



RIDGE

**JAGUAR LAND ROVER, HALEWOOD
BODY IN WHITE SOUTH EXTENSION**

**DRAINAGE TECHNICAL NOTE TO SUPPORT THE FLOOD
RISK ASSESSMENT**

SEPTEMBER 2022

Document Control Sheet

Project No: 5018966

Project Title: JLR, BIW South Extension, Halewood

Report Title: Drainage Technical Note to Support the Flood Risk Assessment

Report Reference: JLR-RDG-00-ZZ-RP-C-0001

Issue: 3

Status: Final

Date: 08.09.2022

Record of Issue

	Status	Author	Approved	Date
1	Final	Adam Matadar	Phil Barrett	08.09.22
2	Final	Adam Matadar	Phil Barrett	15.09.22
3	Final	Adam Matadar	Phil Barrett	16.09.22

Distribution

Issue	Organisation	Quantity
1	KC	1
2	KC	1
3	KC	1



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1.0 Introduction

In August 2022 a planning application was submitted to Knowsley Council for a proposed development that will facilitate the workings and construction of a new manufacturing facility (ref: 22/00458/FUL). The development is a two storey manufacturing facility on the site south of the main facility. As part of the planning application, Ridge and Partners prepared a Drainage Technical note to support the Flood Risk Assessment (JLR-FRA-70091479) prepared by WSP.

2.0 Drainage Strategy

2.1 Surface Water Strategy

The proposed development is situated on hardstanding land which previously housed a temporary tent structure which aided the Body in White (BIW) manufacturing process. The site is classed as brownfield.

The SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail below in **Table 1**:

Table 1: SuDS Hierarchal Approach

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Online data source 'Landis Soilscales' map shows ground conditions at the site to be <i>"Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils"</i> with impeded drainage. According to the Draft Site investigation Report, the site is underlain by Made Ground (up to 1.40m thick) overlying sandy gravelly clay (to a maximum depth of 20m bgl), with groundwater recorded at depths ranging from 1.2m – 6.0m bgl. As such, infiltration is unlikely to be feasible at the site.
Connection to Watercourse	No	An existing local watercourse is located east of the site boundary. Due to the topography and proximity of this watercourses, this approach would not be feasible.
Connection to Surface Water Sewer	Yes	An infrastructure based SW Drainage Strategy is considered feasible for the development, with run off from the hardstanding areas (courtyards and roof) directed to the new below ground infrastructure. A drainage strategy has been undertaken for the site to demonstrate that surface water runoff can be effectively managed within the site, without increasing the risk of flooding to the site or elsewhere.
Connection to Combined Sewer	No	Not feasible due to the private surface water sewer nearby.

Pre-development runoff rates for the brownfield areas were calculated using the Modified Rational method as detailed in the SuDS Manual. Although the Modified Rational Method provided at much higher runoff rate, the existing outfall 225mm dia pipe would not be able to discharge these high rates. Therefore, to be provide an accurate assessment, Colebrook White equation has been used to obtain the existing runoff rate for the existing outfall pipe.

This calculation has been provided within the **Appendix B**.

Table 2: Pre-Development Runoff Rate

Existing Impermeable Area (m ²)	Existing Runoff Rate (l/s)
19100	42.3

A drainage strategy has been undertaken for the site to demonstrate that surface water runoff can be effectively managed within the site, without increasing the risk of flooding to the site or elsewhere.

Table 3: Post-Development Runoff Rate

	Maximum Runoff (l/s)
Proposed Development	21

The post development SW runoff rate shown in **Table 3** is in line with Knowsley Council SFRA. This is a 50% betterment in the existing runoff rates and is in line with the Knowsley SFRA. 2012. At the time of writing this technical note, a pre-development enquiry had been made with the Knowsley Council LLFA. However, we are awaiting a response. Therefore, it is proposed that surface water is to discharge into the existing 450mm dia private surface water sewer (located north east), with a maximum discharge rate of 21l/s.

It is important to note that the red line boundary covers both the proposed building works area, and the proposed drainage works area. A site Location plan has been provided within **Appendix A**.

Proposed surface water from site will be attenuated within below ground geo-cellular storage crates prior to controlled release.

The proposed drainage layout for the new development and proposed highways will be designed in accordance with Design & Construction Guidance (DCG), Building Regulations Part H guidance, Environment Agency (peak rainfall allowances), i.e. up to the 30-year storm return period criterion (including 40% increase to account for climate change) and tested for the 1 in 100 year return period including a 45% increase to account for climate change to confirm that there is no flood risk to the properties.

Surface Water (SW) flows up to the 1 in 100-year event (including a 45% increase to allow for climate change) will be contained below ground to satisfy all guidance. In the case of this development, any flooding arising from blockages occurring in the proposed SW system, the SW flows will be directed away from the buildings and retained within the hard and soft landscaping

areas, with flows directed back into the surface water drainage network as water levels in the drainage network recede. Hydraulic calculations have been provided in **Appendix B**.

A management and maintenance document has been provided in **Appendix A** and will be included within the O&M manual at the site.

2.2 Foul Water Strategy

The outline foul water drainage strategy is to divert the existing foul water drainage that serves the main BIW facility. The proposed FW from the BIW south extension is to connect into the diverted foul water drain. A gravity connection to this sewer can be achieved.

The proposed private drainage layout for the new development site has been designed in accordance with BS EN 752: 2008 and Building Regulations Part H guidance.

