63 St Thomas Street t+44 117 976 5432 Bristol BS1 6JZ f +44 117 976 5433 United Kingdom www.arup.com Project title Job number Hadley Wood Golf Club 255966 сс File reference Prepared by Date Yazdi Batki 17 February 2021 Subject Proposed Drainage Technical Note

1 Introduction and Proposed Development

Ove Arup & Partners (Arup) have been commissioned by Hadley Wood Golf Club to prepare a Surface Water Drainage to discharge planning conditions related to planning application ref: 18/03088/FUL. These conditions are:

- 16: No above ground works shall commence until details of the surfacing materials to be used within the development including footpaths, access roads and parking areas and road markings have been submitted to and approved in writing by the Local Planning Authority. The details shall include measures to prevent gravel spreading outside of the site and on to the highway. The surfacing shall be carried out in accordance with the approved detail before the development is occupied or use commences.
- 20: The development shall not commence until plans detailing the existing and proposed ground levels including the levels of any proposed buildings, roads and/or hard surfaced areas have been submitted to and approved in writing by the Local Planning Authority. The development shall be constructed in accordance with the approved details.
- 27: Notwithstanding the details set out in the submitted Preliminary Drainage Strategy February 2020, prior to the commencement of any construction work, details of the Sustainable Drainage Strategy shall be submitted to and approved in writing by the Local Planning Authority and must conform with the Landscaping Strategy. The details shall include:
 - Sizes, storage volumes, cross-sections, long-sections (where appropriate) and specifications of all proposed SuDS measures including rain gardens, green/brown roofs and permeable paving. Include calculations demonstrating functionality where relevant
 - Information on the flow control mechanisms for the two properties, with the retained property discharging at 3L/s to the surface sewer and the new property discharging close to greenfield runoff rate for 1 in 1 year and 1 in 100 year storm events
 - Management Plan for future maintenance
 - Overland flow routes for exceedance events

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This report accompanies the drawings located in Appendix A to further explain the proposed surface water drainage strategy. This report has been produced in addition to the Flood Risk Assessment previously submitted and accepted. The drainage design follows the principals and guidance set out in the FRA document design and seeks to satisfy the LLFA's criteria.

The proposed development will demolish a 1920s extension and ancillary building to allow the site to be divided into 2 separate plots. The lodge site will be extended and refurbished whilst the new plot of land will be developed to hold a new dwelling; both sites will also have garages, a patio area and large gardens.

The existing roof on the lodge will be replaced with a shallow pitch roof and the proposed lodge extension will hold a green/brown roof. The new build property will have a green and a blue roof for the for most of the roof area although it is proposed there will be several sky lights or ceiling windows. The garages on both plots will have green/brown roofs.

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2 Proposed Surface Water Drainage Strategy

2.1 General

Surface water generated by the proposed buildings and the renovated lodge site will be discharged into the sewer at an attenuated rate discussed within the FRA. The rates differ for each property and are noted below in 2.2; these rates have been agreed with the LLFA within the approved FRA. The proposed Surface Water Drainage Strategy drawing is shown in appendix A and the Microdrainage calculations to accompany them are shown in Appendix B along with a corresponding pipe diagram.

The proposed buildings will have blue and green/brown roofs to attenuate and clean the water prior to discharge. The existing lodge building will have a new, impermeable roof due to building constraints and listing status. This arrangement can be seen in more detail on the Surface Water Drainage Strategy drawing in Appendix A.

Both the existing and proposed buildings have substantial gardens which are soft landscaped and do not require positive drainage.

2.2 The Existing Lodge

The existing lodge site will discharge surface water at a reduced rate of 3 l/s to the adopted sewer as noted in the FRA. Using Microdrainage software to carry out detailed calculations, Arup confirms the rain garden originally proposed in the FRA is no longer required as we have increased several below ground pipe sizes from 150mm to 225mm diameter. The proposed area that would have been used as the rain garden will remain as soft landscaping.

The Lodge site will have a shallow pitch roof on the existing building but the proposed extension and garage will have green/brown roofs. This will help attenuate the first 5-10mm of rainwater and provide clearing and filtration. Any excess water from the green/brown roofs will be discharged to the sewer.

The patio to the rear of the lodge will be at a lower level than the surrounding ground and therefore cannot drain to the soft areas around the property. The patio area will therefore be drained positively to a linear channel which will then discharge into the oversized sewer within the site.

The driveway area will be constructed using a no dig construction method in line with the Tree Officers advice. The surface and subgrade will therefore be permeable along with the surrounding soft landscaping.

2.3 **Proposed New Build**

The proposed new build property has a permitted discharge rate of 0.7 l/s; the lowest rate that can be reliably achieved using a mechanical flow control device such as a Hydrobrake. To achieve this discharge rate a total volume of $5m^3$ attenuation is required on the site, achieved using permeable paving on the driveway, an oversized pipe beneath the driveway and a blue/green roof on the house and garage.

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The drainage condition refers to a stepped surface water discharge rate with a greater volume of surface water permitted to discharge during the heaviest rainfall events. After further investigation and discussion, it has been decided that offering a single rate of discharge at the lower agreed rate is more desirable, will reduce risk of blockages and would be less onerous for any homeowner to maintain.

The proposed building will have a blue roof over approximately 75% of its surface with the exception of the areas required for sky lights, a small section of single ply between the 2 buildings and a small area to the rear. The blue roof will attenuate rainwater and slow the rate of discharge into the sewer network helping to reduce the risk of any flooding downstream in the network. The approximate rate of discharge from the roof will be circa 1 l/s however this will fluctuate during the heaviest and lightest storm events.

A diagram of the proposed roof area is shown below for information. As with lodge site, the garage will have a green/brown roof so the first 5-10mm of water will be attenuated and the remainder filtered prior to discharge into the drainage system.



The driveway will be constructed using permeable paving to a minimum depth of 350mm, although this may increase depending on ground conditions. This will provide attenuation for the drive and the adjacent garage whilst also filtering any hydrocarbons or particles that may be present. The roof of the garage will also discharge surface water into the driveway subbase using a below ground permeable pipe and once through the subbase, the water will be discharged into the drainage system and attenuated within the oversized pipe as required.

The garden area is almost fully soft landscaped apart from the proposed patio areas which will be hard paved allowing rainwater to run off onto the surroundings. The light wells for the basement will also be positively drained using linear channels; the base level is much lower than the surrounding ground therefore cannot drain onto the soft landscaping.

2.4 Exceedance Events

If an exceedance event occurs, the levels are such that surface water will fall away from the properties reducing the risk of internal flooding.

A drawing showing the flow routes and levels strategy is shown in Appendix A, indicating the route water will travel in such an event. Water from the rear of both properties will fall away from the

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houses into the green areas of the garden and toward the rear of the gardens. The front of the lodge property drains to the side and then to the rear whilst the new build property will retain most of the water on the driveway area.

