Nijhuis Saur Industries | UK & Eire

Our Ref: J-15535-01-GS

Date: 25/01/2024

N J Usher & Sons
Unit 10,
Hope Mills Business Centre,
Brimscombe,
Stroud,
Gloucestershire,
GL5 2SE

RE: Proposed New Dwelling at 375 Swindon Road, Cheltenham.

Introduction

The client has received conditional planning permission to develop a new dwelling at 375 Swindon Road. As part of the permission, a number of conditions have been imposed. Condition 4 of 23/01431/FUL states;

Prior to the commencement of development, a surface water drainage scheme, which shall incorporate Sustainable Urban Drainage System (SUDS) principles, shall be submitted to and approved in writing by the Local Planning Authority. The scheme shall include a programme for implementation of the works; and proposals for maintenance and management. The development shall not be carried out unless in accordance with the approved surface water drainage scheme.

Reason: To ensure sustainable drainage of the development, having regard to adopted policy INF2 of the Joint Core Strategy (2017). Approval is required upfront because the design of the drainage is an integral part of the development and its acceptability.

Percolation testing

In order to determine the suitability of the ground for an infiltration-based system, percolation testing was carried out in a single location on site by others 09/01/24. The testing was conducted in accordance with the BRE 365 guidance. BRE 365 Percolation Tests establish whether the ground at the site of a new development is suitable for infiltration forms of Sustainable Drainage Systems (SuDS), such as soakaways.

Trial pit 1 was excavated within the garden space shown in Figure 1.

The result of the trial pit is outlined below.

Percolation test results are included in **Annex A**.

Figure 1. Location of Percolation Test Pit.

Details of the drainage scheme are outlined below.

Trial pit 1 test	Infiltration rate
1	0.261 m/hr
2	0.187 m/hr
3	0.174 m/hr
Average	0.207 m/hr

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Surface Water Drainage Scheme

In line with the Surface Water Drainage Hierarchy, the preferable drainage solution for this site would be to drain all surface water runoff from the development to ground soakaways designed to a minimum 100-year return period storm + 40% allowance for climate change (as per the EA Climate change allowances for the Cheltenham area).

In order to provide a detailed design for such an infiltration system, site investigation was undertaken as stated above. The most conservative rate was used from the three tests taken on the trial pit.

Utilising MicroDrainage software and the infiltration rate above the proposed soakaway for the dwelling is described below.

The impermeable area for the dwelling and associated infrastructure is 92m². The soakaway design calculations based on the average percolation rate described above as 0.207m/hr. It is proposed that the dwelling and parking will be served by a dedicated soakaway with dimensions of 2.0m x 2.5m x 0.7m (depth). The soakaways are based on modular infiltration units using the worst-case design storm with rainfall intensities increased by 40% to allow for the effects of climate change over the lifetime of the development.

A system of downpipes and gullies would convey surface water from the impermeable areas of the dwelling into the soakaway, at this stage the connection to the soakaway is indicative.

The proposed development layout (Drawing 3001) included in Annex C shows the layout of the soakaway on the site which includes maintaining a 5m clearance from properties where possible, as required by Building Regulations.

Soakaway calculations can be found within Annex B of this report.

Maintenance and Management

The soakaway is to be installed by a professional and to the manufacturer's specifications.

The proposed drainage systems will remain private and will be operated and maintained by the owners of the dwelling.

Regular inspection and cleaning of the drainage infrastructure, including guttering, down-pipes, soakaway and gully networks, should be carried out frequently to prevent build-up of silt and debris which will reduce the system conveyance capacity.

Visual inspection should ideally be carried out after any heavy rainfall event during the first year of operation, then six-monthly after that. Particular attention should be paid during the autumn months when leaf litter and other dead plant material may cause obstruction.

Silt removal may be needed from time to time.

Any issues or failures identified with the system should be rectified immediately by a suitable contractor, observing suitable working practices and following the guidance and procedures as identified above.

Below is the CIRIA SuDS Manual extract for the maintenance of soakaways.

Table 1. Operation and maintenance requirements for soakaway structures from CIRIA 753

TABLE 13.1 Operation and maintenance requirements for soakaways

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Please note any specific maintenance recommended by the manufacturers should also be known and implemented.

