
Appendix 1

Site Plan

Notes:
Investigation positions approximated from site operative's notes.



Rogers Geotechnical Services Ltd

Offices 1 & 2, Barncliffe
Business Park,
Near Bank,
Shelley,
Huddersfield,
HD8 8LU

Telephone: 0843 50 66 87
www.rogersgeotech.co.uk

Client:
AGR Solar 2 Limited

Job Number:
C3956/23/E/5995

Project Details:
Bicker Fen Solar Farm
Spalding, Lincolnshire
PE11 4XY

Scale: Not to scale - reference only



Appendix 2

Trial Pit Records



Trial Pit Log

Trialpit No
TP01A
Sheet 1 of 1

Project Name: Bicker Fen Solar Farm

Project No.
C3956/23/E/5995

Co-ords: -
Level:

Date
06/12/2023

Location: Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY

Dimensions (m):

2.1

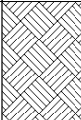
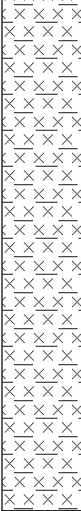
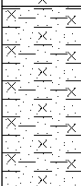
Depth
3.00

0.3

Scale
1:25

Logged
JF

Client: AGR Solar 2 Limited

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.40			TOPSOIL (Brown clayey SILT).
							Very soft dark brown clayey SILT. TIDAL FLAT DEPOSITS
				2.10			Soft dark brown silty CLAY. TIDAL FLAT DEPOSITS
				2.40			Very soft dark grey slightly sandy silty CLAY. Sand is fine. TIDAL FLAT DEPOSITS
				3.00			End of pit at 3.00 m

Remarks: Water strike at 1.1m.

Stability: Major instability throughout pit. Major collapse during soakaway testing.





Trial Pit Log

Trialpit No

TP101

Sheet 1 of 1

Project Name: Bicker Fen Solar Farm

Project No.
C3956/23/E/5995Co-ords: -
Level:Date
06/12/2023

Location: Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY

Dimensions
(m):

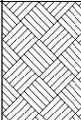
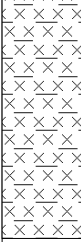
2

Depth
1.20

0.3

Scale
1:25Logged
JF

Client: AGR Solar 2 Limited

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.40			TOPSOIL (Brown clayey SILT).	
				1.20			Very soft dark brown clayey SILT. TIDAL FLAT DEPOSITS	1
							----- End of pit at 1.20 m -----	2
								3
								4
								5

Remarks: Land drain struck at 1.1m, rapid ingress of water. Trial pit concluded.

Stability: Minor instability throughout.





Trial Pit Log

Trialpit No
TP02A
Sheet 1 of 1

Project Name: Bicker Fen Solar Farm

Project No.
C3956/23/E/5995

Co-ords: -
Level:

Date
06/12/2023

Location: Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY

Dimensions (m):

1.7

Depth
2.45

0.3

Scale
1:25

Logged
JF

Client: AGR Solar 2 Limited

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.30			TOPSOIL (Dark grey clayey SILT).	
							Firm becoming soft dark grey and orangish brown silty CLAY.	
							TIDAL FLAT DEPOSITS	
				2.20			Light brown slightly clayey slightly gravelly medium SAND. Gravel is medium rounded and sub rounded sandstone.	
				2.45			TIDAL FLAT DEPOSITS	
							End of pit at 2.45 m	

Remarks: Water strike at 1.6m

Stability: Minor instability in topsoil.







Trial Pit Log

Trialpit No
TP03A
Sheet 1 of 1

Project Name: Bicker Fen Solar Farm

Project No.
C3956/23/E/5995

Co-ords: -
Level:

Date
06/12/2023

Location: Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY

Dimensions (m):
Depth 1.80
2.2
0.3

Scale
1:25
Logged
JF

Client: AGR Solar 2 Limited

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			TOPSOIL (Dark brown silty CLAY).
							Soft dark grey and orange brown sandy laminated silt. Sand is very fine.
							TIDAL FLAT DEPOSITS
				1.80			End of pit at 1.80 m

Remarks: No groundwater encountered.

Stability: Instability within silt.





Trial Pit Log

Trialpit No

TP103

Sheet 1 of 1

Project Name: Bicker Fen Solar Farm

Project No.
C3956/23/E/5995Co-ords: -
Level:Date
06/12/2023

Location: Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY

Dimensions
(m):

2

Depth
1.20

0.3

Scale
1:25Logged
JF

Client: AGR Solar 2 Limited

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.30			TOPSOIL (Dark brown silty CLAY).	
							Soft dark grey and orange brown sandy laminated SILT. Sand is very fine. TIDAL FLAT DEPOSITS	1
				1.20			----- End of pit at 1.20 m -----	2
								3
								4
								5

Remarks: Land drain struck at 1.1m, rapid ingress of water. Trial pit concluded.

Stability: Minor instability.



Appendix 3

Trial Pit Photographs



Photo 1: TP01 showing the ingress of water from the land drain strike.



Photo 2: TP01A showing the collapses throughout the pit.



Photo 3: TP02A, showing water ingress.



Photo 4: TP03A



Rogers Geotechnical Services Ltd

Offices 1 & 2, Barncliffe Business Park,
Near Bank, Shelley,
Huddersfield,

Job No:

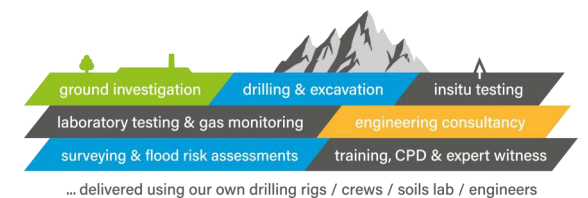
C3956/23/E/5995

Site:

Bicker Fen Solar Farm
Spalding
Lincolnshire
PE11 4XY

Client:

AGR Solar 2 Limited



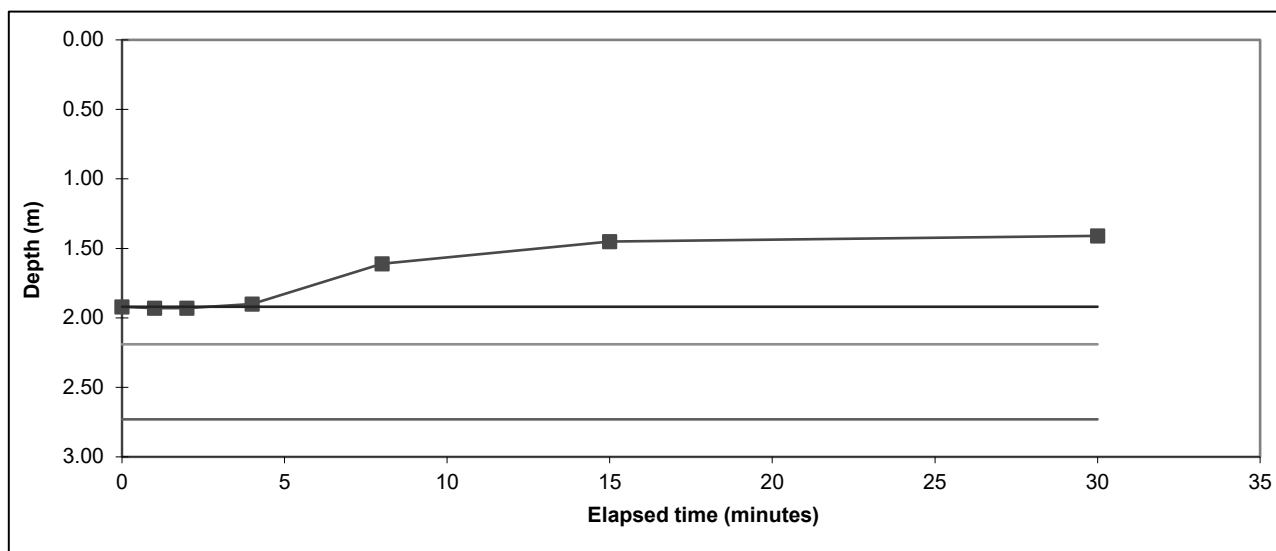
Appendix 4

Soakaway Results

Rogers Geotechnical Services L

Soakaway Test

Trial Pit No:	TP01	Test No:	1	Date:	06/12/2023
Length (m):	2.100	Datum Height:		0.00 m agl	
Width (m):	0.30	Granular infill:	None		
Depth (m):	3.00	Porosity of infill:	1	(assumed)	
	Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)	
	0	1.920			
	1	1.930			
	2	1.930			
	4	1.900			
	8	1.610			
	15	1.450			
	30	1.410			



Start water depth for analysis (mbgl):	1.92		
75% effective depth (mbgl):	2.19	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	2.46		
25% effective depth (mbgl):	2.73	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	3.00		

Volume outflow between 75% and 25% effective depth (m³):

Mean surface area of outflow (m²): 3.22

(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
--------------------------------------	--

