TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP823
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459351.3 E 220009.2 N	Ground Level	69.88 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.10	ES		
0.10			PID=<0.1
0.50	B		
0.50	D		
0.50	ES		
0.50			PID=<0.1
0.60	HV		Av=70kPa
0.70	B		
0.70	D		
0.70	ES		
0.70			PID=<0.1
1.00	HV		Av=79kPa
1.20	D		
1.50	HV		Av=62kPa
1.60	B		
1.60	D		
1.60	ES		
1.60			PID=<0.1
2.00	HV		Av=61kPa
2.10	D		
2.50	HV		Av=64kPa
2.60	B		
2.60	D		
2.60	ES		
2.60			PID=<0.1

Strata — Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		69.88
MADE GROUND: Asphalt.	0.10	1	69.78
MADE GROUND: Weak grey concrete, 50% aggregate of subangular limestone.	0.20	2	69.68
	0.30	3	69.58
	0.37	4	69.51
MADE GROUND: Reddish brown silty sand and gravel. Gravel is angular to subangular fine to coarse granite.	0.57	5	69.31
MADE GROUND: Dark yellowish brown gravelly silty sand. Gravel is angular to subrounded fine to coarse limestone.	1.45	6	68.43
MADE GROUND: Dark reddish grey and brown silty sand and gravel. Gravel is angular to subangular fine to coarse limestone.	2.50	7	67.38
MADE GROUND: Firm greenish grey mottled grey slightly sandy clay with relict rootlets.	3.00	8	66.88
Firm brownish orange mottled light grey slightly sandy CLAY.			
Below 1.80m, becoming light brownish orange.			
Stiff dark brownish grey slightly sandy CLAY with slight organic odour.			
End of Excavation			

Excavation

Plant	JCB 3CX	Width (B)	0.50
Date	16/07/2020	Length (C)	2.50
Shoring	None.	Orientation	006 deg
		Date Backfilled	16/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MJ

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP824
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459267.9 E 219952.9 N	Ground Level	69.48 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.20	B		
0.20	D		
0.20	ES		
0.20			PID=<0.1
0.40	B		mc=25%
0.40	D		mc=24%
0.75	HV		Av=57kPa
0.80	B		
0.80	D		
1.10	B		
1.10	D		
1.10	ES		
1.10			PID=<0.1
1.20	HV		Av=74kPa
1.30	B		
1.30	D		mc=26%
1.80	D		
2.00	HV		Av=60kPa
2.30	D		
2.50	HV		Av=53kPa
2.70	B		
2.70	D		

Strata — Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		69.48
MADE GROUND: Dark brown gravelly slightly silty sand with many roots and rootlets (up to 10mm in diameter). Gravel is angular to subangular fine to medium brick fragments and flint.	0.30	1	69.18
PROBABLE MADE GROUND: Firm orangish brown mottled grey slightly sandy clay with occasional rootlets.	0.70	2	68.78
POSSIBLE MADE GROUND: Firm light grey and light brown slightly sandy CLAY.	1.00	3	68.48
Soft dark grey sandy CLAY with pockets (up to 100mm in size) of decomposed organic material.	1.15	4	68.33
Stiff light grey mottled light brown slightly sandy CLAY with occasional shell fragments (up to 5mm in size).		5	
Below 1.90m, becoming firm.			
Below 2.50m, becoming light grey occasionally mottled light brown.			
End of Excavation	3.00		66.48

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Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	15/07/2020	Length (C)	2.00
Shoring	None.	Orientation	064 deg
		Date Backfilled	15/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP825
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459127.7 E 219954.6 N	Ground Level	70.45 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.00- 0.20	B		
0.10	D		
0.10	ES		
0.10			PID=<0.1
0.20- 0.50	B		
0.20	D		
0.30	D		
0.40	ES		
0.40			PID=<0.1
0.50- 0.80	B		
0.55	HV		Av=120kPa
0.70	D		
0.80- 1.10	B		mc=30%
1.00	D		
1.00	HV		Av=103kPa
1.10- 1.50	B		
1.20	ES		
1.20			PID=<0.1
1.30	D		
1.50	HV		Av=85kPa
1.80	ES		
1.80			PID=<0.1
1.90	D		
2.00- 2.50	B		
2.20	HV		Av=87kPa
2.40	D		

Strata

Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		70.45
MADE GROUND: Firm dark grey slightly sandy slightly gravelly clay with many rootlets and occasional roots (up to 6mm in size). Gravel is angular to subrounded fine to coarse sandstone, limestone and brick fragments.	0.20	1	70.25
MADE GROUND: Firm brown mottled grey slightly sandy slightly gravelly clay with many pockets (up to 120mm in size) of black sandy ash, a low cobble content of limestone, and occasional rootlets and roots (up to 6mm in diameter). Gravel is angular to subangular fine to coarse limestone.	0.50	2	69.95
MADE GROUND: Stiff brown mottled grey slightly sandy slightly gravelly clay. Gravel is angular fine to medium brick fragments, limestone and occasional shell fragments (up to 10mm in size).	0.80	3	69.65
Stiff fissured grey mottled brown slightly sandy CLAY with occasional shells (up to 15mm in size). Fissures are very closely to closely spaced, randomly orientated, smooth and polished.	1.10	4	69.35
Firm to stiff brown mottled grey slightly sandy slightly gravelly calcareous CLAY with occasional shell fragments (up to 15mm in size). Gravel is angular to subangular fine to medium limestone.	2.00	5	68.45
Firm to stiff grey mottled light grey and brown slightly sandy slightly gravelly calcareous CLAY with occasional shells (up to 20mm in size), occasional pockets (up to 200mm in size) of firm orangish brown sandy clay, and rare pockets (up to 20mm in size) of decomposed organic material.	2.50	6	67.95

End of Excavation

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Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	15/07/2020	Length (C)	2.70
Shoring	None.	Orientation	090 deg
		Date Backfilled	15/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP826
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	458980.9 E 219897.6 N	Ground Level	68.90 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.06	ES		
0.06			PID=<0.1
0.40	B		
0.40	D		
0.40	ES		
0.40			PID=<0.1
0.60	HV		Av=75kPa
0.70	B		
0.70	D		mc=30%
1.00	HV		Av=73kPa
1.50	D		
1.50	ES		
1.50	HV		Av=76kPa
1.50			PID=<0.1
2.00	B		
2.00	D		mc=36%
2.00	HV		Av=62kPa
2.50	D		
2.50	HV		Av=58kPa
2.80	D		
2.90	B		
2.90	D		

Strata — Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		68.90
MADE GROUND: Asphalt.	0.15	1	68.75
MADE GROUND: Black very gravelly silty sand with high cobble content of angular to subangular limestone. Gravel is angular to subangular fine to coarse flint, brick, ash, clinker, slag and limestone Between 0.40-0.45m, thin band of yellowish brown limestone.	0.50	2	68.40
Firm light grey slightly sandy calcareous CLAY with occasional shell fragments (up to 8mm in size) and occasional decomposed organic matter (up to 20mm in size).	1.90	3	67.00
Firm dark grey mottled light brown slightly sandy calcareous CLAY with many pockets (up to 10mm in size) of decomposed organic material. Below 2.50m, with many shell fragments (up to 50mm in size).	2.80	4	66.10
Stiff dark brownish grey slightly sandy CLAY with slight organic odour. Between 3.00-3.15m, a pocket (150mm in size) of orangish brown silty sand.	3.00	5	65.90
End of Excavation			

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	16/07/2020	Length (C)	2.50
Shoring	None.	Orientation	006 deg
		Date Backfilled	16/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
3.00	3.00	Seepage.

