

Caddick Developments, Knowsley

TECHNICAL NOTE

Response to LLFA Comments

DOCUMENT CONTROL SHEET

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Project: Knowsley

Document No: 22075-BGL-XX-XX-TN-D-00001

Title: Response to LLFA Comments

Status: P02

Date: 05.10.2022

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Document Revision Record

Version Number	Date	Revision Details
P01	05.10.2022	First Issue
P02	10.10.2022	Updated to suit client team comments

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Response to LLFA

The following technical note has been prepared by Burrows Graham Ltd. on behalf of their client Caddick Developments in response to the LLFA comments received in relation to application ref. 22/00348/FUL.

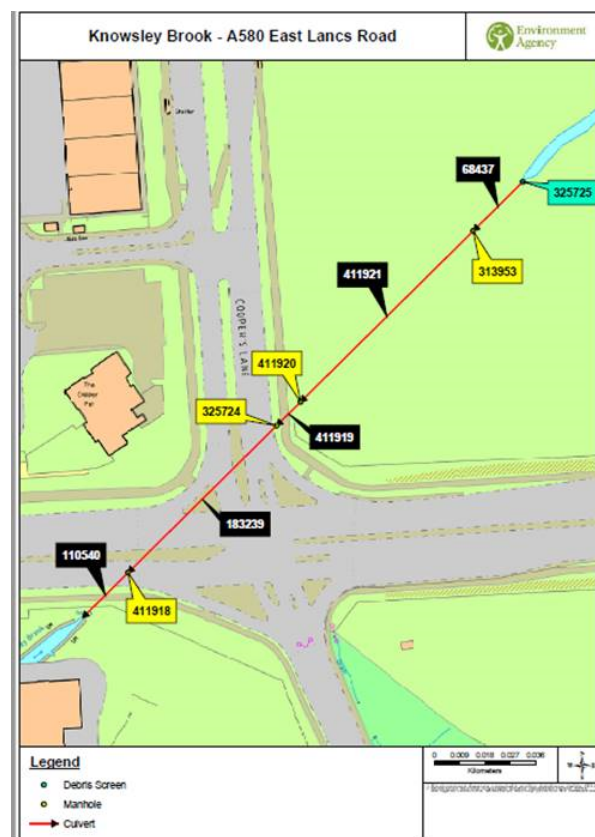
Reference should be made to the sitewide drainage strategy carried out by JPG and the flood risk assessment carried out by JBA.

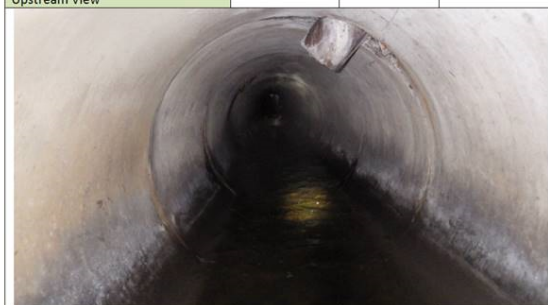
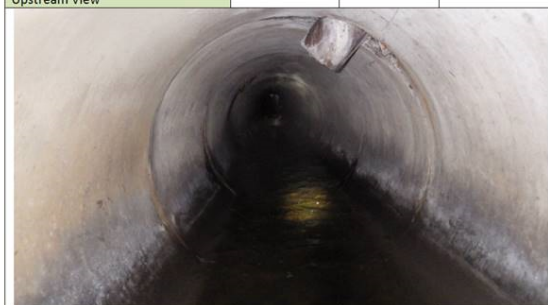
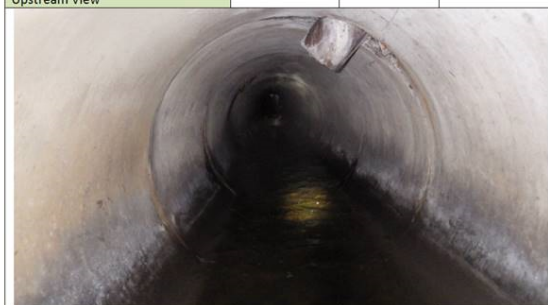
LLFA Comments	Burrows Graham Response
Evidence and justification will be required to demonstrate that in selecting drainage discharge destination, discharge hierarchy, taking into account the site geological and topographical characteristics, has been followed	The drainage strategy for this site follows the principles set out in the NPPG and CIRIA SuDS manual. There is an existing watercourse which runs through the northern part of the site, the topography of the site falls gently to the north which suggests that surface water currently discharges to this watercourse. It is the intention that post development scenario will mimic that of the predevelopment and discharge to the watercourse at greenfield runoff for all storm events, this provides a significant betterment to the existing scenario. Infiltration is not viable as outlined below.
The LLFA strongly advises the applicant to consider infiltration mechanisms as the discharge destination because the alternative solution be the discharge to a culverted section of the Knowsley Brook which is not an ideal solution,	Whilst infiltration is first choice in line with the SuDS hierarchy, it has been discounted for this strategy based on the site conditions. The site investigation shows the soil conditions for the site to be generally comprised of topsoil/made ground underlain by predominantly gravelly sandy clay with pockets of fine sand, the presence of clay was prominent in the nearest borehole/trial pits to the attenuation pond. The combination of clay and groundwater strikes at shallow depth across the site precludes the use of infiltration on the site.
No evidence has been provided to show that what will be happened to the existing land drains. From the proposed drainage system, it appears that some of the land drains will disappear after development. First, it must be demonstrated which one will be kept and which one will be removed; and second, justification will be required to ensure the removal of drains would not impact on natural land drainage and groundwater flooding given likely high groundwater levels at some points and times.	There is an existing watercourse that runs along the northern edge of the site. In conjunction with this, the landowner has implemented some land drainage around the site to help the site drain to the watercourse. These will no longer be required once the development is brought forward as all drainage will have a positive outfall. Although there is no evidence of upstream connectivity to the watercourse, it will still be diverted as part of the drainage proposals.

Should the discharge to the watercourse will be retained in the final design, a survey of the watercourse within the site and the culvert under Ormskirk Road will be required. Free flow conversance from the site to the outfall in Knowsley Brook should be demonstrated by a dye test. The reach from the outlet of the proposed attenuation pond to the Knowsley Brook should be modelled using blockage scenarios (up to 70%) of the culvert under Ormskirk Road for events up to the 100 years plus 40% climate change.

The topographical survey is within Appendix A. The cross-sectional area of the existing watercourse has been calculated to be circa 1.25 sq m on average. The outfall pipe has a cross sectional area of 0.04 sq m, therefore the watercourse is a sufficient size to receive the discharge from the development. The proposed discharge rate is 10.64 l/s based on impermeable area, this provides significant betterment on the existing scenario for all storm events.

As confirmed in the FRA, a dye test has been carried out by JBA which confirms the connectivity from the site watercourse to the Knowsley Brook (as shown below on the connectivity drawing and culvert CCTV). Blockage modelling has previously been undertaken by the EA on the receiving watercourse / culvert under the A580 up to a blockage of 75%. A range of design events and climate change uplifts are also applied as part of this analysis. The site is not at risk of flooding in any of the scenarios considered.



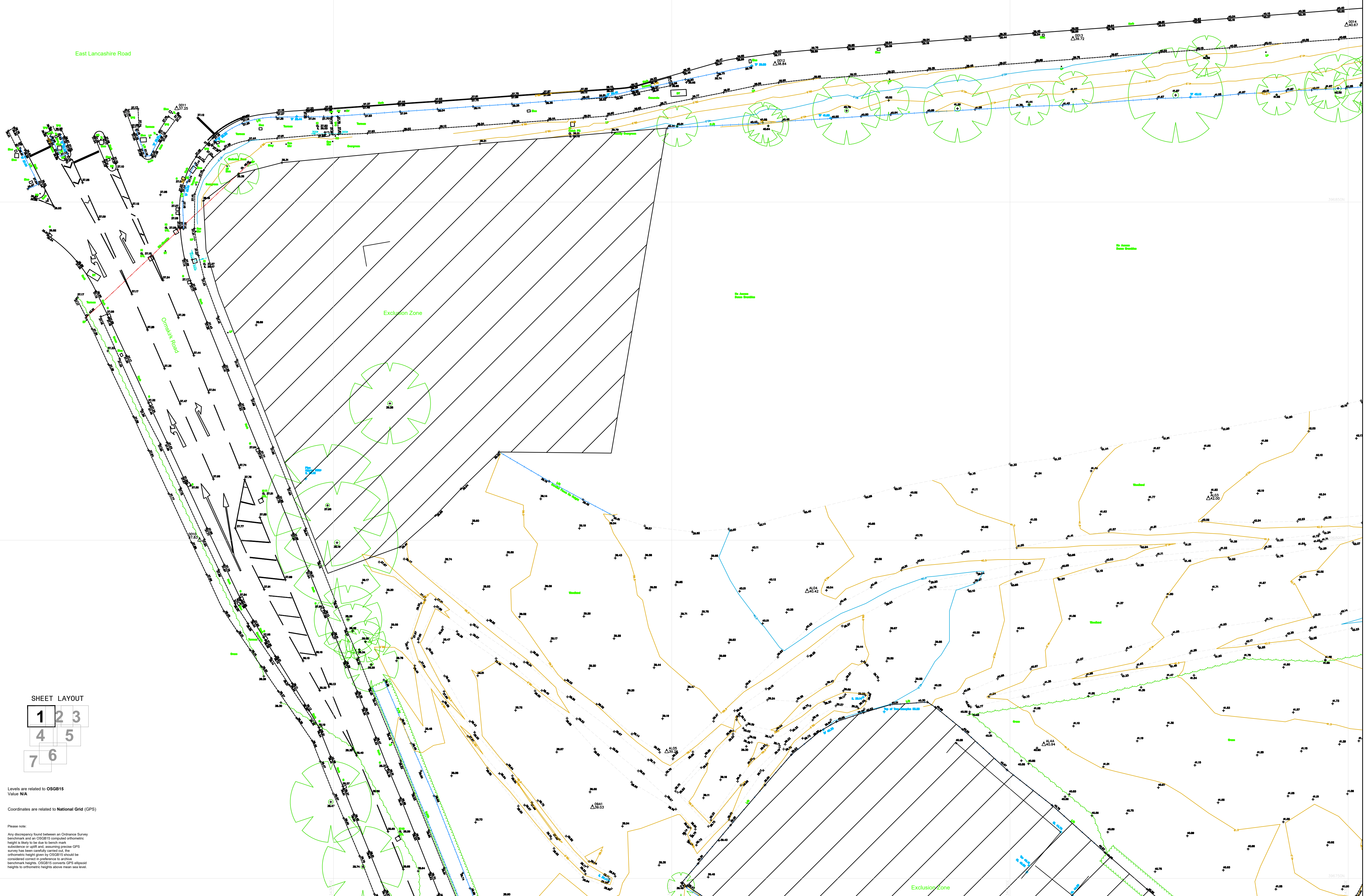
	<table><tr><td>AIMS ID: 183239 Asset Ref: 01214KNOW0101B18 Upstream View</td><td>Height (mm) 1200mm</td><td>Width (mm) 1200mm</td><td>Material Concrete Pipe</td></tr><tr><td colspan="4"></td></tr><tr><td>AIMS ID: 183239 Asset Ref: 01214KNOW0101B18 Downstream View</td><td>Height (mm) 1200mm</td><td>Width (mm) 1200mm</td><td>Material Concrete Pipe</td></tr></table>	AIMS ID: 183239 Asset Ref: 01214KNOW0101B18 Upstream View	Height (mm) 1200mm	Width (mm) 1200mm	Material Concrete Pipe					AIMS ID: 183239 Asset Ref: 01214KNOW0101B18 Downstream View	Height (mm) 1200mm	Width (mm) 1200mm	Material Concrete Pipe
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Should the discharge to the watercourse will be retained in the final design, the proposed permissible discharge rate of 16.46 l/s would be acceptable.	Noted. Proposed discharge rate is less than the max permissible.												
Subject to the discharge in the final design, the provision of evidence that the EA would agree with the connection point and water quality aspect for post-development situation will be required	EA to be consulted.												
An assessment of ground water levels and it's fluctuations will be required.	Groundwater monitoring has been providing in the SI produced by JPG, ref. 5570-JPG-XX-XX-RP-G-0602-S1-P01_Combined_Desk_Study_and_Ground_Investigation. A summary has been provided in Appendix E.												
Evidence of water quality should be provided	To be conditioned as agreed with the LLFA.												
Exceedance routes of surface water should be provided for the post development situation;	Exceedance flow path drawing is shown in Appendix B. This shows minor flooding contained on site for the 100 year plus 40% climate change event. We consider this acceptable.												
An evaluation of impact of potential failure of the drainage system (including risk assessment)	To be conditioned as part of maintenance plan.												
The feasibility and adequacy of the proposed drainage system under 1 in 2, 1 in 30, 1 in 100, and 1 in 100 plus 40% climate change impact should be simulated using Micro Drainage or similar approved hydraulic models	Hydraulic calculations provided within Appendix C.												
Detailed drainage scheme plan that shows the layout of the proposed drainage network, post development impermeable area, post development catchment areas to each SUD feature, location of storage (incl. connection points);	Detailed drainage layout within Appendix D. The manhole references are linked to the flow results in Appendix C.												
Summary Drainage Report setting out Drainage Strategy	It is proposed to discharge into the watercourse on site in line with the drainage hierarchy. The drainage strategy is in line with the outline strategy and principles set out in the FRA.												