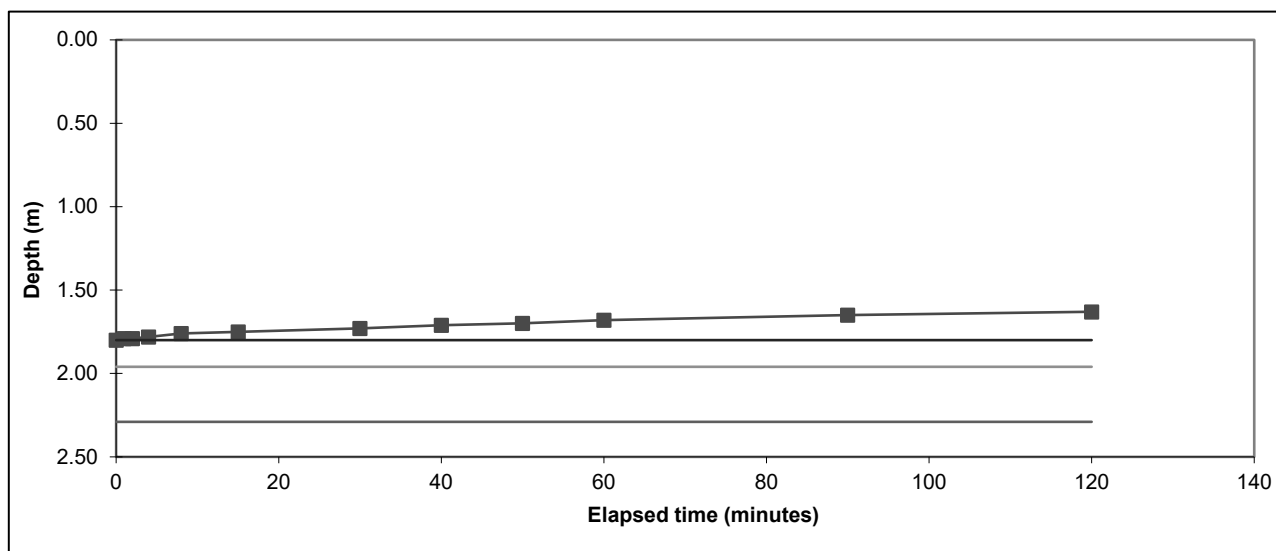
Remarks Results processed following BRE 365 (2007).
Minor collapses from start of test, major collapse around 8 minute mark and complete collapse around 15 minute mark.

Client:	AGR Solar 2 Limited	Job No:	C3956/23/E/5995
Site:	Bicker Fen Solar Farm		

Rogers Geotechnical Services L

Soakaway Test

Trial Pit No:	TP02A	Test No:	1	Date:	06/12/2023
Length (m):	1.700	Datum Height:			0.00 m agl
Width (m):	0.30	Granular infill:	None		
Depth (m):	2.45	Porosity of infill:	1	(assumed)	
	Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)	
	0	1.800			
	1	1.790			
	2	1.790			
	4	1.780			
	8	1.760			
	15	1.750			
	30	1.730			
	40	1.710			
	50	1.700			
	60	1.680			
	90	1.650			
	120	1.630			



Start water depth for analysis (mbgl):	1.80		
75% effective depth (mbgl):	1.96	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	2.13		
25% effective depth (mbgl):	2.29	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	2.45		

Volume outflow between 75% and 25% effective depth (m³):

Mean surface area of outflow (m²): 1.79

(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
--------------------------------------	--

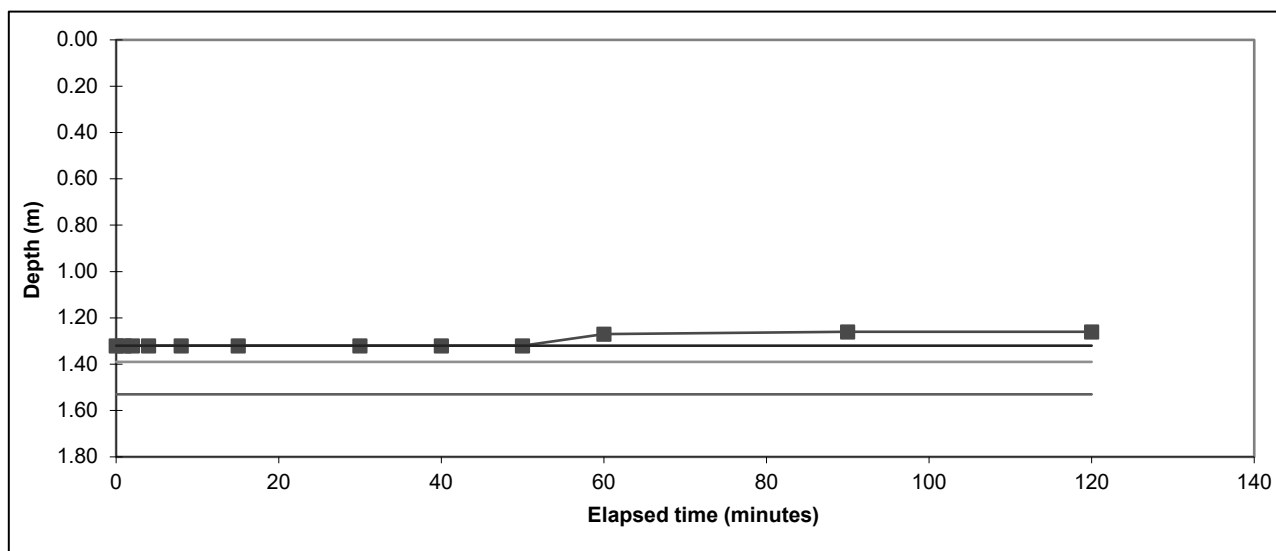
Remarks Results processed following BRE 365 (2007).

Client:	AGR Solar 2 Limited	Job No:	C3956/23/E/5995
Site:	Bicker Fen Solar Farm		

Rogers Geotechnical Services L

Soakaway Test

Trial Pit No:	TP03A	Test No:	1	Date:	06/12/2023
Length (m):	2.200	Datum Height:			0.00 m agl
Width (m):	0.30	Granular infill:	None		
Depth (m):	1.60	Porosity of infill:	1	(assumed)	
	Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)	
	0	1.320			
	1	1.320			
	2	1.320			
	4	1.320			
	8	1.320			
	15	1.320			
	30	1.320			
	40	1.320			
	50	1.320			
	60	1.270			
	90	1.260			
	120	1.260			



Start water depth for analysis (mbgl):	1.32		
75% effective depth (mbgl):	1.39	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.46		
25% effective depth (mbgl):	1.53	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.60		

Volume outflow between 75% and 25% effective depth (m³):

Mean surface area of outflow (m²): 1.36

(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
--------------------------------------	--

Remarks Results processed following BRE 365 (2007).
Collapse around 60 minute mark.

Client:	AGR Solar 2 Limited	Job No:	C3956/23/E/5995
Site:	Bicker Fen Solar Farm		

ANNEX 3

Greenfield Runoff Rates

Calculated by:	warren chan
Site name:	5086 Bicker Fen
Site location:	Lincolnshire

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

Site Details

Latitude:	52.94956° N
Longitude:	0.19392° W
Reference:	835613710
Date:	Jan 03 2024 10:01

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1
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Methodology

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

Notes

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

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

Soil characteristics

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

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

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	558	558
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

(3) Is $SPR/SPRHOST \leq 0.3$?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.4	1.4
1 in 1 year (l/s):	1.22	1.22
1 in 30 years (l/s):	3.42	3.42
1 in 100 year (l/s):	4.98	4.98
1 in 200 years (l/s):	5.88	5.88

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

ANNEX 4

Surface Water Attenuation - Storage Volume Calculation

Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 525 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.775	0.075	0.0	1.0	1.0	23.8	O K
30 min Summer	1.802	0.102	0.0	1.0	1.0	32.4	O K
60 min Summer	1.829	0.129	0.0	1.0	1.0	40.8	O K
120 min Summer	1.852	0.152	0.0	1.0	1.0	48.1	O K
180 min Summer	1.861	0.161	0.0	1.0	1.0	51.1	O K
240 min Summer	1.865	0.165	0.0	1.0	1.0	52.3	O K
360 min Summer	1.865	0.165	0.0	1.0	1.0	52.5	O K
480 min Summer	1.862	0.162	0.0	1.0	1.0	51.3	O K
600 min Summer	1.858	0.158	0.0	1.0	1.0	50.0	O K
720 min Summer	1.853	0.153	0.0	1.0	1.0	48.5	O K
960 min Summer	1.845	0.145	0.0	1.0	1.0	45.9	O K
1440 min Summer	1.830	0.130	0.0	1.0	1.0	41.1	O K
2160 min Summer	1.809	0.109	0.0	1.0	1.0	34.4	O K
2880 min Summer	1.789	0.089	0.0	1.0	1.0	28.3	O K
4320 min Summer	1.757	0.057	0.0	0.9	0.9	17.9	O K
5760 min Summer	1.732	0.032	0.0	0.9	0.9	10.1	O K
7200 min Summer	1.715	0.015	0.0	0.9	0.9	4.7	O K
8640 min Summer	1.705	0.005	0.0	0.9	0.9	1.4	O K
10080 min Summer	1.700	0.000	0.0	0.9	0.9	0.0	O K
15 min Winter	1.786	0.086	0.0	1.0	1.0	27.3	O K
30 min Winter	1.817	0.117	0.0	1.0	1.0	37.1	O K
60 min Winter	1.847	0.147	0.0	1.0	1.0	46.6	O K
120 min Winter	1.874	0.174	0.0	1.0	1.0	55.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	24.3	19
30 min Summer	90.705	0.0	33.6	33
60 min Summer	56.713	0.0	43.3	64
120 min Summer	34.246	0.0	53.4	122
180 min Summer	25.149	0.0	59.2	182
240 min Summer	20.078	0.0	63.3	242
360 min Summer	14.585	0.0	69.2	360
480 min Summer	11.622	0.0	73.7	430
600 min Summer	9.738	0.0	77.3	488
720 min Summer	8.424	0.0	80.1	550
960 min Summer	6.697	0.0	84.9	676
1440 min Summer	4.839	0.0	91.6	952
2160 min Summer	3.490	0.0	98.2	1360
2880 min Summer	2.766	0.0	102.8	1756
4320 min Summer	1.989	0.0	108.6	2504
5760 min Summer	1.573	0.0	112.2	3176
7200 min Summer	1.311	0.0	114.4	3824
8640 min Summer	1.129	0.0	115.7	4496
10080 min Summer	0.994	0.0	116.6	0
15 min Winter	138.153	0.0	27.9	19
30 min Winter	90.705	0.0	38.3	33
60 min Winter	56.713	0.0	49.2	62
120 min Winter	34.246	0.0	60.5	120