Remarks ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP827
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	458985.9 E 219810.4 N	Ground Level	66.84 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.08	ES		
0.08			PID=<0.1
0.30	B		
0.30	ES		
0.30			PID=<0.1
0.50	B		
0.75	HV		Av=49kPa
0.80	B		
0.80	D		
0.80	ES		
0.80			PID=<0.1
1.00	HV		Av=56kPa
1.40	D		
1.50	HV		Av=48kPa
1.70	D		
1.70	ES		
1.70			PID=<0.1
1.90	B		
1.90	D		
2.00	HV		Av=52kPa
2.50	D		
3.00	D		

Strata

Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		66.84
MADE GROUND: Asphalt.	0.15	1	66.69
MADE GROUND: Black very gravelly silty sand with a slight hydrocarbon odour and a high cobble and boulder content of angular to subangular brick, slag and limestone. Gravel is angular to subangular fine to coarse slag, chalk, brick, limestone and tarmac. Below 0.35m, becoming slightly gravelly.	0.70	2	66.14
POSSIBLE MADE GROUND: Light grey mottled greenish brown slightly sandy calcareous CLAY with occasional shell fragments (up to 6mm in size) and occasional relict rootlets. Below 1.60m, with many pockets (up to 20mm in size) of decomposed organic material.	1.80	3	65.04
Firm dark grey occasionally mottled light brown slightly sandy calcareous CLAY with many pockets (up to 40mm in size) of decomposed organic material.		4	
End of Excavation	3.00		63.84

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Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	16/07/2020	Length (C)	2.40
Shoring	None.	Orientation	162 deg
		Date Backfilled	16/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP828
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	458846.5 E 219818.7 N	Ground Level	67.15 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.10	B		
0.10	D		
0.10	ES		
0.10			PID=<0.1
0.30	B		
0.30	D		
0.30	ES		
0.30	HV		Av=130kPa
0.30			PID=<0.1
0.80	B		
0.80	D		mc=26%
0.80	ES		
0.80			PID=<0.1
1.00	HV		Av=64kPa
1.40	B		
1.40	D		
1.40	ES		
1.40			PID=<0.1
1.50	HV		Av=61kPa
2.00	D		
2.00	HV		Av=62kPa
2.70	B		
2.70	D		mc=43%
2.70	D		

Strata

Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		67.15
MADE GROUND: Dark brown gravelly slightly silty sand with many rootlets and roots (up to 10mm diameter). Gravel is angular to subangular fine to coarse brick fragments, clinker, slag, flint and limestone.	0.20	1, 2	66.95
MADE GROUND: Stiff light brown mottled light grey slightly sandy slightly gravelly clay with occasional rootlets. Gravel is angular to subangular fine to medium brick fragments, clinker and ash.	0.70	3	66.45
Firm light brown mottled light grey slightly sandy CLAY with occasional rootlets. Below 0.90m, rootlets absent. Below 1.30m, predominantly light grey occasionally light brown mottled and with many shell fragments (up to 6mm in size).	1.40	4	65.75
Firm dark grey mottled light brown slightly sandy CLAY with many pockets (up to 20mm in size) of decomposed organic material.	2.50	5	64.65
Stiff dark brownish grey slightly sandy CLAY with a slight organic odour.	3.00		64.15

End of Excavation

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.50
Date	16/07/2020	Length (C)	2.10
Shoring	None.	Orientation	098 deg
		Date Backfilled	16/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks AGS

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP829
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	458556.0 E 219889.9 N	Ground Level	67.79 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.20	B		
0.20	D		
0.20	ES		
0.20			PID=<0.1
0.50	B		
0.50	D		mc=22%
0.50	ES		
0.50	HV		Av=61kPa
0.50			PID=<0.1
1.00	B		
1.00	D		
1.00	ES		
1.00	HV		Av=72kPa
1.00			PID=<0.1
2.00	B		
2.00	D		
2.00	HV		Av=84kPa
2.50	D		
3.00	B		
3.00	D		

Strata

Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		67.79
MADE GROUND: Dark brown slightly sandy slightly gravelly silt with many rootlets and occasional roots (up to 6mm in diameter). Gravel is angular to subrounded fine to coarse quartzite and flint.	0.25	1	67.54
PROBABLE MADE GROUND: Firm light grey and light brown slightly sandy slightly gravelly clay. Gravel is angular to subrounded fine to coarse quartzite.	0.35	2	67.44
Firm light grey mottled light brown slightly sandy CLAY with many shell fragments (up to 10mm in size).	0.80	3	66.99
Firm dark grey slightly sandy CLAY with occasional pockets (up to 4mm in size) of grey silt, occasional pockets (up to 20mm in size) decomposed organic material, occasional shell fragments (up to 25mm in size) and many relict rootlets	1.90	4	65.89
Stiff dark grey mottled brown sandy CLAY with many shell fragments (up to 20mm in size) and occasional pockets (up to 20mm in size) of decomposed organic material.	2.80	5	64.99
Stiff grey slightly sandy CLAY with many shell fragments (up to 80mm in size).	3.00	6	64.79
End of Excavation			

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Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	07/08/2020	Length (C)	3.00
Shoring	None.	Orientation	086 deg
		Date Backfilled	07/08/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MJ

Figure 1 of 1

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP830
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	458535.5 E 219877.4 N	Ground Level	66.67 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.05	ES		
0.05			PID=<0.1
0.46	EW		

Strata

Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		66.67
MADE GROUND: Asphalt.	0.10	1	66.57
MADE GROUND: Concrete.	0.30	2	66.37
MADE GROUND: Grey sandy silty gravel. Gravel is subangular to subrounded fine to coarse quartzite.	0.50	3	66.17
End of Excavation			

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	07/08/2020	Length (C)	2.10
Shoring	None.	Orientation	184 deg
		Date Backfilled	07/08/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
0.50	0.50	Fast inflow.

Remarks

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to 0.10m, asphalt up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MJ

Figure 1 of 1

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP831
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	458800.3 E 219776.3 N	Ground Level	65.74 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.10	ES		
0.10			PID=<0.1
0.30	B		
0.30	ES		
0.30			PID=<0.1
0.50	HV		Av=48kPa
0.60	B		
0.60	D		
0.60	ES		
0.60			PID=<0.1
1.00	HV		Av=63kPa
1.20	D		
1.50	HV		Av=50kPa
1.70	B		
1.70	D		
1.70	ES		
1.70			PID=<0.1
2.00	HV		Av=52kPa
2.20	D		
2.40	B		
2.40	D		
3.00	D		

Strata — Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		65.74
MADE GROUND: Asphalt.	0.10	1	65.64
MADE GROUND: Black gravelly silty sand with a hydrocarbon odour. Gravel is angular to subangular fine to coarse brick, concrete, slag, ash and clinker.	0.35	2	65.39
MADE GROUND: Yellowish brown and grey slightly sandy gravel with a high cobble content of angular to subangular medium strong limestone.	0.50	3	65.24
Soft light grey mottled light brown slightly sandy calcareous CLAY with many shell fragments (up to 5mm in size) and many pockets (up to 20mm in size) of decomposed organic material.	1.60	4	64.14
Firm dark grey mottled light brown slightly sandy CLAY with many pockets (up to 25mm in size) of decomposed organic material and relict rootlets and roots (up to 10mm in diameter).	2.30	5	63.44
Stiff dark brownish grey slightly sandy CLAY with a slight organic odour and rare shell fragments (up to 10mm in size).	3.00	6	62.74

End of Excavation

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Excavation

Plant	JCB 3CX	Width (B)	0.50
Date	16/07/2020	Length (C)	2.00
Shoring	None.	Orientation	001 deg
		Date Backfilled	16/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks (AGS)

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MJ

Figure 1 of 1

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP832
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459190.4 E 219672.8 N	Ground Level	64.50 m OD

Samples and Tests / Strata

Scale 1:50

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		64.50
				MADE GROUND: Asphalt.	0.05	1	64.45
0.25	D				0.25	2	64.25
0.25	ES			MADE GROUND: Reinforced concrete.	0.30	3	64.20
0.25			PID=<0.1		0.50		64.00
0.60	B			MADE GROUND: Black sandy silty gravel. Gravel is angular to subrounded fine to medium ash, clinker, quartzite and slag.			
0.60	D						
0.60	ES						
0.60			PID=<0.1				
1.00	D			Firm grey mottled orangish brown slightly sandy CLAY.		4	
1.50	D			Firm grey mottled orangish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse limestone.			
1.50	ES						
1.50			PID=<0.1				
2.00	B			Below 1.50m, with many pockets (up to 3mm in size) of grey silt, occasional rootlets and occasional roots (up to 5mm in diameter).	1.90		62.60
2.00	D						
2.50	D			Firm grey slightly sandy CLAY.		5	
				Below 2.50m, becoming grey mottled light brown.			
3.00	D				3.00		61.50
				End of Excavation			

