

ENVIRONMENT

Wilson Bowden Developments Ltd
Plot J2
Kingsway Business Park, Rochdale
Sustainable Drainage Statement

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Wilson Bowden Developments Ltd Plot J2 Kingsway Business Park, Rochdale Sustainable Drainage Statement

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*Updates to masterplan only

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1. INTRODUCTION

- 1.1 A Sustainable Drainage Statement (SDS) sets out the principles of drainage design for a development and summarises the reasoning behind the chosen design. This includes consideration of national and local guidance, justification of specific flow rates, volumes of attenuated storage, as well as the appropriate level of treatment to be provided to surface water runoff.
- 1.2 This SDS has been produced by BWB Consulting on behalf of Wilson Bowden Developments Ltd in respect of a planning application for the proposed development of Plot J2, Kingsway Business Park, Rochdale (approximate grid reference: SD913114).
- 1.3 This SDS is intended to support a full planning application and as such the level of detail included is commensurate and subject to the nature of the proposals. A Flood Risk Assessment (FRA) has been produced for the site (reference: KPJ-BWB-ZZ-XX-RP-YE-0001_FRA) and this SDS accompanies this overarching document.
- 1.4 It should be noted that outline planning permission existing for development of Plot J2 (application reference 14/00542/OUT) and the approved parameters allow for development across the site in accordance with the approved parameters plan. The only reason that a full application is being submitted is because the height of the buildings have been increased compared to the approved parameters.
- 1.5 It should also be noted that this report includes minor updates to the original submission in October 2022 (reference 22/01200/FUL). These updates are due to a minor change in the development layout which came as a result of various objections and discussions held at Planning Committee 16/2/23.
- 1.6 A proposed site development plan is included as **Appendix 1**.
- 1.7 The location of the site and application boundary is illustrated within **Figure 1.1**, with contextual information provided within **Table 1.1**.

Table 1.1: Site Details

Site Name	Plot J2
Location	Kingsway Business Park, Rochdale
NGR (approx.)	SD913114
Application Site Area (ha)	5.43 (approximately)
Proposed Impermeable Area (ha)	3.533
Development Type	Commercial
Lead Local Flood Authority	Rochdale Borough Council
Local Planning Authority	Rochdale Borough Council

Environment Agency Area	Greater Manchester, Merseyside and Cheshire (GMC)
Sewerage Undertaker	United Utilities

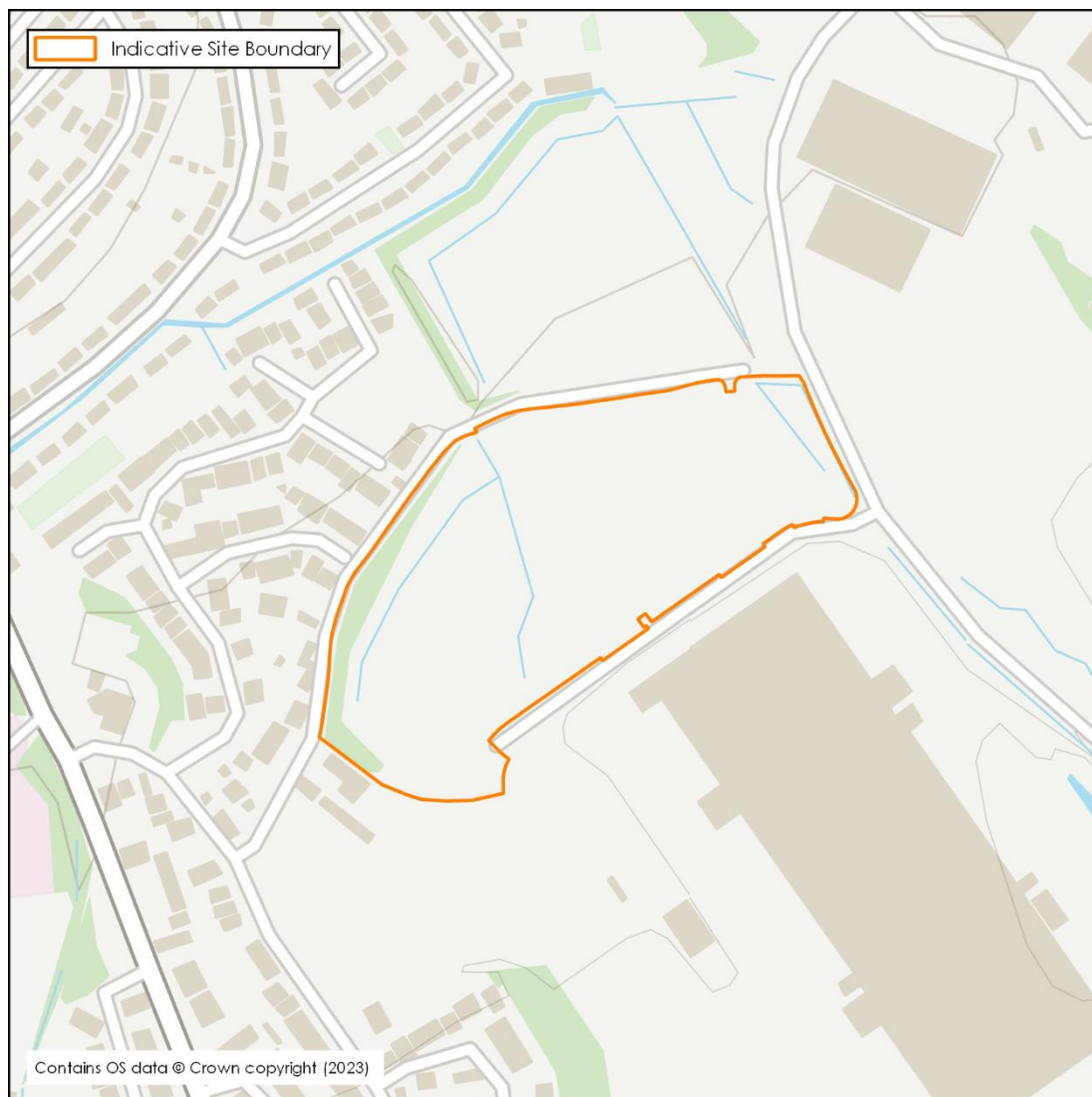


Figure 1.1: Site Location

Sustainable Drainage Guidance

- 1.8 Sustainable Drainage Systems (SuDS) aim to mimic a more natural runoff regime, treating and discharging water close to where it falls. They should be designed with the four pillars of SuDS in mind: water quality, water quantity, amenity and biodiversity.
- 1.9 The Non-Statutory Technical Standards for Sustainable Drainage Systems¹ as published by DEFRA have been utilised to inform the strategy.

¹ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

2. EXISTING CONDITIONS

- 2.1 The site is part of the wider Kingsway Business Park development, located approximately 2.4km south of Rochdale. The site is bound by Lower Lane to the north, John Milne Avenue to the east, James Kearns Avenue to the south and an existing tree line to the west. The majority of the wider business park sits to the east with the existing Asda distribution centre to the south.
- 2.2 A topographical survey has been undertaken and is included as **Appendix 2**. The existing site comprises greenfield land with levels generally falling from south to north. Levels range from approximately 158m Above Ordnance Datum (AOD) in the south west corner to 153m AOD along the northern boundary.
- 2.3 There are two large depressions within the site, one towards the eastern boundary and the second bisecting the centre of the site. At the base of the eastern feature, levels generally sit between 4m and 1.5m below the surrounding levels. The central feature generally sits between 2.8m and 1m below the surrounding levels.
- 2.4 There is an existing ditch located at the eastern site boundary which flows in a northerly direction before discharging via a box culvert located along the north eastern corner of the site. The ditch is culverted (600mm) under James Kearne Avenue and is understood to intercept overland flows from the M62 south of the development. Further details of the wider catchment and hydrology can be found within the FRA (reference: JKP-BWB-ZZ-XX-RP-YE-0001_FRA). It is proposed that this culvert will be abandoned and a new link through to the neighbouring plot provided as part of the Plot J works. The proposed drainage link through is shown on the drainage layout.
- 2.5 The site is considered to drain via a natural regime of infiltration and runoff. During extreme rainfall events where infiltration potential is exceeded, runoff is expected to flow overland towards the two depressions in the topography. Flows exceeding the capacity of these topographical features would leave the site to the north, either via overland routes or the ditch's culverted outfall.
- 2.6 Much of the site wide drainage infrastructure for the business park has already been constructed, which acts to service future plots, as developments are brought forward. There are surface water and foul water sewers within John Milne Avenue and James Kearns Avenue which have been adopted by United Utilities (UU). Within John Milne Avenue the 300mm diameter foul sewer is shown to discharge in a northerly direction towards an existing pumping station. The 1500/1600mm diameter surface water sewer is shown to discharge in an easterly direction towards the existing attenuation ponds which are located approximately 800m east of the application boundary.
- 2.7 For reference, as built records of the wider drainage infrastructure and UU sewer record plans are included as **Appendix 3**.
- 2.8 BWB have previously undertaken three site wide drainage assessments across the business park which demonstrate the installed drainage networks and downstream attenuation has been designed and installed to accommodate the 100-year storm event for all future developments at the site. The technical note produced covering

drainage catchment 1A/1B that Plot J2 is located within has previously been accepted by Rochdale Borough Council and UU, a summary note is included within **Appendix 4**.

2.9 A Phase 2 Geo-Environment Assessment was undertaken by BWB Consulting in February 2018 (reference: KBP-BWB-ZJ-XX-RP-YE-0002_PH2). Findings from the investigation are summarised below:

- Ground conditions were recorded to comprise topsoil or made ground to a maximum depth of 1.1m and 1.4m Below Ground Level (BGL) respectively overlying Hummocky Glacial Deposits to a proven depth of 10m BGL. The underlying Glacial Till was recorded to a maximum depth of 15.5m BGL although the base was unproven.
- Head Deposits, as mapped by the British Geological Survey (BGS), were encountered on site as Alluvium within the two site depressions between 0.25m and 3.7m BGL. Groundwater was monitored between 0.82m and 4.45m BGL.

Existing Runoff Rates

2.10 An assessment of the existing surface water runoff rates from the site have been undertaken and are summarised within **Table 2.1**. Calculations are included as **Appendix 5**.

2.11 The runoff rates have been estimated using the IH124 method, with appropriate prorated adjustments for a site of less than 50ha, as recommended in Interim Code of Practice for Sustainable Drainage². This was undertaken within Micro Drainage, which makes the necessary adjustments for small sites automatically.

Table 2.1: Existing Runoff Rate (3.5ha)

Return Period (Yrs.)	Runoff Rate (l/s)
1	2.1
Mean Annual Flow Rate (QBAR)	2.5
30	4.2
100	5.1

Existing Runoff Volume

2.12 An assessment of the existing surface water runoff rates from for the proposed post development impermeable area (3.5ha) has been made for a 1 in 100-year, 6 hour storm.

2.13 As the existing site is permeable, the runoff volume has been calculated using the Source Control module within Micro Drainage to be **351m³**, results are included within **Appendix 6**.

² The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

3. SURFACE WATER DRAINAGE STRATEGY

- 3.1 Proposals will see the erection of two employment buildings (Classes E(g)(iii), B2 and B8) with ancillary office space, new access, car parking, servicing, boundary treatments, hard and soft landscaping and other associated works. A proposed site drawing is included as **Appendix 1**.
- 3.2 The proposed development forms part of the wider Kingsway Business Park development which was granted outline planning permission in 2014 under reference 14/00542/OUT. This SDS has been progressed based on the criteria set out in the FRA (Ref:MCT/2014/FRA) for the wider site which will be referenced, as appropriate, within this report. Subsequent works by BWB have confirmed that the principles set out in the original FRA have been followed in terms of the as-built infrastructure. A summary note of the findings is included as **Appendix 4**.
- 3.3 For the purposes of this assessment, a measured impermeable area of 3.533ha has been used to assess the attenuation requirements for the site.

Drainage Hierarchy

- 3.4 The Planning Policy Guidance³ and the SuDS Manual⁴ identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:
- i. into the ground (infiltration);
 - ii. to a surface water body;
 - iii. to a surface water sewer, highway drain, or another drainage system;
 - iv. to a combined sewer.
- 3.5 The aim of this approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible. Ground water levels were encountered at shallow depths during the monitoring period, as such the use of infiltration drainage techniques has been discounted.
- 3.6 As outlined previously, there is a network of existing sewers that have been designed and installed to service future plots of Kingsway Business Park.
- 3.7 It is therefore proposed to discharge flows from the development into the existing sewer within James Kearns Avenue to the south. The drainage discharges east towards an existing attenuation pond with flows ultimately discharging to Stanney Brook. While the immediate discharge point doesn't follow the above hierarchical approach, the wider drainage strategy discharges flows to a watercourse and as such the approach is considered to satisfy this criterion.

³ Planning Practice Guidance. <http://planningguidance.planningportal.gov.uk/>.

⁴ The SuDS Manual (C753). CIRIA 2015.

Peak Flow Control

- 3.8 In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S3⁵, runoff from greenfield developments should not exceed the equivalent greenfield rates for the equivalent return period events.
- 3.9 As previously stated, the wider infrastructure has been designed and installed to accommodate the 1 in 100-year storm event, with flows being restricted at the downstream attenuation features. The proposed catchment for Plot J2, amongst others, is served by 'Basin 1A' and 'Basin 1B'. The restricted outflows from the attenuation features are controlled in such a way that the 1 in 10, 30, 50 and 100-year rainfall events do not exceed that of the predeveloped discharge rates.
- 3.10 It is therefore proposed to restrict flows leaving the development to the equivalent 1 in 100-year rate for the associated impermeable area. Rainfall events above this will be restricted to this rate up to and including the 100-year plus climate change event.
- 3.11 Using Micro Drainage, an average rainfall intensity for the 1 in 100-year, 15-minute event has been calculated to be 81.5mm/hr using FSR rainfall data. The resulting rainfall profile is provided as **Appendix 7**.
- 3.12 The contributing runoff rates from the 3.5 ha of drained impermeable surfaces within the site have been estimated using the Rational method, as described within **Figure 3.1**.

$$Q = 2.78 \times A_p \times i$$

Where:
Q = runoff rate (l/s)
A_p = impermeable area (ha)
i = rainfall intensity (mm/hr)

$$Q = 2.78 \times 3.5 \times 81.5 = \underline{792\text{l/s}}$$

Figure 3.1: Rational Method

- 3.13 The maximum discharge rate has been set at the equivalent 1 in 100-year event in line with the wider drainage strategy, however, following completion of the hydraulic modelling of the proposed drainage system, the modelled discharge rates, during the critical storm, for various return periods are outlined within **Table 3.1**. The hydraulic model will be further developed during detailed design. It is possible that the modelled flow rates will change marginally but will remain within the maximum permissible flow.

Table 3.1: Proposed Discharge Rates (combined)

Return Period (Yr.)	Proposed Discharge Rate (l/s)	Maximum Permissible Flow (l/s)
2	339.2	792.0
30 + 40%	524.7	792.0
100 + 45%	666.9	792.0

⁵ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

- 3.14 Considering the downstream infrastructure restricts flows to the equivalent pre-developed runoff rates and proposals do not increase flows above what was designed for and consented, the site is considered to fulfil the necessary peak runoff control criteria.

Attenuated Storage

- 3.15 As the development proposals require a restricted runoff rate, it will be necessary to provide attenuated storage to balance the excess volume in a safe manner within the site.
- 3.16 The surface water storage should be located within the site in a position where it can receive runoff from the development and also in a position where it is hydraulically isolated from any fluvial floodplain or external surface water floodplain / overland flow route that may be present in the site. Environment Agency (EA) mapping shows two overland flow routes crossing the site, however, it is understood that these flow paths have been diverted through a ditch that sits immediately west of John Milne Avenue outside of the application boundary. Further details of this are presented in BWB FRA for the site (report reference KPJ-BWB-ZZ-XX-RP-YE-0001_FRA).
- 3.17 Sufficient storage for events up to the 1 in 100-year storm with an allowance for climate change should be provided.
- 3.18 While the proposed discharge rate has been based on the overall post development impermeable area, proposals for the site dictate that the two units will have to discharge separately to avoid any ongoing maintenance issues associated with a shared outfall.
- 3.19 It is proposed to discharge Unit J1 and J2 at maximum flow rates of 452 l/s and 340 l/s, respectively. Due to the existing site topography and levels of the existing drainage it will be necessary to pump flows from Unit J2.
- 3.20 A simulation has been run using Micro Drainage 'Network' Module to identify the necessary storage provision for each unit. Using a flow control to restrict flows to the equivalent 100-year rate for the contributing areas, the volume of attenuated storage required for the development has been calculated for storm events up to the 100 year + 45% climate change event. The supporting Micro Drainage calculations (undertaken using Flood Studies Report rainfall data) are included as **Appendix 8**.
- 3.21 At this design stage, it is expected that approximately 135m³ of attenuated storage will be provided within the attenuation tank for Unit J1, with the remaining volume being provided by the upstream pipes and manholes.
- 3.22 The necessary storage required for Unit J2 will be provided within the pipes and manholes proposed for that network.

Runoff Volume Control

- 3.23 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6⁶ states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6 hour rainfall event should not exceed the runoff volume prior to development or redevelopment. Additionally, if practicable on previously developed sites, the runoff volume should not exceed the equivalent greenfield runoff volume. Where it is not reasonably practicable to constrain the volume of runoff from a development at or below the existing volume, then the runoff must be discharged in a manner that does not adversely affect flood risk.
- 3.24 An estimate of the post-development runoff volume from the 1 in 100-year 6 hour storm has been calculated using a rainfall depth of 69.12mm (derived from the Flood Estimation Handbook (FEH) Website) across the impermeable areas (3.5ha) of the site.
- 3.25 The rainfall data is provided as **Figure 3.2** with the existing and post-development runoff volumes are compared within **Table 3.2**.

Table 3.2: Runoff Volume Comparison

Existing Volume (m ³)	Proposed Volume (m ³)	Difference (m ³)
351	2,419	+2,068

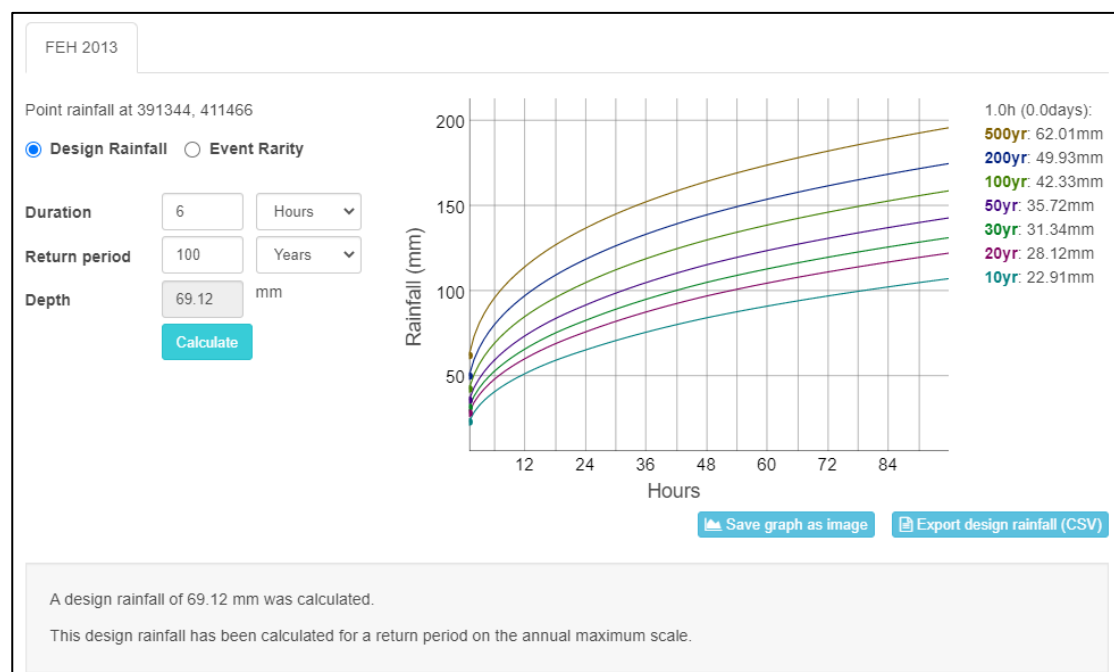


Figure 3.2: FEH Website – 1 in 100-Year, 6 Hour Rainfall Depth Rational Method

⁶ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

- 3.26 The 1 in 100-year 6 hour storm runoff volume from the site has been shown to increase as a result of the proposed development. However, as the runoff volume from the development will be discharged into a site wide drainage network which ultimately discharges flows at a rate equivalent pre-developed runoff rates, the volume control criteria will be met.

Long Term Storage

- 3.27 As the development complies with the volume control criterion, provision for long term storage is not required.

Sustainable Drainage Systems

- 3.28 A drainage layout for the development is shown on BWB Dwg No: KPJ-BWB-DGG-XX-DR-D-0500. The drawing is included as **Appendix 9**.
- 3.29 The nature of the site is such that SuDS techniques are limited, it is proposed that a series of measures are incorporated within the proposed layout to provide an element of treatment to surface water runoff, these include:
- Silt traps
 - Sump outfall units/gullies
 - Filter Drain
 - Full Retention Separators
 - Attenuation storage tanks or pipes
- 3.30 The proposed carpark and service yard will have gullies and filter drains with sumps to allow the collection of silt, and all external runoff will pass through a petrol interceptor before discharging from the site. Using the simple index approach outlined within the SuDS manual the various separators proposed for the scheme will be sufficient to treat flows leaving the high pollution risk areas of the site (services yards & car parking). Further treatment is provided by the downstream attenuation ponds before flows are discharged into the wider catchment.

Residual Risk and Designing for Exceedance

- 3.31 The proposed system has been designed to accommodate all flows during the 1 in 30-year event, during the 1 in 100-year event some minor surface flooding is identified in the detailed hydraulic modelling.
- 3.32 Exceedance flows will generally be contained within the low-lying docking ports of the service yards.

4. MAINTENANCE

- 4.1 The maintenance responsibility of the drainage and SuDS features should be undertaken by the site operator or a suitable appointed management company.
- 4.2 Requirements for ongoing maintenance of the drainage network should form part of the Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.
- 4.3 It is envisaged that a site specific Operation and Maintenance Plan will be developed once the proprietary products have been specified, however, a typical Schedule and key points for consideration are included within a plan included as **Appendix 10**, some examples are also provided below.
- i. All drainage features should be located in open areas which are readily accessible.
 - ii. Gullies should be inspected and de-silted at least once a year, where necessary.
 - iii. Pipes, manholes and silt traps should be inspected and de-silted at least once a year, where necessary.
 - iv. The below ground tank should be regularly inspected and jetted, as appropriate, to remove silt and debris.
 - v. Flow controls should be inspected every 6 months, litter/debris and silt build up should be removed as necessary.
- 4.4 It is understood that the site wide drainage network has been adopted by UU through a Section 104 agreement and 'Basin 1A' and 'Basin 1B' have been adopted by Rochdale Borough Council. Therefore, arrangements for the maintenance of the site wide drainage infrastructure are already in place.

5. FOUL WATER DRAINAGE

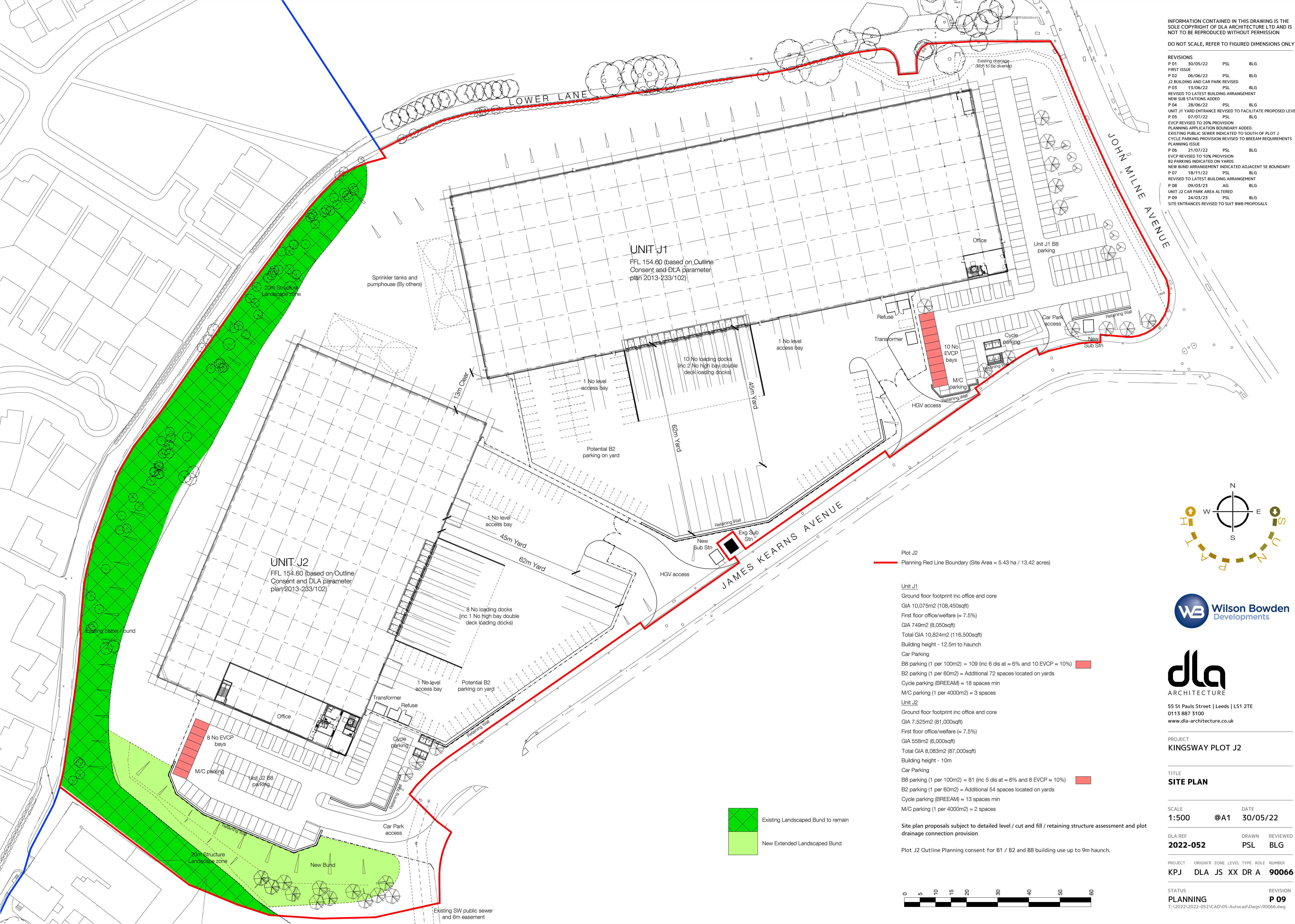
- 5.1 It is proposed to connect foul flows from the development to the existing 225mm diameter foul sewer within James Kearns Avenue to the south. Each Unit will connect separately with Unit J1 discharging via gravity and Unit J2 requiring a pumping station. Connections will be made via the existing spurs that we constructed when the main spine drainage was installed.
- 5.2 As built records of the wider drainage infrastructure and UU sewer record plans are included as **Appendix 3**.
- 5.3 An indicative foul water drainage layout for the development is shown on BWB Dwg No: KPJ-BWB-DGG-XX-DR-D-0500 which is included as **Appendix 9**.