Appendix A – Ridge Design Drawings

CONTENTS	
Identifier	Name
5018966-RDG-ZZ-ZZ-DR-C-0501	Proposed Drainage GA Sheet 1
5018966-RDG-ZZ-ZZ-DR-C-0502	Proposed Drainage GA Sheet 1
5018966-RDG-ZZ-ZZ-SC-C-0503	Manhole Schedule
5018966-RDG-ZZ-ZZ-DR-C-0504	Proposed Impermeable Areas
5018966-RDG-ZZ-ZZ-DR-C-0505	Flood Exceedance Plan
5018966-RDG-XX-ST-PL-A-0001-D	Location Plan

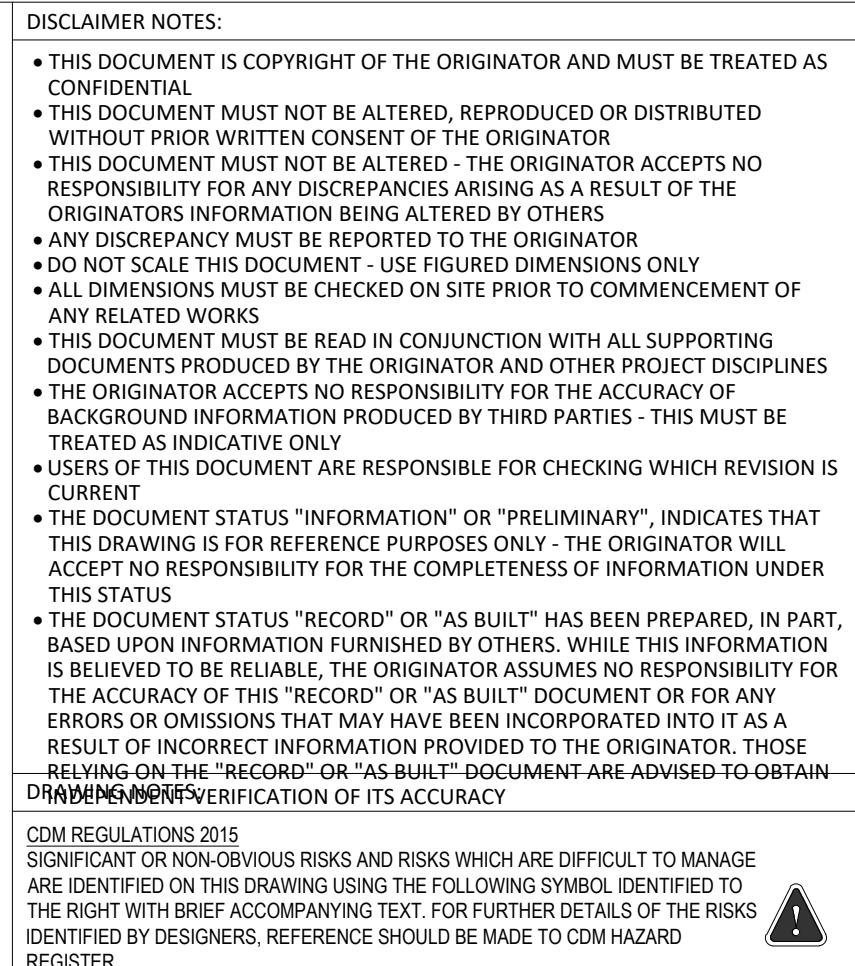
PROPOSED SW ATTENUATION BASED UPON IMPERMEABLE AREA
OF 1.9ha - SEE DRAWING 5017026-RDG-ZZ-ZZ-DR-C-0002 - Proposed
Impermeable Areas

ALL CONNECTIONS TO HAVE ABOVE GROUND
RODDABLE ACCESS.

EXISTING SW DRAINS TO BE
ABANDONED / REMOVED

EXISTING SW DRAINS UNDERNEATH
THE PROPOSED BUILDING ARE NOTED TO BE
ABANDONED. PRIOR TO REMOVING THE
ABANDONED DRAINS, THE SURVEYOR IS
REQUIRED TO CONFIRM IF THEY ARE
OPERATIONAL OR NOT AND CONFIRM
ANY OTHER INCOMING CONNECTIONS
(BLIND / SADDLE CONNECTIONS)

EXISTING FW DRAINS UNDERNEATH THE
PROPOSED BUILDING ARE NOTED TO BE
ABANDONED / REMOVED.
PRIOR TO REMOVING THE FW DRAINS A
CCTV SURVEY IS REQUIRED TO CONFIRM
IF THEY ARE ANY FURTHER INCOMING
CONNECTIONS (BLIND / SADDLE
CONNECTIONS).
EXISTING SVP RUNS TO BE DIVERTED
INTO THE PROPOSED FW SYSTEM



P02	REDUCE BOUNDARY AND THE PROPOSED SW TANK LOCATION UPDATED	15.09.22	AM	AM
P01	PRELIMINARY ISSUE	08.09.22	AP	AM
REV	DESCRIPTION	DATE	BY	CHKD
ORIGINATOR:				

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CLIENT:
JAGUAR LAND ROVER

IN ASSOCIATION
WITH:

PROJECT:
BIW SOUTH EXTENSION

TITLE:
PROPOSED DRAINAGE GA
SHEET 1 OF 2

ENG/TECH:	CSE:	ICSE:	SCALE:	1:250	@ A1
AP	AM	AM	STATUS/ISSUE:	0	

STATUS:	PRELIMINARY
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****UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK****

SUITABILITY:		SO - Initial Status or WIP					
PROJECT:	DOC:	ZONE:	LCUSE:	TYPE:	SOLE:	ALUMISO:	OD:

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018966	RDG	XX	XX	DR	C	0501	P02

REQUIRED INVESTIGATIONS

CONFIRM THE EXISTING SURFACE WATER DRAINS FLOWING WEST UNDERNEATH THE PROPOSED BUILDING ARE REDUNDANT.

INFILTRATION TESTING WITHIN THE SITE TO CONFIRM A SOAKAWAY OPTION IS VIABLE OR NOT.

PROPOSED RUNOFF RATE BASED UPON 50% BETTERMENT OF THE EXISTING RUNOFF RATES - IN LINE WITH THE KNOWSLEY SFRA 2012.

PROPOSED RUNOFF RATE OF 21l/s IS YET TO BE AGREED WITH KNOWSLEY COUNCIL (LLFA).

