43-0827462e78b0_20190405_092621_053.jpg, 00:00:39, 4.14 m
Connection other than junction at 12 o'clock, diameter:

S6X_a4098aa4-0653-4636-a51a-36339279b92e_20190405_092636_205.jpg, 00:00:46, 4.39 m
Connection other than junction at 12 o'clock, diameter:

S6X_c9ec7afd-1a4f-4ea7-9098-e3660764c0f2_20190405_092750_886.jpg, 00:01:54, 14.22 m
Connection other than junction at 12 o'clock, diameter:



S6X_81383c55-9e7a-4746-8099-ef1c849ac6b8_20190405_092812_269.jpg, 00:02:07, 14.77 m
Connection other than junction at 12 o'clock, diameter:

S6X_a74c1424-4840-47fc-b6ea-f90ae8ef89d6_20190405_092853_457.jpg, 00:02:37, 18.16 m
Connection other than junction at 11 o'clock, diameter:

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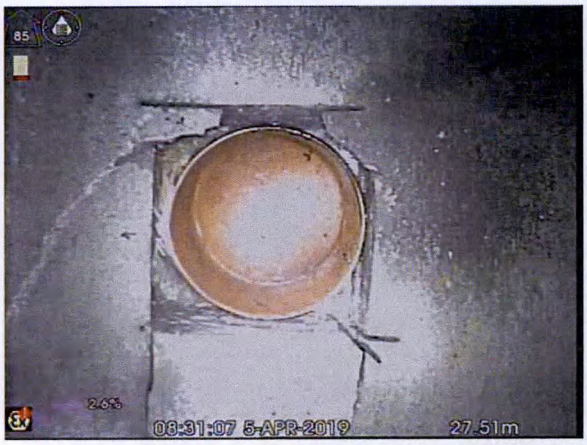
Section Pictures - 05/04/2019 - S6X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S6X	KM.04.19.67	

S6X_bdf240ab-03ce-4839-a13b-4a7ff26210f2_20190405_092906_364.jpg, 00:02:43, 18.17 m
Connection other than junction at 12 o'clock, diameter:



S6X_906c9892-9f70-4388-9326-8bfcfe449905_20190405_093015_084.jpg, 00:03:41, 27.51 m
Connection other than junction at 12 o'clock, diameter:

S6X_d6038f54-fdae-433f-a67f-0de6ba9aa6ba_20190405_093028_351.jpg, 00:03:47, 27.62 m
Connection other than junction at 12 o'clock, diameter:

S6X_3f5f0a68-e51d-4e08-a22b-9b6fb0ced204_20190405_093108_985.jpg, 00:04:20, 32.56 m
Connection other than junction at 12 o'clock, diameter:

S6X_ddbe4989-b184-447f-9b4f-07cca075102e_20190405_093136_478.jpg, 00:04:39, 34.61 m
Connection other than junction at 12 o'clock, diameter:

S6X_1735cf16-efdb-4b0a-88ca-38dbbd134ab1_20190405_093229_036.jpg, 00:05:23, 41.57 m
Connection other than junction at 12 o'clock, diameter:

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Section Pictures - 05/04/2019 - S6X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
7	Downstream	S6X	KM.04.19.67	

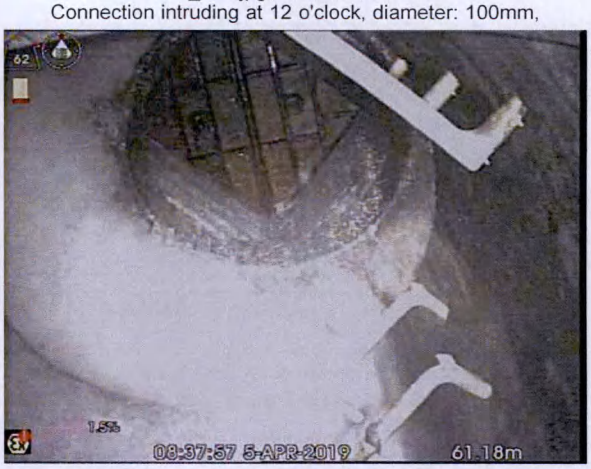
S6X_28decd9d-07d9-44c7-92b2-5de24c9dc43b_20190405_093250_338.jpg, 00:05:35, 42.14 m
Connection other than junction at 12 o'clock, diameter:

S6X_0d19f72f-ee95-4bcb-a8f3-93b19fae9762_20190405_093350_333.jpg, 00:06:23, 48.17 m
Connection intruding at 12 o'clock, diameter: 100mm,

S6X_884f3d3d-f874-4854-8418-3b70886c52c6_20190405_093453_196.jpg, 00:07:02, 52.98 m
Connection intruding at 12 o'clock, diameter: 100mm,

S6X_db2ccba5-02ab-4808-a2f3-f6fb28bc5a34_20190405_093553_252.jpg, 00:07:32, 53.79 m
Connection intruding at 12 o'clock, diameter: 100mm,

S6X_c5a221d9-8216-4a70-82c9-317fa8dbc8cf_20190405_093635_123.jpg, 00:08:05, 58.07 m
Connection other than junction at 12 o'clock, diameter:



S6X_2600c881-53cf-4c40-b02b-ee08dc7ae9b1_20190405_093705_399.jpg, 00:08:30, 61.18 m
Finish node type, manhole, reference number: S7

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Section Inspection - 05/04/2019 - S7X

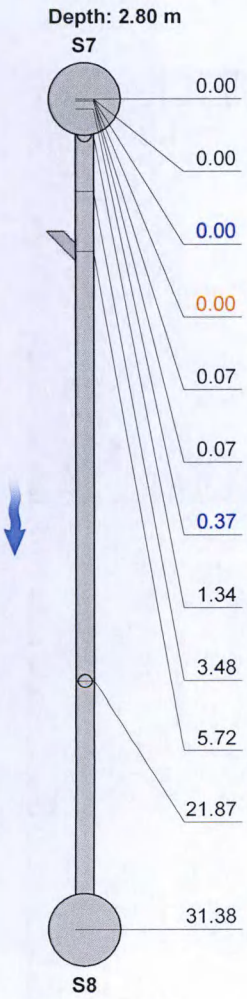
Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
9	1	05/04/19	9:49	KM.04.19.67	No Rain Or Snow	Yes	S7X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S7
Road:	Avoncore Estate	**Inspected Length:**	31.38 m	**Upstream Pipe Depth:**	2.800 m
Location:	Road	**Total Length:**	31.38 m	**Downstream Node:**	S8
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.630 m
Use:	Surface water	**Pipe Shape:**	Circular		
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm		
Year Constructed:		**Pipe Material:**	Concrete		
Flow Control:	No flow control	**Lining Type:**	No Lining		
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining		

Comments:
Recommendations:

Scale: 1:273



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S7	00:00:00		
0.00	GP	General photograph taken at this point: Concrete in line	00:00:07		
0.00	CM	Cracks, multiple from 4 o'clock to 6 o'clock	00:00:24		3
0.00	FS	Fracture spiral from 9 o'clock to 3 o'clock	00:00:40		4
0.07	GP	General photograph taken at this point: Pipe layed through surveying pipe	00:00:54		
0.07	SRB	Sealing ring broken from 3 o'clock to 9 o'clock	00:01:01		1
0.37	CS	Cracks, spiral from 12 o'clock to 12 o'clock	00:01:21		3
1.34	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:01:38		
3.48	GP	General photograph taken at this point: Concrete in line	00:01:58		
5.72	CN	Connection other than junction at 1 o'clock, diameter: 100mm	00:02:16		
21.87	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:03:30		
31.38	MHF	Finish node type, manhole, reference number: S8	00:04:26		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
4	165.0	5.3	165.0	4.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S7X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
9	Downstream	S7X	KM.04.19.67	

S7X_61b2b2d6-a4dc-436d-b3c1-1745fe7a4a02_20190405_095008_174.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S7

S7X_975bed17-9008-4230-9468-a5f4fb99637b_20190405_095036_538.jpg, 00:00:07, 0.00 m
General photograph taken at this point

S7X_e95e40db-f421-4224-9e8c-5d1c64228623_20190405_095114_099.jpg, 00:00:24, 0.00 m
Cracks, multiple from 4 o'clock to 6 o'clock

S7X_ca062aaf-6af5-4bed-ad91-987a9282a6d7_20190405_095147_073.jpg, 00:00:40, 0.00 m
Fracture spiral from 9 o'clock to 3 o'clock

S7X_d006f887-6511-4b65-b4da-cfa26ba72726_20190405_095217_150.jpg, 00:00:54, 0.07 m
General photograph taken at this point

S7X_507b6eab-e483-4ccb-9798-b9840ae9fe90_20190405_095241_489.jpg, 00:01:01, 0.07 m
Sealing ring broken from 3 o'clock to 9 o'clock

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Section Pictures - 05/04/2019 - S7X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
9	Downstream	S7X	KM.04.19.67	

S7X_7668e268-54dd-4054-bff4-0173f5f9763b_20190405_095314_961.jpg, 00:01:21, 0.37 m
Cracks, spiral from 12 o'clock to 12 o'clock

S7X_5389aa5f-4fe3-4cf8-b377-cfb7861908ba_20190405_095338_868.jpg, 00:01:38, 1.34 m
Connection other than junction at 12 o'clock, diameter:

S7X_45db0c5d-8ed2-4482-a9ef-89be9f78f5ff_20190405_095410_824.jpg, 00:01:58, 3.48 m
General photograph taken at this point

S7X_ff2f0039-0154-4204-b1e9-e659e7926ade_20190405_095439_124.jpg, 00:02:16, 5.72 m
Connection other than junction at 1 o'clock, diameter: 100mm

S7X_31436574-988a-4e7e-9a63-8803c35111fa_20190405_095559_947.jpg, 00:03:30, 21.87 m
Connection other than junction at 12 o'clock, diameter:

S7X_a6d2ef8d-17e9-4708-9152-e0ca7997194e_20190405_095701_470.jpg, 00:04:26, 31.38 m
Finish node type, manhole, reference number: S8

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Section Inspection - 05/04/2019 - S8X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
10	1	05/04/19	11:25	KM.04.19.67	No Rain Or Snow	Yes	S8X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S8
Road:	Avoncore Estate	**Inspected Length:**	78.81 m	**Upstream Pipe Depth:**	2.630 m
Location:	Road	**Total Length:**	78.81 m	**Downstream Node:**	S9
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.180 m

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm
Year Constructed:		**Pipe Material:**	Concrete
Flow Control:	No flow control	**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:686	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 2.63 m S8	0.00	MH	Start node type, manhole, reference number: S8	00:00:00		
	78.81	SA	Survey abandoned: Survey will continue from other end	00:14:34		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S8X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
10	Downstream	S8X	KM.04.19.67	

S8X_416171ae-cd8c-4dee-a7c8-081971adace7_20190405_112732_811.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S8

S8X_f3ae3c52-c9e2-435d-85d9-ce996e3978a7_20190405_114838_269.jpg, 00:14:34, 78.81 m
Survey abandoned

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Section Inspection - 05/04/2019 - S8X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
11	1	05/04/19	12:00	KM.04.19.67	No Rain Or Snow	Yes	S8X

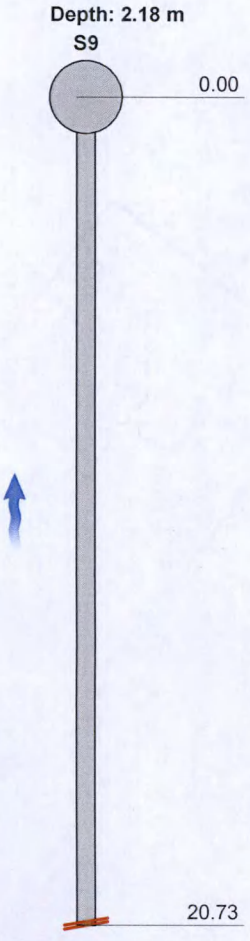
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Upstream	**Upstream Node:**	S8
Road:	Avoncore Estate	**Inspected Length:**	20.73 m	**Upstream Pipe Depth:**	2.630 m
Location:	Road	**Total Length:**	20.73 m	**Downstream Node:**	S9
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.180 m

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm
Year Constructed:		**Pipe Material:**	Concrete
Flow Control:	No flow control	**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:181



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S9	00:00:00		
20.73	SA	Survey abandoned: Survey Complete	00:01:52		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S8X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
11	Upstream	S8X	KM.04.19.67	

S8X_7e3b0df1-74e1-44e9-b001-48fa4edb2e65_20190405_120112_208.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S9

S8X_dd51b15e-55e5-42e3-8028-90a36a45cfef_20190405_120328_014.jpg, 00:01:52, 20.73 m
Survey abandoned

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Section Inspection - 05/04/2019 - S9X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
12	1	05/04/19	12:05	KM.04.19.67	No Rain Or Snow	Yes	S9X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S9
Road:	Elm Grove	**Inspected Length:**	9.92 m	**Upstream Pipe Depth:**	2.180 m
Location:	Road	**Total Length:**	9.92 m	**Downstream Node:**	S10
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	2.130 m

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm
Year Constructed:		**Pipe Material:**	Concrete
Flow Control:	No flow control	**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:87	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 2.18 m						
S9						
	0.00	MH	Start node type, manhole, reference number: S9	00:00:00		
	9.92	MHF	Finish node type, manhole, reference number: S10	00:00:49		
S10						
Depth: 2.13 m						

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S9X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
12	Downstream	S9X	KM.04.19.67	

S9X_144cd6f6-0f76-4b04-90bd-f1f8add8c847_20190405_120737_601.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S9

S9X_ea66e2f4-6960-4c58-b4e6-be7f4ad17f91_20190405_120835_240.jpg, 00:00:49, 9.92 m
Finish node type, manhole, reference number: S10

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Section Inspection - 05/04/2019 - S10X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
13	1	05/04/19	12:42	KM.04.19.67	No Rain Or Snow	Yes	S10X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S10
Road:	Avoncore Estate	**Inspected Length:**	67.57 m	**Upstream Pipe Depth:**	2.130 m
Location:	Road	**Total Length:**	67.57 m	**Downstream Node:**	S11
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	1.250 m
Use:	Surface water			**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer			**Dia/Height:**	600 mm
Year Constructed:				**Pipe Material:**	Concrete
Flow Control:	No flow control			**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition			**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:588	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 2.13 m						
S10						
	0.00	MH	Start node type, manhole, reference number: S10	00:00:00		
	61.26	WL	Water level, 10% of the vertical dimension	00:05:21		
	67.57	MHF	Finish node type, manhole, reference number: S11	00:06:41		
S11						
Depth: 1.25 m						

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S10X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
13	Downstream	S10X	KM.04.19.67	

S10X_fc02f629-fa01-4181-91fa-71543718d68d_20190405_133713_174.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S10

S10X_f3b594ef-ef55-4d79-baf5-181129d52886_20190405_134246_959.jpg, 00:05:21, 61.26 m
Water level, 10% of the vertical dimension

S10X_a69e2a28-feaf-4cff-85c4-7a83b30f4b02_20190405_134412_733.jpg, 00:06:41, 67.57 m
Finish node type, manhole, reference number: S11

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Section Inspection - 05/04/2019 - S11X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
1	1	05/04/19	15:47	KM.04.19.67	No Rain Or Snow	Yes	S11X

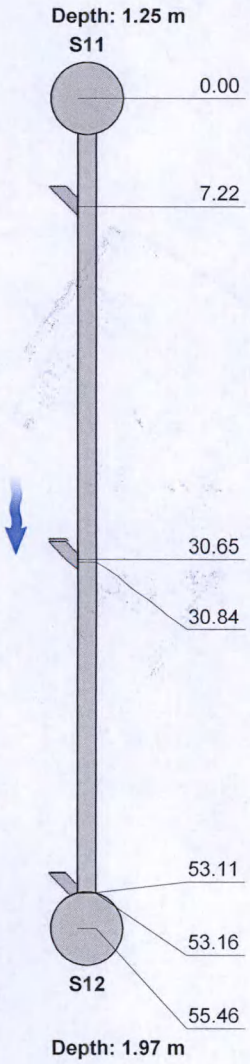
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S11
Road:	R626	**Inspected Length:**	55.46 m	**Upstream Pipe Depth:**	1.250 m
Location:	Road	**Total Length:**	55.46 m	**Downstream Node:**	S12
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	1.970 m

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm
Year Constructed:		**Pipe Material:**	Concrete
Flow Control:	No flow control	**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:483