6. SUMMARY

- 6.1 This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.
- 6.2 This SDS is intended to support a full planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.
- 6.3 This statement and supporting appendices demonstrate that the drainage design for the development is appropriate for the surrounding infrastructure.
- 6.4 Attenuation with the Kingsway Business Park has been designed such that up to the 1 in 100 year event can be accommodated with the existing ponds. It is proposed that the 45% allowance for climate change will be managed and stored entirely within the plot boundary with any surface water flooding will be directed away from access routes.
- 6.5 On Plot attenuation is proposed in order to account for climate change, with SuDS techniques being implemented where practical in order to provide treatment to surface water flows.
- 6.6 The proposed development of Plot J2 will utilise existing attenuation Basins 1A and 1B.
- 6.7 The completed North West SuDS Proforma is provided as **Appendix 11**.

APPENDICES

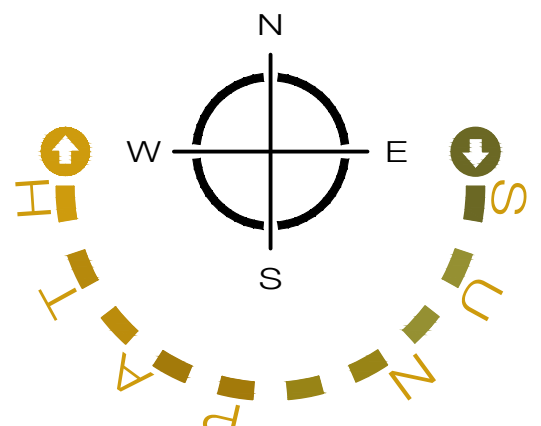
APPENDIX 1: Site Plans



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DO NOT SCALE, REFER TO FIGURED DIMENSIONS ONLY

REVISIONS			
P 01	30/05/22	PSL	BLG
FIRST ISSUE			
P 02	06/06/22	PSL	BLG
J2 BUILDING AND CAR PARK REVISED			
P 03	13/06/22	PSL	BLG
REVISED TO LATEST BUILDING ARRANGEMENT			
NEW SUB STATIONS ADDED			
P 04	28/06/22	PSL	BLG
UNIT J1 YARD ENTRANCE REVISED TO FACILITATE PROPOSED LEVELS			
P 05	07/07/22	PSL	BLG
EVCP REVISED TO 20% PROVISION			
PLANNING APPLICATION BOUNDARY ADDED			
EXISTING PUBLIC SEWER INDICATED TO SOUTH OF PLOT J			
CYCLE PARKING PROVISION REVISED TO BREEAM REQUIREMENTS			
PLANNING ISSUE			
P 06	21/07/22	PSL	BLG
EVCP REVISED TO 10% PROVISION			
B2 PARKING INDICATED ON YARDS			
NEW BUND ARRANGEMENT INDICATED ADJACENT SE BOUNDARY			
P 07	18/11/22	PSL	BLG
REVISED TO LATEST BUILDING ARRANGEMENT			
P 08	09/03/23	AG	BLG
UNIT J2 CAR PARK AREA ALTERED			
P 09	24/03/23	PSL	BLG
SITE ENTRANCES REVISED TO SUIT BWB PROPOSALS			



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PROJECT
KINGSWAY PLOT J2

TITLE
SITE PLAN

SCALE
1:500

DATE
30/05/22

DLA REF
2022-052

DRAWN
PSL

REVIEWED
BLG

PROJECT
KPJ

ORIGIN'R
DLA

ZONE
JS

LEVEL
XX

TYPE
DR

ROLE
A

NUMBER
90066

STATUS
PLANNING

REVISION
P 09

T:\2022\2022-052\CAD\05-Autocad\Drawings\90066.dwg

Plot J2
Planning Red Line Boundary (Site Area = 5.43 ha / 13.42 acres)

Unit J1
Ground floor footprint inc office and core
GIA 10,075m² (108,450sqft)
First floor office/welfare (≈ 7.5%)
GIA 749m² (8,050sqft)
Total GIA 10,824m² (116,500sqft)
Building height - 12.5m to haunch
Car Parking
B8 parking (1 per 100m²) = 109 (inc 6 dis at ≈ 6% and 10 EVCP ≈ 10%)
B2 parking (1 per 60m²) = Additional 72 spaces located on yards
Cycle parking (BREEAM) = 18 spaces min
M/C parking (1 per 4000m²) = 3 spaces

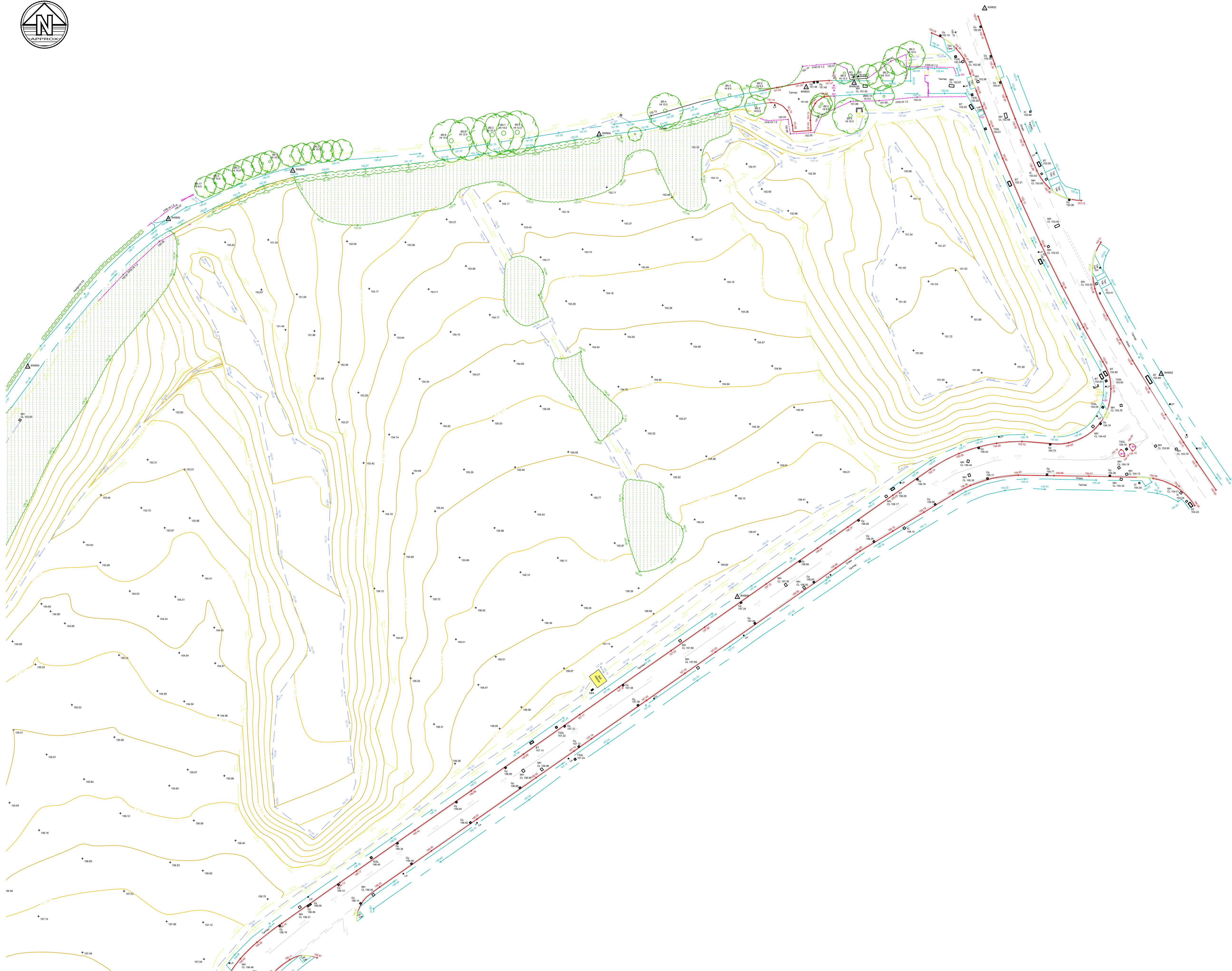
Unit J2
Ground floor footprint inc office and core
GIA 7,525m² (81,000sqft)
First floor office/welfare (≈ 7.5%)
GIA 558m² (6,000sqft)
Total GIA 8,083m² (87,000sqft)
Building height - 10m
Car Parking
B8 parking (1 per 100m²) = 81 (inc 5 dis at ≈ 6% and 8 EVCP ≈ 10%)
B2 parking (1 per 60m²) = Additional 54 spaces located on yards
Cycle parking (BREEAM) = 13 spaces min
M/C parking (1 per 4000m²) = 2 spaces

Site plan proposals subject to detailed level / cut and fill / retaining structure assessment and plot drainage connection provision

Plot J2 Outline Planning consent for B1 / B2 and B8 building use up to 9m haunch.



APPENDIX 2: Topographical Survey



- Notes**
1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
 2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
 3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
 4. Any discrepancies noted on site are to be reported to the engineer immediately.
 5. No scale factor has been applied to this survey, therefore the OS coordinates are to be treated as arbitrary. Please refer to survey station information below for on site control establishment.
 6. All coordinates and height data relate to OSGB36(15). Control stations are coordinated by means of GPS receiving real time corrections via OS smart net.
 7. All manhole data is collected from ground level therefore discrepancies may occur. More accurate data is only achievable via confined space entry.
 8. OS license number: 100022432

Legend	
OS Buildings	Contour Lines
Surveyed Buildings	Inspection Chamber
Building	Flow direction and pipe diameter
Wall	Station and Name
Kerb Channel Line	BH 1
Top of Kerb	Monitoring Borehole
Edge of Surface	Tree / Bush / Sapling
Top of Bank	Area of Vegetation/ Extent of Tree Canopy
Bottom of Bank	Hedge
Canopy / Overhang	Body of Water
Line Marking	Body of Water from OS
Centre Line	Spot Level
Watercourse	Assumed Surface
Centre Line	Water Drainage Line
Barrier	
Fence	
Gate	
Overhead Powerline	
Overhead Utilities	

AP Anchor Point	FBW Fence Barbed Wire	LB Litter Bin
BG Back Gully	FCB Fence Closed Board	LP Lamp Post
BO Bollard	FCL Fence Chain Link	MH Manhole
BS Bus Stop	FEL Fence Electric	Mkr Service Marker
BT British Telecom	FMP Fence Metal Panel	PB Post Box
C Crest	FMR Fence Metal Railing	PT Post
CL Cover Level	FOB Fence Open Board	RE Rodding Eye
CMP Cable Marker	FPW Fence Post & Wire	SP Sign Post
Post	FSP Fence Steel Palisade	ST Stop Tap
CCTVSecurity Camera	FWM Fence Wire Mesh	SV Stop Valve
CTV Cable TV	FFL Finished Floor Level	TCB Telephone
DC Drainage	FP Flagpole	Call Box
Channel	Gas	THL Threshold Level
DK Drop Kerb	GV Gas Valve	TL Traffic Light
DP Down Pipe	GU Gully	TP Telegraph Post
Elec Electric	Ht Height	TS Traffic Signal
EP Electricity Post	IC Inspection Chamber	UTS Unable to Survey
ER Earth Rod	IFL Internal Floor Level	WL Water Level
FH Fire Hydrant	IL Invert Level (as a reduced level)	WM Water Meter
FL Floodlight		WO Wash Out

P1	24.01.18	First Issue	SDS	DS
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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Client

**Wilson Bowden
Developments Ltd**

Project Title

**Plot J Kingsway Business
Park, Rochdale**

Drawing Title

**Existing Site Plan
Sheet 1 of 2**

Drawn:	S. D Shreeves	Reviewed:	D. Smith
BWB Ref:	MCS 2374	Date:	24.01.18
Scale:	A1: 1:500		
Drawing Status			
INFORMATION			
Project - Originator - Zone - Level - Type - Role - Number			Status
KBP-BWB-00-01-DR-G-0001			P1



Notes

- Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
- This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
- All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
- Any discrepancies noted on site are to be reported to the engineer immediately.
- No scale factor has been applied to this survey, therefore the OS coordinates are to be treated as arbitrary. Please refer to survey station information below for on site control establishment.
- All coordinates and height data relate to OSGB36(15). Control stations are coordinated by means of GPS receiving real time corrections via OS smart net.
- All manhole data is collected from ground level therefore discrepancies may occur. More accurate data is only achievable via confined space entry.
- OS license number: 100022432

Legend

	OS Buildings		Contour Lines
	Surveyed Buildings		Inspection Chamber
	Building		Flow direction and pipe diameter
	Wall		Station and Name
	Kerb Channel Line		Monitoring Borehole
	Top of Kerb		Tree / Bush / Sapling
	Edge of Surface		Area of Vegetation/ Extent of Tree Canopy
	Bottom of Bank		Hedge
	Canopy / Overhang		Body of Water
	Line Marking		Body of Water from OS
	Centre Line		Spot Level
	Watercourse		Assumed Surface
	Barrier		Water Drainage Line
	Fence		
	Gate		
	Overhead Powerline		
	Overhead Utilities		

AP	Anchor Point	FBW	Fence Barbed Wire	LB	Litter Bin
BG	Back Gully	FCL	Fence Closed Board	LP	Lamp Post
BO	Bollard	FCL	Fence Chain Link	MH	Manhole
BS	Bus Stop	FEL	Fence Electric	Mkr	Service Marker
BT	British Telecom	FMP	Fence Metal Panel	PB	Post Box
C	Crest	FMR	Fence Metal Railing	PT	Post
CL	Cover Level	FOB	Fence Open Board	RE	Rodding Eye
CMP	Cable Marker	FPW	Fence Post & Wire	SP	Sign Post
Post		FSP	Fence Steel Palisade	ST	Stop Tap
CCTV	Security Camera	FWM	Fence Wire Mesh	SV	Stop Valve
CTV	Cable TV	FFL	Finished Floor Level	TCB	Telephone
DC	Drainage	FP	Flagpole	Call Box	
Channel		Gas	Gas	THL	Threshold Level
DK	Drop Kerb	GV	Gas Valve	TL	Traffic Light
DP	Down Pipe	GY	Gully	TP	Telegraph Post
Elec	Electric	HT	Height	TS	Traffic Signal
EP	Electricity Post	IC	Inspection Chamber	UTS	Unable to Survey
ER	Earth Rod	IFL	Internal Floor Level	WL	Water Level
FH	Fire Hydrant	IL	Invert Level	WM	Water Meter
FL	Floodlight	(as a reduced level)		WO	Wash Out

P1	24.01.18	First Issue	SDS DS
Rev	Date	Details of issue / revision	Drw Rev

Issues & Revisions

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Client
Wilson Bowden Developments Ltd

Project Title
Plot J Kingsway Business Park, Rochdale

Drawing Title
Existing Site Plan Sheet 2 of 2

Drawn:	S. D Shreeves	Reviewed:	D. Smith
BWB Ref:	MCS 2374	Date:	24.01.18
Scale:	A1: 1:500		
Drawing Status	INFORMATION		
Project - Originator - Zone - Level - Type - Role - Number	Status	Rev	
KBP-BWB-00-02-DR-G-0001	S2	P1	

APPENDIX 3: As-built Drainage Drawings & United Utilities Sewer Records



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

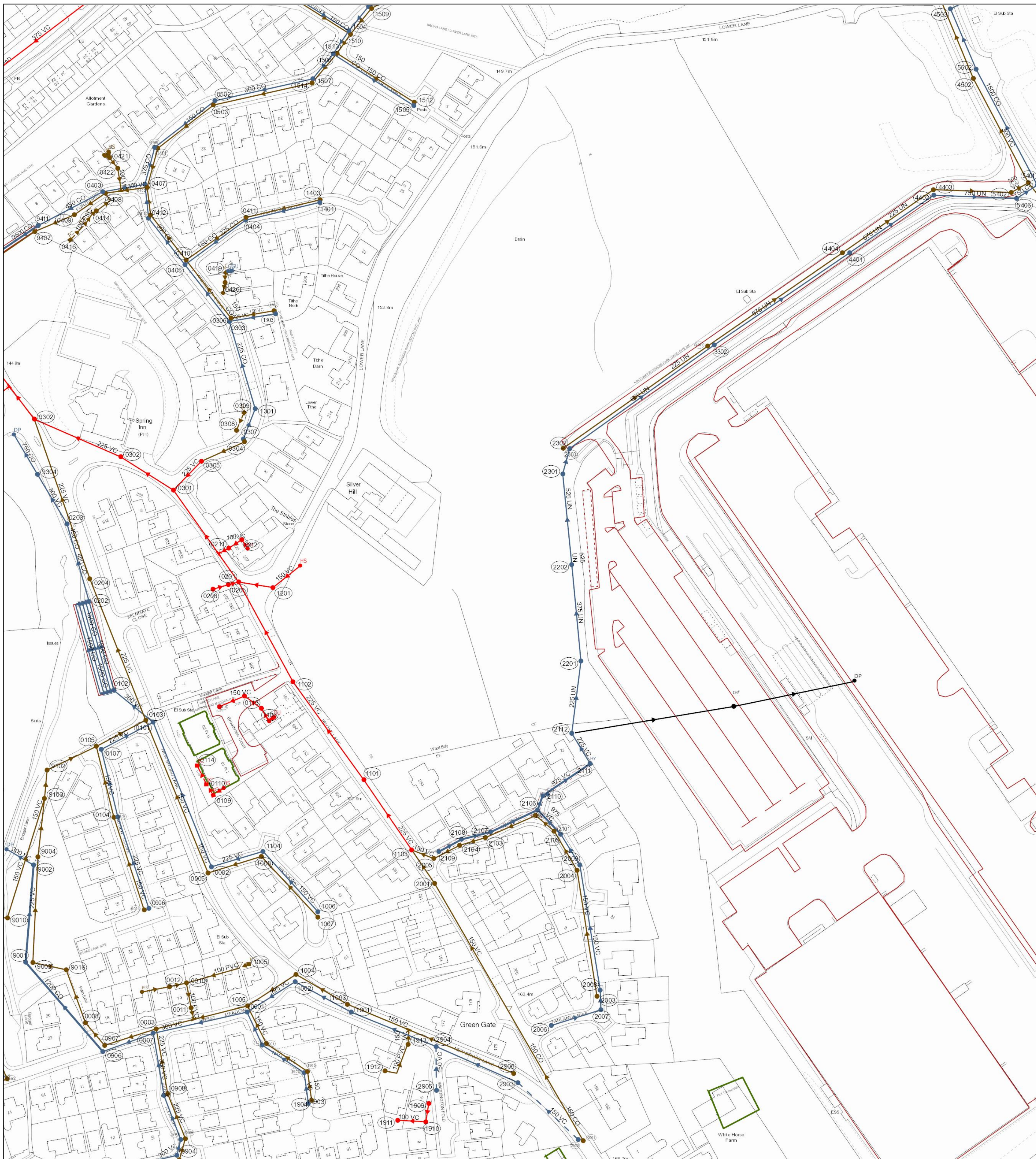
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Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
5906	148.88	SW	146.57	225	225	VC	0	23.0879	1 in 203
7405	148.88	SW	146.57	225	225	VC	0	15.2047	1 in 203
9304	158.8	SW	154.1	1200	1200	CO	0	43.8008	1 in 203
9304	158.8	SW	154.1	1200	1200	CO	0	65.10599	1 in 203
9304	158.8	SW	154.1	1200	1200	CO	0	25.63293	1 in 203
4907	150.41	SW	146.85	225	225	VC	0	7.81025	1 in 25
9406	150.41	SW	146.85	225	225	VC	0	25.04042	1 in 235
6509	150.41	SW	146.85	225	225	VC	0	21.94175	1 in 93
6001	146.83	SW	145.97	100	100	VC	0	79.69643	1 in 49
6003	146.83	SW	145.97	100	100	VC	0	9.44902	1 in 49
8101	150.41	SW	146.85	225	225	VC	0	13.13839	1 in 18
8101	150.41	SW	146.85	225	225	VC	0	13.13839	1 in 18
8402	150.41	SW	146.85	225	225	VC	0	23.3281	1 in 18
8402	150.41	SW	146.85	225	225	VC	0	23.3281	1 in 18
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8402	150.41	SW	146.85	225	225	VC	0	23.3281	1 in 18
8402	150.41	SW	146.85	225	225	VC	0	23.3281	1 in 18
8402	150.41	SW	146.85	225	225	VC	0	23.3281	1 in 18
8402	150.41	SW	146.85	225	225	VC			



7000	7000	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
7000	7000		CO		150			VC	11.02596	
7014	7014		SW	140.5	1200			CO	2.87761	1 in 129
8004	8004		SW	140.5	1200			CO	3.87781	1 in 129
8005	8005	145.43	CO	142.89	225			VC	10.63766	1 in 82
9001	9001		SW	0	225			VC	20.9506	
9704	9704	140.29	CO	130.45	150			VC	8.002258	
9705	9705		CO	145.8	150			VC	4.983559	
9903	9903	138.79	CO	135.59	460			BR	16.64332	
9904	9904		FO	142.53	300			VC	23.71328	1 in 148
9909	9909		FO	142.53	300			VC	23.71328	1 in 148
9910	9910		FO	142.53	300			VC	23.71328	1 in 148
9911	9911	140.02	CO	138.5	225			VC	60.87903	1 in 39
9922	9922	151.77	CO	148.66	300			VC	72.84992	1 in 163
9927	9927	149.27	CO	145.47	225			VC	91.97245	1 in 46
9928	9928		CO	145.8	100			VC	10.67031	
9933	9933	143.06	CO	139.18	150			VC	6.403124	
9939	9939	148.99	CO	145.8	150			VC	76.29432	
9958	9958		CO	0	225			VC	24.24323	
9959	9959		CO	0	600			VC	12.04163	
9964	9964	138.45	SW	136.09	225			BR	22.54409	
9967	9967	145.07	CO	142.21	375			VC	78.49203	1 in 92
9968	9968	148.71	CO	143.36	225			VC	59.84796	1 in 89
9969	9969	142.25	CO	138.98	225			VC	21.2132	1 in 40
9970	9970	142.25	CO	138.98	225			VC	21.2132	1 in 40
9971	9971	141.83	SW	139.9	1000			CO	24.20744	1 in 303
9972	9972	141.83	SW	139.9	1000			CO	24.20744	1 in 303
9984	9984		CO	0	225			PVC	4.126227	
9989	9989	144.24	CO	0	150			VC	49.89331	
9998	9998		SW	0	150			LN	7.476387	
9999	9999		CO	0	300			VC	35.96058	
9999	9999		CO	0	225			VC	41.81701	
9999	9999	139.49	FO	138.94	150			VC	32.55784	
9999	9999	149.75	CO	0	300			VC	10.04697	
9999	9999	149.75	CO	0	300			VC	28.84441	
9999	9999	140.37	CO	136.87	450			VC	43.58604	1 in 39
9999	9999		CO	0	100			PVC	4.404187	
9999	9999		CO	0	150			VC	20.40897	
9999	9999		CO	0	225			VC	20.40897	
9999	9999	141.67	CO	139.77	150			VC	65.30377	1 in 948
9999	9999	141.28	CO	139.42	525			VC	25.31788	1 in 29
9999	9999	146.44	CO	140.33	225			VC	65.51338	1 in 67
9999	9999	142	CO	140.17	225			VC	38.63936	1 in 61
9999	9999		CO	0	100			VC	10.76314	
9999	9999		CO	0	100			VC	8.98749	
9999	9999		CO	0	100			VC	14.85812	
9999	9999		CO	0	100			VC	7.302782	
9999	9999	143.15	CO	141.78	225			VC	76.26311	1 in 55
9999	9999		CO	0	150			VC	87.23620	1 in 29
9999	9999		CO	0	150			VC	8	
9999	9999		CO	0	470			BR	15	
9999	9999		CO	0	660			BR	17	
9999	9999	139.71	CO	138.53	150			VC	23.34524	1 in 35
9999	9999		CO	0	525			VC	53.07542	
9999	9999		CO	0	525			VC	53.07542	
9999	9999	145.6	CO	142.25	225			VC	97.28532	1 in 35
9999	9999	145.6	CO	142.25	225			VC	97.28532	1 in 35
9999	9999		CO	0	100			VC	8.515662	
9999	9999		CO	0	100			VC	8.515662	
9999	9999	141.67	CO	139.11	225			VC	26.1725	
9999	9999	141.67	CO	139.11	225			VC	26.1725	
9999	9999		CO	0	225			VC	8.776383	
9999	9999		CO	0	225			VC	8.776383	
9999	9999	142.17	CO	138.18	525			VC	72.13876	1 in 67
9999	9999	141.77	CO	140.33	225			VC	72.13876	1 in 67
9999	9999		CO	0	150			VC	8.14004	
9999	9999		CO	0	150			VC	8.14004	
9999	9999	142.14	CO	139.6	375			VC	18.11077	1 in 181
9999	9999	142.14	CO	139.6	375			VC	18.11077	1 in 181
9999	9999	142.37	CO	139.77	375			VC	25.18439	1 in 148
9999	9999	142.37	CO	139.77	375			VC	25.18439	1 in 148
9999	9999		CO	0	225			VC	3.670241	
9999	9999		CO	0	225			VC	3.670241	
9999	9999	142.31	CO	139.93	375			VC	14.31782	1 in 143
9999	9999	142.31	CO	139.93	375			VC	14.31782	1 in 143
9999	9999		CO	0	100			VC	3.548553	
9999	9999		CO	0	100			VC	3.548553	
9999	9999	138.21	CO	137.35	225			VC	60.00833	1 in 107
9999	9999	138.21	CO	137.35	225			VC	60.00833	1 in 107





