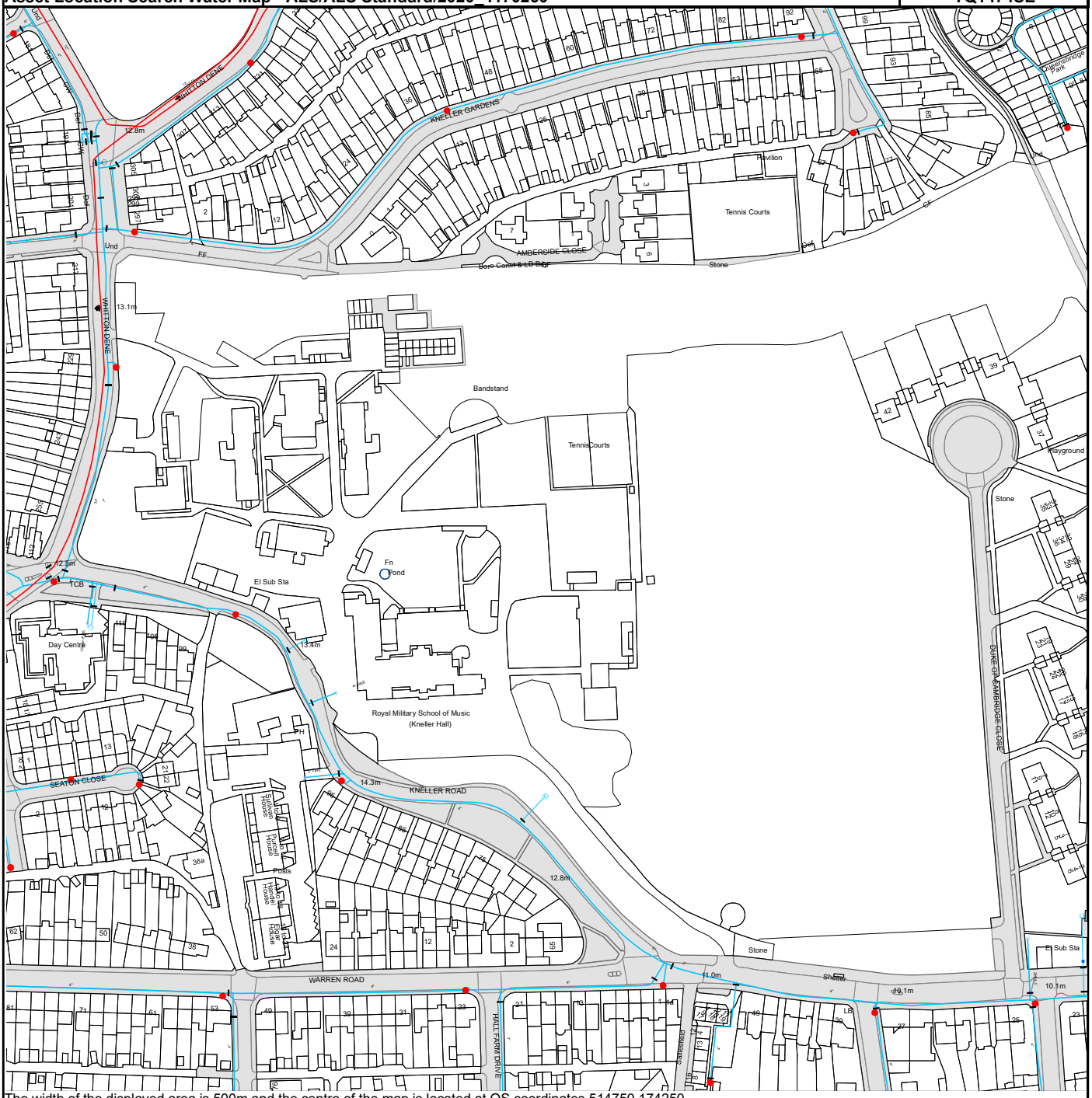
Asset Location Search Water Map - ALS/ALS Standard/2020_4170260