	Sustainable Drainage Systems (SuDS) will be utilised in line with The SuDS Manual (C753) guidance and aim to minimise the impact a development has on the runoff quantity and quality and maximise amenity and biodiversity opportunities. The management train approach is a fundamental principle of SuDS, it aims to primarily reduce pollution, flow rates and volume of runoff from the site. The main objective is to treat the runoff as close to the source as possible and it is imperative that as many of the following should be included within the drainage strategy. - Prevention – The use of good site design and rainwater re-use measures to prevent runoff. - Source Control – Controlling the runoff as close to source as possible by using; green roofs, porous pavements and soakaways. - Site Control – Use of water management techniques within local area, i.e. detention basins and geo-cellular storage. - Regional Control – Management of water from a number of sites in a specific location, i.e. balancing ponds and wetlands. The drainage strategy for this development will incorporate site control in the form of flow control and associated attenuation pond. Water quality has been considered and the following measures have been included within the surface water drainage proposals: - All drainage from car park areas, which are considered low risk, will pass through either a Class 1 by-pass separator or a swale prior to discharging to the main attenuation pond, which will provide a second stage of treatment for all runoff from these areas. - All drainage from service yards, which are considered high risk, will pass through a Class 1 full retention separator prior to discharging to the main attenuation pond, which will provide a second stage of treatment for all runoff from these areas.
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	- All drainage from the site road and other hard surfaces will pass through the main attenuation pond, which will provide treatment for runoff from these areas. - Silt will be prevented from entering the system by the use of channels with silt traps and catch pits where required.
Construction details; and a timetable for implementation of works and an update to the management and maintenance plan if any changes made.	To be conditioned once contractor has preferred details and programme.

Based on the information provided within this report, we consider the comments to be addressed and planning can be granted with the conditions noted.

Appendix A – Topographical Survey

[illegible]

Unless otherwise stated:

DRAWING NOTES

Topographical Surveys

There are drawn to scale showing the average canopy spread. Descriptions and heights should be used in a guide only.

All building names, descriptions, number of stories, construction type including roof details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including: sizes, depth, description etc. will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to finished walls will be taken to the wall finishes at approx 1m above the floor level and will be assumed to be vertical.

General

The contractor must check and verify all sizes and building dimensions, levels, heights and drainage details and cover prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale applies. All measurements in inches are given unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

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Do not scale from this drawing.

Drainage/Services Legend

	Foul		CATV		CCTV
	Surface		E		Electric
	Combined		TH		Street lighting
	Drainage (unspecified)		TH		Traffic management
	British Telecom		QAS		Gas
	T		W		Water
	T		F		Fuel
	FT		U		Unknown / misc
	CATV		U		Ducting
	Utility Service Boundary		UTT		Untrace

Drainage pipe size data has been determined from the surface, in order to comply with confined spaces

Notes and explanations: Please refer to data as appropriate.

PAS128 Quality Level

Please refer to PAS128-02B Table 1. "Quality level of survey outputs (normality)" for an articulated category of quality levels.

All entries are located to PAS128-QL-02 unless otherwise stated.

The following table identifies the PAS128 quality level based on the test notes shown on the drawing:

Annotated drawing on drawing	PAS128 Quality Level
As-built from records	PAS128 QL-D
Trench survey, direct tunnel	PAS128 QL-D
Visual non-invasiveness to utility	PAS128 QL-C
Assumed route	PAS128 QL-B
Liveline to obtain depth	PAS128 QL-B3
QL-B3	PAS128 QL-B3
QL-B3P	PAS128 QL-B3P
QL-B3D	PAS128 QL-B3D
QL-B1P	PAS128 QL-B1P

Quality levels ending with a "P" refer to a quality that has been taken with post processing Ground Penetrating Radar (GPR).

Drawing controls, please refer:

- Using survey outputs in accordance with site procedures using approved detectors.

Depth data is limited by the accuracy of the detection equipment. Average accuracy is $\pm 10\%$ of depth with GPR and $\pm 10\%$ of the depth with electromagnetic technologies.

US procedure is required for utility undergrounds plans prior to and during the survey as a guide for the survey team.

In accordance with British Survey's national policy survey companies are not permitted to use any RT inspection chamber.

Drainage routes between manholes, if not able to be traced by SLS survey methodologies, are assumed to be direct lines between SLS survey

SURVEY CONTROL CO-ORDINATES				
STATION	EASTING	NORTHING	LEVEL	DESCRIPTION
0001	343855.60	345682.49	42.48	
0002	343811.15	345685.44	42.48	
0003	343766.79	345688.40	42.48	
0004	343722.43	345691.35	41.53	
0005	343678.07	345694.30	41.53	
0006	343740.13	345694.40	42.08	
0007	343695.77	345697.35	42.08	
0008	343651.41	345697.35	42.08	
0009	343607.05	345697.35	42.08	
0010	343562.69	345697.35	42.08	
0011	343518.33	345697.35	42.08	
0012	343473.97	345697.35	42.08	
0013	343429.61	345697.35	42.08	
0014	343385.25	345697.35	42.08	
0015	343340.89	345697.35	42.08	
0016	343296.53	345697.35	42.08	
0017	343252.17	345697.35	42.08	
0018	343207.81	345697.35	42.08	
0019	343163.45	345697.35	42.08	
0020	343119.09	345697.35	42.08	
0021	343074.73	345697.35	42.08	
0022	343030.37	345697.35	42.08	
0023	342986.01	345697.35	42.08	
0024	342941.65	345697.35	42.08	
0025	342897.29	345697.35	42.08	
0026	342852.93	345697.35	42.08	
0027	342808.57	345697.35	42.08	
0028	342764.21	345697.35	42.08	
0029	342719.85	345697.35	42.08	
0030	342675.49	345697.35	42.08	
0031	342631.13	345697.35	42.08	
0032	342586.77	345697.35	42.08	
0033	342542.41	345697.35	42.08	
0034	342498.05	345697.35	42.08	
0035	342453.69	345697.35	42.08	
0036	342409.33	345697.35	42.08	
0037	342364.97	345697.35	42.08	
0038	342320.61	345697.35	42.08	
0039	342276.25	345697.35	42.08	
0040	342231.89	345697.35	42.08	
0041	342187.53	345697.35	42.08	
0042	342143.17	345697.35	42.08	
0043	342098.81	345697.35	42.08	
0044	342054.45	345697.35	42.08	
0045	342010.09	345697.35	42.08	
0046	341965.73	345697.35	42.08	
0047	341921.37	345697.35	42.08	
0048	341877.01	345697.35	42.08	
0049	341832.65	345697.35	42.08	
0050	341788.29	345697.35	42.08	
0051	341743.93	345697.35	42.08	
0052	341699.57	345697.35	42.08	
0053	341655.21	345697.35	42.08	
0054	341610.85	345697.35	42.08	
0055	341566.49	345697.35	42.08	
0056	341522.13	345697.35	42.08	
0057	341477.77	345697.35	42.08	
0058	341433.41	345697.35	42.08	
0059	341389.05	345697.35	42.08	
0060	341344.69	345697.35	42.08	
0061	341300.33	345697.35	42.08	
0062	341255.97	345697.35	42.08	
0063	341211.61	345697.35	42.08	
0064	341167.25	345697.35	42.08	

REV	DESCRIPTION	DRAWN	APP'D	DATE
 SURVEY SOLUTIONS				
LAND SURVEILLANCE BUILDING SURVEILLANCE UNDERGROUND SURVEILLANCE STEEL SURVEILLANCE SCAFFOLDING		0845 040 5999 survey-solutions.co.uk		
PURVIS SURVEY COMPANY LIMITED LONDON BIRMINGHAM MANCHESTER NOTTINGHAM				

PROJECT TITLE Knowsley Lane/Killing Road, Knowsley L34 8HA			
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 1 of 7			
CLIENT JPGS Consulting Group Limited		SCALE 1:200	
SURVEYOR NB CM AL JJ	SURVEY DATE Mar 22	CHECKED BY AG NB	APPROVED BY AG NB
DRAWING NUMBER 3960/MC/L3-01		DWG STATUS FINAL	
		ISSUE DATE 10/03/22	

SHEET LAYOUT

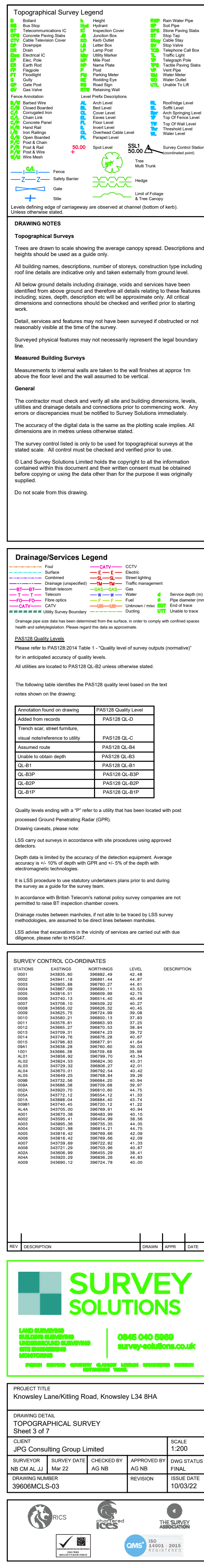


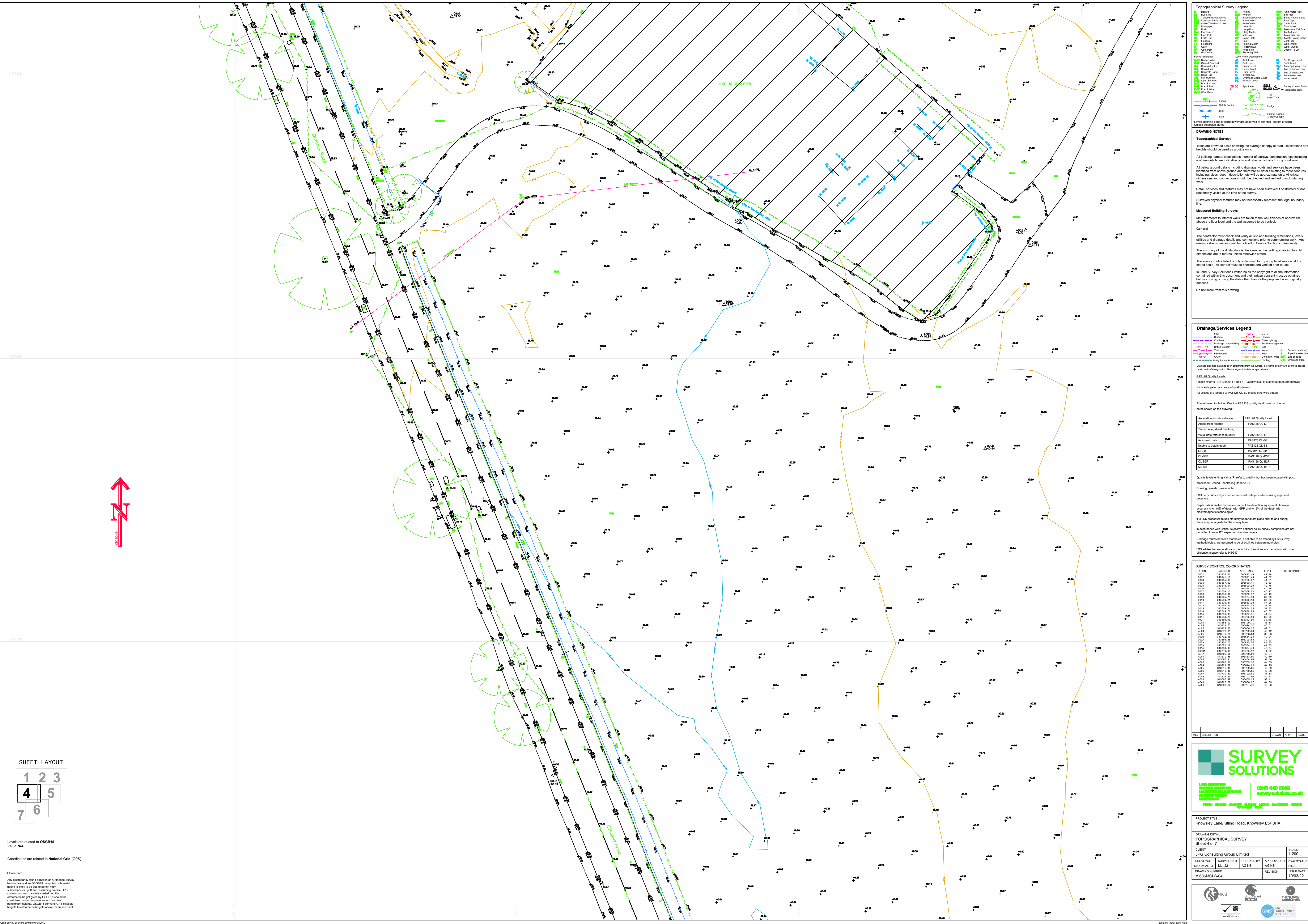
Levels are related to **OSGB15**
Value **N/A**

Coordinates are related to **National Grid (G)**

Please note:

Any discrepancy found between an Ordnance Survey benchmark and an OSGB15 computed orthometric height is likely to be due to bench mark subsidence or uplift and, assuming precise GPS survey has been carefully carried out, the orthometric height given by OSGB15 should be considered correct in preference to archive benchmark heights. OSGB15 connects GPS ellipsoid heights to orthometric heights above mean sea level.





Topographical Survey Legend		
Spot Level	Spot Level	Spot Level
Contour Line	Contour Line	Contour Line
...	...	...

DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including: size, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

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Do not scale from this drawing.

Drainage/Services Legend		
Surface	Surface	Surface
...	...	...

PAS128 Quality Levels

Please refer to PAS128:2014 Table 1 - "Quality level of survey outputs (normative)" for in anticipated accuracy of quality levels.