Summary of Results for 100 year Return Period (+40%)								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	
180 min Winter	1.885	0.185	0.0	1.0	1.0	58.8	O	K
240 min Winter	1.891	0.191	0.0	1.0	1.0	60.5	O	K
360 min Winter	1.894	0.194	0.0	1.0	1.0	61.4	O	K
480 min Winter	1.892	0.192	0.0	1.0	1.0	60.7	O	K
600 min Winter	1.887	0.187	0.0	1.0	1.0	59.1	O	K
720 min Winter	1.881	0.181	0.0	1.0	1.0	57.3	O	K
960 min Winter	1.870	0.170	0.0	1.0	1.0	53.8	O	K
1440 min Winter	1.848	0.148	0.0	1.0	1.0	47.0	O	K
2160 min Winter	1.816	0.116	0.0	1.0	1.0	36.9	O	K
2880 min Winter	1.787	0.087	0.0	1.0	1.0	27.7	O	K
4320 min Winter	1.740	0.040	0.0	0.9	0.9	12.8	O	K
5760 min Winter	1.709	0.009	0.0	0.9	0.9	2.9	O	K
7200 min Winter	1.700	0.000	0.0	0.9	0.9	0.0	O	K
8640 min Winter	1.700	0.000	0.0	0.7	0.7	0.0	O	K
10080 min Winter	1.700	0.000	0.0	0.6	0.6	0.0	O	K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	67.0	178
240 min Winter	20.078	0.0	71.6	236
360 min Winter	14.585	0.0	78.3	350
480 min Winter	11.622	0.0	83.2	458
600 min Winter	9.738	0.0	87.3	560
720 min Winter	8.424	0.0	90.6	586
960 min Winter	6.697	0.0	95.9	732
1440 min Winter	4.839	0.0	103.5	1038
2160 min Winter	3.490	0.0	111.3	1468
2880 min Winter	2.766	0.0	116.5	1872
4320 min Winter	1.989	0.0	123.5	2596
5760 min Winter	1.573	0.0	127.9	3176
7200 min Winter	1.311	0.0	131.0	0
8640 min Winter	1.129	0.0	133.0	0
10080 min Winter	0.994	0.0	134.3	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.115

Time (mins)		Area
From:	To:	(ha)
0	4	0.115

Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	105.7
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	293.6	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.700	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

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	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 2853 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.722	0.072	0.0	0.9	0.9	95.0	O K
30 min Summer	1.749	0.099	0.0	0.9	0.9	131.2	O K
60 min Summer	1.778	0.128	0.0	1.0	1.0	168.4	O K
120 min Summer	1.806	0.156	0.0	1.0	1.0	205.3	O K
180 min Summer	1.821	0.171	0.0	1.0	1.0	225.8	O K
240 min Summer	1.831	0.181	0.0	1.0	1.0	239.1	O K
360 min Summer	1.845	0.195	0.0	1.0	1.0	256.8	O K
480 min Summer	1.854	0.204	0.0	1.0	1.0	268.6	O K
600 min Summer	1.860	0.210	0.0	1.0	1.0	276.8	O K
720 min Summer	1.864	0.214	0.0	1.0	1.0	282.7	O K
960 min Summer	1.869	0.219	0.0	1.0	1.0	289.4	O K
1440 min Summer	1.871	0.221	0.0	1.0	1.0	292.3	O K
2160 min Summer	1.865	0.215	0.0	1.0	1.0	283.8	O K
2880 min Summer	1.856	0.206	0.0	1.0	1.0	272.5	O K
4320 min Summer	1.840	0.190	0.0	1.0	1.0	251.1	O K
5760 min Summer	1.827	0.177	0.0	1.0	1.0	233.3	O K
7200 min Summer	1.814	0.164	0.0	1.0	1.0	216.6	O K
8640 min Summer	1.802	0.152	0.0	1.0	1.0	200.9	O K
10080 min Summer	1.791	0.141	0.0	1.0	1.0	185.8	O K
15 min Winter	1.733	0.083	0.0	0.9	0.9	109.2	O K
30 min Winter	1.763	0.113	0.0	0.9	0.9	149.7	O K
60 min Winter	1.795	0.145	0.0	1.0	1.0	191.5	O K
120 min Winter	1.827	0.177	0.0	1.0	1.0	233.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	77.5	19
30 min Summer	90.705	0.0	78.8	34
60 min Summer	56.713	0.0	157.6	64
120 min Summer	34.246	0.0	160.0	124
180 min Summer	25.149	0.0	161.0	184
240 min Summer	20.078	0.0	161.5	244
360 min Summer	14.585	0.0	161.8	364
480 min Summer	11.622	0.0	161.6	482
600 min Summer	9.738	0.0	161.1	602
720 min Summer	8.424	0.0	160.4	722
960 min Summer	6.697	0.0	158.7	962
1440 min Summer	4.839	0.0	154.4	1440
2160 min Summer	3.490	0.0	310.8	2016
2880 min Summer	2.766	0.0	304.1	2340
4320 min Summer	1.989	0.0	285.1	3108
5760 min Summer	1.573	0.0	440.1	3920
7200 min Summer	1.311	0.0	448.3	4752
8640 min Summer	1.129	0.0	452.9	5536
10080 min Summer	0.994	0.0	455.1	6352
15 min Winter	138.153	0.0	78.1	19
30 min Winter	90.705	0.0	79.6	34
60 min Winter	56.713	0.0	159.5	64
120 min Winter	34.246	0.0	162.3	122

Summary of Results for 100 year Return Period (+40%)								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	
180 min Winter	1.844	0.194	0.0	1.0	1.0	256.5	O	K
240 min Winter	1.856	0.206	0.0	1.0	1.0	271.8	O	K
360 min Winter	1.871	0.221	0.0	1.0	1.0	292.4	O	K
480 min Winter	1.882	0.232	0.0	1.0	1.0	306.3	O	K
600 min Winter	1.890	0.240	0.0	1.0	1.0	316.3	O	K
720 min Winter	1.895	0.245	0.0	1.0	1.0	323.4	O	K
960 min Winter	1.902	0.252	0.0	1.0	1.0	332.8	O	K
1440 min Winter	1.907	0.257	0.0	1.0	1.0	339.4	O	K
2160 min Winter	1.904	0.254	0.0	1.0	1.0	335.0	O	K
2880 min Winter	1.894	0.244	0.0	1.0	1.0	322.6	O	K
4320 min Winter	1.874	0.224	0.0	1.0	1.0	295.4	O	K
5760 min Winter	1.855	0.205	0.0	1.0	1.0	271.0	O	K
7200 min Winter	1.837	0.187	0.0	1.0	1.0	246.8	O	K
8640 min Winter	1.819	0.169	0.0	1.0	1.0	223.2	O	K
10080 min Winter	1.802	0.152	0.0	1.0	1.0	200.5	O	K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	163.5	182
240 min Winter	20.078	0.0	164.1	240
360 min Winter	14.585	0.0	164.7	358
480 min Winter	11.622	0.0	164.7	476
600 min Winter	9.738	0.0	164.3	594
720 min Winter	8.424	0.0	163.7	710
960 min Winter	6.697	0.0	162.2	942
1440 min Winter	4.839	0.0	158.1	1400
2160 min Winter	3.490	0.0	318.4	2072
2880 min Winter	2.766	0.0	312.0	2680
4320 min Winter	1.989	0.0	295.7	3328
5760 min Winter	1.573	0.0	502.6	4264
7200 min Winter	1.311	0.0	513.5	5120
8640 min Winter	1.129	0.0	520.6	6048
10080 min Winter	0.994	0.0	513.1	6864

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.455

Time (mins) Area
From: To: (ha)

0 4 0.455

Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	44.0
Membrane Percolation (mm/hr)	1000	Length (m)	100.0
Max Percolation (l/s)	1222.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.650	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