Conclusions

Percolation testing proved that infiltration was viable at this site. Therefore, a soakaway-based drainage system has been designed for the 1 in 100-year storm event with a 40% allowance for climate change.

The proposed conceptual drainage layout is included in **Annex C**.

Provided the recommendations outlined in this report are adopted in the development proposal then there is the capacity to manage the surface water runoff from the development onsite.

Yours sincerely
For and on behalf of Nijhuis Industries Ltd

Georgia Spence
Graduate Field Scientist

[redacted]

Enc. Annex A Percolation Test Results
Annex B Calculations
Annex C Proposed Drainage Design

Annex A Percolation Test Results

nijhuis Nijhuis Saur Industries | UK & Eire	Job No.	Job Name	Prepared	Date
Nijhuis H_2OK Ltd., Nanjerrick Court, Allet, Truro, TR4 9DJ Tel: 0333 7000 007	15535	375 Swindon Road	GS	09/01/2024

Pit Dimensions

Depth (m)	Length (m)	Width (m)
1.30	1.04	0.50

Test Date:	10/01/2024
Trial Pit No.:	1.00
Test No.:	1

Soakaway test - tabulated data

Time (hh:mm)	Depth to Water (m)	Elapsed Time (sec)	Water Depth (m)	% Effective	Volume (m^3)
08:00	0.30	0	1.00	100%	0.52
08:03	0.55	232	0.75	75%	0.39
08:35	1.05	2108	0.25	25%	0.13
08:47	1.30	2842	0.00	0%	0.00

% Effective	Vol (m^3)	T (sec)
100%	0.52	0
75%	0.39	232
75%	0.39	232
75%	0.39	232
0%	0.00	2842
25%	0.13	1972
75%-25%	0.26	1740

Effective Values Summary

Datum (0,0) is ground level at pit

Initial Depth	0.30	m (below datum)
Final Depth	1.30	m (below datum)
Storage Depth	1.00	m (effective depth)
$a_{p50\%}$	2.06	m^-

$$q = \frac{V_{p75\text{-}25}}{a_{p50} \times t_{p75\text{-}25}}$$

Where:

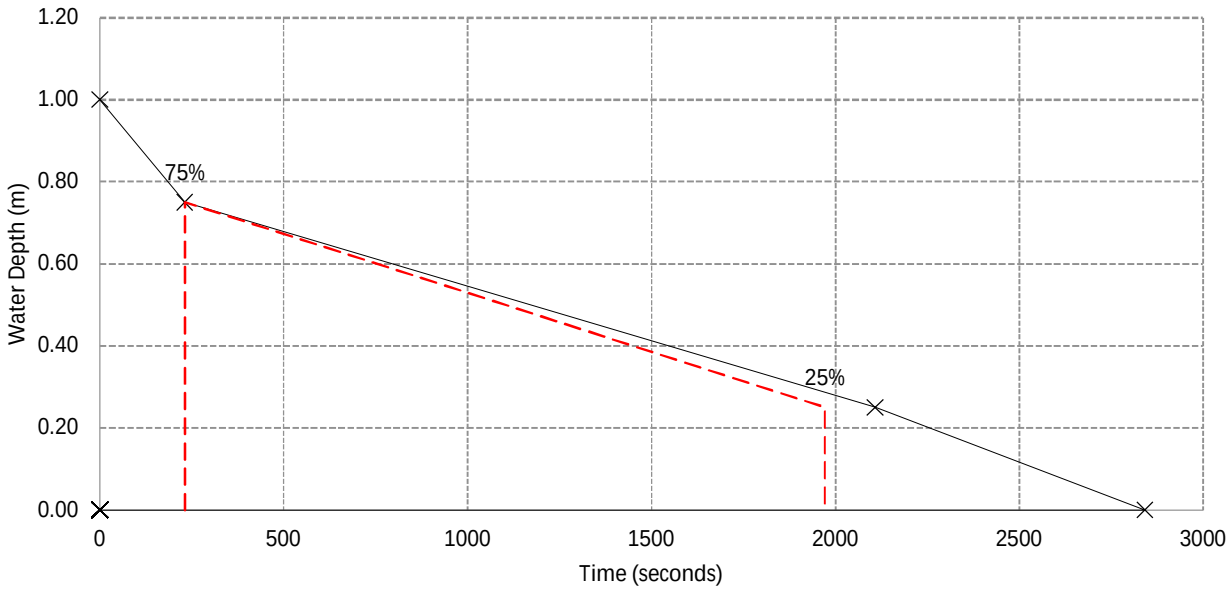
$a_{p50\%}$: Internal surface area of pite up to 50% effective depth, including base area