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3 Maintenance

3.1 General

Maintenance of the general drainage system will be the responsibility of the property owner up to their boundary. They will have the same responsibility as other home owners to ensure the pipework is well maintained and working properly.

3.2 Flow Control devices

The Hydrobrake devices will need to be maintained as per the manufacturer's instructions. This usually entails a visual inspection every six month to ensure no debris or blockages and annual servicing. This may be more or less frequent depending on the flow control device selected.

3.3 Blue roof

Depending on the system used, the maintenance will differ. A blue roof generally requires very little maintenance other than visual inspections and clearance of any debris from in or around the rainwater pipe outlets. The crates are usually hidden and therefore need to be inspected by a professional and may occasionally require cleaning. Frequency to be confirmed by the blue roof provider.

3.4 Green/Brown roof

The green/brown roofs on top of the garages and lodge extension will require maintenance in the form of regular visual inspections to ensure no debris has come loose or there are no blockages in the rainwater pipe.

The roofs may require occasional cutting/trimming depending on the type of system chosen however this is often not essential and most plants are chosen for minimal maintenance and hardiness.

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4 Summary

This Technical note has been written to accompany the drainage strategy as set out in the drainage drawings shown in appendix A and in the previously submitted FRA.

The development includes the refurbishment and extension of the existing lodge site as well as the construction of a new 2 storey building. Both will drain positively to the adopted sewer at a controlled rate.

The existing lodge site will discharge surface water to the sewer at a limited rate of 3l/s. this will require on site attenuation in the form of oversized pipes below ground. The green/brown roof on the extension and the garage area assist in keeping the discharge rate low.

Microdrainage calculations show that by using larger pipes we can negate the requirement for a rain garden on the existing lodge site as was previously stated in the FRA. The area will remain as soft landscaping/grass.

The proposed building and garage will discharge surface water at a rate of 0.7 l/s into the adopted sewer. This will require on site attenuation including a blue roof, green/brown roof, below ground oversized pipes and a permeable driveway.

The garden areas of both properties are soft landscaped with the exception of the patio areas which will drain onto the surrounding soft ground.

During exceedance events the storm water will flow away from the properties reducing the risk of any internal flooding.

Maintenance of the drainage system for both properties will be the responsibility of the individual home owners. The blue/green/brown roofs and flow control devices will all require regular inspection and occasional cleaning or repair depending on the manufacturer's instructions.

	Prepared by	Checked by	Approved by		
Name	Yazdi Batki	Jonathan Millard	Wayne Dyer		
Signature					

DOCUMENT CHECKING (not mandatory for File Note)