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	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 2979 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.615	0.115	0.0	0.9	0.9	100.4	O K
30 min Summer	1.655	0.155	0.0	0.9	0.9	135.9	O K
60 min Summer	1.697	0.197	0.0	0.9	0.9	172.5	O K
120 min Summer	1.739	0.239	0.0	0.9	0.9	208.9	O K
180 min Summer	1.762	0.262	0.0	0.9	0.9	229.1	O K
240 min Summer	1.776	0.276	0.0	1.0	1.0	242.1	O K
360 min Summer	1.797	0.297	0.0	1.0	1.0	259.8	O K
480 min Summer	1.810	0.310	0.0	1.0	1.0	271.6	O K
600 min Summer	1.819	0.319	0.0	1.0	1.0	279.7	O K
720 min Summer	1.826	0.326	0.0	1.0	1.0	285.6	O K
960 min Summer	1.834	0.334	0.0	1.0	1.0	292.5	O K
1440 min Summer	1.838	0.338	0.0	1.0	1.0	295.9	O K
2160 min Summer	1.829	0.329	0.0	1.0	1.0	287.8	O K
2880 min Summer	1.815	0.315	0.0	1.0	1.0	275.8	O K
4320 min Summer	1.792	0.292	0.0	1.0	1.0	255.4	O K
5760 min Summer	1.773	0.273	0.0	1.0	1.0	239.0	O K
7200 min Summer	1.756	0.256	0.0	0.9	0.9	223.9	O K
8640 min Summer	1.739	0.239	0.0	0.9	0.9	209.5	O K
10080 min Summer	1.723	0.223	0.0	0.9	0.9	195.7	O K
15 min Winter	1.630	0.130	0.0	0.9	0.9	114.3	O K
30 min Winter	1.676	0.176	0.0	0.9	0.9	154.2	O K
60 min Winter	1.723	0.223	0.0	0.9	0.9	195.3	O K
120 min Winter	1.770	0.270	0.0	1.0	1.0	236.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	70.5	19
30 min Summer	90.705	0.0	72.7	34
60 min Summer	56.713	0.0	145.6	64
120 min Summer	34.246	0.0	149.8	124
180 min Summer	25.149	0.0	152.1	184
240 min Summer	20.078	0.0	153.5	244
360 min Summer	14.585	0.0	155.0	364
480 min Summer	11.622	0.0	155.8	482
600 min Summer	9.738	0.0	156.2	602
720 min Summer	8.424	0.0	156.2	722
960 min Summer	6.697	0.0	155.6	962
1440 min Summer	4.839	0.0	153.1	1440
2160 min Summer	3.490	0.0	302.9	2096
2880 min Summer	2.766	0.0	299.6	2416
4320 min Summer	1.989	0.0	284.3	3152
5760 min Summer	1.573	0.0	456.3	3968
7200 min Summer	1.311	0.0	468.4	4760
8640 min Summer	1.129	0.0	477.4	5616
10080 min Summer	0.994	0.0	473.4	6360
15 min Winter	138.153	0.0	71.3	19
30 min Winter	90.705	0.0	73.9	34
60 min Winter	56.713	0.0	148.4	64
120 min Winter	34.246	0.0	153.3	122

Summary of Results for 100 year Return Period (+40%)								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	
180 min Winter	1.796	0.296	0.0	1.0	1.0	259.3	O	K
240 min Winter	1.813	0.313	0.0	1.0	1.0	274.3	O	K
360 min Winter	1.837	0.337	0.0	1.0	1.0	294.8	O	K
480 min Winter	1.852	0.352	0.0	1.0	1.0	308.8	O	K
600 min Winter	1.864	0.364	0.0	1.0	1.0	318.7	O	K
720 min Winter	1.872	0.372	0.0	1.0	1.0	326.0	O	K
960 min Winter	1.883	0.383	0.0	1.0	1.0	335.5	O	K
1440 min Winter	1.891	0.391	0.0	1.0	1.0	342.8	O	K
2160 min Winter	1.887	0.387	0.0	1.0	1.0	339.4	O	K
2880 min Winter	1.874	0.374	0.0	1.0	1.0	327.9	O	K
4320 min Winter	1.843	0.343	0.0	1.0	1.0	300.6	O	K
5760 min Winter	1.818	0.318	0.0	1.0	1.0	278.8	O	K
7200 min Winter	1.794	0.294	0.0	1.0	1.0	257.2	O	K
8640 min Winter	1.769	0.269	0.0	0.9	0.9	236.0	O	K
10080 min Winter	1.746	0.246	0.0	0.9	0.9	215.4	O	K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	155.8	182
240 min Winter	20.078	0.0	157.4	240
360 min Winter	14.585	0.0	159.1	358
480 min Winter	11.622	0.0	160.0	476
600 min Winter	9.738	0.0	160.3	594
720 min Winter	8.424	0.0	160.4	712
960 min Winter	6.697	0.0	159.7	944
1440 min Winter	4.839	0.0	157.0	1400
2160 min Winter	3.490	0.0	311.8	2072
2880 min Winter	2.766	0.0	307.8	2708
4320 min Winter	1.989	0.0	295.5	3368
5760 min Winter	1.573	0.0	517.3	4272
7200 min Winter	1.311	0.0	532.2	5192
8640 min Winter	1.129	0.0	527.5	6056
10080 min Winter	0.994	0.0	503.3	6960

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.447

Time (mins)		Area
From:	To:	(ha)
0	4	0.447

Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	29.2
Membrane Percolation (mm/hr)	1000	Length (m)	100.0
Max Percolation (l/s)	811.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.500	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

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	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 3189 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.722	0.072	0.0	0.9	0.9	104.2	O K
30 min Summer	1.749	0.099	0.0	0.9	0.9	143.9	O K
60 min Summer	1.777	0.127	0.0	1.0	1.0	184.8	O K
120 min Summer	1.805	0.155	0.0	1.0	1.0	225.7	O K
180 min Summer	1.821	0.171	0.0	1.0	1.0	248.3	O K
240 min Summer	1.831	0.181	0.0	1.0	1.0	263.2	O K
360 min Summer	1.845	0.195	0.0	1.0	1.0	283.1	O K
480 min Summer	1.854	0.204	0.0	1.0	1.0	296.7	O K
600 min Summer	1.861	0.211	0.0	1.0	1.0	306.2	O K
720 min Summer	1.866	0.216	0.0	1.0	1.0	313.1	O K
960 min Summer	1.872	0.222	0.0	1.0	1.0	321.7	O K
1440 min Summer	1.875	0.225	0.0	1.0	1.0	327.1	O K
2160 min Summer	1.871	0.221	0.0	1.0	1.0	320.6	O K
2880 min Summer	1.863	0.213	0.0	1.0	1.0	309.1	O K
4320 min Summer	1.847	0.197	0.0	1.0	1.0	286.2	O K
5760 min Summer	1.834	0.184	0.0	1.0	1.0	267.4	O K
7200 min Summer	1.822	0.172	0.0	1.0	1.0	250.0	O K
8640 min Summer	1.811	0.161	0.0	1.0	1.0	233.5	O K
10080 min Summer	1.800	0.150	0.0	1.0	1.0	217.7	O K
15 min Winter	1.732	0.082	0.0	0.9	0.9	119.7	O K
30 min Winter	1.763	0.113	0.0	0.9	0.9	164.2	O K
60 min Winter	1.795	0.145	0.0	1.0	1.0	210.2	O K
120 min Winter	1.826	0.176	0.0	1.0	1.0	256.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	138.153	0.0	77.6	19			
30 min Summer	90.705	0.0	78.9	34			
60 min Summer	56.713	0.0	158.1	64			
120 min Summer	34.246	0.0	160.4	124			
180 min Summer	25.149	0.0	161.6	184			
240 min Summer	20.078	0.0	162.0	244			
360 min Summer	14.585	0.0	162.3	364			
480 min Summer	11.622	0.0	162.1	482			
600 min Summer	9.738	0.0	161.6	602			
720 min Summer	8.424	0.0	160.9	722			
960 min Summer	6.697	0.0	159.1	962			
1440 min Summer	4.839	0.0	154.8	1442			
2160 min Summer	3.490	0.0	312.6	2140			
2880 min Summer	2.766	0.0	305.9	2448			
4320 min Summer	1.989	0.0	287.9	3160			
5760 min Summer	1.573	0.0	482.2	3976			
7200 min Summer	1.311	0.0	491.1	4760			
8640 min Summer	1.129	0.0	496.4	5616			
10080 min Summer	0.994	0.0	489.7	6448			
15 min Winter	138.153	0.0	78.2	19			
30 min Winter	90.705	0.0	79.7	34			
60 min Winter	56.713	0.0	160.1	64			
120 min Winter	34.246	0.0	162.8	122			

Summary of Results for 100 year Return Period (+40%)								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	
180 min Winter	1.844	0.194	0.0	1.0	1.0	282.1	O	K
240 min Winter	1.856	0.206	0.0	1.0	1.0	299.0	O	K
360 min Winter	1.872	0.222	0.0	1.0	1.0	322.2	O	K
480 min Winter	1.883	0.233	0.0	1.0	1.0	338.1	O	K
600 min Winter	1.891	0.241	0.0	1.0	1.0	349.5	O	K
720 min Winter	1.897	0.247	0.0	1.0	1.0	357.9	O	K
960 min Winter	1.904	0.254	0.0	1.0	1.0	369.3	O	K
1440 min Winter	1.911	0.261	0.0	1.0	1.0	378.7	O	K
2160 min Winter	1.910	0.260	0.0	1.0	1.0	377.0	O	K
2880 min Winter	1.902	0.252	0.0	1.0	1.0	366.0	O	K
4320 min Winter	1.882	0.232	0.0	1.0	1.0	337.3	O	K
5760 min Winter	1.865	0.215	0.0	1.0	1.0	312.2	O	K
7200 min Winter	1.848	0.198	0.0	1.0	1.0	287.5	O	K
8640 min Winter	1.831	0.181	0.0	1.0	1.0	263.1	O	K
10080 min Winter	1.815	0.165	0.0	1.0	1.0	239.5	O	K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	164.0	182
240 min Winter	20.078	0.0	164.6	240
360 min Winter	14.585	0.0	165.2	358
480 min Winter	11.622	0.0	165.1	476
600 min Winter	9.738	0.0	164.7	594
720 min Winter	8.424	0.0	164.2	712
960 min Winter	6.697	0.0	162.6	944
1440 min Winter	4.839	0.0	158.4	1402
2160 min Winter	3.490	0.0	320.2	2076
2880 min Winter	2.766	0.0	313.8	2712
4320 min Winter	1.989	0.0	298.0	3376
5760 min Winter	1.573	0.0	550.8	4320
7200 min Winter	1.311	0.0	562.9	5192
8640 min Winter	1.129	0.0	548.4	6128
10080 min Winter	0.994	0.0	521.6	6960