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	29/07/2020	Length (C)	2.30
Shoring	None.	Orientation	253 deg
		Date Backfilled	29/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks (AGS)

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP832A
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459191.7 E 219669.8 N	Ground Level	64.61 m OD

Samples and Tests

Depth	Type	Stratum No	Results
1.00	B		mc=27%
1.00	B		
1.00	B		
1.00	D		
1.00	D		
1.00	ES		
1.00			PID=<0.1

Strata — Scale 1:50

Description	Depth	Legend	Level m OD
MADE GROUND: Soft to firm dark brownish grey very sandy silty gravel with a high cobble content of angular to subangular brick and concrete. Gravel is angular to subrounded fine to coarse glass, metal, plastic, brick, concrete, asphalt, clinker, slag, limestone and quartzite. [Stockpile]	G.L.	1	64.61
End of Excavation	1.00		63.61

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	29/07/2020	Length (C)	1.00
Shoring	None.	Orientation	253 deg
		Date Backfilled	29/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks AGS

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP833
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459146.0 E 219638.0 N	Ground Level	64.41 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.50	B		
0.50	ES		
0.50			PID=<0.1
0.90	B		
0.90	D		
0.90	ES		
0.90	HV		Av=82kPa
0.90			PID=<0.1
1.40	D		mc=22%
1.50	D		
1.50	HV		Av=79kPa
1.75	B		
2.00	B		
2.00	D		
2.00	ES		
2.00	HV		Av=83kPa
2.00			PID=<0.1
2.50	D		
2.50	HV		Av=77kPa
3.00	D		
3.00	HV		Av=124kPa

Strata — Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		64.41
MADE GROUND: Concrete.	0.15	1	64.26
MADE GROUND: Black gravelly very silty sand. Gravel is angular to subrounded fine to medium quartzite, ash, slag and clinker.	0.60	2	63.81
Stiff grey mottled orangish brown slightly sandy CLAY.	0.80	3	63.61
Stiff grey mottled orangish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse mudstone. Below 1.00m, with rare pockets (up to 2mm in size) of grey silt.	1.90	4	62.51
Between 1.30-1.45m, a layer of soft orangish brown sandy clay. At 1.70m, with a pocket (200mm in size) of sandy very silty gravel of subangular to subrounded fine to coarse quartzite.		5	
Stiff dark grey, occasionally mottled orangish brown, slightly sandy CLAY. Below 2.50m, with occasional pockets (up to 2mm in size) of grey silt.	3.00		61.41

End of Excavation

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	29/07/2020	Length (C)	2.60
Shoring	None.	Orientation	145 deg
		Date Backfilled	29/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
0.60	0.70	Slow inflow.

Remarks (AGS)

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP833A
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459148.4 E 219640.1 N	Ground Level	64.31 m OD

Samples and Tests — **Strata** — Scale 1:50

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
				MADE GROUND: Soft to firm dark brownish grey slightly sandy gravelly clay with a low cobble content of subangular brick and concrete.. Gravel is angular to subrounded fine to coarse glass, metal, plastic, brick, concrete, asphalt, clinker, slag, limestone and quartzite. [Stockpile]	G.L.		64.31
1.00	B				1.00		63.31
1.00	B		mc=28%	End of Excavation			
1.00	B						
1.00	D						
1.00	D						
1.00	ES						
1.00			PID=<0.1				

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	29/07/2020	Length (C)	1.00
Shoring	None.	Orientation	145 deg
		Date Backfilled	29/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP834
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459161.1 E 219658.8 N	Ground Level	64.57 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.70	HV		Av=63kPa
0.75	B		
0.75	D		
0.75	ES		
0.75			PID=<0.1
1.00	B		
1.00	D		
1.20	HV		Av=78kPa
1.50	D		
1.50	ES		
1.50			PID=<0.1
2.00	B		
2.00	D		
2.00	HV		Av=71kPa
2.50	D		
3.00	D		

Strata

Scale 1:50

Description	Depth	Legend	Level m OD
MADE GROUND: Concrete.	G.L.	1	64.57
	0.15	2	64.42
MADE GROUND: Orangish brown gravelly sand. Gravel is angular to subangular fine to coarse sandstone.	0.20	3	64.37
MADE GROUND: Black slightly sandy very silty gravel. Gravel is angular to subrounded fine to coarse slag, quartzite, clinker and ash.	0.35	4	64.22
POSSIBLE MADE GROUND: Firm grey mottled orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse mudstone. At 0.90m, a pocket (170mm in size) of orangish brown sandy very silty gravel of angular to subangular fine to coarse quartzite. Below 1.40m, becoming dark grey mottled orangish brown.	1.90	5	62.67
Firm grey slightly sandy CLAY with occasional rootlets and roots (up to 4mm in diameter). Below 2.40m, becoming grey mottled light brown.	3.00		61.57

End of Excavation

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	29/07/2020	Length (C)	2.30
Shoring	None.	Orientation	260 deg
		Date Backfilled	29/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks (AGS)

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP834A
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459160.7 E 219661.1 N	Ground Level	64.57 m OD

Samples and Tests | **Strata** | Scale 1:50

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
				MADE GROUND: Soft to firm dark brownish grey slightly sandy slightly gravelly silt. Gravel is angular to subrounded fine to coarse glass, metal, plastic, brick, concrete, asphalt, clinker, slag, limestone and quartzite. [Stockpile]	G.L.		64.57
1.00	B			End of Excavation	1.00		63.57
1.00	B						
1.00	B						
1.00	D		mc=35%				
1.00	D						
1.00	ES						
1.00			PID=<0.1				

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	29/07/2020	Length (C)	1.00
Shoring	None.	Orientation	260 deg
		Date Backfilled	29/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks AGS

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP835
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459239.8 E 219640.9 N	Ground Level	64.21 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.00- 0.20	B		
0.10	ES		
0.10			PID=<0.1
0.15	D		
0.20- 0.50	B		
0.30	D		
0.40	ES		
0.40			PID=<0.1
0.50	HV		Av=120kPa
0.60- 0.80	B		
0.70	D		mc=28%
0.70	D		
0.80- 1.10	B		
0.80	ES		
0.80			PID=<0.1
1.00	D		
1.00	HV		Av=85kPa
1.10- 1.40	B		
1.20	D		mc=28%
1.40- 1.70	B		
1.50	HV		Av=60kPa
1.60	D		
1.60	ES		
1.60			PID=<0.1
1.90	D		
2.00- 2.50	B		
2.00	HV		Av=90kPa
2.40	D		

Strata

Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		64.21
MADE GROUND: Firm dark grey slightly sandy slightly gravelly clay with many rootlets and occasional roots (up to 12mm in diameter). Gravel is angular to subrounded fine to coarse brick, limestone, flint and concrete.	0.20	1	64.01
MADE GROUND: Stiff grey mottled brown slightly sandy slightly gravelly clay with a low cobble content of subangular limestone and brick and many rootlets and occasional roots (up to 12mm in diameter). Gravel is angular to rounded fine to coarse limestone, brick, concrete, slag and rare metal fragments.	0.60	2	63.61
Stiff orangish brown mottled grey slightly sandy CLAY with occasional gypsum crystals (up to 3mm in size) and rare pockets (up to 25mm in size) of orangish brown sandy clay.	0.85	3	63.36
Stiff grey mottled reddish brown CLAY with rare gypsum crystals (up to 2mm in size) and rare shell fragments (up to 3mm in size).	1.10	4	63.11
Firm grey mottled orangish brown and dark brown slightly sandy CLAY with occasional gypsum crystals (up to 2mm in size), occasional pockets of orangish brown and lightly grey sandy clay and occasional pockets (up to 3mm in size) of decomposed organic material.	1.40	5	62.81
Firm brown mottled orangish brown and light grey sandy CLAY with occasional gypsum crystals (up to 3mm in size), many pockets (up to 5mm in size) of decomposed organic material and occasional pockets (up to 25mm in size) of light grey and brown sandy clay.	1.80	6	62.41
Stiff dark grey slightly sandy CLAY with low organic odour and occasional gypsum crystals (up to 2mm in size). Below 2.10m, with occasional pockets of light brown sandy clay.	2.50	7	61.71
End of Excavation			