All utilities are located to PAS128 QL-B2 unless otherwise stated.

The following table identifies the PAS128 quality level based on the text notes shown on the drawing:

Annotation found on drawing	PAS128 Quality Level
Added from records	PAS128 QL-D
Trench scar, street furniture	PAS128 QL-D
Visual reference to utility	PAS128 QL-C
Assumed route	PAS128 QL-D4
Unable to obtain depth	PAS128 QL-B3
QL-B1	PAS128 QL-B1
QL-B3P	PAS128 QL-B3P
QL-B2P	PAS128 QL-B2P
QL-B1P	PAS128 QL-B1P

Quality levels ending with a "P" refer to a utility that has been located with post processed Ground Penetrating Radar (GPR).

Drawing caveat, please note:

LSS carry out surveys in accordance with site procedures using approved detection.

Depth data is limited by the accuracy of the detection equipment. Average accuracy is +/- 10% of depth with GPR and +/- 5% of the depth with electromagnetic induction.

It is LSS procedure to use statutory undertakers plans prior to and during the survey as a guide for the survey team.

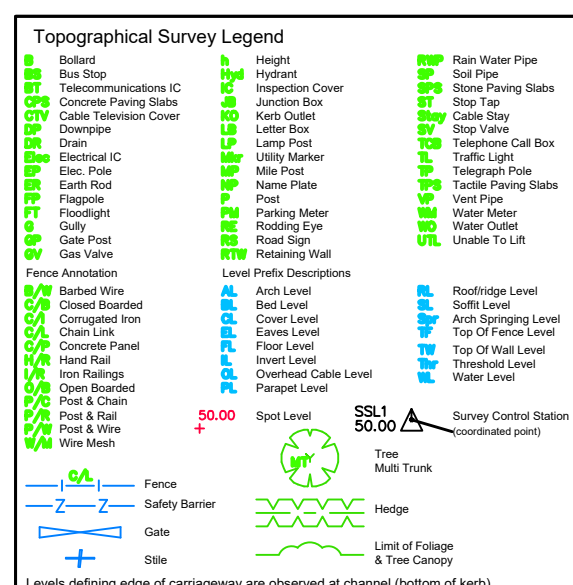
In accordance with British Telecom's national policy survey companies are not permitted to use BT inspection chamber covers.

Drainage routes between manholes, if not able to be traced by LSS survey methodologies, are assumed to be direct lines between manholes.

LSS advise that excavations in the vicinity of services are carried out with due diligence, please refer to HSE47.

SURVEY CONTROL CO-ORDINATES			
STATION	EASTING	NORTHING	LEVEL
0001	343800.00	56660.48	42.45
0002	343801.08	56660.27	44.41
0003	343803.08	56660.27	44.41
0004	343807.00	56660.11	43.35
0005	343816.11	56660.99	42.75
0006	343740.13	56661.40	40.25
0007	343736.00	56660.20	40.25
0008	343658.02	56662.32	40.45
0009	343655.10	566724.09	40.25
0010	343680.21	56660.13	37.45
0011	343676.01	56660.80	37.45
0012	343676.01	56660.80	37.45
0013	343709.21	56674.23	39.72
0014	343709.20	56674.23	40.27
0015	343796.00	56667.01	41.64
0016	343698.00	56670.00	39.25
0017	343698.00	56670.00	39.25
0018	343698.00	56670.00	39.25
0019	343698.00	56670.00	39.25
0020	343698.00	56670.00	39.25
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0042	343698.00	56670.00	39.25
0043	343698.00	56670.00	39.25
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0045	343698.00	56670.00	39.25
0046	343698.00	56670.00	39.25
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0073	343698.00	56670.00	39.25
0074	343698.00	56670.00	39.25
0075	343698.00	56670.00	39.25
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0077	343698.00	56670.00	39.25
0078	343698.00	56670.00	39.25
0079	343698.00	56670.00	39.25
0080	343698.00	56670.00	39.25
0081	343740.45	56670.12	41.12
0082	343700.00	56670.00	40.34
0083	343670.00	56640.00	40.10
0084	343690.00	56640.00	39.25
0085	343690.00	56640.00	39.25
0086	343690.00	56640.00	39.25
0087	343690.00	56640.00	39.25
0088	343690.00	56640.00	39.25
0089	343690.00	56640.00	39.25
0090	343690.00	56640.00	39.25
0091	343690.00	56640.00	39.25
0092	343690.00	56640.00	39.25
0093	343690.00	56640.00	39.25
0094	343690.00	56640.00	39.25
0095	343690.00	56640.00	39.25
0096	343690.00	56640.00	39.25
0097	343690.00	56640.00	39.25
0098	343690.00	56640.00	39.25
0099	343690.00	56640.00	39.25
0100	343690.00	56640.00	39.25
0101	343690.00	56640.00	39.25
0102	343690.00	56640.00	39.25
0103	343690.00	56640.00	39.25
0104	343690.00	56640.00	39.25
0105	343690.00	56640.00	39.25
0106	343690.00	56640.00	39.25
0107	343690.00	56640.00	39.25
0108	343690.00	56640.00	39.25
0109	343690.00	56640.00	39.25
0110	343690.00	56640.00	39.25
0111	343690.00	56640.00	39.25
0112	343690.00	56640.00	39.25
0113	343690.00	56640.00	39.25
0114	343690.00	56640.00	39.25
0115	343690.00	56640.00	39.25
0116	343690.00	56640.00	39.25
0117	343690.00	56640.00	39.25
0118	343690.00	56640.00	39.25
0119	343690.00	56640.00	39.25
0120	343690.00	56640.00	39.25
0121	343690.00	56640.00	39.25
0122	343690.00	56640.00	39.25
0123	343690.00	56640.00	39.25
0124	343690.00	56640.00	39.25
0125	343690.00	56640.00	39.25
0126	343690.00	56640.00	39.25
0127	343690.00	56640.00	39.25
0128	343690.00	56640.00	39.25
0129	343690.00	56640.00	39.25
0130	343690.00	56640.00	39.25
0131	343690.00	56640.00	39.25
0132	343690.00	56640.00	39.25
0133	343690.00	56640.00	39.25
0134	343690.00	56640.00	39.25
0135	343690.00	56640.00	39.25
0136	343690.00	56640.00	39.25
0137	343690.00	56640.00	39.25
0138	343690.00	56640.00	39.25
0139	343690.00	56640.00	39.25
0140	343690.00	56640.00	39.25
0141	343690.00	56640.00	39.25
0142	343690.00	56640.00	39.25
0143	343690.00	56640.00	39.25
0144	343690.00	56640.00	39.25
0145	343690.00	56640.00	39.25
0146	343690.00	56640.00	39.25
0147	343690.00	56640.00	39.25
0148	343690.00	56640.00	39.25
0149	343690.00	56640.00	39.25
0150	343690.00	56640.00	39.25
0151	343690.00	56640.00	39.25
0152	343690.00	56640.00	39.25
0153	343690.00	56640.00	39.25
0154	343690.00	56640.00	39.25
0155	343690.00	56640.00	39.25
0156	343690.00	56640.00	39.25
0157	343690.00	56640.00	39.25
0158	343690.00	56640.00	39.25
0159	343690.00	56640.00	39.25
0160	343690.00	56640.00	39.25
0161	343690.00	56640.00	39.25
0162	343690.00	56640.00	39.25
0163	343690.00	56640.00	39.25
0164	343690.00	56640.00	39.25
0165	343690.00	56640.00	39.25
0166	343690.00	56640.00	39.25
0167	343690.00	56640.00	39.25
0168	343690.00	56640.00	39.25
0169	343690.00	56640.00	39.25
0170	343690.00	56640.00	39.25
0171	343690.00	56640.00	39.25
0172	343690.00	56640.00	39.25
0173	343690.00	56640.00	39.25
0174	343690.00	56640.00	39.25
0175	343690.00	56640.00	39.25
0176	343690.00	56640.00	39.25
0177	343690.00	56640.00	39.25
0178	343690.00	56640.00	39.25
0179	343690.00	56640.00	39.25
0180	343690.00	56640.00	39.25
0181	343690.00	56640.00	39.25
0182	343690.00	56640.00	39.25
0183	343690.00	56640.00	39.25
0184	343690.00	56640.00	39.25
0185	343690.00	56640.00	39.25
0186	343690.00	56640.00	39.25
0187	343690.00	56640.00	39.25
0188	343690.00	56640.00	39.25
0189	343690.00	56640.00	39.25
0190	343690.00	56640.00	39.25
0191	343690.00	56640.00	39.25
0192	343690.00	56640.00	39.25
0193	343690.00	56640.00	39.25
0194	343690.00	56640.00	39.25
0195	343690.00	56640.00	39.25
0196	343690.00	56640.00	39.25
0197	343690.00	56640.00	39.25
0198	343690.00	56640.00	39.25
0199	343690.00	56640.00	39.25
0200	343690.00	56640.00	39.25
0201	343690.00	56640.00	39.25
0202	343690.00	56640.00	39.25
0203	343690.00	56640.00	39.25
0204	343690.00	56640.00	39.25
0205	343690.00	56640.00	39.25
0206	343690.00	56640.00	39.25
0207	343690.00	56640.00	39.25
0208	343690.00	56640.00	39.25
0209	343690.00	56640.00	39.25
0210	343690.00	56640.00	39.25
0211	343690.00	56640.00	39.25
0212	343690.00	56640.00	39.25
0213	343690.00	56640.00	39.25
0214	343690.00	56640.00	39.25
0215	343690.00	56640.00	39.25
0216	343690.00	56640.00	39.25
0217	343690.00	56640.00	39.25
0218	343690.00	56640.00	39.25





Drainage/Services Legend

	Foul		CATV		CCTV
	Surface		E		Electric
	Combined		SL		Street lighting
	Drainage (unspecified)		SL		Traffic management
	BT - BT		GS		Gas
	T		W		Water
	TV		F		Fuel
	Fibre optics		U		Unknown / misc
	CATV		U		End of trace
	Utility Survey Boundary		U		Unable to trace

Drainage pipe size data has been determined from the surface, in order to comply with confined spaces

health and safety/purpose. Please report the data as appropriate.

PAS128 Quality Levels

Please refer to PAS128:2014 Table 1 - "Quality level of survey outputs (normative)" for an anticipated accuracy of results.

All utilities are located to PAS128 QL-B2 unless otherwise stated.

The following table identifies the PAS128 quality level based on the notes shown on the drawing.

Annotation focused on drawing	PAS128 Quality Level
Added from records	PAS128 QL-D
Trench scar, street furniture,	
visual note/inference to utility	PAS128 QL-C
Assumed route	PAS128 QL-B4
Unable to obtain depth	PAS128 QL-B3
QL-B1	PAS128 QL-B1
QL-B2P	PAS128 QL-B2P
QL-B3P	PAS128 QL-B3P

QL-81P	PAS228 QL-81P
Quality levels ending with a "P" refer to a utility that has been located with post processing Ground Penetrating Radar (GPR). Drawing categories, please note: LSS carry out surveys in accordance with site procedures using approved detectors. Depth data is limited by the accuracy of the detection equipment. Average accuracy is +/- 10% of depth with GPR and +/- 3% of the depth with electromagnetic technologies. It is LSS procedure to use substation underground plans prior to and during the survey as a guide to the survey times. In accordance with British Telecom's national policy survey companies are not permitted to raise BT inspection chamber covers. Drainage routes between manholes, if not able to be traced by LSS survey methodologies, should be direct line times between manholes.	

SURVEY CONTROL CO-ORDINATES					DESCRIPTION
STATIONS	EASTINGS	NORTHINGS	LEVEL		
0001	345851.48	369999.44	42.68		
0002	345941.18	369999.44	44.87		
0003	345655.88	369999.27	42.71		
0004	345655.88	369999.99	42.75		
0005	345655.88	369999.99	42.75		
0006	345738.10	369999.22	42.72		
0007	345738.10	369999.22	42.72		
0008	345738.10	369999.22	42.72		
0010	345691.21	369999.13	37.83		
0011	345691.21	369999.13	37.83		
0012	345696.27	369870.53	38.34		
0013	345739.21	369870.53	38.34		
0014	345739.21	369870.53	38.34		
0015	345696.27	369870.53	38.34		
0016	345696.27	369870.53	38.34		
1001	345696.27	369870.53	38.34		
1002	345696.27	369870.53	38.34		
1003	345696.27	369870.53	38.34		
AL03	345728.32	369848.27	42.61		
AL04	345728.32	369848.27	42.61		
AL05	345728.32	369848.27	42.61		
AL06	345699.25	369768.84	39.06		
AL07	345732.66	369688.20	37.00		
AL08	345699.25	369768.84	39.06		
AL09	345699.25	369768.84	39.06		
AL10	345699.25	369768.84	39.06		
AL11	345699.25	369768.84	39.06		
AL12	345699.25	369768.84	39.06		
AL13	345699.25	369768.84	39.06		
AL14	345699.25	369768.84	39.06		
AL15	345699.25	369768.84	39.06		
AL16	345699.25	369768.84	39.06		
AL17	345699.25	369768.84	39.06		
AL18	345699.25	369768.84	39.06		
AL19	345699.25	369768.84	39.06		
AL20	345699.25	369768.84	39.06		
AL21	345699.25	369768.84	39.06		
AL22	345699.25	369768.84	39.06		
AL23	345699.25	369768.84	39.06		
AL24	345699.25	369768.84	39.06		
AL25	345699.25	369768.84	39.06		
AL26	345699.25	369768.84	39.06		
AL27	345699.25	369768.84	39.06		
AL28	345699.25	369768.84	39.06		
AL29	345699.25	369768.84	39.06		
AL30	345699.25	369768.84	39.06		
AL31	345699.25	369768.84	39.06		
AL32	345699.25	369768.84	39.06		
AL33	345699.25	369768.84	39.06		
AL34	345699.25	369768.84	39.06		
AL35	345699.25	369768.84	39.06		
AL36	345699.25	369768.84	39.06		
AL37	345699.25	369768.84	39.06		
AL38	345699.25	369768.84	39.06		
AL39	345699.25	369768.84	39.06		
AL40	345699.25	369768.84	39.06		
AL41	345699.25	369768.84	39.06		
AL42	345699.25	369768.84	39.06		
AL43	345699.25	369768.84	39.06		
AL44	345699.25	369768.84	39.06		
AL45	345699.25	369768.84	39.06		
AL46	345699.25	369768.84	39.06		
AL47	345699.25	369768.84	39.06		
AL48	345699.25	369768.84	39.06		
AL49	345699.25	369768.84	39.06		
AL50	345699.25	369768.84	39.06		

REV	DESCRIPTION	TRAIN	LOCO	DATE
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SURVEY SOLUTIONS

LAND SURVEYING
BUILDING SURVEYING
UNDERGROUND SURVEYING
SITE INVESTIGATION
RECOGNITION

0845 040 5980
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FINCH HARTFORD COWLEY GLASGOW LONDON STRATFORD URMINGHAM WINDLE

PROJECT TITLE Knowsley Lane/Killing Road, Knowsley L34 8HA			
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 6 of 7			
CLIENT JPG Consulting Group Limited			SCALE 1:200
SURVEYOR NB CM ALJ	SURVEY DATE Mar 22	CHECKED BY AG NB	APPROVED BY AG NB
DRAWING NUMBER 3960/RM/CJ-S-06		REVISION	DWG STATUS FINAL 10/03/22





[illegible]

DRAWING NOTES

Topographic Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of stories, construction type including roof type, and other indicators of use and taken extensively from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details related to these features including depth, direction and location will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx. 1m above the floor level and the wall assumed to be vertical.