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.499

Time (mins)		Area
From:	To:	(ha)
0	4	0.499

Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	48.4
Membrane Percolation (mm/hr)	1000	Length (m)	100.0
Max Percolation (l/s)	1344.4	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.650	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

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	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 1857 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.722	0.072	0.0	0.9	0.9	65.9	O K
30 min Summer	1.750	0.100	0.0	0.9	0.9	90.8	O K
60 min Summer	1.777	0.127	0.0	1.0	1.0	116.2	O K
120 min Summer	1.805	0.155	0.0	1.0	1.0	141.0	O K
180 min Summer	1.819	0.169	0.0	1.0	1.0	154.4	O K
240 min Summer	1.829	0.179	0.0	1.0	1.0	162.8	O K
360 min Summer	1.840	0.190	0.0	1.0	1.0	173.4	O K
480 min Summer	1.847	0.197	0.0	1.0	1.0	179.9	O K
600 min Summer	1.852	0.202	0.0	1.0	1.0	183.9	O K
720 min Summer	1.854	0.204	0.0	1.0	1.0	186.2	O K
960 min Summer	1.856	0.206	0.0	1.0	1.0	187.4	O K
1440 min Summer	1.850	0.200	0.0	1.0	1.0	182.8	O K
2160 min Summer	1.839	0.189	0.0	1.0	1.0	172.4	O K
2880 min Summer	1.828	0.178	0.0	1.0	1.0	162.7	O K
4320 min Summer	1.810	0.160	0.0	1.0	1.0	146.3	O K
5760 min Summer	1.794	0.144	0.0	1.0	1.0	131.2	O K
7200 min Summer	1.778	0.128	0.0	1.0	1.0	117.0	O K
8640 min Summer	1.764	0.114	0.0	0.9	0.9	103.7	O K
10080 min Summer	1.750	0.100	0.0	0.9	0.9	91.2	O K
15 min Winter	1.733	0.083	0.0	0.9	0.9	75.7	O K
30 min Winter	1.764	0.114	0.0	0.9	0.9	103.6	O K
60 min Winter	1.795	0.145	0.0	1.0	1.0	132.2	O K
120 min Winter	1.826	0.176	0.0	1.0	1.0	160.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	66.1	19
30 min Summer	90.705	0.0	78.1	34
60 min Summer	56.713	0.0	118.4	64
120 min Summer	34.246	0.0	145.9	124
180 min Summer	25.149	0.0	158.2	184
240 min Summer	20.078	0.0	158.7	244
360 min Summer	14.585	0.0	159.1	362
480 min Summer	11.622	0.0	158.9	482
600 min Summer	9.738	0.0	158.5	602
720 min Summer	8.424	0.0	157.9	722
960 min Summer	6.697	0.0	156.3	960
1440 min Summer	4.839	0.0	152.2	1370
2160 min Summer	3.490	0.0	268.5	1704
2880 min Summer	2.766	0.0	280.8	2076
4320 min Summer	1.989	0.0	270.3	2896
5760 min Summer	1.573	0.0	305.6	3696
7200 min Summer	1.311	0.0	311.4	4536
8640 min Summer	1.129	0.0	314.9	5280
10080 min Summer	0.994	0.0	316.6	6056
15 min Winter	138.153	0.0	75.9	19
30 min Winter	90.705	0.0	78.9	34
60 min Winter	56.713	0.0	134.4	64
120 min Winter	34.246	0.0	159.4	122

Summary of Results for 100 year Return Period (+40%)								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	
180 min Winter	1.843	0.193	0.0	1.0	1.0	175.7	O	K
240 min Winter	1.853	0.203	0.0	1.0	1.0	185.4	O	K
360 min Winter	1.867	0.217	0.0	1.0	1.0	198.1	O	K
480 min Winter	1.876	0.226	0.0	1.0	1.0	206.0	O	K
600 min Winter	1.882	0.232	0.0	1.0	1.0	211.2	O	K
720 min Winter	1.885	0.235	0.0	1.0	1.0	214.5	O	K
960 min Winter	1.889	0.239	0.0	1.0	1.0	217.5	O	K
1440 min Winter	1.886	0.236	0.0	1.0	1.0	215.6	O	K
2160 min Winter	1.873	0.223	0.0	1.0	1.0	203.7	O	K
2880 min Winter	1.860	0.210	0.0	1.0	1.0	191.5	O	K
4320 min Winter	1.835	0.185	0.0	1.0	1.0	168.7	O	K
5760 min Winter	1.810	0.160	0.0	1.0	1.0	146.3	O	K
7200 min Winter	1.787	0.137	0.0	1.0	1.0	124.9	O	K
8640 min Winter	1.765	0.115	0.0	0.9	0.9	105.0	O	K
10080 min Winter	1.745	0.095	0.0	0.9	0.9	86.6	O	K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	160.7	180
240 min Winter	20.078	0.0	161.4	240
360 min Winter	14.585	0.0	162.0	358
480 min Winter	11.622	0.0	162.0	474
600 min Winter	9.738	0.0	161.7	590
720 min Winter	8.424	0.0	161.2	706
960 min Winter	6.697	0.0	159.7	934
1440 min Winter	4.839	0.0	155.8	1382
2160 min Winter	3.490	0.0	304.3	1968
2880 min Winter	2.766	0.0	302.3	2220
4320 min Winter	1.989	0.0	282.6	3152
5760 min Winter	1.573	0.0	349.3	4032
7200 min Winter	1.311	0.0	356.7	4896
8640 min Winter	1.129	0.0	361.7	5704
10080 min Winter	0.994	0.0	365.1	6456

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.316

Time (mins)		Area
From:	To:	(ha)
0	4	0.316

Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	30.4
Membrane Percolation (mm/hr)	1000	Length (m)	100.0
Max Percolation (l/s)	844.4	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.650	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

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	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 586 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.772	0.072	0.0	1.0	1.0	25.7	O K
30 min Summer	1.799	0.099	0.0	1.0	1.0	35.2	O K
60 min Summer	1.825	0.125	0.0	1.0	1.0	44.4	O K
120 min Summer	1.847	0.147	0.0	1.0	1.0	52.5	O K
180 min Summer	1.858	0.158	0.0	1.0	1.0	56.1	O K
240 min Summer	1.862	0.162	0.0	1.0	1.0	57.7	O K
360 min Summer	1.864	0.164	0.0	1.0	1.0	58.4	O K
480 min Summer	1.861	0.161	0.0	1.0	1.0	57.5	O K
600 min Summer	1.858	0.158	0.0	1.0	1.0	56.2	O K
720 min Summer	1.854	0.154	0.0	1.0	1.0	54.8	O K
960 min Summer	1.846	0.146	0.0	1.0	1.0	51.9	O K
1440 min Summer	1.832	0.132	0.0	1.0	1.0	47.0	O K
2160 min Summer	1.813	0.113	0.0	1.0	1.0	40.1	O K
2880 min Summer	1.795	0.095	0.0	1.0	1.0	33.8	O K
4320 min Summer	1.764	0.064	0.0	0.9	0.9	22.7	O K
5760 min Summer	1.739	0.039	0.0	0.9	0.9	14.0	O K
7200 min Summer	1.722	0.022	0.0	0.9	0.9	7.7	O K
8640 min Summer	1.709	0.009	0.0	0.9	0.9	3.3	O K
10080 min Summer	1.702	0.002	0.0	0.9	0.9	0.8	O K
15 min Winter	1.783	0.083	0.0	1.0	1.0	29.6	O K
30 min Winter	1.813	0.113	0.0	1.0	1.0	40.2	O K
60 min Winter	1.842	0.142	0.0	1.0	1.0	50.7	O K
120 min Winter	1.869	0.169	0.0	1.0	1.0	60.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	26.3	19
30 min Summer	90.705	0.0	36.3	33
60 min Summer	56.713	0.0	46.9	64
120 min Summer	34.246	0.0	57.8	122
180 min Summer	25.149	0.0	64.1	182
240 min Summer	20.078	0.0	68.6	242
360 min Summer	14.585	0.0	75.0	360
480 min Summer	11.622	0.0	79.9	458
600 min Summer	9.738	0.0	83.6	508
720 min Summer	8.424	0.0	86.9	570
960 min Summer	6.697	0.0	92.0	694
1440 min Summer	4.839	0.0	99.2	966
2160 min Summer	3.490	0.0	106.3	1364
2880 min Summer	2.766	0.0	111.3	1760
4320 min Summer	1.989	0.0	117.5	2512
5760 min Summer	1.573	0.0	121.4	3232
7200 min Summer	1.311	0.0	123.5	3896
8640 min Summer	1.129	0.0	124.8	4576
10080 min Summer	0.994	0.0	125.7	5152
15 min Winter	138.153	0.0	30.1	19
30 min Winter	90.705	0.0	41.4	33
60 min Winter	56.713	0.0	53.3	62
120 min Winter	34.246	0.0	65.5	120