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S11	00:00:00		
7.22	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:00:53		
30.65	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:03:15		
30.84	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:03:25		
53.11	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:07:57		
53.16	CN	Connection other than junction at 1 o'clock, diameter: 150mm	00:08:06		
55.46	MHF	Finish node type, manhole, reference number: S12	00:08:50		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

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Section Pictures - 05/04/2019 - S11X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Downstream	S11X	KM.04.19.67	

S11X_0f7f2399-5c83-4708-94ca-2adb86d599b4_20190405_155152_771.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S11

S11X_8c26414c-5570-4c5c-9c45-72a3d62b1144_20190405_155300_478.jpg, 00:00:53, 7.22 m
Connection other than junction at 1 o'clock, diameter: 150mm

S11X_97e89ff1-cece-4ded-a60d-67b0788aebb6_20190405_155533_720.jpg, 00:03:15, 30.65 m
Connection other than junction at 1 o'clock, diameter: 150mm

S11X_b51732fa-f87c-498b-98f5-c59dd0c10ad3_20190405_155550_998.jpg, 00:03:25, 30.84 m
Connection other than junction at 1 o'clock, diameter: 150mm

S11X_bced69d4-79c0-4d55-a302-6040b96b55cc_20190405_160032_561.jpg, 00:07:57, 53.11 m
Connection other than junction at 1 o'clock, diameter: 150mm

S11X_4159b65c-b355-45a4-92e8-229edce50242_20190405_160051_701.jpg, 00:08:06, 53.16 m
Connection other than junction at 1 o'clock, diameter: 150mm

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Section Pictures - 05/04/2019 - S11X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Downstream	S11X	KM.04.19.67	

S11X_0c83f958-bcf9-481f-9fee-3e27b1badafb_20190405_160142_182.jpg, 00:08:50, 55.46 m
Finish node type, manhole, reference number: S12

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Section Inspection - 05/04/2019 - S12X

Section	Inspection	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
14	1	05/04/19	14:45	KM.04.19.67	No Rain Or Snow	Yes	S12X

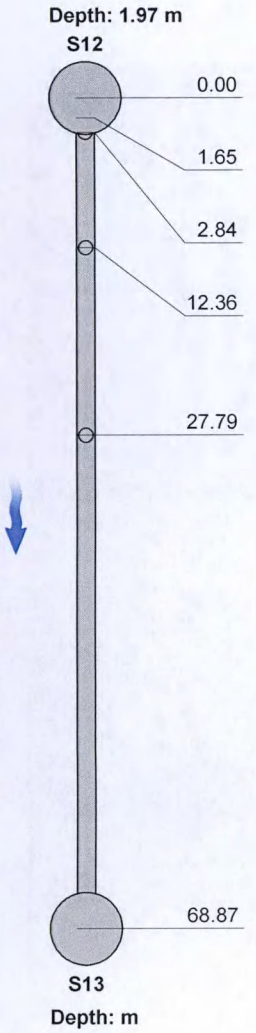
Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Kenneth Murray	141	Mini-Cam	Not Specified	Not Specified	Not Specified

Town or Village:	Midleton	**Inspection Direction:**	Downstream	**Upstream Node:**	S12
Road:	R626	**Inspected Length:**	68.87 m	**Upstream Pipe Depth:**	1.970 m
Location:	Road	**Total Length:**	68.87 m	**Downstream Node:**	S13
Surface Type:	Asphalt Highway	**Joint Length:**	0.00 m	**Downstream Pipe Depth:**	

Use:	Surface water	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	600 mm
Year Constructed:		**Pipe Material:**	Concrete
Flow Control:	No flow control	**Lining Type:**	No Lining
Inspection Purpose:	Sample survey to determine asset condition	**Lining Material:**	No Lining

Comments: No access to S13 for invert level
Recommendations:

Scale: 1:599



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node type, manhole, reference number: S12	00:00:00		
1.65	WL	Water level, 10% of the vertical dimension	00:00:12		
2.84	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:00:28		
12.36	CN	Connection other than junction at 12 o'clock, diameter: 150mm	00:04:18		
27.79	CN	Connection other than junction at 12 o'clock, diameter: 100mm	00:06:39		
68.87	MHF	Finish node type, manhole, reference number: S13: Cover in manhole	00:11:35		

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Section Pictures - 05/04/2019 - S12X

Section	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
14	Downstream	S12X	KM.04.19.67	

S12X_530986e0-6df5-4e9a-9f86-33bcdb7ea806_20190405_145505_405.jpg, 00:00:00, 0.00 m
Start node type, manhole, reference number: S12

S12X_a4c78e13-8fa1-48da-99c7-0acaecf3be4c_20190405_145527_027.jpg, 00:00:12, 1.65 m
Water level, 10% of the vertical dimension

S12X_c8a29280-971f-4478-a52d-44cf951e9945_20190405_145551_027.jpg, 00:00:28, 2.84 m
Connection other than junction at 12 o'clock, diameter:

S12X_1bd62a68-ad66-4de4-b315-8e019f14ab10_20190405_145952_710.jpg, 00:04:18, 12.36 m
Connection other than junction at 12 o'clock, diameter:

S12X_7c569883-7420-47af-be2e-602fc3a58e52_20190405_150225_562.jpg, 00:06:39, 27.79 m
Connection other than junction at 12 o'clock, diameter:

S12X_14a235e1-3da0-4edc-ba07-3a80a5ae47d2_20190405_150825_482.jpg, 00:11:35, 68.87 m
Finish node type, manhole, reference number: S13

Munster Drain Services

Tel. 021 - 4770797
info@munsterdrain.com

WinCan

Notes:

Thank you for choosing to use Munster Drain Services to carry out your drainage investigation works.

The results and views carried in this report are those of the engineer(s) appointed to carry out the investigation and are considered relevant on the day of the survey. Drain and sewer performance is known to alter over time, so liability cannot be accepted for differences between the recorded data and the actual data at a time after this report was generated.

This survey has been created in accordance with the drainage standard used in the country and language settings for this PC.

If a DVD has been supplied with this report, please note that it can only be used in a Windows based PC. Please browse the DVD and navigate to the PDF folder to find project-based documents such as drawings, engineer's site notes and survey specifications amongst others.

CCTV subsidence investigations do not account for the water tightness of the pipes and are merely a visual inspection of inside of the drains. CCTV drainage engineers are generally not qualified to comment on the causes of subsidence, and can only suggest required remedial actions for the pipes, and not the affected buildings.

Subsidence is a building structural failure, which can occur for many reasons. Although drainage failures can contribute to subsidence problems, other causes should always be investigated as part of a considered approach. In order to eliminate drains from suspicion, it is suggested that all pipes within at least 10m of the subsidence area be pressure tested over and above a CCTV inspection, and remedial suggestions considered based on the findings.

Unless otherwise specified in an associated task order (or similar), the data gathered in this report may not be suitable for use as a pre-lining investigation. Munster Drain are happy to carry out such surveys, but this must be agreed prior to the commencement of the works, and a the client must specify the data they wish to capture and the acceptable tolerances.

Where GPS coordinates and heights have been issued within this report, they are to 1m accuracy, and 2m accuracy for heights. Greater accuracy can be provided on request.

Appendix C:
Surface Water Receiving Network – Design Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	10	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	30.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
ES01	1.991	30.00		18.850	1500	587914.225	574698.340	3.150
ES02	0.126	30.00	53.0	18.981	1500	587898.759	574697.948	3.330
ES03	0.046	30.00		17.938	1500	587898.370	574658.624	2.565
ES04				17.434	1500	587885.854	574664.711	2.150
ES05	0.333	30.00		17.060	1500	587828.502	574699.391	2.630
ES06	0.183	30.00		14.970	1500	587762.925	574719.103	2.330
ES07	0.684	30.00		14.893	1500	587733.243	574774.628	2.800
ES08				14.316	1500	587701.968	574762.770	2.630
ES09				11.588	1500	587613.683	574714.989	2.180
ES10				11.324	1500	587619.057	574704.295	2.130
ES11	0.152	30.00		9.895	1500	587557.883	574670.588	1.250
ES12				9.670	1500	587584.670	574619.283	1.970
ES13				9.670	1500	587503.473	574567.803	2.771

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	ES01	ES02	15.471	0.600	15.700	15.651	0.049	315.7	525	30.00	35.0
1.001	ES02	ES03	39.326	0.600	15.651	15.373	0.278	141.5	525	30.00	35.0
1.002	ES03	ES04	13.918	0.600	15.373	15.284	0.089	156.4	525	30.00	35.0
1.003	ES04	ES05	67.022	0.600	15.284	14.430	0.854	78.5	525	30.00	35.0
1.004	ES05	ES06	68.476	0.600	14.430	12.640	1.790	38.3	525	30.00	35.0
1.005	ES06	ES07	62.961	0.600	12.640	12.093	0.547	115.1	600	30.00	35.0
1.006	ES07	ES08	33.448	0.600	12.093	11.686	0.407	82.2	600	30.00	35.0
1.007	ES08	ES09	100.386	0.600	11.686	9.408	2.278	44.1	600	30.00	35.0
1.008	ES09	ES10	11.968	0.600	9.408	9.194	0.214	55.9	600	30.00	35.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.255	271.6	188.7	2.625	2.805	1.991	0.0	323	1.351
1.001	1.881	407.2	253.6	2.805	2.040	2.117	53.0	301	1.978
1.002	1.788	387.1	258.0	2.040	1.625	2.163	53.0	314	1.908
1.003	2.530	547.6	258.0	1.625	2.105	2.163	53.0	254	2.494
1.004	3.629	785.6	289.5	2.105	1.805	2.496	53.0	220	3.366
1.005	2.269	641.5	306.8	1.730	2.200	2.678	53.0	292	2.244
1.006	2.687	759.8	371.6	2.200	2.030	3.362	53.0	296	2.674
1.007	3.675	1039.0	371.6	2.030	1.580	3.362	53.0	247	3.381
1.008	3.260	921.8	371.6	1.580	1.530	3.362	53.0	265	3.093

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.009	ES10	ES11	69.846	0.600	9.194	8.645	0.549	127.2	600	30.00	35.0
1.010	ES11	ES12	57.877	0.600	8.645	7.700	0.945	61.2	600	30.00	35.0
1.011	ES12	ES13	96.141	0.600	7.700	6.899	0.801	120.0	600	30.00	35.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.009	2.157	610.0	371.6	1.530	0.650	3.362	53.0	339	2.258
1.010	3.115	880.7	386.1	0.650	1.370	3.515	53.0	277	3.016
1.011	2.222	628.2	386.1	1.370	2.171	3.515	53.0	341	2.329

Pipeline Schedule

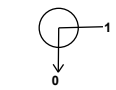
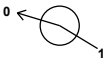
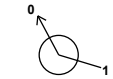
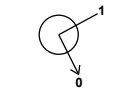
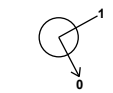
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.471	315.7	525	Circular	18.850	15.700	2.625	18.981	15.651	2.805
1.001	39.326	141.5	525	Circular	18.981	15.651	2.805	17.938	15.373	2.040
1.002	13.918	156.4	525	Circular	17.938	15.373	2.040	17.434	15.284	1.625
1.003	67.022	78.5	525	Circular	17.434	15.284	1.625	17.060	14.430	2.105
1.004	68.476	38.3	525	Circular	17.060	14.430	2.105	14.970	12.640	1.805
1.005	62.961	115.1	600	Circular	14.970	12.640	1.730	14.893	12.093	2.200
1.006	33.448	82.2	600	Circular	14.893	12.093	2.200	14.316	11.686	2.030
1.007	100.386	44.1	600	Circular	14.316	11.686	2.030	11.588	9.408	1.580
1.008	11.968	55.9	600	Circular	11.588	9.408	1.580	11.324	9.194	1.530
1.009	69.846	127.2	600	Circular	11.324	9.194	1.530	9.895	8.645	0.650
1.010	57.877	61.2	600	Circular	9.895	8.645	0.650	9.670	7.700	1.370
1.011	96.141	120.0	600	Circular	9.670	7.700	1.370	9.670	6.899	2.171

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	ES01	1500	Manhole	Adoptable	ES02	1500	Manhole	Adoptable
1.001	ES02	1500	Manhole	Adoptable	ES03	1500	Manhole	Adoptable
1.002	ES03	1500	Manhole	Adoptable	ES04	1500	Manhole	Adoptable
1.003	ES04	1500	Manhole	Adoptable	ES05	1500	Manhole	Adoptable
1.004	ES05	1500	Manhole	Adoptable	ES06	1500	Manhole	Adoptable
1.005	ES06	1500	Manhole	Adoptable	ES07	1500	Manhole	Adoptable
1.006	ES07	1500	Manhole	Adoptable	ES08	1500	Manhole	Adoptable
1.007	ES08	1500	Manhole	Adoptable	ES09	1500	Manhole	Adoptable
1.008	ES09	1500	Manhole	Adoptable	ES10	1500	Manhole	Adoptable
1.009	ES10	1500	Manhole	Adoptable	ES11	1500	Manhole	Adoptable
1.010	ES11	1500	Manhole	Adoptable	ES12	1500	Manhole	Adoptable
1.011	ES12	1500	Manhole	Adoptable	ES13	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
ES01	587914.225	574698.340	18.850	3.150	1500				
						0	1.000	15.700	525

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
ES02	587898.759	574697.948	18.981	3.330	1500	1	1.000	15.651	525
									
						0	1.001	15.651	525
ES03	587898.370	574658.624	17.938	2.565	1500	1	1.001	15.373	525
									
						0	1.002	15.373	525
ES04	587885.854	574664.711	17.434	2.150	1500	1	1.002	15.284	525
									
						0	1.003	15.284	525
ES05	587828.502	574699.391	17.060	2.630	1500	1	1.003	14.430	525
									
						0	1.004	14.430	525
ES06	587762.925	574719.103	14.970	2.330	1500	1	1.004	12.640	525
									
						0	1.005	12.640	600
ES07	587733.243	574774.628	14.893	2.800	1500	1	1.005	12.093	600
									
						0	1.006	12.093	600
ES08	587701.968	574762.770	14.316	2.630	1500	1	1.006	11.686	600
									
						0	1.007	11.686	600
ES09	587613.683	574714.989	11.588	2.180	1500	1	1.007	9.408	600
									
						0	1.008	9.408	600
ES10	587619.057	574704.295	11.324	2.130	1500	1	1.008	9.194	600
									
						0	1.009	9.194	600
ES11	587557.883	574670.588	9.895	1.250	1500	1	1.009	8.645	600
									
						0	1.010	8.645	600
ES12	587584.670	574619.283	9.670	1.970	1500	1	1.010	7.700	600
									
						0	1.011	7.700	600
ES13	587503.473	574567.803	9.670	2.771	1500	1	1.011	6.899	600
									

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	Scotland and Ireland	Additional Storage (m³/ha)	20.0
M5-60 (mm)	19.000	Check Discharge Rate(s)	✓
Ratio-R	0.300	1 year (l/s)	20.2
Summer CV	0.750	30 year (l/s)	40.2
Winter CV	0.840	100 year (l/s)	47.7
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	✓	100 year 360 minute (m³)	1702

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	10	0	0
10	10	0	0
30	10	0	0
100	10	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.65
Greenfield Method	IH124	Growth Factor 100 year	1.96
Positively Drained Area (ha)	7.950	Betterment (%)	0
SAAR (mm)	1091	QBar	24.4
Soil Index	2	Q 1 year (l/s)	20.2
SPR	0.30	Q 30 year (l/s)	40.2
Region	11	Q 100 year (l/s)	47.7
Growth Factor 1 year	0.83		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	7.950	Storm Duration (mins)	360
Soil Index	2	Betterment (%)	0
SPR	0.30	PR	0.341
CWI	125.228	Runoff Volume (m³)	1702