$t_{p75\text{-}25}$: Time for water to dall from 75% to 25% effective depth

$V_{p75\text{-}25}$: Effective storage volume between 75% & 25% effective depth

q= 7.25E-05 m/sec

0.261 m/hr



nijhuis Nijhuis Saur Industries | UK & Eire	Job No.	Job Name	Prepared	Date
Nijhuis H_2OK Ltd., Nanjerrick Court, Allet, Truro, TR4 9DJ Tel: 0333 7000 007	15535	375 Swindon Road	GS	09/01/2024

Pit Dimensions

Depth (m)	Length (m)	Width (m)
1.30	1.04	0.50

Test Date:	10/01/2024
Trial Pit No.:	1.00
Test No.:	2

Soakaway test - tabulated data

Time (hh:mm)	Depth to Water (m)	Elapsed Time (sec)	Water Depth (m)	% Effective	Volume (m^3)
09:00	0.30	0	1.00	100%	0.52
09:05	0.55	324	0.75	75%	0.39
09:46	1.05	2762	0.25	25%	0.13
10:06	1.30	3960	0.00	0%	0.00

% Effective	Vol (m^3)	T (sec)
100%	0.52	0
75%	0.39	324
75%	0.39	324
75%	0.39	324
0%	0.00	3960
25%	0.13	2748
75%-25%	0.26	2424

Effective Values Summary

Datum (0,0) is ground level at pit

Initial Depth	0.30	m (below datum)
Final Depth	1.30	m (below datum)
Storage Depth	1.00	m (effective depth)
$a_{p50\%}$	2.06	m^2

$$q = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

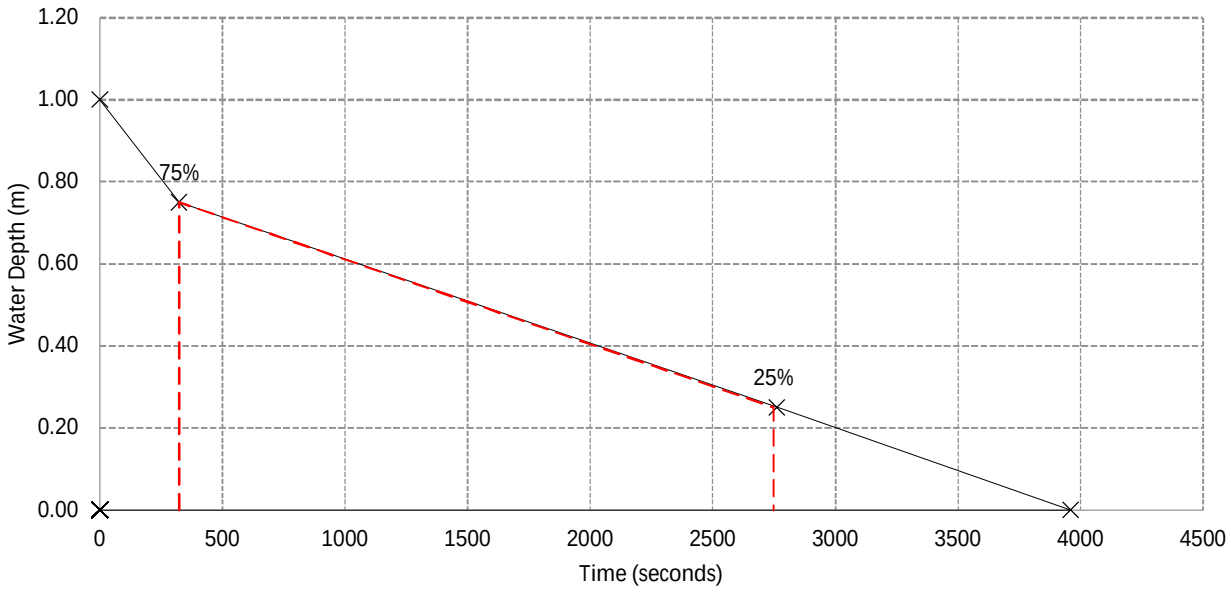
$a_{p50\%}$: Internal surface area of pite up to 50% effective depth, including base area