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PN 1.000 1.001 1.002 1.003 1.004 PI 1.00 1.00 1.00 1.00	Length (m) 9.600 7.500 14.800 11.800 5.000 N Ra: (mm/ 000 50 001 50 001 50	Fall (m) 0.096 0.075 0.099 0.079 0.050 in T hr) (n .00 .00	Slope (1:X) 100.0 150.0 150.0 100.0 5.0 5.16 5.28 5.28	Tot <u>Netwo</u> I.Area (ha) 0.003 0.005 0.004 0.007 0.000 <u>I</u> US/IL (m) 88.903 88.807 88.657	al Pipe rk Desi rk Desi (mins) 5.00 5.00 0.000 0.000 0.000 Network E I.Area (ha) 0.003 0.003 0.008 0.012	Volume (m ³) .gn Table Base Flow (l/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Results 2 E Base Flow (l/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	= 1.4 for S k (mm) 0.600 0.600 0.600 0.600 0.600 <u>Table</u> Foul (1/s) 0.0 0.0	48 torm HYD SECT 0 0 0 0 0 0 0 0 0 0 0 0 0	DIA (mm) 150 225 150 Flow (s) 0.2 0.4 0.6	Secti Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.00	on Type Conduit Conduit Conduit Conduit Conduit Conduit Cap (1/s) 17.8 17.8 17.8	Auto Design Image: I
PN 1.000 1.001 1.002 1.003 1.004 PI 1.00	Length (m) 9.600 7.500 14.800 11.800 5.000 11.800 5.000 001 5.000 001 50 001 50 002 50	Fall (m) 0.096 0.075 0.099 0.079 0.050 in T (hr) (n .00 .00 .00	Slope (1:X) 100.0 150.0 150.0 100.0 5.16 5.28 5.52 5.70 5.70	Tot <u>Netwo</u> I.Area (ha) 0.003 0.004 0.007 0.000 <u>1</u> US/IL (m) 88.903 88.807 88.657 88.558	al Pipe <u>rk Desi</u> T.E. (mins) 5.00 0.00 0.00 0.00 0.00 <u>Vetwork</u> E I.Area (ha) 0.003 0.003 0.003 0.003 0.003 0.003 0.004 0.003 0.003 0.004 0.003 0.004 0.003 0.004 0.003 0.004 0.004 0.003 0.004 0.00	Volume (m ³) .gn Table Base Flow (l/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	= 1.4 for S k (mm) 0.600 0.600 0.600 0.600 0.600 <u>Table</u> Foul (1/s) 0.0 0.0 0.0	48 torm HYD SECT 0 0 0 0 0 0 0 0 0 0 0 0 0	DIA (mm) 150 225 225 150 Flow (s) 0.2 0.4 0.6 1.0	Secti Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.00 1.07 1.07	on Type Conduit Conduit Conduit Conduit Conduit Conduit 17.8 17.8 17.8 17.8 42.4 42.4	Auto Design Image: Constraint of the second seco
PN 1.000 1.001 1.002 1.003 1.004 PI 1.00	Length (m) 9.600 7.500 14.800 11.800 5.000 11.800 5.000 000 5.000 000 5.000 000 5.000 000	Fall (m) 0.096 0.075 0.099 0.079 0.050 in I (hr) (n 0.00 0.00 0.00	Slope (1:X) 100.0 150.0 150.0 100.0 5.16 5.28 5.52 5.70 5.78	Tot <u>Netwo</u> I.Area (ha) 0.003 0.005 0.004 0.007 0.000 <u>N</u> US/IL (m) 88.903 88.807 88.657 88.558 88.480	al Pipe rk Desi T.E. (mins) 5.00 5.00 0.00 0.00 0.00 Vetwork E I.Area (ha) 0.003 0.003 0.003 0.003 0.003 0.003 0.012 0.019	Volume (m ³) .gn Table Base Flow (l/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	= 1.4 for S k (mm) 0.600 0.600 0.600 0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0 0.0	48 torm HYD SECT 0 0 0 0 0 0 0 0 0 0 0 0 0	DIA (mm) 150 225 225 150 Flow (s) 0.2 0.4 0.6 1.0 1.0	Secti Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.07 1.07	on Type Conduit Conduit Conduit Conduit Conduit Conduit 17.8 17.8 17.8 42.4 42.4 17.8	e Auto Design : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1 : 1
PN 1.000 1.001 1.002 1.003 1.004 PI 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	Length (m) 9.600 7.500 14.800 11.800 5.000 N Ra: (mm/ 000 50 001 50 002 50 002 50 003 50	Fall (m) 0.096 0.075 0.099 0.079 0.050 in T hr) (n .00 .00 .00 .00	Slope (1:X) 100.0 150.0 150.0 100.0 5.0 5.16 5.28 5.52 5.70 5.78	Tot <u>Netwo</u> I.Area (ha) 0.003 0.005 0.004 0.007 0.000 <u>I</u> US/IL (m) 88.903 88.807 88.657 88.558 88.480	al Pipe rk Desi rk Desi (mins) 5.00 0.00 0.00 0.00 0.00 Network E I.Area (ha) 0.003 0.003 0.003 0.003 0.003 0.0012 0.019 0.019	Volume (m ³) .gn Table Base Flow (l/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	= 1.4 for S k (mm) 0.600 0.0000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000000	48 torm HYD SECT 0 0 0 0 0 0 0 0 0 0 0 0 0	DIA (mm) 150 225 150 Flow (s) 0.2 0.4 0.6 1.0 1.0	Secti Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.00 1.07 1.07	on Type Conduit Conduit Conduit Conduit Conduit Conduit 17.8 17.8 17.8 17.8 42.4 42.4 17.8	Auto Design Image: I
PN 1.000 1.001 1.002 1.003 1.004 PI 1.00	Length (m) 9.600 7.500 14.800 11.800 5.000 11.800 5.000 00 5.000 00 00 00 5.000 00 00 5.000 0 5.0000 5.0000 5.0000 5.0000 5.00000 5.0000 5.000000 5.0000 5.0000 5.0000 5.00000000	Fall (m) 0.096 0.075 0.099 0.050 0.050 in T (hr) (n .00 .00 .00 .00	Slope (1:X) 100.0 150.0 150.0 100.0 5.16 5.28 5.52 5.70 5.78	Tot <u>Netwo</u> I.Area (ha) 0.003 0.004 0.007 0.000 <u>1</u> US/IL (m) 88.903 88.807 88.657 88.558 88.480	al Pipe <u>rk Desi</u> T.E. (mins) 5.00 0.00 0.00 0.00 <u>Vetwork</u> E I.Area (ha) 0.003 0.003 0.003 0.003 0.003 0.003 0.0012 0.019	Volume (m ³) .gn Table Base Flow (l/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	= 1.4 for S k (mm) 0.600 0.600 0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0 0.0 0.0	48 torm HYD SECT 0 0 0 0 0 0 0 0 0 0 0 0 0	DIA (mm) 150 225 225 150 Flow (s) 0.2 0.4 0.6 1.0 1.0	Secti Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.07 1.07 1.07	on Type Conduit Conduit Conduit Conduit Conduit Conduit 17.8 17.8 17.8 42.4 42.4 17.8	Auto Design Flow (1/s) 0.6 1.5 2.3 3.6 3.6
PN 1.000 1.001 1.002 1.003 1.004 PI 1.00	Length (m) 9.600 7.500 14.800 11.800 5.000 N Ra: (mm/ 000 50 001 50 002 50 002 50 003 50	Fall (m) 0.096 0.075 0.099 0.079 0.050 in I (hr) (n 0.00 0.00 0.00 0.00	Slope (1:X) 100.0 150.0 150.0 100.0 5.0 5.16 5.28 5.52 5.70 5.78	Tot <u>Netwo</u> I.Area (ha) 0.003 0.005 0.004 0.007 0.000 <u>P</u> US/IL (m) 88.903 88.807 88.657 88.558 88.480	al Pipe rk Desi T.E. (mins) 5.00 0.00 0.00 0.00 0.00 Network E I.Area (ha) 0.003 0.003 0.003 0.003 0.003 0.012 0.019 0.019	Volume (m ³) .gn Table Base Flow (l/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	= 1.4 for S k (mm) 0.600 0.0000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000000	48 torm HYD SECT 0 0 0 0 Add (1)	DIA (mm) 150 225 150 Flow (s) 0.2 0.4 0.6 1.0 1.0	Secti Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.07 1.07 1.00	on Type Conduit Conduit Conduit Conduit Conduit Conduit 17.8 17.8 17.8 42.4 42.4 17.8	Auto Design Image: I
PN 1.000 1.001 1.002 1.003 1.004 PI 1.00 1.00 1.00 1.00 1.00 1.00	Length (m) 9.600 7.500 14.800 11.800 5.000 11.800 5.000 00 5.0000 5.0000 5.0000 5.0000 5.0000 5.0000 5.00000 5.00000000	Fall (m) 0.096 0.075 0.099 0.079 0.050 in T hr) (n 0.00 .00 .00 .00	Slope (1:X) 100.0 150.0 150.0 100.0 5.16 5.28 5.52 5.70 5.78	Tot <u>Netwo</u> I.Area (ha) 0.003 0.005 0.004 0.007 0.000 <u>N</u> US/IL (m) 88.903 88.807 88.657 88.558 88.480	al Pipe <u>rk Desi</u> T.E. (mins) 5.00 5.00 0.000 0.000 0.000 0.000 <u>Network</u> E I.Area (ha) 0.003 0.003 0.003 0.003 0.003 0.003 0.012 0.019 0.019	Volume (m ³) .gn Table Base Flow (l/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	= 1.4 for S k (mm) 0.600 0.600 0.600 0.600 0.600 Table Foul (1/s) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	48 torm HYD SECT 0 0 0 0 0 0 0 0 0 0 0 0 0	DIA (mm) 150 225 150 Flow (s) 0.2 0.4 0.6 1.0 1.0	Secti Pipe/ Pipe/ Pipe/ Pipe/ Vel (m/s) 1.00 1.07 1.07 1.07	on Type Conduit Conduit Conduit Conduit Conduit Conduit 17.8 17.8 17.8 17.8 42.4 42.4 17.8	Auto Design Image: Constraint of the second seco

Page 1

Ove Arup & Partners International Ltd

Ove Arup & Partners International Ltd			
Hadley Wood Golf Course			
Existing Lodge			
	Micro		
Designed by YB			
Checked by JJM	Diamade		
Network 2020.1			
	Al Ltd Hadley Wood Golf Course Existing Lodge Designed by YB Checked by JJM Network 2020.1		