Results for 5 year +10% CC Critical Storm Duration. Lowest mass balance: 97.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	ES01	45	16.025	0.325	158.0	4.6766	0.0000	OK
60 minute winter	ES02	45	15.949	0.298	219.8	0.7529	0.0000	OK
60 minute winter	ES03	45	15.684	0.311	222.6	0.6605	0.0000	OK
60 minute winter	ES04	54	15.529	0.245	221.7	0.4333	0.0000	OK
60 minute winter	ES05	45	14.628	0.198	247.2	0.8504	0.0000	OK
60 minute winter	ES06	45	12.915	0.275	260.8	0.9180	0.0000	OK
60 minute winter	ES07	45	12.388	0.295	313.6	1.9622	0.0000	OK
60 minute winter	ES08	45	11.906	0.220	312.1	0.3887	0.0000	OK
60 minute winter	ES09	54	9.712	0.304	310.9	0.5371	0.0000	OK
60 minute winter	ES10	54	9.512	0.318	310.8	0.5626	0.0000	OK
60 minute winter	ES11	55	8.900	0.255	320.5	1.0701	0.0000	OK
60 minute winter	ES12	55	8.012	0.312	320.8	0.5514	0.0000	OK
60 minute winter	ES13	55	7.195	0.296	320.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	ES01	1.000	ES02	156.8	1.175	0.577	2.0639	
60 minute winter	ES02	1.001	ES03	218.9	1.687	0.538	5.1064	
60 minute winter	ES03	1.002	ES04	221.7	1.914	0.573	1.6111	
60 minute winter	ES04	1.003	ES05	222.1	2.570	0.406	5.7981	
60 minute winter	ES05	1.004	ES06	246.3	2.611	0.314	6.4701	
60 minute winter	ES06	1.005	ES07	259.3	1.983	0.404	8.3053	
60 minute winter	ES07	1.006	ES08	312.1	2.703	0.411	3.8694	
60 minute winter	ES08	1.007	ES09	310.9	2.638	0.299	11.8821	
60 minute winter	ES09	1.008	ES10	310.8	2.107	0.337	1.7658	
60 minute winter	ES10	1.009	ES11	309.9	2.337	0.508	9.2756	
60 minute winter	ES11	1.010	ES12	320.8	2.451	0.364	7.5774	
60 minute winter	ES12	1.011	ES13	320.9	2.241	0.511	13.7715	1587.7

Results for 10 year +10% CC Critical Storm Duration. Lowest mass balance: 97.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	ES01	50	16.056	0.356	183.4	5.1289	0.0000	OK
60 minute winter	ES02	50	15.974	0.323	246.6	0.8148	0.0000	OK
60 minute winter	ES03	50	15.707	0.334	249.7	0.7099	0.0000	OK
60 minute winter	ES04	54	15.546	0.262	248.8	0.4634	0.0000	OK
60 minute winter	ES05	50	14.641	0.211	278.5	0.9072	0.0000	OK
60 minute winter	ES06	50	12.936	0.296	294.2	0.9890	0.0000	OK
60 minute winter	ES07	50	12.411	0.318	355.6	2.1191	0.0000	OK
60 minute winter	ES08	50	11.921	0.235	353.8	0.4160	0.0000	OK
60 minute winter	ES09	54	9.740	0.332	352.5	0.5862	0.0000	OK
60 minute winter	ES10	54	9.538	0.344	352.4	0.6085	0.0000	OK
60 minute winter	ES11	54	8.920	0.275	364.2	1.1564	0.0000	OK
60 minute winter	ES12	55	8.038	0.338	363.5	0.5973	0.0000	OK
60 minute winter	ES13	55	7.218	0.319	364.3	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	ES01	1.000	ES02	182.0	1.232	0.670	2.2833	
60 minute winter	ES02	1.001	ES03	245.5	1.728	0.603	5.5878	
60 minute winter	ES03	1.002	ES04	248.8	1.968	0.643	1.7568	
60 minute winter	ES04	1.003	ES05	249.1	2.643	0.455	6.3256	
60 minute winter	ES05	1.004	ES06	277.4	2.685	0.353	7.0812	
60 minute winter	ES06	1.005	ES07	292.5	2.031	0.456	9.1497	
60 minute winter	ES07	1.006	ES08	353.8	2.785	0.466	4.2550	
60 minute winter	ES08	1.007	ES09	352.5	2.697	0.339	13.1548	
60 minute winter	ES09	1.008	ES10	352.4	2.155	0.382	1.9574	
60 minute winter	ES10	1.009	ES11	351.9	2.399	0.577	10.2417	
60 minute winter	ES11	1.010	ES12	363.5	2.514	0.413	8.3686	
60 minute winter	ES12	1.011	ES13	364.3	2.307	0.580	15.1814	1687.7

Results for 30 year +10% CC Critical Storm Duration. Lowest mass balance: 97.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	ES01	46	16.118	0.418	232.1	6.0182	0.0000	OK
60 minute winter	ES02	46	16.022	0.371	298.0	0.9373	0.0000	OK
60 minute winter	ES03	46	15.751	0.378	302.1	0.8043	0.0000	OK
60 minute winter	ES04	46	15.579	0.295	301.0	0.5207	0.0000	OK
60 minute winter	ES05	46	14.665	0.235	338.5	1.0110	0.0000	OK
60 minute winter	ES06	46	12.977	0.337	358.5	1.1247	0.0000	OK
60 minute winter	ES07	46	12.456	0.363	436.1	2.4135	0.0000	OK
60 minute winter	ES08	46	11.949	0.263	433.9	0.4656	0.0000	OK
60 minute winter	ES09	54	9.793	0.385	432.4	0.6801	0.0000	OK
60 minute winter	ES10	54	9.588	0.394	431.6	0.6962	0.0000	OK
60 minute winter	ES11	54	8.959	0.314	447.6	1.3200	0.0000	OK
60 minute winter	ES12	55	8.088	0.388	446.3	0.6853	0.0000	OK
60 minute winter	ES13	55	7.262	0.363	447.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	ES01	1.000	ES02	230.3	1.323	0.848	2.6889	
60 minute winter	ES02	1.001	ES03	296.7	1.798	0.729	6.4879	
60 minute winter	ES03	1.002	ES04	301.0	2.059	0.777	2.0273	
60 minute winter	ES04	1.003	ES05	299.7	2.764	0.547	7.3192	
60 minute winter	ES05	1.004	ES06	337.2	2.803	0.429	8.2226	
60 minute winter	ES06	1.005	ES07	356.3	2.110	0.556	10.7383	
60 minute winter	ES07	1.006	ES08	433.9	2.919	0.571	4.9698	
60 minute winter	ES08	1.007	ES09	432.4	2.789	0.416	15.5343	
60 minute winter	ES09	1.008	ES10	431.6	2.230	0.468	2.3166	
60 minute winter	ES10	1.009	ES11	432.1	2.498	0.708	12.0618	
60 minute winter	ES11	1.010	ES12	446.3	2.611	0.507	9.8813	
60 minute winter	ES12	1.011	ES13	447.2	2.411	0.712	17.8323	1881.4

Results for 100 year +10% CC Critical Storm Duration. Lowest mass balance: 97.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	ES01	48	16.219	0.519	300.3	7.4848	0.0000	OK
60 minute winter	ES02	48	16.104	0.453	369.7	1.1419	0.0000	OK
60 minute winter	ES03	48	15.816	0.443	374.9	0.9412	0.0000	OK
60 minute winter	ES04	48	15.624	0.340	373.7	0.6011	0.0000	OK
60 minute winter	ES05	48	14.699	0.269	422.5	1.1551	0.0000	OK
60 minute winter	ES06	48	13.036	0.396	448.5	1.3199	0.0000	OK
60 minute winter	ES07	48	12.518	0.425	549.2	2.8287	0.0000	OK
60 minute winter	ES08	48	11.987	0.301	546.7	0.5318	0.0000	OK
60 minute winter	ES09	54	9.874	0.466	544.9	0.8227	0.0000	OK
60 minute winter	ES10	54	9.663	0.469	542.7	0.8284	0.0000	OK
60 minute winter	ES11	54	9.015	0.370	564.3	1.5538	0.0000	OK
60 minute winter	ES12	55	8.165	0.465	563.1	0.8215	0.0000	OK
60 minute winter	ES13	55	7.327	0.428	563.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	ES01	1.000	ES02	297.7	1.426	1.096	3.1996	
60 minute winter	ES02	1.001	ES03	368.0	1.876	0.904	7.7141	
60 minute winter	ES03	1.002	ES04	373.7	2.164	0.965	2.3823	
60 minute winter	ES04	1.003	ES05	372.3	2.890	0.680	8.6874	
60 minute winter	ES05	1.004	ES06	420.9	2.926	0.536	9.7859	
60 minute winter	ES06	1.005	ES07	446.0	2.195	0.695	12.9263	
60 minute winter	ES07	1.006	ES08	546.7	3.067	0.720	5.9358	
60 minute winter	ES08	1.007	ES09	544.9	2.872	0.524	18.8535	
60 minute winter	ES09	1.008	ES10	542.7	2.308	0.589	2.8178	
60 minute winter	ES10	1.009	ES11	544.2	2.588	0.892	14.6110	
60 minute winter	ES11	1.010	ES12	563.1	2.695	0.639	12.0440	
60 minute winter	ES12	1.011	ES13	563.4	2.508	0.897	21.5969	2151.2

Appendix D:
Greenfield Run-Off Rate – Design Calculations

Print | Close Report

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	George Forde
Site name:	Broomfield
Site location:	Midleton, Co. Cork

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

Site Details

Latitude:	51.92721° N
Longitude:	8.17265° W
Reference:	1677466448
Date:	May 02 2023 15:19

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 7.95

Methodology

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

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

Hydrological characteristics	Default	Edited
SAAR (mm):	1005	1091
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	22.12	24.35
1 in 1 year (l/s):	18.8	20.7
1 in 30 years (l/s):	36.5	40.18
1 in 100 year (l/s):	43.13	47.48
1 in 200 years (l/s):	47.56	52.35

Appendix E:
Site Infiltration Test Reports

TRIAL HOLE A

Depth	**900mm**
Volume ^{75}	**1.06m^3**
Volume ^{25}	**0.268m^3**

Test

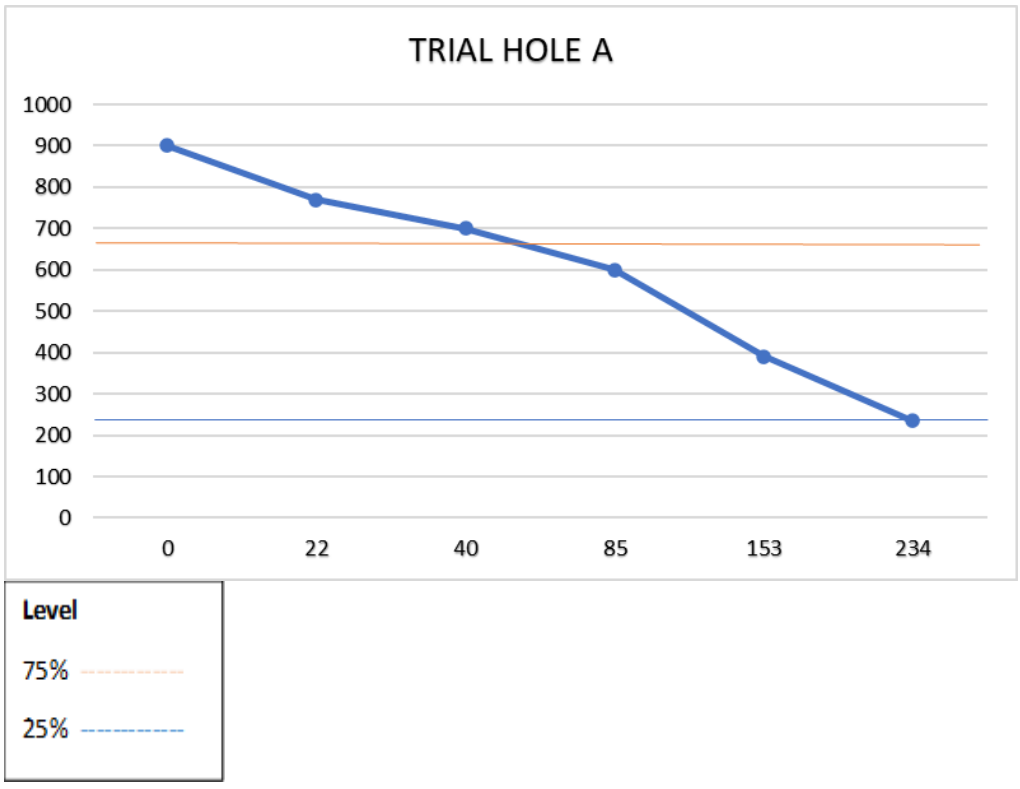
Level (mm)	Elapsed Time (min)
900	**0**
770	**22**
700	**40**
600	**85**
390	**153**
150	**134**

(Ap 50) = 3.036m^2

Vp75-25 = 1.06-0.268 = 0.792m^3

Tp75-25 = 156 minutes

Soil Infiltration Rate F: $\frac{Vp75\text{-}25}{Ap50 \times tp75\text{-}25} = \frac{0.792}{3.036 \times 156 \times 60} =$ 2.8x10^{-5}m/s



TRIAL HOLE B

Depth	**920mm**
Volume ^{75}	**1.534m^3**
Volume ^{25}	**0.396m^3**

Test

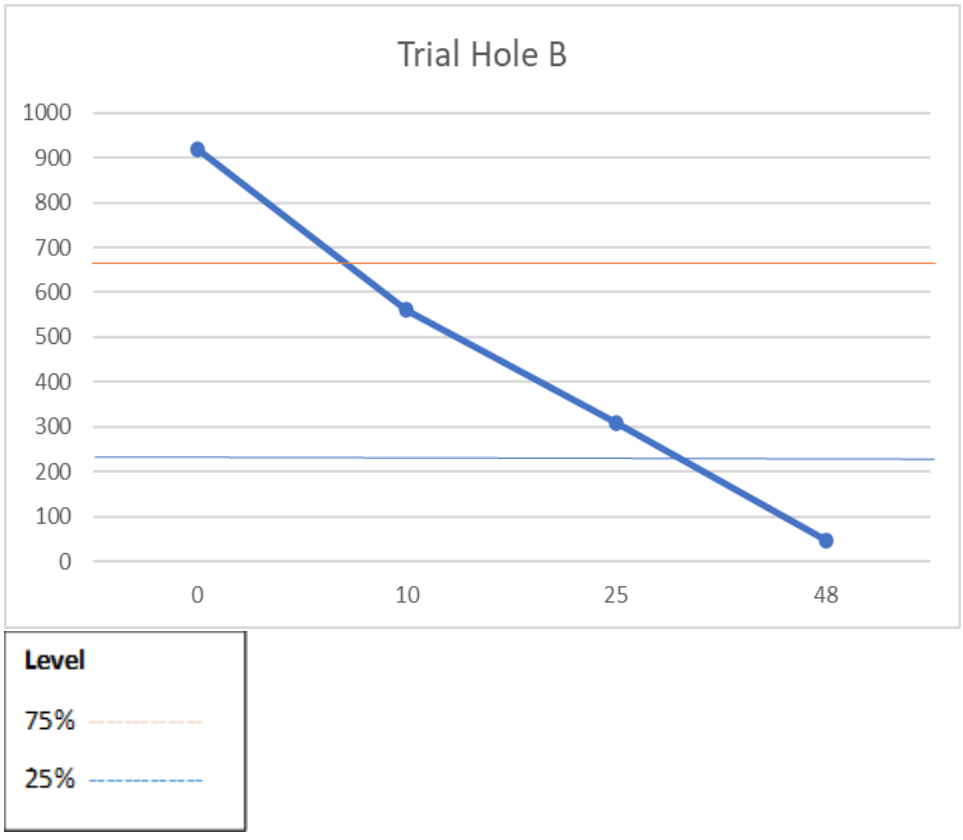
Level (mm)	Elapsed Time (min)
920	**0**
560	**10**
310	**25**
48	**48**

(Ap 50) = 4.46m^2

Vp75-25 = 1.138m^3

Tp75-25 = 28 minutes

Soil Infiltration Rate: F: $\frac{Vp75\text{-}25}{Ap50 \times tp75\text{-}25} = \frac{1.138}{4.46 \times 28 \times 60} = 15.2\times10^{-5}$m/s