Refo	Cover	Func	Invert	Size x	Size y	Shape	Mat	Length	Grad	Refo	Cover	Func	Invert	Size x	Size y	Shape	Mat	Length	Grad			
0902	159.96	SW	157.37	0	300	VC	16.88111	1 in 333	44502	FO	157.37	0	300	VC	16.88111	1 in 333	44502	FO	157.37			
0411	FO	146.08	150	CO	40.58736	1 in 116	44502	FO	157.37	0	300	VC	16.88111	1 in 333	44502	FO	157.37	1 in 333	44502	FO	157.37	
0411	FO	146.08	150	CO	40.58736	1 in 116	44502	FO	157.37	0	300	VC	16.88111	1 in 333	44502	FO	157.37	1 in 333	44502	FO	157.37	
1513	FO	144.32	150	CO	21.407	1 in 143	1007	FO	144.32	150	CO	21.407	1 in 143	1007	FO	144.32	150	CO	21.407	1 in 143		
1513	FO	144.32	150	CO	21.407	1 in 143	1007	FO	144.32	150	CO	21.407	1 in 143	1007	FO	144.32	150	CO	21.407	1 in 143		
1904	FO	0	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
0906	158.8	SW	154.1	1200	CO	65.10599	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
0906	158.8	SW	154.1	1200	CO	65.10599	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
8304	SW	0	750	CO	25.63263	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
8304	SW	0	750	CO	25.63263	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
1403	FO	148.08	150	CO	41.84739	1 in 21	10106	SW	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
1403	FO	148.08	150	CO	41.84739	1 in 21	10106	SW	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
0307	SW	152.75	225	CO	17.85656	1 in 31	0204	FO	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
0201	CO	0	160	VC	13.79129	1 in 100	0204	FO	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
0009	156.69	FO	152.91	150	VC	35.07051	1 in 125	15405	153.8	SW	150.3	1000	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203
1911	FO	144.72	150	CO	72.72096	1 in 102	15405	153.8	SW	150.3	1000	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
2101	160.3	FO	158.36	150	VC	13.28811	1 in 106	0203	FO	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
0003	160.15	FO	157.51	225	VC	29.93069	1 in 36	0203	FO	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
1103	FO	157.78	225	VC	46.79236	1 in 22	19103	154.45	FO	152.1	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
2005	SW	150.39	150	VC	24.26135	1 in 11	19103	154.45	FO	152.1	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
0306	FO	150.39	150	VC	45.79684	1 in 9	44002	155.41	SW	151.32	750	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
2112	159.33	SW	157	225	UN	40.09301	1 in 40.486458	44002	155.41	SW	151.32	750	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203
0413	FO	144.8	150	VC	15.32646	1 in 9	44002	155.41	SW	151.32	750	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
0413	FO	144.8	150	VC	15.32646	1 in 9	44002	155.41	SW	151.32	750	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
1504	SW	144.75	300	CO	15.48764	1 in 258	10116	FO	0	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
1504	SW	144.75	300	CO	15.48764	1 in 258	10116	FO	0	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
1006	SW	0	150	VC	45.0378	1 in 254	1514	FO	144.17	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
1006	SW	0	150	VC	45.0378	1 in 254	1514	FO	144.17	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
1506	SW	144.69	300	VC	17.76127	1 in 254	1514	FO	144.17	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
1506	SW	144.69	300	VC	17.76127	1 in 254	1514	FO	144.17	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
5403	FO	0	300	VC	47.72846	1 in 254	1514	FO	144.17	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
5403	FO	0	300	VC	47.72846	1 in 254	1514	FO	144.17	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
1901	SW	0	225	VC	20.0131	1 in 254	1514	FO	144.17	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
1901	SW	0	225	VC	20.0131	1 in 254	1514	FO	144.17	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203		
0909	FO	152.61	225	VC	26.60524	1 in 173	15406	154.36	SW	150.81	750	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
4404	FO	152.61	225	VC	26.60524	1 in 173	15406	154.36	SW	150.81	750	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
1002	161.29	SW	159.63	225	VC	10.87437	1 in 258	15406	154.36	SW	150.81	750	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203
1002	161.29	SW	159.63	225	VC	10.87437	1 in 258	15406	154.36	SW	150.81	750	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203
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1902	SW	0	225	VC	27.6642	1 in 145	2111	159.32	SW	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
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2303	156.37	UN	153.15	225	UN	97.55244	1 in 12	19010	155.78	FO	152.63	150	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203
1401	SW	149.33	225	VC	42.1358	1 in 21	19001	157.08	SW	153.78	1200	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
1401	SW	149.33	225	VC	42.1358	1 in 21	19001	157.08	SW	153.78	1200	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
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1903	SW	0	150	VC	14.58994	1 in 104	19003	155.74	SW	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
1903	SW	0	150	VC	14.58994	1 in 104	19003	155.74	SW	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
2902	SW	0	150	VC	14.58994	1 in 104	19003	155.74	SW	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
5401	FO	0	300	VC	14.58994	1 in 104	19003	155.74	SW	0	225	VC	16.033	1 in 203	1101	FO	0	150	VC	16.033	1 in 203	
5401	FO	0	300	VC	14.58994	1 in 104</																

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LEGEND

Abandoned

Foul

Surface Water

Combined

Public Sewer

Private Sewer

Section 104

Rising Main

Sludge Main

Overflow

Water Course

Highway Drain

All point assets follow the standard colour convention:

● red - combined
● brown - foul

● blue - surface water
● purple - overflow

● Manhole - Head of System - Extent of Survey - Rodding Eye - Inlet - Discharge Point - Vortex - Penstock - Washout Chamber - Valve - Air Valve - Non Return Valve - Soakaway - Gully - Cascade - Flow Meter - Hatch Box - Oil Interceptor - Summit - Drop Shaft - Orifice Plate	- Side Entry Manhole - Outfall - Screen Chamber - Inspection Chamber - Bifurcation Chamber - Lamp Hole - T Junction / Saddle - Catchpit - Valve Chamber - Vent Column - Vortex Chamber - Penstock Chamber - Network Storage Tank - Sewer Overflow - Ww Treatment Works - Ww Pumping Station - Septic Tank - Control Kiosk - Change of Characteristic
---	---

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	Horse/Shoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CC	Concrete Box Culverted
PSC	Plastic / Steel Composite
GRC	Glass Reinforced Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Address or Site Reference:

Plot J2 Kingsway Business Park,

OS sheet SD9111NW

Number:

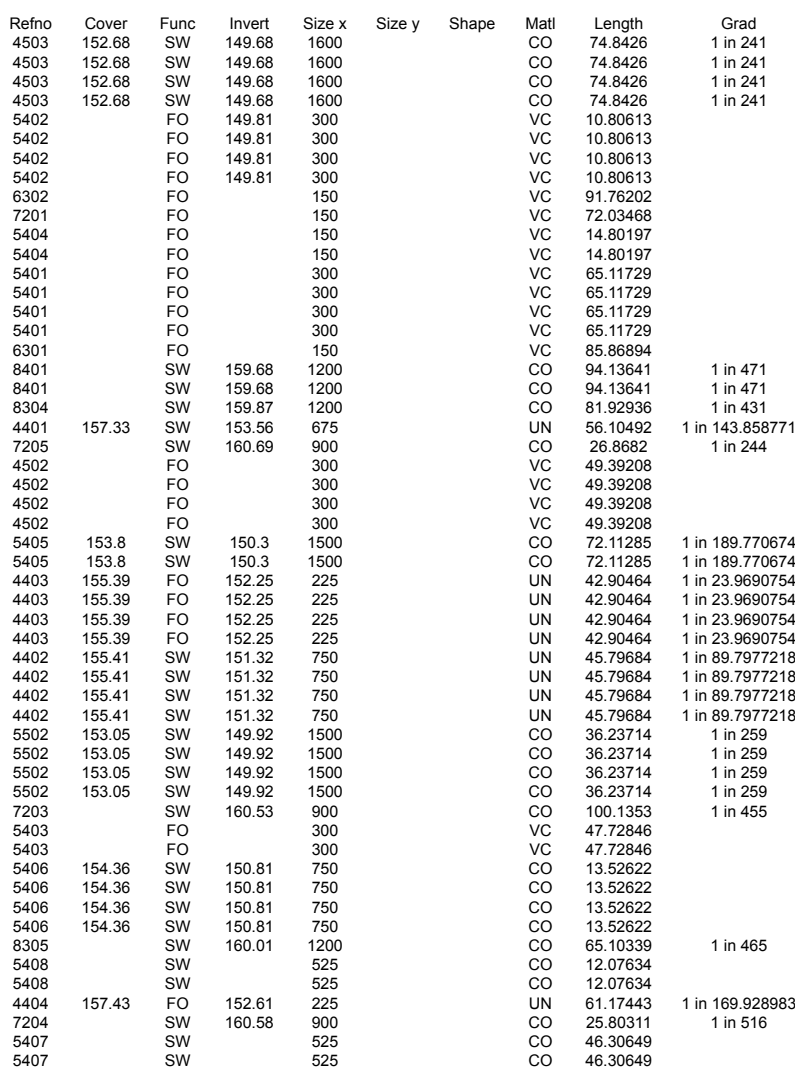
Scale: 1:1250

Nodes: 233

Sheet: 4 of 6

Date: 08/03/2022

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Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

All point assets follow the standard colour convention:

red	- combined	blue	- surface water
brown	- foul	purple	- overflow

- Manhole
 - Head of System
 - Extent of Survey
 - Rodding Eye
 - Inlet
 - Discharge Point
 - Vortex
 - Penstock
 - Washout Chamber
 - Valve
 - Air Valve
 - Non Return Valve
 - Soakaway
 - Gully
 - Cascade
 - Flow Meter
 - Hatch Box
 - Oil Interceptor
 - Summit
 - Drop Shaft
 - Orifice Plate
 - Side Entry Manhole
 - Outfall
 - Screen Chamber
 - Inspection Chamber
 - Bifurcation Chamber
 - Lamp Hole
 - T Junction / Saddle
 - Catchpit
 - Valve Chamber
 - Vent Column
 - Vortex Chamber
 - Penstock Chamber
 - Network Storage Tank
 - Sewer Overflow
 - Ww Treatment Works
 - Ww Pumping Station
 - Septic Tank
 - Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

- | | |
|----|--------|
| FO | Foul |
| SW | Surfa |
| CO | Comb |
| OV | Overfl |

SEWER SHAPE

- | | | | |
|----|-------------|----|-------------|
| CI | Circular | TR | Trapezoidal |
| EG | Egg | AR | Arch |
| OV | Oval | BA | Barrel |
| FT | Flat Top | HO | HorseShoe |
| RE | Rectangular | UN | Unspecified |
| SQ | Square | | |

SEWER MATERIAL

- | | |
|-----|---------------------------|
| AC | Asbestos Cement |
| BR | Brick |
| PE | Polyethylene |
| RP | Reinforced Plastic Matrix |
| CO | Concrete |
| CSB | Concrete Segment Bolted |
| CSU | Concrete Segment Unbolted |
| CC | Concrete Box Culverted |
| PSC | Plastic / Steel Composite |
| GRC | Glass Reinforced Plastic |
| DI | Ductile Iron |
| PVC | Polyvinyl Chloride |
| CI | Cast Iron |
| SI | Spun Iron |
| ST | Steel |
| VC | Vitrified Clay |
| PP | Polypropylene |
| PF | Pitch Fibre |
| MAC | Masonry, Coursed |
| MAR | Masonry, Random |
| U | Unspecified |

Address or Site Reference:

Plot J2 Kingsway Business Park.

OS sheet SD9111SE
Number:
Scale: 1:1250 Date: 08/03/2021
Nodes: 54
Sheet: 5 of 6

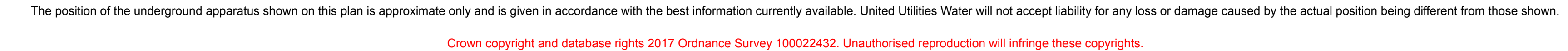
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SEWER RECORDS



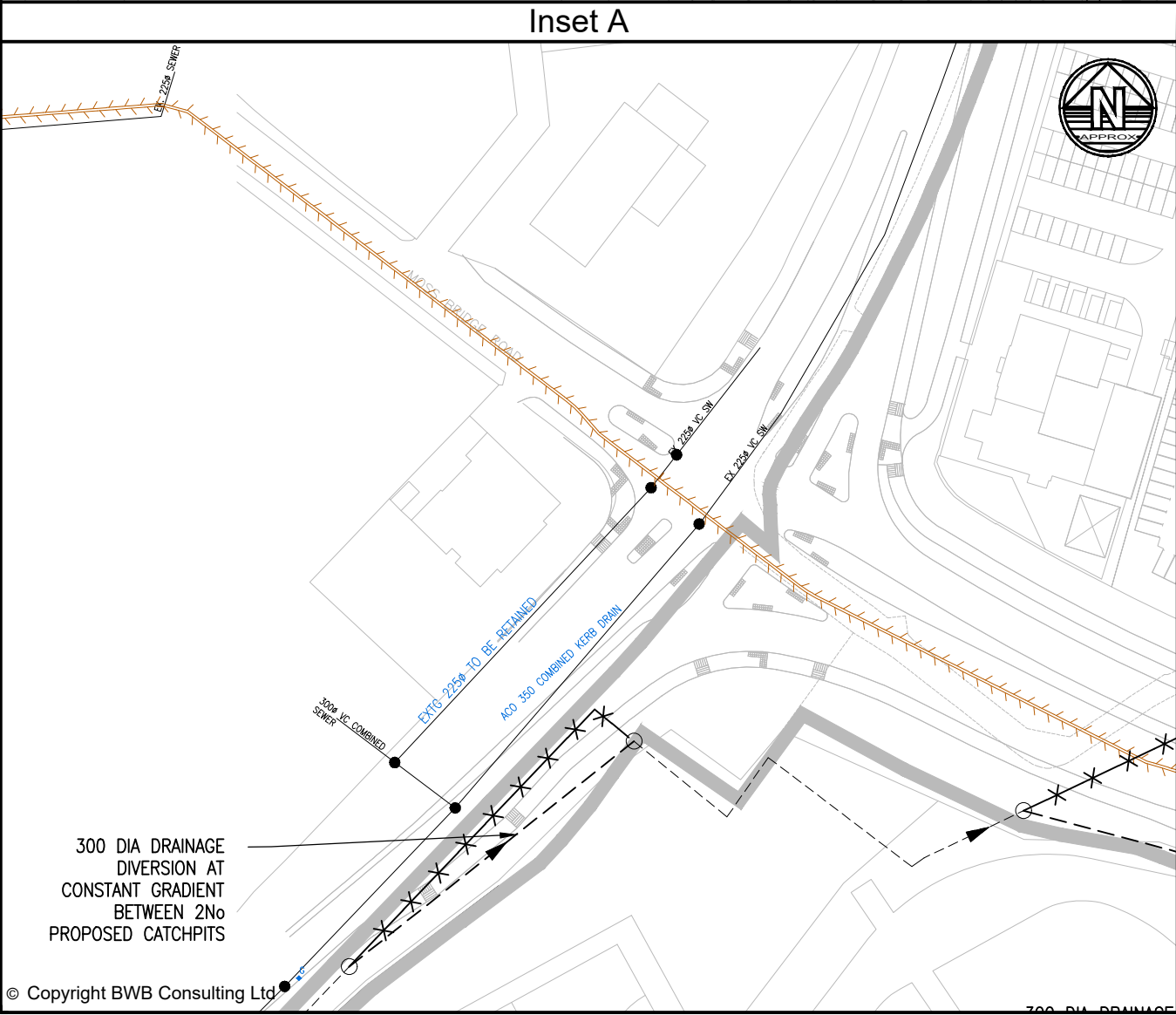
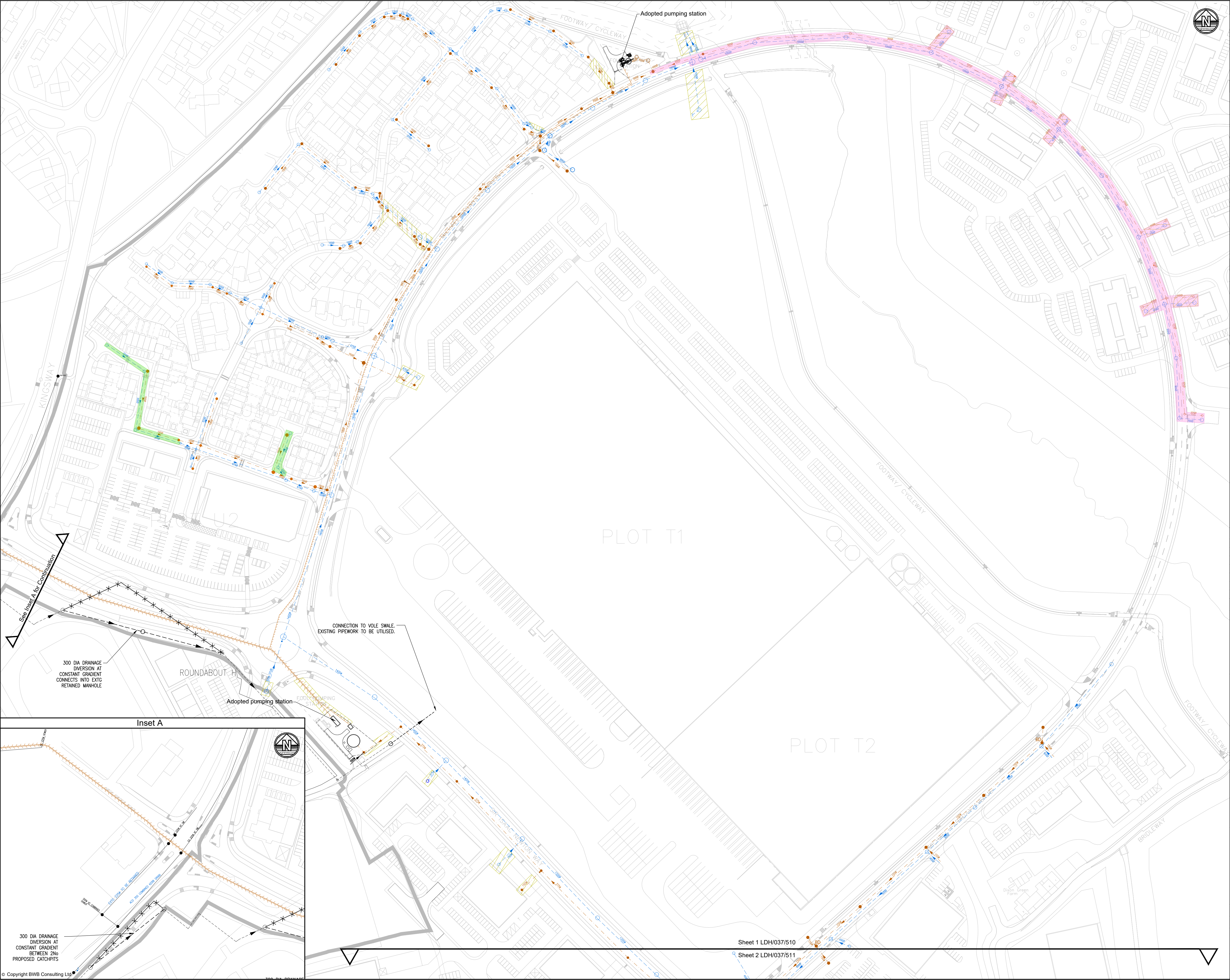
The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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**SEWER
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 **United
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Water for the North West



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- This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
- All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
- Any discrepancies noted on site are to be reported to the engineer immediately.

Key Plan

Legend

- ADOPTED SURFACE WATER SEWER
- ADOPTED FOUL WATER SEWER
- ADOPTED FOUL RISING MAIN
- S104 EASEMENT IN ACCORDANCE WITH SEWERS FOR ADOPTION TABLE 2.1
- ABANDONED SURFACE WATER SEWER
- DRAINAGE MAINTAINED BY ASDA
- DRAINAGE MAINTAINED BY BARRATT
- DRAINAGE MAINTAINED BY WBD

The information shown within this drawing is based upon the following drawings:

- I-WYG S104 Design Agreement 1 FW
- I-WYG S104 Design Agreement 2 FW
- I-WYG S104 Design Agreement 1 SW
- I-WYG S104 Design Agreement 2 SW
- I-WYG S104 Design Agreement 3 SW
- WYG Drawing A032196-21-C-D/100-H Plot E Drainage Layout

LDH/058/011D/001 Adoptable Drainage Layout General Arrangement
LDH/058/012D/002 Proposed foul and surface water sewers longitudinal sections sheet 2
LDH/048/365 Section 104 Drainage layout (LDH048)

TAR-BWB-HDG-XX-DR-D-0500 Proposed Drainage Layout (MCS2292)
KBF-BWB-HDG-S104-DR-C-0500 Proposed Drainage Layout (MCS2381)
KBD-BWB-HDG-XX-DR-D-0551 SW & FW Drainage Layout (MCS2326)
KPK-BWB-ZZ-XX-DR-D-500 Drainage Layout (MCS2129)
KBP-BWB-HDG-ZN-DR-D-0500 Proposed SW & FW Drainage Layout(MCS2379)

C10303/270 Access road S104 sewer adoption agreement plan (Hydrock)
20095_03_001 Engineering layout (Mewies Engineering Consultants LTD)
H7276/S104 Section 104 Plan (David Wilson Homes)

I-Kingsway Masterplan
DLA Drawing 2010-095/1826 (26/04/18)

P6	08.07.20	Drainage maintained by Barratt extents updated	MC	AL
P5	06.08.19	Updated following UU comments	GDJ	AL
P4	01.08.19	Drainage adoptions updated	MC	AL
P3	26.07.19	Drainage adoptions updated	JM	KJ
P2	17.05.19	Drainage updated as per comments	MC	KJ
P1	23.01.19	Draft Issue	MC	KJ
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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Client

WILSON BOWDEN DEVELOPMENTS

Project Title

**KINGSWAY BUSINESS PARK
ROCHDALE**

Drawing Title

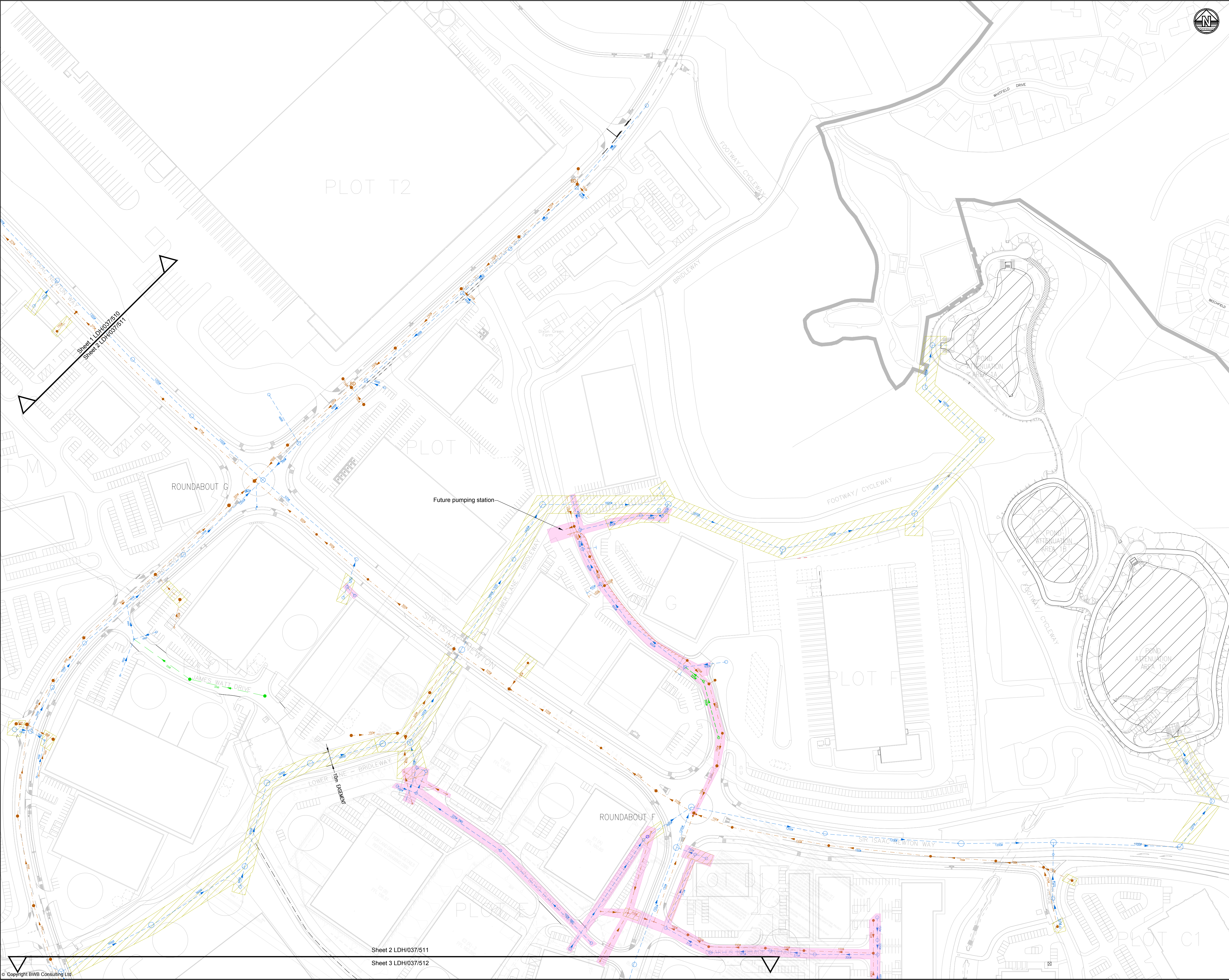
**Drainage Adoptions Plan
(Sheet 1 of 3)**

Drawn:	M Carlisle	Reviewed:	K James
BWB Ref:	LDH037	Date:	23.01.19
Scale@A1:	1:1250		

Drawing Status

DRAFT

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
LDH/037/510	S0	P6



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Key Plan

Legend

- ADOPTED SURFACE WATER SEWER
- ADOPTED FOUL WATER SEWER
- ADOPTED FOUL RISING MAIN
- ADOPTED HIGHWAY SURFACE WATER SEWER
- S104 EASEMENT IN ACCORDANCE WITH SEWERS FOR ADOPTION TABLE 2.1
- DRAINAGE MAINTAINED BY ASDA
- DRAINAGE MAINTAINED BY BARRATT
- DRAINAGE MAINTAINED BY WBD

The information shown within this drawing is based upon the following drawings:

- I-WYG S104 Design Agreement 1 FW
- I-WYG S104 Design Agreement 2 FW
- I-WYG S104 Design Agreement 1 SW
- I-WYG S104 Design Agreement 2 SW
- I-WYG S104 Design Agreement 3 SW

WYG Drawing A032196-21-C-D/100-H Plot E Drainage Layout

LDH/058/011D/001 Adoptable Drainage Layout General Arrangement
LDH/058/012D/002 Proposed foul and surface water sewers longitudinal sections sheet 2
LDH/048/365 Section 104 Drainage layout (LDH048)