General

The contractor must check and verify all data and all building dimensions, levels, materials and drainage details and coordinates prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale used. All dimensions are in metres unless otherwise stated.

The survey is intended to be only as used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

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Do not scale from this drawing.

Drainage/Services Legend

	Flood		CATV		CCTV		
	Surface		E		Electric		Service depth (m)
	Combined		SL		Emergency lighting		Point of parameter (mm)
	Drainage (unspecified)		TM		Traffic management		End of trace
	British Telecom		W		Water		UTT
	Telecoms		F		Fuel		Unable to trace
	Fibre optic		U		Unknown / misc		
	CATV				Ducting		
	Utility Service Boundary						

Drainage pipe size data has been determined from the surface, in order to comply with confined spaces health and safety legislation. Please regard this data as approximate.

PAS129 Quality Levels

Please refer to PAS129 Table 1 – "Quality level of survey outputs (normalised)" for anticipated accuracy of quality levels.

All utilities are located to PAS129 QL-B2 unless otherwise stated.

The following table identifies the PAS129 quality level based on the text notes shown on the drawing:

Annotation found on drawing	PAS129 Quality Level
Added from records	PAS129 QL-D
Trench scar, street furniture, utility infrastructure to utility	PAS129 QL-C
As noted on record	PAS129 QL-B4
Unstable to certain depth	PAS129 QL-B3
QL-B1	PAS129 QL-B1
QL-B3P	PAS129 QL-B3P
QL-B2P	PAS129 QL-B2P
QL-B1P	PAS129 QL-B1P

Quality levels ending with a "P" refer to a utility that has been located with post processed Ground Penetrating Radar (GPR).

Drawing caveats, please note:

- LSS carry out surveys in accordance with site procedures using approved standard methods.
- Depth data is limited by the accuracy of the detection equipment. Average accuracy is +/- 10% of depth with GPR and +/- 5% of the depth with electromagnetic technologies.
- It is LSS procedure to use statutory undertakers plans prior to and during the survey as a guide for the survey team.
- In accordance with British Telecom's national policy survey procedures are not permitted to raise BT inspection chamber covers.
- Drawings routes between manholes, if not able to be traced by LSS survey methodologies, are assumed to be direct lines between manholes.
- LSS advise that excavations in the vicinity of services are carried out with due

SURVEY CONTROL CO-ORDINATES				
STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
0001	345491.18	345601.44	42.48	
0002	345491.18	345601.44	44.87	
0003	345491.18	345601.44	42.48	
0004	345689.19	345601.44	43.03	
0005	345689.19	345601.44	43.03	
0006	345689.19	345601.44	43.03	
0007	345678.10	345601.44	42.45	
0008	345658.12	345601.44	42.45	
0009	345658.12	345674.99	39.08	
0010	345658.12	345674.99	39.08	
0011	345658.12	345674.99	39.08	
0012	345665.27	345674.99	38.84	
0013	345699.21	345674.99	38.84	
0014	345665.27	345670.28	42.47	
0015	345665.27	345670.28	42.47	
0016	345665.27	345670.28	42.47	
0017	345665.27	345670.28	39.98	
0018	345665.27	345670.28	39.98	
0019	345665.27	345670.28	39.98	
AL 01	345624.33	345684.00	40.31	
AL 02	345624.33	345684.00	40.31	
AL 03	345624.33	345684.00	40.31	
AL 04	345624.33	345684.00	40.31	
AL 05	345649.25	345691.84	39.28	
AL 06	345649.25	345691.84	39.28	
AL 07	345649.25	345691.84	39.28	
AL 08	345649.25	345691.84	39.28	
AL 09	345649.25	345691.84	39.28	
AL 10	345649.25	345691.84	39.28	
AL 11	345649.25	345691.84	39.28	
AL 12	345649.25	345691.84	39.28	
AL 13	345649.25	345691.84	39.28	
AL 14	345649.25	345691.84	39.28	
AL 15	345649.25	345691.84	39.28	
AL 16	345649.25	345691.84	39.28	
AL 17	345649.25	345691.84	39.28	
AL 18	345649.25	345691.84	39.28	
AL 19	345649.25	345691.84	39.28	
AL 20	345649.25	345691.84	39.28	
AL 21	345649.25	345691.84	39.28	
AL 22	345649.25	345691.84	39.28	
AL 23	345649.25	345691.84	39.28	
AL 24	345649.25	345691.84	39.28	
AL 25	345649.25	345691.84	39.28	
AL 26	345649.25	345691.84	39.28	
AL 27	345649.25	345691.84	39.28	
AL 28	345649.25	345691.84	39.28	
AL 29	345649.25	345691.84	39.28	
AL 30	345649.25	345691.84	39.28	
AL 31	345649.25	345691.84	39.28	
AL 32	345649.25	345691.84	39.28	
AL 33	345649.25	345691.84	39.28	
AL 34	345649.25	345691.84	39.28	
AL 35	345649.25	345691.84	39.28	
AL 36	345649.25	345691.84	39.28	
AL 37	345649.25	345691.84	39.28	
AL 38	345649.25	345691.84	39.28	
AL 39	345649.25	345691.84	39.28	
AL 40	345649.25	345691.84	39.28	
AL 41	345649.25	345691.84	39.28	
AL 42	345649.25	345691.84	39.28	
AL 43	345649.25	345691.84	39.28	
AL 44	345649.25	345691.84	39.28	
AL 45	345649.25	345691.84	39.28	

REV	DESCRIPTION	DRAWN	APPR	DATE
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SURVEY SOLUTIONS

LAND SURVEYING
BUILDING SURVEYING
UNDERGROUND SURVEYING
SITE INVESTIGATION
SCAFFOLDING

0845 040 5060
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DESIGN SURVEY CONVEYOR GLASSER LAMINATE MECHANICAL MASONRY TIE-ROD

PROJECT TITLE Knowsley Lane/Kitting Road, Knowsley L34 8HA				
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 7 of 7				
CLIENT JPG Consulting Group Limited				SCALE 1:200
SURVEYOR NB CM AL JJ	SURVEY DATE Mar 22	CHECKED BY AG NB	APPROVED BY AG NB	DWG STATUS FINAL
DRAWING NUMBER 39606MCLS-07			REVISION	ISSUE DATE 10/03/22



Appendix B – Exceedance Flow Paths

Appendix C – Hydraulic Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	6.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
U1-SW-01	0.222	6.00	40.770	1350	123.734	-158.024	1.020
U1-SW-02	0.061	6.00	40.770	1350	148.054	-129.440	1.224
U1-SW-03	0.203	6.00	40.900	1350	180.257	-91.336	1.539
U1-SW-04	0.173	6.00	41.625	1350	201.573	-47.046	2.446
U1-SW-07	0.039	6.00	41.700	1350	148.445	-5.071	2.690
SW-SW-03	0.042	6.00	42.000	1350	140.702	6.887	3.026
SW-SW-04	0.051	6.00	41.570	1800	97.105	-43.502	2.707
SW-SW-06	0.017	6.00	41.300	1800	72.590	-53.597	2.481
SW-SW-05	0.037	6.00	40.950	1200	48.374	-63.946	1.500
CP-SW-02	0.017	6.00	41.200	1200	67.404	-63.037	1.546
U1-SW-08	0.006	6.00	41.320	1350	74.279	-58.809	1.700
U1-SW-05	0.221	6.00	41.700	1200	174.416	-29.349	1.500
U1-SW-06	0.221	6.00	41.700	1350	152.080	-10.576	1.633
SW-SW-01	0.091	6.00	41.700	1200	184.667	-27.429	1.500
U3-SW-01	0.040	6.00	41.770	1200	159.530	102.369	1.802
U3-SW-02	0.232	6.00	41.770	1200	176.836	87.230	1.907
SW-SW-02	0.136	6.00	42.100	1350	195.619	71.360	2.656
U3-SW-03	0.000	6.00	41.950	1200	167.519	46.457	1.500
U3-SW-04	0.158	6.00	42.000	1350	137.882	12.077	1.718
U2-SW-01	0.013	6.00	41.690	1350	222.514	-16.755	1.600
U2-SW-02	0.129	6.00	41.690	1350	235.374	-1.791	1.690
U2-SW-03	0.007	6.00	42.000	1350	240.024	43.450	2.207
Depth/Area 1	0.217	6.00	40.500		50.215	-27.057	2.000
Watercourse Headwall			38.930	1200	22.083	20.374	0.765
U2-SW-04	0.025	6.00	42.200	1350	209.145	73.299	2.705
U2-SW-05	0.072	6.00	42.025	1200	231.219	46.333	1.425
U2-SW-06	0.072	6.00	42.025	1200	204.336	68.869	1.657
Flow Control Chamber			40.500	1200	26.151	0.603	2.250
U3-CD-02	0.038	6.00	40.700	1200	135.982	74.034	0.700
U2-CD-02	0.019	6.00	40.900	1350	199.870	2.075	0.700
U1-CD-01	0.066	6.00	40.500	1350	122.151	-107.485	0.800
CP-SW-01	0.017	6.00	41.200	1200	51.702	-81.512	1.350
SW-SW-07			39.500	1200	23.397	3.813	1.305

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.000	U1-SW-01	U1-SW-02	37.530	0.600	39.750	39.613	0.137	273.9	375	6.57	48.2
4.001	U1-SW-02	U1-SW-03	49.890	0.600	39.546	39.361	0.185	270.0	375	7.33	45.7
4.002	U1-SW-03	U1-SW-04	49.152	0.600	39.361	39.179	0.182	270.0	375	8.08	43.4
4.003	U1-SW-04	U1-SW-07	67.709	0.600	39.179	39.010	0.169	400.0	450	9.20	40.6
4.004	U1-SW-07	SW-SW-03	14.246	0.600	39.010	38.974	0.036	400.0	450	9.43	40.0
1.006	SW-SW-03	SW-SW-04	66.631	0.600	38.974	38.863	0.111	600.0	750	10.41	38.0
1.007	SW-SW-04	SW-SW-06	26.512	0.600	38.863	38.819	0.044	600.0	750	10.80	37.3
1.008	SW-SW-06	Depth/Area 1	34.713	0.600	38.863	38.500	0.363	95.6	750	11.00	36.9
10.000	SW-SW-05	SW-SW-06	26.335	0.600	39.450	39.330	0.120	220.0	300	6.42	48.8
9.001	CP-SW-02	U1-SW-08	8.071	0.600	39.654	39.620	0.034	237.4	300	6.58	48.2
9.002	U1-SW-08	SW-SW-06	5.479	0.600	39.620	39.606	0.014	400.0	450	6.67	47.9
2.000	U2-SW-05	U2-SW-06	35.080	0.600	40.600	40.394	0.206	170.0	225	6.58	48.2
8.000	U3-SW-03	U3-SW-04	45.391	0.600	40.450	40.282	0.168	270.0	300	6.79	47.4
6.000	U1-SW-05	U1-SW-06	29.178	0.600	40.200	40.067	0.133	220.0	300	6.46	48.6
6.001	U1-SW-06	U1-SW-07	6.596	0.600	40.067	40.043	0.024	270.0	375	6.56	48.3
7.000	SW-SW-01	SW-SW-03	55.771	0.600	40.200	39.946	0.254	220.0	300	6.88	47.1
3.001	U3-SW-01	U3-SW-02	22.993	0.600	39.968	39.863	0.105	220.0	300	7.71	44.5
3.002	U3-SW-02	SW-SW-02	24.589	0.600	39.868	39.756	0.112	220.0	300	8.10	43.4
1.005	SW-SW-02	SW-SW-03	84.691	0.600	39.449	39.135	0.314	270.0	450	9.25	40.5
8.001	U3-SW-04	SW-SW-03	5.908	0.600	40.287	40.267	0.020	290.0	375	6.89	47.1
1.001	U2-SW-01	U2-SW-02	19.730	0.600	40.090	40.000	0.090	220.0	375	6.72	47.7