PROPOSED SW ATTENUATION BASED UPON IMPERMEABLE AREA OF 1.9ha - SEE DRAWING 5017026-RDG-ZZ-ZZ-DR-C-0002 - Proposed Impermeable Areas

EXISTING SERVICES UNDERNEATH THE PROPOSED BUILDING TO BE REMOVED OR DIVERTED. TBC AT THE APPROPRIATE STAGE.

ALL EXISTING DRAINAGE INFRASTRUCTURE UNDERNEATH THE PROPOSED BUILDING TO BE REMOVED / GRUBBED OUT UNLESS NOTED OTHERWISE.

ALL PROPOSED DRAINAGE INFRASTRUCTURE TO BE PRIVATE.

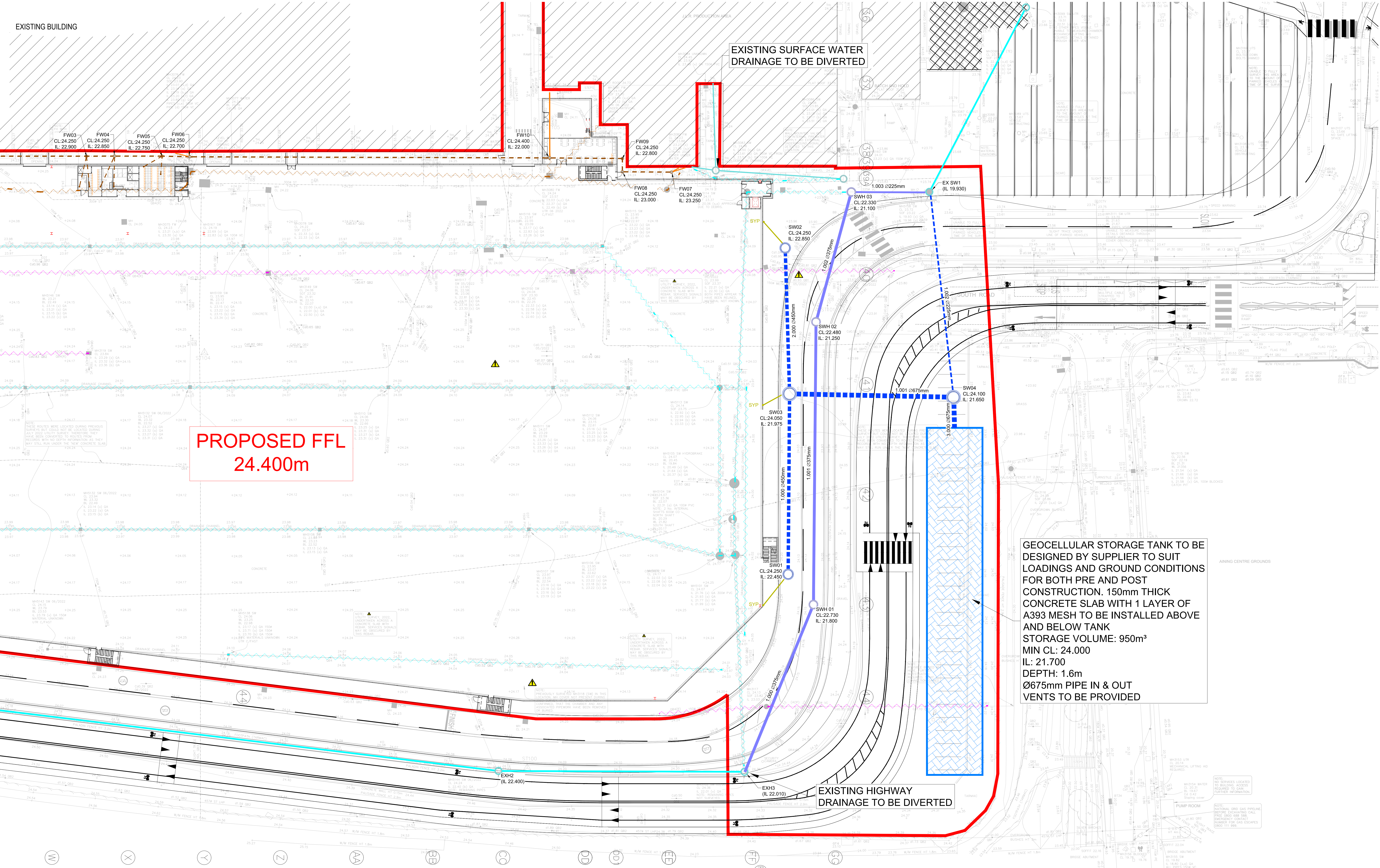
ALL RWP DROP LOCATIONS AND SYPHONIC DRAINAGE TO BE CONFIRMED BY OTHERS.

ALL CONNECTIONS TO HAVE ABOVE GROUND RODDABLE ACCESS.

DRAINAGE KEY

- PROPOSED FW SEWER
- PROPOSED FW MANHOLE
- PROPOSED SW SEWER
- PROPOSED SW MANHOLE
- PROPOSED HIGHWAY DRAINAGE DIVERSION
- EXISTING HIGHWAY DRAIN
- PROPOSED FW DIVERSION
- PROPOSED SIPHONIC DRAIN

- EXISTING SW DRAINS TO BE ABANDONED / REMOVED
- EXISTING SW DRAINS UNDERNEATH THE PROPOSED BUILDING ARE NOTED TO BE ABANDONED. PRIOR TO REMOVING THE ABANDONED DRAINS, A CCTV SURVEY IS REQUIRED TO CONFIRM IF THEY ARE OPERATIONAL OR NOT AND CONFIRM ANY OTHER INCOMING CONNECTIONS (BLIND / SADDLE CONNECTIONS)
- EXISTING FW DRAINS UNDERNEATH THE PROPOSED BUILDING ARE NOTED TO BE ABANDONED / REMOVED. PRIOR TO REMOVING THE FW DRAINS A CCTV SURVEY IS REQUIRED TO CONFIRM IF THEY ARE ANY FURTHER INCOMING CONNECTIONS (BLIND / SADDLE CONNECTIONS). EXISTING SVP RUNS TO BE DIVERTED INTO THE PROPOSED FW SYSTEM