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004		91.700	88.430	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type Summer
Return Period (years)	100	Cv (Summer) 0.750
Region Er	ngland and Wales	Cv (Winter) 0.840
M5-60 (mm)	20.000 Storm	Duration (mins) 30
Ratio R	0.450	

Ove Arup & Par	tners	Internati	lonal Ltd				Page 3
The Arup Campu	IS		Hadley	Wood Gol	f Course		
Blyth Gate			Existin	ng Lodge			
Solihull B90	8AE						Micco
Date 03/02/202	21		Designe	ed by YB			
File Existing	Lodge.	MDX	Checked	l bv JJM			Drainage
XP Solutions			Networl	2020 1			
			1.001.011				
<u>Hydro-B</u>	rake® (<u>Onl</u> Optimum M	ine Control anhole: 5,	s for St DS/PN: 1	<u>orm</u> .004, Vol	lume (m³)	: 3.7
			Unit Reference	MD_SHF_(0080-3000-	1151-3000	
		Ľ	esion Head (r	e MD-SHE-(1)	000-3000-	1.151	
		Des	ign Flow (1/s	;)		3.0	
			Flush-Flo	™	C	alculated	
			Objectiv	re Minimis	se upstrea	m storage	
			Applicatio	n		Surface	
			Diameter (mr	.ອ ເ)		105 80	
		In	vert Level (r	ı)		88.480	
M	inimum C	utlet Pipe	Diameter (mr	ι)		100	
	Suggest	ed Manhole	Diameter (mr	1)		1200	
		Contro	l Points	Head (m)	Flow (l/s	;)	
	D	esian Point	. (Calculated) 1.151	3.	0	
	_		Flush-Flo	,	3.	0	
			Kick-Flo	B 0.714	2.	4	
	M	ean Flow or	ver Head Rang	e –	2.	6	
The hydrologic Hydro-Brake® Op Hydro-Brake Op invalidated	al calcu ptimum a timum® k	alations ha as specifie be utilised	ve been based d. Should and then these s	d on the He nother type storage rou	ead/Discha e of contro uting calco	rge relation ol device o ulations with	onship for the other than a ill be
Depth (m) Flor	w (l/s)	Depth (m)	Flow (1/s) D	epth (m) E	'low (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.200	3.1	3.000	4.7	7.000	7.0
0.200	2.8	1.400	3.3	3.500	5.0	7.500	7.2
0.300	3.0	1.600	3.5	4.000	5.3	8.000	7.4
0.500	2.9	2.000	3.9	5.000	5.9	9.000	7.8
0.600	2.8	2.200	4.0	5.500	6.2	9.500	8.1
0.800	2.5	2.400	4.2	6.000	6.5		
1.000	2.8	2.600	4.4	6.500	6.7		

Ove Arup & Partners Ir	nternationa	l Ltd			Page 4
The Arup Campus		Hadley Wood	d Golf Cou	rse	
Blyth Gate		Existing Lo	odge		
Solihull B90 8AE			2		Micco
Date 03/02/2021		Designed by	7 YB		
File Existing Lodge.MI	X	Checked by	JJM		Urainage
XP Solutions		Network 202	20.1		
<u>Summary of Crit</u> Areal Reduct	<u>ical Result</u> <u>Sin</u> ion Factor 1	nulation Crite	m Level (: <u>ria</u> onal Flow -	Rank 1) for : % of Total Flo	<u>Storm</u> ww 40.000
Hot St Hot Start Manhole Headloss Coef Foul Sewage per hec	art (mins) Level (mm) ff (Global) 0 tare (l/s) 0	0 MA 0 .500 Flow per .000	DD Factor * In: Person per	10m³/ha Storag Let Coeffiecien Day (l/per/day	re 2.000 ht 0.800 r) 0.000
Number of I Number of Number of	nput Hydrogr Online Cont Offline Cont	aphs 0 Number rols 1 Number rols 0 Number	of Storage of Time/Are of Real Tir	Structures 0 ea Diagrams 0 me Controls 0	
	Synthe	tic Rainfall I	<u>Details</u>	D 0 450	
Rainfa	Region Eng	FSI land and Wales	k Ratio s Cv (Summen	к 0.450 c) 0.750	
м5	-60 (mm)	20.000) Cv (Winter	c) 0.840	
Monstin for	Elect Dick I	lowning (mm) 2	0.0.0	D Status OFF	
Margin ior	Analys	sis Timestep	Fine Inerti	a Status OFF	
	- 1	DTS Status	ON		
	Profile(s)		Sı	ummer and Winte	er
Duration	n(s) (mins) 1	5, 30, 60, 12	0, 240, 360,	480, 960, 144	0
Return Period ((s) (years)			1, 30, 10	0
Climate	Change (%)			0, 0, 4	0
	turn Climate	Finat (V)	First (V)	Finat (7) Ora	Water
PN Name Storm Pe	riod Change	Surcharge	Flood	Overflow Ac	ct. (m)
	100	100/15 0			
1.000 I 30 Winter	100 +40% 100 +40%	100/15 Summe:	r		89.586 89.584
1.002 3 30 Winter	100 +40%	30/15 Winte:	r		89.581
1.003 4 30 Winter	100 +40%	30/15 Summe:	r		89.577
1.004 5 30 Winter	100 +40%	30/15 Summe:	r		89.573
Surcharged	Flooded	F	Aalf Drain	Pipe	
US/MH Depth	Volume Flow	v / Overflow	Time	Flow	
					Level
PN Name (m)	(m³) Caj	b. (l/s)	(mins)	(1/s) Status	Level Exceeded
PN Name (m) 1.000 1 0.533	(m³) Cap). (1/s) .11	(mins)	(1/s) Status 1.7 SURCHARGE	Level Exceeded
PN Name (m) 1.000 1 0.533 1.001 2 0.627 1 002 2	(m ³) Caj 0.000 0 0.000 0	.11 .29	(mins)	 (1/s) Status 1.7 SURCHARGE 4.4 FLOOD RIS 4.0 PLOOD RIS 	Level Exceeded
PN Name (m) 1.000 1 0.533 1.001 2 0.627 1.002 3 0.699 1.003 4 0.794	(m ³) Caj 0.000 0 0.000 0 0.000 0	 (1/s) 11 29 13 14 	(mins)	 (1/s) Status 1.7 SURCHARGE 4.4 FLOOD RIS 4.9 FLOOD RIS 5.1 SURCHARGE 	Level Exceeded
PN Name (m) 1.000 1 0.533 1.001 2 0.627 1.002 3 0.699 1.003 4 0.794 1.004 5 0.943	(m ³) Cay 0.000 0 0.000 0 0.000 0 0.000 0 0.000 0	 (1/s) .11 .29 .13 .14 .21 	(mins)	<pre>(1/s) Status 1.7 SURCHARGE 4.4 FLOOD RIS 4.9 FLOOD RIS 5.1 SURCHARGE 3.0 SURCHARGE</pre>	Level Exceeded
PN Name (m) 1.000 1 0.533 1.001 2 0.627 1.002 3 0.699 1.003 4 0.794 1.004 5 0.943	(m ³) Cay 0.000 0 0.000 0 0.000 0 0.000 0 0.000 0	(1/s)	(mins)	<pre>(1/s) Status 1.7 SURCHARGE 4.4 FLOOD RIS 4.9 FLOOD RIS 5.1 SURCHARGE 3.0 SURCHARGE</pre>	Level Exceeded
PN Name (m) 1.000 1 0.533 1.001 2 0.627 1.002 3 0.699 1.003 4 0.794 1.004 5 0.943	(m ³) Cay 0.000 0 0.000 0 0.000 0 0.000 0 0.000 0	(1/s)	(mins)	<pre>(1/s) Status 1.7 SURCHARGE 4.4 FLOOD RIS 4.9 FLOOD RIS 5.1 SURCHARGE 3.0 SURCHARGE</pre>	Level Exceeded
PN Name (m) 1.000 1 0.533 1.001 2 0.627 1.002 3 0.699 1.003 4 0.794 1.004 5 0.943	(m ³) Cay 0.000 0 0.000 0 0.000 0 0.000 0 0.000 0	 (1/s) .11 .29 .13 .14 .21 	(mins)	<pre>(1/s) Status 1.7 SURCHARGE 4.4 FLOOD RIS 4.9 FLOOD RIS 5.1 SURCHARGE 3.0 SURCHARGE</pre>	Level Exceeded
PN Name (m) 1.000 1 0.533 1.001 2 0.627 1.002 3 0.699 1.003 4 0.794 1.004 5 0.943	(m ³) Cay 0.000 0 0.000 0 0.000 0 0.000 0 0.000 0	 (1/s) .11 .29 .13 .14 .21 	(mins)	<pre>(1/s) Status 1.7 SURCHARGE 4.4 FLOOD RIS 4.9 FLOOD RIS 5.1 SURCHARGE 3.0 SURCHARGE</pre>	Level Exceeded
PN Name (m) 1.000 1 0.533 1.001 2 0.627 1.002 3 0.699 1.003 4 0.794 1.004 5 0.943	(m ³) Caj 0.000 0 0.000 0 0.000 0 0.000 0 0.000 0	(1/s)	(mins)	<pre>(1/s) Status 1.7 SURCHARGE 4.4 FLOOD RIS 4.9 FLOOD RIS 5.1 SURCHARGE 3.0 SURCHARGE</pre>	Level Exceeded