TAR-BWB-HDG-XX-DR-D-0500 Proposed Drainage Layout (MCS2292)
KBP-BWB-HDG-S104-DR-C-0500 Proposed Drainage Layout (MCS2381)
KBD-BWB-HDG-XX-DR-D-0551 SW & FW Drainage Layout (MCS2328)
KPK-BWB-ZZ-XX-DR-D-500 Drainage Layout (MCS2129)
KBP-BWB-HDG-ZN-DR-D-0500 Proposed SW & FW Drainage Layout (MCS2379)

C10303/270 Access road S104 sewer adoption agreement plan (Hydrock)
20095_03_001 Engineering layout (Mewies Engineering Consultants LTD)
H7276/S104 Section 104 Plan (David Wilson Homes)

I-Kingsway Masterplan
DLA Drawing 2010-095/1826 (26/04/18)

P5	06.08.19	Updated following UU comments	GDJ	AL
P4	01.08.19	Drainage adoptions updated	MC	AL
P3	26.07.19	Drainage adoptions updated	JM	KJ
P2	17.05.19	Drainage updated as per comments	MC	KJ
P1	23.01.19	Draft Issue	MC	KJ
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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Client

WILSON BOWDEN DEVELOPMENTS

Project Title

**KINGSWAY BUSINESS PARK
ROCHDALE**

Drawing Title

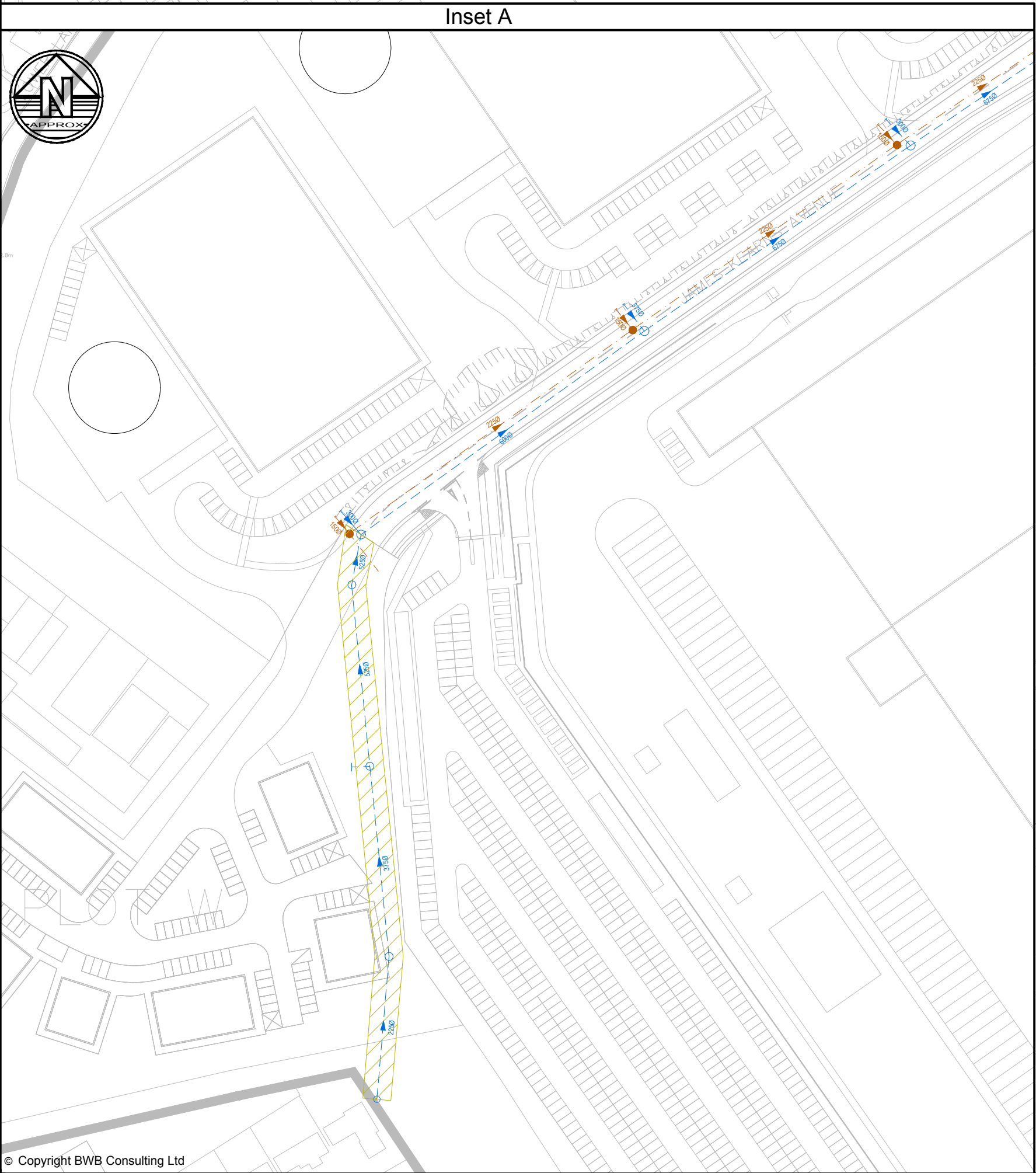
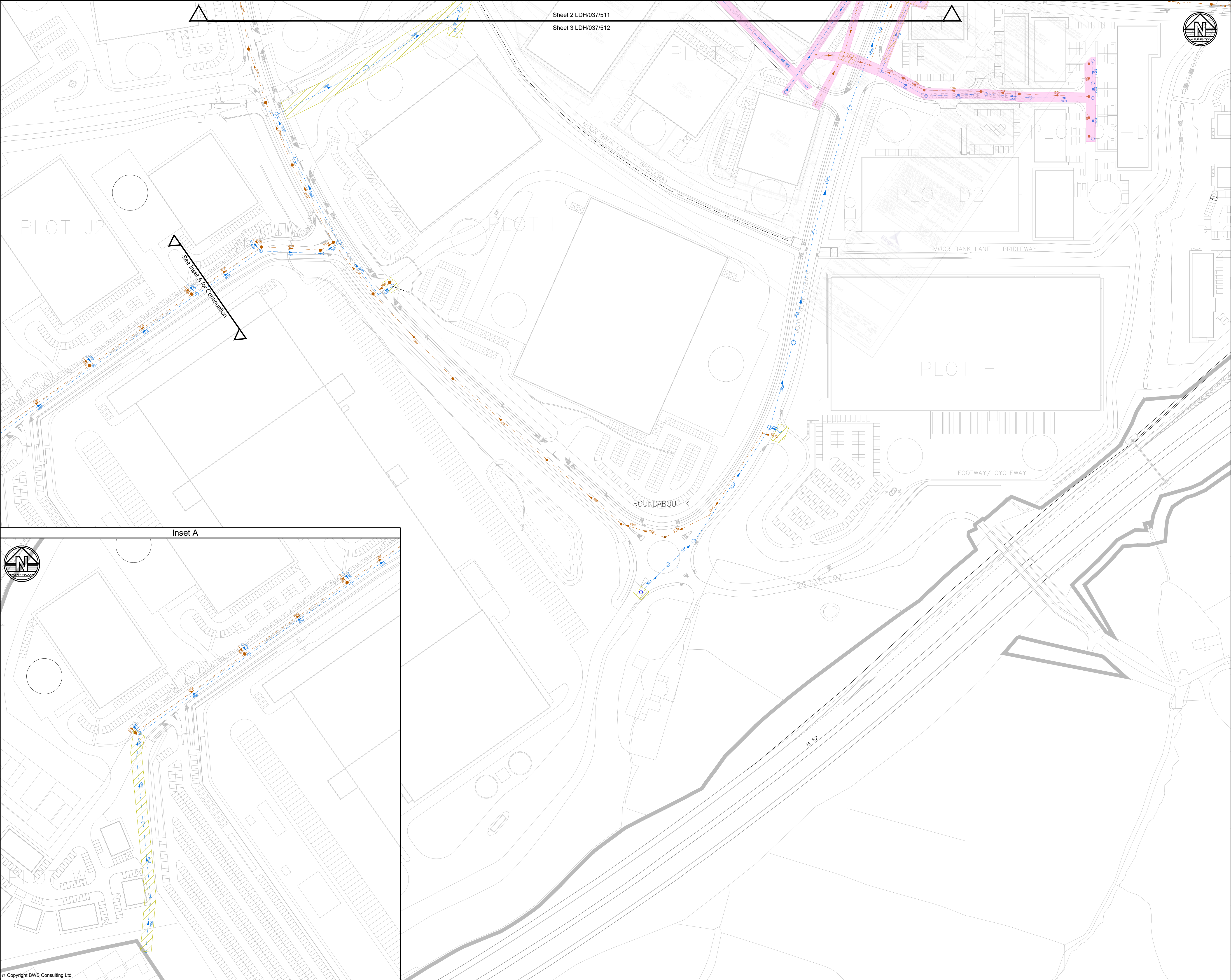
**Drainage Adoptions Plan
(Sheet 2 of 3)**

Drawn:	M Carlisle	Reviewed:	K James
BWB Ref:	LDH037	Date:	23.01.19
Scale@A1:		1:1250	

Drawing Status

DRAFT

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
LDH/037/511	S0	P5



Notes

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Key Plan

Legend

- ADOPTED SURFACE WATER SEWER
- ADOPTED FOUL WATER SEWER
- ADOPTED FOUL RISING MAIN
- S104 EASEMENT IN ACCORDANCE WITH SEWERS FOR ADOPTION TABLE 2.1
- DRAINAGE MAINTAINED BY ASDA
- DRAINAGE MAINTAINED BY BARRATT
- DRAINAGE MAINTAINED BY WBD

The information shown within this drawing is based upon the following drawings:

- I-WYG S104 Design Agreement 1 FW
- I-WYG S104 Design Agreement 2 FW
- I-WYG S104 Design Agreement 1 SW
- I-WYG S104 Design Agreement 2 SW
- I-WYG S104 Design Agreement 3 SW
- WYG Drawing A032196-21-C-D/100-H Plot E Drainage Layout

LDH/058/011D/001 Adoptable Drainage Layout General Arrangement
LDH/058/012D/002 Proposed foul and surface water sewers longitudinal sections sheet 2
LDH/049/365 Section 104 Drainage layout (LDH048)
TAR-BWB-HDG-XX-DR-D-0500 Proposed Drainage Layout (MCS2282)
KBF-BWB-HDG-S104-DR-C-0500 Proposed Drainage Layout (MCS2381)
KBD-BWB-HDG-XX-DR-D-0551 SW & FW Drainage Layout (MCS2328)
KPK-BWB-ZZ-XX-DR-D-500 Drainage Layout (MCS2129)
KBP-BWB-HDG-ZN-DR-D-0500 Proposed SW & FW Drainage Layout(MCS2379)

C10303/270 Access road S104 sewer adoption agreement plan (Hydrock)
20095_03_001 Engineering layout (Mewies Engineering Consultants LTD)
H7276/S104 Section 104 Plan (David Wilson Homes)

I-Kingsway Masterplan
DLA Drawing 2010-095/1828 (26/04/18)

P4	06.08.19	Updated following UIU comments	GDJ	AL
P3	26.07.19	Drainage adoptions updated	JM	KJ
P2	17.05.19	Drainage updated as per comments	MC	KJ
P1	23.01.19	Draft Issue	MC	KJ
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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Client

WILSON BOWDEN DEVELOPMENTS

Project Title

**KINGSWAY BUSINESS PARK
ROCHDALE**

Drawing Title

**Drainage Adoptions Plan
(Sheet 3 of 3)**

Drawn:	M Carlisle	Reviewed:	K James
BWB Ref:	LDH037	Date:	23.01.19
Scale@A1:		1:1250	
Drawing Status			
DRAFT			
Project - Originator - Zone - Level - Type - Role - Number			Status
LDH/037/512			S0 P4

APPENDIX 4: Site Wide Assessment Summary Note

Project	Kingsway Business Park		
Document Number	KBP-BWB-ZZ-XX-RP-CD-0004	BWB Ref	NTW2889
Author	David Gray	Status	S2
Checked	Matthew Bailey	Revision	P1
Approved	Rowan Jobling	Date	15.07.2022

Summary of Surface Water Sewer Modelling

- 1.1. This Technical Note provides a summary of the detailed hydraulic modelling exercises undertaken to date on the surface water sewers that serve the Kingsway Business Park.
- 1.2. The drainage strategy across the business park is split into three distinct catchments (as shown on **Figure 1.1** below).

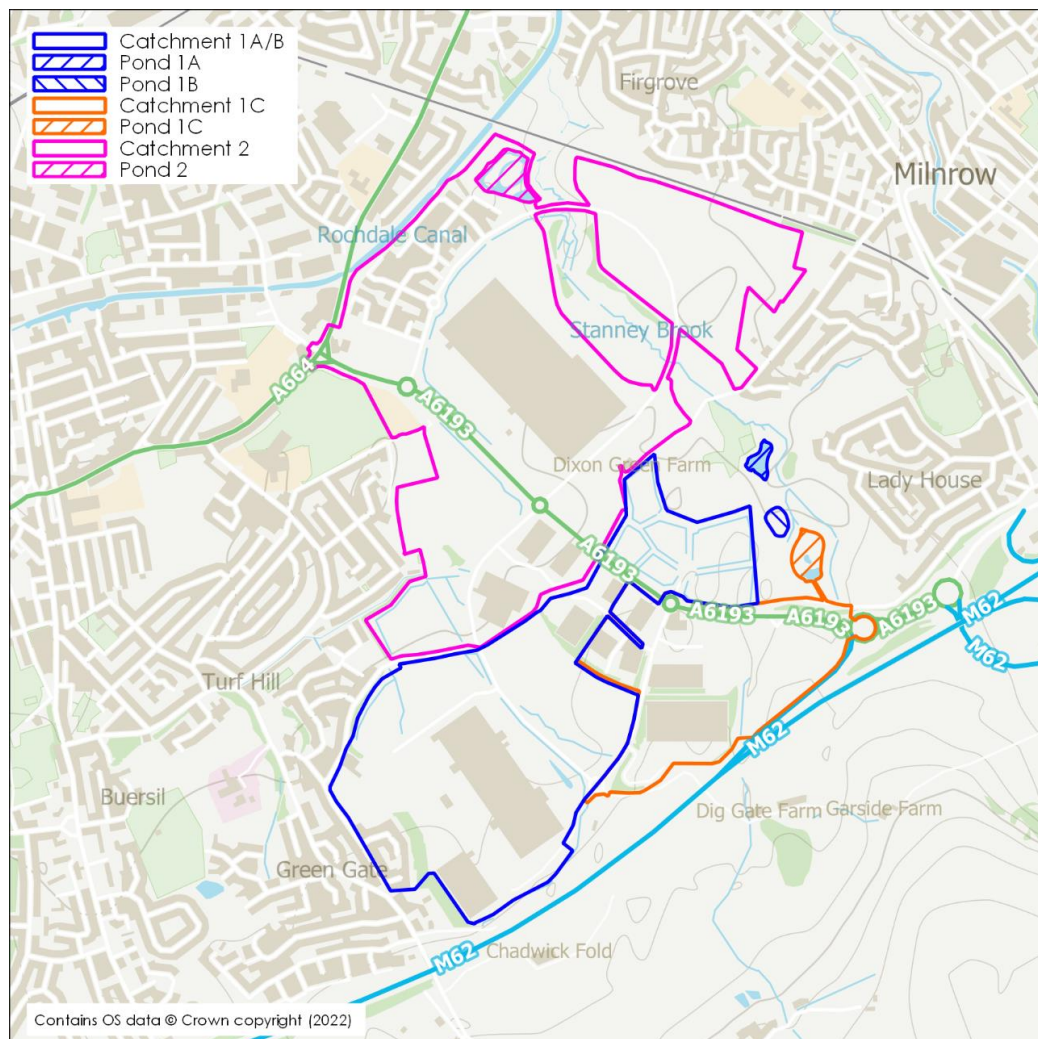


Figure 1.1: Business Park overall indicative catchments and attenuation ponds

- 1.3. Each drainage catchment is served by separate piped systems discharging to separate attenuation features. The existing drainage was constructed in 1999 and the hydraulic modelling exercises have shown that the surface water sewers have been designed to accommodate the 1 in 100-year storm event with no allowance for climate change for all plots across the business park.
- 1.4. Detailed hydraulic modelling and drawings for each drainage catchment are covered by individual reports, as listed below:
- Catchment 1A/1B – Report reference KBP-BWB-ZZ_XX-RP-CD-0001
 - Catchment 1C – Report reference KBP-BWB-ZZ_XX-RP-CD-0002
 - Catchment 2 – Report reference KBP-BWB-ZZ_XX-RP-CD-0003
- 1.5. **Table 1.1** (below) lists which Drainage catchment each development plot discharges to:

Table 1.1: Drainage Catchment Split per Plot

Drainage Catchment	Development Plots
1A/B	E (West), F, G, I, J1, J2, W
1C	C1, D1, D2, D3, D4, E(East), H
2	K, L, M, N, O, P1, P2, P3, Q, R, S, T1, T2, U1, U2, V, X

Design Parameters and Assumptions

- 1.6. The design parameters and assumptions used for each catchment vary depending on the level of information that was available at the time of the modelling work. Catchment specific information is stated in each report and key parameters are listed below:
- Impermeable areas generally taken as 90% for industrial areas and 65% for residential areas
 - Impermeable areas for roads taken as 100%
 - Where plots have been constructed, a more detailed estimate of impermeable area has been used based on the detailed drainage design
 - Network model simulation criteria set to default settings in MicroDrainage 2019.1.
 - Simulations have been run for the network model using the 'Seasonal Return Period Wizard' for all storm durations for the 1 in 100-year event on 2.5 second increments with Dynamic Time Step turned off, Dynamic Viscous Dampening and Inertia turned on.

- Simulations have been run using both Flood Studies Report (FSR) and Flood Estimation Handbook (FEH) rainfall methodologies.
- The detention basin volumes have been checked by recreating them in AutoCAD Civils 3D Software before being input into the MicroDrainage Network Model.
- Note that the original drainage system was designed using FSR rainfall (as stated within 'Attenuation Ponds Health & Safety File'), however FEH simulations have been ran as a sensitivity test for the recreated network model.

Summary of findings from Catchment 1A/1B

- 1.7. The report and modelling results were reviewed and accepted by United Utilities and Rochdale Borough Council (correspondence contained within **Appendix A**)
- 1.8. A summary of the findings from the as-built drainage study is below:
 - The pipe network operates well for all modelled storm events up to and including the 1 in 100-year with minimal surcharging.
 - The maximum water level in the pond was higher than the original Section 104 design and is predicted to overtop the weir wall once all plots within the catchment have been developed.
 - The peak flow rate from Pond 1A/1B is shown to be lower than the consented flows to the Stanney Brook.
 - Several options were investigated to remedy the overtopping of the weir wall. The option suggested in the drainage study report was to raise the weir wall by 200mm which solved the overtopping issue.
 - In subsequent conversations and meetings with Rochdale Borough Council's drainage engineer, Stephen McCann, it was agreed that the existing orifice plate flow control would be replaced with a larger diameter orifice plate. This option lowers the anticipated maximum water level within the pond to below the weir level while maintaining peak flows below the consented flows.
 - During a site visit, it was observed that the flow control could be liable to becoming blocked with vegetation and litter. To lower the risk of future blockages, it has also been agreed to install a debris screen over the flow control.

Summary of findings from Catchment 1C

- 1.9. The report was issued to United Utilities and Rochdale Borough Council
- 1.10. A summary of the findings from the as-built drainage study is below:
- The pipe network operates well for all modelled storm events up to and including the 1 in 100-year with minimal surcharging.
 - The maximum modelled water level within Pond 1C is below the original design level and peak flows are shown to be below the consented flow rate.
 - The drainage forming catchment 1C is considered to be operating efficiently, safely and in line with the original design.

Summary of findings from Catchment 2

- 1.11. The report and modelling results have been reviewed and accepted by Rochdale Borough Council (correspondence contained within **Appendix A**)
- 1.12. Untitled Utilities have reviewed the report and commented on some minor flooding located within Sir Isaac Newton Way. This was discussed with United Utilities who were happy with the explanation and had no further concerns (correspondence contained within **Appendix A**).
- 1.13. A summary of the findings from the as-built drainage study is below:
- The pipe network operates well for all modelled storm events up to and including the 1 in 100-year with one area of minimal flooding within Sir Isaac Newton Way.
 - The flooding was in the short duration, high intensity rainfall event and would be expected to pond within the road corridor for a short time before draining back into the sewer network once the peak storm has passed.
 - The flooding in the sewer network is unrelated to water levels in Pond 2.
 - The maximum modelled water level within Pond 2 is below the original design level and peak flows are shown to be below the consented flow rate.
 - The drainage forming catchment 2 is considered to be operating efficiently, safely and in line with the original design.

Appendix A

Correspondence with United Utilities and Rochdale Borough Council

David Gray

From:

Sent:

To:

Cc:

Subject:

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Good evening all and thank you for taking my call earlier David,

Firstly I would like to thank bwb for pulling together the modelling report, it has certainly helped clarify matters. Following a conversation between myself and Stephen McCann at the Lead Local Flood Authority we are now in a position to accept the proposed modelling report essentially as a drainage masterplan for the Business Park moving forward. However, we would request that this is subject to the provision of the mdx. Microdrainage model files being provided to Stephen at the Council for review against the modelling report to ensure its accuracy.

Once reviewed and the Lead Local Flood Authority are happy with the model outputs we will both be providing comments on the individual plots/below planning applications in turn:

DC/21/2987 – 21/00881/REM

DC/21/3213 – 21/01039/DOC

DC/21/3492 – 21/01041/DOC

As a point of note, we understand that there are a number of concerns the Lead Local Flood Authority have about Plot J2 which should be addressed but this sits outside United Utilities remit to comment.

I am on annual leave from tomorrow until Tuesday 24th August and for further information in my absence, I would suggest that Stephen McCann or David Gray would be best placed to answer any queries but I hope that this brings everyone together onto the same page.

Kind regards,



Robert Brenton

Developer Engineer

Developer Services & Metering

Customer Services

M: 07880299827

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David Gray

From:

Sent:

To:

Subject:

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

To All

The matter of the capacity and flow discharge from the Kingsway Park Drainage Ponds to Stanney brook was raised when BWB submitted Drainage Details for Planning Applications for the latest Kingsway Plots G, I and J2. When BWB ran the drainage model with the new plots being developed it was realised that the pond would just overtop in a 1 in 100 year storm including climate change allowance of 40%. Although this is a rare event, it was deemed necessary to avoid the overtopping. David Gray looked at options and came up with a simple but effective proposal:-

- to change the low level orifice plate in the outlet weir wall (to Stanney Brook) from 200 to 226mm dia.

This does not require major works and will fulfil the original agreed discharge flow rate to Stanney Brook. It will also and keep water levels under the crest of the weir wall, and maintain a minimum of 300mm freeboard within the pond.

Therefore, I am suggesting that David Gray now organises the replacement of the orifice plate. In terms of installation, BWB will need to arrange to do this when water levels are low and obtain access through the gates. I have advised David that he can contact Michael Cummings to arrange access?

There is an email trail below.

Any comments / queries – please address them to David and myself.

I can forward the diagram of the location of the orifice plate – upon request.

regards

Stephen McCann

Drainage & Flooding Engineer

Highways, Property & Strategic Housing



ROCHDALE
BOROUGH COUNCIL

☎ 01706 924606

☎ 07552 570262

✉ stephen.mccann@rochdale.gov.uk

Rochdale Borough Council
Floor 2, Number One Riverside
Smith Street, Rochdale, OL16 1XU

From: David Gray <David.Gray@bwbconsulting.com>

Sent: 07 November 2021 16:30

To: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>

Cc: Iqbal Rassool <Iqbal.Rassool@bwbconsulting.com>; Peter Davies <Peter.Davies@bwbconsulting.com>; Darren Clark <Darren.Clark@gleeds.com>; Davies, Nick <nick.davies@wilsonbowden.co.uk>; Ellis, Dave <dave.ellis@wilsonbowden.co.uk>; Henson, Henry <henry.henson@wilsonbowden.co.uk>

Subject: RE: Kingsway - Question to EA re. Weir Wall to Stanney Brook

Hi Steve,

Following our discussion last week on the weir wall at Kingsway after reviewing John's email below, I have remodelled the outflow orifice so that the proposed flows are closer to the consented flows of 304 l/sec. The modified orifice is 226mm diameter (upsized from 200mm) with the higher orifice remaining as 250mm. This seems like an eminently sensible resolution.

This does lower water levels within the basin to just below the existing weir wall as shown in the extracts from Microdrainage below. The existing weir is set at 148.25m, the modelled water level is shown to be 148.231m and the flow is 303.4 l/sec.

From previous conversations, you suggested that you would be happy with the original situation, however John's email suggests that the outflow from the pond needs to stay within the consented discharge, which we understand to be 304 l/sec. In this situation, who makes the final decision on the acceptable flow rates? At the Outlet from Pond 1A, Stanney Brook is classed as Ordinary Watercourse so falls under the remit of the LLFA so I would think that myself as LLFA Officer can approve this modification to the orifice plate. Stanney Brook changes to 'Main River' after crossing Buckley Hill lane.

The revised hydraulic modelling shows that altering the orifice does lower the estimated water levels to just below the existing weir wall while keeping within the 304 l/sec flow rate, would this proposal be acceptable to RBC?

I understand that RBC are responsible for maintenance of the pond, are you able to confirm if this extends to the outfall structure as well? If not, are you able to confirm who is responsible for the outfall structure? I understand that Environment received monies from the Developer and now maintain the pond and structures. The managers are Tracy Hibbert and Gerard Proudman who have been cc'd to this email.

I am happy to run through the revised modelling and discuss with yourself this week and agree the best way forward.

Kind Regards

David Gray

Principal Engineer | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ
M 07437 015 337 T 0115 924 1100

David Gray

From:
Sent:
To:
Subject:
Attachments:

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Hi David,

For your ref. see appended and below.

Thanks v much for sending all the extra info this morning. The complexity of the mdx models is beyond my familiarity with using MicroDrainage but your explanations filled in the gaps so I have been able to be confident in 'approving' the proposals.

regards

Stephen McCann

Drainage & Flooding Engineer
Highways, Property & Strategic Housing



☎ 01706 924606

📠 07552 570262

✉ stephen.mccann@rochdale.gov.uk

Rochdale Borough Council
Floor 2, Number One Riverside
Smith Street, Rochdale, OL16 1XU

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For news and social media updates go to www.rochdale.gov.uk/news

Please consider the environment before printing this email.

From: Stephen McCann

Sent: 22 April 2022 15:50

To: Michael Doyle <Michael.Doyle@Rochdale.Gov.UK>; 'Mohammed.Aljafarawi@uuplc.co.uk' <Mohammed.Aljafarawi@uuplc.co.uk>

Subject: Drainage Consultation Ref: 22/00373/FUL Plot M Kingsway

Hello Michael (Principal Planning Officer) and Mohammed (UU Engineer),

[Kingsway Hydraulic Modelling, Catchment 2 - 4200045304](#)

I have written my consultation, appended.