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2 0 2 4 6 8 10
1:250

PROJECT: BIW SOUTH EXTENSION

TITLE: PROPOSED DRAINAGE GA SHEET 2 OF 2

ENG/TECH: CSE: AM KCE: AM SCALE: 1:250 @ A1 STATUS: PRELIMINARY

SUBMITTAL: 50 - Initial Status of VPP

PROJECT: 5018966 RDG XX XX DR C 0502 P02

MANHOLE SCHEDULE - HIGHWAY DIVERSION									
MANHOLE NO.	MANHOLE CO-ORDINATES	COVER LEVEL (m)	DEPTH TO INVERT (m)	MANHOLE SIZE	MANHOLE TYPE	PIPE IN NAME, INVERT LEVEL (m) & DIA	PIPE OUT NAME, INVERT LEVEL (m) & DIA	COVER SIZE (mm) & GRADE	COMMENTS
SWH 01	E:344661.665 N:383672.737	22.730	0.930	1,200	Type-B	1.000, IL=21.800, 375mmØ	1.001, IL=21.800, 375mmØ	600x600 D400	
SWH 02	E:344662.129 N:383723.651	22.480	1.230	1,200	Type-B	1.001, IL=21.250, 375mmØ	1.002, IL=21.250, 375mmØ	600x600 D400	
SWH 03	E:344668.491 N:383747.030	22.330	1.230	1,200	Type-B	1.002, IL=21.100, 375mmØ	1.003, IL=21.100, 225mmØ	600x600 D400	

SW MANHOLE SCHEDULE - BIW SOUTH EXTENSION									
MANHOLE NO.	MANHOLE CO-ORDINATES	COVER LEVEL (m)	DEPTH TO INVERT (m)	MANHOLE SIZE	MANHOLE TYPE	PIPE IN NAME, INVERT LEVEL (m) & DIA	PIPE OUT NAME, INVERT LEVEL (m) & DIA	COVER SIZE (mm) & GRADE	COMMENTS
SW01	E:344657.108 N:383678.204	24.250	1.800	1,500	Type-B		1.000, IL=22.450, 450mmØ	600x600 D400	
SW02	E:344656.581 N:383736.955	24.250	1.400	1,500	Type-B		2.000, IL=22.700, 450mmØ	600x600 D400	
SW03	E:344657.366 N:383710.696	24.050	2.075	2,100	Type-B	1.000, IL=22.200, 450mmØ 2.000, IL=22.200, 450mmØ	1.001, IL=21.975, 675mmØ	600 x 600 D400	
SW04	E:344686.789 N:383710.124	24.100	2.450	2,100	Flow Control	1.001, IL=21.650, 675mmØ 3.000, IL=21.650, 675mmØ	1.002, IL=21.650, 225mmØ	1200x675 D400	DESIGN FLOW: 21l/s DESIGN HEAD: 1.8m

FW MANHOLE SCHEDULE - BIW SOUTH EXTENSION									
MANHOLE NO.	MANHOLE CO-ORDINATES	COVER LEVEL (m)	DEPTH TO INVERT (m)	MANHOLE SIZE	MANHOLE TYPE	PIPE IN NAME, INVERT LEVEL (m) & DIA	PIPE OUT NAME, INVERT LEVEL (m) & DIA	COVER SIZE (mm) & GRADE	COMMENTS
FW01	E:344470.355 N:383750.234	24.250	0.900	450	IC	Pipe27, IL=23.350, 100mmØ	Pipe17, IL=23.350, 150mmØ	450 C250	CAST IRON AND FRAME
FW02	E:344470.355 N:383753.489	24.250	0.950	450	IC	Pipe17, IL=23.300, 150mmØ	Pipe18, IL=23.300, 150mmØ	450 C250	CAST IRON AND FRAME
FW03	E:344530.732 N:383753.491	24.250	1.350	450	IC	Pipe18, IL=22.900, 150mmØ Pipe31, IL=22.900, 100mmØ Pipe32, IL=22.900, 100mmØ	Pipe19, IL=22.900, 150mmØ	450 C250	CAST IRON AND FRAME
FW04	E:344535.792 N:383753.508	24.250	1.400	450	IC	Pipe19, IL=22.850, 150mmØ Pipe30, IL=22.850, 100mmØ Pipe33, IL=22.850, 100mmØ	Pipe20, IL=22.850, 150mmØ	450 C250	CAST IRON AND FRAME
FW05	E:344544.350 N:383753.499	24.250	1.500	450	IC	Pipe20, IL=22.750, 150mmØ Pipe28, IL=22.750, 100mmØ Pipe29, IL=22.750, 100mmØ Pipe36, IL=22.750, 100mmØ	Pipe21, IL=22.750, 150mmØ	450 C250	CAST IRON AND FRAME
FW06	E:344549.325 N:383753.381	24.250	1.550	450	IC	Pipe21, IL=22.700, 150mmØ Pipe34, IL=22.700, 100mmØ Pipe35, IL=22.700, 100mmØ	Pipe22, IL=22.700, 150mmØ	450 C250	CAST IRON AND FRAME
FW07	E:344636.108 N:383750.620	24.250	1.000	450	IC	Pipe37, IL=23.250, 100mmØ Pipe38, IL=23.250, 100mmØ	Pipe23, IL=23.250, 150mmØ	450 C250	CAST IRON AND FRAME
FW08	E:344627.247 N:383750.679	24.250	1.250	450	IC	Pipe23, IL=23.000, 150mmØ	Pipe24, IL=23.000, 150mmØ	450 C250	CAST IRON AND FRAME
FW09	E:344627.247 N:383753.072	24.250	1.450	450	IC	Pipe24, IL=22.800, 150mmØ	Pipe25, IL=22.800, 150mmØ	450 C250	CAST IRON AND FRAME
FW10	E:344614.168 N:383753.180	24.400	2.400	450	IC	Pipe22, IL=22.000, 150mmØ Pipe25, IL=22.000, 150mmØ	Pipe26, IL=22.000, 150mmØ	450 C250	RECESSED COVER