TQ1474SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 514750,174250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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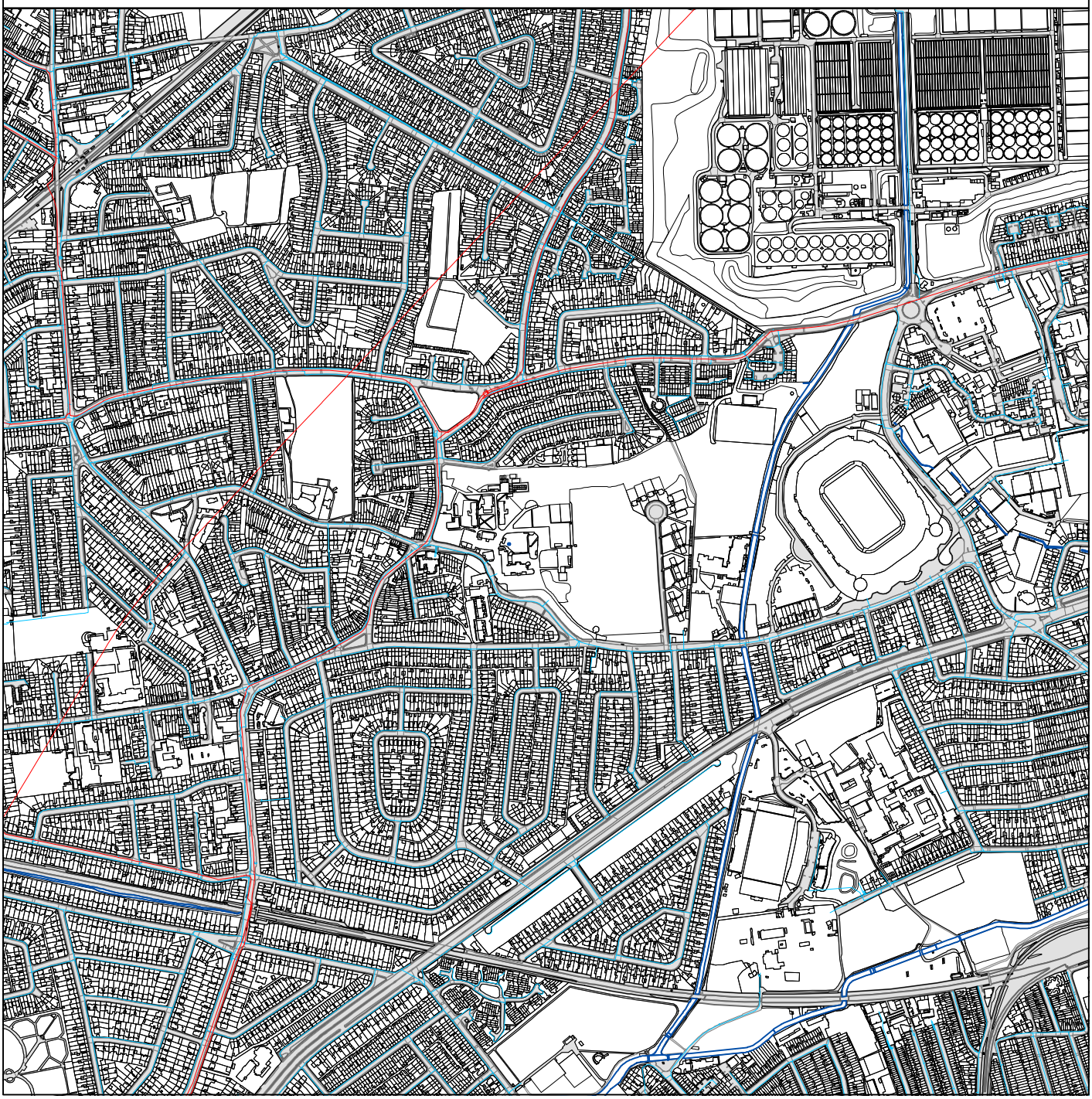
ALS/ALS Standard/2020_4170260



0 45 90 180 270 360
Meters

Scale:	1:7158
Width:	2000m
Printed By:	G1KANAGA
Print Date:	12/03/2020
Map Centre:	514743,174224
Grid Reference:	TQ1474SE

Comments:

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4" — **Distribution Main:** The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16" — **Trunk Main:** A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY — **Supply Main:** A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE — **Fire Main:** Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED — **Metered Pipe:** A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

JOB No. 12490

LEGEND

FW MH/IC

SW MH/IC

INTERCEPTOR

FW GULLY
SW GULLY
ST/VP:STACK
RWP

SW:SURFACE WATER
SURFACE WATER ROUTE

FW:FOUL WATER
FOUL WATER ROUTE

BUILDING OUTLINE

OVERHEAD BUILDING LINE

BOUNDARY LINE

ROAD

PROPOSED

BANK

BANK SYMBOL

UTS: Unable to Survey
UTL: Unable to Lift

TREE

W/C

NOT TO SCALE

Drawing Notes

Rev.	Date	Description	By

EXPRESS SOLUTIONS GROUP

Head Office:
152-154 Commercial Road
Staines-Upon-Thames
Surrey
TW18 2QW
Tel 020 8979 5444
VAT 851970604
Company No 04935559