Ove Arup & Partners Internationa	Page 5	
The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	Existing Lodge	
Solihull B90 8AE		Mirro
Date 03/02/2021	Designed by YB	
File Existing Lodge.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	·

Rainfall Hyetograph for 30 minute 100 year Winter I+40% for Pipe 1.000 (Storm)

Time (mins)	Rain (mm/hr)								
1	12.759	7	47.850	13	184.556	19	153.795	25	42.587
2	31.347	8	58.265	14	210.974	20	124.106	26	41.240
3	39.261	9	74.513	15	229.719	21	97.249	27	41.223
4	41.223	10	97.249	16	229.719	22	74.513	28	39.261
5	41.239	11	124.106	17	210.974	23	58.264	29	31.347
6	42.587	12	153.795	18	184.556	24	47.850	30	12.758

Ove Arup & Partners Internationa	Page 6	
The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	Existing Lodge	
Solihull B90 8AE		Mirro
Date 03/02/2021	Designed by YB	
File Existing Lodge.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	

Rainfall Hyetograph for 30 minute 100 year Winter I+40% for Pipe 1.001 (Storm)

Time (mins)	Rain (mm/hr)								
1	12.759	7	47.850	13	184.556	19	153.795	25	42.587
2	31.347	8	58.265	14	210.974	20	124.106	26	41.240
3	39.261	9	74.513	15	229.719	21	97.249	27	41.223
4	41.223	10	97.249	16	229.719	22	74.513	28	39.261
5	41.239	11	124.106	17	210.974	23	58.264	29	31.347
6	42.587	12	153.795	18	184.556	24	47.850	30	12.758

Ove Arup & Partners Internationa	Page 7	
The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	Existing Lodge	
Solihull B90 8AE		Mirro
Date 03/02/2021	Designed by YB	
File Existing Lodge.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	·

Rainfall Hyetograph for 30 minute 100 year Winter I+40% for Pipe 1.002 (Storm)

Time (mins)	Rain (mm/hr)								
1	12.759	7	47.850	13	184.556	19	153.795	25	42.587
2	31.347	8	58.265	14	210.974	20	124.106	26	41.240
3	39.261	9	74.513	15	229.719	21	97.249	27	41.223
4	41.223	10	97.249	16	229.719	22	74.513	28	39.261
5	41.239	11	124.106	17	210.974	23	58.264	29	31.347
6	42.587	12	153.795	18	184.556	24	47.850	30	12.758

Ove Arup & Partners Internationa	Page 8	
The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	Existing Lodge	
Solihull B90 8AE		Mirro
Date 03/02/2021	Designed by YB	
File Existing Lodge.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	

Rainfall Hyetograph for 30 minute 100 year Winter I+40% for Pipe 1.003 (Storm)

Time (mins)	Rain (mm/hr)								
1	12.759	7	47.850	13	184.556	19	153.795	25	42.587
2	31.347	8	58.265	14	210.974	20	124.106	26	41.240
3	39.261	9	74.513	15	229.719	21	97.249	27	41.223
4	41.223	10	97.249	16	229.719	22	74.513	28	39.261
5	41.239	11	124.106	17	210.974	23	58.264	29	31.347
6	42.587	12	153.795	18	184.556	24	47.850	30	12.758

Ove Arup & Partners Internationa	Page 9	
The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	Existing Lodge	
Solihull B90 8AE		Mirro
Date 03/02/2021	Designed by YB	
File Existing Lodge.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	·

Rainfall Hyetograph for 30 minute 100 year Winter I+40% for Pipe 1.004 (Storm)

Time (mins)	Rain (mm/hr)								
1	12.759	7	47.850	13	184.556	19	153.795	25	42.587
2	31.347	8	58.265	14	210.974	20	124.106	26	41.240
3	39.261	9	74.513	15	229.719	21	97.249	27	41.223
4	41.223	10	97.249	16	229.719	22	74.513	28	39.261
5	41.239	11	124.106	17	210.974	23	58.264	29	31.347
6	42.587	12	153.795	18	184.556	24	47.850	30	12.758