t_{p75-25}: Time for water to dall from 75% to 25% effective depth

V_{p75-25}: Effective storage volume between 75% & 25% effective depth

q= 5.21E-05 m/sec

0.187 m/hr



nijhuis Nijhuis Saur Industries | UK & Eire	Job No.	Job Name		Prepared	Date
Nijhuis H_2OK Ltd., Nanjerrick Court, Allet, Truro, TR4 9DJ Tel: 0333 7000 007	15535	375 Swindon Road		GS	09/01/2024

Pit Dimensions

Depth (m)	Length (m)	Width (m)
1.30	1.04	0.50

Test Date:	10/01/2024
Trial Pit No.:	1.00
Test No.:	3

Soakaway test - tabulated data

Time (hh:mm)	Depth to Water (m)	Elapsed Time (sec)	Water Depth (m)	% Effective	Volume (m^3)
11:00	0.30	0	1.00	100%	0.52
11:06	0.55	401	0.75	75%	0.39
11:50	1.05	3000	0.25	25%	0.13
12:12	1.30	4320	0.00	0%	0.00

% Effective	Vol (m^3)	T (sec)
100%	0.52	0
75%	0.39	401
75%	0.39	401
75%	0.39	401
0%	0.00	4320
25%	0.13	3014
75%-25%	0.26	2613

Effective Values Summary

Datum (0,0) is ground level at pit

Initial Depth	0.30	m (below datum)
Final Depth	1.30	m (below datum)
Storage Depth	1.00	m (effective depth)
$a_{p50\%}$	2.06	m^2

$$q = \frac{V_{p75\text{-}25}}{a_{p50} \times t_{p75\text{-}25}}$$

Where:

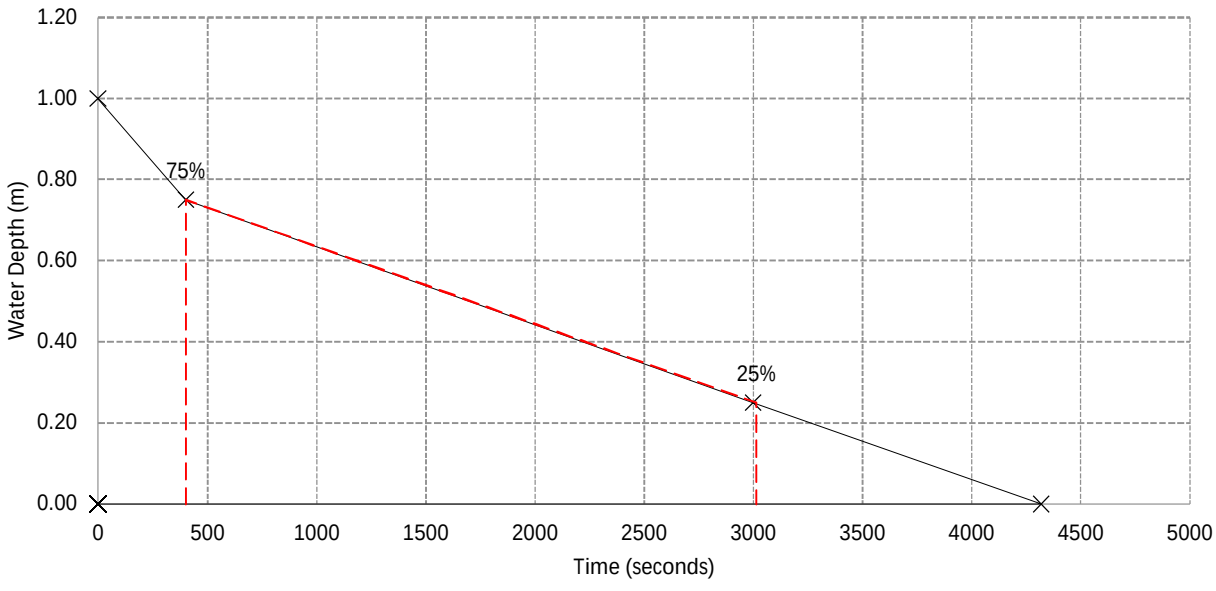
$a_{p50\%}$: Internal surface area of pite up to 50% effective depth, including base area