Client	Radnor House School LTD
Site Address	65 Kneller Road Twickenham London TW2 7DN
Drawing title	Plan
Scales	NOT TO SCALE
Surveyor	JC
Drawn By	EA
Date	24.07.2022
JOB No.	12490

Appendix E

Greenfield Run-off Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	9.700	Urban	0.000
SAAR (mm)	600	Region Number	Region 6

Results l/s

QBAR Rural	14.8
QBAR Urban	14.8
Q100 years	47.1
Q1 year	12.5
Q30 years	33.5
Q100 years	47.1

Appendix F

Brownfield Peak Run-off Rates

Existing Brownfield Peak Runoff Rates (using Modified Rational Method)

Project Number

Project Name

Average Rainfall

SRP	15	30	60	120	180	240	360
1 in 1	31.170	20.279	12.800	7.915	5.945	4.848	3.615
1 in 2	40.288	26.041	16.200	9.865	7.341	5.943	4.399
1 in 30	76.481	49.648	30.811	18.560	13.654	10.935	7.976
1 in 100	99.281	64.990	40.510	24.391	17.887	14.269	10.347

Existing Runoff Rates

$Q = 2.78CIA$

		2.78	
Coefficient of Runoff	C	0.840	
Average Rainfall Intensity (Obtained from MICRODRAINAGE)	I	Above	
Contributing Area	A	2.350	ha

	15	30	60	120	180	240	360	
1 year	171.052	111.285	70.243	43.435	32.624	26.604	19.838	l/s
2 year	221.089	142.906	88.901	54.136	40.285	32.614	24.140	l/s
30 year	419.706	272.454	169.082	101.852	74.929	60.008	43.770	l/s
100 year	544.826	356.647	222.308	133.851	98.159	78.304	56.781	l/s

Total Existing 6 Hour Runoff Volume (1 Year Event)	428.16	m^3
Total Existing 6 Hour Runoff Volume (2 Year Event)	521.02	m^3
Total Existing 6 Hour Runoff Volume (30 Year Event)	944.68	m^3
Total Existing 6 Hour Runoff Volume (100 Year Event)	1225.50	m^3

Date 14 March 2022

Proposed Unattenuated Brownfield Peak Runoff Rates (using Modified Rational Method)

Project Number L221004

Project Name Kneller Hall, Twickenham

Average Rainfall

SRP	15	30	60	120	180	240	360
1 in 1	31.170	20.279	12.800	7.915	5.945	4.848	3.615
1 in 2	40.288	26.041	16.200	9.865	7.341	5.943	4.399
1 in 30	76.481	49.648	30.811	18.560	13.654	10.935	7.976
1 in 100	99.281	64.990	40.510	24.391	17.887	14.269	10.347
1 in 100 + 40 %	138.993	90.986	56.713	34.148	25.042	19.977	14.486

Existing Runoff Rates

Q = 2.78CIA

2.78

Coefficient of Runoff	C	0.840	
Average Rainfall Intensity (Obtained from MICRODRAINAGE)	I	Above	
Contributing Area	A	0.258	ha

	15	30	60	120	180	240	360	
1 year	18.779	12.218	7.712	4.769	3.582	2.921	2.178	l/s
2 year	24.273	15.689	9.760	5.943	4.423	3.581	2.650	l/s
30 year	46.078	29.912	18.563	11.182	8.226	6.588	4.805	l/s
100 year	59.815	39.155	24.407	14.695	10.777	8.597	6.234	l/s
100 year + 40 %	83.741	54.817	34.169	20.574	15.087	12.036	8.728	l/s

Date 08 September 2022

. .

Appendix G

Drainage Strategy & Impermeable Areas

Thames Water's combined sewer outfall.

Foul drainage to be connected at the proposed foul sewers and surface water at the proposed surface water sewers.

Proposed foul pipes from newly erected buildings to be connected at the existing manhole.

IL: 11.40

3m freeboard for maintenance purposes.

Infiltration Pond
Capacity: 613m³
Base depth: 0.9m
Area: 814m²
Infiltration rate: 1.63x10^{-5} m/s

Sport field drainage to be designed by others.

Soakaway 1
Max capacity: 316.8 m3
Dimensions: 24x11x1.2
Base depth: 3m
Cover: 1.8m
Infiltration Rate: 1.63x10^{-5} m/s

Foul drainage to be connected at the proposed foul sewers and surface water at the proposed surface water sewers.

Green roof to be installed and designed by a third party. To be considered at the hydraulic calculations at the detailed design phase.