The two MicroDrainage Models, which Mohammed asked me to look at are pretty complex. I've talked to David Gray of BWB a couple of times about this and he's shown me the models in online Teams Screenshare and he has provided details to satisfy me that the system is well designed.

Mohammed, feel free to ring me to discuss OR you can ask David Gray. There are quite large flows coming off Plot M into the adopted Michael Faraday Ave sewer, but this was originally planned as such.

regards

Stephen McCann

Drainage & Flooding Engineer

Highways, Property & Strategic Housing



 01706 924606

 07552 570262

 stephen.mccann@rochdale.gov.uk

Rochdale Borough Council

Floor 2, Number One Riverside

Smith Street, Rochdale, OL16 1XU

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David Gray

From:
Sent:
To:
Cc:
Subject:

Attachments:

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Good Morning David,

Thanks for the prompt response. I am happy with your explanation, I don't have any further concerns. I would like to receive a modelling results confirmation to proceed.

Stephen,

Could you run the model as you did for catchment 1A as a sense check? Then provide confirmation of this results please.

Kind regards,



Mohammed Aljafarawi
Developer Engineer
Developer Services & Metering
Customer Services
Email: Mohammed.Aljafarawi@uuplc.co.uk
M: 07950474499
unitedutilities.com

From: David Gray
Sent: 10 February 2022 14:38
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>; 'Stephen McCann' <>
Cc: Francis Comyn <>; Darren Clark <>; Davies, Nick <nick.davies@wilsonbowden.co.uk>
Subject: RE: Kingsway Hydraulic Modelling, Catchment 2 - 4200045304

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Mohammed, Steve,

Please find attached the MDX for Network 2 (Plot M catchment) file as mentioned in the email below.

Mohammed, the flooding occurs in the sewers located quite some way from Pond 2 and is not affected by the water level within Pond 2 or the flow rate from Pond 2.

As shown in the extract below, the flooding occurs at MH S317 in the short duration (30 min) / high intensity rainfall event and is due to the flow rate exceeding the capacity of the pipe for a short duration. Based on

the volume shown in the hydraulic model, any flooding would be entirely contained within Sir Isaac Newton Water and drain back down into the system once the peak storm has passed. This is standard practice for designing drainage systems.

In reality, surface water drainage features (gullies, slot drains, kerb drains) are not designed generally designed a much lower storm event, typically the 5 year storm. So although the model shows flooding in the 100 year storm, the water would not have drained into the sewers in the first instance. The surface water would pond on the road surface as the capacities of the road gullies would have been exceeded before the capacity of the sewers.

1.006	S306	30 minute 100 year Winte	148.876	147.154	2.494	0.000	1.34	
1.007	S315	30 minute 100 year Winte	148.210	146.712	2.427	0.000	1.44	
1.008	S316	30 minute 100 year Winte	147.154	146.248	2.262	0.000	1.26	
9.000	SPM	30 minute 100 year Winte	148.105	145.997	1.960	0.000	0.84	
1.009	S317	30 minute 100 year Winte	145.764	145.776	2.192	13.308	1.01	
10.000	SPV	30 minute 100 year Winte	148.108	145.509	1.383	0.000	0.03	
1.010	S318	30 minute 100 year Winte	145.562	145.508	2.310	0.000	1.03	

If it would be beneficial, I would be happy to attend a Teams meeting to discuss this in more detail and answer any other queries you may have.

Kind Regards

David Gray

Principal Engineer | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ

M 07437 015 337 **T** 0115 924 1100

From:

Sent:

To:

Cc:

Subject:

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Good afternoon Stephen,

Thanks for your email, I had this morning a conversation with my colleague Robert, I understand that previously both of you deals with Catchment 1A/B (blue in the below picture).

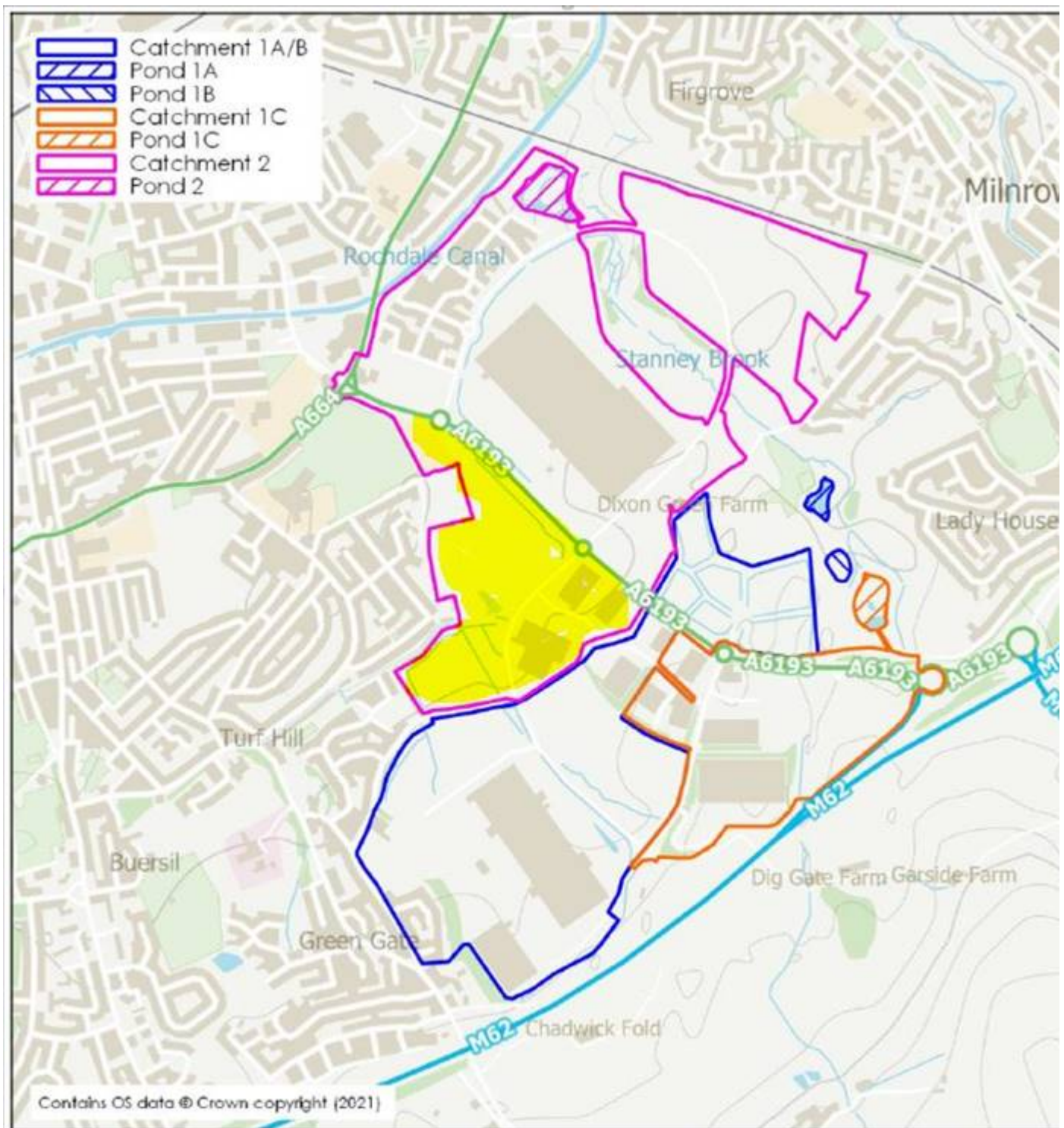


Figure 1.1: Business Park overall indicative catchments and attenuation ponds.

Currently, we are dealing with catchment 2 (pink colour), the developer contact our team regarding plot M (highlighted in yellow).

The provided modelling of catchment 2 has been done in line with previous model of catchment 1A. Previously 1A showed issues at the pond but the sewer network was fine.

Where catchment 2 model shows the pond is fine but the sewer network has a small amount of flooding (13m³) within Sir Isaac Newton Way.

Also, the developer stated in the document no: KBP-BWB-ZZ-XX-RP-CD-0003, that the 'Pond 2' discharges surface water at a lower rate (444.5l/s) that of the original design intent (555l/s).

Could the developer provide the mdx. file to Stephen to run the model as you did for catchment 1A as a sense check.

Stephen, could you then provide confirmation of this results please.

Finally, whilst we have no problems with the proposal in principle...as there is a small amount of flooding on the sewer network, we request that this is investigated as there may be some remedial work to be done at the pond again as it does not appear to be passing forward the flow to the watercourse as it was originally designed to.

Kind regards,



Mohammed Aljafarawi

Developer Engineer
Developer Services & Metering
Customer Services

Email: Mohammed.Aljafarawi@uuplc.co.uk

M: 07950474499

unitedutilities.com

From:
Sent:
To:
Cc:
Subject:

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Hello Mohammed,

With reference to your email below, the LLFA part of the Council, myself and Francis Comyn, are aware of the upgrade proposals to the Kingsway park pond 1A, as proposed by BWB - on behalf of the Kingsway Business park developers (Wilson Bowden, Homes England, & Rochdale Development Agency?).

I have recently done a site walkover with David Gray of BWB to discuss the options. As LLFA we agree that the upgrades, which should include a better trash screen on one of the ponds and an increased orifice plate are appropriate.

The previous UU consultee, Robert Brenton (UU) was involved in looking at the Kingsway Drainage Masterplan; he may be able to update you as he has recently dealt with several recent Kingsway Business park plot planning applications.

regards

Stephen McCann

Drainage & Flooding Engineer
Highways, Property & Strategic Housing



 01706 924606

07552 570262

stephen.mccann@rochdale.gov.uk

From:

Sent:

To:

Cc:

Subject:

Good afternoon,

Thanks for providing the report.

After reviewing the site it would appear that the drainage infrastructure was installed around the year 2000 with agreement from the Rochdale council who acted as our agent at the time.

It would appear that the previously agreed drainage strategy was to freely drain the development areas through the large-diameter adopted sewers to the pond.

The pond appears to have been designed to act as storage to contain storm events up to the 1 in 100 years storm event, and the outfall to the pond was constructed to control flows into the watercourse.

Unfortunately, legislation has changed since the surface water strategy was agreed upon and the system was installed. We must therefore speak to the LLFA to ensure that the previously agreed strategy is still acceptable.

The LLFA will have to decide whether they are happy with the current arrangement where the drainage system, attenuation pond and outfall/flow control (350mm + 200mm ORIFICE plates) has already been constructed and is operational. **OR** whether they would like to restrict and attenuate flow on site in line with the latest legislation/guidance.

- Please contact the LLFA to agree on a way forward and let me know what their position is.
- If the LLFA are willing to accept the previously agreed strategy, could you please highlight the contributing area from the proposed development and the associated pipe length in the submitted Micro Drainage calculations so that the discharge rate from the proposed parcel can be confirmed?

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,



Mohammed Aljafarawi

Developer Engineer

Developer Services & Metering

Customer Services

Email: Mohammed.Aljafarawi@uuplc.co.uk

M: 07950474499

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APPENDIX 5: Greenfield Runoff Rate Calculation

BWB Partnership		Page 1
Friars Studio 3 Friar Gate Derby DE1 1BU	LDA2943 PLOT J2 KBP	
Date 23/03/2021 File	Designed by RJ Checked by	
Micro Drainage Source Control 2019.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	2	Soil	0.150
Area (ha)	3.500	Urban	0.000
SAAR (mm)	1120	Region Number	Region 10

Results 1/s

QBAR Rural	2.5
QBAR Urban	2.5
Q2 years	2.3
Q1 year	2.1
Q30 years	4.2
Q100 years	5.1

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APPENDIX 6: Greenfield Runoff Volume Calculation

BWB Partnership		Page 1
Friars Studio 3 Friar Gate Derby DE1 1BU	LDA2943 PLOT J2 KBP	
Date 23/03/2021 File	Designed by RJ Checked by	
Micro Drainage Source Control 2019.1		

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.000
Ratio R	0.273
Areal Reduction Factor	1.00
Area (ha)	3.500
SAAR (mm)	1137
CWI	123.672
Urban	0.000
SPR	10.000

Results

Percentage Runoff (%)	14.47
Greenfield Runoff Volume (m ³)	351.470

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APPENDIX 7: 100-Year Rainfall Profile

BWB Partnership		Page 1
Friars Studio 3 Friar Gate Derby DE1 1BU	LDA2943	
	100yr 15min Rainfall Profile	
Date 23/03/2021	Designed by RJ	
File	Checked by	
Micro Drainage	Source Control 2019.1	

Rainfall profile

Storm duration (mins) 15

FSR Data

Region England and Wales

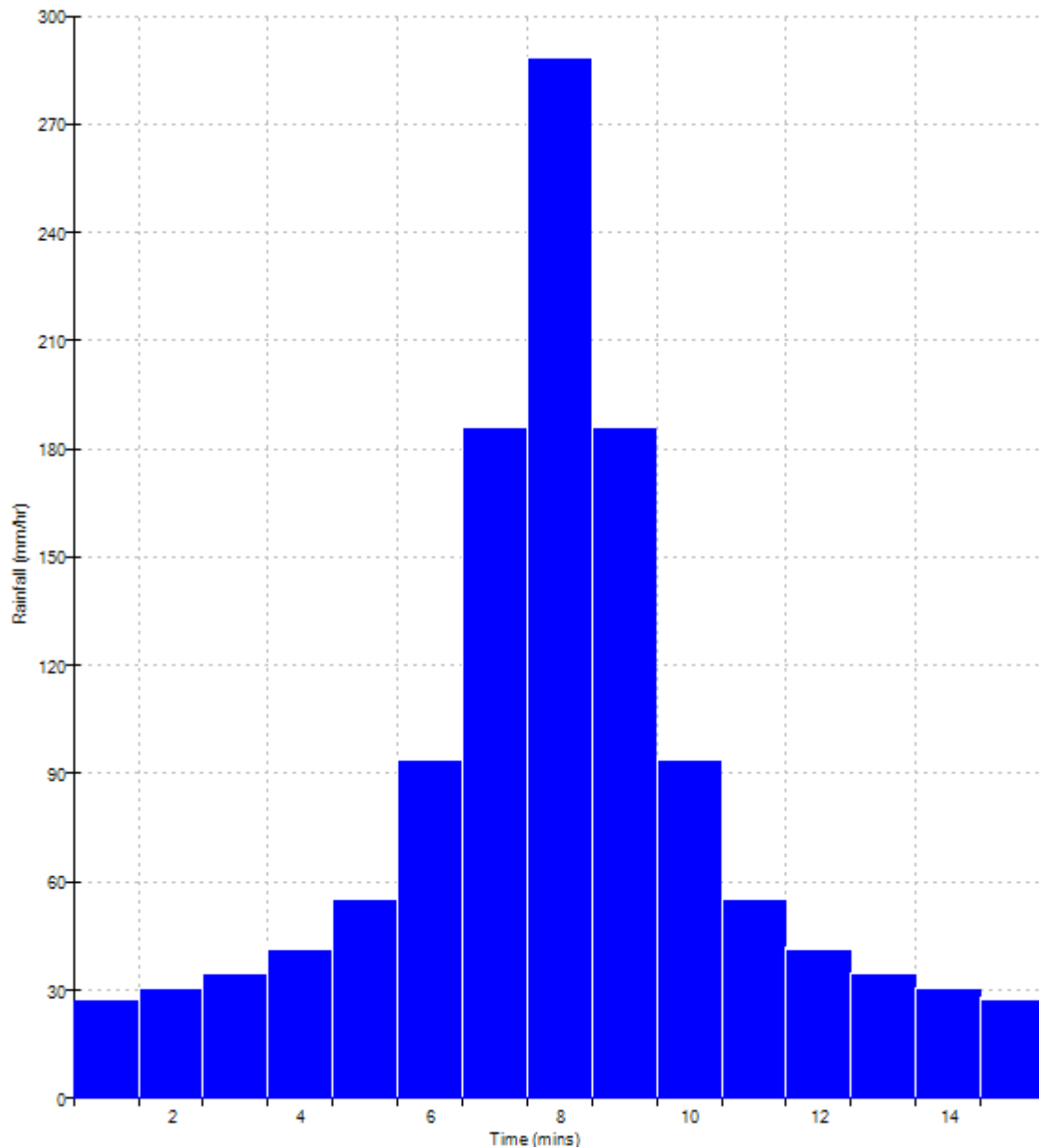
M5-60 (mm) 19.000

Ratio R 0.272

Peak Intensity (mm/hr) 288.020

Ave. Intensity (mm/hr) 81.500

Return Period (years) 100.0



APPENDIX 8: MicroDrainage Network Calculations

BWB Consulting Ltd							Page 2	
5th Floor, Waterfront House 35 Station Street Nottingham, NG2 3DQ				Kingsway Business Park Unit J1				
Date 16/02/2023 File 220810-Unit J1-SW Netwo...				Designed by EN Checked by IB				
Innovyze				Network 2020.1				
Summary of Critical Results by Maximum Level (Rank 1) for Storm								
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000		S15 152.587	-0.199	0.000	0.03		1.2	OK
1.001		S16 152.342	-0.295	0.000	0.10		14.8	OK
2.000	Channel Outlet	152.349	-0.151	0.000	0.24		8.8	OK*
1.002		S17 152.106	-0.305	0.000	0.22		36.9	OK
3.000		S20 152.237	-0.259	0.000	0.05		3.5	OK
1.003		S18 152.024	-0.294	0.000	0.21		49.8	OK
4.000	S19A	152.890	-0.150	0.000	0.00		0.0	OK
1.004		S19 151.999	-0.210	0.000	0.20		49.5	OK
5.000		S22 152.600	-0.360	0.000	0.09		27.3	OK
5.001		S23 152.294	-0.306	0.000	0.22		70.0	OK
5.002		S24 152.018	-0.194	0.000	0.35		88.0	OK
6.000		S25 153.173	-0.133	0.000	0.03		0.6	OK
6.001		S26 153.019	-0.154	0.000	0.22		8.7	OK
7.000		S29 152.019	-0.209	0.000	0.11		8.4	OK
6.002		S27 152.010	-0.117	0.000	0.20		21.5	OK
6.003		S28 152.002	-0.055	0.000	0.15		20.4	OK
8.000	Attenuation Tank	151.899	-0.186	0.000	0.18	11	12.5	OK*
PN	US/MH Name	Level Exceeded						
1.000		S15						
1.001		S16						
2.000	Channel Outlet							
1.002		S17						
3.000		S20						
1.003		S18						
4.000	S19A							
1.004		S19						
5.000		S22						
5.001		S23						
5.002		S24						
6.000		S25						
6.001		S26						
7.000		S29						
6.002		S27						
6.003		S28						
8.000	Attenuation Tank							
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BWB Consulting Ltd		Page 3
5th Floor, Waterfront House 35 Station Street Nottingham, NG2 3DQ	Kingsway Business Park Unit J1	
Date 16/02/2023 File 220810-Unit J1-SW Netwo...	Designed by EN Checked by IB	
Innovyze	Network 2020.1	

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

US/MH		Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act. Level
								(m)
5.003	S31	60 Summer	2	+0%				151.989
1.005	S32	60 Summer	2	+0%				151.980

US/MH		Depth	Volume	Flow /	Overflow	Half Drain	Pipe	Level	
PN	Name	(m)	(m³)	Cap.	(l/s)	Time	Flow	Status	Exceeded
						(mins)	(l/s)		
5.003	S31	-0.136	0.000	0.40			86.6	OK	
1.005	S32	-0.195	0.000	0.38			129.2	OK	

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File 220810-Unit J1-SW Netwo...

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Kingsway Business Park
Unit J1

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

Simulation Criteria

Areal Reduction Factor 1.000

Hot Start (mins) 0

Hot Start Level (mm) 0

Manhole Headloss Coeff (Global) 0.500

Foul Sewage per hectare (l/s) 0.000

Additional Flow - % of Total Flow 0.000

MADD Factor * 10m³/ha Storage 2.000

Inlet Coeffiecient 0.800

Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0

Number of Online Controls 1

Number of Offline Controls 0

Number of Storage Structures 1

Number of Time/Area Diagrams 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH

FEH Rainfall Version 2013

Site Location GB 391344 411466 SD 91344 11466

Data Type Point

Cv (Summer) 0.750

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status OFF

Inertia Status OFF

Profile(s) Summer and Winter

Duration(s) (mins) 60, 120, 240, 360, 480, 960, 1440

Return Period(s) (years) 30

Climate Change (%) 0

PN

US/MH Name

Storm

Return Period

Climate Change

First (X) Surge

First (Y) Flood

First (Z) Overflow

Overflow Act.

1.000

Channel Outlet

S15 60 Winter

30

+0%

1.001

S16 60 Winter

30

+0%

30/60 Summer

2.000

S17 60 Summer

30

+0%

1.002

S17 60 Winter

30

+0%

30/60 Summer

3.000

S20 60 Winter

30

+0%

30/60 Summer

1.003

S18 60 Winter

30

+0%

30/60 Summer

4.000

S19A 60 Summer

30

+0%

1.004

S19 60 Winter

30

+0%

30/60 Summer

5.000

S22 60 Summer

30

+0%

5.001

S23 60 Summer

30

+0%

30/60 Summer

5.002

S24 60 Summer

30

+0%

30/60 Summer

6.000

S25 60 Summer

30

+0%

6.001

S26 60 Summer

30

+0%

7.000

S29 60 Winter

30

+0%

30/60 Summer

6.002

S27 60 Winter

30

+0%

30/60 Summer

6.003

S28 60 Winter

30

+0%

30/60 Summer

8.000

Attenuation Tank 60 Winter

30

+0%

30/60 Summer

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

		Water	Surcharged	Flooded				Half Drain	Pipe
	US/MH	Level	Depth	Volume	Flow /	Overflow	Time	Flow	
PN	Name	(m)	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	
1.000	Channel Outlet	S15 152.746	-0.040	0.000	0.06			2.3	
1.001		S16 152.743	0.106	0.000	0.20			28.8	
2.000		152.500	0.000	0.000	0.50			18.6	
1.002		S17 152.728	0.317	0.000	0.36			59.4	
3.000		S20 152.707	0.211	0.000	0.08			5.9	
1.003		S18 152.703	0.385	0.000	0.37			86.6	
4.000		S19A 152.890	-0.150	0.000	0.00			0.0	
1.004		S19 152.684	0.475	0.000	0.35			88.4	
5.000		S22 152.818	-0.142	0.000	0.21			64.0	
5.001		S23 152.798	0.198	0.000	0.44			137.9	
5.002	S24 152.727	0.515	0.000	0.72			182.1		
6.000	Attenuation Tank	S25 153.183	-0.123	0.000	0.07			1.3	
6.001		S26 153.071	-0.102	0.000	0.57			23.1	
7.000		S29 152.709	0.481	0.000	0.19			14.2	
6.002		S27 152.701	0.574	0.000	0.41			43.4	
6.003		S28 152.689	0.632	0.000	0.30			41.5	
8.000		152.670	0.585	0.000	0.91		21	61.4	

PN	US/MH Name	Status	Level
			Exceeded
1.000			OK
1.001			SURCHARGED
2.000	Channel Outlet		SURCHARGED*
1.002			SURCHARGED
3.000			SURCHARGED
1.003			SURCHARGED
4.000			OK
1.004			SURCHARGED
5.000			OK
5.001			SURCHARGED
5.002			SURCHARGED
6.000			OK
6.001			OK
7.000			SURCHARGED
6.002			SURCHARGED
6.003			SURCHARGED
8.000	Attenuation Tank		SURCHARGED*

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<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>																																																	
<table><tr><td colspan="2">US/MH</td><td colspan="2">Return Climate</td><td>First (X)</td><td>First (Y)</td><td>First (Z)</td><td>Overflow</td><td>Water</td></tr><tr><td>PN</td><td>Name</td><td>Storm</td><td>Period</td><td>Change</td><td>Surcharge</td><td>Flood</td><td>Overflow</td><td>Act.</td><td>Level (m)</td></tr><tr><td>5.003</td><td>S31</td><td>60 Winter</td><td>30</td><td>+0%</td><td>30/60 Summer</td><td></td><td></td><td></td><td>152.673</td></tr><tr><td>1.005</td><td>S32</td><td>60 Winter</td><td>30</td><td>+0%</td><td>30/60 Summer</td><td></td><td></td><td></td><td>152.658</td></tr></table>										US/MH		Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water	PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level (m)	5.003	S31	60 Winter	30	+0%	30/60 Summer				152.673	1.005	S32	60 Winter	30	+0%	30/60 Summer				152.658	
US/MH		Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water																																									
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level (m)																																								
5.003	S31	60 Winter	30	+0%	30/60 Summer				152.673																																								
1.005	S32	60 Winter	30	+0%	30/60 Summer				152.658																																								
<table><tr><td colspan="2">US/MH</td><td>Surcharged</td><td>Flooded</td><td colspan="2">Flow / Overflow</td><td>Half Drain</td><td>Pipe</td><td colspan="2">Level</td></tr><tr><td>PN</td><td>Name</td><td>Depth (m)</td><td>Volume (m³)</td><td>Flow / Cap.</td><td>Overflow (l/s)</td><td>Time (mins)</td><td>Flow (l/s)</td><td>Status</td><td>Exceeded</td></tr><tr><td>5.003</td><td>S31</td><td>0.548</td><td>0.000</td><td>0.59</td><td></td><td></td><td>128.1</td><td>SURCHARGED</td><td></td></tr><tr><td>1.005</td><td>S32</td><td>0.483</td><td>0.000</td><td>0.55</td><td></td><td></td><td>186.2</td><td>SURCHARGED</td><td></td></tr></table>										US/MH		Surcharged	Flooded	Flow / Overflow		Half Drain	Pipe	Level		PN	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Exceeded	5.003	S31	0.548	0.000	0.59			128.1	SURCHARGED		1.005	S32	0.483	0.000	0.55			186.2	SURCHARGED	
US/MH		Surcharged	Flooded	Flow / Overflow		Half Drain	Pipe	Level																																									
PN	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Exceeded																																								
5.003	S31	0.548	0.000	0.59			128.1	SURCHARGED																																									
1.005	S32	0.483	0.000	0.55			186.2	SURCHARGED																																									
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
1.000	S15		153.863	1.077	0.000	0.23		
1.001	S16		153.861	1.224	35.876	0.96		
2.000	Channel Outlet		152.500	0.000	0.000	0.99		
1.002	S17		153.863	1.452	37.949	1.10		
3.000	S20		153.864	1.368	0.000	0.16		
1.003	S18		153.859	1.541	33.982	0.83		
4.000	S19A		153.856	0.816	0.000	0.05		
1.004	S19		153.856	1.647	5.642	0.76		
5.000	S22		154.334	1.374	13.664	0.38		
5.001	S23		154.320	1.720	0.461	0.75		
5.002	S24		154.201	1.989	0.000	1.33		
6.000	S25		154.179	0.873	0.000	0.16		
6.001	S26		154.172	0.999	0.000	0.74		
7.000	S29		154.070	1.842	0.205	0.39		
6.002	S27		154.049	1.922	0.000	0.87		
6.003	S28		154.029	1.972	0.000	0.64		
8.000	Attenuation Tank		153.186	1.101	0.000	1.29		34