TRIAL HOLE C

Depth	**1400mm**
Volume ^{75}	**1.119m^3**
Volume ^{25}	**0.327m^3**

Test

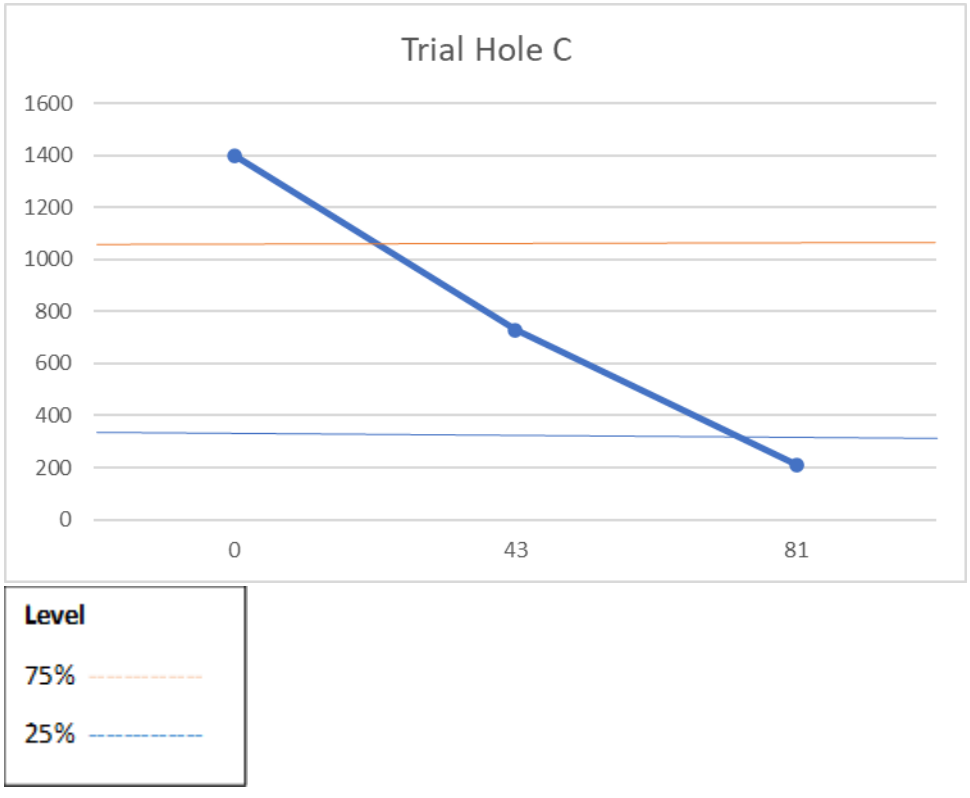
Level (mm)	Elapsed Time (min)
1400	**0**
730	**43**
210	**81**

(Ap 50) = 2.752m^2

Vp75-25 = 0.792m^3

Tp75-25 = 46 minutes

Soil Infiltration Rate: F: $\frac{Vp75\text{-}25}{Ap50 \times tp75\text{-}25} = \frac{0.792}{2.752 \times 46 \times 60} =$ 10.427 x 10^{-5}m/s



TRIAL HOLE D

Depth	**1320mm**
Volume ^{75}	**2.64m^3**
Volume ^{25}	**0.81m^3**

Test

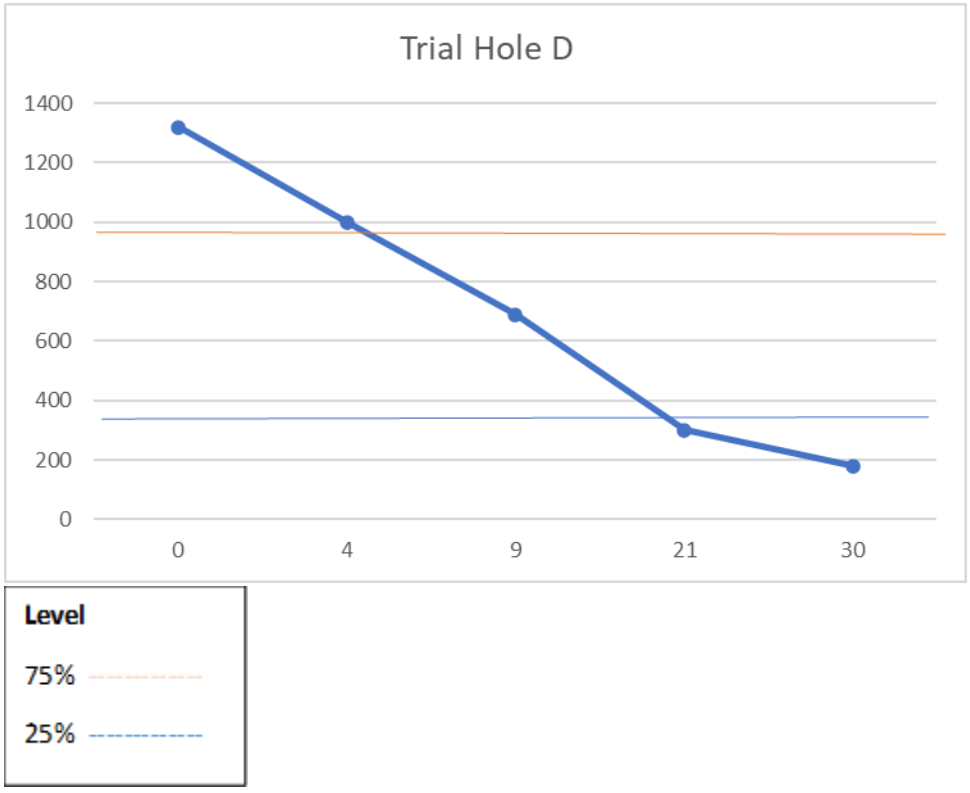
Level (mm)	Elapsed Time (min)
1320	**0**
1000	**4**
690	**9**
300	**21**
180	**30**

(Ap 50) = 6.55m^2

Vp75-25 = 1.831m^3

Tp75-25 = 15.5 minutes

Soil Infiltration Rate: F: $\frac{Vp75\text{-}25}{Ap50 \times tp75\text{-}25} = \frac{1.831}{6.55 \times 15.5 \times 60} =$ 30.06 x10^{-5}m/s



TRIAL HOLE E

Depth	**1600mm**
Volume ^{75}	**3.17m^3**
Volume ^{25}	**1.06m^3**

Test

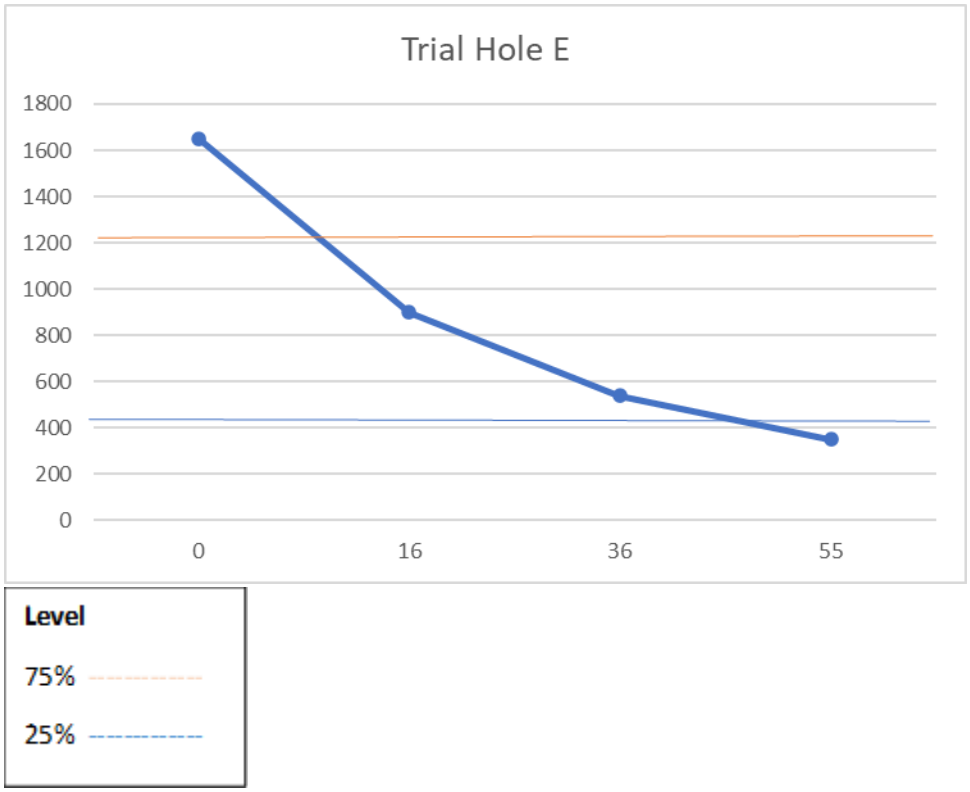
Level (mm)	Elapsed Time (min)
1650	**0**
900	**16**
540	**36**
350	**55**

(Ap 50) = 8.08m^2

Vp75-25 = 2.112m^3

Tp75-25 = 44 minutes

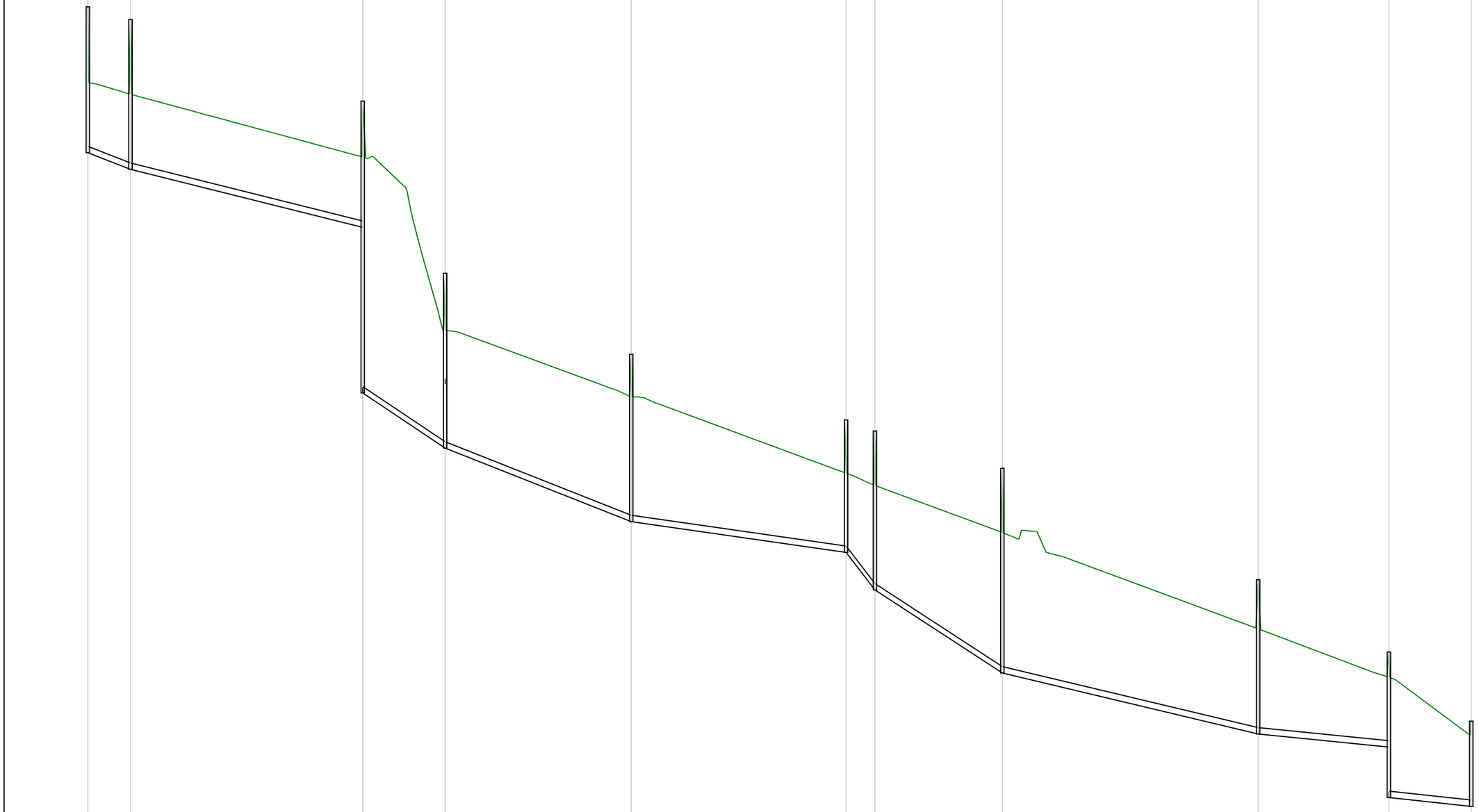
Soil Infiltration Rate: F: $\frac{Vp75\text{-}25}{Ap50 \times tp75\text{-}25} = \frac{2.112}{8.08 \times 44 \times 60} = 9.9 \times 10^{-5}$m/s



Appendix F:
Foul Water Drainage - Design Calculations

CAUSEWAY	Brian O'Kennedy and Associates Shannon House Church Road Douglas, Cork	File: Broomfield Midleton.pfd Network: Foul Network 2 George Forde 20/09/2023

Residential Development
Broomfield,
Midleton, Co. Cork

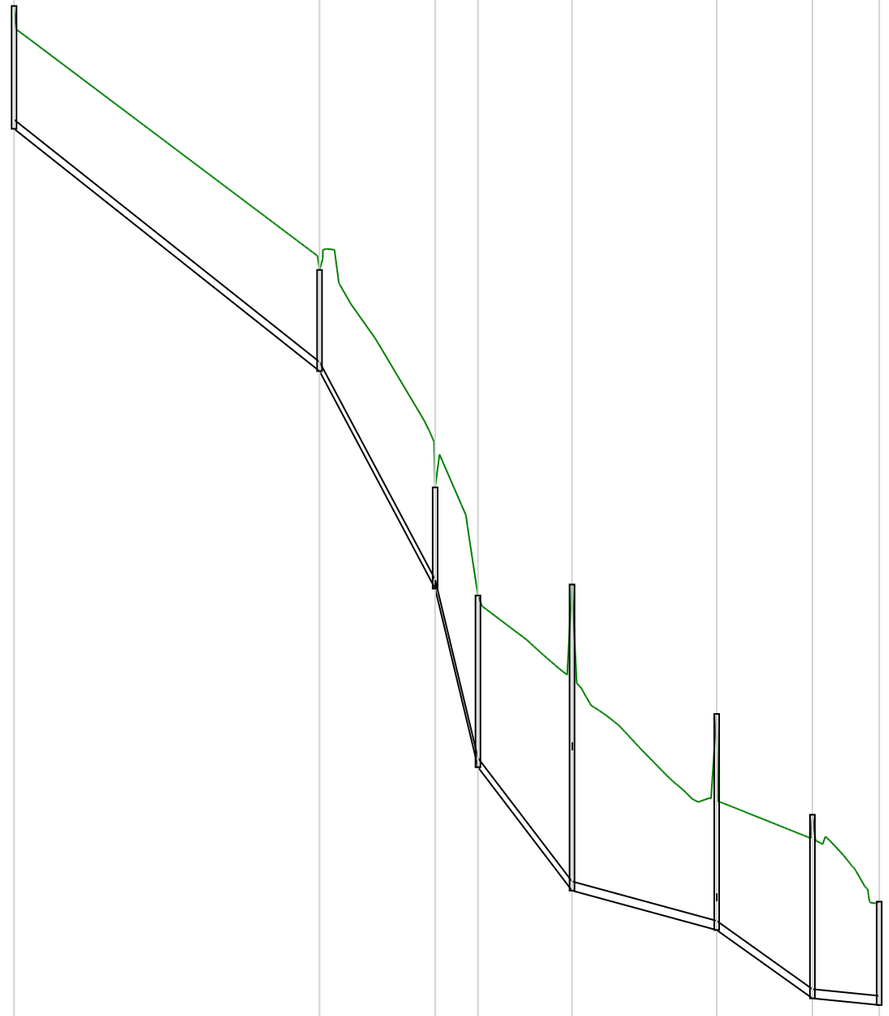


A3 drawing

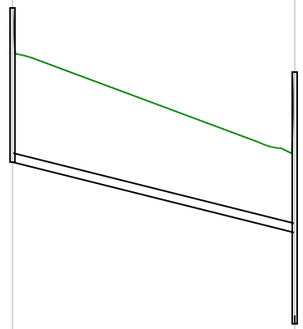
Hor Scale 1500
Ver Scale 100

Datum (m) 42.000

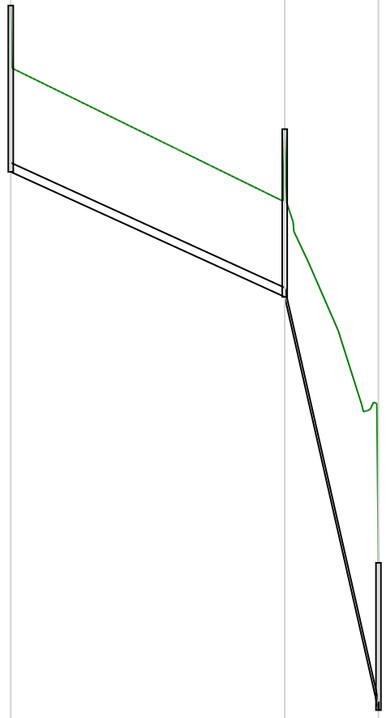
Node Name	22	23	24	25	26	27	28	29	30	31	32
Link Name	1.000	1.001	1.002	1.003	1.004	1.005	1.006	1.007	1.008	1.009	
Section Type	150mm	150mm	150mm	150mm	150mm	150mm	150mm	150mm	150mm	150mm	
Slope (1:X)	38.4	60.0	22.4	38.0	104.7	11.5	23.0	62.9	149.9	138.8	
Cover Level (m)	61.764	61.464	59.550	55.511	53.610	52.070	51.810	50.934	48.320	46.622	45.000
Invert Level (m)	58.340	57.950 57.950	56.588	52.702 51.407	51.407 49.682	49.682 48.959	48.959 48.079	48.079 46.130	46.130 44.699	44.699 44.392	43.208 42.999
Length (m)	15.001	81.714	29.001	65.499	75.599	10.1	44.837	90.000	46.006	28.983	