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PD	UPDATED TO SUIT THE LATEST DRAINAGE GA	15.08.22	AM	AM
PT	PRELIMINARY ISSUE	08.09.22	AP	AM
REV	DESCRIPTION	DATE	BY	CHKD

ORIGINATOR:

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JAGUAR LAND ROVER

IN ASSOCIATION
WITH:

PROJECT:
BIW SOUTH EXTENSION

TITLE:
PROPOSED MANHOLE SCHDULE

ENG/TECH:	CSE:	ICSE:	SCALE:	N.T.S	@	A1
AP	AM	AM	STATUS ISSUE	?		

STATUS:
PRELIMINARY

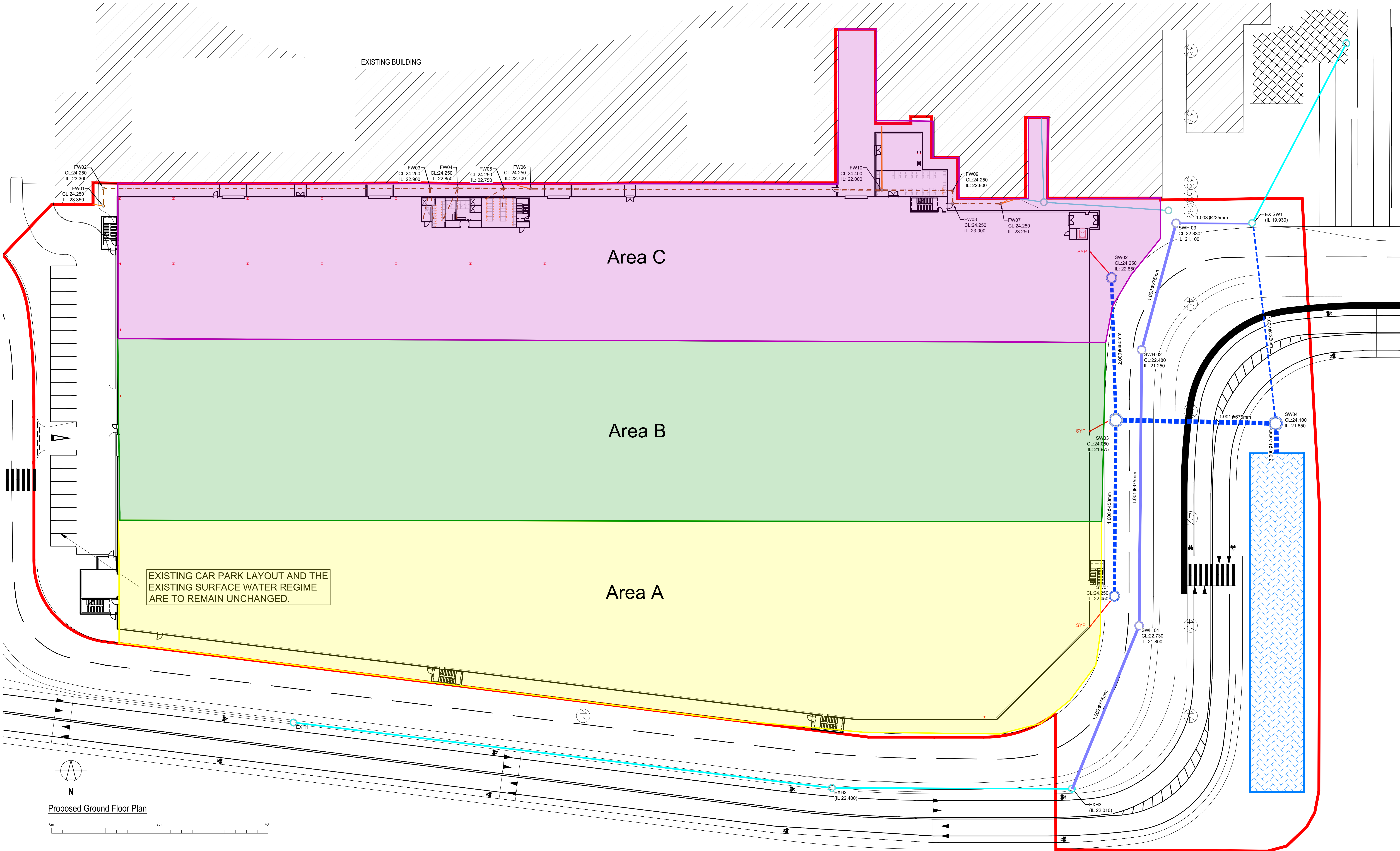
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SUITABILITY: SD - Initial Status or WIP

PROJECT:	ORG:	ZONE	LEVEL	TYPE	ROLE	NUMBER	REV:
5018966	RDG	XX	XX	SC	C	0503	P02

Catchment Area:

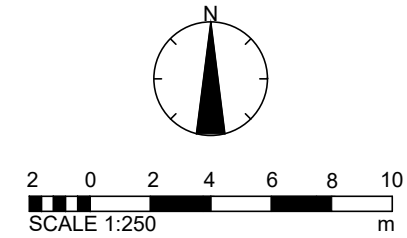
	AREA (ha)	PIPE No.
Area A	0.590	1.000
Area B	0.605	1.001
Area C	0.575	2.000
Total	1.770	