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.000	1.090	120.3	29.0	0.645	0.782	0.222	0.0	125	0.902
4.001	1.098	121.2	43.2	0.849	1.164	0.349	0.0	154	1.008
4.002	1.098	121.2	65.0	1.164	2.071	0.552	0.0	195	1.115
4.003	1.010	160.7	79.7	1.996	2.240	0.725	0.0	224	1.008
4.004	1.010	160.7	130.9	2.240	2.576	1.206	0.0	310	1.121
1.006	1.135	501.4	235.0	2.276	1.957	2.280	0.0	361	1.117
1.007	1.135	501.4	235.5	1.957	1.731	2.331	0.0	361	1.118
1.008	2.862	1264.3	242.6	1.687	1.250	2.425	0.0	221	2.235
10.000	1.056	74.6	4.9	1.200	1.670	0.037	0.0	52	0.603
9.001	1.016	71.8	4.4	1.246	1.400	0.034	0.0	50	0.568
9.002	1.010	160.7	5.2	1.250	1.244	0.040	0.0	55	0.470
2.000	1.000	39.7	9.4	1.200	1.406	0.072	0.0	74	0.821
8.000	0.952	67.3	0.0	1.200	1.418	0.000	0.0	0	0.000
6.000	1.056	74.6	29.1	1.200	1.333	0.221	0.0	130	0.992
6.001	1.098	121.2	57.8	1.258	1.282	0.442	0.0	182	1.084
7.000	1.056	74.6	11.6	1.200	1.754	0.091	0.0	79	0.772
3.001	1.056	74.6	9.4	1.502	1.607	0.078	0.0	72	0.729
3.002	1.056	74.6	36.4	1.602	2.044	0.310	0.0	148	1.050
1.005	1.232	196.0	85.9	2.201	2.415	0.783	0.0	208	1.192
8.001	1.059	116.9	20.2	1.338	1.358	0.158	0.0	105	0.800
1.001	1.217	134.4	4.1	1.225	1.315	0.032	0.0	45	0.559

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.009	Depth/Area 1	Flow Control Chamber	5.000	0.600	38.500	38.250	0.250	20.0	225	11.03	36.9
1.004	U2-SW-04	SW-SW-02	13.665	0.600	39.495	39.444	0.051	270.0	375	8.02	43.6
2.001	U2-SW-06	U2-SW-04	6.539	0.600	40.368	40.338	0.030	220.0	300	6.69	47.8
1.010	Flow Control Chamber	SW-SW-07	4.229	0.600	38.250	38.215	0.035	120.8	225	11.09	36.8
3.000	U3-CD-02	U3-SW-01	36.842	0.600	40.000	39.968	0.032	1151.3	300	7.35	45.6
1.000	U2-CD-02	U2-SW-01	29.450	0.600	40.200	40.090	0.110	267.7	375	6.45	48.7
5.000	U1-CD-01	U1-SW-02	33.956	0.600	39.700	39.574	0.126	270.0	375	6.52	48.4
9.000	CP-SW-01	CP-SW-02	24.247	0.600	39.850	39.654	0.196	123.7	150	6.45	48.7
1.002	U2-SW-02	U2-SW-03	45.480	0.600	40.000	39.793	0.207	220.0	375	7.34	45.6
1.003	U2-SW-03	U2-SW-04	42.947	0.600	39.800	39.495	0.305	140.8	375	7.81	44.2
1.011	SW-SW-07	Watercourse Headwall	16.613	0.600	38.195	38.165	0.030	553.8	225	11.59	35.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.009	2.939	116.8	263.9	1.775	2.025	2.642	0.0	225	2.993
1.004	1.098	121.2	39.8	2.330	2.281	0.337	0.0	148	0.987
2.001	1.056	74.6	18.7	1.357	1.562	0.144	0.0	102	0.881
1.010	1.188	47.2	263.2	2.025	1.060	2.642	0.0	225	1.210
3.000	0.455	32.2	4.7	0.400	1.502	0.038	0.0	77	0.325
1.000	1.102	121.7	2.5	0.325	1.225	0.019	0.0	37	0.446
5.000	1.098	121.2	8.7	0.425	0.821	0.066	0.0	67	0.642
9.000	0.902	15.9	2.2	1.200	1.396	0.017	0.0	38	0.636
1.002	1.217	134.4	19.9	1.315	1.832	0.161	0.0	97	0.881
1.003	1.525	168.4	20.1	1.825	2.330	0.168	0.0	87	1.038
1.011	0.549	21.8	256.9	1.080	0.540	2.642	0.0	225	0.559

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.000	37.530	273.9	375	Circular	40.770	39.750	0.645	40.770	39.613	0.782
4.001	49.890	270.0	375	Circular	40.770	39.546	0.849	40.900	39.361	1.164
4.002	49.152	270.0	375	Circular	40.900	39.361	1.164	41.625	39.179	2.071
4.003	67.709	400.0	450	Circular	41.625	39.179	1.996	41.700	39.010	2.240
4.004	14.246	400.0	450	Circular	41.700	39.010	2.240	42.000	38.974	2.576

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	U1-SW-01	1350	Manhole	Adoptable	U1-SW-02	1350	Manhole	Adoptable
4.001	U1-SW-02	1350	Manhole	Adoptable	U1-SW-03	1350	Manhole	Adoptable
4.002	U1-SW-03	1350	Manhole	Adoptable	U1-SW-04	1350	Manhole	Adoptable
4.003	U1-SW-04	1350	Manhole	Adoptable	U1-SW-07	1350	Manhole	Adoptable
4.004	U1-SW-07	1350	Manhole	Adoptable	SW-SW-03	1350	Manhole	Adoptable

Pipeline Schedule

	Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
	1.006	66.631	600.0	750	Circular	42.000	38.974	2.276	41.570	38.863	1.957
	1.007	26.512	600.0	750	Circular	41.570	38.863	1.957	41.300	38.819	1.731
	1.008	34.713	95.6	750	Circular	41.300	38.863	1.687	40.500	38.500	1.250
	10.000	26.335	220.0	300	Circular	40.950	39.450	1.200	41.300	39.330	1.670
	9.001	8.071	237.4	300	Circular	41.200	39.654	1.246	41.320	39.620	1.400
	9.002	5.479	400.0	450	Circular	41.320	39.620	1.250	41.300	39.606	1.244
	2.000	35.080	170.0	225	Circular	42.025	40.600	1.200	42.025	40.394	1.406
	8.000	45.391	270.0	300	Circular	41.950	40.450	1.200	42.000	40.282	1.418
	6.000	29.178	220.0	300	Circular	41.700	40.200	1.200	41.700	40.067	1.333
	6.001	6.596	270.0	375	Circular	41.700	40.067	1.258	41.700	40.043	1.282
	7.000	55.771	220.0	300	Circular	41.700	40.200	1.200	42.000	39.946	1.754
	3.001	22.993	220.0	300	Circular	41.770	39.968	1.502	41.770	39.863	1.607
	3.002	24.589	220.0	300	Circular	41.770	39.868	1.602	42.100	39.756	2.044
	1.005	84.691	270.0	450	Circular	42.100	39.449	2.201	42.000	39.135	2.415
	8.001	5.908	290.0	375	Circular	42.000	40.287	1.338	42.000	40.267	1.358
	1.001	19.730	220.0	375	Circular	41.690	40.090	1.225	41.690	40.000	1.315
	1.009	5.000	20.0	225	Circular	40.500	38.500	1.775	40.500	38.250	2.025
	1.004	13.665	270.0	375	Circular	42.200	39.495	2.330	42.100	39.444	2.281
	2.001	6.539	220.0	300	Circular	42.025	40.368	1.357	42.200	40.338	1.562
	1.010	4.229	120.8	225	Circular	40.500	38.250	2.025	39.500	38.215	1.060
	3.000	36.842	1151.3	300	Circular	40.700	40.000	0.400	41.770	39.968	1.502
	1.000	29.450	267.7	375	Circular	40.900	40.200	0.325	41.690	40.090	1.225
Link	US Node		Dia (mm)	Node Type	MH Type	DS Node		Dia (mm)	Node Type	MH Type	
1.006	SW-SW-03		1350	Manhole	Adoptable	SW-SW-04		1800	Manhole	Adoptable	
1.007	SW-SW-04		1800	Manhole	Adoptable	SW-SW-06		1800	Manhole	Adoptable	
1.008	SW-SW-06		1800	Manhole	Adoptable	Depth/Area 1			Junction		
10.000	SW-SW-05		1200	Manhole	Adoptable	SW-SW-06		1800	Manhole	Adoptable	
9.001	CP-SW-02		1200	Manhole	Adoptable	U1-SW-08		1350	Manhole	Adoptable	
9.002	U1-SW-08		1350	Manhole	Adoptable	SW-SW-06		1800	Manhole	Adoptable	
2.000	U2-SW-05		1200	Manhole	Adoptable	U2-SW-06		1200	Manhole	Adoptable	
8.000	U3-SW-03		1200	Manhole	Adoptable	U3-SW-04		1350	Manhole	Adoptable	
6.000	U1-SW-05		1200	Manhole	Adoptable	U1-SW-06		1350	Manhole	Adoptable	
6.001	U1-SW-06		1350	Manhole	Adoptable	U1-SW-07		1350	Manhole	Adoptable	
7.000	SW-SW-01		1200	Manhole	Adoptable	SW-SW-03		1350	Manhole	Adoptable	
3.001	U3-SW-01		1200	Manhole	Adoptable	U3-SW-02		1200	Manhole	Adoptable	
3.002	U3-SW-02		1200	Manhole	Adoptable	SW-SW-02		1350	Manhole	Adoptable	
1.005	SW-SW-02		1350	Manhole	Adoptable	SW-SW-03		1350	Manhole	Adoptable	
8.001	U3-SW-04		1350	Manhole	Adoptable	SW-SW-03		1350	Manhole	Adoptable	
1.001	U2-SW-01		1350	Manhole	Adoptable	U2-SW-02		1350	Manhole	Adoptable	
1.009	Depth/Area 1			Junction		Flow Control Chamber		1200	Manhole	Adoptable	
1.004	U2-SW-04		1350	Manhole	Adoptable	SW-SW-02		1350	Manhole	Adoptable	
2.001	U2-SW-06		1200	Manhole	Adoptable	U2-SW-04		1350	Manhole	Adoptable	
1.010	Flow Control Chamber		1200	Manhole	Adoptable	SW-SW-07		1200	Manhole	Adoptable	
3.000	U3-CD-02		1200	Manhole	Adoptable	U3-SW-01		1200	Manhole	Adoptable	
1.000	U2-CD-02		1350	Manhole	Adoptable	U2-SW-01		1350	Manhole	Adoptable	

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	33.956	270.0	375	Circular	40.500	39.700	0.425	40.770	39.574	0.821
9.000	24.247	123.7	150	Circular	41.200	39.850	1.200	41.200	39.654	1.396
1.002	45.480	220.0	375	Circular	41.690	40.000	1.315	42.000	39.793	1.832
1.003	42.947	140.8	375	Circular	42.000	39.800	1.825	42.200	39.495	2.330
1.011	16.613	553.8	225	Circular	39.500	38.195	1.080	38.930	38.165	0.540

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	U1-CD-01	1350	Manhole	Adoptable	U1-SW-02	1350	Manhole	Adoptable
9.000	CP-SW-01	1200	Manhole	Adoptable	CP-SW-02	1200	Manhole	Adoptable
1.002	U2-SW-02	1350	Manhole	Adoptable	U2-SW-03	1350	Manhole	Adoptable
1.003	U2-SW-03	1350	Manhole	Adoptable	U2-SW-04	1350	Manhole	Adoptable
1.011	SW-SW-07	1200	Manhole	Adoptable	Watercourse Headwall	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
U1-SW-01	123.734	-158.024	40.770	1.020	1350		0	4.000	39.750	375
U1-SW-02	148.054	-129.440	40.770	1.224	1350		1	5.000	39.574	375
						2	4.000	39.613	375	
						0	4.001	39.546	375	
U1-SW-03	180.257	-91.336	40.900	1.539	1350		1	4.001	39.361	375
						0	4.002	39.361	375	
U1-SW-04	201.573	-47.046	41.625	2.446	1350		1	4.002	39.179	375
						0	4.003	39.179	450	
U1-SW-07	148.445	-5.071	41.700	2.690	1350		1	6.001	40.043	375
						2	4.003	39.010	450	
						0	4.004	39.010	450	
SW-SW-03	140.702	6.887	42.000	3.026	1350		1	8.001	40.267	375
						2	7.000	39.946	300	
						3	4.004	38.974	450	
						4	1.005	39.135	450	
						0	1.006	38.974	750	
SW-SW-04	97.105	-43.502	41.570	2.707	1800		1	1.006	38.863	750
						0	1.007	38.863	750	
SW-SW-06	72.590	-53.597	41.300	2.481	1800		1	10.000	39.330	300
						2	9.002	39.606	450	
						3	1.007	38.819	750	
						0	1.008	38.863	750	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW-SW-05	48.374	-63.946	40.950	1.500	1200				
						0	10.000	39.450	300
CP-SW-02	67.404	-63.037	41.200	1.546	1200		1	9.000	39.654
						0	9.001	39.654	300
U1-SW-08	74.279	-58.809	41.320	1.700	1350		1	9.001	39.620
						0	9.002	39.620	450
U1-SW-05	174.416	-29.349	41.700	1.500	1200		0	6.000	40.200
						0	6.000	40.067	300
U1-SW-06	152.080	-10.576	41.700	1.633	1350		1	6.000	40.067
						0	6.001	40.067	375
SW-SW-01	184.667	-27.429	41.700	1.500	1200		0	7.000	40.200
						0	3.000	39.968	300
U3-SW-01	159.530	102.369	41.770	1.802	1200		1	3.001	39.968
						0	3.001	39.863	300
U3-SW-02	176.836	87.230	41.770	1.907	1200		1	3.002	39.868
						0	3.002	39.756	300
SW-SW-02	195.619	71.360	42.100	2.656	1350		1	1.004	39.444
						2	1.005	39.449	450
						0			
U3-SW-03	167.519	46.457	41.950	1.500	1200		0	8.000	40.450
						0	8.000	40.282	300
U3-SW-04	137.882	12.077	42.000	1.718	1350		1	8.001	40.287
						0	8.001	40.090	375
U2-SW-01	222.514	-16.755	41.690	1.600	1350		1	1.000	40.090
						0	1.001	40.000	375
U2-SW-02	235.374	-1.791	41.690	1.690	1350		1	1.002	40.000
						0	1.002	39.793	375
U2-SW-03	240.024	43.450	42.000	2.207	1350		1	1.003	39.800
						0	1.003	38.500	750
Depth/Area 1	50.215	-27.057	40.500	2.000			1	1.008	38.500
						0	1.009	38.500	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
Watercourse Headwall	22.083	20.374	38.930	0.765	1200		1	1.011	38.165	225
U2-SW-04	209.145	73.299	42.200	2.705	1350		1 2 0	2.001 1.003 1.004	40.338 39.495 39.495	300 375 375
U2-SW-05	231.219	46.333	42.025	1.425	1200		0	2.000	40.600	225
U2-SW-06	204.336	68.869	42.025	1.657	1200		1 0	2.000 2.001	40.394 40.368	225 300
Flow Control Chamber	26.151	0.603	40.500	2.250	1200		1 0	1.009 1.010	38.250 38.250	225 225
U3-CD-02	135.982	74.034	40.700	0.700	1200		0	3.000	40.000	300
U2-CD-02	199.870	2.075	40.900	0.700	1350		0	1.000	40.200	375
U1-CD-01	122.151	-107.485	40.500	0.800	1350		0	5.000	39.700	375
CP-SW-01	51.702	-81.512	41.200	1.350	1200		0	9.000	39.850	150
SW-SW-07	23.397	3.813	39.500	1.305	1200		1 0	1.010 1.011	38.215 38.195	225 225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m ³ /ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	0	0	0
30	0	0	0	100	40	0	0