Summary of Results for 100 year Return Period (+40%)								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	
180 min Winter	1.881	0.181	0.0	1.0	1.0	64.4	O	K
240 min Winter	1.887	0.187	0.0	1.0	1.0	66.5	O	K
360 min Winter	1.891	0.191	0.0	1.0	1.0	68.1	O	K
480 min Winter	1.891	0.191	0.0	1.0	1.0	67.8	O	K
600 min Winter	1.887	0.187	0.0	1.0	1.0	66.6	O	K
720 min Winter	1.882	0.182	0.0	1.0	1.0	64.7	O	K
960 min Winter	1.872	0.172	0.0	1.0	1.0	61.1	O	K
1440 min Winter	1.852	0.152	0.0	1.0	1.0	54.2	O	K
2160 min Winter	1.823	0.123	0.0	1.0	1.0	43.9	O	K
2880 min Winter	1.796	0.096	0.0	1.0	1.0	34.3	O	K
4320 min Winter	1.751	0.051	0.0	0.9	0.9	18.2	O	K
5760 min Winter	1.718	0.018	0.0	0.9	0.9	6.5	O	K
7200 min Winter	1.701	0.001	0.0	0.9	0.9	0.2	O	K
8640 min Winter	1.700	0.000	0.0	0.8	0.8	0.0	O	K
10080 min Winter	1.700	0.000	0.0	0.7	0.7	0.0	O	K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	72.7	178
240 min Winter	20.078	0.0	77.6	236
360 min Winter	14.585	0.0	84.8	350
480 min Winter	11.622	0.0	90.3	462
600 min Winter	9.738	0.0	94.6	566
720 min Winter	8.424	0.0	98.3	658
960 min Winter	6.697	0.0	104.0	744
1440 min Winter	4.839	0.0	112.3	1052
2160 min Winter	3.490	0.0	120.5	1492
2880 min Winter	2.766	0.0	126.1	1904
4320 min Winter	1.989	0.0	133.7	2640
5760 min Winter	1.573	0.0	138.4	3288
7200 min Winter	1.311	0.0	141.7	3744
8640 min Winter	1.129	0.0	143.7	0
10080 min Winter	0.994	0.0	145.0	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.125

Time (mins)		Area
From:	To:	(ha)
0	4	0.125

Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	118.7
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	329.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.700	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

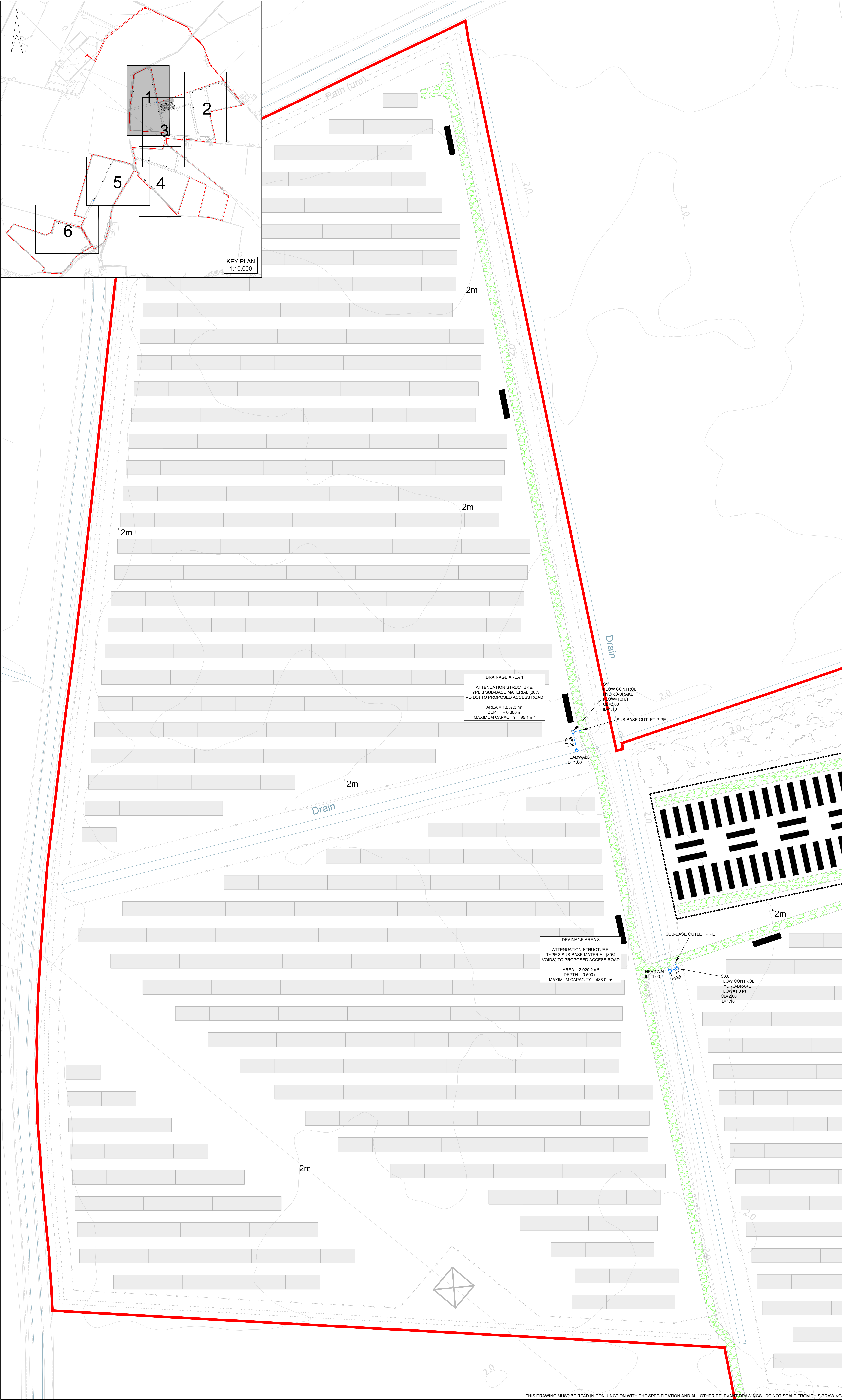
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

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	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