IL: 11.85

Existing tennis court to remain and be resurfaced.

Foul drainage to be connected at the existing foul sewers and surface water at the proposed surface water sewers.

Green roof to be installed and designed by a third party. To be considered at the hydraulic calculations at the detailed design phase.

Foul drainage to be connected at the proposed foul sewers and surface water at the proposed surface water sewers.

Existing sewer pipe to be redirected.

Foul drainage to be connected at the existing foul sewers and surface water at the proposed surface water sewers.

Existing basketball court to remain and be resurfaced.

Green roof to be installed and designed by a third party. To be considered at the hydraulic calculations at the detailed design phase.

Thames Water's combined sewer outfall.

Existing drainage to remain.

Existing drainage to remain.

Proposed building to discharge foul water at the existing combined sewer.

Sport field drainage to be designed by others.

Thames Water's combined sewer outfall.

Scale 1:500 (m)
0 5 10 15 20 25

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Do NOT scale from this drawing. AKSWard takes no responsibility for errors during photographic reproduction or printing. Any discrepancy's are to be reported to the engineer immediately.

GENERAL NOTES

1. All setting out to be in accordance with the Architects drawings. Any discrepancies between the Engineers and the Architects drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.
2. All drainage to be installed in accordance with relevant Building Regulations documents and Current Sewers for Adoption where applicable.
3. Connections to Public sewers to be agreed and inspected by Water Authority.
4. Invert level, size and cover levels to existing manholes and sewers to be checked prior to any construction. Any discrepancies to be reported immediately.
5. Invert to base of soil stack bends to be 450mm below lowest branch connection for up to 3 storeys buildings. For buildings up to 5 storeys the invert to base of soil stack bends should be not less than 750mm.
6. All RWP and Foul Water drain point setting out is to be confirmed by Architect.
7. All RWP & SVP sizes & setting out by Architect / M&E Engineer. All below ground connections to match above ground outlet size, Min 100/110mm diameter.
8. Foul drains to project 100mm above finished floor level.
9. All internal Manholes and Inspection Chambers to have double sealed recessed covers to suit floor finishes by Architect.
10. All external covers in footpaths and roads in non tarmac areas to have recessed trays to suit the paving material.
11. Refer to drainage specification for pipe materials.
12. All pipework to be 100/110Ø UNO. Refer to note 7 connection sizes.
13. All foul and surface water drainage stacks to have above ground rodding access, refer to above ground drainage layout by others.
14. This drawing has been produced in colour and should be reproduced in colour for clarity.
15. A CCTV Survey and report in WINCAN format for all new drainage will be required before the "As Built" drawings will be issued.
16. All foul water pipework to be 150Ø laid with a 1 in 150 slope.

Note!
Discharge from West Rooms to be via direct connection made under the slab to the adjacent SVP, to be coordinated with M&E drawings

Key

- Existing building to remain
- Proposed buildings
- Existing combined drainage
- Existing surface water drainage
- Existing drainage to be abandoned or removed
- Proposed foul sewer drainage
- Foul sewer inspection chamber.
- Precast concrete foul water manhole.
- Proposed storm water sewer/drain.
- Proposed ACO drainage channel.
- Storm water inspection chamber.
- Precast concrete storm water manhole.
- RG Proposed road gull.y
- Proposed surface water soakaway Geocellular System.
- Sport field drainage. To be designed by others.
- Proposed buildings with green roof installed.
- Flood exceedance route.
- Impermeable hard-landscape areas.
- Permeable paved areas - Permeable block.
- Permeable paved areas - Resin bound gravel.

IDENTIFIES RISKS DURING THE CONSTRUCTION PROCESS ON THE DRAWINGS:

NOTE: The list below and notes on the drawing identify risks which are deemed to be unusual, abnormal, residual or unexpected to a competent contractor carrying out the works. These notes relate to risks which we have been unable to design out.

Rev.	Amendment	Drn	Chkd	Date
P07	Issued for planning	GK	KJ	14/09/22
P06	Issued for planning	GK	KJ	08/09/22
P05	Update following E. Penson's comments	GK	KJ	06/09/22
P04	Masterplan Update	GK	KJ	02/09/22
P03	Update	GK	KJ	25/08/22
P02	First Issue	GK	KJ	03/08/22
P01	Draft for Comments	GK	KJ	08/04/22

Drg. Status: **PRELIMINARY** Suitability: **S1**

AKSWard²
CONSTRUCTION CONSULTANTS
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■ London
□ Hitchin
□ Oxford
□ Southampton
□ Birmingham