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	16/07/2020	Length (C)	2.50
Shoring	None.	Orientation	001 deg
		Date Backfilled	16/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks AGS

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP836
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459410.5 E 219561.5 N	Ground Level	62.67 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.20	D		
0.20	ES		
0.20			PID=<0.1
0.50	HV		Av=36kPa
0.55	B		
0.55	D		
0.55	ES		
0.55			PID=<0.1
1.00	B		
1.00	D		
1.00	ES		
1.00	HV		Av=35kPa
1.00			PID=<0.1
2.00	B		
2.00	D		
2.00	ES		
2.00	HV		Av=86kPa
2.00			PID=<0.1
2.50	D		
3.00	B		
3.00	D		

Strata — Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		62.67
MADE GROUND: Concrete.	0.15	1	62.52
MADE GROUND: Black sandy very silty gravel. Gravel is angular to subangular fine to medium ash, clinker, slag and quartzite.	0.25	2	62.42
Soft greenish grey mottled orangish brown slightly sandy CLAY.	0.85	3	61.82
Soft light grey mottled light orangish brown slightly sandy CLAY. Below 1.70m, becoming firm.	1.80	4	60.87
Stiff dark greyish brown mottled light brown slightly sandy CLAY with many gypsum crystals (up to 3mm in size), occasional pockets (up to 3mm in size) of grey silt and occasional pockets (up to 10mm in size) of grey silty sand.	2.80	5	59.87
Stiff grey slightly sandy CLAY with occasional gypsum crystals (up to 8mm in size).	3.00	6	59.67
End of Excavation			

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	29/07/2020	Length (C)	2.50
Shoring	None.	Orientation	100 deg
		Date Backfilled	29/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks (AGS)

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP837
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459331.0 E 219715.9 N	Ground Level	64.93 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.15	ES		
0.15			PID=<0.1
0.17	ES		
0.17			PID=<0.1
0.30	ES		
0.30			PID=<0.1
0.70	B		
0.70	B		
0.70	D		
0.70	ES		
0.70	HV		Av=51kPa
0.70			PID=<0.1
1.00	HV		Av=64kPa
1.30	B		
1.30	B		
1.30	D		
1.50	HV		Av=68kPa
1.70	D		
1.80	B		
1.80	B		
1.80	D		
2.00	HV		Av=39kPa
2.10	B		
2.10	B		
2.10	D		
2.50	D		
2.80	HV		Av=59kPa
3.00	B		
3.00	D		

Strata — Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		64.93
MADE GROUND: Asphalt.	0.16	1	64.77
MADE GROUND: Light yellowish brown gravelly slightly silty sand. Gravel is angular to subrounded fine to medium limestone.	0.20	2	64.73
MADE GROUND: Dark grey and black gravelly silty sand with a low cobble content of angular to subangular brick. Gravel is angular to subangular fine to coarse concrete, brick and limestone.	0.35	3	64.58
MADE GROUND: Grey slightly sandy gravel with a high cobble content of angular to subangular medium strong limestone.	0.60	4	64.33
Firm dark greenish grey mottled black slightly sandy CLAY with occasional pockets (up to 40mm in size) of decomposed organic material.	1.20	5	63.73
Below 0.80m, becomes light greenish grey mottled light grey.	1.70	6	63.23
Firm light grey occasionally mottled orangish brown slightly sandy CLAY.	2.00	7	62.93
Soft orangish brown mottled grey slightly sandy CLAY.	3.00	8	61.93
Stiff dark brown slightly sandy CLAY.			
Below 2.60m, becomes mottled yellowish cream.			
End of Excavation			

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	14/07/2020	Length (C)	1.90
Shoring	None.	Orientation	210 deg
		Date Backfilled	14/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks AGS

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MJ

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP838
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459310.4 E 219819.7 N	Ground Level	66.09 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.10	ES		
0.10			PID=<0.1
0.30	B		
0.30	D		
0.30	ES		
0.30			PID=<0.1
0.60	B		
0.60	B		
0.60	D		mc=33%
0.60	ES		
0.60			PID=<0.1
0.70	HV		Av=50kPa
1.20	D		
1.20	HV		Av=51kPa
1.60	B		
1.60	D		
1.90	B		
1.90	B		
1.90	D		
2.40	D		
2.90	B		
2.90	D		

Strata

Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		66.09
MADE GROUND: Asphalt.	0.15	1	65.94
MADE GROUND: Yellowish brown and grey very gravelly slightly silty sand.	0.30	2	65.79
PROBABLE MADE GROUND: Grey slightly sandy gravel with a high cobble content of angular to subangular medium strong limestone.	0.55	3	65.54
Firm brown mottled light grey and brown slightly sandy CLAY. Below 0.90m, becomes brown mottled orangish brown.	1.90	4	64.19
Soft to firm brown mottled dark brownish orange slightly sandy CLAY with many gypsum crystals (up to 3mm in size). Below 2.30m, gypsum crystals absent. Below 2.40m, becomes predominantly dark brown occasionally mottled orangish brown.	3.00	5	63.09
End of Excavation			

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	14/07/2020	Length (C)	1.90
Shoring	None.	Orientation	126 deg
		Date Backfilled	14/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		None encountered during excavation.

Remarks ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit — Draft

Project	GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)	Engineer	WATERMAN INFRASTRUCTURE & ENVIRONMENT LIMITED	Trial Pit	TP839
				Project No	PC207899
Client	GRAVEN HILL VILLAGE DEVELOPMENT COMPANY LIMITED	National Grid Coordinates	459318.2 E 219886.1 N	Ground Level	66.96 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.10	ES		
0.10			PID=<0.1
0.20	ES		
0.20			PID=<0.1
0.40	B		
0.40	B		
0.90	HV		Av=50kPa
1.00	B		
1.00	B		
1.00	D		mc=42%
1.00	ES		
1.00			PID=<0.1
1.50	D		
1.50	ES		
1.50	HV		Av=61kPa
1.50			PID=<0.1
1.80	HV		Av=52kPa
1.90	D		
2.10	B		
2.10	B		
2.10	D		mc=34%
2.60	D		

Strata

Scale 1:50

Description	Depth	Legend	Level m OD
	G.L.		66.96
MADE GROUND: Asphalt.	0.17	1	66.79
MADE GROUND: Light yellowish brown gravelly slightly silty sand. Gravel is angular to subangular fine to coarse limestone and brick. Between 0.20-0.25m, a layer of black sandy silt.	0.40	2	66.56
PROBABLE MADE GROUND: Grey slightly sandy gravel with a high cobble and boulder content of angular to subangular medium strong limestone.	0.90	3	66.06
Firm light grey and brown slightly sandy CLAY. Below 1.30m, becoming light grey mottled orangish brown.	1.95	4	65.01
Stiff dark brown slightly sandy CLAY Below 2.30m, becoming very stiff.		5	
End of Excavation	3.00		63.96

DRAFT

Excavation

Plant	JCB 3CX	Width (B)	0.60
Date	14/04/2020	Length (C)	1.90
Shoring	None.	Orientation	216 deg
		Date Backfilled	14/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
0.45	0.45	Fast seepage.