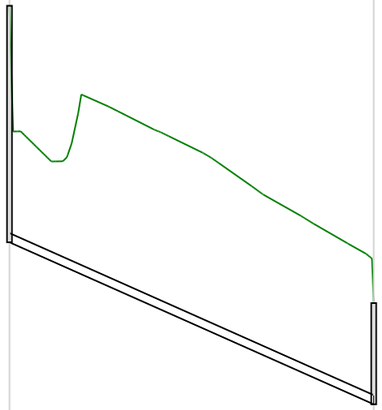
Node Name	32	33	34	35	36	37	38	39
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 27.000								
Link Name	1.010	1.011	1.012	1.013	1.014	1.015	1.016	
Section Type	150mm	150mm	150mm	150mm	150mm	150mm	150mm	
Slope (1:X)	18.9	8.0	3.6	11.4	55.1	21.0	149.9	
Cover Level (m)	45.000	40.698	37.153	35.390	35.570	33.460	31.817	30.400
Invert Level (m)	42.999	39.048	39.048	35.503	35.503 32.592	32.592	30.580	30.580	29.938	29.938	28.824	28.824	28.715	
Length (m)	74.718	28.275	10.47	23.006	35.373	23.410	16.339	

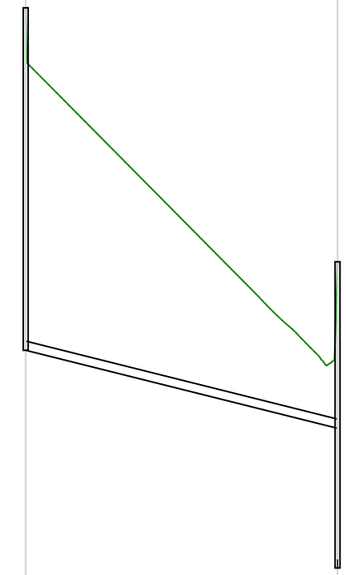
Node Name	48	24
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 46.000		
Link Name		2.0(
Section Type		150
Slope (1:X)		2.0
Cover Level (m)		59.380 59.550
Invert Level (m)		56.483 56.703
Length (m)		7.4

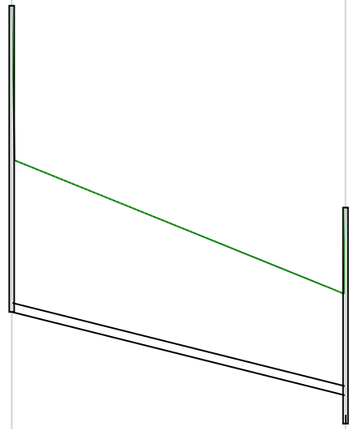
Node Name		44	25
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 44.000			
Link Name		3.000	
Section Type		150mm	
Slope (1:X)		60.0	
Cover Level (m)		56.557	55.511
Invert Level (m)		54.043	52.893
Length (m)		68.999	

Node Name		45		46		47		42		43		31
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 40.000												
Link Name		4.000		4.001		4.002		4.003		4.004		
Section Type		150mm		150mm		150mm		150mm		150mm		
Slope (1:X)		60.0		33.3		28.0		5.4		27.2		
Cover Level (m)		56.360		55.430		53.776		52.380		51.280		46.622
Invert Level (m)		54.453	53.688	53.688	52.126	52.126	49.980	49.980	44.574	44.574	43.208	
Length (m)		45.865		52.041		59.999		29.438		37.193		

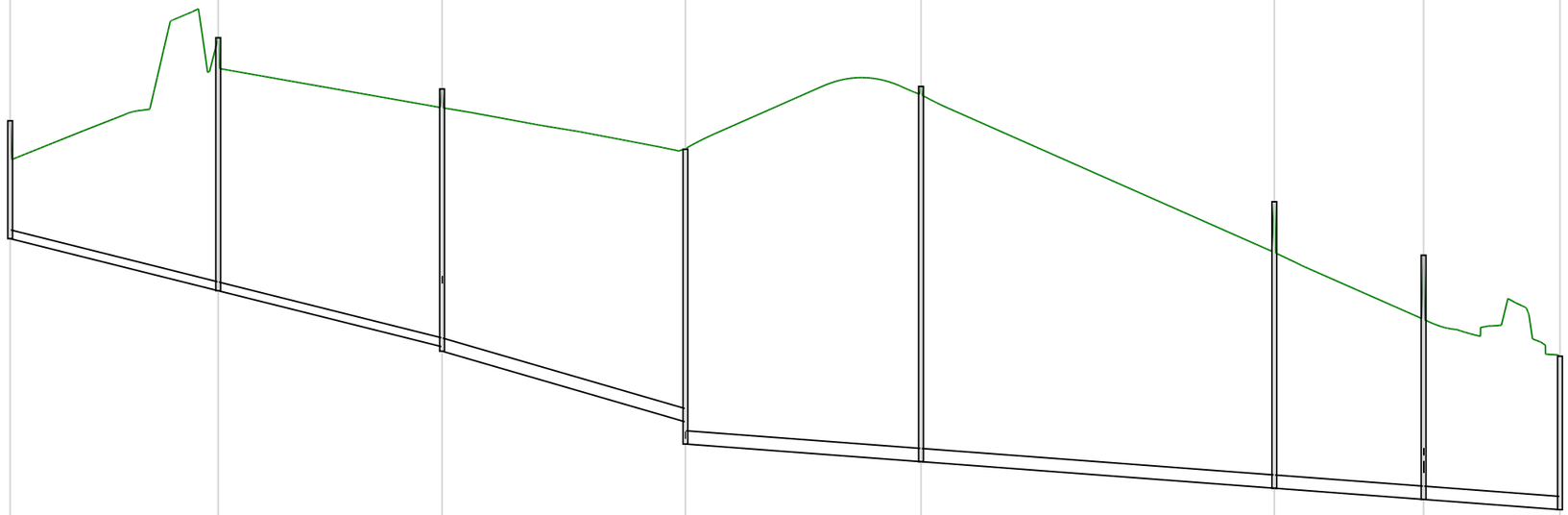
Node Name		40	41	42
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 46.000				
Link Name		5.000	5.001	
Section Type		150mm	150mm	
Slope (1:X)		32.9	3.4	
Cover Level (m)		61.464	59.450	52.380
Invert Level (m)		58.753	56.715 / 56.715	49.980
Length (m)		67.000	22.927	

Node Name		49	34
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 29.000			
Link Name		6.000	
Section Type		150mm	
Slope (1:X)		33.7	
Cover Level (m)		42.000	37.153
Invert Level (m)		38.144	35.503
Length (m)		89.081	

Node Name		50	36
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 25.000			
Link Name		7.000	
Section Type		150mm	
Slope (1:X)		60.0	
Cover Level (m)		39.710	35.570
Invert Level (m)		34.128	32.856
Length (m)		76.277	

Node Name		51	37
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 23.000			
Link Name		8.000	
Section Type		150mm	
Slope (1:X)		60.0	
Cover Level (m)		36.750	33.460
Invert Level (m)		31.758	30.397
Length (m)		81.631	

Node Name	1	2	3	4	5	6	7	8

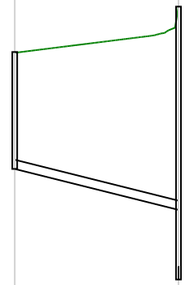


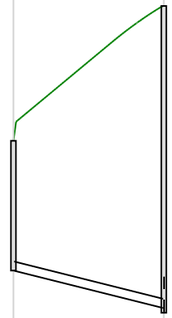
A3 drawing

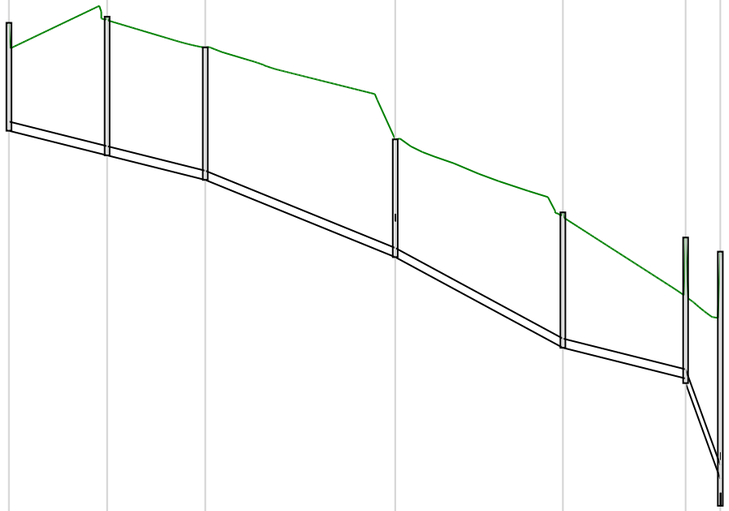
Hor Scale 1500
Ver Scale 100

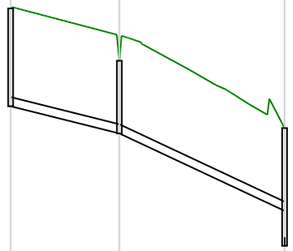
Datum (m) 53.000

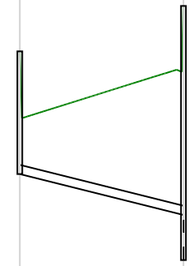
Link Name	1.000	1.001	1.002	1.003	1.004	1.005	1.006	
Section Type	150mm	150mm	225mm	225mm	225mm	225mm	225mm	
Slope (1:X)	59.9	60.0	51.7	200.0	200.0	200.0	199.7	
Cover Level (m)	65.250	66.660	65.790	64.768	65.833	63.877	62.970	61.256
Invert Level (m)	63.251	62.367 / 62.367	61.417 / 61.342	60.142 / 59.767	59.467 / 59.467	59.017 / 59.017	58.827 / 58.827	58.653
Length (m)	52.993	57.000	62.000	60.000	90.000	38.000	34.742	

Node Name	9	3
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 53.000		
Link Name	2.000	
Section Type	150mm	
Slope (1:X)	60.0	
Cover Level (m)	65.050	65.790
Invert Level (m)	63.144	62.477
Length (m)	40.043	

Node Name		10	4
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 52.000			
Link Name		3.000	
Section Type		150mm	
Slope (1:X)		60.0	
Cover Level (m)		62.570	64.768
Invert Level (m)		60.455	59.842
Length (m)		36.771	

Node Name		16	17	18	13	14	15	7
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 53.000								
Link Name		4.000	4.001	4.002	4.003	4.004	4.00	
Section Type		150mm	150mm	150mm	150mm	150mm	225	
Slope (1:X)		59.9	60.0	36.9	27.7	59.9	5.4	
Cover Level (m)		66.700	66.800	66.300	64.800	63.610	63.200	62.970
Invert Level (m)		64.940 64.539	64.539 64.139	64.139 62.880	62.880 61.403	61.403 60.902	60.827 59.266	
Length (m)		24.018	23.999	46.461	41.000	30.017	8.48	

Node Name		11	12	13
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 55.000				
Link Name		5.000	5.001	
Section Type		150mm	150mm	
Slope (1:X)		60.0	32.0	
Cover Level (m)		66.750	65.897	64.800
Invert Level (m)		65.155	64.712 / 64.712	63.450
Length (m)		26.587	40.396	

Node Name		19	7
A3 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 51.000			
Link Name		6.000	
Section Type		150mm	
Slope (1:X)		60.1	
Cover Level (m)		62.230	62.970
Invert Level (m)		60.229	59.563
Length (m)		40.003	

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	0.89
Flow per dwelling per day (l/day)	450	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	5.3	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Area (ha)	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
11		66.750	Adoptable	588092.937	575228.383	1.595
2	0.024	66.660	Adoptable	588125.070	575243.874	4.293
3	0.169	65.790	Adoptable	588159.436	575198.399	4.448
4	0.122	64.768	Adoptable	588184.446	575141.667	5.001
5	0.142	65.833	Adoptable	588129.897	575116.679	6.366
6	0.134	63.877	Adoptable	588039.965	575120.165	4.860
7	0.091	62.970	Adoptable	588002.272	575124.987	4.143
8		61.256	Adoptable	587967.881	575129.914	2.603
9		65.050	Adoptable	588196.898	575212.542	1.906
1	0.024	65.250	Adoptable	588166.203	575277.286	1.999
10		62.570	Adoptable	588218.318	575155.978	2.115
12	0.035	65.897	Adoptable	588071.945	575212.067	1.185
13	0.056	64.800	Adoptable	588040.159	575187.138	1.920
14		63.610	Adoptable	588010.597	575158.729	2.207
15	0.047	63.200	Adoptable	588009.889	575128.720	2.373
16		66.700	Adoptable	588111.988	575144.735	1.760
17	0.031	66.800	Adoptable	588101.474	575166.330	2.261
18	0.031	66.300	Adoptable	588086.577	575185.146	2.161
19		62.230	Adoptable	588001.762	575084.987	2.001

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
5.000	11	12	26.587	1.500	65.155	64.712	0.443	60.0	150
1.001	2	3	57.000	1.500	62.367	61.417	0.950	60.0	150
1.002	3	4	62.000	1.500	61.342	60.142	1.200	51.7	225
1.003	4	5	60.000	1.500	59.767	59.467	0.300	200.0	225
1.004	5	6	90.000	1.500	59.467	59.017	0.450	200.0	225
1.005	6	7	38.000	1.500	59.017	58.827	0.190	200.0	225
1.006	7	8	34.742	1.500	58.827	58.653	0.174	199.7	225
4.005	15	7	8.483	1.500	60.827	59.266	1.561	5.4	225

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
5.000	0.000	1.132	20.0	0.0	1.445	1.035	0.000	0	0.0	0.0	0	0.000
1.001	0.259	1.132	20.0	0.3	4.143	4.223	0.049	0	0.0	0.0	12	0.372
1.002	0.423	1.599	63.6	1.2	4.223	4.401	0.218	0	0.0	0.0	22	0.610
1.003	0.307	0.810	32.2	1.8	4.776	6.141	0.340	0	0.0	0.0	36	0.435
1.004	0.340	0.810	32.2	2.6	6.141	4.635	0.482	0	0.0	0.0	43	0.479
1.005	0.371	0.810	32.2	3.3	4.635	3.918	0.617	0	0.0	0.0	49	0.521
1.006	0.422	0.811	32.2	4.8	3.918	2.378	0.907	0	0.0	0.0	58	0.580
4.005	0.891	4.941	196.4	1.1	2.148	3.479	0.200	0	0.0	0.0	12	1.250

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	1	2	52.993	1.500	63.251	62.367	0.884	59.9	150
2.000	9	3	40.043	1.500	63.144	62.477	0.667	60.0	150
5.001	12	13	40.396	1.500	64.712	63.450	1.262	32.0	150
4.003	13	14	41.000	1.500	62.880	61.403	1.478	27.7	150
4.004	14	15	30.017	1.500	61.403	60.902	0.501	59.9	150
3.000	10	4	36.771	1.500	60.455	59.842	0.613	60.0	150
4.000	16	17	24.018	1.500	64.940	64.539	0.401	59.9	150
4.001	17	18	23.999	1.500	64.539	64.139	0.400	60.0	150
4.002	18	13	46.461	1.500	64.139	62.880	1.259	36.9	150
6.000	19	7	40.003	1.500	60.229	59.563	0.666	60.1	150