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S15	9.0	SURCHARGED	
1.001	S16	137.9	FLOOD	4
2.000	Channel Outlet	36.8	SURCHARGED*	
1.002	S17	182.1	FLOOD	3
3.000	S20	12.6	SURCHARGED	
1.003	S18	193.3	FLOOD	2
4.000	S19A	2.4	SURCHARGED	
1.004	S19	191.1	FLOOD	2
5.000	S22	117.8	FLOOD	2
5.001	S23	233.3	FLOOD	2
5.002	S24	334.7	FLOOD RISK	
6.000	S25	2.9	SURCHARGED	
6.001	S26	29.7	FLOOD RISK	
7.000	S29	29.2	FLOOD	
6.002	S27	93.1	FLOOD RISK	
6.003	S28	89.6	SURCHARGED	
8.000	Attenuation Tank	87.0	SURCHARGED*	

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

									Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)
5.003	S31	60 Summer	100	+45%	100/60 Summer				154.004
1.005	S32	60 Summer	100	+45%	100/60 Summer				153.962

PN	US/MH Name	Surcharged	Flooded			Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)		
5.003	S31	1.879	0.000	1.49			323.0	SURCHARGED	
1.005	S32	1.787	0.000	0.97			326.9	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 0.800

Manhole Headloss Coeff (Global) 0.500

Flow per Person per Day (l/per/day) 0.000

Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 1

Number of Online Controls 1

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model

FSR

Ratio R 0.250

Region England and Wales Cv (Summer) 0.750

M5-60 (mm)

19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)

300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status

ON

DVD Status

OFF

Inertia Status

OFF

Profile(s) Summer and Winter

Duration(s) (mins)

15, 30

Return Period(s) (years)

2

Climate Change (%)

0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000		S15 15 Winter	2	+0%				
1.001		S16 15 Winter	2	+0%				
2.000	Channel Outlet	15 Winter	2	+0%				
1.002		S17 15 Winter	2	+0%				
3.000		S20 15 Winter	2	+0%				
1.003		S18 15 Winter	2	+0%				
4.000		S19A 15 Summer	2	+0%				
1.004		S19 15 Winter	2	+0%				
5.000		S22 15 Winter	2	+0%				
5.001		S23 15 Winter	2	+0%				
5.002		S24 15 Winter	2	+0%				
6.000		S25 15 Winter	2	+0%				
6.001		S26 15 Winter	2	+0%				
7.000		S29 15 Winter	2	+0%				
6.002		S27 15 Winter	2	+0%				
6.003		S28 15 Winter	2	+0%	2/15 Summer			
8.000	Attenuation Tank	30 Winter	2	+0%				
5.003		S31 15 Winter	2	+0%				
1.005		S32 15 Winter	2	+0%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
1.000		S15 152.593	-0.193	0.000	0.05			1.9
1.001		S16 152.359	-0.278	0.000	0.15			21.5
2.000	Channel Outlet	152.371	-0.129	0.000	0.37			13.7
1.002		S17 152.155	-0.256	0.000	0.32			53.4
3.000		S20 152.249	-0.247	0.000	0.07			5.5
1.003		S18 152.117	-0.201	0.000	0.28			64.6
4.000		S19A 152.890	-0.150	0.000	0.00			0.0
1.004		S19 152.100	-0.109	0.000	0.25			61.9
5.000		S22 152.622	-0.338	0.000	0.14			42.7
5.001		S23 152.325	-0.275	0.000	0.32			101.2
5.002		S24 152.125	-0.087	0.000	0.48			121.5
6.000		S25 153.177	-0.129	0.000	0.05			0.9
6.001		S26 153.035	-0.138	0.000	0.32			12.7
7.000		S29 152.120	-0.108	0.000	0.17			12.9
6.002		S27 152.113	-0.014	0.000	0.26			28.1
6.003		S28 152.103	0.046	0.000	0.18			24.9
8.000	Attenuation Tank	151.975	-0.110	0.000	0.37		9	25.3
5.003		S31 152.087	-0.038	0.000	0.52			112.8
1.005		S32 152.076	-0.099	0.000	0.45			150.6

PN	US/MH Name	Status	Level Exceeded
1.000	S15	OK	
1.001	S16	OK	
2.000	Channel Outlet	OK*	
1.002	S17	OK	
3.000	S20	OK	
1.003	S18	OK	
4.000	S19A	OK	
1.004	S19	OK	
5.000	S22	OK	
5.001	S23	OK	
5.002	S24	OK	
6.000	S25	OK	
6.001	S26	OK	
7.000	S29	OK	
6.002	S27	OK	
6.003	S28	SURCHARGED	
8.000	Attenuation Tank	OK*	
5.003	S31	OK	
1.005	S32	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000

Hot Start (mins) 0

Hot Start Level (mm) 0

Manhole Headloss Coeff (Global) 0.500

Foul Sewage per hectare (l/s) 0.000

Additional Flow - % of Total Flow 0.000

MADD Factor * 10m³/ha Storage 2.000

Inlet Coefficient 0.800

Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0

Number of Online Controls 1

Number of Offline Controls 0

Number of Storage Structures 1

Number of Time/Area Diagrams 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Region England and Wales Cv (Summer) 0.750

M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status OFF

Inertia Status OFF

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30

Return Period(s) (years) 30

Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S15	30 Winter	30	+0%				
1.001	S16	30 Winter	30	+0%	30/15 Summer			
2.000	Channel Outlet	15 Summer	30	+0%				
1.002	S17	30 Winter	30	+0%	30/15 Summer			
3.000	S20	30 Winter	30	+0%	30/15 Summer			
1.003	S18	30 Winter	30	+0%	30/15 Summer			
4.000	S19A	15 Summer	30	+0%				
1.004	S19	30 Winter	30	+0%	30/15 Summer			
5.000	S22	15 Winter	30	+0%				
5.001	S23	15 Winter	30	+0%	30/15 Summer			
5.002	S24	30 Winter	30	+0%	30/15 Summer			
6.000	S25	15 Winter	30	+0%				
6.001	S26	15 Winter	30	+0%				
7.000	S29	30 Winter	30	+0%	30/15 Summer			
6.002	S27	30 Winter	30	+0%	30/15 Summer			
6.003	S28	30 Winter	30	+0%	30/15 Summer			
8.000	Attenuation Tank	30 Winter	30	+0%	30/15 Summer			
5.003	S31	30 Winter	30	+0%	30/15 Summer			
1.005	S32	30 Winter	30	+0%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
1.000		S15 152.770	-0.016	0.000	0.07			2.9
1.001		S16 152.766	0.129	0.000	0.26			37.1
2.000	Channel Outlet	152.500	0.000	0.000	0.59			22.1
1.002		S17 152.748	0.337	0.000	0.42			69.5
3.000		S20 152.722	0.226	0.000	0.09			7.2
1.003		S18 152.716	0.398	0.000	0.45			103.6
4.000		S19A 152.890	-0.150	0.000	0.00			0.0
1.004		S19 152.688	0.479	0.000	0.41			104.2
5.000		S22 152.862	-0.098	0.000	0.25			78.3
5.001		S23 152.837	0.237	0.000	0.54			167.2
5.002		S24 152.759	0.547	0.000	0.75			189.6
6.000		S25 153.187	-0.119	0.000	0.09			1.6
6.001		S26 153.093	-0.080	0.000	0.73			29.5
7.000		S29 152.719	0.491	0.000	0.24			17.9
6.002		S27 152.705	0.578	0.000	0.51			54.8
6.003		S28 152.687	0.630	0.000	0.37			51.9
8.000	Attenuation Tank	152.590	0.505	0.000	0.91		16	61.4
5.003		S31 152.661	0.536	0.000	0.61			131.8
1.005		S32 152.651	0.476	0.000	0.55			184.7

PN	US/MH Name	Status	Level Exceeded
1.000	S15	OK	
1.001	S16	SURCHARGED	
2.000	Channel Outlet	SURCHARGED*	
1.002	S17	SURCHARGED	
3.000	S20	SURCHARGED	
1.003	S18	SURCHARGED	
4.000	S19A	OK	
1.004	S19	SURCHARGED	
5.000	S22	OK	
5.001	S23	SURCHARGED	
5.002	S24	SURCHARGED	
6.000	S25	OK	
6.001	S26	OK	
7.000	S29	SURCHARGED	
6.002	S27	SURCHARGED	
6.003	S28	SURCHARGED	
8.000	Attenuation Tank	SURCHARGED*	
5.003	S31	SURCHARGED	
1.005	S32	SURCHARGED	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.250	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.415	4-8	0.577

Total Area Contributing (ha) = 1.992

Total Pipe Volume (m³) = 56.929

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	21.628	0.149	145.2	0.013	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	35.005	0.226	154.9	0.159	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	17.297	0.089	194.3	0.095	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	41.990	0.140	300.0	0.159	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	75.00	5.33	152.561	0.013	0.0	0.0	0.0	1.08	43.1	2.6
1.001	75.00	5.73	152.262	0.172	0.0	0.0	0.0	1.45	160.5	34.9
2.000	75.00	5.31	152.275	0.095	0.0	0.0	0.0	0.93	37.2	19.3
1.002	75.00	6.33	151.961	0.426	0.0	0.0	0.0	1.17	185.8	86.5

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
3.000	17.756	0.118	150.0	0.038	5.00	0.0	0.600	o	300	Pipe/Conduit		
1.003	29.151	0.097	300.5	0.160	0.00	0.0	0.600	o	525	Pipe/Conduit		
4.000	11.555	0.914	12.6	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit		
1.004	55.061	0.184	299.2	0.025	0.00	0.0	0.600	o	525	Pipe/Conduit		
5.000	28.820	0.360	80.1	0.293	5.00	0.0	0.600	o	450	Pipe/Conduit		
5.001	31.006	0.388	79.9	0.513	0.00	0.0	0.600	o	450	Pipe/Conduit		
5.002	15.974	0.200	79.9	0.257	0.00	0.0	0.600	o	450	Pipe/Conduit		
6.000	10.644	0.133	80.0	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit		
6.001	40.494	0.270	150.0	0.095	0.00	0.0	0.600	o	225	Pipe/Conduit		
7.000	15.139	0.100	151.4	0.092	5.00	0.0	0.600	o	300	Pipe/Conduit		
6.002	10.534	0.070	150.5	0.086	0.00	0.0	0.600	o	375	Pipe/Conduit		
6.003	23.491	0.157	149.6	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit		
8.000	3.633	0.073	49.8	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	75.00	5.23	152.196	0.038	0.0	0.0	0.0	1.28	90.6	7.7
1.003	75.00	6.71	151.793	0.624	0.0	0.0	0.0	1.29	278.6	126.7
4.000	75.00	5.07	152.890	0.000	0.0	0.0	0.0	2.85	50.3	0.0
1.004	75.00	7.42	151.684	0.649	0.0	0.0	0.0	1.29	279.2	131.8
5.000	75.00	5.21	152.510	0.293	0.0	0.0	0.0	2.27	361.6	59.5
5.001	75.00	5.44	152.150	0.806	0.0	0.0	0.0	2.28	362.0	163.7
5.002	75.00	5.56	151.762	1.063	0.0	0.0	0.0	2.28	362.1	215.9
6.000	75.00	5.16	153.156	0.006	0.0	0.0	0.0	1.12	19.9	1.2
6.001	75.00	5.79	152.948	0.101	0.0	0.0	0.0	1.07	42.4	20.5
7.000	75.00	5.20	151.928	0.092	0.0	0.0	0.0	1.28	90.2	18.7
6.002	75.00	5.91	151.752	0.279	0.0	0.0	0.0	1.47	162.9	56.7
6.003	75.00	6.18	151.682	0.279	0.0	0.0	0.0	1.48	163.3	56.7
8.000	75.00	5.03	151.785	0.000	0.0	0.0	0.0	2.23	157.9	0.0

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Online Controls for Storm Orifice Manhole: S32, DS/PN: 1.005, Volume (m³): 50.5 Diameter (m) 0.341 Discharge Coefficient 0.600 Invert Level (m) 151.500		
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Storage Structures for Storm

Cellular Storage Manhole: Attenuation Tank, DS/PN: 8.000

Invert Level (m) 151.785 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	100.0	100.0	1.401	0.0	140.0
1.400	100.0	140.0			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000		S1 153.150	-0.351	0.000	0.11			20.7	OK
1.001		S2 153.083	-0.307	0.000	0.22			53.2	OK
2.000		S4 153.258	-0.242	0.000	0.08			7.0	OK
3.000		S6 154.310	-0.125	0.000	0.07			2.0	OK
3.001		S7 153.535	-0.190	0.000	0.06			5.9	OK
2.001		S5 153.005	-0.202	0.000	0.23			24.3	OK
1.002		S8 152.593	-0.388	0.000	0.15			93.9	OK
1.003		S3 152.059	-0.291	0.000	0.41			93.1	OK
1.004		S9 151.952	-0.299	0.000	0.38			92.5	OK
4.000	Channel Outlet	152.340	-0.168	0.000	0.15			7.6	OK*
4.001		S10 152.067	-0.251	0.000	0.24			37.7	OK
4.002		S11 151.841	-0.197	0.000	0.41			37.2	OK
5.000		S13 152.261	-0.193	0.000	0.05			1.9	OK
5.001		S12 152.158	-0.195	0.000	0.04			1.8	OK
1.005		S14 151.808	-0.287	0.000	0.42			132.0	OK

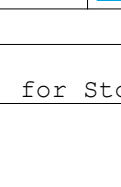
PN	US/MH Name	Level Exceeded
1.000		S1
1.001		S2
2.000		S4
3.000		S6
3.001		S7
2.001		S5
1.002		S8
1.003		S3
1.004		S9
4.000	Channel Outlet	
4.001		S10
4.002		S11
5.000		S13
5.001		S12
1.005		S14

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

US/MH		Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act. Level
								(m)
1.006	PS1	60 Summer	2	+0%				151.483
1.007	S23	60 Summer	2	+0%				151.580

US/MH		Surcharged	Flooded	Half Drain		Pipe	Level	
PN	Name	Depth	Volume	Flow /	Overflow	Time	Flow	Status Exceeded
		(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	
1.006	PS1	-0.448	0.000	0.53			131.9	OK
1.007	S23	-0.291	0.000	0.41			131.6	OK

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 391344 411466 SD 91344 11466
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	60 Summer	30	+0%				
1.001	S2	60 Summer	30	+0%				
2.000	S4	60 Summer	30	+0%				
3.000	S6	60 Summer	30	+0%				
3.001	S7	60 Summer	30	+0%				
2.001	S5	60 Summer	30	+0%				
1.002	S8	60 Summer	30	+0%				
1.003	S3	60 Summer	30	+0%				
1.004	S9	60 Summer	30	+0%				
4.000	Channel Outlet	60 Summer	30	+0%				
4.001	S10	60 Summer	30	+0%				
4.002	S11	60 Summer	30	+0%	30/60 Summer			
5.000	S13	60 Summer	30	+0%				
5.001	S12	60 Summer	30	+0%				
1.005	S14	60 Summer	30	+0%				

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

PN	US/MH Name	Water		Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)			
1.000	S1	153.222	-0.279	0.000	0.26			49.3	
1.001	S2	153.182	-0.208	0.000	0.55			134.8	
2.000	S4	153.290	-0.210	0.000	0.20			16.7	
3.000	S6	154.325	-0.110	0.000	0.16			4.9	
3.001	S7	153.558	-0.167	0.000	0.15			15.1	
2.001	S5	153.074	-0.133	0.000	0.59			61.8	
1.002	S8	152.684	-0.297	0.000	0.39			239.3	
1.003	S3	152.350	0.000	0.000	1.03			234.0	
1.004	S9	152.171	-0.080	0.000	0.94			226.5	
4.000	Channel Outlet	152.375	-0.133	0.000	0.35			18.2	
4.001	S10	152.158	-0.160	0.000	0.62			98.0	
4.002	S11	152.070	0.032	0.000	1.01			90.5	
5.000	S13	152.280	-0.174	0.000	0.12			4.4	
5.001	S12	152.176	-0.177	0.000	0.10			4.4	
1.005	S14	152.033	-0.062	0.000	1.00			310.7	

PN	US/MH Name	Status	Level Exceeded
1.000	S1	OK	
1.001	S2	OK	
2.000	S4	OK	
3.000	S6	OK	
3.001	S7	OK	
2.001	S5	OK	
1.002	S8	OK	
1.003	S3	OK	
1.004	S9	OK	
4.000	Channel Outlet	OK*	
4.001	S10	OK	
4.002	S11	SURCHARGED	
5.000	S13	OK	
5.001	S12	OK	
1.005	S14	OK	

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

US/MH		Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act. Level
								(m)
1.006	PS1	60 Summer	30	+0%				151.589
1.007	S23	60 Summer	30	+0%				151.757

US/MH		Surcharged	Flooded	Half Drain		Pipe	Level	
PN	Name	Depth	Volume	Flow /	Overflow	Time	Flow	Status Exceeded
		(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	
1.006	PS1	-0.342	0.000	1.25			310.7	OK
1.007	S23	-0.114	0.000	0.97			310.7	OK

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

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 0.800

Manhole Headloss Coeff (Global) 0.500

Flow per Person per Day (l/per/day) 0.000

Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 0

Number of Online Controls 1

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH

FEH Rainfall Version 2013

Site Location GB 391344 411466 SD 91344 11466

Data Type Point

Cv (Summer) 0.750

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status OFF

Inertia Status OFF

Profile(s) Summer and Winter

Duration(s) (mins) 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Period(s) (years) 100

Climate Change (%) 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow
1.000	S1	60 Summer	100	+45%	100/60 Summer		
1.001	S2	60 Summer	100	+45%	100/60 Summer		
2.000	S4	60 Summer	100	+45%	100/60 Summer		
3.000	S6	60 Summer	100	+45%	100/60 Summer		
3.001	S7	60 Summer	100	+45%	100/60 Summer		
2.001	S5	60 Summer	100	+45%	100/60 Summer		
1.002	S8	60 Summer	100	+45%	100/60 Summer	100/60 Summer	
1.003	S3	60 Summer	100	+45%	100/60 Summer		
1.004	S9	60 Summer	100	+45%	100/60 Summer		
4.000	Channel Outlet	60 Summer	100	+45%			
4.001	S10	60 Summer	100	+45%	100/60 Summer	100/60 Summer	
4.002	S11	60 Summer	100	+45%	100/60 Summer		
5.000	S13	60 Summer	100	+45%	100/60 Summer		
5.001	S12	60 Summer	100	+45%	100/60 Summer		
1.005	S14	60 Summer	100	+45%	100/60 Summer		

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

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
1.000	S1		154.521	1.020	0.000	0.45			84.6
1.001	S2		154.497	1.107	0.000	0.93			226.4
2.000	S4		154.449	0.949	0.000	0.36			30.9
3.000	S6		154.468	0.033	0.000	0.32			9.6
3.001	S7		154.438	0.713	0.000	0.29			29.6
2.001	S5		154.417	1.210	0.000	0.99			104.3
1.002	S8		154.302	1.321	2.037	0.56			339.4
1.003	S3		154.187	1.837	0.000	1.41			320.0
1.004	S9		154.059	1.808	0.000	1.25			300.3
4.000	Channel Outlet		152.508	0.000	0.000	0.51			26.7
4.001	S10		153.959	1.641	8.857	0.91			144.9
4.002	S11		153.908	1.870	0.000	1.51			135.4
5.000	S13		153.905	1.451	0.000	0.35			13.1
5.001	S12		153.894	1.541	0.000	0.45			19.1
1.005	S14		153.879	1.784	0.000	1.34			416.2

PN	US/MH Name	Status	Level Exceeded
1.000	S1	FLOOD RISK	
1.001	S2	FLOOD RISK	
2.000	S4	FLOOD RISK	
3.000	S6	SURCHARGED	
3.001	S7	SURCHARGED	
2.001	S5	FLOOD RISK	
1.002	S8	FLOOD	1
1.003	S3	FLOOD RISK	
1.004	S9	SURCHARGED	
4.000	Channel Outlet	SURCHARGED*	
4.001	S10	FLOOD	2
4.002	S11	FLOOD RISK	
5.000	S13	SURCHARGED	
5.001	S12	SURCHARGED	
1.005	S14	SURCHARGED	

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Innovyze					Network 2020.1																																												
<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>																																																	
<table><tr><th colspan="2">US/MH</th><th rowspan="2">Storm</th><th colspan="2">Return Climate</th><th>First (X)</th><th>First (Y)</th><th>First (Z)</th><th>Overflow</th><th rowspan="2">Water Level (m)</th></tr><tr><th>PN</th><th>Name</th><th>Period</th><th>Change</th><th>Surcharge</th><th>Flood</th><th>Overflow</th><th>Act.</th></tr><tr><td>1.006</td><td>PS1</td><td>60 Summer</td><td>100</td><td>+45%</td><td>100/60 Summer</td><td></td><td></td><td></td><td>153.689</td></tr><tr><td>1.007</td><td>S23</td><td>120 Summer</td><td>100</td><td>+45%</td><td></td><td></td><td></td><td></td><td>151.871</td></tr></table>												US/MH		Storm	Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water Level (m)	PN	Name	Period	Change	Surcharge	Flood	Overflow	Act.	1.006	PS1	60 Summer	100	+45%	100/60 Summer				153.689	1.007	S23	120 Summer	100	+45%					151.871
US/MH		Storm	Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water Level (m)																																								
PN	Name		Period	Change	Surcharge	Flood	Overflow	Act.																																									
1.006	PS1	60 Summer	100	+45%	100/60 Summer				153.689																																								
1.007	S23	120 Summer	100	+45%					151.871																																								
<table><tr><th colspan="2">US/MH</th><th colspan="2">Surcharged Flooded</th><th colspan="2">Flow / Overflow</th><th>Half Drain</th><th>Pipe</th><th rowspan="2">Status</th><th rowspan="2">Level Exceeded</th></tr><tr><th>PN</th><th>Name</th><th>Depth (m)</th><th>Volume (m³)</th><th>Cap.</th><th>(l/s)</th><th>Time (mins)</th><th>Flow (l/s)</th></tr><tr><td>1.006</td><td>PS1</td><td>1.758</td><td>0.000</td><td></td><td>1.37</td><td></td><td>340.0</td><td>SURCHARGED</td><td></td></tr><tr><td>1.007</td><td>S23</td><td>0.000</td><td>0.000</td><td></td><td>1.06</td><td></td><td>340.0</td><td>OK</td><td></td></tr></table>												US/MH		Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded	PN	Name	Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)	1.006	PS1	1.758	0.000		1.37		340.0	SURCHARGED		1.007	S23	0.000	0.000		1.06		340.0	OK	
US/MH		Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded																																								
PN	Name	Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)																																										
1.006	PS1	1.758	0.000		1.37		340.0	SURCHARGED																																									
1.007	S23	0.000	0.000		1.06		340.0	OK																																									
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FEH
 FEH Rainfall Version 2013
 Site Location GB 391344 411466 SD 91344 11466
 Data Type Point
 Cv (Summer) 0.750
 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000		S1 60 Summer	100	+0%				
1.001		S2 60 Summer	100	+0%				
2.000		S4 60 Summer	100	+0%				
3.000		S6 60 Summer	100	+0%				
3.001		S7 60 Summer	100	+0%				
2.001		S5 60 Summer	100	+0%				
1.002		S8 60 Summer	100	+0%				
1.003		S3 60 Summer	100	+0%	100/60 Summer			
1.004		S9 60 Summer	100	+0%	100/60 Summer			
4.000	Channel Outlet	60 Summer	100	+0%				
4.001		S10 60 Summer	100	+0%	100/60 Summer			
4.002		S11 60 Summer	100	+0%	100/60 Summer			
5.000		S13 60 Summer	100	+0%	100/60 Summer			
5.001		S12 60 Summer	100	+0%	100/60 Summer			
1.005		S14 60 Summer	100	+0%	100/60 Summer			

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

PN	US/MH Name	Water		Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)			
1.000	S1	153.267	-0.234	0.000	0.35			66.6	
1.001	S2	153.235	-0.155	0.000	0.75			182.0	
2.000	S4	153.305	-0.195	0.000	0.27			22.6	
3.000	S6	154.332	-0.103	0.000	0.22			6.6	
3.001	S7	153.569	-0.156	0.000	0.20			20.4	
2.001	S5	153.111	-0.096	0.000	0.80			83.6	
1.002	S8	152.895	-0.086	0.000	0.52			315.3	
1.003	S3	152.802	0.452	0.000	1.33			302.0	
1.004	S9	152.689	0.438	0.000	1.23			296.4	
4.000	Channel Outlet	152.508	0.000	0.000	0.47			24.2	
4.001	S10	152.666	0.348	0.000	0.76			119.8	
4.002	S11	152.573	0.535	0.000	1.25			112.2	
5.000	S13	152.539	0.085	0.000	0.20			7.5	
5.001	S12	152.531	0.178	0.000	0.33			13.8	
1.005	S14	152.533	0.438	0.000	1.31			406.6	

PN	US/MH Name	Status	Level Exceeded
1.000	S1	OK	
1.001	S2	OK	
2.000	S4	OK	
3.000	S6	OK	
3.001	S7	OK	
2.001	S5	OK	
1.002	S8	OK	
1.003	S3	SURCHARGED	
1.004	S9	SURCHARGED	
4.000	Channel Outlet	SURCHARGED*	
4.001	S10	SURCHARGED	
4.002	S11	SURCHARGED	
5.000	S13	SURCHARGED	
5.001	S12	SURCHARGED	
1.005	S14	SURCHARGED	

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

									Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)
1.006	PS1	60 Summer	100	+0%	100/60 Summer				152.343
1.007	S23	60 Summer	100	+0%					151.871

US/MH		Surcharged	Flooded	Half Drain		Pipe			
PN	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded
1.006	PS1	0.412	0.000	1.37			340.0	SURCHARGED	
1.007	S23	0.000	0.000	1.06			340.0	OK	