Client: **Dukes Education Group Ltd**

Project: **Kneller Hall, Twickenham**

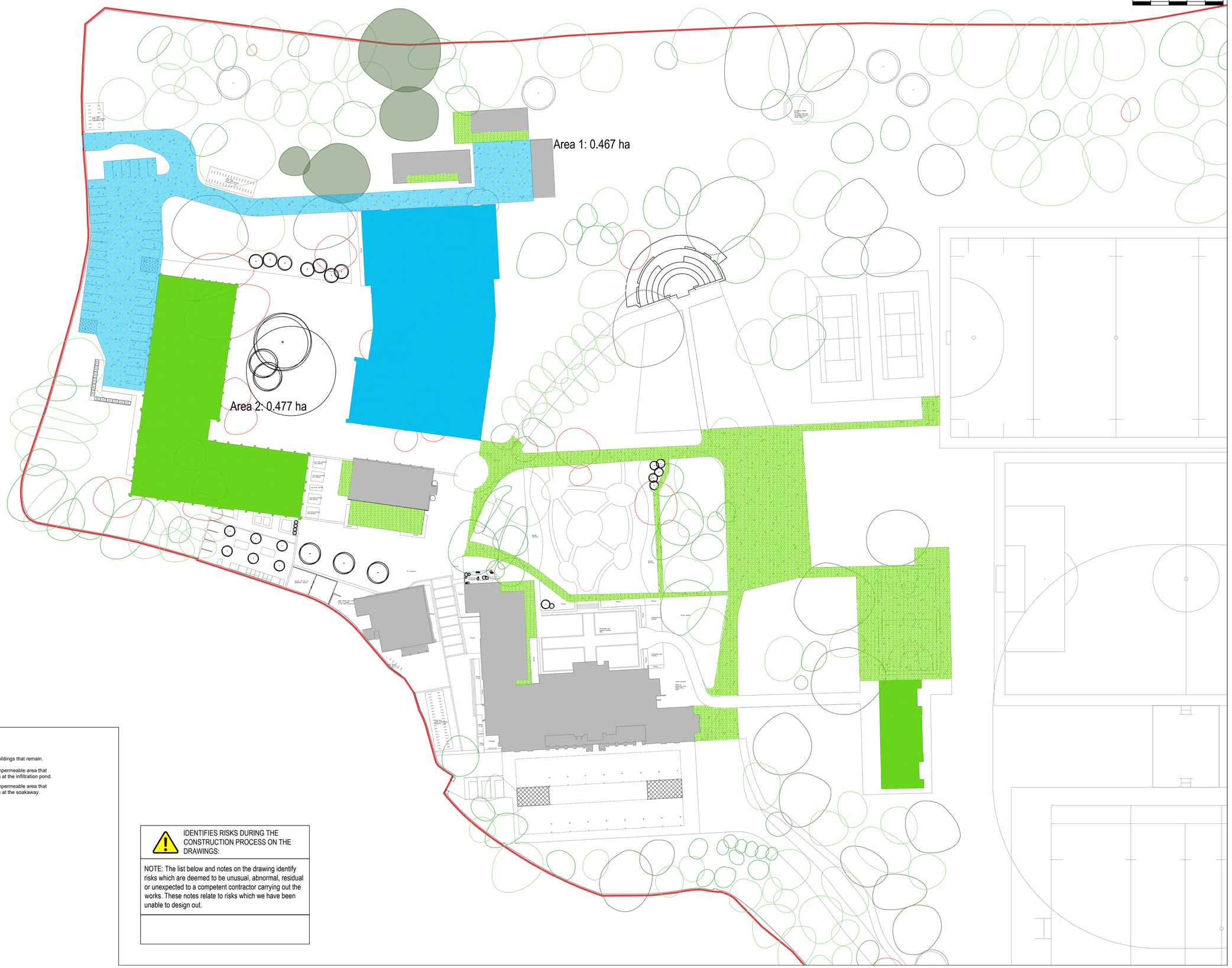
Title: **Drainage Layout**

Reviewed Scheme: GK Date: 3006/22
Reviewed Final: Date:
Scales at A1: 1: 500 Project No.: **L22104**

Project Ref.	Originator	Zone	Level	Type	Role	Drg No.	Rev.
KNE	AKS	ZZ	XX	DR	C	9201	P07

GENERAL NOTES

Scale 1:500 (m)
0 5 10 15 20 25



Key

- Existing buildings that remain.
- Area 1 - Impermeable area that discharges at the infiltration pond.
- Area 2 - Impermeable area that discharges at the soakaway.