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.210	1.133	20.0	0.1	1.849	4.143	0.024	0	0.0	0.0	9	0.304
2.000	0.000	1.132	20.0	0.0	1.756	3.163	0.000	0	0.0	0.0	0	0.000
5.001	0.289	1.552	27.4	0.2	1.035	1.200	0.035	0	0.0	0.0	9	0.418
4.003	0.491	1.667	29.5	0.8	1.770	2.057	0.153	0	0.0	0.0	17	0.708
4.004	0.385	1.133	20.0	0.8	2.057	2.148	0.153	0	0.0	0.0	21	0.543
3.000	0.000	1.132	20.0	0.0	1.965	4.776	0.000	0	0.0	0.0	0	0.000
4.000	0.000	1.133	20.0	0.0	1.610	2.111	0.000	0	0.0	0.0	0	0.000
4.001	0.227	1.132	20.0	0.2	2.111	2.011	0.031	0	0.0	0.0	10	0.332
4.002	0.332	1.445	25.5	0.3	2.011	1.770	0.062	0	0.0	0.0	12	0.476
6.000	0.000	1.131	20.0	0.0	1.851	3.257	0.000	0	0.0	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	26.587	60.0	150	Circular	66.750	65.155	1.445	65.897	64.712	1.035
1.001	57.000	60.0	150	Circular	66.660	62.367	4.143	65.790	61.417	4.223
1.002	62.000	51.7	225	Circular	65.790	61.342	4.223	64.768	60.142	4.401
1.003	60.000	200.0	225	Circular	64.768	59.767	4.776	65.833	59.467	6.141
1.004	90.000	200.0	225	Circular	65.833	59.467	6.141	63.877	59.017	4.635
1.005	38.000	200.0	225	Circular	63.877	59.017	4.635	62.970	58.827	3.918
1.006	34.742	199.7	225	Circular	62.970	58.827	3.918	61.256	58.653	2.378
4.005	8.483	5.4	225	Circular	63.200	60.827	2.148	62.970	59.266	3.479
1.000	52.993	59.9	150	Circular	65.250	63.251	1.849	66.660	62.367	4.143
2.000	40.043	60.0	150	Circular	65.050	63.144	1.756	65.790	62.477	3.163

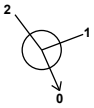
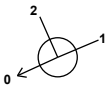
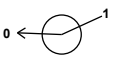
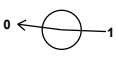
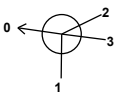
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.004	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.005	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.006	7	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
4.005	15	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
2.000	9	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.001	40.396	32.0	150	Circular	65.897	64.712	1.035	64.800	63.450	1.200
4.003	41.000	27.7	150	Circular	64.800	62.880	1.770	63.610	61.403	2.057
4.004	30.017	59.9	150	Circular	63.610	61.403	2.057	63.200	60.902	2.148
3.000	36.771	60.0	150	Circular	62.570	60.455	1.965	64.768	59.842	4.776
4.000	24.018	59.9	150	Circular	66.700	64.940	1.610	66.800	64.539	2.111
4.001	23.999	60.0	150	Circular	66.800	64.539	2.111	66.300	64.139	2.011
4.002	46.461	36.9	150	Circular	66.300	64.139	2.011	64.800	62.880	1.770
6.000	40.003	60.1	150	Circular	62.230	60.229	1.851	62.970	59.563	3.257

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.001	12	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
4.003	13	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
4.004	14	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
3.000	10	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
4.000	16	1200	Manhole	Adoptable	17	1200	Manhole	Adoptable
4.001	17	1200	Manhole	Adoptable	18	1200	Manhole	Adoptable
4.002	18	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
6.000	19	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
11	588092.937	575228.383	66.750	1.595	1200		0	5.000	65.155	150
2	588125.070	575243.874	66.660	4.293	1200		1	1.000	62.367	150
							0	1.001	62.367	150
3	588159.436	575198.399	65.790	4.448	1200		1	2.000	62.477	150
							2	1.001	61.417	150
							0	1.002	61.342	225
4	588184.446	575141.667	64.768	5.001	1200		1	3.000	59.842	150
							2	1.002	60.142	225
							0	1.003	59.767	225
5	588129.897	575116.679	65.833	6.366	1200		1	1.003	59.467	225
							0	1.004	59.467	225
6	588039.965	575120.165	63.877	4.860	1200		1	1.004	59.017	225
							0	1.005	59.017	225
7	588002.272	575124.987	62.970	4.143	1200		1	6.000	59.563	150
							2	4.005	59.266	225
							3	1.005	58.827	225
							0	1.006	58.827	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
8	587967.881	575129.914	61.256	2.603	1200	1	1.006	58.653	225
9	588196.898	575212.542	65.050	1.906	1200	0	2.000	63.144	150
1	588166.203	575277.286	65.250	1.999	1200	0	1.000	63.251	150
10	588218.318	575155.978	62.570	2.115	1200	0	3.000	60.455	150
12	588071.945	575212.067	65.897	1.185	1200	1	5.000	64.712	150
						0	5.001	64.712	150
13	588040.159	575187.138	64.800	1.920	1200	1	5.001	63.450	150
						2	4.002	62.880	150
						0	4.003	62.880	150
14	588010.597	575158.729	63.610	2.207	1200	1	4.003	61.403	150
						0	4.004	61.403	150
15	588009.889	575128.720	63.200	2.373	1200	1	4.004	60.902	150
						0	4.005	60.827	225
16	588111.988	575144.735	66.700	1.760	1200	0	4.000	64.940	150
17	588101.474	575166.330	66.800	2.261	1200	1	4.000	64.539	150
						0	4.001	64.539	150
18	588086.577	575185.146	66.300	2.161	1200	1	4.001	64.139	150
						0	4.002	64.139	150
19	588001.762	575084.987	62.230	2.001	1200	0	6.000	60.229	150

Simulation Settings

Analysis Speed	Normal	Drain Down Time (mins)	240
Skip Steady State	✓	Foul Event Duration (mins)	60

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.65
Greenfield Method	IH124	Growth Factor 100 year	1.96
Positively Drained Area (ha)	7.950	Betterment (%)	0
SAAR (mm)	1091	QBar	24.4
Soil Index	2	Q 1 year (l/s)	20.2
SPR	0.30	Q 30 year (l/s)	40.2
Region	11	Q 100 year (l/s)	47.7
Growth Factor 1 year	0.83		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	7.950	Storm Duration (mins)	360
Soil Index	2	Betterment (%)	0
SPR	0.30	PR	0.341
CWI	125.228	Runoff Volume (m^3)	1702

Results for Foul Event Critical Storm Duration. Lowest mass balance: 80.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
Foul Event	11	1	65.155	0.000	0.0	0.0000	0.0000	OK
Foul Event	2	57	62.378	0.011	0.2	0.0122	0.0000	OK
Foul Event	3	49	61.363	0.021	1.1	0.0236	0.0000	OK
Foul Event	4	61	59.911	0.144	3.5	0.1631	0.0000	OK
Foul Event	5	61	59.905	0.438	5.3	0.4957	0.0000	SURCHARGED
Foul Event	6	61	59.903	0.886	6.3	1.0022	0.0000	SURCHARGED
Foul Event	7	60	59.904	1.077	5.8	1.2176	0.0000	SURCHARGED
Foul Event	8	60	59.904	1.251	3.8	1.4150	0.0000	OK
Foul Event	9	1	63.144	0.000	0.0	0.0000	0.0000	OK
Foul Event	1	33	63.259	0.008	0.1	0.0088	0.0000	OK
Foul Event	10	1	60.455	0.000	0.0	0.0000	0.0000	OK
Foul Event	12	33	64.721	0.009	0.2	0.0106	0.0000	OK
Foul Event	13	30	62.898	0.018	0.9	0.0206	0.0000	OK
Foul Event	14	32	61.424	0.022	0.9	0.0248	0.0000	OK
Foul Event	15	28	60.839	0.012	1.1	0.0141	0.0000	OK
Foul Event	16	1	64.940	0.000	0.0	0.0000	0.0000	OK
Foul Event	17	20	64.550	0.011	0.2	0.0122	0.0000	OK
Foul Event	18	22	64.152	0.013	0.4	0.0150	0.0000	OK
Foul Event	19	1	60.229	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
Foul Event	11	5.000	12	0.0	0.000	0.000	0.0060	
Foul Event	2	1.001	3	0.2	0.359	0.010	0.0317	
Foul Event	3	1.002	4	1.1	0.601	0.017	0.1134	
Foul Event	4	1.003	5	-1.8	0.402	-0.054	1.9995	
Foul Event	5	1.004	6	-2.8	0.443	-0.088	3.5794	
Foul Event	6	1.005	7	3.1	0.417	0.098	1.5113	
Foul Event	7	1.006	8	3.8	0.391	0.118	1.3817	0.0
Foul Event	9	2.000	3	0.0	0.000	0.000	0.0000	
Foul Event	1	1.000	2	0.1	0.282	0.005	0.0239	
Foul Event	10	3.000	4	0.0	0.000	0.000	0.1460	
Foul Event	12	5.001	13	0.2	0.447	0.007	0.0181	
Foul Event	13	4.003	14	0.9	0.776	0.031	0.0574	
Foul Event	14	4.004	15	0.9	0.568	0.045	0.0476	
Foul Event	15	4.005	7	1.1	1.306	0.006	0.1722	
Foul Event	16	4.000	17	0.0	0.000	0.000	0.0067	
Foul Event	17	4.001	18	0.2	0.311	0.010	0.0157	
Foul Event	18	4.002	13	0.4	0.411	0.016	0.0456	
Foul Event	19	6.000	7	0.0	0.000	0.000	0.3521	

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	0.89
Flow per dwelling per day (l/day)	450	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	5.3	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.500
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Dwellings	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
22		61.764	Adoptable	588150.429	575048.425	3.424
23	2	61.464	Adoptable	588164.443	575053.776	3.514
24	13	59.550	Adoptable	588237.911	575089.548	6.848
25	12	55.511	Adoptable	588250.452	575063.399	4.104
26		53.610	Adoptable	588269.495	575000.729	3.928
27	12	52.070	Adoptable	588198.363	574975.127	3.111
28	2	51.810	Adoptable	588188.347	574976.763	3.731
29	6	50.934	Adoptable	588145.886	574962.362	4.804
30	12	48.320	Adoptable	588055.897	574963.760	3.621
31	6	46.622	Adoptable	588009.891	574963.569	3.414
32	1	45.000	Adoptable	587981.228	574959.274	2.001
33	6	40.698	Adoptable	587907.335	574948.201	1.650
35		35.390	Adoptable	587905.722	574909.488	2.798
36	6	35.570	Adoptable	587927.735	574902.802	4.990
37	6	33.460	Adoptable	587924.098	574867.616	3.522
38		31.817	Adoptable	587900.895	574870.722	2.993
39		30.400	Adoptable	587885.297	574865.858	1.685
44		56.557	Adoptable	588184.966	575041.663	2.514
40		61.464	Adoptable	588093.554	575049.311	2.711
41	10	59.450	Adoptable	588026.590	575051.505	2.735
42	10	52.380	Adoptable	588021.079	575029.250	2.400
43		51.280	Adoptable	588015.761	575000.296	6.706
45		56.360	Adoptable	588176.197	575044.968	1.907
46	8	55.430	Adoptable	588133.117	575029.230	1.742
47	6	53.776	Adoptable	588081.077	575028.853	1.650
48	2	59.380	Adoptable	588244.478	575093.068	2.897
50		39.710	Adoptable	588003.465	574911.922	5.582
51		36.750	Adoptable	588005.013	574878.401	4.992
49		42.000	Adoptable	587994.665	574928.631	3.856
34	7	37.153	Adoptable	587906.007	574919.957	1.650

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	22	23	15.001	1.500	58.340	57.950	0.390	38.4	150
1.001	23	24	81.714	1.500	57.950	56.588	1.362	60.0	150
1.002	24	25	29.001	1.500	52.702	51.407	1.295	22.4	150
1.003	25	26	65.499	1.500	51.407	49.682	1.726	38.0	150
1.004	26	27	75.599	1.500	49.682	48.959	0.722	104.7	150
1.005	27	28	10.149	1.500	48.959	48.079	0.880	11.5	150
1.006	28	29	44.837	1.500	48.079	46.130	1.949	23.0	150
1.007	29	30	90.000	1.500	46.130	44.699	1.431	62.9	150
1.008	30	31	46.006	1.500	44.699	44.392	0.307	149.9	150
1.009	31	32	28.983	1.500	43.208	42.999	0.209	138.8	150
1.010	32	33	74.718	1.500	42.999	39.048	3.951	18.9	150
1.011	33	34	28.275	1.500	39.048	35.503	3.545	8.0	150
1.013	35	36	23.006	1.500	32.592	30.580	2.012	11.4	150
1.014	36	37	35.373	1.500	30.580	29.938	0.642	55.1	150
1.015	37	38	23.410	1.500	29.938	28.824	1.114	21.0	150
1.016	38	39	16.339	1.500	28.824	28.715	0.109	149.9	150
3.000	44	25	68.999	1.500	54.043	52.893	1.150	60.0	150
5.000	40	41	67.000	1.500	58.753	56.715	2.038	32.9	150
5.001	41	42	22.927	1.500	56.715	49.980	6.736	3.4	150
4.003	42	43	29.438	1.500	49.980	44.574	5.406	5.4	150
4.004	43	31	37.193	1.500	44.574	43.208	1.366	27.2	150
4.000	45	46	45.865	1.500	54.453	53.688	0.765	60.0	150
4.001	46	47	52.041	1.500	53.688	52.126	1.562	33.3	150
4.002	47	42	59.999	1.500	52.126	49.980	2.146	28.0	150

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.000	1.416	25.0	0.0	3.274	3.364	0.000	0	0.0	0.0	0	0.000
1.001	0.090	1.132	20.0	0.0	3.364	2.812	0.000	2	0.0	0.0	3	0.134
1.002	0.256	1.856	32.8	0.1	6.698	3.954	0.000	17	0.0	0.0	6	0.374
1.003	0.265	1.425	25.2	0.2	3.954	3.778	0.000	29	0.0	0.0	8	0.365
1.004	0.183	0.856	15.1	0.2	3.778	2.961	0.000	29	0.0	0.0	11	0.261
1.005	0.445	2.589	45.8	0.2	2.961	3.581	0.000	41	0.0	0.0	8	0.633
1.006	0.342	1.832	32.4	0.2	3.581	4.654	0.000	43	0.0	0.0	9	0.494
1.007	0.253	1.106	19.5	0.3	4.654	3.471	0.000	49	0.0	0.0	13	0.376
1.008	0.208	0.714	12.6	0.3	3.471	2.080	0.000	61	0.0	0.0	17	0.295
1.009	0.252	0.742	13.1	0.5	3.264	1.851	0.000	101	0.0	0.0	21	0.355
1.010	0.493	2.021	35.7	0.5	1.851	1.500	0.000	102	0.0	0.0	13	0.712
1.011	0.676	3.114	55.0	0.6	1.500	1.500	0.000	108	0.0	0.0	11	0.958
1.013	0.600	2.600	45.9	0.6	2.648	4.840	0.000	115	0.0	0.0	12	0.860
1.014	0.361	1.182	20.9	0.6	4.840	3.372	0.000	121	0.0	0.0	18	0.512
1.015	0.517	1.916	33.9	0.7	3.372	2.843	0.000	127	0.0	0.0	15	0.737
1.016	0.265	0.714	12.6	0.7	2.843	1.535	0.000	127	0.0	0.0	24	0.373
3.000	0.000	1.132	20.0	0.0	2.364	2.468	0.000	0	0.0	0.0	0	0.000
5.000	0.000	1.531	27.1	0.0	2.561	2.585	0.000	0	0.0	0.0	0	0.000
5.001	0.394	4.770	84.3	0.1	2.585	2.250	0.000	10	0.0	0.0	3	0.580
4.003	0.525	3.770	66.6	0.2	2.250	6.556	0.000	34	0.0	0.0	6	0.764
4.004	0.314	1.683	29.7	0.2	6.556	3.264	0.000	34	0.0	0.0	8	0.432
4.000	0.000	1.132	20.0	0.0	1.757	1.592	0.000	0	0.0	0.0	0	0.000
4.001	0.182	1.521	26.9	0.0	1.592	1.500	0.000	8	0.0	0.0	5	0.259
4.002	0.229	1.661	29.4	0.1	1.500	2.250	0.000	14	0.0	0.0	6	0.310

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
2.000	48	24	7.451	1.500	56.483	52.702	3.781	2.0	150
7.000	50	36	76.277	1.500	34.128	32.856	1.272	60.0	150
8.000	51	37	81.631	1.500	31.758	30.397	1.361	60.0	150
6.000	49	34	89.081	1.500	38.144	35.503	2.641	33.7	150
1.012	34	35	10.473	1.500	35.503	32.592	2.911	3.6	150