Node Flow Control Chamber Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	x
Invert Level (m)	38.250	Product Number	CTL-CHE-0126-1060-2000-1060
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	10.6	Min Node Diameter (mm)	1200

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	38.850
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1215.0	0.0	2.000	2069.5	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.01%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	U1-SW-01	11	39.889	0.139	33.6	0.8015	0.0000	OK
15 minute winter	U1-SW-02	12	39.713	0.167	52.4	0.4062	0.0000	OK
15 minute winter	U1-SW-03	12	39.590	0.229	81.5	0.9335	0.0000	OK
15 minute winter	U1-SW-04	13	39.528	0.349	104.4	0.9924	0.0000	OK
15 minute winter	U1-SW-07	13	39.471	0.461	162.2	0.7937	0.0000	SURCHARGED
15 minute winter	SW-SW-03	13	39.415	0.441	316.2	0.7536	0.0000	OK
15 minute winter	SW-SW-04	13	39.271	0.408	317.3	1.1922	0.0000	OK
600 minute winter	SW-SW-06	585	39.256	0.437	50.1	1.1730	0.0000	OK
15 minute winter	SW-SW-05	11	39.506	0.056	5.6	0.0910	0.0000	OK
15 minute winter	CP-SW-02	11	39.712	0.058	5.2	0.0778	0.0000	OK
15 minute winter	U1-SW-08	11	39.680	0.060	6.1	0.0902	0.0000	OK
15 minute winter	U1-SW-05	11	40.341	0.141	33.4	0.5755	0.0000	OK
15 minute winter	U1-SW-06	11	40.285	0.218	66.7	0.9004	0.0000	OK
15 minute winter	SW-SW-01	11	40.287	0.087	13.8	0.2032	0.0000	OK
15 minute winter	U3-SW-01	11	40.052	0.084	11.8	0.1323	0.0000	OK
15 minute winter	U3-SW-02	11	40.046	0.183	45.7	0.6514	0.0000	OK
15 minute winter	SW-SW-02	12	39.699	0.255	113.5	0.6263	0.0000	OK
15 minute summer	U3-SW-03	1	40.450	0.000	0.0	0.0000	0.0000	OK
15 minute winter	U3-SW-04	11	40.411	0.129	23.9	0.4220	0.0000	OK
15 minute winter	U2-SW-01	11	40.137	0.047	4.9	0.0757	0.0000	OK
15 minute winter	U2-SW-02	11	40.109	0.109	24.2	0.3230	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	U1-SW-01	4.000	U1-SW-02	33.2	0.935	0.276	1.3361	
15 minute winter	U1-SW-02	4.001	U1-SW-03	51.4	0.874	0.424	2.9475	
15 minute winter	U1-SW-03	4.002	U1-SW-04	79.1	1.000	0.653	4.3264	
15 minute winter	U1-SW-04	4.003	U1-SW-07	96.4	0.683	0.600	9.8263	
15 minute winter	U1-SW-07	4.004	SW-SW-03	159.5	1.008	0.993	2.2516	
15 minute winter	SW-SW-03	1.006	SW-SW-04	311.5	1.212	0.621	17.1243	
15 minute winter	SW-SW-04	1.007	SW-SW-06	316.4	1.494	0.631	5.7142	
600 minute winter	SW-SW-06	1.008	Depth/Area 1	49.5	0.781	0.039	11.6959	
15 minute winter	SW-SW-05	10.000	SW-SW-06	5.5	0.621	0.074	0.2351	
15 minute winter	CP-SW-02	9.001	U1-SW-08	5.2	0.530	0.072	0.0785	
15 minute winter	U1-SW-08	9.002	SW-SW-06	6.0	0.534	0.037	0.0615	
15 minute winter	U1-SW-05	6.000	U1-SW-06	33.3	0.759	0.447	1.2735	
15 minute winter	U1-SW-06	6.001	U1-SW-07	66.5	1.094	0.549	0.4007	
15 minute winter	SW-SW-01	7.000	SW-SW-03	13.3	0.807	0.178	0.9249	
15 minute winter	U3-SW-01	3.001	U3-SW-02	12.0	0.398	0.160	0.7020	
15 minute winter	U3-SW-02	3.002	SW-SW-02	45.1	1.089	0.604	1.0183	
15 minute winter	SW-SW-02	1.005	SW-SW-03	114.8	1.211	0.586	8.1128	
15 minute summer	U3-SW-03	8.000	U3-SW-04	0.0	0.000	0.000	0.6234	
15 minute winter	U3-SW-04	8.001	SW-SW-03	23.8	0.811	0.203	0.1733	
15 minute winter	U2-SW-01	1.001	U2-SW-02	4.7	0.288	0.035	0.3421	
15 minute winter	U2-SW-02	1.002	U2-SW-03	24.0	0.946	0.178	1.1538	

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.01%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	U2-SW-03	12	39.896	0.103	25.1	0.1538	0.0000	OK
600 minute winter	Depth/Area 1	585	39.256	0.756	54.1	531.3065	0.0000	SURCHARGED
15 minute winter	Watercourse Headwall	7	38.241	0.076	8.7	0.0000	0.0000	OK
15 minute winter	U2-SW-04	12	39.719	0.224	49.7	0.3616	0.0000	OK
15 minute winter	U2-SW-05	11	40.680	0.080	10.9	0.1722	0.0000	OK
15 minute winter	U2-SW-06	11	40.489	0.121	21.8	0.2418	0.0000	OK
600 minute winter	Flow Control Chamber	585	39.255	1.005	23.3	1.1366	0.0000	SURCHARGED
15 minute winter	U3-CD-02	11	40.085	0.085	5.8	0.1887	0.0000	OK
15 minute winter	U2-CD-02	11	40.239	0.039	2.9	0.0777	0.0000	OK
15 minute winter	U1-CD-01	11	39.772	0.072	10.0	0.2205	0.0000	OK
15 minute winter	CP-SW-01	11	39.891	0.041	2.6	0.0564	0.0000	OK
15 minute winter	SW-SW-07	7	38.294	0.099	8.5	0.1124	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	U2-SW-03	1.003	U2-SW-04	24.8	0.575	0.147	1.9488	
600 minute winter	Depth/Area 1	1.009	Flow Control Chamber	23.3	0.774	0.199	0.1989	
15 minute winter	U2-SW-04	1.004	SW-SW-02	49.6	0.677	0.409	1.0140	
15 minute winter	U2-SW-05	2.000	U2-SW-06	10.9	0.764	0.275	0.5021	
15 minute winter	U2-SW-06	2.001	U2-SW-04	21.7	0.874	0.291	0.1626	
600 minute winter	Flow Control Chamber	1.010	SW-SW-07	7.8	0.706	0.164	0.0479	
15 minute winter	U3-CD-02	3.000	U3-SW-01	5.7	0.350	0.176	0.5995	
15 minute winter	U2-CD-02	1.000	U2-SW-01	2.9	0.406	0.024	0.2086	
15 minute winter	U1-CD-01	5.000	U1-SW-02	9.9	0.428	0.082	0.8782	
15 minute winter	CP-SW-01	9.000	CP-SW-02	2.6	0.516	0.163	0.1223	
15 minute winter	SW-SW-07	1.011	Watercourse Headwall	8.7	0.609	0.400	0.2384	92.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.01%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	U1-SW-01	13	40.337	0.587	63.6	3.3929	0.0000	SURCHARGED
15 minute winter	U1-SW-02	13	40.292	0.746	95.0	1.8106	0.0000	SURCHARGED
15 minute winter	U1-SW-03	13	40.210	0.849	125.4	3.4542	0.0000	SURCHARGED
15 minute winter	U1-SW-04	13	39.995	0.815	157.2	2.3209	0.0000	SURCHARGED
15 minute winter	U1-SW-07	12	39.799	0.789	276.6	1.3570	0.0000	SURCHARGED
960 minute winter	SW-SW-03	930	39.633	0.659	58.6	1.1261	0.0000	OK
960 minute winter	SW-SW-04	930	39.633	0.770	58.4	2.2489	0.0000	SURCHARGED
960 minute winter	SW-SW-06	930	39.633	0.814	59.4	2.1829	0.0000	SURCHARGED
960 minute winter	SW-SW-05	930	39.633	0.183	1.0	0.2970	0.0000	OK
15 minute winter	CP-SW-02	11	39.735	0.081	9.8	0.1099	0.0000	OK
15 minute winter	U1-SW-08	11	39.703	0.083	11.5	0.1244	0.0000	OK
15 minute winter	U1-SW-05	11	40.500	0.300	63.3	1.2221	0.0000	OK
15 minute winter	U1-SW-06	11	40.388	0.321	124.9	1.3295	0.0000	OK
15 minute winter	SW-SW-01	11	40.323	0.123	26.1	0.2889	0.0000	OK
15 minute winter	U3-SW-01	12	40.167	0.199	20.1	0.3134	0.0000	OK
15 minute winter	U3-SW-02	12	40.158	0.295	83.3	1.0515	0.0000	OK
15 minute winter	SW-SW-02	13	39.954	0.510	206.8	1.2522	0.0000	SURCHARGED
15 minute winter	U3-SW-03	12	40.465	0.015	0.9	0.0174	0.0000	OK
15 minute winter	U3-SW-04	11	40.461	0.179	45.3	0.5867	0.0000	OK
15 minute winter	U2-SW-01	11	40.157	0.067	9.1	0.1074	0.0000	OK
15 minute winter	U2-SW-02	11	40.154	0.154	45.7	0.4554	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	U1-SW-01	4.000	U1-SW-02	61.9	1.035	0.514	4.1394	
15 minute winter	U1-SW-02	4.001	U1-SW-03	87.0	0.913	0.718	5.5027	
15 minute winter	U1-SW-03	4.002	U1-SW-04	123.2	1.117	1.017	5.4213	
15 minute winter	U1-SW-04	4.003	U1-SW-07	160.7	1.014	1.000	10.7280	
15 minute winter	U1-SW-07	4.004	SW-SW-03	277.4	1.751	1.727	2.2572	
960 minute winter	SW-SW-03	1.006	SW-SW-04	57.1	0.591	0.114	28.3182	
960 minute winter	SW-SW-04	1.007	SW-SW-06	57.0	0.517	0.114	11.6685	
960 minute winter	SW-SW-06	1.008	Depth/Area 1	58.5	0.752	0.046	15.2779	
960 minute winter	SW-SW-05	10.000	SW-SW-06	1.0	0.388	0.013	1.5194	
15 minute winter	CP-SW-02	9.001	U1-SW-08	9.8	0.625	0.136	0.1260	
15 minute winter	U1-SW-08	9.002	SW-SW-06	11.4	0.633	0.071	0.0991	
15 minute winter	U1-SW-05	6.000	U1-SW-06	61.8	0.880	0.829	2.0539	
15 minute winter	U1-SW-06	6.001	U1-SW-07	124.1	1.354	1.023	0.6003	
15 minute winter	SW-SW-01	7.000	SW-SW-03	25.6	0.961	0.343	1.4896	
15 minute winter	U3-SW-01	3.001	U3-SW-02	23.6	0.528	0.317	1.3769	
15 minute winter	U3-SW-02	3.002	SW-SW-02	81.7	1.273	1.095	1.5487	
15 minute winter	SW-SW-02	1.005	SW-SW-03	191.6	1.261	0.978	13.4187	
15 minute winter	U3-SW-03	8.000	U3-SW-04	-0.9	-0.044	-0.013	1.0193	
15 minute winter	U3-SW-04	8.001	SW-SW-03	44.3	0.964	0.379	0.2718	
15 minute winter	U2-SW-01	1.001	U2-SW-02	9.1	0.348	0.068	0.5521	
15 minute winter	U2-SW-02	1.002	U2-SW-03	45.4	1.135	0.338	2.2992	