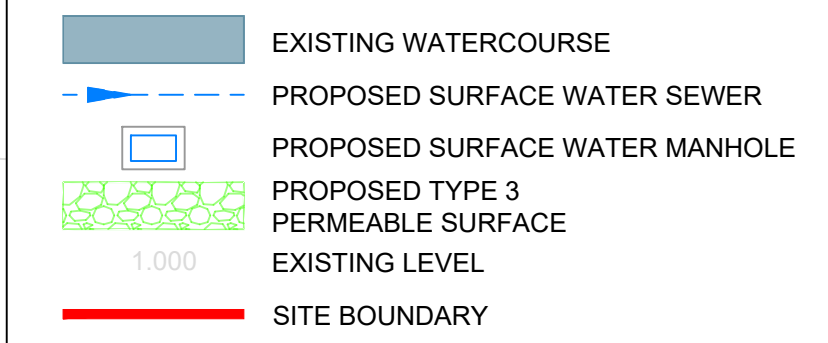
ANNEX 5

Preliminary Surface Water Drainage Layout

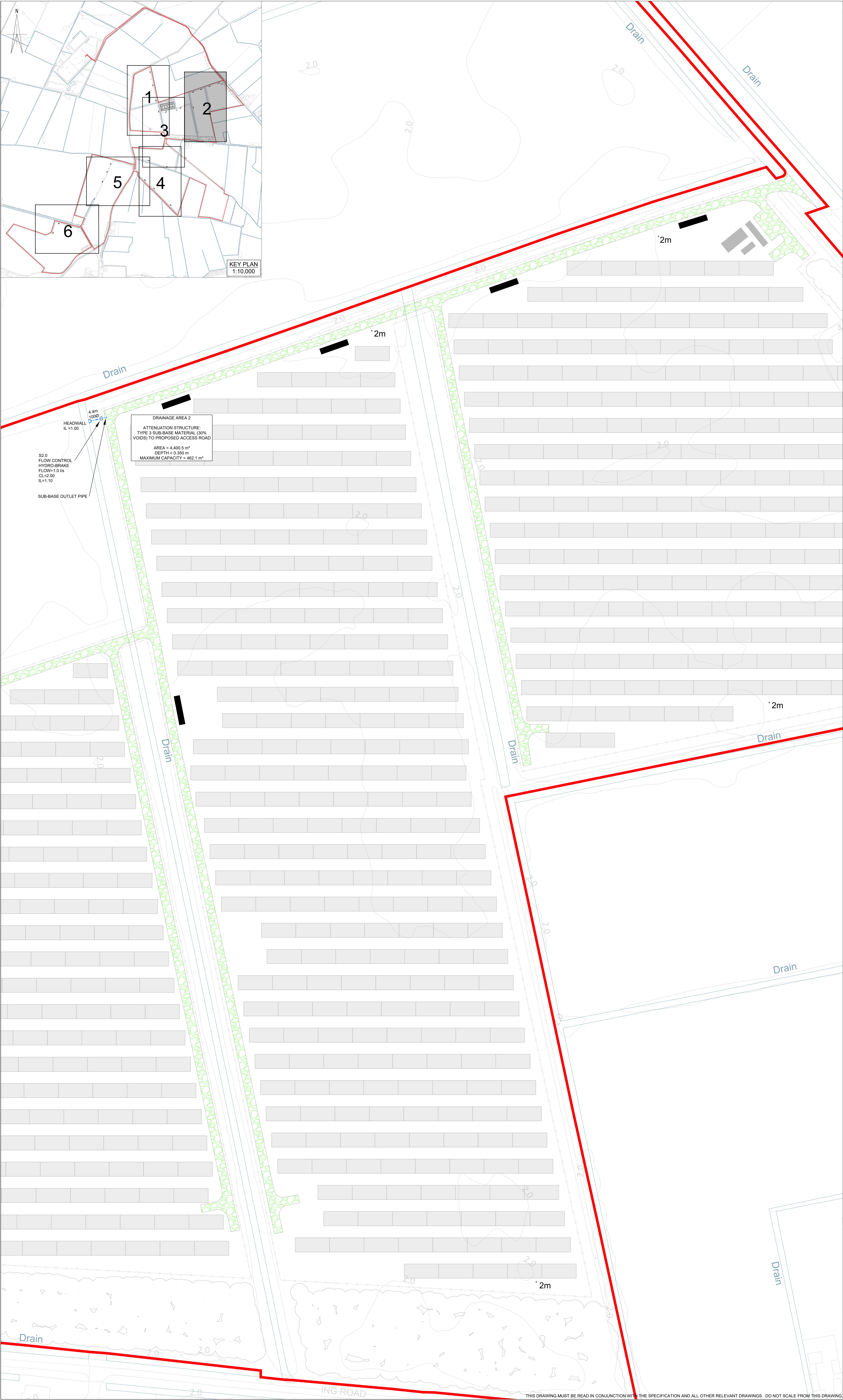


NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.
2. PROPOSED SITE LAYOUT TAKEN FROM AXIS 'GENERAL ARRANGEMENT' DRAWING (REF: 2920-01-03 REV E RECEIVED ON 06.11.2023).
3. EXISTING LEVEL INFORMATION TAKEN FROM LIDAR DATA



P1	17.01.24	INITIAL ISSUE	WC	TB
REV	DATE	DESCRIPTION	DRAWN CHECK	
		Park House, Fford Byrner Gwear, Mold CH1 1FQ Tel 01352 700045 info@weetwood.net www.weetwood.net		
Client				
AGR SOLAR 2 LIMITED				
Drawing Status			Date	JAN 2024
PLANNING			Scale	1:500
Project			Drawn	WC
BICKER FEN			Checked	TB
LINCOLNSHIRE			Project No	5086
Title			Drawing No	101
PROPOSED SURFACE WATER DRAINAGE LAYOUT			Revision	P1
1 OF 6				



NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.

2. PROPOSED SITE LAYOUT TAKEN FROM AXIS 'GENERAL ARRANGEMENT' DRAWING (REF: 2920-01-03 REV E RECEIVED ON 06.11.2023).

3. EXISTING LEVEL INFORMATION TAKEN FROM LIDAR DATA.

EXISTING WATERCOURSE

PROPOSED SURFACE WATER SEWER

PROPOSED SURFACE WATER MANHOLE

PROPOSED TYPE 3 PERMEABLE SURFACE

EXISTING LEVEL

SITE BOUNDARY

P1	17.01.24	INITIAL ISSUE	WC	TB
REV	DATE	DESCRIPTION	DRAWN CHECK	

Client

AGR SOLAR 2 LIMITED

Drawing Status

PLANNING

Project

BICKER FEN LINCOLNSHIRE

Date

JAN 2024

Scale (A0)

1:500

Drawn

WC

Checked

TB

Project No

5086

Drawing No

102

Revision

P1

Title

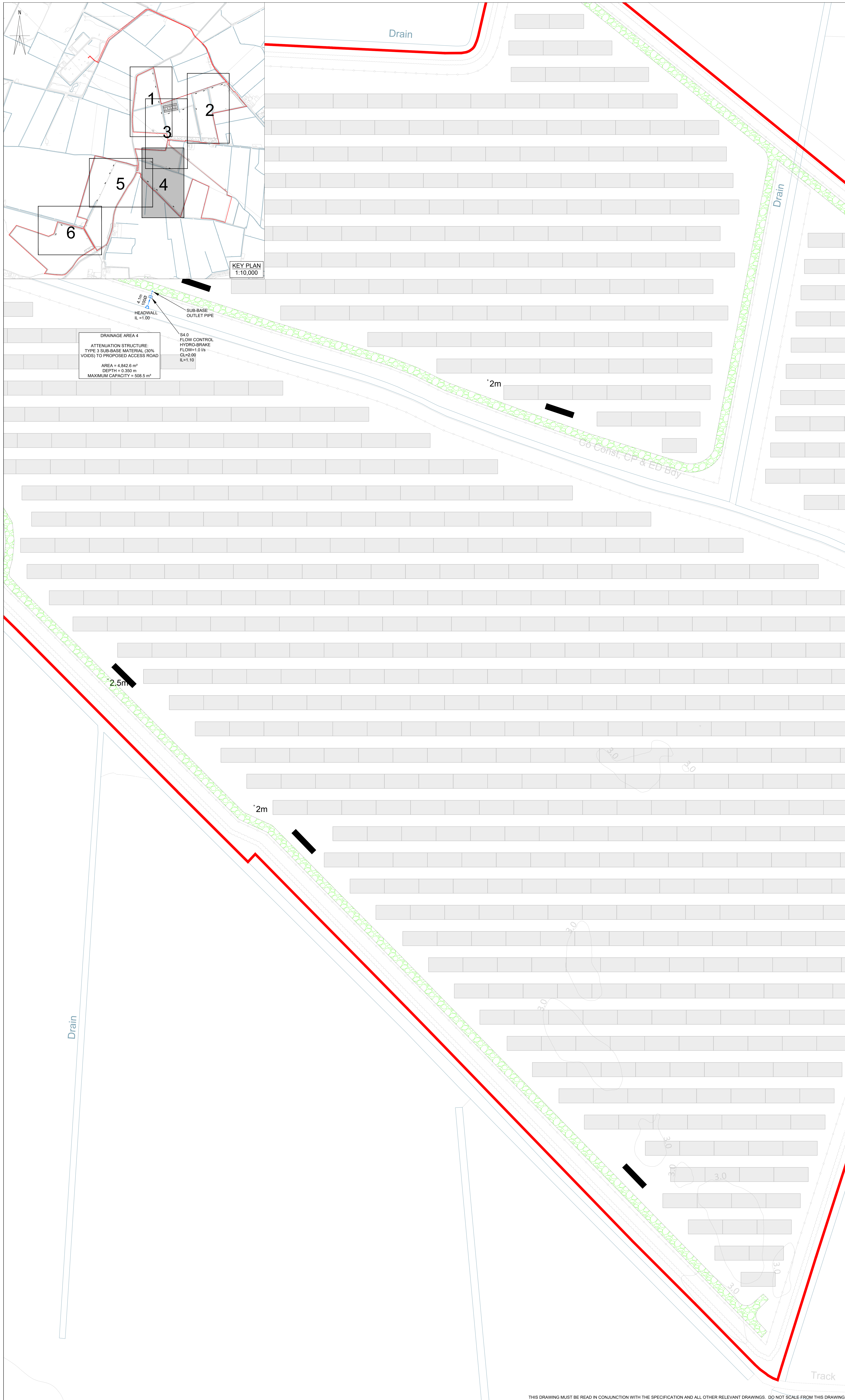
PROPOSED SURFACE WATER DRAINAGE LAYOUT

2 OF 6

Client

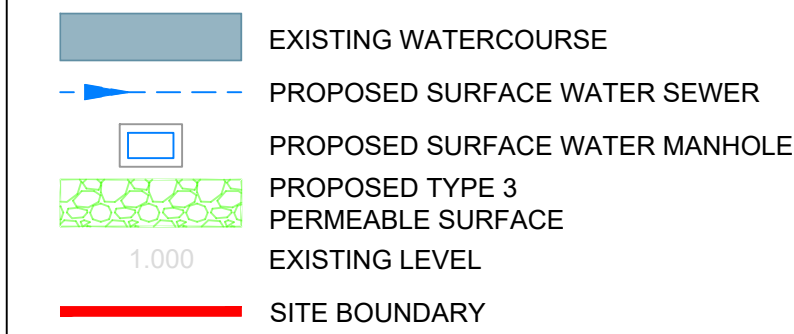
Park House, Flordd
Bymer Gwair, Mold
CH7 1FQ
Tel 01352 700045
info@weetwood.net
www.weetwood.net

THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE SPECIFICATION AND ALL OTHER RELEVANT DRAWINGS. DO NOT SCALE FROM THIS DRAWING.



NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.
2. PROPOSED SITE LAYOUT TAKEN FROM AXIS 'GENERAL ARRANGEMENT' DRAWING (REF: 2920-01-03 REV E RECEIVED ON 06.11.2023).
3. EXISTING LEVEL INFORMATION TAKEN FROM LIDAR DATA.



P1	17.01.24	INITIAL ISSUE	WC	TB
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REV	DATE	DESCRIPTION	DRAWN	CHECK
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Drawing Status	Date
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PLANNING JAN 2024

PLANNING	(A0)	1:500
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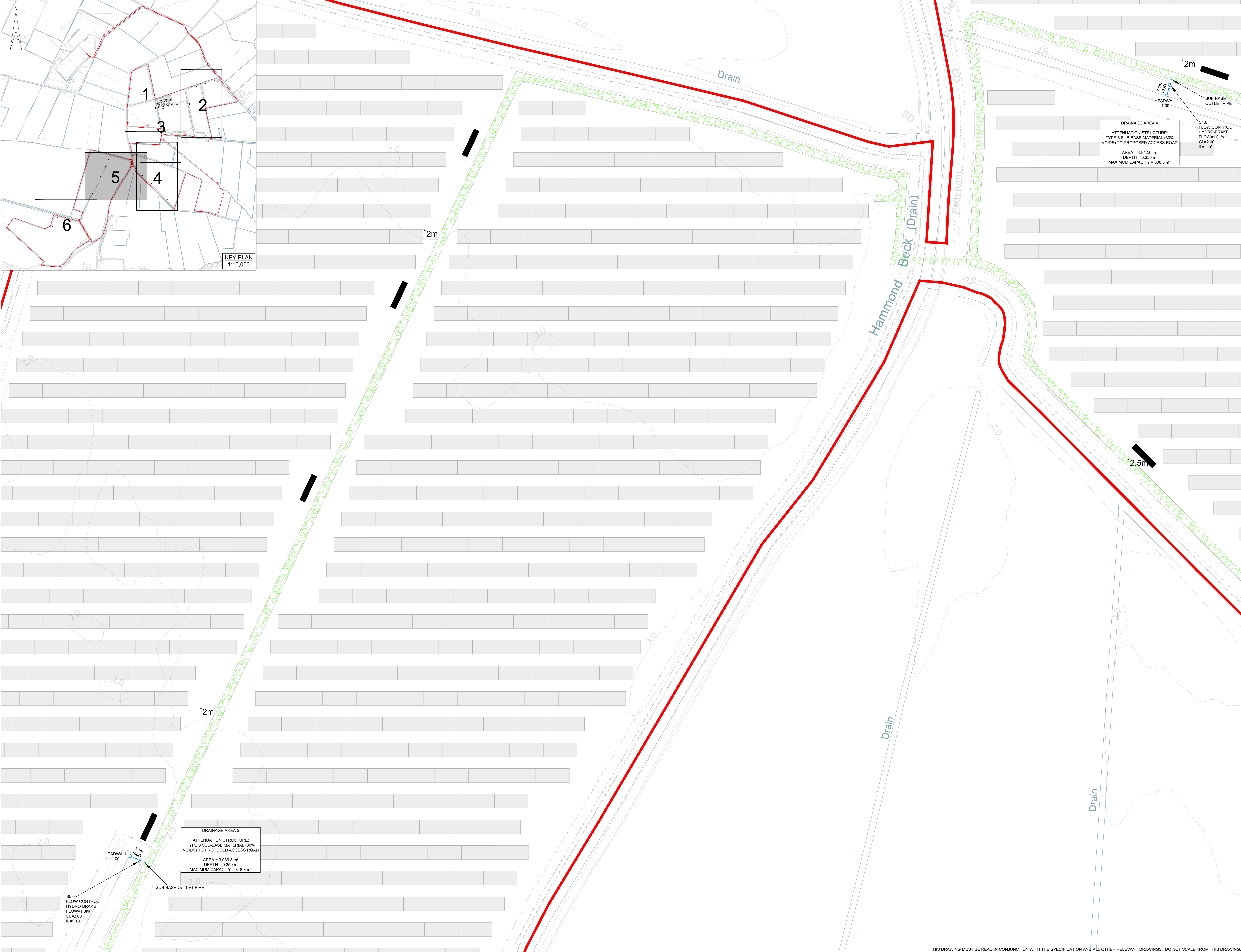
Project	DRAWN	WC
PICKED UP		

Checked	TB
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ENVIRONMENTAL	Project No.
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5086

PROPOSED SURFACE WATER : :DRAINAGE LAYOUT 104



NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.

2. PROPOSED SITE LAYOUT TAKEN FROM AXIS 'GENERAL ARRANGEMENT' DRAWING (REF: 2820-01-03 REV E RECEIVED ON 06.11.2023).

3. EXISTING LEVEL INFORMATION TAKEN FROM LIDAR DATA.

EXISTING WATERCOURSE

PROPOSED SURFACE WATER SEWER

PROPOSED SURFACE WATER MANHOLE

PROPOSED TYPE 3 PERMEABLE SURFACE

EXISTING LEVEL

SITE BOUNDARY

17.01.24

INITIAL ISSUE

WC

TB

REV

DATE

DESCRIPTION

DRAWN CHECK

Client

AGR SOLAR 2 LIMITED

Drawing Status

PLANNING

Date

JAN 2024

Project

BICKER FEN
LINCOLNSHIRE

Scale

1:500

Drawn

WC

Checked

TB

Title

PROPOSED SURFACE WATER DRAINAGE LAYOUT
5 OF 6

Project No.

5086

Drawn No.

105

Revision

P1

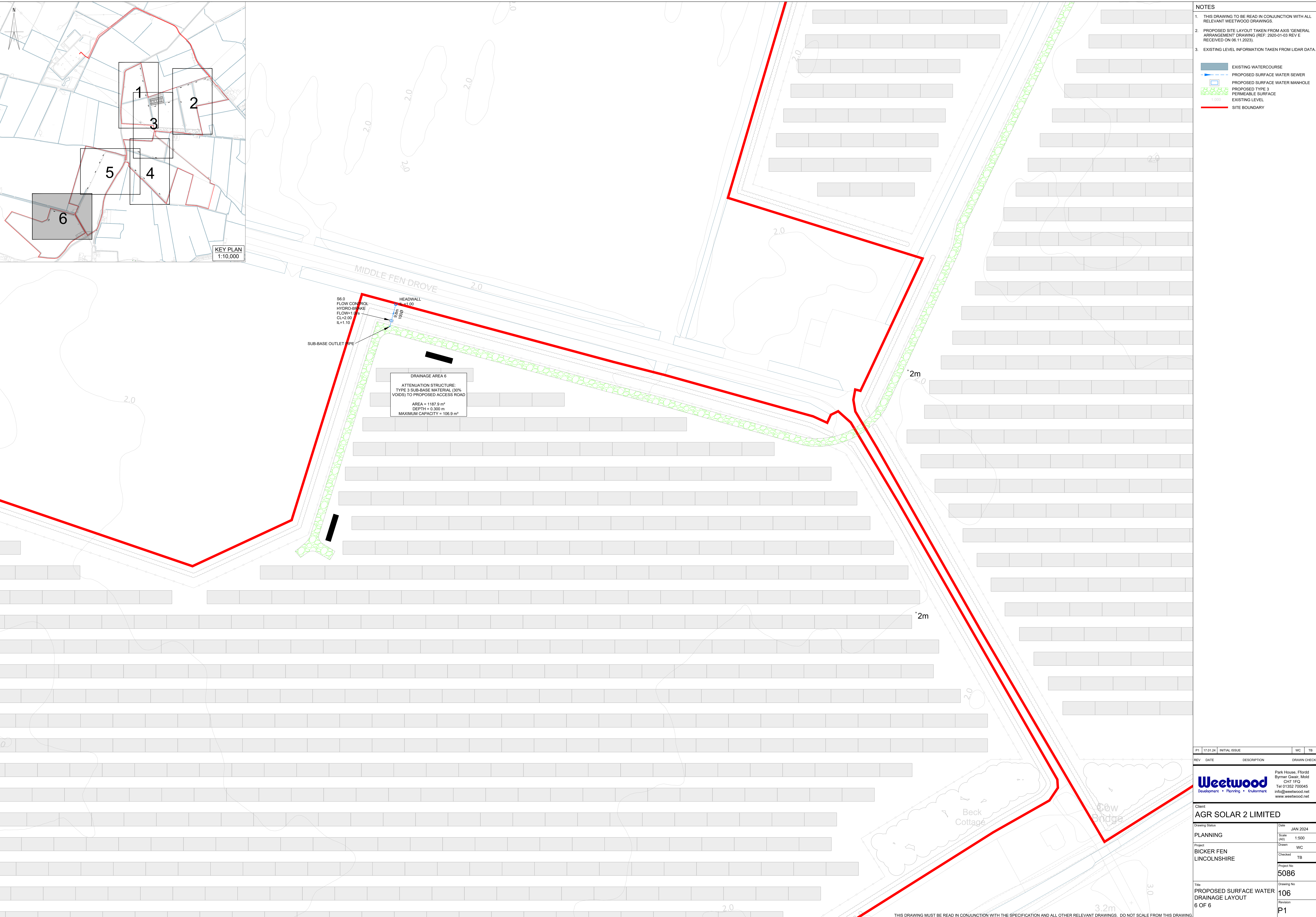
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Development

Planning

Environment

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