IDENTIFIES RISKS DURING THE CONSTRUCTION PROCESS ON THE DRAWINGS:

NOTE: The list below and notes on the drawing identify risks which are deemed to be unusual, abnormal, residual or unexpected to a competent contractor carrying out the works. These notes relate to risks which we have been unable to design out.

Note!
Discharge from West Rooms to be via direct connection made under the slab to the adjacent SVP, to be coordinated with M&E drawings

Rev.	Amendment	Drn	Chkd	Date
P02	Masterplan update	GK	KJ	08/09/22
P01	First Issue	GK	KJ	29/07/22

Drg. Status: **PRELIMINARY** Suitability: **S1**

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■ London
□ Hitchin
□ Oxford
□ Southampton
□ Birmingham

Client: **Dukes Education Group Ltd**

Project: **Kneller Hall, Twickenham**

Title: **Proposed Impermeable Areas**

Reviewed Scheme GK Date 27/07/22
Reviewed Final Date
Scales at A1 1: 500 Project No. **L22104**

Project Ref.	Originator	Zone	Level	Type	Role	Drg No.	Rev.
KNE	AKS	ZZ	XX	DR	C	9202	P02

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Appendix H

Soakaway & Infiltration Basin Calculations

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

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Volume (m^3)	Status
15 min Summer	1.310	0.210	125.5	O K
30 min Summer	1.369	0.269	162.7	O K
60 min Summer	1.428	0.328	200.7	O K
120 min Summer	1.486	0.386	239.2	O K
180 min Summer	1.519	0.419	261.7	O K
240 min Summer	1.542	0.442	277.5	O K
360 min Summer	1.575	0.475	300.2	O K
480 min Summer	1.599	0.499	317.5	O K
600 min Summer	1.619	0.519	331.4	O K
720 min Summer	1.635	0.535	343.1	O K
960 min Summer	1.662	0.562	362.1	O K
1440 min Summer	1.701	0.601	390.1	Flood Risk
2160 min Summer	1.741	0.641	419.7	Flood Risk
2880 min Summer	1.770	0.670	441.7	Flood Risk
4320 min Summer	1.813	0.713	474.1	Flood Risk
5760 min Summer	1.844	0.744	498.1	Flood Risk
7200 min Summer	1.869	0.769	517.3	Flood Risk
8640 min Summer	1.889	0.789	533.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	143.355	0.0	27
30 min Summer	92.906	0.0	42
60 min Summer	57.296	0.0	72
120 min Summer	34.148	0.0	132
180 min Summer	24.910	0.0	192
240 min Summer	19.808	0.0	252
360 min Summer	14.285	0.0	372
480 min Summer	11.332	0.0	492
600 min Summer	9.462	0.0	612
720 min Summer	8.163	0.0	732
960 min Summer	6.461	0.0	972
1440 min Summer	4.641	0.0	1452
2160 min Summer	3.329	0.0	2172
2880 min Summer	2.627	0.0	2892
4320 min Summer	1.880	0.0	4332
5760 min Summer	1.481	0.0	5776
7200 min Summer	1.231	0.0	7216
8640 min Summer	1.058	0.0	8656

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

Storm Event	Max Level (m)	Max Depth (m)	Max Volume (m³)	Status
10080 min Summer	1.907	0.807	547.3	Flood Risk
15 min Winter	1.334	0.234	140.6	O K
30 min Winter	1.399	0.299	182.2	O K
60 min Winter	1.464	0.364	224.8	O K
120 min Winter	1.528	0.428	267.9	O K
180 min Winter	1.565	0.465	293.2	O K
240 min Winter	1.590	0.490	310.8	O K
360 min Winter	1.626	0.526	336.2	O K
480 min Winter	1.653	0.553	355.6	O K
600 min Winter	1.675	0.575	371.2	O K
720 min Winter	1.692	0.592	384.2	O K
960 min Winter	1.721	0.621	405.5	Flood Risk
1440 min Winter	1.764	0.664	436.9	Flood Risk
2160 min Winter	1.807	0.707	470.1	Flood Risk
2880 min Winter	1.839	0.739	494.7	Flood Risk
4320 min Winter	1.886	0.786	531.0	Flood Risk
5760 min Winter	1.920	0.820	557.9	Flood Risk
7200 min Winter	1.947	0.847	579.4	Flood Risk
8640 min Winter	1.969	0.869	597.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	0.930	0.0	10096
15 min Winter	143.355	0.0	27
30 min Winter	92.906	0.0	42
60 min Winter	57.296	0.0	72
120 min Winter	34.148	0.0	132
180 min Winter	24.910	0.0	192
240 min Winter	19.808	0.0	252
360 min Winter	14.285	0.0	372
480 min Winter	11.332	0.0	492
600 min Winter	9.462	0.0	612
720 min Winter	8.163	0.0	732
960 min Winter	6.461	0.0	972
1440 min Winter	4.641	0.0	1452
2160 min Winter	3.329	0.0	2172
2880 min Winter	2.627	0.0	2892
4320 min Winter	1.880	0.0	4332
5760 min Winter	1.481	0.0	5776
7200 min Winter	1.231	0.0	7216
8640 min Winter	1.058	0.0	8656