Remarks

ES sample = 2 x vial, 1 x plastic jar and 2 amber jar
Radioactive screening at discrete sample depths, using a Thermo Scientific Mini 900E. No activity detected.
Backfill details from base of hole: arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MJ

Figure 1 of 1

06/11/2020

geotechnics

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PID	Photo Ionisation Detection (ppm)
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike

Depth Water Rose To

Instrumentation

Seal

Filter

Seal

Strata Legend

Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

Gravel

Sand

Silt

Clay

Peat

Note: Composite soil types shown by combined symbols

Chalk

Limestone

Sandstone

Coal

Strata, Continued

Mudstone

Siltstone

Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock

Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

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C. In-Situ Test Results

In-situ CBR Test Results (TRL DCP)

Soakaway Test Results

In Situ Testing - Dynamic Cone Penetration Test

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company Limited

Coordinates 459530.0 E, 220018.2 N **Ground Level** 66.76 m OD

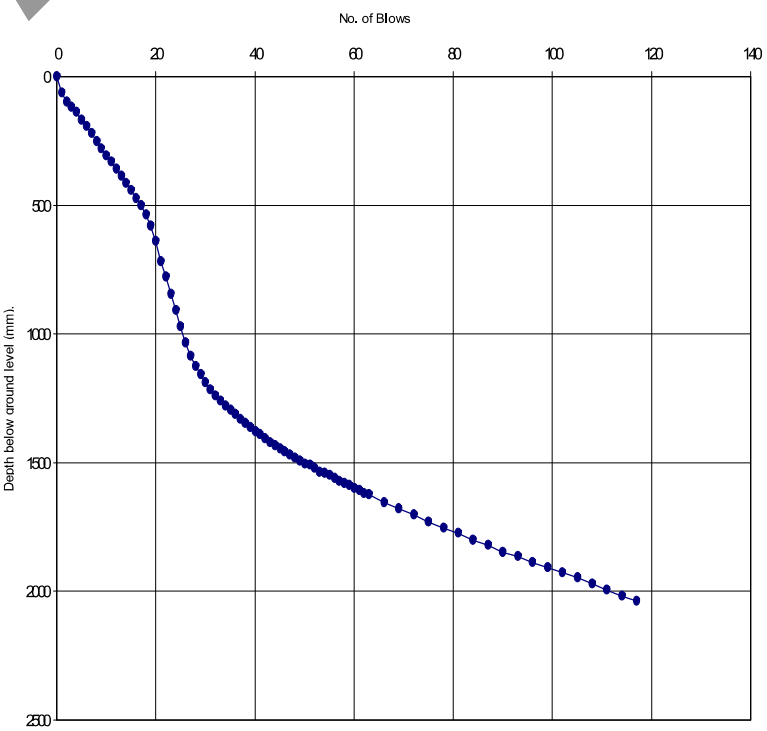
Location No. RC804
Project No. PC207899
Test No. 1
Test Date 24/07/2020

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	115	0	1	21	1	833	718	1	42	2	727	1405
1	1	1	180	65	1	22	2	100	778	1	43	2	743	1421
1	2	1	212	97	1	23	2	166	844	1	44	2	755	1433
1	3	1	234	119	1	24	2	230	908	1	45	2	766	1444
1	4	1	255	140	1	25	2	293	971	1	46	2	780	1458
1	5	1	283	168	1	26	2	357	1035	1	47	2	791	1469
1	6	1	310	195	1	27	2	410	1088	1	48	2	803	1481
1	7	1	337	222	1	28	2	447	1125	1	49	2	814	1492
1	8	1	366	251	1	29	2	481	1159	1	50	2	827	1505
1	9	1	395	280	1	30	2	511	1189	1	51	2	832	1510
1	10	1	423	308	1	31	2	537	1215	1	52	3	50	1520
1	11	1	447	332	1	32	2	561	1239	1	53	3	65	1535
1	12	1	474	359	1	33	2	582	1260	1	54	3	70	1540
1	13	1	503	388	1	34	2	601	1279	1	55	3	80	1550
1	14	1	531	416	1	35	2	619	1297	1	56	3	91	1561
1	15	1	559	444	1	36	2	635	1313	1	57	3	101	1571
1	16	1	587	472	1	37	2	654	1332	1	58	3	110	1580
1	17	1	616	501	1	38	2	669	1347	1	59	3	118	1588
1	18	1	652	537	1	39	2	685	1363	1	60	3	130	1600
1	19	1	697	582	1	40	2	699	1377	1	61	3	138	1608
1	20	1	753	638	1	41	2	713	1391	1	62	3	148	1618

Test Started at	0.00 m
Operator	EPS
Checked by	TNH

Rod No.	Zero Reading (mm)
1	115
2	40
3	40

Depth bgl (mm) Top	Base	Blows No. Top	Base	DCP mm/blow	CBR %
0	65	0	1	65	3.7
65	280	1	9	27	9.3
65	280	9	18	24	10.5
537	778	18	22	60	4.0
778	1125	22	28	58	4.1
1125	1239	28	32	29	8.8
1239	1405	32	42	17	15.5
1405	1540	42	54	11	23.4
1540	1800	54	84	9	30.8
1800	2039	84	117	7	37.2



Remarks
CBR estimated using correlation in Highways Agency Interim Advice Note 73/06 Rev 1 (2009).

Printed: 28/09/2020

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In Situ Testing - Dynamic Cone Penetration Test

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company Limited

Coordinates 459530.0 E, 220018.2 N **Ground Level** 66.76 m OD

Location No. RC804
Project No. PC207899
Test No. 1
Test Date 24/07/2020

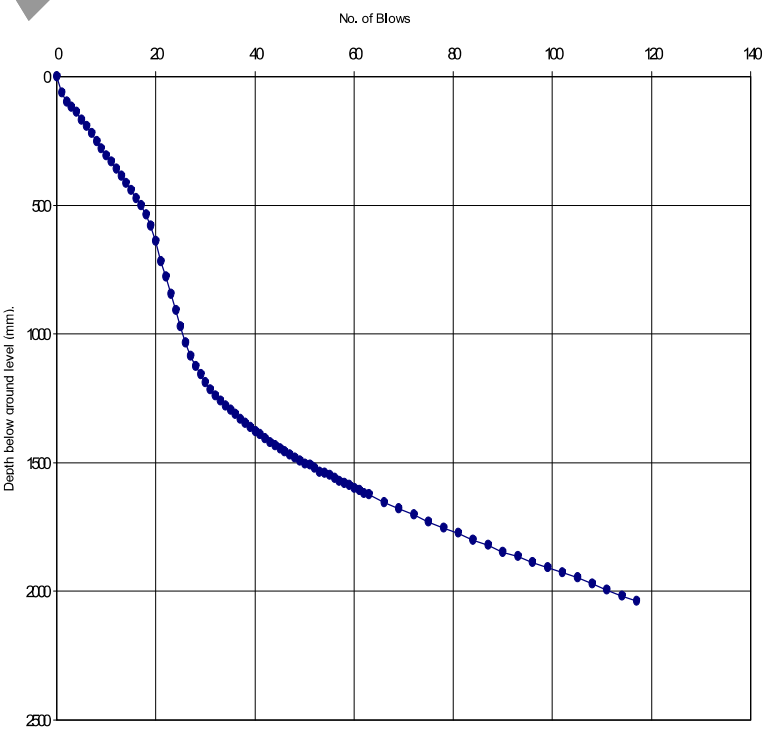
Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
1	63	3	154	1624
3	66	3	183	1653
3	69	3	210	1680
3	72	3	234	1704
3	75	3	259	1729
3	78	3	284	1754
3	81	3	305	1775
3	84	3	330	1800
3	87	3	352	1822
3	90	3	378	1848
3	93	3	396	1866
3	96	3	416	1886
3	99	3	437	1907
3	102	3	458	1928
3	105	3	479	1949
3	108	3	502	1972
3	111	3	524	1994
3	114	3	547	2017
3	117	3	569	2039

DRAFT

Test Started at	0.00 m
Operator	EPS
Checked by	TNH

Rod No.	Zero Reading (mm)
1	115
2	40
3	40

Depth bgl (mm) Top	Base	Blows No. Top	Base	DCP mm/blow	CBR %
0	65	0	1	65	3.7
65	280	1	9	27	9.3
65	280	9	18	24	10.5
537	778	18	22	60	4.0
778	1125	22	28	58	4.1
1125	1239	28	32	29	8.8
1239	1405	32	42	17	15.5
1405	1540	42	54	11	23.4
1540	1800	54	84	9	30.8
1800	2039	84	117	7	37.2



Remarks
CBR estimated using correlation in Highways Agency Interim Advice Note 73/06 Rev 1 (2009).