$t_{p75\text{-}25}$: Time for water to dall from 75% to 25% effective depth

$V_{p75\text{-}25}$: Effective storage volume between 75% & 25% effective depth

q= 4.83E-05 m/sec

0.174 m/hr



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Annex B Calculations

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 105 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.080	0.380	0.2	1.8	O K
30 min Summer	99.186	0.486	0.3	2.3	O K
60 min Summer	99.266	0.566	0.3	2.7	O K
120 min Summer	99.299	0.599	0.3	2.8	O K
180 min Summer	99.298	0.598	0.3	2.8	O K
240 min Summer	99.283	0.583	0.3	2.8	O K
360 min Summer	99.243	0.543	0.3	2.6	O K
480 min Summer	99.205	0.505	0.3	2.4	O K
600 min Summer	99.169	0.469	0.3	2.2	O K
720 min Summer	99.135	0.435	0.3	2.1	O K
960 min Summer	99.074	0.374	0.2	1.8	O K
1440 min Summer	98.976	0.276	0.2	1.3	O K
2160 min Summer	98.873	0.173	0.2	0.8	O K
2880 min Summer	98.805	0.105	0.2	0.5	O K
4320 min Summer	98.748	0.048	0.2	0.2	O K
5760 min Summer	98.738	0.038	0.1	0.2	O K
7200 min Summer	98.732	0.032	0.1	0.2	O K
8640 min Summer	98.728	0.028	0.1	0.1	O K
10080 min Summer	98.725	0.025	0.1	0.1	O K
15 min Winter	99.129	0.429	0.3	2.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	117.448	0.0	18
30 min Summer	79.010	0.0	32
60 min Summer	50.812	0.0	60
120 min Summer	31.621	0.0	94
180 min Summer	23.637	0.0	128
240 min Summer	19.105	0.0	162
360 min Summer	14.037	0.0	232
480 min Summer	11.286	0.0	300
600 min Summer	9.522	0.0	366
720 min Summer	8.282	0.0	434
960 min Summer	6.640	0.0	560
1440 min Summer	4.854	0.0	808
2160 min Summer	3.541	0.0	1168
2880 min Summer	2.828	0.0	1524
4320 min Summer	2.055	0.0	2196
5760 min Summer	1.637	0.0	2936
7200 min Summer	1.371	0.0	3656
8640 min Summer	1.186	0.0	4400
10080 min Summer	1.049	0.0	5120
15 min Winter	117.448	0.0	18

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.251	0.551	0.3	2.6	O K
60 min Winter	99.347	0.647	0.3	3.1	O K
120 min Winter	99.386	0.686	0.3	3.3	O K
180 min Winter	99.382	0.682	0.3	3.2	O K
240 min Winter	99.359	0.659	0.3	3.1	O K
360 min Winter	99.298	0.598	0.3	2.8	O K
480 min Winter	99.241	0.541	0.3	2.6	O K
600 min Winter	99.187	0.487	0.3	2.3	O K
720 min Winter	99.138	0.438	0.3	2.1	O K
960 min Winter	99.053	0.353	0.2	1.7	O K
1440 min Winter	98.923	0.223	0.2	1.1	O K
2160 min Winter	98.799	0.099	0.2	0.5	O K
2880 min Winter	98.748	0.048	0.1	0.2	O K
4320 min Winter	98.735	0.035	0.1	0.2	O K
5760 min Winter	98.728	0.028	0.1	0.1	O K
7200 min Winter	98.723	0.023	0.1	0.1	O K
8640 min Winter	98.720	0.020	0.1	0.1	O K
10080 min Winter	98.718	0.018	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	79.010	0.0	31
60 min Winter	50.812	0.0	60
120 min Winter	31.621	0.0	98
180 min Winter	23.637	0.0	136
240 min Winter	19.105	0.0	174
360 min Winter	14.037	0.0	250
480 min Winter	11.286	0.0	322
600 min Winter	9.522	0.0	392
720 min Winter	8.282	0.0	460
960 min Winter	6.640	0.0	590
1440 min Winter	4.854	0.0	840
2160 min Winter	3.541	0.0	1192
2880 min Winter	2.828	0.0	1468
4320 min Winter	2.055	0.0	2204
5760 min Winter	1.637	0.0	2848
7200 min Winter	1.371	0.0	3552
8640 min Winter	1.186	0.0	4376
10080 min Winter	1.049	0.0	5136