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

Storm Event	Max Level (m)	Max Depth (m)	Max Volume (m³)	Status
10080 min Winter	1.988	0.888	613.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	0.930	0.0	10096

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)	20.200	Shortest Storm (mins)	15
Ratio R	0.431	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.467

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.156	4	8	0.156	8	12	0.155

Model Details

Storage is Online Cover Level (m) 2.000

Tank or Pond Structure

Invert Level (m) 1.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	570.0	0.900	821.4

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

Half Drain Time : 970 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	1.632	0.482	2.4	121.0	O K
30 min Summer	1.779	0.629	2.5	157.7	O K
60 min Summer	1.924	0.774	2.6	194.2	O K
120 min Summer	2.058	0.908	2.7	227.8	O K
180 min Summer	2.124	0.974	2.7	244.2	O K
240 min Summer	2.159	1.009	2.7	253.1	O K
360 min Summer	2.194	1.044	2.7	261.9	O K
480 min Summer	2.205	1.055	2.8	264.6	O K
600 min Summer	2.201	1.051	2.8	263.7	O K
720 min Summer	2.189	1.039	2.7	260.5	O K
960 min Summer	2.158	1.008	2.7	252.8	O K
1440 min Summer	2.098	0.948	2.7	237.8	O K
2160 min Summer	2.021	0.871	2.6	218.3	O K
2880 min Summer	1.951	0.801	2.6	200.8	O K
4320 min Summer	1.823	0.673	2.5	168.9	O K
5760 min Summer	1.710	0.560	2.5	140.4	O K
7200 min Summer	1.609	0.459	2.4	115.2	O K
8640 min Summer	1.522	0.372	2.4	93.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	138.514	0.0	26
30 min Summer	90.826	0.0	41
60 min Summer	56.713	0.0	70
120 min Summer	34.204	0.0	130
180 min Summer	25.103	0.0	188
240 min Summer	20.035	0.0	246
360 min Summer	14.542	0.0	364
480 min Summer	11.583	0.0	484
600 min Summer	9.702	0.0	602
720 min Summer	8.391	0.0	714
960 min Summer	6.667	0.0	816
1440 min Summer	4.815	0.0	1062
2160 min Summer	3.471	0.0	1472
2880 min Summer	2.749	0.0	1876
4320 min Summer	1.977	0.0	2684
5760 min Summer	1.563	0.0	3464
7200 min Summer	1.301	0.0	4248
8640 min Summer	1.120	0.0	4936

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
10080 min Summer	1.447	0.297	2.3	74.4	O K
15 min Winter	1.691	0.541	2.5	135.8	O K
30 min Winter	1.856	0.706	2.6	177.2	O K
60 min Winter	2.021	0.871	2.6	218.5	O K
120 min Winter	2.176	1.026	2.7	257.2	O K
180 min Winter	2.253	1.103	2.8	276.7	O K
240 min Winter	2.297	1.147	2.8	287.7	O K
360 min Winter	2.345	1.195	2.8	299.6	O K
480 min Winter	2.368	1.218	2.8	304.7	O K
600 min Winter	2.375	1.225	2.8	305.7	O K
720 min Winter	2.365	1.215	2.8	304.2	O K
960 min Winter	2.333	1.183	2.8	296.6	O K
1440 min Winter	2.256	1.106	2.8	277.4	O K
2160 min Winter	2.152	1.002	2.7	251.2	O K
2880 min Winter	2.050	0.900	2.7	225.7	O K
4320 min Winter	1.861	0.711	2.6	178.3	O K
5760 min Winter	1.694	0.544	2.5	136.4	O K
7200 min Winter	1.551	0.401	2.4	100.4	O K
8640 min Winter	1.429	0.279	2.3	70.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	0.987	0.0	5656
15 min Winter	138.514	0.0	26
30 min Winter	90.826	0.0	41
60 min Winter	56.713	0.0	70
120 min Winter	34.204	0.0	126
180 min Winter	25.103	0.0	184
240 min Winter	20.035	0.0	242
360 min Winter	14.542	0.0	358
480 min Winter	11.583	0.0	472
600 min Winter	9.702	0.0	586
720 min Winter	8.391	0.0	696
960 min Winter	6.667	0.0	908
1440 min Winter	4.815	0.0	1130
2160 min Winter	3.471	0.0	1588
2880 min Winter	2.749	0.0	2048
4320 min Winter	1.977	0.0	2900
5760 min Winter	1.563	0.0	3696
7200 min Winter	1.301	0.0	4472
8640 min Winter	1.120	0.0	5184