The Aru	up Camp	ous			Hac	dley Wood	Golf	Course				
Blyth (Gate				New	v Build Pr	copert	У				
Solihu	ll B90) 8AE								Mi		
Date 03	3/02/20)21			Des	signed by	YB			Dc		
File PH	ROPOSEI	D BUI	LDING	.MDX	Che	ecked by J	JJM				maye	
XP Solu	utions				Net	work 2020).1					
STORM SEWER DESIGN by the Modified Rational Method Design Criteria for Storm Dige Sizes STANDARD Manhole Sizes STANDARD FSR Rainfall Model - England and Wales Return Period (years) 100 Model - England and Wales Return Period (years) 100 Model - England and Wales MET (%) 100 Model Flow / Climate Change (%) 40 Maximum Rainfall (mm/hr) 50 Maximum Time of Concentration (mins) 30 Min Design Depth for Optimisation (m) 1.200 Maximum Time of Concentration (mins) 30 Min Design Depth for Optimisation (m) 1.200 Foul Sewage (1/s/ha) 0.000 Min Vel for Auto Design only (m/s) 1.00 Designed with Level Soffits												
				De	signed w	ith Level S	offits					
				Time	<u>Area</u> D) iagram fo	<u>r Sto</u>	rm				
				: (1	Time Ar mins) (b	ea Time a) (mins)	Area (ba)					
				(1			()					
					0-4 0.0	021 4-8	0.004					
				Total A	Area Cont	ributing (h	na) = 0	.025				
				Tota	al Dine V	(m ³)	- 2 10	0				
				1000	ai ripe v		- 2.13	9				
				Netwo	rk Desi	nn Table i	for st	orm				
				<u>INC CWO</u>	LK DCBI			201111				
PN	Length (m)	Fall (m)	Slop (1:X	e I.Area) (ha)	a T.E. (mins)	Base Flow (l/s)	k (mm)	HYD DIA SECT (mm)	Secti	on Type	Auto Design	
S1.000	7.800	0.078	100.	0 0.003	5.00	0.0	0.600	0 150) Pipe/	Conduit	- -	
s1.001 s1.002	23.200	0.232	100. 100.	U U.006 0 0.003	0.00 0.00	0.0	U.600 0.600	o 150 o 225) Pipe/	Conduit Conduit	- 7	
21.002	0.100	0.001	±00.			0.0	5.000	0 220	P 0 /		U	
S2.000	8.500	0.085	100.	0 0.004	5.00	0.0	0.600	0 150) Pipe/	Conduit	- 0	
52.001	12.000	0.130	00.	2 0.000	0.00	0.0	0.600	0 150) FIDe/	Conduit	O	
				N	atwork	Regulte T	ahle					
				<u>11</u>		NCOULCO I	UNTE					
PN	I Ra	in !	I.C.	US/IL	Σ I.Area	Σ Base	Foul	Add Flow	Vel	Cap	Flow	
	(mm/	nr) (i	uins)	(m)	(na)	FIOW (1/S)	(1/S)	(1/S)	(m/s)	(1/S)	(1/5)	
S1.0				89.350	0.003	0.0	0.0	0.2	1.00	17.8	0.6	
01 0	00 50	.00	5.13	90 071	0 000		1.1 1.1	U 5	· · · · · · · · · · · · · · · · · · ·	1.1 0	1 7	
S1.0 S1.0)00 50)01 50)02 50	.00 .00 .00	5.13 5.51 5.62	89.271 89.030	0.009 0.012	0.0	0.0	0.6	1.31	17.8 52.0	1.7 2.3	
S1.0 S1.0	000 50 001 50 002 50	.00	5.13 5.51 5.62	89.271 89.030	0.009	0.0	0.0	0.6	1.31	17.8	1.7 2.3	
s1.0 s1.0 s2.0 s2.0	000 50 001 50 002 50 000 50 000 50 001 50	.00 .00 .00	5.13 5.51 5.62 5.14	89.271 89.030 89.180 89.095	0.009 0.012 0.004 0.004	0.0 0.0 0.0	0.0	0.6	1.00 1.31 1.00 1.07	17.8 52.0 17.8 18 9	1.7 2.3 0.8	
s1.0 s1.0 s2.0 s2.0	000 50 001 50 002 50 000 50 001 50 001 50	.00 .00 .00 .00	5.13 5.51 5.62 5.14 5.33	89.271 89.030 89.180 89.095	0.009 0.012 0.004 0.004	0.0 0.0 0.0	0.0	0.2	1.00 1.31 1.00 1.07	17.8 52.0 17.8 18.9	1.7 2.3 0.8 0.8	
\$1.0 \$1.0 \$2.0 \$2.0	000 50 001 50 002 50 000 50 001 50	.00 .00 .00 .00	5.13 5.51 5.62 5.14 5.33	89.271 89.030 89.180 89.095	0.009 0.012 0.004 0.004 0.004	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	0.2	1.00 1.31 1.00 1.07	17.8 52.0 17.8 18.9	1.7 2.3 0.8 0.8	

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Ove Arup & Partners International Ltd

Ove Arup & Partners Internationa	Page 2	
The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	New Build Property	
Solihull B90 8AE		Mirro
Date 03/02/2021	Designed by YB	
File PROPOSED BUILDING.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Ba Flow	ise (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.003 S1.004	8.000 4.700	0.036 0.047	222.2 100.0	0.009	0.00		0.0	0.600	0	375 150	Pipe/Conduit Pipe/Conduit	ð ď

<u>Network Results Table</u>

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (1/s)	Add Flow (l/s)	Vel (m/s)	Cap (1/s)	Flow (l/s)
S1.003	50.00	5.73	87.864	0.025	0.0	0.0	1.4	1.21	133.8	4.7
S1.004	50.00	5.81	87.828	0.025	0.0	0.0	1.4	1.00	17.8	4.7