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P02	RED LINE BOUNDARY AND SW TANK LOCATION UPDATED	15/08/22	AM	AM
P01	PRELIMINARY ISSUE	08/08/22	AP	AM
REV	DESCRIPTION	DATE	BY	CHKD

ORIGINATOR:

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CLIENT:
JAGUAR LAND ROVER

IN ASSOCIATION
WITH:

PROJECT:
BIW SOUTH EXTENSION

TITLE:
PROPOSED
IMPERMEABLE AREAS

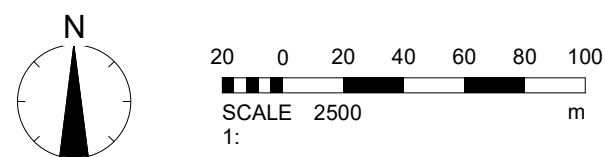
ENG/TECH: CSE: AM ICSE: AM SCALE: 1:250 @ A1

STATUS: PRELIMINARY

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SUITABILITY: 50 - Initial Status - VPP

PROJECT: 5018966 RDG: XX XX DR C 0504 P02



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- CDM REGULATIONS 2015
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REV	DESCRIPTION	DATE	BY	CHKD
D	Updated to show full building outlines	05/09/22	KS	PW
C	Updated following comments received 02/09/22	02/09/22	KS	PW
B	PLANNING Issue	01/09/22	KS	PW
A	Interim design issue for client review	11/08/22	KS	PW

CLIENT



IN ASSOCIATION WITH:

PROJECT

South Apron BIW Building

TITLE:
Location Plan

DRAWN BY:	PG	SCALE:	As @ A1
CHECKED:	KS	DATE:	indicated 08/10/22

STATUS

PLANNING

DRAWING No:

PROJECT	ORG.	ZONE	LEVEL	TYPE	ROLE	NUMBER	REV
5018966	RDG	ZZ	ST	PL	A	0001	D

ORIGINATOR:

RIDGE

5th Floor Belvedere House
12 Booth Street
Manchester
M2 4AW

TEL NO: 0161 833 9579

WWW.RIDGE.CO.UK

Appendix B – Hydraulic Calculations

Outputs from the Microdrainage software for the surface water drainage networks serving the development are provided. Pipe references from the hydraulic models can be located on the drainage layout plan.

BROWNFIELD CALCUALTION

MODIFIED RATIONAL METHOD

$$Q = 2.78 \times C_v \times i \times A_i$$

$$= 2.78 \times 1 \times 50\text{mm/hr} \times 1.9\text{ha}$$
$$= 264.1\text{l/s}$$

$$225 \text{ dia Pipe Capacity} = 42.3\text{l/s}$$

Therefore the existing Runoff Rate from the site = 42.3l/s

To be in line with Knowlsey SFRA 2012, the existing Runoff Rate is to be reduced by 50%

$$\text{Proposed Runoff Rate} = 21\text{l/s}$$

PROJECT BIW South Extension		DRAWING BROWNFIELD CALCULATION	
RIDGE THE COWYARDS BLENHEIM PARK OXFORD ROAD WOODSTOCK, OX20 1QR www.ridge.co.uk Also at Reading, Bristol, London and Leicester		CLIENT JAGUAR LAND ROVER	
SCALE	DATE SEPT 2022	DRAWN BY AM	CHECKED BY PB
FILE REFERENCE:			
DRG NO		REV	

Culvert 1-8

COLEBROOK WHITE

Roughness	0.6	mm	State Grad (y/n) U/S level	Y				State Gradient 1 in x		121	fluid kinematic viscosity			
				0.0006							1.140E-06			
											base			
Diam(mm)	225	mm	D/S level Gradient	0.225							viscosity correction			
Length	52.3	m						0.00826446		1in	121	1.00 water@15C		
PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH _mm_	V^2/2g	Froude No	
FULL	0.70685835	0.039760782	0.0562500	0.382	0.00072072	6.6591E-05	-3.1038534	1.19	47.16	225	0	0.07	N/A	
0.01	0.04507534	6.72971E-05	0.0014930	0.062	0.02715388	0.01539968	-1.371064	0.09	0.01	2	45	0.00	0.70	
0.02	0.06385367	0.000189769	0.0029719	0.088	0.01364111	0.00548326	-1.718413	0.15	0.03	5	63	0.00	0.88	
0.03	0.07833735	0.000347567	0.0044368	0.107	0.00913736	0.00300604	-1.9156599	0.21	0.07	7	77	0.00	0.97	
0.04	0.09061106	0.000533473	0.0058875	0.124	0.00688586	0.00196653	-2.0529392	0.25	0.14	9	88	0.00	1.04	
0.05	0.10148103	0.00074325	0.0073240	0.138	0.00553528	0.00141734	-2.1578516	0.30	0.22	11	98	0.00	1.09	
0.1	0.14478775	0.002069311	0.0142920	0.193	0.00283658	0.00051994	-2.4741097	0.48	0.98	23	135	0.01	1.23	
0.15	0.17896474	0.003739907	0.0208975	0.233	0.00193998	0.00029408	-2.6509071	0.62	2.31	34	161	0.02	1.29	
0.2	0.20864142	0.00566108	0.0271331	0.265	0.00149414	0.00019877	-2.7713667	0.74	4.16	45	180	0.03	1.32	
0.25	0.23561945	0.007773277	0.0329908	0.293	0.00122884	0.00014825	-2.8610351	0.84	6.51	56	195	0.04	1.34	
0.3	0.26083788	0.010032273	0.0384617	0.316	0.00105405	0.00011778	-2.9311374	0.93	9.29	68	206	0.04	1.34	
0.35	0.28487333	0.012402137	0.0435356	0.336	0.0009312	9.7798E-05	-2.9875837	1.00	12.45	79	215	0.05	1.33	
0.4	0.30812364	0.014851846	0.0482009	0.354	0.00084107	8.3949E-05	-3.0338476	1.07	15.94	90	220	0.06	1.32	
0.45	0.3308915	0.017353366	0.0524443	0.369	0.00077302	7.3969E-05	-3.0721215	1.13	19.66	101	224	0.07	1.30	
0.5	0.35342917	0.019880391	0.0562500	0.382	0.00072072	6.6591E-05	-3.1038534	1.19	23.58	113	225	0.07	1.27	
0.55	0.37596684	0.022407416	0.0595994	0.393	0.00068022	6.1057E-05	-3.1300214	1.23	27.58	124	224	0.08	1.24	
0.6	0.39873471	0.024908936	0.0624699	0.403	0.00064896	5.6897E-05	-3.1512827	1.27	31.58	135	220	0.08	1.20	
0.65	0.42198502	0.027358645	0.0648332	0.410	0.00062531	5.3815E-05	-3.1680535	1.30	35.54	146	215	0.09	1.16	
0.7	0.44602046	0.029728509	0.0666528	0.416	0.00060823	5.1626E-05	-3.1805476	1.32	39.30	158	206	0.09	1.11	
0.75	0.4712389	0.031987505	0.0678796	0.420	0.00059724	5.0233E-05	-3.188777	1.34	42.80	169	195	0.09	1.05	
0.8	0.49821692	0.034099702	0.0684435	0.421	0.00059232	4.9614E-05	-3.192509	1.35	45.86	180	180	0.09	0.99	
0.85	0.52789361	0.036020875	0.0682351	0.421	0.00059413	4.9841E-05	-3.1911335	1.34	48.34	191	161	0.09	0.90	
0.9	0.5620706	0.037691471	0.0670583	0.417	0.00060456	5.1159E-05	-3.1832843	1.33	50.05	203	135	0.09	0.80	
0.95	0.60537731	0.039017532	0.0644516	0.409	0.00062901	5.4293E-05	-3.1653879	1.29	50.49	214	98	0.09	0.66	
1	0.70685835	0.039760782	0.0562500	0.382	0.00072072	6.6591E-05	-3.1038534	1.19	47.16	225	0	0.07	N/A	
0.7975	0.49681394	0.033998216	0.0684325	0.421	0.00059242	4.9625E-05	-3.1924365	1.35	45.73	179	181	0.09	0.99	