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	0.227	6.270	110.8	0.0	2.747	6.698	0.000	2	0.0	0.0	1	0.381
7.000	0.000	1.132	20.0	0.0	5.432	2.564	0.000	0	0.0	0.0	0	0.000
8.000	0.000	1.132	20.0	0.0	4.842	2.913	0.000	0	0.0	0.0	0	0.000
6.000	0.000	1.512	26.7	0.0	3.706	1.500	0.000	0	0.0	0.0	0	0.000
1.012	0.872	4.640	82.0	0.6	1.500	2.648	0.000	115	0.0	0.0	10	1.316

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.001	38.4	150	Circular	61.764	58.340	3.274	61.464	57.950	3.364
1.001	81.714	60.0	150	Circular	61.464	57.950	3.364	59.550	56.588	2.812
1.002	29.001	22.4	150	Circular	59.550	52.702	6.698	55.511	51.407	3.954
1.003	65.499	38.0	150	Circular	55.511	51.407	3.954	53.610	49.682	3.778
1.004	75.599	104.7	150	Circular	53.610	49.682	3.778	52.070	48.959	2.961
1.005	10.149	11.5	150	Circular	52.070	48.959	2.961	51.810	48.079	3.581
1.006	44.837	23.0	150	Circular	51.810	48.079	3.581	50.934	46.130	4.654
1.007	90.000	62.9	150	Circular	50.934	46.130	4.654	48.320	44.699	3.471
1.008	46.006	149.9	150	Circular	48.320	44.699	3.471	46.622	44.392	2.080
1.009	28.983	138.8	150	Circular	46.622	43.208	3.264	45.000	42.999	1.851
1.010	74.718	18.9	150	Circular	45.000	42.999	1.851	40.698	39.048	1.500
1.011	28.275	8.0	150	Circular	40.698	39.048	1.500	37.153	35.503	1.500
1.013	23.006	11.4	150	Circular	35.390	32.592	2.648	35.570	30.580	4.840
1.014	35.373	55.1	150	Circular	35.570	30.580	4.840	33.460	29.938	3.372
1.015	23.410	21.0	150	Circular	33.460	29.938	3.372	31.817	28.824	2.843

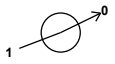
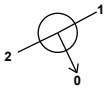
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	22	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable
1.001	23	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
1.002	24	1200	Manhole	Adoptable	25	1200	Manhole	Adoptable
1.003	25	1200	Manhole	Adoptable	26	1200	Manhole	Adoptable
1.004	26	1200	Manhole	Adoptable	27	1200	Manhole	Adoptable
1.005	27	1200	Manhole	Adoptable	28	1200	Manhole	Adoptable
1.006	28	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable
1.007	29	1200	Manhole	Adoptable	30	1200	Manhole	Adoptable
1.008	30	1200	Manhole	Adoptable	31	1200	Manhole	Adoptable
1.009	31	1200	Manhole	Adoptable	32	1200	Manhole	Adoptable
1.010	32	1200	Manhole	Adoptable	33	1200	Manhole	Adoptable
1.011	33	1200	Manhole	Adoptable	34	1200	Manhole	Adoptable
1.013	35	1200	Manhole	Adoptable	36	1200	Manhole	Adoptable
1.014	36	1200	Manhole	Adoptable	37	1200	Manhole	Adoptable
1.015	37	1200	Manhole	Adoptable	38	1200	Manhole	Adoptable

Pipeline Schedule

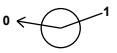
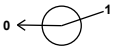
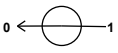
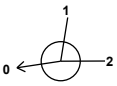
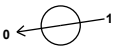
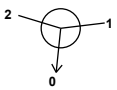
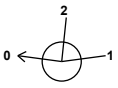
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.016	16.339	149.9	150	Circular	31.817	28.824	2.843	30.400	28.715	1.535
3.000	68.999	60.0	150	Circular	56.557	54.043	2.364	55.511	52.893	2.468
5.000	67.000	32.9	150	Circular	61.464	58.753	2.561	59.450	56.715	2.585
5.001	22.927	3.4	150	Circular	59.450	56.715	2.585	52.380	49.980	2.250
4.003	29.438	5.4	150	Circular	52.380	49.980	2.250	51.280	44.574	6.556
4.004	37.193	27.2	150	Circular	51.280	44.574	6.556	46.622	43.208	3.264
4.000	45.865	60.0	150	Circular	56.360	54.453	1.757	55.430	53.688	1.592
4.001	52.041	33.3	150	Circular	55.430	53.688	1.592	53.776	52.126	1.500
4.002	59.999	28.0	150	Circular	53.776	52.126	1.500	52.380	49.980	2.250
2.000	7.451	2.0	150	Circular	59.380	56.483	2.747	59.550	52.702	6.698
7.000	76.277	60.0	150	Circular	39.710	34.128	5.432	35.570	32.856	2.564
8.000	81.631	60.0	150	Circular	36.750	31.758	4.842	33.460	30.397	2.913
6.000	89.081	33.7	150	Circular	42.000	38.144	3.706	37.153	35.503	1.500
1.012	10.473	3.6	150	Circular	37.153	35.503	1.500	35.390	32.592	2.648

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.016	38	1200	Manhole	Adoptable	39	1200	Manhole	Adoptable
3.000	44	1200	Manhole	Adoptable	25	1200	Manhole	Adoptable
5.000	40	1200	Manhole	Adoptable	41	1200	Manhole	Adoptable
5.001	41	1200	Manhole	Adoptable	42	1200	Manhole	Adoptable
4.003	42	1200	Manhole	Adoptable	43	1200	Manhole	Adoptable
4.004	43	1200	Manhole	Adoptable	31	1200	Manhole	Adoptable
4.000	45	1200	Manhole	Adoptable	46	1200	Manhole	Adoptable
4.001	46	1200	Manhole	Adoptable	47	1200	Manhole	Adoptable
4.002	47	1200	Manhole	Adoptable	42	1200	Manhole	Adoptable
2.000	48	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
7.000	50	1200	Manhole	Adoptable	36	1200	Manhole	Adoptable
8.000	51	1200	Manhole	Adoptable	37	1200	Manhole	Adoptable
6.000	49	1200	Manhole	Adoptable	34	1200	Manhole	Adoptable
1.012	34	1200	Manhole	Adoptable	35	1200	Manhole	Adoptable

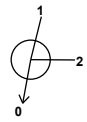
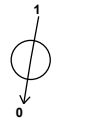
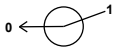
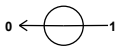
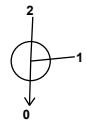
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
22	588150.429	575048.425	61.764	3.424	1200				
						0	1.000	58.340	150
23	588164.443	575053.776	61.464	3.514	1200	1	1.000	57.950	150
									
						0	1.001	57.950	150
24	588237.911	575089.548	59.550	6.848	1200	1	2.000	52.702	150
						2	1.001	56.588	150
									
						0	1.002	52.702	150
25	588250.452	575063.399	55.511	4.104	1200	1	3.000	52.893	150
						2	1.002	51.407	150
									
						0	1.003	51.407	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
26	588269.495	575000.729	53.610	3.928	1200		1	1.003	49.682	150
							0	1.004	49.682	150
27	588198.363	574975.127	52.070	3.111	1200		1	1.004	48.959	150
							0	1.005	48.959	150
28	588188.347	574976.763	51.810	3.731	1200		1	1.005	48.079	150
							0	1.006	48.079	150
29	588145.886	574962.362	50.934	4.804	1200		1	1.006	46.130	150
							0	1.007	46.130	150
30	588055.897	574963.760	48.320	3.621	1200		1	1.007	44.699	150
							0	1.008	44.699	150
31	588009.891	574963.569	46.622	3.414	1200		1	4.004	43.208	150
							2	1.008	44.392	150
							0	1.009	43.208	150
32	587981.228	574959.274	45.000	2.001	1200		1	1.009	42.999	150
							0	1.010	42.999	150
33	587907.335	574948.201	40.698	1.650	1200		1	1.010	39.048	150
							0	1.011	39.048	150
35	587905.722	574909.488	35.390	2.798	1200		1	1.012	32.592	150
							0	1.013	32.592	150
36	587927.735	574902.802	35.570	4.990	1200		1	7.000	32.856	150
							2	1.013	30.580	150
							0	1.014	30.580	150
37	587924.098	574867.616	33.460	3.522	1200		1	8.000	30.397	150
							2	1.014	29.938	150
							0	1.015	29.938	150
38	587900.895	574870.722	31.817	2.993	1200		1	1.015	28.824	150
							0	1.016	28.824	150
39	587885.297	574865.858	30.400	1.685	1200		1	1.016	28.715	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
44	588184.966	575041.663	56.557	2.514	1200		0	3.000	54.043	150
40	588093.554	575049.311	61.464	2.711	1200		0	5.000	58.753	150
41	588026.590	575051.505	59.450	2.735	1200		1	5.000	56.715	150
							0	5.001	56.715	150
42	588021.079	575029.250	52.380	2.400	1200		1	5.001	49.980	150
							2	4.002	49.980	150
							0	4.003	49.980	150
43	588015.761	575000.296	51.280	6.706	1200		1	4.003	44.574	150
							0	4.004	44.574	150
45	588176.197	575044.968	56.360	1.907	1200		0	4.000	54.453	150
46	588133.117	575029.230	55.430	1.742	1200		1	4.000	53.688	150
							0	4.001	53.688	150
47	588081.077	575028.853	53.776	1.650	1200		1	4.001	52.126	150
							0	4.002	52.126	150
48	588244.478	575093.068	59.380	2.897	1200		0	2.000	56.483	150
50	588003.465	574911.922	39.710	5.582	1200		0	7.000	34.128	150
51	588005.013	574878.401	36.750	4.992	1200		0	8.000	31.758	150
49	587994.665	574928.631	42.000	3.856	1200		0	6.000	38.144	150
34	587906.007	574919.957	37.153	1.650	1200		1	6.000	35.503	150
							2	1.011	35.503	150
							0	1.012	35.503	150

Simulation Settings

Analysis Speed	Normal	Drain Down Time (mins)	240
Skip Steady State	✓	Foul Event Duration (mins)	60

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.65
Greenfield Method	IH124	Growth Factor 100 year	1.96
Positively Drained Area (ha)	7.950	Betterment (%)	0
SAAR (mm)	1091	QBar	24.4
Soil Index	2	Q 1 year (l/s)	20.2
SPR	0.30	Q 30 year (l/s)	40.2
Region	11	Q 100 year (l/s)	47.7
Growth Factor 1 year	0.83		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	7.950	Storm Duration (mins)	360
Soil Index	2	Betterment (%)	0
SPR	0.30	PR	0.341
CWI	125.228	Runoff Volume (m^3)	1702

Results for Foul Event Critical Storm Duration. Lowest mass balance: 93.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
Foul Event	22	1	58.340	0.000	0.0	0.0000	0.0000	OK
Foul Event	23	1	57.950	0.000	0.0	0.0000	0.0000	OK
Foul Event	24	19	52.709	0.006	0.1	0.0071	0.0000	OK
Foul Event	25	8	51.418	0.010	0.2	0.0115	0.0000	OK
Foul Event	26	58	49.695	0.013	0.2	0.0147	0.0000	OK
Foul Event	27	59	48.968	0.009	0.3	0.0100	0.0000	OK
Foul Event	28	59	48.090	0.010	0.3	0.0118	0.0000	OK
Foul Event	29	60	46.143	0.013	0.3	0.0149	0.0000	OK
Foul Event	30	59	44.717	0.019	0.4	0.0212	0.0000	OK
Foul Event	31	60	43.231	0.024	0.6	0.0268	0.0000	OK
Foul Event	32	60	43.013	0.014	0.6	0.0160	0.0000	OK
Foul Event	33	60	39.060	0.012	0.6	0.0132	0.0000	OK
Foul Event	35	61	32.604	0.012	0.6	0.0138	0.0000	OK
Foul Event	36	61	30.599	0.018	0.6	0.0209	0.0000	OK
Foul Event	37	61	29.952	0.014	0.6	0.0159	0.0000	OK
Foul Event	38	61	29.108	0.284	0.7	0.3212	0.0000	SURCHARGED
Foul Event	39	61	29.108	0.393	0.5	0.4445	0.0000	OK
Foul Event	44	1	54.043	0.000	0.0	0.0000	0.0000	OK
Foul Event	40	1	58.753	0.000	0.0	0.0000	0.0000	OK
Foul Event	41	15	56.720	0.004	0.1	0.0046	0.0000	OK
Foul Event	42	18	49.986	0.006	0.2	0.0070	0.0000	OK
Foul Event	43	24	44.583	0.009	0.2	0.0101	0.0000	OK
Foul Event	45	1	54.453	0.000	0.0	0.0000	0.0000	OK
Foul Event	46	1	53.688	0.000	0.0	0.0000	0.0000	OK
Foul Event	47	1	52.126	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
Foul Event	22	1.000	23	0.0	0.000	0.000	0.0000	
Foul Event	23	1.001	24	0.0	0.000	0.000	0.0000	
Foul Event	24	1.002	25	0.1	0.340	0.003	0.0108	
Foul Event	25	1.003	26	0.2	0.537	0.008	0.0395	
Foul Event	26	1.004	27	0.2	0.359	0.013	0.0434	
Foul Event	27	1.005	28	0.3	0.640	0.007	0.0048	
Foul Event	28	1.006	29	0.3	0.571	0.009	0.0285	
Foul Event	29	1.007	30	0.3	0.318	0.015	0.0904	
Foul Event	30	1.008	31	0.4	0.333	0.032	0.0553	
Foul Event	31	1.009	32	0.6	0.468	0.046	0.0378	
Foul Event	32	1.010	33	0.6	0.824	0.017	0.0547	
Foul Event	33	1.011	34	0.6	1.129	0.011	0.0151	
Foul Event	35	1.013	36	0.6	0.778	0.013	0.0219	
Foul Event	36	1.014	37	0.6	0.586	0.029	0.0365	
Foul Event	37	1.015	38	0.6	0.630	0.018	0.2157	
Foul Event	38	1.016	39	0.5	0.347	0.042	0.2876	0.0
Foul Event	44	3.000	25	0.0	0.000	0.000	0.0000	
Foul Event	40	5.000	41	0.0	0.000	0.000	0.0042	
Foul Event	41	5.001	42	0.1	0.574	0.001	0.0042	
Foul Event	42	4.003	43	0.2	0.906	0.003	0.0097	
Foul Event	43	4.004	31	0.2	0.506	0.007	0.0409	
Foul Event	45	4.000	46	0.0	0.000	0.000	0.0000	
Foul Event	46	4.001	47	0.0	0.000	0.000	0.0000	
Foul Event	47	4.002	42	0.0	0.000	0.000	0.0072	

Results for Foul Event Critical Storm Duration. Lowest mass balance: 93.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
Foul Event	48	1	56.483	0.000	0.0	0.0000	0.0000	OK
Foul Event	50	1	34.128	0.000	0.0	0.0000	0.0000	OK
Foul Event	51	1	31.758	0.000	0.0	0.0000	0.0000	OK
Foul Event	49	1	38.144	0.000	0.0	0.0000	0.0000	OK
Foul Event	34	60	35.512	0.009	0.6	0.0105	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
Foul Event	48	2.000	24	0.0	0.000	0.000	0.0009	
Foul Event	50	7.000	36	0.0	0.000	0.000	0.0000	
Foul Event	51	8.000	37	0.0	0.000	0.000	0.0000	
Foul Event	49	6.000	34	0.0	0.000	0.000	0.0198	
Foul Event	34	1.012	35	0.6	1.087	0.007	0.0058	

Appendix G:
Irish Water – Confirmation of Feasibility

Brian O'Kennedy

Shannon House
Church Rd
Douglas
Cork
T12 PW40

Uisce Éireann
Bosca OP448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

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

www.water.ie

12 January 2023

Re: CDS21001664 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 272 unit(s) & creche at Broomfield East, Midleton, Cork