Ove Arup & Partners Internationa	l Ltd	Page 3
The Arup Campus	Hadley Wood Golf Cou	rse
Blyth Gate	New Build Property	
Solibull B90 8AF		
Data 03/02/2021	Designed by VP	MICCO
Eilo PROPOSED BULLDING MDY	Checked by IM	Drainage
PILE PROPOSED BUILDING.MDX		_
XP Solutions	Network 2020.1	
Area	Summary for Storm	
Pipe PIMP PIMP PI	MP Gross Imp. P.	ipe Total
Number Type Name (b) Area (ha) Area (ha)	(ha)
1.000 1	00 0.003 0.003	0.003
1.001 1		0.006
2 000 1	0 0 004 0 004	0.004
2.001 1	00 0.000 0.000	0.000
1.003 1	00 0.009 0.009	0.009
1.004 1	00 0.000 0.000	0.000
	Total Total	Total
	0.025 0.025	0.025
<u>Free Flowing</u>	<u>Outfall Details for S</u>	torm
0+5-11 0+5-11 0	Level I Level Min	
Outfall Outfall C	(m) (m) I Lovel	
ripe Number Name	(m) (m)	
	(/	
S1.004 S	90.700 87.781 0.000	0 0
Simulatio	on Criteria for Storm	
Volumetrie Duroff Cooff (750 Additional Eleve	° of motol Flow 40 000
Areal Reduction Factor 1	.750 Additional Flow -	$\frac{10m^3}{ha}$ Storage 2 000
Hot Start (mins)	0 Inl	et Coefficcient 0.800
Hot Start Level (mm)	0 Flow per Person per	Day (1/per/day) 0.000
Manhole Headloss Coeff (Global) 0	.500	Run Time (mins) 60
Foul Sewage per hectare (1/s) 0	.000 Output	Interval (mins) 1
Number of Input Hydrogr	aphs U Number of Storage	Structures 0
Number of Offline Cont	rols () Number of Real Tim	e Controls 0
Synthet	<u>ic Rainfall Details</u>	
Rainfall Model	FSR Dro	ofile Type Summer
Return Period (vears)	100 Cx	(Summer) 0.750
Region Engla	nd and Wales Cv	(Winter) 0.840
M5-60 (mm)	20.000 Storm Durati	on (mins) 30
Ratio R	0.450	

Ove Arup &	Partners	Internation	al Ltd				Page 4			
The Arup Ca	ampus		Hadley	Wood Gol	f Course					
Blvth Gate	Ĩ		New Bui	ld Prope	ertv					
Solihull 1	390 8AE			1 -	- 1		Micco			
Date 03/02	/2021		Designe	d by YB			MICIO			
File PROPOR	SED BUTLDI	NG MDX	Checker	by J.TM			Drainage			
XP Solution			Network	· 2020 1						
XI SOLUCIO	.15		Network	2020.1						
Online Controls for Storm										
<u>Hydro</u>	-Brake® Op	otimum Manho	ole: S7,	DS/PN: S	1.004, Vo	lume (m³): 4.9			
Unit Reference MD-SHE-0032-7000-2300-7000 Design Head (m) 2.300 Design Flow (1/s) 0.7 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 32 Invert Level (m) 87.828 Minimum Outlet Pipe Diameter (mm) 75 Suggested Manhole Diameter (mm) 1200 Control Points Head (m) Flow (1/s) Design Point (Calculated) 2.300 0.7 Flush-Flo™ 0.141 0.3 Kick-Flo® 0.282 0.3										
	М	ean Flow over	Head Range	e –	0.	5				
The hydrol Hydro-Brak Hydro-Brak invalidate	ogical calco e® Optimum a e Optimum® D d	ulations have as specified. be utilised th	been based Should ar en these s	l on the He other type torage roo	ead/Dischar e of contro uting calcu	ge relatic l device c lations wi	onship for the other than a ll be			
Depth (m)	Flow (l/s)	Depth (m) Flo	ow (l/s) D	epth (m) I	'low (l/s)	Depth (m)	Flow (l/s)			
0.100	0.3	1.200	0.5	3.000	0.8	7.000	1.2			
0.200	0.3	1.400	0.6	3.500	0.8	7.500	1.2			
0.300	0.3	1.600	0.6	4.000	0.9	8.000	1.2			
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.3			
0.500	0.4	2.000	0.7	5.000	1.0	9.000	1.3			
0.800	0.4	2.400	0.7	6.000	1.1	5.500	1.5			
1.000	0.5	2.600	0.7	6.500	1.1					

Ove Arup & Partners Int	ernational Ltd	Page 5										
The Arup Campus	Hadley Wood	d Golf Course										
Blyth Gate	New Build B	Property										
Solihull B90 8AE		Micco										
Date 03/02/2021	Designed by											
File PROPOSED BUILDING.	MDX Checked by	JJM Uldindye										
XP Solutions	Network 202	20.1										
Summary of Critic	Summary of Critical Results by Maximum Level (Rank 1) for Storm											
	Circulation Onits											
Areal Reductio	on Factor 1.000 Additi	eria onal Flow - % of Total Flow 40.000										
Hot Sta:	rt (mins) 0 MA	DD Factor * 10m ³ /ha Storage 2.000										
Hot Start Le	evel (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 necta	are (1/s) 0.000											
Number of Int	put Hydrographs 0 Number	of Storage Structures 0										
Number of (Online Controls 1 Number	of Time/Area Diagrams 0										
Number of O:	ffline Controls 0 Number	of Real Time Controls 0										
	Synthetic Rainfall	Details										
Rainfal	l Model FSI	R Ratio R 0.446										
	Region England and Wale	s Cv (Summer) 0.750										
M5-6	60 (mm) 20.00	0 Cv (Winter) 0.840										
Margin for E	lood Pick Marning (mm) 3	200 0 DVD Status OFF										
Margin for F	Analysis Timestep	Fine Inertia Status OFF										
	DTS Status	ON										
	rofile(s)	Summer and Winter										
Duration (s) (mins) 15, 30, 60, 12	0, 240, 360, 480, 960, 1440										
Return Period(s) (years)	1, 30, 100										
Climate C	hange (%)	0, 0, 40										
US/MH R	Return Climate First ()	K) First (Y) First (Z) Overflow										
PN Name Storm P	eriod Change Surcharg	ge Flood Overflow Act.										
S1.000 S1 240 Winter	100 +40% 100/15 Sur	nmer 100/60 Winter										
S1.001 S2 120 Winter	100 +40% 30/60 Wir	nter 100/60 Winter										
S1.002 S3 120 Winter	100 +40% 30/30 Wir	hter										
S2.000 S4 I20 Winter S2 001 S5 120 Winter	100 +40% 30/60 W11	lter										
S1.003 S6 120 Winter	100 +40% 1/15 Wir	hter										
S1.004 S7 120 Winter	100 +40% 1/15 Sur	nmer										
Water Sur	charged Flooded	Half Drain Pipe										
US/MH Level C	epth Volume Flow / O	verflow Time Flow										
PN Name (m)	(m) (m ³) Cap.	(l/s) (mins) (l/s) Status										
C1 000 C1 00 C01	0 701 0 001 0 00											
SI.UUU SI 90.201 SI 001 S2 90 202	U./UL U.96L U.U5 0 781 1 869 0 11	U.S FLOOD										
S1.002 S3 90.202	0.959 0.000 0.05	2.1 FLOOD RISK										
s2.000 s4 90.220	0.890 0.000 0.05	0.8 SURCHARGED										
S2.001 S5 90.219	0.974 0.000 0.04	0.7 SURCHARGED										
S1.003 S6 90.216	1.977 0.000 0.02	2.2 SURCHARGED										
a1 004	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0											
S1.004 S7 90.216	2.238 0.000 0.05	0.7 SURCHARGED										
S1.004 S7 90.216	2.238 0.000 0.05	0.7 SURCHARGED										
S1.004 S7 90.216	2.238 0.000 0.05	0.7 SURCHARGED										