Scott Hughes Design Ltd		Page 0
The Flint Glass Works 64 Jersey Street Manchester M4 6JW	JLR BIW, HALEWOOD SW RESULTS	
Date 07/09/2022	Designed by AM	
File SW_P1.mdx	Checked by PB	
Micro Drainage		Network 2018.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Proposed SW

Pipe Sizes Pipe Manhole Sizes Manhole

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.600
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	400

Designed with Level Soffits

Network Design Table for Proposed SW

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	32.447	0.250	129.8	0.600	5.00	0.0	0.600	o	450	Pipe/Conduit	
2.000	26.329	0.250	105.3	0.600	5.00	0.0	0.600	o	450	Pipe/Conduit	
1.001	32.560	0.325	100.2	0.600	0.00	0.0	0.600	o	675	Pipe/Conduit	
3.000	24.071	0.050	481.4	0.000	5.00	0.0	0.600	o	675	Pipe/Conduit	
1.002	36.922	0.200	184.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.30	22.450	0.600	0.0	0.0	0.0	1.78	283.6	81.2
2.000	50.00	5.22	22.450	0.600	0.0	0.0	0.0	1.98	315.0	81.2
1.001	50.00	5.51	21.975	1.800	0.0	0.0	0.0	2.62	937.1	243.7
3.000	50.00	5.34	21.700	0.000	0.0	0.0	0.0	1.19	425.0	0.0
1.002	50.00	6.15	21.650	1.800	0.0	0.0	0.0	0.96	38.1«	243.7



Manhole Schedules for Proposed SW

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW01	24.250	1.800	Open Manhole	1500	1.000	22.450	450				
SW02	24.250	1.800	Open Manhole	1500	2.000	22.450	450				
SW03	24.250	2.275	Open Manhole	2100	1.001	21.975	675	1.000	22.200	450	
								2.000	22.200	450	
SW TANK	24.000	2.300	Sealed Manhole	0	3.000	21.700	675				
SW04	24.100	2.450	Open Manhole	2100	1.002	21.650	225	1.001	21.650	675	
								3.000	21.650	675	
SW05	23.750	2.300	Open Manhole	900		OUTFALL		1.002	21.450	225	

PIPELINE SCHEDULES for Proposed SW

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	450	SW01	24.250	22.450	1.350	Open Manhole	1500
2.000	o	450	SW02	24.250	22.450	1.350	Open Manhole	1500
1.001	o	675	SW03	24.250	21.975	1.600	Open Manhole	2100
3.000	o	675	SW TANK	24.000	21.700	1.625	Sealed Manhole	0
1.002	o	225	SW04	24.100	21.650	2.225	Open Manhole	2100

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	32.447	129.8	SW03	24.250	22.200	1.600	Open Manhole	2100
2.000	26.329	105.3	SW03	24.250	22.200	1.600	Open Manhole	2100
1.001	32.560	100.2	SW04	24.100	21.650	1.775	Open Manhole	2100
3.000	24.071	481.4	SW04	24.100	21.650	1.775	Open Manhole	2100
1.002	36.922	184.6	SW05	23.750	21.450	2.075	Open Manhole	900

Free Flowing Outfall Details for Proposed SW

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
---------------------	--------------	--------------	--------------	------------------	----------	--------

1.002 SW05 23.750 21.450 0.000 900 0

Simulation Criteria for Proposed SW

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

Scott Hughes Design Ltd		Page 3
The Flint Glass Works 64 Jersey Street Manchester M4 6JW	JLR BIW, HALEWOOD SW RESULTS	
Date 07/09/2022	Designed by AM	
File SW_P1.mdx	Checked by PB	
Micro Drainage		Network 2018.1