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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)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.009

Time (mins) From:	To:	Area (ha)
0	4	0.009

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Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 98.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.20700 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.20700

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	5.0	5.0	0.701	0.0	11.3
0.700	5.0	11.3			

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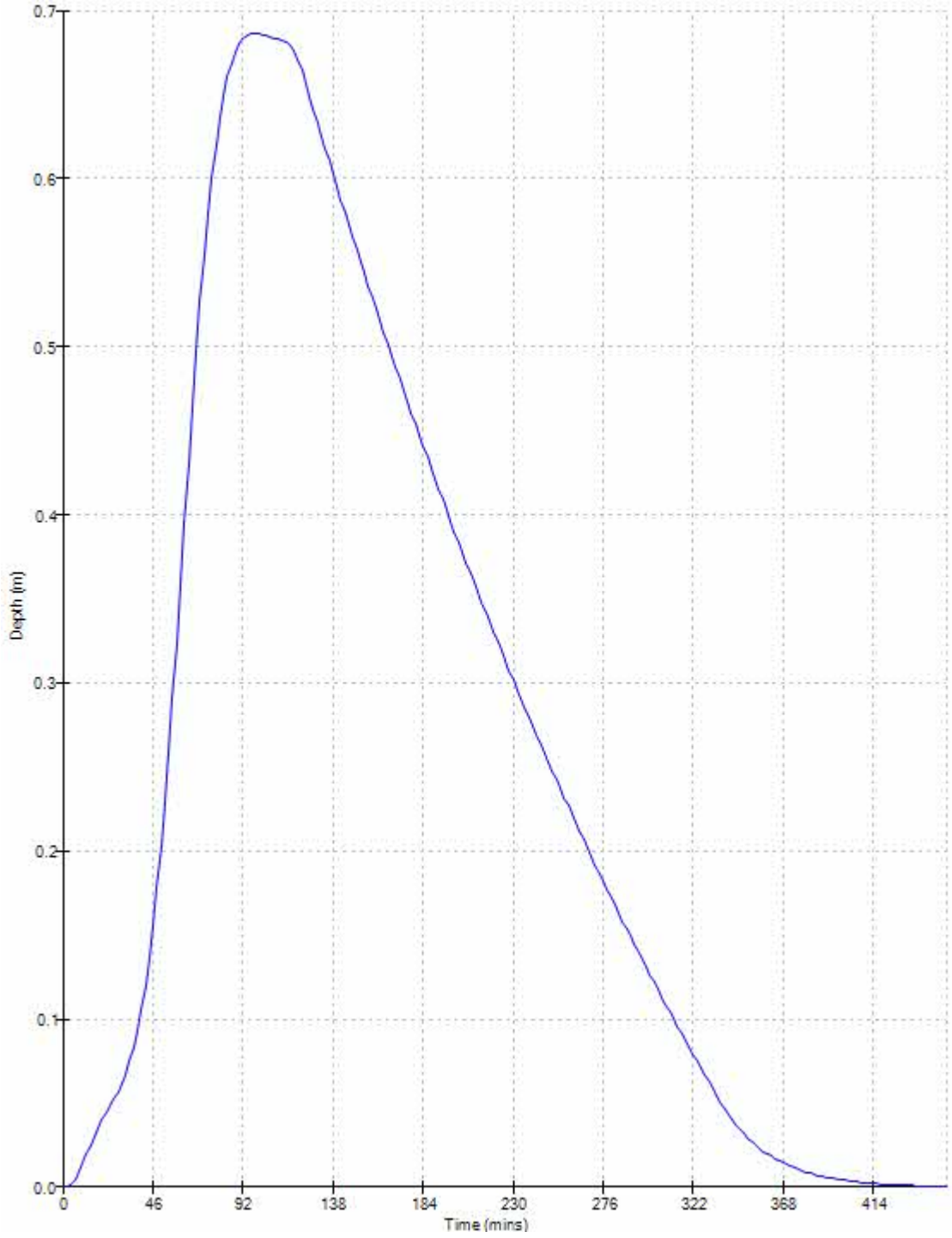
Event: 120 min Winter