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000		S1 153.178	-0.323	0.000	0.17			32.7	OK
1.001		S2 153.120	-0.270	0.000	0.33			79.7	OK
2.000		S4 153.273	-0.227	0.000	0.13			11.1	OK
3.000		S6 154.318	-0.117	0.000	0.11			3.3	OK
3.001		S7 153.545	-0.180	0.000	0.09			8.9	OK
2.001		S5 153.030	-0.177	0.000	0.35			36.7	OK
1.002		S8 152.626	-0.355	0.000	0.23			139.8	OK
1.003		S3 152.123	-0.227	0.000	0.61			138.5	OK
1.004		S9 152.011	-0.240	0.000	0.56			135.8	OK
4.000	Channel Outlet	152.357	-0.151	0.000	0.23			12.1	OK*
4.001		S10 152.098	-0.220	0.000	0.35			56.2	OK
4.002		S11 151.893	-0.145	0.000	0.61			54.4	OK
5.000		S13 152.271	-0.183	0.000	0.08			2.9	OK
5.001		S12 152.166	-0.187	0.000	0.07			2.9	OK
1.005		S14 151.865	-0.230	0.000	0.61			188.8	OK
1.006		PS1 151.518	-0.413	0.000	0.76			187.7	OK
1.007		S23 151.638	-0.233	0.000	0.59			188.6	OK

PN	US/MH Name	Level Exceeded
1.000		S1
1.001		S2
2.000		S4
3.000		S6
3.001		S7
2.001		S5
1.002		S8
1.003		S3
1.004		S9
4.000	Channel Outlet	
4.001		S10
4.002		S11
5.000		S13
5.001		S12
1.005		S14
1.006		PS1
1.007		S23

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

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 0.800

Manhole Headloss Coeff (Global) 0.500

Flow per Person per Day (l/per/day) 0.000

Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 0

Number of Online Controls 1

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model

FSR

Ratio R 0.262

Region England and Wales Cv (Summer) 0.750

M5-60 (mm)

19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)

300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status

ON

DVD Status

OFF

Inertia Status

OFF

Profile(s) Summer and Winter

Duration(s) (mins)

15, 30

Return Period(s) (years)

30

Climate Change (%)

0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow Overflow	Overflow Act.
1.000		S1 15 Winter	30	+0%				
1.001		S2 15 Winter	30	+0%				
2.000		S4 15 Winter	30	+0%				
3.000		S6 15 Winter	30	+0%				
3.001		S7 15 Winter	30	+0%				
2.001		S5 15 Winter	30	+0%				
1.002		S8 15 Winter	30	+0%				
1.003		S3 15 Winter	30	+0%	30/15 Summer			
1.004		S9 15 Winter	30	+0%	30/15 Summer			
4.000	Channel Outlet	15 Winter	30	+0%				
4.001		S10 15 Winter	30	+0%				
4.002		S11 15 Winter	30	+0%	30/15 Summer			
5.000		S13 15 Winter	30	+0%				
5.001		S12 15 Winter	30	+0%				
1.005		S14 15 Winter	30	+0%	30/15 Summer			
1.006		PS1 15 Winter	30	+0%				
1.007		S23 15 Summer	30	+0%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
1.000		S1 153.259	-0.242	0.000	0.33		61.6
1.001		S2 153.226	-0.164	0.000	0.70		170.2
2.000		S4 153.302	-0.198	0.000	0.25		20.8
3.000		S6 154.331	-0.104	0.000	0.20		6.2
3.001		S7 153.567	-0.158	0.000	0.19		19.6
2.001		S5 153.105	-0.102	0.000	0.75		78.9
1.002		S8 152.721	-0.260	0.000	0.49		301.5
1.003		S3 152.493	0.143	0.000	1.28		290.9
1.004		S9 152.349	0.098	0.000	1.15		276.5
4.000	Channel Outlet	S10 152.388	-0.120	0.000	0.44		22.9
4.001		S10 152.282	-0.036	0.000	0.76		120.9
4.002		S11 152.191	0.153	0.000	1.26		113.1
5.000		S13 152.287	-0.167	0.000	0.15		5.5
5.001		S12 152.182	-0.171	0.000	0.13		5.5
1.005		S14 152.149	0.054	0.000	1.21		374.7
1.006		PS1 151.879	-0.052	0.000	1.37		340.0
1.007		S23 151.875	0.004	0.000	1.06		340.0

PN	US/MH Name	Status	Level Exceeded
1.000	S1	OK	
1.001	S2	OK	
2.000	S4	OK	
3.000	S6	OK	
3.001	S7	OK	
2.001	S5	OK	
1.002	S8	OK	
1.003	S3	SURCHARGED	
1.004	S9	SURCHARGED	
4.000	Channel Outlet	OK*	
4.001	S10	OK	
4.002	S11	SURCHARGED	
5.000	S13	OK	
5.001	S12	OK	
1.005	S14	SURCHARGED	
1.006	PS1	OK	
1.007	S23	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 0.800

Manhole Headloss Coeff (Global) 0.500

Flow per Person per Day (l/per/day) 0.000

Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 0

Number of Online Controls 1

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.262

Region England and Wales Cv (Summer) 0.750

M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status OFF

Inertia Status OFF

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30

Return Period(s) (years) 100

Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000		S1 15 Winter	100	+0%				
1.001		S2 15 Winter	100	+0%				
2.000		S4 15 Winter	100	+0%				
3.000		S6 15 Winter	100	+0%				
3.001		S7 15 Winter	100	+0%				
2.001		S5 15 Winter	100	+0%				
1.002		S8 15 Winter	100	+0%	100/15 Winter			
1.003		S3 15 Winter	100	+0%	100/15 Summer			
1.004		S9 15 Winter	100	+0%	100/15 Summer			
4.000	Channel Outlet	15 Summer	100	+0%				
4.001		S10 15 Winter	100	+0%	100/15 Summer			
4.002		S11 15 Winter	100	+0%	100/15 Summer			
5.000		S13 15 Winter	100	+0%	100/15 Summer			
5.001		S12 15 Winter	100	+0%	100/15 Summer			
1.005		S14 15 Winter	100	+0%	100/15 Summer			
1.006		PS1 15 Winter	100	+0%	100/15 Summer			
1.007		S23 30 Summer	100	+0%	100/30 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
1.000		S1 153.313	-0.188	0.000	0.42		79.7
1.001		S2 153.284	-0.106	0.000	0.90		219.3
2.000		S4 153.318	-0.182	0.000	0.32		26.9
3.000		S6 154.337	-0.098	0.000	0.26		7.9
3.001		S7 153.576	-0.149	0.000	0.25		25.3
2.001		S5 153.153	-0.054	0.000	0.96		101.0
1.002		S8 153.110	0.129	0.000	0.58		352.4
1.003		S3 153.017	0.667	0.000	1.43		325.9
1.004		S9 152.915	0.664	0.000	1.29		309.7
4.000	Channel Outlet	S10 152.508	0.000	0.000	0.50		25.9
4.001		S10 152.866	0.548	0.000	0.91		144.7
4.002		S11 152.794	0.756	0.000	1.45		129.9
5.000		S13 152.698	0.244	0.000	0.22		8.2
5.001		S12 152.689	0.336	0.000	0.43		18.0
1.005		S14 152.761	0.666	0.000	1.35		419.4
1.006		PS1 152.578	0.647	0.000	1.37		340.0
1.007		S23 151.875	0.004	0.000	1.06		340.0

PN	US/MH Name	Status	Level Exceeded
1.000	S1	OK	
1.001	S2	OK	
2.000	S4	OK	
3.000	S6	OK	
3.001	S7	OK	
2.001	S5	OK	
1.002	S8	SURCHARGED	
1.003	S3	SURCHARGED	
1.004	S9	SURCHARGED	
4.000	Channel Outlet	SURCHARGED*	
4.001	S10	SURCHARGED	
4.002	S11	SURCHARGED	
5.000	S13	SURCHARGED	
5.001	S12	SURCHARGED	
1.005	S14	SURCHARGED	
1.006	PS1	SURCHARGED	
1.007	S23	SURCHARGED	

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

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
1.000	S1		154.656	1.155	0.000	0.64			120.1
1.001	S2		154.619	1.229	28.826	0.81			197.2
2.000	S4		154.701	1.201	0.953	0.43			36.3
3.000	S6		154.840	0.405	0.000	0.40			12.0
3.001	S7		154.728	1.003	0.000	0.36			36.7
2.001	S5		154.652	1.445	2.402	1.18			124.2
1.002	S8		154.406	1.425	105.582	0.37			224.0
1.003	S3		154.370	2.020	69.824	0.75			170.0
1.004	S9		154.402	2.151	1.639	0.61			146.7
4.000	Channel Outlet		152.508	0.000	0.000	0.87			45.0
4.001	S10		154.124	1.806	174.094	0.36			57.7
4.002	S11		154.172	2.134	221.727	0.42			37.7
5.000	S13		154.340	1.886	0.000	0.34			12.5
5.001	S12		154.331	1.978	0.000	0.26			11.2
1.005	S14		154.400	2.305	0.649	0.11			33.7
1.006	PS1		154.450	2.519	0.000	0.00			0.1
1.007	S23		151.347	-0.524	0.000	0.00			0.1

PN	US/MH Name	Status	Level Exceeded
1.000	S1	FLOOD RISK	
1.001	S2	FLOOD	4
2.000	S4	FLOOD	4
3.000	S6	SURCHARGED	
3.001	S7	FLOOD RISK	
2.001	S5	FLOOD	4
1.002	S8	FLOOD	4
1.003	S3	FLOOD	4
1.004	S9	FLOOD	4
4.000	Channel Outlet	SURCHARGED*	
4.001	S10	FLOOD	4
4.002	S11	FLOOD	4
5.000	S13	FLOOD RISK	
5.001	S12	FLOOD RISK	
1.005	S14	FLOOD	4
1.006	PS1	SURCHARGED	
1.007	S23	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.250	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.850	4-8	0.712

Total Area Contributing (ha) = 1.562

Total Pipe Volume (m³) = 58.024

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	16.636	0.111	149.9	0.222	5.00	0.0	0.600	o	450	Pipe/Conduit	
1.001	61.368	0.409	150.0	0.384	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.000	43.876	0.293	149.7	0.076	5.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	22.122	0.710	31.2	0.022	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	8.710	0.518	16.8	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	40.55	5.17	153.051	0.222	0.0	0.0	0.0	1.66	263.8	24.4
1.001	38.85	5.78	152.940	0.606	0.0	0.0	0.0	1.66	263.6	63.8
2.000	39.42	5.57	153.200	0.076	0.0	0.0	0.0	1.28	90.7	8.1
3.000	40.45	5.20	154.285	0.022	0.0	0.0	0.0	1.81	32.0	2.4
3.001	40.32	5.25	153.500	0.067	0.0	0.0	0.0	3.21	127.5	7.3

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.001	19.290	0.229	84.2	0.133	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	19.486	0.631	30.9	0.192	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.003	31.666	0.099	320.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.004	49.830	0.156	319.4	0.004	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.000	19.013	0.190	100.0	0.082	5.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	36.081	0.280	128.9	0.352	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.002	13.240	0.044	300.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.000	15.222	0.101	150.7	0.020	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.001	34.587	0.258	134.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	24.451	0.164	149.1	0.030	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.006	6.030	0.060	100.5	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.007	17.432	0.174	100.2	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.001	38.92	5.76	152.907	0.276	0.0	0.0	0.0	1.71	121.2	29.1
1.002	38.64	5.86	152.456	1.074	0.0	0.0	0.0	4.04	874.8	112.4
1.003	37.59	6.29	151.825	1.074	0.0	0.0	0.0	1.25	269.9	112.4
1.004	36.07	6.95	151.726	1.078	0.0	0.0	0.0	1.25	270.1	112.4
4.000	40.34	5.24	152.283	0.082	0.0	0.0	0.0	1.31	52.0	9.0
4.001	39.29	5.62	151.943	0.434	0.0	0.0	0.0	1.59	176.1	46.2
4.002	38.73	5.83	151.663	0.434	0.0	0.0	0.0	1.04	114.8	46.2
5.000	40.35	5.24	152.229	0.020	0.0	0.0	0.0	1.06	42.3	2.2
5.001	38.94	5.75	152.128	0.020	0.0	0.0	0.0	1.13	44.8	2.2
1.005	35.60	7.18	151.570	1.562	0.0	0.0	0.0	1.83	396.6	150.6
1.006	35.50	7.22	151.406	1.562	0.0	0.0	0.0	2.23	483.7	150.6
1.007	35.24	7.35	151.346	1.562	0.0	0.0	0.0	2.24	484.5	150.6

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.222	0.222	0.222
1.001	-	-	100	0.384	0.384	0.384
2.000	-	-	100	0.076	0.076	0.076
3.000	-	-	100	0.022	0.022	0.022
3.001	-	-	100	0.045	0.045	0.045
2.001	-	-	100	0.133	0.133	0.133
1.002	-	-	100	0.192	0.192	0.192
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.004	0.004	0.004
4.000	-	-	100	0.082	0.082	0.082
4.001	-	-	100	0.352	0.352	0.352
4.002	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.020	0.020	0.020
5.001	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.030	0.030	0.030
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.562	1.562	1.562

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.007		157.569	151.172	0.000	2100	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000	
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000	
Hot Start (mins)	0	Inlet Coefficient	0.800	
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000	
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60	
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1	
Number of Input Hydrographs		0	Number of Storage Structures	0
Number of Online Controls		1	Number of Time/Area Diagrams	0
Number of Offline Controls		0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.250		

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Online Controls for Storm

Pump Manhole: PS1, DS/PN: 1.006, Volume (m³): 18.3

Invert Level (m) 151.406

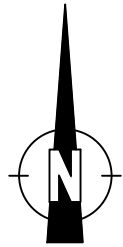
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	340.0000	1.800	340.0000	3.400	340.0000	5.000	340.0000
0.400	340.0000	2.000	340.0000	3.600	340.0000	5.200	340.0000
0.600	340.0000	2.200	340.0000	3.800	340.0000	5.400	340.0000
0.800	340.0000	2.400	340.0000	4.000	340.0000	5.600	340.0000
1.000	340.0000	2.600	340.0000	4.200	340.0000	5.800	340.0000
1.200	340.0000	2.800	340.0000	4.400	340.0000	6.000	340.0000
1.400	340.0000	3.000	340.0000	4.600	340.0000		
1.600	340.0000	3.200	340.0000	4.800	340.0000		

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APPENDIX 9: Drainage Drawings

Note:
Levels to be reduced to provide link from
headwall to existing ditch on plot.

Note:
Localised
Earthworks to be
carried out to suit
proposed outfall
invert level, to
provide connection
into existing ditch
within Plot L.



Note:
Existing ditch levels
to be reduced locally
to suit Headwall IL.

Inset A

Length of existing ditch impacted by proposed site
layout to be filled. Based on an initial site visit it is
considered that there are no incoming or outgoing
connections. Further investigation to be carried out
by contractor once site is cleared to confirm.

Existing headwall to be removed.
Existing headwall in Plot L to be removed.
Existing culvert to be grubbed out and
abandoned.

Note:
Existing ditch levels
to be reduced locally
to suit Headwall IL.

100yr + 45% climate change flood
volume = c.15m³. To be stored within
parking bays and drained back into SW
system via kerb drain. Approximate
0.10m depth.

Existing ditch to remain
unaffected by works.

100yr + 45% climate change flood volume
= c.103m³. To be stored within docks and
drained back into SW system via slot
drain. Approximate 0.200m depth.

FR1 -
SPEL STORMCEPTOR CLASS 1
FULL RETENTION SEPARATOR
MODEL P400 - 10/SC OR
SIMILAR APPROVED.
CATCHMENT AREA PROVIDED
= 4.730m²
CL 153.950m
IL 151.531m (in)
IL 151.481m (out)

100yr + 45% climate change flood
volume = 31m³. To be stored within
docks and drained back into SW system
via slot drain. Approximate 0.1m depth.

Existing SW MH 05 IL taken as 153.783m.
Proposed SW connection = 153.933m.
Information taken from Hydrock drawing 'C10303/270'.
Existing 375dia stub connection to be removed and
replaced with 525dia pipe. Existing manhole base
benching to be broken out and amended to suit larger
connecting pipe.

Connection shown subject to S106 approval.
Proposed drainage connection across carriageway is
to be undertaken in phases to ensure vehicle access
is maintained at all times to the Asda car park.
Traffic management proposals shall be designed,
implemented and managed by a suitably qualified
contractor in accordance with Chapter 8 of the Traffic
Signs Manual.

Existing FW stub connection IL taken as 153.223m.
Information taken from Hydrock drawing 'C10303/270'.
Existing stub connection to be retained - no works
required to existing manhole in carriageway.

Connection shown subject to S106 approval.

PS2
CL 155.500m
Incoming IL = 152.000m
Design head = 3.5m
Design flow = To be
confirmed by M&E
consultant.
To be provided by
specialist.
Building Control to confirm
storage requirements.

F21 - Vented Chamber
CL 156.800m
IL 153.233m
To be constructed on line of existing
stub connection. Stub connection to
be retained - no works required to
existing manhole in carriageway.

PS1
CL 155.284m
Incoming IL = 151.358m
Design head = 3.5m
Design flow = 340l/s
To be provided by
specialist.
Building Control to confirm
if storage is required.

LOCATION OF SIPHONIC
RAINWATER PIPES, RAINWATER
PIPES, FOUL WATER POP-UPS
ARE TO BE CONFIRMED BY
ARCHITECT/SIPHONIC.
DESIGNER/ M&E ENGINEER

PROPOSALS ARE SUBJECT TO
APPROVAL

PROPOSALS ARE SUBJECT TO
CHANGE DURING DETAILED
DESIGN AND PROJECT TEAM
REVIEW

Important CDM / H&S note

The Designers would draw the readers attention to the key residual health and safety risks that have not been eliminated from the designs shown on this drawing by the design process. These key residual risks are identified below:

- Existing Drainage and Service Infrastructure not to be compromised.
- Care to be taken around deep excavations. Plant to be kept at safe distance.
- Moving plant. Care to be taken around site.
- Care to be taken when working in the vicinity of existing water features and in high ground water conditions.

Any construction personnel including operatives intending to construct the designs shown on this drawing should ensure that they have been regularly and thoroughly briefed by the principal Contractor on all health and safety matters and have had sight of:

- The full Designers and Contractors risk assessments and risk registers.
- The developed construction health and safety plan.
- The Contractors construction method statements.

Hazards that are obvious to a competent Contractor are not shown, as are every day and low risk hazards.

Drainage Assumptions:

Roof drainage :
Subject to confirmation from the Client / Architect it is understood that roof drainage will be siphonic. Details of any siphonic systems (including flow rates) to be confirmed by specialist supplier.

Discharge flow rates :
The Site is being built out under the Outline Planning Permission 14/00542/OUT.

The Kingsway Business Park sewer network has capacity to convey surface water from the development site for all storm events up to the 1 in 100 year return period without flooding.

The discharge rate for the development is limited by the 792l/s agreed flow rate for the site.

Attenuation strategy :
It is currently envisaged that storm water storage, in addition to the volume provided in the site drainage network, due to the attenuation flows will not be required to accommodate the 100 year plus 20% climate change storm events.

Storage is required for the 100yr + 45% climate change event.

Proposed foul drainage strategy:

Existing drainage :
The Kingsway Business Park sewer network has capacity to convey foul water from the development site.

A spur to the network was provided for the site to the sewer at the time of construction.

Proposed drainage :
It is envisaged that foul flows from the site will be able to discharge by a gravity connection to the off-site sewers for Plot J1 and will require pumping for Plot J2.

General drainage :

Pumped solutions are currently used for both surface water and foul water connections for Plot J2. Detailed pump assessment, design and specification to be confirmed by proprietary supplier / MEP Engineer.

FEH2013 rainfall has been used as part of the surface water design calculation to show that the proposed drainage system has capacity for 1:100 year return period plus a 45% increase for the potential effects of climate change within the Reserved Matters red line boundary.

Notes

- Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
- This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
- All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
- Any discrepancies noted on site are to be reported to the engineer immediately.
- For site plan refer to DLA Architecture drawing '2022-052_KPJ-DLA-JS-XX-DR-A-90066_RevP 08_SITE PLAN' dated 09.03.23.
- For topographical survey refer to BWB drawings 'KBP-BWB-00-ZZ-M3-G-001-Existing_Site_3D_Model' & dated 07/06/22.
- For drainage notes refer to BWB drawing 'KPJ-BWB-XX-XX-DR-D-0001_Civil Engineering Notes'.

Key Plan

Proposed Drainage Key

- Proposed Surface Water Drainage
- Channel Drain
- Kerb Drain
- Slot Drain - QMax
- Filter Drain
- Surface Water Rising Main
- Back of Wall Drainage
- Gully
- Rain Water Pipe
- Siphonic Rain Water Pipe
- Secondary Siphonic Rain Water Pipe
- Channel Drain Sump
- Surface Water Vented Access Chamber
- Surface Water Flow Control Chamber
- Surface Water Catchpit
- Surface Water Rodding Eye
- Headwall
- Surface Water Pumping Station
- Full Retention Interceptor
- Bypass Interceptor
- Petrol Interceptor Vent Pipe
- Cellular Attenuation Tank
- Indicative Area of Surface Water Flood containment
- Proposed Foul Sewer Drainage
- Foul Sewer Rising Main
- Foul Sewer Vented Access Chamber
- Foul Back Drop
- Internal Floor Gully
- Foul Rodding Eye
- Foul Pop Up
- Sprinkler Tank Drain Down
- Foul Pumping Station

Existing Drainage Key

- Surface Water Drainage
- Foul Sewer Drainage
- Existing Drainage To Be Removed

P08	31.03.23	Updated to suit latest site layout	SM	PJL
T06	22.03.23	Tender Issue	IB	PJL
P07	22.03.23	Site boundary updated in line with architects plan	IB	PJL
P08	17.03.23	Updated to suit architects latest site layout	EN	PLJ
T05	03.02.23	Additional detail added - Refer to Rev clouds	MH	JR
T04	02.02.23	Refer to Rev clouds	UK	JR
T03	17.01.23	Refer to Rev clouds	UK	JR
T02	06.12.22	Tender Issue	UK	JR
P05	06.12.22	Drainage layout updated to suit levels changes.	UK	JR
P04	01.12.22	For Planning Issue	UK	JR
T01	01.12.22	For Tender Issue	UK	JR
P03	21.07.22	Pumping storage requirement notes updated	JT	JR
P02	19.07.22	Bund drainage added	JT	JR
P01	15.07.22	For Planning	JT	JR
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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Client

Wilson Bowden

Project Title

Plot J2 Kingsway Business Park

Drawing Title

Proposed Drainage Layout

Drawn:	J Taylor	Reviewed:	J Roberts
BWB Ref:	220810	Date:	July 22

Scale@A1: 1:500

Drawing Status

Planning

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
KPJ-BWB-DGG-XX-DR-D-0500	S2	P08

APPENDIX 10: SuDS O&M Manual

TECHNICAL NOTE

Kingsway Business Park Plot J2 Drainage O&M Manual



1.0 Introduction

- 1.1. The proposed drainage system for Kingsway Business Park Plot J2 adopts a series of drainage features to collect and convey storm water discharge. It is important that the site owner maintains the drainage to ensure that the drainage system elements operate effectively for their lifetime.
- 1.2. This site drainage strategy will be incorporated within the Operation and Maintenance (O&M) manual for the site and be accessible to those who undertake maintenance. This document should be read in conjunction with the drainage system drawings.

2.0 Overview of Maintenance

- 2.1. All drainage systems, whether piped systems or SuDS systems require regular maintenance. The maintenance of the drainage system at Kingsway Business Park Plot J2 should be included alongside other regular maintenance tasks. The table below gives an overview of typical maintenance tasks and the frequency with which they need to be undertaken.

Activity	Indicative Frequency	Typical Tasks
Routine / regular maintenance	Monthly to annually (for normal care of SuDS)	Litter picking Inspections
Occasional maintenance	Annually (dependent on the design)	Sediment removal Vegetation management
Remedial maintenance	As required (tasks to repair problems due to damage or vandalism)	Inlet/outlet repair Erosion repairs Reinstatement works Reinstatement following pollution Removal of silt build up
Unplanned incidents	As required as reactive measures for unforeseen accidents/spillages	

TECHNICAL NOTE

Kingsway Business Park Plot J2 Drainage O&M Manual



- 2.2. The below table lists the drainage features present on the Kingsway Business Park Plot J2 site and provides a description of their function and design criteria.

Component	Function
Channel Drains	Channel drains are located at low points on the hardstanding external to collect surface water run-off and connect into the underground drainage system. A silt trap is located at the outfall of the channel drain to collect silt and debris prior to entering the underground surface water drainage system.
Gullies	Gullies are located at low points on the hardstanding external to collect surface water run-off and connect into the underground drainage system. A silt trap is located the base of the gully to collect silt and debris prior to entering the underground surface water drainage system.
Filter Drains	A stone filled trench with a perforated pipe at the bottom which collects, cleans and stores runoff before conveying the water to the downstream drainage system.
Geocellular Attenuation Tank	A modular cellular below-ground voided structure wrapped in an impermeable membrane, to prevent water seeping into the surrounding ground, which attenuates surface water flow prior to discharge from the site.
Vortex Control	A self-activating device that regulates the flow of water through the device depending on the height of the water above the opening (hydraulic head) by creating a swirling vortex flow which restrict discharge rates from the site.

- 2.3. The required maintenance for each of the drainage components that make up the drainage system is scheduled below.

3.0 Maintenance Guidance

- 3.1. The following maintenance guidance for the drainage system at Kingsway Business Park Plot J2 is based on CIRIA C753 – The SuDS Manual. These O&M requirements are to be continually monitored by the body responsible for the operation and maintenance of below ground drainage and SuDS features and modified as necessary to suit requirements of the site once operational.
- 3.2. All inspections should comply with all relevant Health and Safety legislation (Health and Safety at Work Regulations, 1999) including the development of risk assessments for working close to or in water.
- 3.3. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. In the majority of cases, it will be acceptable to distribute the sediment on site if there is an appropriate safe and acceptable location to do so.