Online Controls for Proposed SW

Hydro-Brake® Optimum Manhole: SW04, DS/PN: 1.002, Volume (m³): 27.6

Unit Reference	MD-SHE-0191-2100-1800-2100
Design Head (m)	1.800
Design Flow (l/s)	21.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	191
Invert Level (m)	21.650
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	21.0	Kick-Flo®	1.139	16.9
Flush-Flo™	0.532	21.0	Mean Flow over Head Range	-	18.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	0.800	20.4	2.000	22.1	4.000	30.8	7.000	40.3
0.200	17.6	1.000	19.0	2.200	23.1	4.500	32.6	7.500	41.7
0.300	19.9	1.200	17.3	2.400	24.1	5.000	34.2	8.000	43.0
0.400	20.7	1.400	18.6	2.600	25.0	5.500	35.9	8.500	44.3
0.500	21.0	1.600	19.8	3.000	26.8	6.000	37.4	9.000	45.5
0.600	20.9	1.800	21.0	3.500	28.8	6.500	38.9	9.500	46.7

Storage Structures for Proposed SW

Cellular Storage Manhole: SW TANK, DS/PN: 3.000

Invert Level (m) 21.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	625.0	0.0	1.600	625.0	0.0	1.601	0.0	0.0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Proposed SW

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 Coeffiecient 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 Offline Controls 0
Number of Online Controls	1	Number of Storage Structures 1
		Number of Time/Area Diagrams 0
		Number of Real Time Controls 0
Synthetic Rainfall Details		
Rainfall Model	FSR M5-60 (mm)	20.000 Cv (Summer) 0.750
Region England and Wales	Ratio R	0.400 Cv (Winter) 0.840
Margin for Flood Risk Warning (mm)		300.0
Analysis Timestep	2.5 Second Increment (Extended)	
DTS Status		OFF
DVD Status		ON
Inertia Status		ON
Profile(s)		Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080	
Return Period(s) (years)		1, 30, 100
Climate Change (%)		0, 40, 45

PN	US/MH		Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume
	Name	Storm							(m)	(m)	(m³)
1.000	SW01	15 Winter	1	+0%	30/15 Summer				22.632	-0.268	0.000
2.000	SW02	15 Winter	1	+0%	30/15 Summer				22.624	-0.276	0.000
1.001	SW03	15 Winter	1	+0%	30/15 Summer				22.469	-0.181	0.000
3.000	SW TANK	60 Winter	1	+0%	30/30 Summer				21.910	-0.465	0.000
1.002	SW04	15 Summer	1	+0%	1/15 Summer	100/60 Winter			22.388	0.513	0.000

PN	US/MH Name	Pipe		Status	Level Exceeded
		Flow / Cap.	Overflow (l/s)		
1.000	SW01	0.33	82.0	OK	
2.000	SW02	0.31	83.0	OK	
1.001	SW03	0.30	217.7	OK	
3.000	SW TANK	0.06	18.0	OK	
1.002	SW04	0.58	20.9	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Proposed SW

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 Coeffiecient 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 Offline Controls 0
Number of Online Controls	1	Number of Storage Structures 1
		Number of Time/Area Diagrams 0
		Number of Real Time Controls 0
Synthetic Rainfall Details		
Rainfall Model	FSR M5-60 (mm)	20.000 Cv (Summer) 0.750
Region England and Wales	Ratio R	0.400 Cv (Winter) 0.840
Margin for Flood Risk Warning (mm)		300.0
Analysis Timestep	2.5 Second Increment (Extended)	
DTS Status		OFF
DVD Status		ON
Inertia Status		ON
Profile(s)		Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080	
Return Period(s) (years)		1, 30, 100
Climate Change (%)		0, 40, 45

										Water	Surcharged	Flooded
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.		Level (m)	Depth (m)	Volume (m³)
1.000	SW01	15 Winter	30	+40%	30/15 Summer					23.432	0.532	0.000
2.000	SW02	15 Winter	30	+40%	30/15 Summer					23.373	0.473	0.000
1.001	SW03	15 Winter	30	+40%	30/15 Summer					23.203	0.553	0.000
3.000	SW TANK	240 Winter	30	+40%	30/30 Summer					22.756	0.381	0.000
1.002	SW04	60 Winter	30	+40%	1/15 Summer	100/60 Winter				22.976	1.101	0.000

		Pipe		Level	
PN	US/MH Name	Flow / Overflow Cap. (l/s)	Flow (l/s)	Status	Exceeded
1.000	SW01	1.07	264.4	SURCHARGED	
2.000	SW02	1.01	268.9	SURCHARGED	
1.001	SW03	1.08	781.1	SURCHARGED	
3.000	SW TANK	0.06	19.9	SURCHARGED*	
1.002	SW04	0.58	20.9	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Proposed SW

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume
									(m)	(m)	(m³)
1.000	SW01	15 Winter	100	+45%	30/15 Summer				24.216	1.316	0.000
2.000	SW02	60 Winter	100	+45%	30/15 Summer				24.146	1.246	0.000
1.001	SW03	120 Winter	100	+45%	30/15 Summer				24.081	1.431	0.000
3.000	SW TANK	240 Winter	100	+45%	30/30 Summer				23.285	0.910	0.000
1.002	SW04	120 Winter	100	+45%	1/15 Summer	100/60 Winter			23.975	2.100	0.000

PN	US/MH Name	Pipe Flow / Overflow		Pipe Flow (l/s)	Status	Level Exceeded
		Cap.	(l/s)			
1.000	SW01	1.42		348.8	FLOOD RISK	
2.000	SW02	0.77		204.8	FLOOD RISK	
1.001	SW03	0.48		348.9	FLOOD RISK	
3.000	SW TANK	0.06		19.3	SURCHARGED*	
1.002	SW04	0.58		20.9	FLOOD RISK	