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In Situ Testing - Dynamic Cone Penetration Test

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company Limited

Coordinates 459203.9 E, 219929.9 N **Ground Level** 69.27 m OD

Location No. RC807
Project No. PC207899
Test No. 1
Test Date 31/07/2020

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	115	0
1	1	1	185	70
1	2	1	226	111
1	3	1	260	145
1	4	1	293	178
1	5	1	321	206
1	6	1	350	235
1	7	1	376	261
1	8	1	403	288
1	9	1	428	313
1	10	1	458	343
1	11	1	488	373
1	12	1	527	412
1	13	1	553	438
1	14	1	583	468
1	15	1	616	501
1	16	1	647	532
1	17	1	679	564
1	18	1	716	601
1	19	1	755	640
1	20	1	794	679

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
1	21	1	825	710
1	22	1	856	741
1	23	2	97	772
3	26	2	212	887
3	29	2	313	988
3	32	2	401	1076
3	35	2	498	1173
3	38	2	606	1281
3	41	2	711	1386
3	44	2	788	1463
3	47	2	845	1520
3	50	3	497	1571
3	53	3	544	1618
3	56	3	587	1661
3	59	3	625	1699
3	62	3	659	1733
3	65	3	694	1768
3	68	3	723	1797
3	71	3	750	1824
3	74	3	778	1852
3	77	3	803	1877

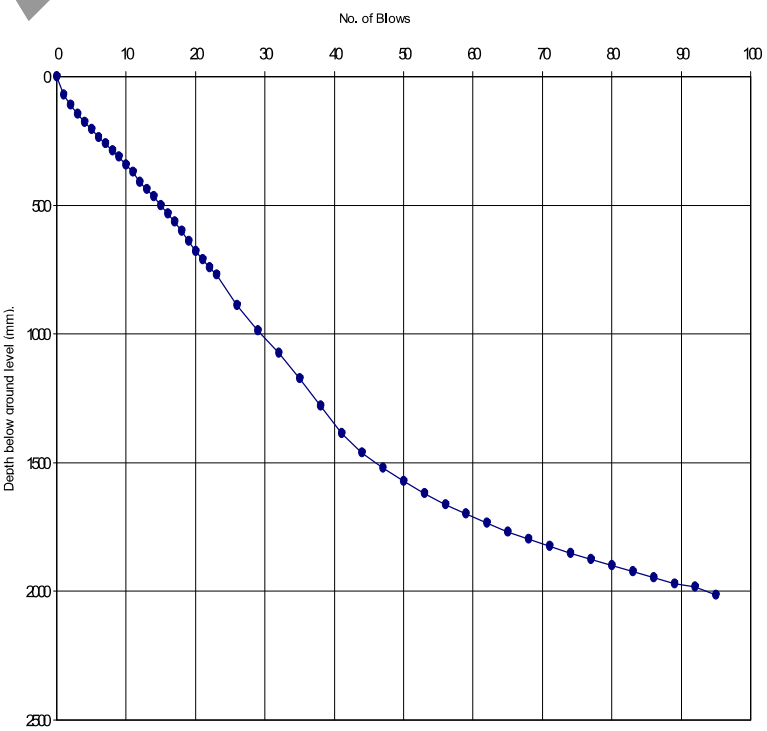
Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
3	80	3	826	1900
3	83	3	851	1925
3	86	3	875	1949
3	89	3	896	1970
3	92	3	910	1984
3	95	3	940	2014

DRAFT

Test Started at	0.00 m
Operator	EPS
Checked by	TNH

Rod No.	Zero Reading (mm)
1	115
2	66
3	446

Depth bgl (mm) Top	Depth bgl (mm) Base	Blows No. Top	Blows No. Base	DCP mm/blow	CBR %
0	111	0	2	111	2.1
111	373	2	11	29	8.6
373	772	11	23	33	7.4
772	988	23	29	36	6.8
988	1173	29	35	31	8.1
1173	1386	35	41	36	6.9
1386	1520	41	47	22	11.3
1520	1661	47	56	16	16.5
1661	1797	56	68	11	23.2
1797	2014	68	95	8	33.4



Remarks
CBR estimated using correlation in Highways Agency Interim Advice Note 73/06 Rev 1 (2009).

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In Situ Testing - Dynamic Cone Penetration Test

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company Limited

Coordinates 459229.2 E, 219850.0 N **Ground Level** 66.57 m OD

Location No. RC808
Project No. PC207899
Test No. 1
Test Date 31/07/2020

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	110	0
1	1	1	140	30
1	2	1	166	56
1	3	1	187	77
1	4	1	209	99
1	5	1	225	115
1	6	1	244	134
1	7	1	258	148
1	8	1	271	161
1	9	1	286	176
1	10	1	308	198
1	11	1	330	220
1	12	1	355	245
1	13	1	392	282
1	14	1	425	315
1	15	1	452	342
1	16	1	484	374
1	17	1	507	397
1	18	1	535	425
1	19	1	566	456
1	20	1	598	488

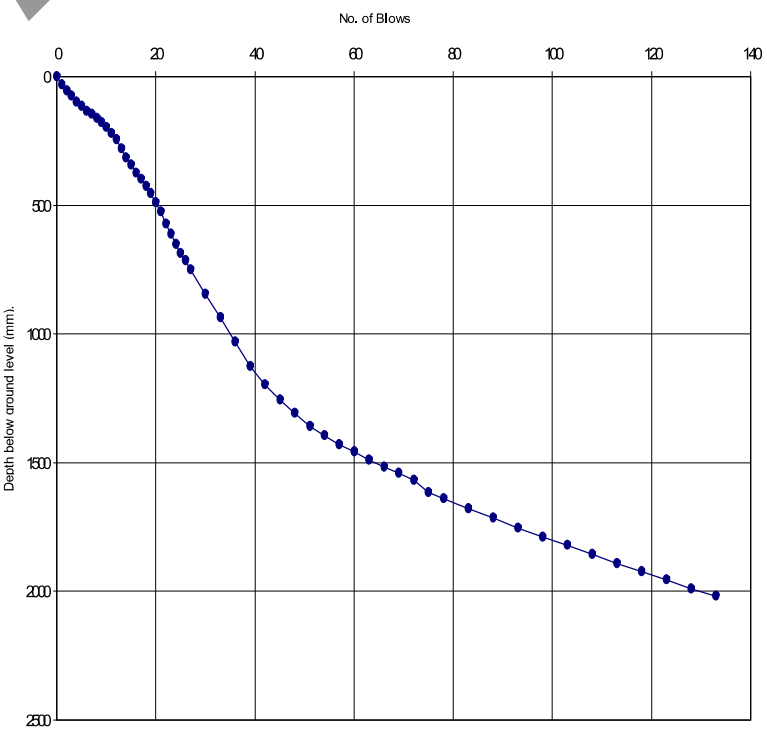
Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
1	21	1	636	526
1	22	1	681	571
1	23	1	722	612
1	24	1	761	651
1	25	1	797	687
1	26	1	826	716
1	27	1	860	750
3	30	2	146	845
3	33	2	238	937
3	36	2	333	1032
3	39	2	428	1127
3	42	2	497	1196
3	45	2	558	1257
3	48	2	610	1309
3	51	2	658	1357
3	54	2	694	1393
3	57	2	730	1429
3	60	2	760	1459
3	63	2	788	1487
3	66	2	818	1517
3	69	2	842	1541

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
3	72	3	468	1566
3	75	3	517	1615
3	78	3	541	1639
5	83	3	580	1678
5	88	3	618	1716
5	93	3	654	1752
5	98	3	690	1788
5	103	3	724	1822
5	108	3	759	1857
5	113	3	792	1890
5	118	3	826	1924
5	123	3	858	1956
5	128	3	894	1992
5	133	3	920	2018

Test Started at	0.00 m
Operator	EPS
Checked by	TNH

Rod No.	Zero Reading (mm)
1	110
2	51
3	443

Depth bgl (mm) Top	Depth bgl (mm) Base	Blows No. Top	Blows No. Base	DCP mm/blow	CBR %
0	115	0	5	23	11.0
115	198	5	10	17	15.5
198	425	10	18	28	8.8
425	750	18	27	36	6.8
750	1195	27	42	30	8.4
1195	1356	42	51	18	14.3
1356	1428	51	57	12	21.8
1428	1565	57	72	9	29.1
1565	1614	72	75	16	15.8
1614	2017	75	133	7	38.9



Remarks
CBR estimated using correlation in Highways Agency Interim Advice Note 73/06 Rev 1 (2009).