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Annex C Proposed Drainage Design

N

BOARDED FENCE

47.33

47.27

47.35

47.32

47.19

47.38

47.38

TARMAC

GRAVEL

47.31

TARMAC

DK

EXISTING SHARED SITE ENTRANCE & HIGHWAY VISIBILTY LINES TO BE RETAINED

47.37

47.41

47.34

47.33

47.23

47.33

47.29

47.33

SILT TRAP

PROPOSED SOAKAWAY WITH AN AREA OF 5M2 WITH A DEPTH OF 0.7M

47.27

47.42

1.8m CLOSE BOARDED FENCE

LP

Garden

47.44

GL 47.50

GRASS

KERB

EXISTING DEAD TREE TO BE REMOVED

2 No. Parking

47.35

MH

47.25

GRAVEL

GRASS

47.48

47.38

Garden

GL 47.50

47.47

EAVE 50.02

47.54

TARMAC

EXISTING TREE TO BE REMOVED

PROPOSED NEW DWELLING

Garden

TREE

47.49

RIDGE 51.88

47.30

47.50

1 STOREY RENDER

FFL 47.65

47.45

BRICK GARAGE

Footway

GL 47.50

1.8m CLOSE BOARDED FENCE

47.55

GRASS

Patio

47.48

47.54

TAR

FP

GL 47.50

47.51

TREE

TREE

TREE

EXISTING PLANTING TO BE REMOVED

47.53

TP

47.33

47.61

Garden

47.43

47.76

EAVE 52.71

1.8m CLOSE BOARDED FENCE

47.55

KERB

No.373 SWINDON ROAD

2 STOREY BRICK

W-HT 48.87

Parking

RIDGE 54.54

BRICKWORK WALL

SWINDON ROAD

NOTES

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3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS, DETAILS AND SPECIFICATIONS PERTAINING TO THE WORK DESCRIBED.
4. MATERIALS AND WORKMANSHIP SHALL COMPLY TO THE APPROPRIATE BRITISH STANDARDS AND CODES OF PRACTICE UNLESS OTHERWISE STATED.
5. THE ACTIVITIES REQUIRED TO CONSTRUCT THE WORK, SHOWN ON DRAWINGS CLEARLY MARKED FOR CONSTRUCTION, MAY BE SUBJECT TO THE PROVISIONS OF THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2015 THE CONTRACTOR AND CLIENT MUST ENSURE THAT THEY ARE ADEQUATELY CONVERSANT WITH THESE REGULATIONS AND THAT THE APPROPRIATE PROCEDURES REQUIRED UNDER THE REGULATIONS ARE OBSERVED AT ALL TIMES.

KEY

- PROPOSED SITE BOUNDARY
- PROPOSED 5m INFILTRATION BOUNDARY
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED SOAKWAY
- OVERLAND FLOW ARROW

Name	Date	Remarks	Revision
GS	25.01.24	PRELIMINARY	P01

INFORMATION

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#missionwater

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NSI Office	UK	Drawn by	GS	Date	25.01.24	Status	S2

Title	CONCEPTUAL SURFACE WATER DRAINAGE SCHEME
Project	375 SWINDON ROAD
Project №	J-15535
Quotation №	
Document №	J-15535-NUK-XX-XX-DR-D-3001

Revision	P01
Checked by	HG
Release Date	25.01.24
Size	A1
Sheet	1 OF 1
Scale	1/50
Unit	MM