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
10080 min Winter	1.331	0.181	2.3	45.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	0.987	0.0	5848

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	0.403	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.477

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.159	4	8	0.159	8	12	0.159

Model Details

Storage is Online Cover Level (m) 3.000

Cellular Storage Structure

Invert Level (m) 1.150 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.05868 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.05868

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	264.0	264.0	1.300	0.0	348.0
1.200	264.0	348.0			

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Appendix I

Foul Drainage Calculations

British Water Flows and Loads

Building Type	Flow Litres/ person/ day	Maximum Population	Occupation time (hrs)	Peak flow factor	Peak flow (litres/sec)	Average flow (Litres/sec)
Non Residential School with Canteen	90	1170	12	6	14.63	2.44
Residential School with Canteen	175			6	#DIV/0!	#DIV/0!
Office / Factory without canteen	50			6	#DIV/0!	#DIV/0!
Office / Factory with canteen	100			6	#DIV/0!	#DIV/0!
Student Accommodation	100			6	#DIV/0!	#DIV/0!
Sports Centre	50			6	#DIV/0!	#DIV/0!
Residential Nursing Home	350			6	#DIV/0!	#DIV/0!
Hospital	450			6	#DIV/0!	#DIV/0!
Standard residential	150			6	#DIV/0!	#DIV/0!

.

Appendix J

London Sustainable Drainage SUDS Proforma

LONDON BOROUGH OF RICHMOND UPON THAMES

LoDEG

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	Kneller Hall - Stage 3
Address & post code	65 Kneller Road, Twickenham of London Borough of Richmond upon Thames (LBR), TW2 7DT
OS Grid ref. (Easting, Northing)	E 514684
	N 174191
LPA reference (if applicable)	
Brief description of proposed work	The development consists of change of use of existing buildings and construction of new ones
Total site Area	97000 m^2
Total existing impervious area	23500 m^2
Total proposed impervious area	9433 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	No
Existing drainage connection type and location	Thames Water combined sewer
Designer Name	Georgios Kalogerakis
Designer Position	Principal Civil Engineer

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	*Taplow Gravel Member - Sand And Gravel superficial deposits. *Kempton Park Gravel Member - Sand And Gravel
Bedrock geology classification	London Clay Formation - Clay And Silt
Site infiltration rate	1.63x10-5 m/s
Depth to groundwater level	2-4m m below ground level
Is infiltration feasible?	

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use		
2 use infiltration techniques, such as porous surfaces in non-clay areas	Feasible (Y/N	oposed (Y/
3 attenuate rainwater in ponds or open water features for gradual release		
4 attenuate rainwater by storing in tanks or sealed water features for gradual release		
5 discharge rainwater direct to a watercourse		
6 discharge rainwater to a surface water sewer/drain		
7 discharge rainwater to the combined sewer.		

2c. Proposed Discharge Details

Proposed discharge location	As existing for the buildings that remain.
Has the owner/regulator of the discharge location been	S106 application to be submitted

	Designer Company	AKSWard Ltd		consulted?	

LONDON BOROUGH OF RICHMOND UPON THAMES

LoDEG

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	14.8			
1 in 1	12.5	171.052	0	18.779
1 in 30	33.5	419.706	0	46.078
1 in 100	47.1	544.826	0	59.815
1 in 100 + CC				83.741
Climate change allowance used		40%		
3b. Principal Method of Flow Control		N/A		

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^2)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	4770		317
Green roofs	4336	0	tbc
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	3221	0	0
Swales	0	0	0
Basins/ponds	4670	0	613
Attenuation tanks	0		0
Total	**16997**	**0**	**930**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	Appendix B
Drainage hierarchy (2b)	Section 4
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	-
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Appendix H
Proposed SuDS measures & specifications (3b)	Section 4
4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Appendix C
Detailed drainage design drawings, including exceedance flow routes	Appendix G
Detailed landscaping plans	Appendix C
Maintenance strategy	-
Demonstration of how the proposed SuDS measures improve:	Section 6
a) water quality of the runoff?	
b) biodiversity?	
c) amenity?	