Printed: 28/09/2020

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DRAFT

In Situ Testing - Dynamic Cone Penetration Test

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company Limited

Coordinates 459280.9 E, 219766.1 N **Ground Level** 66.22 m OD

Location No. RC809
Project No. PC207899
Test No. 1
Test Date 07/08/2020

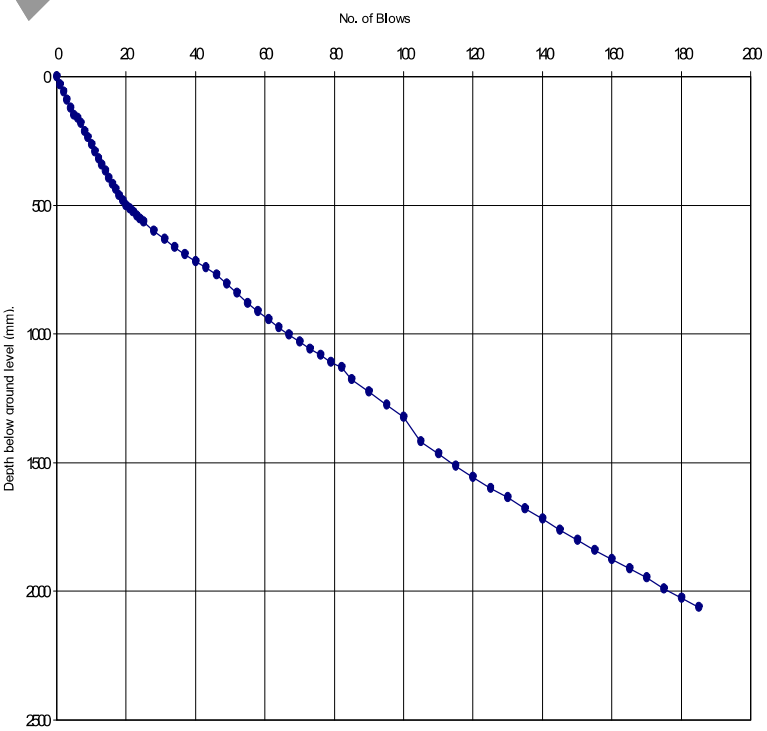
Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	140	0	1	21	1	654	514	3	76	2	388	1084
1	1	1	172	32	1	22	1	667	527	3	79	2	412	1108
1	2	1	201	61	1	23	1	681	541	3	82	2	434	1130
1	3	1	229	89	1	24	1	692	552	3	85	2	479	1175
1	4	1	263	123	1	25	1	704	564	5	90	2	528	1224
1	5	1	292	152	3	28	1	739	599	5	95	2	580	1276
1	6	1	301	161	3	31	1	772	632	5	100	2	629	1325
1	7	1	321	181	3	34	1	802	662	5	105	2	723	1419
1	8	1	353	213	3	37	1	830	690	5	110	2	771	1467
1	9	1	378	238	3	40	1	859	719	5	115	2	816	1512
1	10	1	404	264	3	43	1	883	743	5	120	2	862	1558
1	11	1	432	292	3	46	1	910	770	5	125	2	905	1601
1	12	1	459	319	3	49	2	109	805	5	130	2	941	1637
1	13	1	485	345	3	52	2	146	842	5	135	3	514	1679
1	14	1	509	369	3	55	2	183	879	5	140	3	554	1719
1	15	1	534	394	3	58	2	217	913	5	145	3	595	1760
1	16	1	557	417	3	61	2	246	942	5	150	3	634	1799
1	17	1	580	440	3	64	2	279	975	5	155	3	674	1839
1	18	1	602	462	3	67	2	307	1003	5	160	3	711	1876
1	19	1	623	483	3	70	2	336	1032	5	165	3	746	1911
1	20	1	642	502	3	73	2	361	1057	5	170	3	784	1949

DRAFT

Test Started at	0.00 m
Operator	EPS
Checked by	TNH

Rod No.	Zero Reading (mm)
1	140
2	74
3	472

Depth bgl (mm) Top	Depth bgl (mm) Base	Blows No. Top	Blows No. Base	DCP mm/blow	CBR %
0	502	0	20	25	10.0
502	632	20	31	12	22.2
632	743	31	43	9	28.8
743	1003	43	67	11	24.3
1003	1325	67	100	10	27.2
1325	1419	100	105	19	13.6
1419	1601	105	125	9	29.3
1601	2060	125	185	8	35.2



Remarks
CBR estimated using correlation in Highways Agency Interim Advice Note 73/06 Rev 1 (2009).

Printed: 28/09/2020

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In Situ Testing - Dynamic Cone Penetration Test

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company Limited

Coordinates 459280.9 E, 219766.1 N **Ground Level** 66.22 m OD

Location No. RC809
Project No. PC207899
Test No. 1
Test Date 07/08/2020

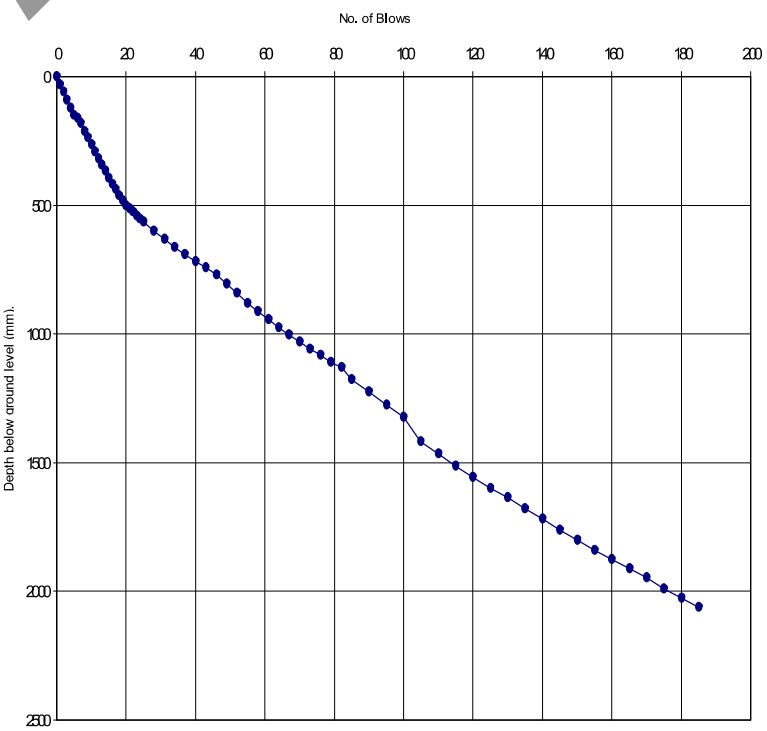
Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
5	175	3	824	1989
5	180	3	861	2026
5	185	3	895	2060

DRAFT

Test Started at	0.00 m
Operator	EPS
Checked by	TNH

Rod No.	Zero Reading (mm)
1	140
2	74
3	472

Depth bgl (mm) Top	Base	Blows No. Top	Base	DCP mm/blow	CBR %
0	502	0	20	25	10.0
502	632	20	31	12	22.2
632	743	31	43	9	28.8
743	1003	43	67	11	24.3
1003	1325	67	100	10	27.2
1325	1419	100	105	19	13.6
1419	1601	105	125	9	29.3
1601	2060	125	185	8	35.2



Remarks
CBR estimated using correlation in Highways Agency Interim Advice Note 73/06 Rev 1 (2009).