Dear Sir/Madam,

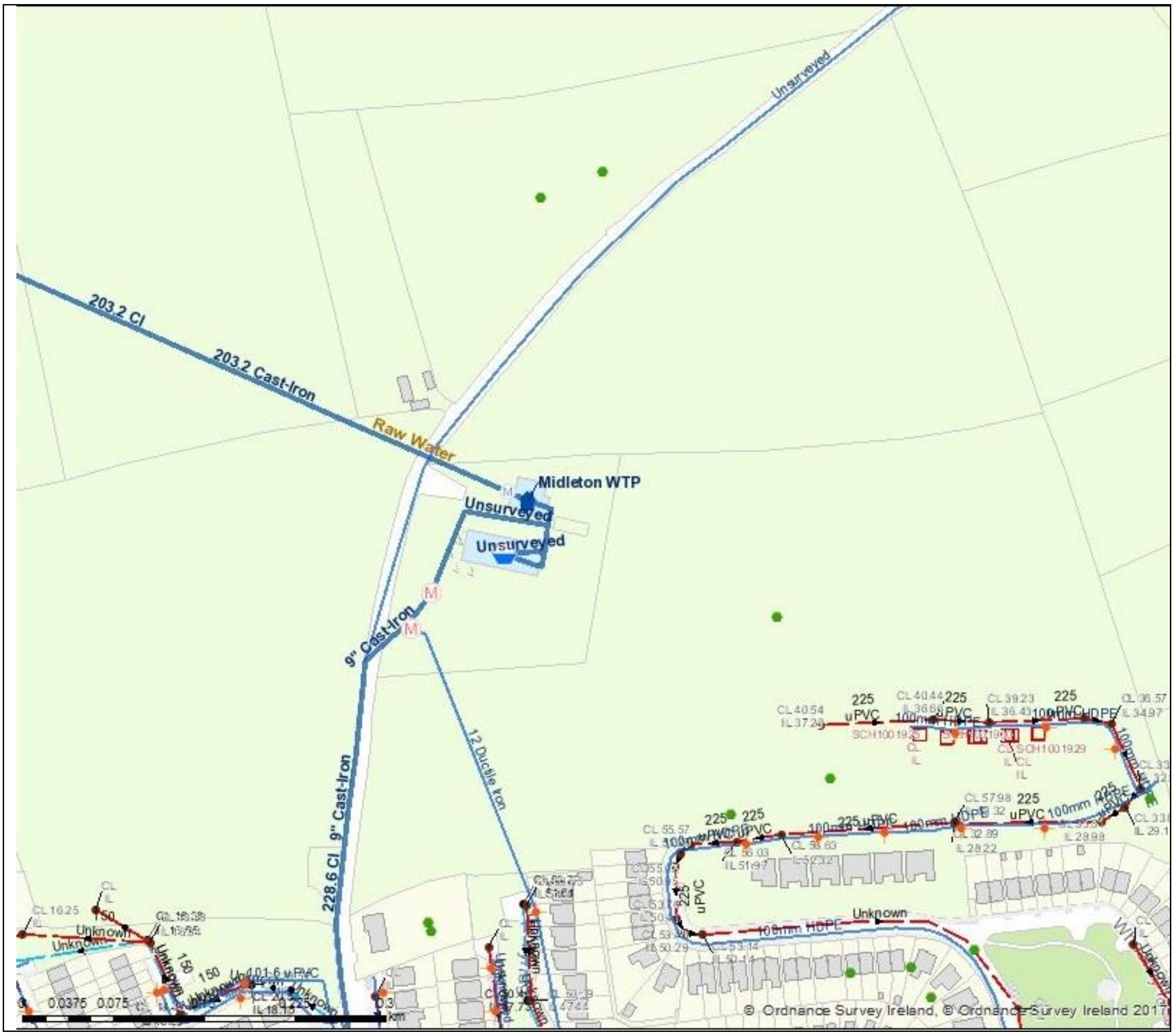
Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Broomfield East, Midleton, Cork (the **Premises**).

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible Subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	As portions of the site are above the level of the adjoining Midleton WTP reservoir, pressure boosting on the watermains servicing the development will be required. Details of such to be agreed with Irish Water at connection application stage. Please note that there is a 12" watermain crossing the site south of the Midleton WTP. This may have to diverted depending on the site layout.
Wastewater Connection	Wastewater Treatment: In order to accommodate your proposed connection, works are required to create additional capacity in the wastewater treatment system. Irish Water is currently progressing two projects to provide this additional wastewater treatment capacity. The first of these projects is due for completion in Q4 2023 (subject to change) and the proposed connection could be completed as soon as possibly practicable after this date.

<table>
<tr><td></td><td><u>Wastewater Network:</u>

Due to the volume of proposed discharge, localised upsizing of existing sewers may be required. The extent of this will be determined by site plans and discharge points. Details of such to be agreed with Irish Water at connection application stage.</td></tr>
<tr><td colspan="2">The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.</td></tr>
</table>

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



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

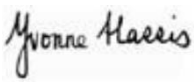
Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

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

If you have any further questions, please contact Michael Galvin from the design team at mgalvin@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

Appendix H:
SuDS Checklists

TABLE B.3 Detailed drainage design documentation suggested for submission at full planning

Ref	Requirements	Details (or referencedocumentation)	Accepted?
(a)	Where infiltration is proposed, an acceptable Infiltration Assessment has been submitted, including any geotechnical test results and evaluations	Infiltration Rate Testing was carried out in accordance with BRE365. See Appendix E, Engineering report, See section 5.11.2.1 for Filter Drain Assessment and design. See Section 5.11.3 for Permeable Paving Assessment and design.	
(b)	A scheme design assessment with appropriate supporting calculations that has been submitted that demonstrates design conformity with the required design criteria for the site; justification of any non-compliance to national or locally set standards	Full SuDS design has been carried out with reference to CCDP2022, Greater Dublin Strategic Drainage Study Vol2 and SuDS manual CIRIA Report C753. No non-compliance issues.	
(c)	Plans of the proposed drainage system, showing: ' drainage catchment and sub-catchment areas (including impermeable and permeable zones, and any phasing details) ' existing and proposed site sections and levels ' long- and cross-sections for the proposed drainage system (including exceedance flow management routes) and final building finished floor levels ' details for connections to watercourses and sewers ' maintenance access and any arisings storage and disposal arrangements ' operational characteristics of any mechanical features	Full details as listed. See the following: Drawing P.1303 – Existing Drainage System Sections. Drawings P.1321 & P.1322 – Proposed SW Layout. Drawing P.1324 – Existing Receiving S.W. System. Engineering Report – Appendix 'A' – S.W. Design Output. Appendix 'B' – S.W. Receiving Network CCTV. Appendix 'C' – S.W. Receiving Network Design.	
(d)	All necessary consents required for off-site works	No Off-Site Work	
(e)	Commitments for approval and adoption arrangements for all elements of the system (including exceedance flow management components); commitments to any cost contributions, valuation and security of any required non-performance bond	Compliance will be met in relation to any conditions or bonds specified as part of a grant of planning permission	
(f)	Appropriate consideration and management of any health and safety issues relating to SuDS implementation	SuDS recommendations in relation to safe design of measures have been met. E.g. max slope of swale side slopes.	
(g)	The design of each element undertaken in accordance with best practice (using detailed design checklists, where required)	See Drainage Impact Assessment Design, Section 5.0 of Engineering Report	
(h)	Specifications prepared and approved for all materials used in the design	All materials will be in accordance with appropriate/relevant EN Standards	

continued...

(i)	A construction method statement for the proposed SuDS system submitted including: ' construction processes to protect the SuDS functionality (including the provision of any required temporary drainage systems) ' programming to protect the SuDS functionality ' landscape planting ' consideration of access for inspections by the approving or adopting organisation	Construction Stage Requirement Only.	

continued from...

TABLE B.3 Table B.3 Detailed drainage design documentation suggested for submission at full planning

Ref	Requirements	Details (or reference documentation)	Accepted?
(j)	A Maintenance Plan for the proposed SuDS submitted including: ' a description of the system and how each part of the system is expected to work ' management objectives for the site ' inspection and maintenance schedules, material, tools and initial cost estimates ' maintenance access points, easements and outfalls	Construction Stage Requirement Only	
(k)	An information and communications plan for the proposed SuDS scheme submitted, where appropriate, including: ' communication with and education of existing residents ' communication with and education of new residents ' site and SuDS component specific information boards ' local community education and education strategies (eg through schools). Note: this is only likely to be required on larger sites and may be provided by the drainage approving body or the developer (to be agreed between them)	Construction Stage Requirement Only	

continued...

TABLE B.4 Scheme design assessment checklist

Requirements						
Site ID	Castle Rock Homes Development Broomfield West Midleton Co Cork					
Site location and co-ordinates	Broomfield West, Midleton. ITM 188168E, 075044N					
Site description	Housing Development Site	Drawing reference(s)			P-1101. P-1102, P-1103 Site Layout Plans	
Date of assessment	October 2023	Specification reference				
Type of development	Domestic Housing & Creche	Site area			7.95Ha	
		SuDS manual section	**Y**	**N**	**Summary of details**	**Comments/remedial actions**
Water quantity						
Is surface water used as a resource, where appropriate?		3.2.2	✓		Swale drainage to support natural flora/fauna	
Does the design meet the following discharge hierarchy (with acceptable justification for moving between levels): 1 infiltration to the maximum extent that is practical – where it is safe and acceptable to do so 2 discharge to surface waters 3 discharge to surface water sewer 4 discharge to combined sewer (last resort)		3.2.3	✓ ✓ ✓	✓	Substantial area of permeable paving incorporated. Attenuated green field rate run off to discharge to S.W. (river) via existing S.W. infrastructure.	
If infiltration is used: confirm that an acceptable infiltration assessment has been undertaken and submitted			✓		See Section 2.2 Eng Report	
If discharge to a sewerage asset is proposed, has evidence been provided that the design criteria have been agreed with the sewerage undertaker and that an appropriate connection detail has been agreed?			✓		Connection to existing S.W. sewer proposed. See full design Section 2 Engineering Reports and Appendix 'A', Stormwater Sewer Design Output.	
Has runoff and flooding from all sources (both on and off site) been considered and taken into account in the design?		3.3.3	✓		See Section 5.0 Drainage Impact Assessment in Engineering Report	
Does the scheme design demonstrate on-site retention of approximately the first 5 mm of runoff from impermeable surfaces for most events? How is Interception to be delivered (eg infiltration, green roofs, permeable pavements, vegetated surfaces, bespoke design – provide details)?		3.3.1 4.3.1	✓ ✓		See Engineering Report, Section 5.3 SuDS design criteria. Infiltration, permeable paving, vegetated surfaces (swales). See Section 5.0 Drawing Impact Assessment of Engineering report.	

continued...

TABLE B.4 Scheme design assessment checklist

Requirements					
Does the design demonstrate adequate control of the 1 year, critical duration site event?	3.2.3 3.3.2	✓		See Appendix 'A' of Engineering Report Storm Network 1 and 2 Reports See design and simulation settings	
Does the design demonstrate adequate control of the 100 year, critical duration site event (including urban creep and climate change allowances)?	3.2.3 3.2.7 3.3.2	✓		See Appendix 'A' of Engineering Report Storm Network 1 and 2 Reports See design and simulation settings	
Does the design demonstrate adequate control of the 100 year, 6 hour runoff volume from the site?	3.2.3 3.3.1	✓		See Appendix 'A' of Engineering Report Storm Network 1 and 2 Reports See design and simulation settings	
Are any natural hydrological features on the site adequately protected by the design?	3.2.4		✓	No natural hydrological features present.	
Are all SuDS components outside any areas of significant flood risk? If not, provide justification and evidence that the risks to system performance are acceptable	3.2.5	✓		Exceedance floor/flood areas highlighted in Engineering Report Section 6.10. Pluvial exceedance. All SuDs features lie outside these areas.	
Is pumping a requirement for the operation of the system? If yes, have all other possible alternatives been considered appropriately?	3.2.5		✓	No pumping required – all gravity sewers.	
Have infiltration rates, hydraulic gradients and any downstream constraints been evaluated to ensure that the components will drain down within a suitable timescale?	3.2.5	✓		Greenfield runoff calculated – See Appendix 'D' of Engineering report. Attenuation design calculated to suit - See Appendix 'A of Engineering Report. S.W. receiving network design confirmed – See Appendix 'B' of Engineering Report.	
Are flows up to the agreed standard of service event (including allowances for urban creep and climate change) fully conveyed within the drainage system?	3.2.6 3.2.7 3.3.3	✓		10% and 20% climate change simulations used for S.S. drainage design as per SuDS design criteria and as per Table 11.4 of Cork Co Co Development Plan.	
Are flows up to the agreed exceedance standard of service event (including allowances for urban creep and climate change) contained or stored on site within safe exceedance storage areas and flow paths? Are these areas and flow paths protected from future development?	3.2.6 3.2.7 3.3.3	✓		See Engineering Report section 6.0 – Flood Risk Assessment for exceedance flow paths and management. Future development will not be possible at these areas.	
Water quality					
Does the design include an appropriate treatment strategy to ensure that: ' sediment is trapped and retained on site in accessible and maintainable areas? ' suitable SuDS components have been provided in series before discharge that provide acceptable treatment, taking account of proposed site land use and the status of all receiving water bodies?	4.2.2 4.3.2	✓ ✓		No runoff for small (< 5mm) events. All S.W. gullies fitted with silt traps. Swales will provide filtration of S.W. Filter drains incorporate filter membrane with sacrificial top layer. Permeable paving will provide for filtration of sediment filter.	

continued...

continued from...

TABLE B.4 Scheme design assessment checklist

Has consideration been given to the potential implications of climate change on the capability of the SuDS components to provide the required treatment?	4.2.3	✓		Climate change predications of 10% and 20% used for S.W. design, see Appendix 'A' of Engineering Report.	
Requirements					
Amenity criteria					
Where the drainage system serves more than one property, is public space used and integrated with the drainage system in an appropriate and beneficial way?	5.2.2	✓		Swales and filter drains are incorporated into open aeras. Permeable paving to common courtyard areas. Total 1950sqm	
Does the proposed scheme enhance the visual character of the development?	5.2.3	✓		Planted swales provide green corridors.	
Are the proposed components safe for any proposed amenity use? Has a health and safety risk assessment been undertaken?	5.2.4 Chapter 36 Checklist B.3	✓		Swale incorporated into green areas. Side slopes design in accordance with SuDS suggestion. H&S risk to be assessed prior to construction stage.	
Have opportunities been taken to use the drainage system to enhance development resilience to future climate change scenarios?	5.2.5	✓		Future climate change scenarios have been modelled into the S.W. design system.	
Is the structure and function of the drainage system clear and obvious to the local community?	5.2.6			To be assessed at construction stage	
Do the design proposals include sufficient provision for community engagement and awareness raising?	5.2.7			To be assessed at construction stage	
Biodiversity criteria					
Will the drainage system support and protect natural local habitats and species?	6.2.1	✓		See Landscape Report Masterplan Drawing L206 notes.	
Will the drainage system contribute to the delivery of local biodiversity objectives?	6.2.2	✓		See Landscape Report Masterplan Drawing L206 notes.	
Does the design support local (and wider where possible) habitat connectivity?	6.2.3			Habitat connectivity to be considered in conjunction with further development of adjoining launch.	
Does the design promote the creation of diverse, self-sustaining and resilient ecosystems?	6.2.4	✓		See Landscape Report Green Infrastructure Drawing L202	
Constructability					

continued...

Has an acceptable construction method statement been submitted and approved?	Chapter 31		✓	Construction materials are non-technical and incorporate standard build techniques. Details construction method statements to be considered at construction stage.	

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TABLE B.4 Scheme design assessment checklist

Maintainability					
Are the design features sufficiently durable to ensure structural integrity over the system design life, with reasonable maintenance requirements?	Chapter 32	✓		Permeable system to be fully Constructed in accordance with manufacturers proprietary system. Swales have suitable side slopes, falls and planting.	
Requirements					
Are the operating and maintenance requirements of the drainage system adequately defined?	Chapter 32	✓		Design of elements has incorporated design measures as outlined on SuDS manual Circa report C753 and Greater Dublin Strategic Drainage Study Vol2. Detailed assessment at construction stage.	
Has an acceptable Maintenance Plan been submitted and approved?	Chapter 32		✓	To be assessed at construction stage.	
Cost-effectiveness					
Is operation and maintenance achievable at an acceptable cost to the adopting body (including any pumping requirements)?	Chapter 35	✓			
Safety					
Are the proposed components safe to construct, maintain and operate? Has a health and safety risk assessment been undertaken?	Chapter 36 Checklist B.3	✓		Component design has had regard for H&S and incorporated design manual layout. Detailed H&S risk assessment to be carried out at Construction Stage.	

System design acceptability	Summary details including any changes required	Acceptable (Y/N)	Date changes made
Acceptable: Minor changes required: Major changes required/redesign:			