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.01%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	U2-SW-03	13	40.007	0.214	47.4	0.3202	0.0000	OK
960 minute winter	Depth/Area 1	930	39.633	1.133	64.2	1085.2400	0.0000	SURCHARGED
60 minute summer	Watercourse Headwall	9	38.241	0.076	8.7	0.0000	0.0000	OK
15 minute winter	U2-SW-04	13	39.996	0.501	94.8	0.8093	0.0000	SURCHARGED
15 minute winter	U2-SW-05	11	40.714	0.114	20.6	0.2435	0.0000	OK
15 minute winter	U2-SW-06	11	40.545	0.177	41.2	0.3542	0.0000	OK
960 minute winter	Flow Control Chamber	930	39.631	1.381	21.9	1.5618	0.0000	SURCHARGED
15 minute winter	U3-CD-02	12	40.174	0.174	10.9	0.3856	0.0000	OK
15 minute winter	U2-CD-02	11	40.253	0.053	5.4	0.1046	0.0000	OK
15 minute winter	U1-CD-01	13	40.261	0.561	40.3	1.7296	0.0000	FLOOD RISK
15 minute winter	CP-SW-01	11	39.907	0.057	4.9	0.0786	0.0000	OK
60 minute summer	SW-SW-07	9	38.294	0.099	8.4	0.1121	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	U2-SW-03	1.003	U2-SW-04	54.4	0.602	0.323	3.7089	
960 minute winter	Depth/Area 1	1.009	Flow Control Chamber	21.9	0.562	0.188	0.1989	
15 minute winter	U2-SW-04	1.004	SW-SW-02	90.8	0.823	0.749	1.5072	
15 minute winter	U2-SW-05	2.000	U2-SW-06	20.6	0.849	0.518	0.8499	
15 minute winter	U2-SW-06	2.001	U2-SW-04	41.1	1.022	0.550	0.2626	
960 minute winter	Flow Control Chamber	1.010	SW-SW-07	8.6	0.784	0.183	0.0506	
15 minute winter	U3-CD-02	3.000	U3-SW-01	10.7	0.350	0.332	1.6938	
15 minute winter	U2-CD-02	1.000	U2-SW-01	5.4	0.488	0.044	0.3367	
15 minute winter	U1-CD-01	5.000	U1-SW-02	-23.0	0.442	-0.190	3.7452	
15 minute winter	CP-SW-01	9.000	CP-SW-02	4.9	0.618	0.307	0.1924	
60 minute summer	SW-SW-07	1.011	Watercourse Headwall	8.7	0.609	0.398	0.2375	125.2

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.01%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	U1-SW-01	19	40.632	0.882	80.1	5.0986	0.0000	FLOOD RISK
30 minute winter	U1-SW-02	19	40.553	1.007	92.3	2.4457	0.0000	FLOOD RISK
15 minute winter	U1-SW-03	12	40.503	1.142	128.0	4.6477	0.0000	SURCHARGED
15 minute winter	U1-SW-04	12	40.290	1.111	178.8	3.1625	0.0000	SURCHARGED
15 minute winter	U1-SW-07	12	40.046	1.036	349.8	1.7833	0.0000	SURCHARGED
1440 minute winter	SW-SW-03	1380	39.868	0.894	54.2	1.5281	0.0000	SURCHARGED
1440 minute winter	SW-SW-04	1380	39.868	1.005	53.7	2.9359	0.0000	SURCHARGED
1440 minute winter	SW-SW-06	1380	39.868	1.049	54.9	2.8137	0.0000	SURCHARGED
1440 minute winter	SW-SW-05	1380	39.868	0.418	0.9	0.6790	0.0000	SURCHARGED
1440 minute winter	CP-SW-02	1380	39.868	0.214	0.8	0.2892	0.0000	OK
1440 minute winter	U1-SW-08	1380	39.868	0.248	0.9	0.3726	0.0000	OK
15 minute winter	U1-SW-05	11	40.664	0.464	81.9	1.8937	0.0000	SURCHARGED
15 minute winter	U1-SW-06	11	40.466	0.399	163.4	1.6496	0.0000	SURCHARGED
15 minute winter	SW-SW-01	11	40.343	0.143	33.7	0.3355	0.0000	OK
15 minute winter	U3-SW-01	12	40.514	0.546	30.9	0.8606	0.0000	SURCHARGED
15 minute winter	U3-SW-02	12	40.480	0.617	105.2	2.1982	0.0000	SURCHARGED
15 minute winter	SW-SW-02	12	40.215	0.771	227.5	1.8919	0.0000	SURCHARGED
15 minute winter	U3-SW-03	11	40.496	0.046	2.5	0.0517	0.0000	OK
15 minute winter	U3-SW-04	11	40.488	0.206	58.5	0.6743	0.0000	OK
15 minute winter	U2-SW-01	13	40.312	0.222	29.7	0.3541	0.0000	OK
15 minute winter	U2-SW-02	13	40.314	0.314	60.8	0.9284	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	U1-SW-01	4.000	U1-SW-02	73.1	1.039	0.608	4.1394	
30 minute winter	U1-SW-02	4.001	U1-SW-03	88.6	0.893	0.731	5.5027	
15 minute winter	U1-SW-03	4.002	U1-SW-04	131.5	1.192	1.084	5.4213	
15 minute winter	U1-SW-04	4.003	U1-SW-07	181.1	1.143	1.128	10.7280	
15 minute winter	U1-SW-07	4.004	SW-SW-03	351.6	2.219	2.188	2.2572	
1440 minute winter	SW-SW-03	1.006	SW-SW-04	52.5	0.513	0.105	29.3257	
1440 minute winter	SW-SW-04	1.007	SW-SW-06	52.7	0.418	0.105	11.6685	
1440 minute winter	SW-SW-06	1.008	Depth/Area 1	54.1	0.778	0.043	15.2779	
1440 minute winter	SW-SW-05	10.000	SW-SW-06	0.9	0.378	0.012	1.8545	
1440 minute winter	CP-SW-02	9.001	U1-SW-08	0.8	0.314	0.011	0.4685	
1440 minute winter	U1-SW-08	9.002	SW-SW-06	0.9	0.319	0.006	0.5078	
15 minute winter	U1-SW-05	6.000	U1-SW-06	81.5	1.158	1.092	2.0547	
15 minute winter	U1-SW-06	6.001	U1-SW-07	163.2	1.529	1.346	0.6728	
15 minute winter	SW-SW-01	7.000	SW-SW-03	33.2	1.027	0.445	1.8075	
15 minute winter	U3-SW-01	3.001	U3-SW-02	36.3	0.629	0.487	1.6192	
15 minute winter	U3-SW-02	3.002	SW-SW-02	100.5	1.428	1.347	1.7315	
15 minute winter	SW-SW-02	1.005	SW-SW-03	228.5	1.443	1.166	13.4187	
15 minute winter	U3-SW-03	8.000	U3-SW-04	-2.5	-0.100	-0.037	1.3247	
15 minute winter	U3-SW-04	8.001	SW-SW-03	57.0	1.038	0.488	0.3248	
15 minute winter	U2-SW-01	1.001	U2-SW-02	26.5	0.483	0.197	1.6425	
15 minute winter	U2-SW-02	1.002	U2-SW-03	67.8	1.163	0.504	4.7487	

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.01%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	U2-SW-03	13	40.293	0.500	68.8	0.7479	0.0000	SURCHARGED
1440 minute winter	Depth/Area 1	1380	39.868	1.368	59.4	1461.9630	0.0000	SURCHARGED
1440 minute winter	Watercourse Headwall	1380	38.244	0.079	9.3	0.0000	0.0000	OK
15 minute winter	U2-SW-04	13	40.262	0.767	106.8	1.2387	0.0000	SURCHARGED
15 minute winter	U2-SW-05	11	40.733	0.133	26.7	0.2856	0.0000	OK
15 minute winter	U2-SW-06	11	40.576	0.208	53.4	0.4165	0.0000	OK
1440 minute winter	Flow Control Chamber	1380	39.866	1.616	9.7	1.8273	0.0000	SURCHARGED
15 minute winter	U3-CD-02	12	40.543	0.543	14.1	1.2036	0.0000	FLOOD RISK
15 minute winter	U2-CD-02	13	40.330	0.130	7.0	0.2570	0.0000	OK
15 minute winter	U1-CD-01	11	40.500	0.800	79.3	2.4648	10.3491	FLOOD
15 minute winter	CP-SW-01	11	39.915	0.065	6.3	0.0902	0.0000	OK
1440 minute winter	SW-SW-07	1380	38.297	0.102	9.3	0.1159	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	U2-SW-03	1.003	U2-SW-04	85.7	0.830	0.509	4.7369	
1440 minute winter	Depth/Area 1	1.009	Flow Control Chamber	9.7	0.356	0.083	0.1989	
15 minute winter	U2-SW-04	1.004	SW-SW-02	115.1	1.044	0.950	1.5072	
15 minute winter	U2-SW-05	2.000	U2-SW-06	26.7	0.897	0.671	1.0343	
15 minute winter	U2-SW-06	2.001	U2-SW-04	53.3	1.108	0.714	0.3142	
1440 minute winter	Flow Control Chamber	1.010	SW-SW-07	9.3	0.728	0.197	0.0542	
15 minute winter	U3-CD-02	3.000	U3-SW-01	17.4	0.374	0.542	2.5944	
15 minute winter	U2-CD-02	1.000	U2-SW-01	14.1	0.485	0.116	1.5008	
15 minute winter	U1-CD-01	5.000	U1-SW-02	-57.0	-0.517	-0.470	3.7452	
15 minute winter	CP-SW-01	9.000	CP-SW-02	6.3	0.665	0.395	0.2294	
1440 minute winter	SW-SW-07	1.011	Watercourse Headwall	9.3	0.624	0.428	0.2490	777.4

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.01%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	U1-SW-01	10	40.770	1.020	115.2	5.8997	4.9508	FLOOD
15 minute summer	U1-SW-02	10	40.766	1.220	137.9	2.9624	0.0000	FLOOD RISK
15 minute winter	U1-SW-03	10	40.767	1.406	127.1	5.7191	0.0000	FLOOD RISK
15 minute winter	U1-SW-04	10	40.673	1.494	194.9	4.2520	0.0000	SURCHARGED
15 minute winter	U1-SW-07	11	40.405	1.395	421.0	2.4012	0.0000	SURCHARGED
1440 minute winter	SW-SW-03	1410	40.306	1.332	74.0	2.2759	0.0000	SURCHARGED
1440 minute winter	SW-SW-04	1410	40.306	1.443	75.3	4.2143	0.0000	SURCHARGED
1440 minute winter	SW-SW-06	1410	40.306	1.487	78.0	3.9874	0.0000	SURCHARGED
1440 minute winter	SW-SW-05	1410	40.306	0.856	1.3	1.3897	0.0000	SURCHARGED
1440 minute winter	CP-SW-02	1410	40.306	0.652	1.2	0.8805	0.0000	SURCHARGED
1440 minute winter	U1-SW-08	1410	40.306	0.686	1.4	1.0300	0.0000	SURCHARGED
15 minute winter	U1-SW-05	11	40.989	0.789	114.6	3.2172	0.0000	SURCHARGED
15 minute winter	U1-SW-06	11	40.602	0.535	228.1	2.2140	0.0000	SURCHARGED
15 minute winter	SW-SW-01	11	40.377	0.177	47.2	0.4144	0.0000	OK
15 minute winter	U3-SW-01	12	40.830	0.862	55.9	1.3569	0.0000	SURCHARGED
15 minute winter	U3-SW-02	12	40.868	1.005	121.5	3.5835	0.0000	SURCHARGED
15 minute winter	SW-SW-02	12	40.711	1.267	272.7	3.1095	0.0000	SURCHARGED
15 minute winter	U3-SW-03	11	40.537	0.087	4.8	0.0988	0.0000	OK
15 minute winter	U3-SW-04	11	40.535	0.253	82.6	0.8274	0.0000	OK
15 minute winter	U2-SW-01	12	40.921	0.831	88.5	1.3247	0.0000	SURCHARGED
30 minute summer	U2-SW-02	19	40.900	0.900	76.3	2.6618	0.0000	SURCHARGED