4.0 Channel Drains

4.1. Maintenance requirements for channel drains are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Litter and debris removal	Monthly
	Check channel grating is secure and undamaged	Monthly
	Strim vegetation 1m min. Surround to channel drains and keep areas free from silt and debris	Monthly (during growing season)
	Undertake inspection of channel drains after leaf fall in autumn	As required
Occasional maintenance	Repair physical damage if necessary	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Monitoring	Inspect structures for evidence of poor operation.	Monthly/after large storms
	Inspect silt accumulation rates and establish appropriate removal, frequencies.	Half yearly
Incident remediation	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event

5.0 Gullies

5.1. Maintenance requirements for gullies are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Litter and debris removal	Monthly
	Strim vegetation 1m min. Surround to gullies and keep areas free from silt and debris	Monthly (during growing season)
	Undertake inspection of gullies after leaf fall in autumn	As required
Occasional maintenance	Repair physical damage if necessary	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Monitoring	Inspect structures for evidence of poor operation.	Monthly/after large storms
	Inspect silt accumulation rates and establish appropriate removal, frequencies.	Half yearly
Incident remediation	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event

TECHNICAL NOTE

Kingsway Business Park Plot J2
Drainage O&M Manual



6.0 Filter Drains

6.1. Maintenance requirements for filter drains are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Remove weeds on trench surface	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
	Removal and washing of exposed stones on the trench surface	Bi-annually or when silts is evident on surface
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required
Remedial maintenance	Clear perforated pipework blockages.	As Required
	Rehabilitate infiltration and filtration surfaces.	As Required
	Replace	As Required
	Replace geotextiles and clean and replace filter media, if clogging occurs.	As Required
Monitoring	Inspect pre-treatment systems, inlets, trench surfaces and perforated pipework for silt accumulation. Establish appropriate silt removal frequencies	Half Yearly
Incident remediation	Remove surface geotextile and replace, and wash or replace overlying filter medium	After spillage event
	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event

TECHNICAL NOTE

Kingsway Business Park Plot J2
Drainage O&M Manual



7.0 Geocellular Attenuation Tanks

7.1. Maintenance requirements for the geocellular attenuation tanks are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Inspect surface structures removing obstructions and silt as necessary. Check there is no physical damage	Annually, after major storm event, or as required
	Remove debris from the catchment surface (where it may cause risks to performance)	Annually, after major storm event, or as required
	Remove sediment from pre-treatment structures and/or internal forebays	As required
Remedial maintenance	Repair physical damage if necessary	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Monthly/after large storms
	Survey inside of tank for sediment build-up and remove if necessary.	Half yearly
Incident remediation	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event
	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event

TECHNICAL NOTE

Kingsway Business Park Plot J2 Drainage O&M Manual



8.0 Control Chambers

- 8.1. Maintenance requirements for control chambers (vortex control and orifice) are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Inspect surface structures removing obstructions and silt as necessary. Check there is no physical damage	Annually, after major storm event, or as required
	Remove control manhole cover and inspect ensuring water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt	Annually, after major storm event, or as required
	Undertake inspection of control chamber after leaf fall in autumn	As required
Occasional maintenance	Repair physical damage if necessary	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Monitoring	Inspect structures for evidence of poor operation.	Monthly/after large storms
	Inspect silt accumulation rates and establish appropriate removal, frequencies.	Half yearly
	Check flow control device is functioning and that the emergency drain down mechanism is working.	Half yearly
Incident remediation	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event
	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event

TECHNICAL NOTE

Kingsway Business Park Plot J2
Drainage O&M Manual



9.0 Flood Routes

- 9.1. Flood routes (exceedance routes) allow water volumes that exceed the capacity of the drainage system to pass through or round the site without causing damage to property. These routes must be clear of obstructions at all times.
- 9.2. Maintenance requirements for flood routes are given in the below table.

Maintenance Activity	Action Required	Frequency
Regular maintenance	Make visual inspection. Check route is not blocked by new fences, walls, soil or other rubbish. Remove as necessary	Monthly/after large storms

TECHNICAL NOTE

Kingsway Business Park Plot J2
Drainage O&M Manual



10.0 Proprietary Devices

- 10.1. Maintenance and inspection of proprietary devices, such as oil separators & pumping stations, should follow the advice provided by the manufacturer or supplier and should be included on the maintenance schedule for the site.
- 10.2. All proprietary devices should be checked during the first year of operation to make sure they are appropriate for the operation

TECHNICAL NOTE

Kingsway Business Park Plot J2
Drainage O&M Manual



11.0 Spillage - Emergency Action

- 11.1. Most spillages on development sites are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown in a treatment system. Therefore small spillages of oil or other known organic substances should be removed where possible using soak mats as recommended by the Environment Agency with residual spillage allowed to bio-remediate in the drainage system.
- 11.2. In the event of a serious spillage, either by volume or of unknown or toxic compounds, the spillage should be isolated with soil, turf or fabric and the penstocks located in the manholes up and downstream of the ponds should be closed. If the spillage occurs upstream of the ponds outlet pipes from manhole chamber(s) downstream of the spillage should be blocked with a bung(s). (A bung for blocking pipes may be made by wrapping soil or turf in a plastic sheet or close woven fabric.)
- 11.3. During a major spillage the Environment Agency should be contacted immediately

APPENDIX 11: North West SuDS Proforma

NORTH WEST SuDS PRO-FORMA TEMPLATE

Document Change Log		
Version	Date Agreed	Changes made
Version 1	April 2020	Initial version issued
Version 2	July 2020	- Page 1 – ‘Guidance to support you’ section – word ‘approved’ changed to ‘appropriate’ - Section 5 – Box 4 ‘Evidence Required’ - word ‘approved’ changed to ‘appropriate’ - Section 5 – Box 9 ‘Summarise how storage will be provided for 1 in 100 year (plus climate change) event on site’ - word ‘approved’ changed to ‘appropriate’
Version 3	August 2020	- Front sheet and Document Change Log added - Page 1 – Para 1 Footnote – words ‘of 0.5 hectares’ removed
Version 4	July 2021	- Front page amended and branding removed. - Section 1 - Previously Developed/ Brownfield Site – words ‘<i>then one of the approaches outlined in Section 24.5 of The SuDS Manual (C753) should be adopted</i>’ removed. - Section 7b – Hierarchy Level 2 – Note wording amended from ‘<i>Where third party land is cited as a barrier, you should provide visibility of discussions held to date with the riparian landowner of the waterbody</i>’ to ‘<i>Where discharge of any element in the hierarchy is discounted, an applicant should provide justification. If the reasoning for discounting a discharge of surface water to watercourse relates to issues associated with third party land or the securing of any other required consent, it may be necessary for the applicant to provide evidence to the local planning authority to support their proposed approach</i>’
Version 5	May 2022	Pro-forma guidance updated to take account of the new climate change allowances published on 10 May 2022. There is no change to the pro-forma itself.

Website: [The Flood Hub](#)

This website is an online resource which has been funded by the North West Regional Flood and Coastal Committee as a one stop shop for flood advice and information across the North West.

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[PLEASE ADD LOCAL AUTHORITY LOGO TO THIS PAGE]

[*LOCAL AUTHORITY*] SuDS PRO-FORMA

This Pro-forma is endorsed by the North West Regional Flood and Coastal Committee, including representatives from Lead Local Flood Authorities, Highway Authorities, United Utilities and the Environment Agency

[Amend as appropriate]

NORTH WEST SuDS PRO-FORMA

This pro-forma is a requirement for any planning application for major development¹.

It supports applicants in summarising and confirming how surface water from a development will be managed sustainably under current and future conditions.

Your sustainable drainage system should be designed in accordance with [CIRIA The SuDS Manual C753](#) and any necessary adoption standards.

HOW TO COMPLETE

Blue Box	Instruction/ Question
Orange Box	Evidence Required
White Box	To be completed by Developer / Consultant

1. Complete ALL white boxes
2. Submit this pro-forma to the Local Planning Authority, along with:
 - Sustainable Drainage Strategy
 - Site Specific Flood Risk Assessment (if required)
 - Minimum supporting evidence, as indicated in orange boxes of this pro-forma.

GUIDANCE TO SUPPORT YOU

The pro-forma should be completed in conjunction with ‘Completing your SuDS Pro Forma Guide.’

The pro-forma can be completed using freely available tools such as [Tools for Sustainable Drainage Systems](#) or appropriate industry standard surface water management design software.

¹ as defined in Section 2 of [Statutory Instrument 2015 No. 595](#) or on sites in Critical Drainage Areas.

SECTION 1. APPLICATION & DEVELOPMENT DETAILS

Planning Application Reference <i>(if available)</i>		
State type of planning application <i>i.e. Pre-application, Outline, Full, Hybrid, Reserved Matters*</i> *Information only required if drainage is to be considered as part of reserved matters application	Full	
Developer(s) Name:	Wilson Bowden Developments Ltd	
Consultant(s) Name:	BWB Consulting	
Development Address <i>(including postcode)</i>	Kingsway Business Park, Rochdale, OL16 4NR	
Development Grid Reference <i>(Eastings/Northings)</i>	391300, 411400	
Total Development Site Area (Ha)	5.43ha (approx)	
Drained Area (Ha)* of Development	3.504ha	
Please indicate the flood zone that your development is in. Tick all that apply. <i>Based on the Environment Agency Flood Map for Planning and the relevant Local Authority Strategic Flood Risk Assessment (to identify Flood Zones 3a/3b).</i>	Flood Zone 1 ☒ Flood Zone 2 ☐ Flood Zone 3a ☐ Flood Zone 3b ☐	
What is the surface water risk of the site? Tick all that apply. <i>Based on the Environment Agency Surface Water Flood Map.</i>	High ☒ Medium ☒ Low ☒	
Have you submitted a Site Specific Flood Risk Assessment (FRA)? <i>See separate guidance notes for clarification on when a FRA is required</i>	Yes ☒ No ☐	
Have you submitted a Sustainable Drainage Strategy?	Yes ☒ No ☐	
Does your drainage proposal provide multi-functional benefits via SuDS?	Yes ☒ No ☐	
Expected Lifetime of Development <i>(years)</i> <i>Refer to Planning Practice Guidance "Flood Risk and Coastal Change" Paragraph 026</i>	60	
Development Type:		State Proposed Number of Units
Greenfield Site Site is wholly undeveloped, and a new drainage system will be installed	☒	2
Previously Developed/ Brownfield Site - Site is already developed, and the <u>entirety</u> of the existing surface water drainage system will be used to serve the new development (evidence must be provided to prove existing surface water drainage system is reusable); <u>OR</u> - Where records of the previously developed system are not available so that the hydraulic characteristics of the system cannot be determined or where the drainage system is not in reasonable working order i.e. broken, blocked or no longer operational for other reasons.	☐	
Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 1.	KPJ-BWB-ZZ-XX-RP-CD-0001_SDS KPJ-BWB-ZZ-XX-RP-YE-0001_FRA	

SECTION 2: IMPERMEABLE AREA AND EXISTING DRAINAGE

	Existing (E)	Proposed (P)	Change (P – E)
State Impermeable Area (Ha)	0	3.504	3.504
Evidence Required: Plans showing development layout of site with existing and proposed impermeable areas.			☒

Are there existing sewers, watercourses, water bodies, highway drains, soakaways or filter drains on the site?	Yes ☐ No ☒ Don't Know ☐
Evidence Required: Plan(s) showing existing layout to include all: - Watercourses, open and culverted - Water bodies – ponds, swales etc. - Sewers, including manholes - Highway drains, include manholes, gullies etc. - Infiltration features - soakaways, filter drains etc.	There is watercourse beyond the eastern boundary and an extensive network of UU sewers serving the existing business park

Drainage Design <u>Outline planning applications</u> should be able to demonstrate that a suitable drainage system is achievable. <u>All other type of planning application</u> should provide full details or reference to previous planning application where drainage details have been submitted or approved.	
Select which design approach you are taking to manage water quantity (refer to Section 3.3 SuDS Manual)	
Approach 1 – Volume control / Long Term Storage (Technical Standards S2/3, S4/5) - The attenuated runoff volume for the 1 in 100 year 6 hour event (plus climate change allowance) is limited to the greenfield runoff volume for the 1 in 100 year 6 hour event, with any additional runoff volume utilising long term storage and either infiltrated or released at 2 l/s/ha - The discharge rate for the critical duration 1 in 1 year event is restricted to the 1 in 1 year greenfield runoff rate - The discharge rate for the critical duration 1 in 100 year event (plus climate change allowance) is restricted to the 1 in 100 year greenfield runoff rate	☐
Approach 2 – Qbar (Technical Standards S6) Justification has been provided that the provision of volume control/long term storage is not appropriate and an attenuation only approach is proposed. All events up to the critical duration 1 in 100 year event (plus climate change allowance) are limited to Qbar (1 in 2 year greenfield rate) or 2 l/s/ha, whichever is greater.	☒
Evidence Required: Plans showing: - Existing flow routes and flood risks - Modified flow routes - Contributing and impermeable areas - Current (if any) and proposed 'source control' and 'management train' locations of sustainable drainage components (C753 Chapter 7) - Details of drainage ownership - Details of exceedance routes (Technical Standards S9) - Topographic survey - Locations and number of existing and proposed discharge points	☒

Note consideration should be given to manage surface water from both impermeable and permeable surfaces (including gardens and verges) likely to enter the drainage system.

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 2.

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SECTION 3: PEAK RUNOFF RATES – TECHNICAL STANDARDS S2, S3 AND S6 (UNLESS S1 APPLIES)

Rainfall Event	Existing Rate (l/s)	Greenfield Rate (l/s)	Proposed Rate (l/s) <i>Previously developed sites - In line with S3 should be equivalent to Greenfield runoff rates – discuss with LLFA if this is not achievable pre-application</i>
Qbar (Approach 2)	Proposed flow rates have been set to discharge at the 1 in 100yr event in line within the wider strategy.	2.5	-
1 in 1 Year Event (Approach 1)	Downstream controls restrict the entire development to the equivalent greenfield rates on a catchment basis.	2.1	320.4
1 in 30 Year Event		4.2	(+40% cc) 684.6
1 in 100 Year Event* (Approach 1)		5.1	(+45% cc) 792.0
* Total discharge at the 1 in 100 year rate should be restricted to the greenfield runoff volume for the 1 in 100 Year 6 hour event with additional volumes (long-term storage volume) released at a rate no greater than 2 l/s/ha where infiltration is not possible. The climate change allowance should only be applied to the proposed rate and not the existing or greenfield rate.			
Evidence Required: Methodology used to calculate peak runoff rate clearly stated and justified. Impermeable areas plan, supported by topographical survey confirming positive drainage. Hydraulic calculations and details of software used.			☒ ☒ ☒

State the hydraulic method used in your calculations
(Refer to Table 24.1 of The SuDS Manual)

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Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 3.

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SECTION 4: DISCHARGE VOLUME – TECHNICAL STANDARDS S4, S5 AND S6 (UNLESS S1 APPLIES)

Rainfall Event	Existing Volume (m ³)	Greenfield Volume (m ³)	Proposed Volume (m ³)
1 in 100 Year 6 Hour Event <i>(Approach 1)</i>		351	2,419
Does the below statement apply to your development proposal? Long term storage is not achievable on this site and, in accordance with S6 of the Non Statutory Technical Standards for SuDS, the surface water discharge rates for events up to and including the 1 in 100 year critical event are limited to Qbar (Approach 2)			Yes ☒ No ☐
Evidence Required: Approach to managing the quantity of surface water leaving the site clearly stated and justified Methodology used to calculate discharge volume clearly stated and justified. Hydraulic calculations and details of software used.			☒ ☒ ☒

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 4.	KPJ-BWB-ZZ-XX-RP-CD-0001_SDS
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SECTION 5: STORAGE – TECHNICAL STANDARDS S7 AND S8

State climate change allowance used (%)	45
State housing density (houses per ha)	N/A
State urban creep allowance used (%)	N/A
Evidence Required: State / used in appropriate industry standard surface water management design software.	☒

State storage volume required (m³) (excluding non-void spaces) <i>Must include an allowance for climate change and urban creep</i>	100m ³ plus oversized pipes and manholes to provide additional storage
Have you incorporated interception into your design? <i>(Refer to Chapter 24 of The SuDS Manual C753)</i> <i>Where possible, infiltration or other techniques are to be used to try and achieve zero discharge to receiving waters for rainfall depths up to 5mm.</i>	Yes ☐ No ☒
Evidence Required: Drainage plans showing location of attenuation and all flow control devices and supporting calculations.	☒

Summarise how storage will be provided for 1 in 30 year event on site. <i>Storage must be designed to ensure that at no flooding occurs onsite in a 1 in 30 year event except in designed areas and no flooding occurs offsite in a 1 in 100 year (plus climate change allowance) event.</i>	Sufficient storage is provided within the pipes and manholes provided as part of the network
Summarise how storage will be provided for 1 in 100 year (plus climate change) event on site. <i>Where storage above the 1 in 30 year rainfall event is provided in designated areas designed to accommodate excess surface water volumes, plans showing storage locations and surface water depths and supported by calculations used in appropriate industry standard surface water management design software. It is important to run a range of duration events to ensure the worst case condition is found for each drainage element on the site</i>	Sufficient storage is provided within the pipes and manholes provided as part of the network. Unit J1 also incorporates a below ground attenuation tank of 100m ³
Evidence Required: Plans showing size and location of storage and supporting calculations. Where there is controlled flooding, extents and depths must be indicated.	☒

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 5.	KPJ-BWB-ZZ-XX-RP-CD-0001_SDS
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SECTION 6: WATER QUALITY PROTECTION

Contaminated surface water run-off can have negative impacts on the quality of receiving water bodies. The potential level of contamination will influence final the design of an appropriate treatment train as part of your sustainable drainage system.

Is the proposal site known to be or potentially contaminated?	Yes ☐	No ☒
If the site is contaminated, it should be demonstrated that the sustainable drainage system will not increase the risk of pollution to controlled waters through the mobilisation of contaminants and/or creation of new pollution pathways.		

Confirm the Pollution Hazard Level of the proposed development - Tick <u>ALL</u> that apply <i>Refer to Pollution Hazard Indices for different Land Use Classifications in Table 26.2 of The SuDS Manual C753 for further guidance.</i>		
Pollution Hazard Level <i>Tick <u>ALL</u> that apply</i>		Surface water run-off from the proposed development will drain from:
VERY LOW	☐	Residential roofs
LOW	☒	- Other roofs (typically commercial/industrial roofs) - Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, home-zones and general access roads) - Non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day
MEDIUM	☒	- Commercial yard and delivery areas - Non-residential car parking with frequent change (e.g. hospitals, retail) - All roads except low traffic roads and trunk roads/motorways²
HIGH	☐	- Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites) - Sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured - Industrial sites - Trunk roads and motorways¹

If the development's Pollution Hazard Level is 'Very Low' or 'Low', has the sustainable drainage design been risk assessed and appropriate mitigation measures included?	Yes ☒	No ☐
If the proposed development has a very low or low polluting potential, you should design your sustainable drainage system to include an appropriate treatment train in accordance with The SuDS Manual (C753).		

If the development's Pollution Hazard Level is 'Medium' or 'High', is the application supported by a detailed water quality risk assessment?	Yes ☒	No ☐
- If the proposed development has a high polluting potential, a detailed risk assessment <u>will</u> be required to identify an appropriate SuDS treatment train and ensure compliance with Paragraph 170 of the National Planning Policy Framework. - If the proposed development has a medium polluting potential, a detailed risk assessment <u>may</u> be required depending on the nature, scale and location of the development.		

Has pre-application advice on water quality been obtained from the Environment Agency?	Yes ☐	No ☒
If YES, provide details:		

² Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 6.

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SECTION 7: DETAILS OF YOUR SUSTAINABLE DRAINAGE SYSTEM

a) Function of your Sustainable Drainage System

Do your proposals store rainwater for later use (as a resource)?	Yes ☐ No ☒
Evidence Required: Please provide a brief sentence in the adjacent white box to describe how this function has been achieved.	

Do your proposals promote source control to manage rainfall close to where it falls? (e.g. promoting natural losses through soakage, infiltration and evapotranspiration)	Yes ☒ No ☐
Evidence Required: Please provide a brief sentence in the adjacent white box to describe how this function has been achieved.	On-plot attenuation is provided before water discharges to the downstream network which provides further attenuation at the existing ponds

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 7a.

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b) Hierarchy of Drainage Options – Planning Practice Guidance

The proposed method of discharge are set out within order of priority. Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

Proposed method of surface water discharge		Is this proposed?	
Hierarchy Level 1: Into the ground (via infiltration)		Yes ☐ No ☒	
If YES - Evidence Required		If NO – Evidence Required Tick ALL that apply	
☐	A. Completed Infiltration Checklist from The SuDS Manual (C753) Appendix B <i>An editable version of this form is available on SusDrain website.</i>	☒	A. Site investigation to demonstrate that the ground is not free draining. Test results to be provided in accordance with: - The methodology within BRE 365 (2016), OR - Falling head permeability tests BS EN ISO 22282-2: 2012
☐	B. British Geological Survey (BGS) Infiltration SuDS Map	☒	B. NOTE: where an applicant is unable to access a site to undertake testing, e.g. where unable to access a site for an outline application, they can submit a SuDS GeoReport or similar.
☐	C. Infiltration testing to BRE 365 (2016) or falling head permeability tests to BS EN ISO 22282-2: 2012 (optional for outline)	☒	C. Evidence to confirm that infiltration to ground would result in a risk of deterioration to ground water quality.
☐	'Plan B' sustainable drainage plan and statement of approach with an alternative discharge method, in case infiltration proposals are proven not feasible upon	☒	D. Geotechnical advice from a competent person* which determines that infiltration of water to ground would pose an unacceptable risk of geohazards to the site and/or local area.

	further site specific ground investigation e.g. to consider seasonal variations to groundwater.		<i>*Note: Competent person may include a Chartered Engineer, Chartered Geologists, Registered Ground Engineering Professionals (RoGEP).</i>
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Proposed method of surface water discharge		Is this proposed?	
Hierarchy Level 2: To a surface water body <i>(select type)</i> NOTE: Consent from LLFA or Permit from Environment Agency may be required – refer to guidance		Yes ☐ No ☒ N/A ☐	
		☐ Main river ☐ Ordinary watercourse	☐ Canal ☐ Other water body
If YES - Evidence Required		If NO – Evidence Required Tick ALL that apply	
☐ Surface water body / watercourse survey and report	☒ Plan showing nearby watercourses and waterbodies AND ☒ Statement providing justification in your Sustainable Drainage Strategy <i>Note: Where discharge of any element in the hierarchy is discounted, an applicant should provide justification. If the reasoning for discounting a discharge of surface water to watercourse relates to issues associated with third party land or the securing of any other required consent, it may be necessary for the applicant to provide evidence to the local planning authority to support their proposed approach.</i>		

Proposed method of surface water discharge		Is this proposed?	
Hierarchy Level 3: To a surface water sewer or highway drain <i>(select type)</i>		Yes ☒ No ☐ N/A ☐	
		☒ Surface water sewer	☐ Highway drain
If YES - Evidence Required		If NO – Evidence Required Tick ALL that apply	
☒ Written correspondence from Water and Sewerage Company/ Highway Authority regarding proposed connection.	☐ Plan showing nearby sewers and highway drains AND ☐ Statement providing justification in your Sustainable Drainage Strategy		

Proposed method of surface water discharge		Is this proposed?	
Hierarchy Level 4: To combined sewer		Yes ☐ No ☐ N/A ☒	
If YES - Evidence Required		If NO – Evidence Required	
☐ Written correspondence from Water and Sewerage Company	N/A		

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 7b.	KPJ-BWB-ZZ-XX-RP-CD-0001_SDS
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c) Proposed SuDS Component Types

	Tick ALL that apply				
Within property boundary	☐ Rainwater harvesting	☐ Green/ blue roofs	☐ Pervious pavements [Type: A ☐ B ☐ C ☐	☐ Soakaway	☐ Bio retention systems

	Tick ALL that apply				
Within development site boundary (not property)	☐ Infiltration system [Type: ☐ Surface level ☐ Below ground]		☐ Filter strips	☒ Filter drains	☐ Swales
	☐ Bio retention system	☐ Detention basins	☐ Ponds and wetlands	☒ Attenuation tanks/ Oversized pipes	☒ Other (state below)
	If 'Other' please state: Due to the nature of the development a number of separators are proposed to treat flows leaving the higher risk areas.				

Off site (not within the boundary of the proposed development)	Please state: Further treatment, flow & volume control is provided by the downstream attenuation ponds prior to discharge into the wider catchment
--	--

I confirm that the above selected components have been designed in accordance with The SuDS Manual (C753).	I confirm ☒
I confirm that the management of flows resulting from rainfall in excess of a 1 in 100 year plus climate change rainfall event, and their exceedance route(s), has been fully considered in order to minimise the risks to people, property (new and existing) and infrastructure.	I confirm ☒

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 7c.	KPJ-BWB-ZZ-XX-RP-CD-0001_SDS
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SECTION 8: OPERATION AND MAINTENANCE – TECHNICAL STANDARD S12 AND NATIONAL PLANNING POLICY FRAMEWORK

The applicant is responsible to ensure that ALL components selected in Section 7 can be maintained for the design life of the development. This information is required so the Local Planning Authority can ensure the maintenance and management of the sustainable drainage system. The Local Planning Authority will discuss how this will be secured (e.g. via planning condition or planning obligation).

	Information Provided?
Management Plan	Yes ☒ No ☐
Evidence Required: Plan/ drawing provided to show the position of the different SuDS components with: - Key included to identify any of the adopting bodies that you will be offering your sustainable drainage components for adoption (<i>relates to maintenance and management arrangements below</i>). - Plan/ drawing to identify any areas where certain activities are prohibited, detailing reasons why.	Refer to drainage drawing ☐
Action plan for accidental pollutant spillages.	☐

	Information Provided?
Maintenance Schedule	Yes ☒ No ☐
Evidence Required: A copy of the maintenance schedule including: Proactive and preventative maintenance Detailing regular, occasional and remedial maintenance activities including recommendations for inspection and monitoring. This should include recommended frequencies, advice on plant/ machinery required and an explanation of the objectives for the maintenance proposed and potential implications of not meeting them. Reactive and corrective maintenance (e.g. product repair and replacement). Including advice on excavations, or similar works, in locations that could affect the SuDS components/ adjacent structures.	☐

	Information Provided?
Maintenance and Management Arrangements	Yes ☒ No ☐
Evidence Required: Evidence of formal agreement with the party responsible for undertaking maintenance. Please select any of the adopting bodies that you will be offering your sustainable drainage components for adoption. Tick all that apply. ☐ Water and Sewerage Company Section 104 agreement (Water Industry Act 1991) ☐ Highway Authority Section 278/38 agreement (Highways Act 1980) ☐ Local Authority Public Open Space [Refer to Local Authority Policy] Please select the arrangement(s) for all non-adopted sustainable drainage components. Tick all that apply. ☒ Management Company ☒ Property Owner (for SuDS components within property boundary only) ☐ Other (please state) 	☐ Formal arrangements to be finalised prior to occupation

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 8.

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DECLARATION AND SUBMISSION

This pro-forma has been completed using evidence from information which has been submitted with the planning application.

The information submitted in the Sustainable Drainage Strategy and site-specific Flood Risk Assessment (FRA), where submitted, is proportionate to the site conditions, flood risks and magnitude of development and I agree that this information can be used as evidence to this sustainable drainage approach.

Submitter Details			
Completed by	Rowan Jobling	Email Address	rowan.jobling@bwbconsulting.com
		Telephone Number(s)	
Signed off by		Accreditation(s) and/or Qualification(s) of Signatory	BEng (Hons)
Date (dd/mm/yyyy)	14/08/22	Company	BWB Consulting

Client Details			
Name		Company	Wilson Bowden Developments Ltd