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The Arup Campus	Hadley Wood Golf Course				
Blyth Gate	New Build Property				
Solihull B90 8AE		Mirro			
Date 03/02/2021	Designed by YB				
File PROPOSED BUILDING.MDX	Checked by JJM	Diamage			
XP Solutions	Network 2020.1				

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

	US/MH	Level
PN	Name	Exceeded
S1.000	S1	4
S1.001	S2	4
S1.002	S3	
S2.000	S4	
S2.001	S5	
S1.003	S6	
S1.004	S7	

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The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	New Build Property	
Solihull B90 8AE		Mirro
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XP Solutions	Network 2020.1	·

Rainfall Hyetograph for 240 minute 100 year Winter I+40% for Pipe S1.000 (Storm)

Time (mins)	Rain (mm/hr)								
4	1.382	52	9.653	100	37.269	148	33.824	196	9.080
8	3.974	56	10.433	104	40.202	152	30.734	200	8.797
12	5.876	60	11.468	108	42.937	156	27.690	204	8.665
16	7.282	64	12.989	112	45.623	160	24.406	208	8.646
20	8.028	68	14.665	116	47.528	164	21.675	212	8.664
24	8.453	72	16.613	120	48.901	168	19.147	216	8.640
28	8.640	76	19.147	124	48.901	172	16.613	220	8.453
32	8.664	80	21.675	128	47.528	176	14.665	224	8.028
36	8.646	84	24.406	132	45.623	180	12.989	228	7.282
40	8.665	88	27.690	136	42.937	184	11.468	232	5.876
44	8.797	92	30.734	140	40.202	188	10.433	236	3.974
48	9.080	96	33.824	144	37.269	192	9.653	240	1.382

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The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	New Build Property	
Solihull B90 8AE		Mirro
Date 03/02/2021	Designed by YB	
File PROPOSED BUILDING.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	1

Rainfall Hyetograph for 120 minute 100 year Winter I+40% for Pipe S1.001 (Storm)

Time (mins)	Rain (mm/hr)								
4	4.633	28	17.374	52	67.011	76	55.842	100	15.463
8	11.382	32	21.155	56	76.603	80	45.062	104	14.974
12	14.256	36	27.055	60	83.409	84	35.310	108	14.968
16	14.968	40	35.310	64	83.409	88	27.055	112	14.256
20	14.974	44	45.062	68	76.603	92	21.155	116	11.382
24	15.463	48	55.842	72	67.011	96	17.374	120	4.632

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The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	New Build Property	
Solihull B90 8AE		Mirro
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File PROPOSED BUILDING.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	

Rainfall Hyetograph for 120 minute 100 year Winter I+40% for Pipe S1.002 (Storm)

Time (mins)	Rain (mm/hr)								
4	4.633	28	17.374	52	67.011	76	55.842	100	15.463
8	11.382	32	21.155	56	76.603	80	45.062	104	14.974
12	14.256	36	27.055	60	83.409	84	35.310	108	14.968
16	14.968	40	35.310	64	83.409	88	27.055	112	14.256
20	14.974	44	45.062	68	76.603	92	21.155	116	11.382
24	15.463	48	55.842	72	67.011	96	17.374	120	4.632

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The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	New Build Property	
Solihull B90 8AE		Micro
Date 03/02/2021	Designed by YB	
File PROPOSED BUILDING.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	1

Rainfall Hyetograph for 120 minute 100 year Winter I+40% for Pipe S2.000 (Storm)

Time (mins)	Rain (mm/hr)								
4	4.633	28	17.374	52	67.011	76	55.842	100	15.463
8	11.382	32	21.155	56	76.603	80	45.062	104	14.974
12	14.256	36	27.055	60	83.409	84	35.310	108	14.968
16	14.968	40	35.310	64	83.409	88	27.055	112	14.256
20	14.974	44	45.062	68	76.603	92	21.155	116	11.382
24	15.463	48	55.842	72	67.011	96	17.374	120	4.632

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The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	New Build Property	
Solihull B90 8AE		Mirro
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File PROPOSED BUILDING.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	

Rainfall Hyetograph for 120 minute 100 year Winter I+40% for Pipe S2.001 (Storm)

Time (mins)	Rain (mm/hr)								
4	4.633	28	17.374	52	67.011	76	55.842	100	15.463
8	11.382	32	21.155	56	76.603	80	45.062	104	14.974
12	14.256	36	27.055	60	83.409	84	35.310	108	14.968
16	14.968	40	35.310	64	83.409	88	27.055	112	14.256
20	14.974	44	45.062	68	76.603	92	21.155	116	11.382
24	15.463	48	55.842	72	67.011	96	17.374	120	4.632

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The Arup Campus	Hadley Wood Golf Course				
Blyth Gate	New Build Property				
Solihull B90 8AE		Mirro			
Date 03/02/2021	Designed by YB				
File PROPOSED BUILDING.MDX	Checked by JJM	Diamage			
XP Solutions	Network 2020.1				

Rainfall Hyetograph for 120 minute 100 year Winter I+40% for Pipe S1.003 (Storm)

Time (mins)	Rain (mm/hr)								
4	4.633	28	17.374	52	67.011	76	55.842	100	15.463
8	11.382	32	21.155	56	76.603	80	45.062	104	14.974
12	14.256	36	27.055	60	83.409	84	35.310	108	14.968
16	14.968	40	35.310	64	83.409	88	27.055	112	14.256
20	14.974	44	45.062	68	76.603	92	21.155	116	11.382
24	15.463	48	55.842	72	67.011	96	17.374	120	4.632

Ove Arup & Partners Internationa	Page 13	
The Arup Campus	Hadley Wood Golf Course	
Blyth Gate	New Build Property	
Solihull B90 8AE		Micro
Date 03/02/2021	Designed by YB	
File PROPOSED BUILDING.MDX	Checked by JJM	Diamage
XP Solutions	Network 2020.1	

Rainfall Hyetograph for 120 minute 100 year Winter I+40% for Pipe S1.004 (Storm)

Time (mins)	Rain (mm/hr)								
4	4.633	28	17.374	52	67.011	76	55.842	100	15.463
8	11.382	32	21.155	56	76.603	80	45.062	104	14.974
12	14.256	36	27.055	60	83.409	84	35.310	108	14.968
16	14.968	40	35.310	64	83.409	88	27.055	112	14.256
20	14.974	44	45.062	68	76.603	92	21.155	116	11.382
24	15.463	48	55.842	72	67.011	96	17.374	120	4.632