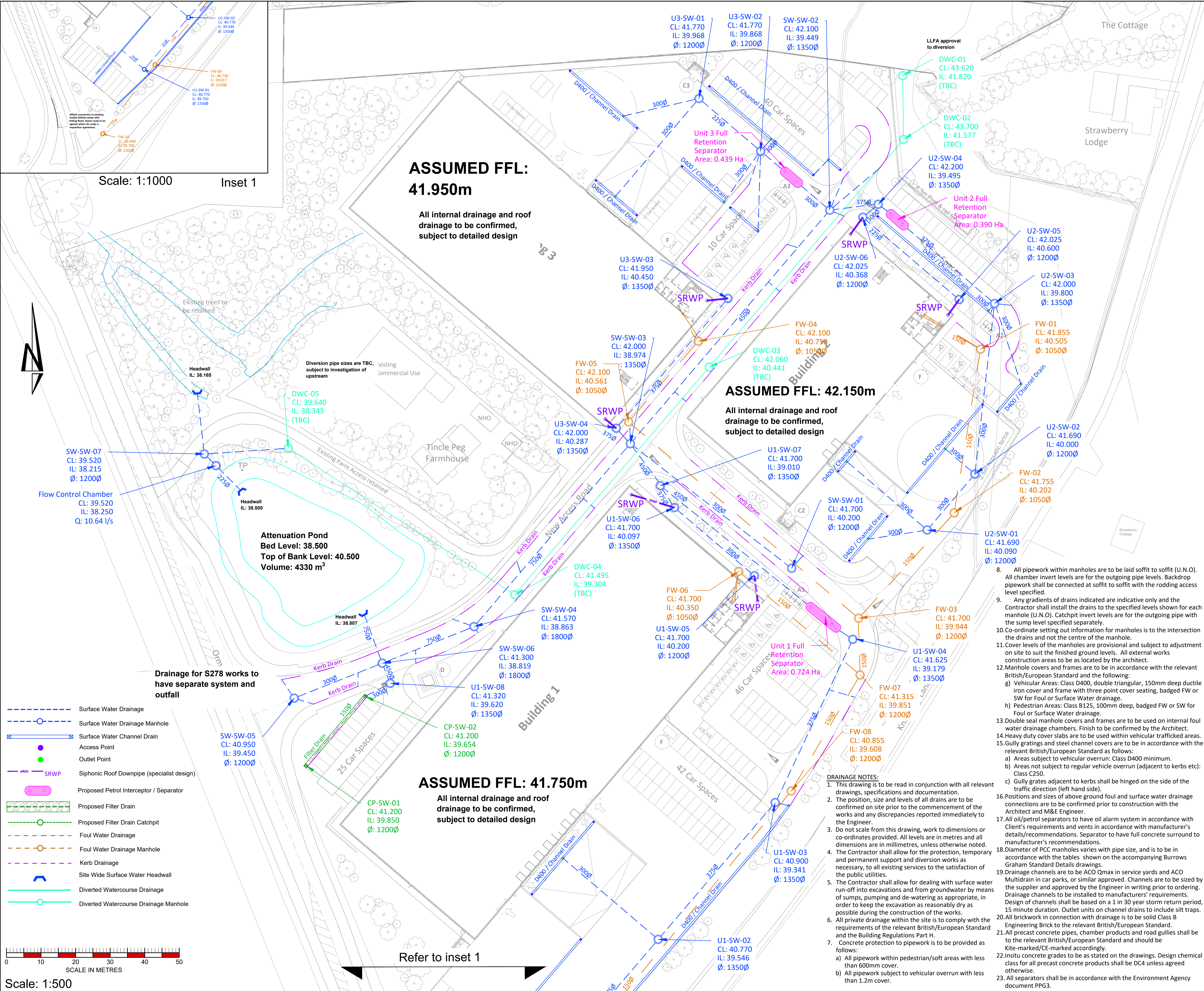
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	U1-SW-01	4.000	U1-SW-02	96.8	1.051	0.805	4.1394	
15 minute summer	U1-SW-02	4.001	U1-SW-03	87.3	0.910	0.721	5.5027	
15 minute winter	U1-SW-03	4.002	U1-SW-04	128.0	1.161	1.056	5.4213	
15 minute winter	U1-SW-04	4.003	U1-SW-07	183.1	1.156	1.140	10.7280	
15 minute winter	U1-SW-07	4.004	SW-SW-03	418.7	2.643	2.606	2.2572	
1440 minute winter	SW-SW-03	1.006	SW-SW-04	73.6	0.501	0.147	29.3257	
1440 minute winter	SW-SW-04	1.007	SW-SW-06	75.2	0.448	0.150	11.6685	
1440 minute winter	SW-SW-06	1.008	Depth/Area 1	77.8	0.777	0.062	15.2779	
1440 minute winter	SW-SW-05	10.000	SW-SW-06	1.2	0.387	0.016	1.8545	
1440 minute winter	CP-SW-02	9.001	U1-SW-08	1.2	0.352	0.017	0.5684	
1440 minute winter	U1-SW-08	9.002	SW-SW-06	1.4	0.362	0.009	0.8681	
15 minute winter	U1-SW-05	6.000	U1-SW-06	113.6	1.613	1.522	2.0547	
15 minute winter	U1-SW-06	6.001	U1-SW-07	227.7	2.065	1.879	0.7236	
15 minute winter	SW-SW-01	7.000	SW-SW-03	46.6	1.118	0.624	2.3283	
15 minute winter	U3-SW-01	3.001	U3-SW-02	-37.0	0.660	-0.495	1.6192	
15 minute winter	U3-SW-02	3.002	SW-SW-02	110.9	1.575	1.486	1.7315	
15 minute winter	SW-SW-02	1.005	SW-SW-03	275.8	1.741	1.407	13.4187	
15 minute winter	U3-SW-03	8.000	U3-SW-04	-4.8	-0.154	-0.072	1.8246	
15 minute winter	U3-SW-04	8.001	SW-SW-03	81.7	1.162	0.699	0.4151	
15 minute winter	U2-SW-01	1.001	U2-SW-02	-72.5	-0.736	-0.539	2.1762	
30 minute summer	U2-SW-02	1.002	U2-SW-03	80.4	1.164	0.598	5.0163	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.01%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	U2-SW-03	20	40.817	1.024	81.4	1.5309	0.0000	SURCHARGED
1440 minute winter	Depth/Area 1	1410	40.306	1.806	85.2	2225.9610	0.0000	FLOOD RISK
1440 minute winter	Watercourse Headwall	1410	38.249	0.084	10.5	0.0000	0.0000	OK
15 minute winter	U2-SW-04	12	40.806	1.311	143.1	2.1193	0.0000	SURCHARGED
15 minute winter	U2-SW-05	12	41.034	0.434	37.3	0.9285	0.0000	SURCHARGED
15 minute winter	U2-SW-06	12	40.857	0.489	73.0	0.9771	0.0000	SURCHARGED
1440 minute winter	Flow Control Chamber	1410	40.303	2.053	10.5	2.3216	0.0000	FLOOD RISK
15 minute winter	U3-CD-02	10	40.700	0.700	75.6	1.5519	14.9743	FLOOD
15 minute summer	U2-CD-02	12	40.900	0.700	83.9	1.3818	0.8463	FLOOD
30 minute winter	U1-CD-01	16	40.500	0.800	149.0	2.4648	49.3061	FLOOD
1440 minute winter	CP-SW-01	1410	40.306	0.456	0.6	0.6303	0.0000	SURCHARGED
1440 minute winter	SW-SW-07	1410	38.304	0.109	10.5	0.1236	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	U2-SW-03	1.003	U2-SW-04	93.4	0.856	0.555	4.7369	
1440 minute winter	Depth/Area 1	1.009	Flow Control Chamber	10.5	0.265	0.090	0.1989	
15 minute winter	U2-SW-04	1.004	SW-SW-02	148.9	1.351	1.229	1.5072	
15 minute winter	U2-SW-05	2.000	U2-SW-06	35.7	0.945	0.898	1.3952	
15 minute winter	U2-SW-06	2.001	U2-SW-04	71.5	1.225	0.958	0.4605	
1440 minute winter	Flow Control Chamber	1.010	SW-SW-07	10.5	0.740	0.223	0.0602	
15 minute winter	U3-CD-02	3.000	U3-SW-01	-57.6	-0.818	-1.792	2.5944	
15 minute summer	U2-CD-02	1.000	U2-SW-01	-74.8	-0.713	-0.614	3.2482	
30 minute winter	U1-CD-01	5.000	U1-SW-02	-119.9	-1.087	-0.989	3.7452	
1440 minute winter	CP-SW-01	9.000	CP-SW-02	0.6	0.343	0.038	0.4269	
1440 minute winter	SW-SW-07	1.011	Watercourse Headwall	10.5	0.647	0.483	0.2706	854.0

Appendix D – Drainage Layout



THIS DRAWING IS THE COPYRIGHT OF BURROWS GRAHAM LIMITED.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION

MAINTENANCE

DEMOLITION

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT

GENERAL NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL THE RELEVANT ARCHITECTS, ENGINEERS' AND SERVICE ENGINEERS DRAWINGS & SPECIFICATIONS.

24. All below ground plastic/grp tanks shall be installed in accordance with the manufacturers instructions. They shall be provided with sufficient concrete surround to counter floatation and shall have a wall thickness adequate to resist the highest ground water level which could be encountered at their location.

25. All existing drainage/structures to be abandoned shall be broken out and removed from site, the excavation shall be backfilled with a suitable granular material to the required level. Alternatively, deep drains may be cleaned and grouted with a 1:10 cementitious grout, with structures broken down 1m below finished ground level and backfilled with a suitable granular material.

26. Where utility/land drainage trenches etc cross over drainage trenches, the Contractor shall construct an impermeable barrier to prevent groundwater infiltrating into the drainage trench.

27. Upon completion of the works the Contractor shall clean all drainage by jetting, removing all debris from site. no debris shall be permitted to enter the existing drainage system.

28. All works are assumed to be within public highway or within land owners lands & no works are required on third party land owners property.

29. All RWP, gully and channel connections shall be 150mm dia U.N.O. Waste/soil stack connections shall be 100mm dia. UNO and shall have internal above ground rodding eyes or large access fittings in accordance with Building Regulations.

30. Design assumes that no water authority sewers or other drainage systems require modification, diversion or abandoning.

31. Backfill to all drainage trenches to be Class 6F1 material.

32. All works within the public highway to be reinstated to highway authority requirements.

33. Unless otherwise agreed all outfalls to ponds and watercourses to be proprietary PCC Units. Headwall details to be approved by local Internal Drainage Board where applicable.

34. Penstocks where indicated shall be electronically operated complete with power supply and connection (refer to service engineers drawings for cable and ducting etc.)

35. Syphonic break chambers (i.e. with SRWP entering) to be constructed with open grated manhole covers. (waterway 2000 or similar approved)

36. No deep rooting trees/vegetation should be planted within 5.0m of any drainage works.

37. All WPC's, SRWP's and RWP's are shown indicatively. Locations shall be confirmed by others.

38. All manholes less than 1.5m deep are considered as none man entry and shall be maintained from ground level.

39. All sprinkler drain and gully locations and flow rates to be confirmed by the sprinkler Contractor. Potential local storage manholes for sprinkler discharge are to be confirmed following definition of system requirements. It is assumed that future sprinkler installation points will be located close to foul water drainage runs.

40. Below ground drainage connections to be provided to all canopy downpipes - 150mm dia with concrete bed and surround UNO.

41. All sewers to be adopted shall be in accordance with sewers for adoption and local water board details.

42. All headwalls to have guardrail and headwalls greater than 375mm dia to have a trash screen/grating fitted.

P1	05.08.22	RO	PRELIMINARY	JW
REV	DATE	BY	REVISION	CHK'D

Burrows Graham

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CLIENT

CaddickConstruction.

PROJECT

**KNOWSLEY BUSINESS PARK
KNOWSLEY**

DRAWING TITLE

DRAINAGE LAYOUT

OUR PROJECT NUMBER	DRAWING STATUS	OFFICE
22075	PRELIMINARY	NORTH
SCALE @ A1	DATE	DRAWN BY
AS SHOWN	05.08.2022	RO
DRAWING No	CHECKED BY	REV
22075-BGL-XX-XX-DR-C-00210	JW	P1

Appendix E – JPG Groundwater Results



CBR values of between 0.2% and 0.4% were obtained in the soft to firm low strength cohesive natural ground and CBR values of between 2.2% and 2.7% were obtained in the firm medium strength cohesive natural ground. CBR values of between 8.8% and 12.0% were obtained in the stiff high strength cohesive natural ground.

CBR values of between 1.9% and 2.4% were recorded in the granular natural ground.

7.4 Groundwater

During the investigation, water strikes, perched water and running sand were encountered in several exploratory holes. These are summarised in Table 7.4.1 below.

Table 7.4.1 – Summary Groundwater Levels encountered During Site Works

Exp. Hole	Groundwater Encountered
BH101	Water strike at 4.90m, no rise recorded.
TP101	Perched water encountered at 1.70m.
TP102	Perched water encountered at 2.20m.
TP103	Perched water encountered at 2.20m.
TP104	Perched water and running sand were encountered within sand lenses at 1.50m.
TP105	Perched water and running sand were encountered within sand lenses at 1.20m.
TP106	Perched water and running sand were encountered within sand lenses at 2.00m.
TP110	Perched water and running sand were encountered within sand lenses at 1.10m.
TP115	Perched water and running sand were encountered within sand lenses at 1.80m.
TP117	Perched water and running sand were encountered within sand lenses at 1.40m.
TP119	Perched water and running sand were encountered within sand lenses at 1.10m.
TP120	Perched water and running sand were encountered within sand lenses at 1.60m.

Gas and groundwater monitoring wells were installed in all the cable percussive boreholes. A summary of the monitored groundwater levels is presented in Table 7.4.2 below.

Table 7.4.2 – Summary of Monitored Groundwater Levels

Location	Water level during monitoring (m bgl)					
	3.05.2019	8.05.2019	15.05.2019	28/05/2019	13/06/2019	18/06/2019
BH101	1.95	1.78	1.78	1.87	1.80	1.55
BH102	1.52	1.46	1.43	1.48	1.31	DRY
BH103	1.30	1.33	1.42	1.55	0.90	1.17
BH104	6.70	6.80	6.83	DRY	DRY	DRY
BH105	0.90	0.80	0.95	0.98	0.66	0.76
BH106	3.29	3.30	3.33	3.30	2.43	3.20
BH107	3.28	3.40	3.34	DRY	0.81	0.97

Seven monitoring wells were installed and sealed within the natural ground.

Groundwater monitoring has been carried out on six occasions. Groundwater levels in BH101 to BH106 remained fairly consistent throughout the monitoring period.