Printed: 28/09/2020

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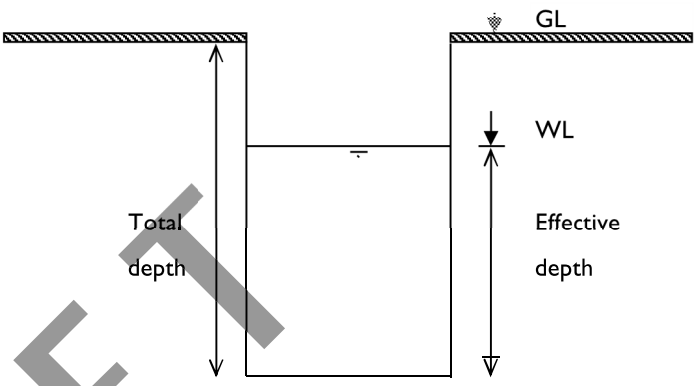
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP801
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	13/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.25	1.45	100.00
1.00	1.25	1.45	100.00
2.00	1.25	1.45	100.00
3.00	1.25	1.45	100.00
4.00	1.25	1.45	100.00
5.00	1.25	1.45	100.00
10.00	1.25	1.45	100.00
15.00	1.25	1.45	100.00
20.00	1.25	1.45	100.00
30.00	1.25	1.45	100.00
45.00	1.25	1.45	100.00
60.00	1.25	1.45	100.00
90.00	1.25	1.45	100.00
120.00	1.25	1.45	100.00
180.00	1.25	1.45	100.00
240.00	1.25	1.45	100.00

TRIAL PIT SOAKAWAY



Trial pit length	=	3.700	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.700	m
Effective depth (Head of Water)	=	1.450	m

Initial depth from GL	=	1.250m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	1.088	1.613	
25%	0.363	2.338	
Vp75-25	=	m3	
ap50	=	m2	
tp75-25	=	min	
Soil Infiltration, f	=	*	m/sec

DRAFT

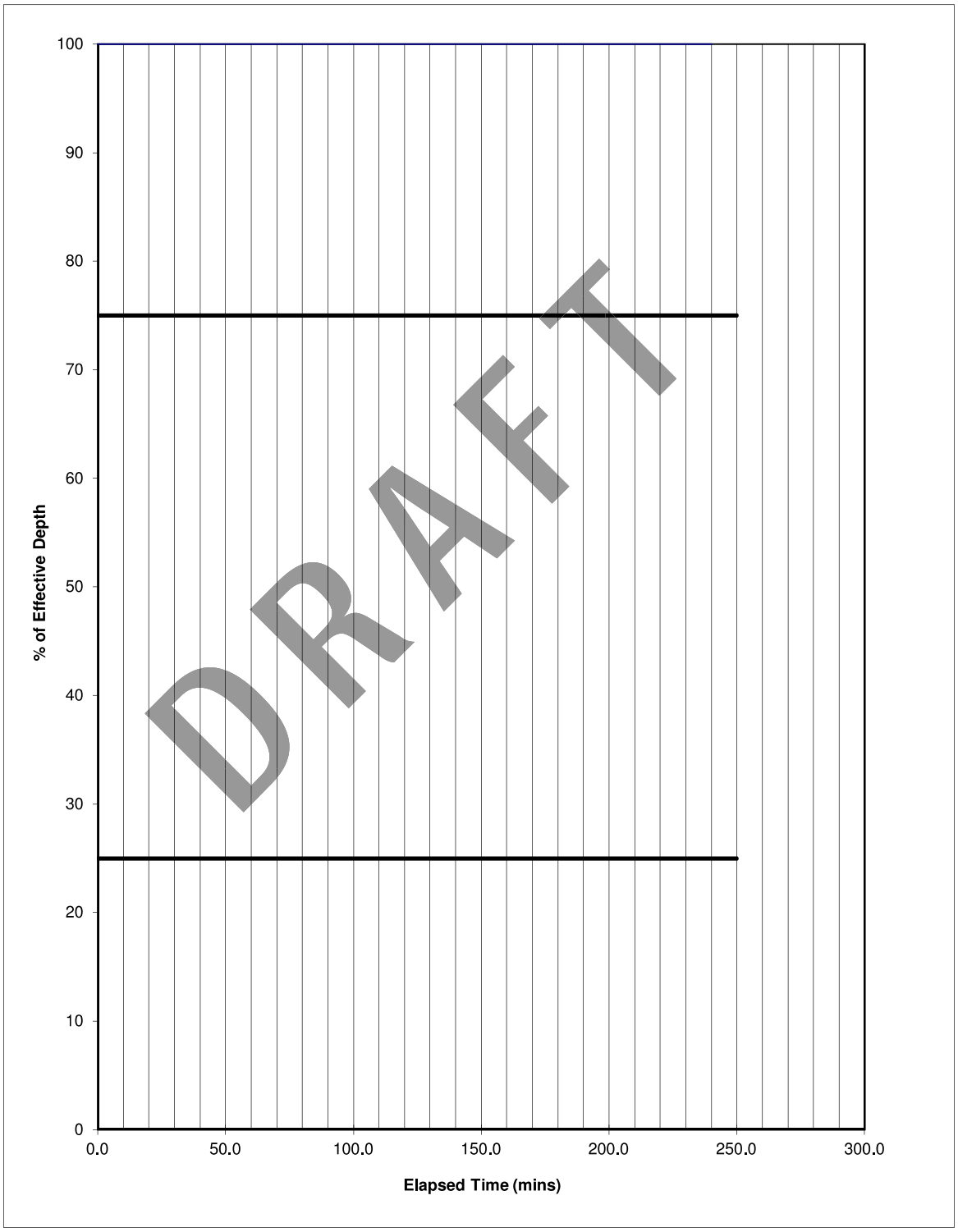
Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP801
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	13/07/2020



tp75	=
tp25	=

Sheet 2

Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

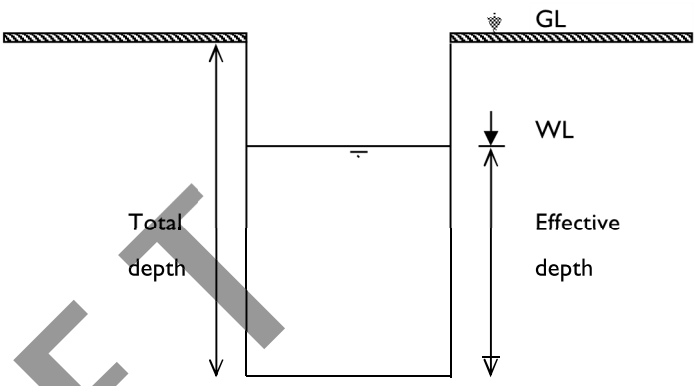
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP813
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	14/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.60	0.90	100.00
1.00	1.61	0.89	98.89
2.00	1.62	0.88	97.78
3.00	1.62	0.88	97.78
4.00	1.62	0.88	97.78
5.00	1.62	0.88	97.78
10.00	1.62	0.88	97.78
15.00	1.62	0.88	97.78
20.00	1.62	0.88	97.78
30.00	1.62	0.88	97.78
45.00	1.62	0.88	97.78
60.00	1.62	0.88	97.78
90.00	1.62	0.88	97.78
120.00	1.62	0.88	97.78
180.00	1.62	0.88	97.78
240.00	1.62	0.88	97.78

TRIAL PIT SOAKAWAY



Trial pit length	=	2.500	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.500	m
Effective depth (Head of Water)	=	0.900	m

Initial depth from GL	=	1.600m		
% of effective depth	Head (m)	Depth from GL (m)		Time (mins)
75%	0.675	1.825		0.00
25%	0.225	2.275		0.00
Vp75-25	=	0.675	m3	
ap50	=	4.290	m2	
tp75-25	=	0.000	min	
Soil Infiltration, f	=	*	m/sec	

DRAFT

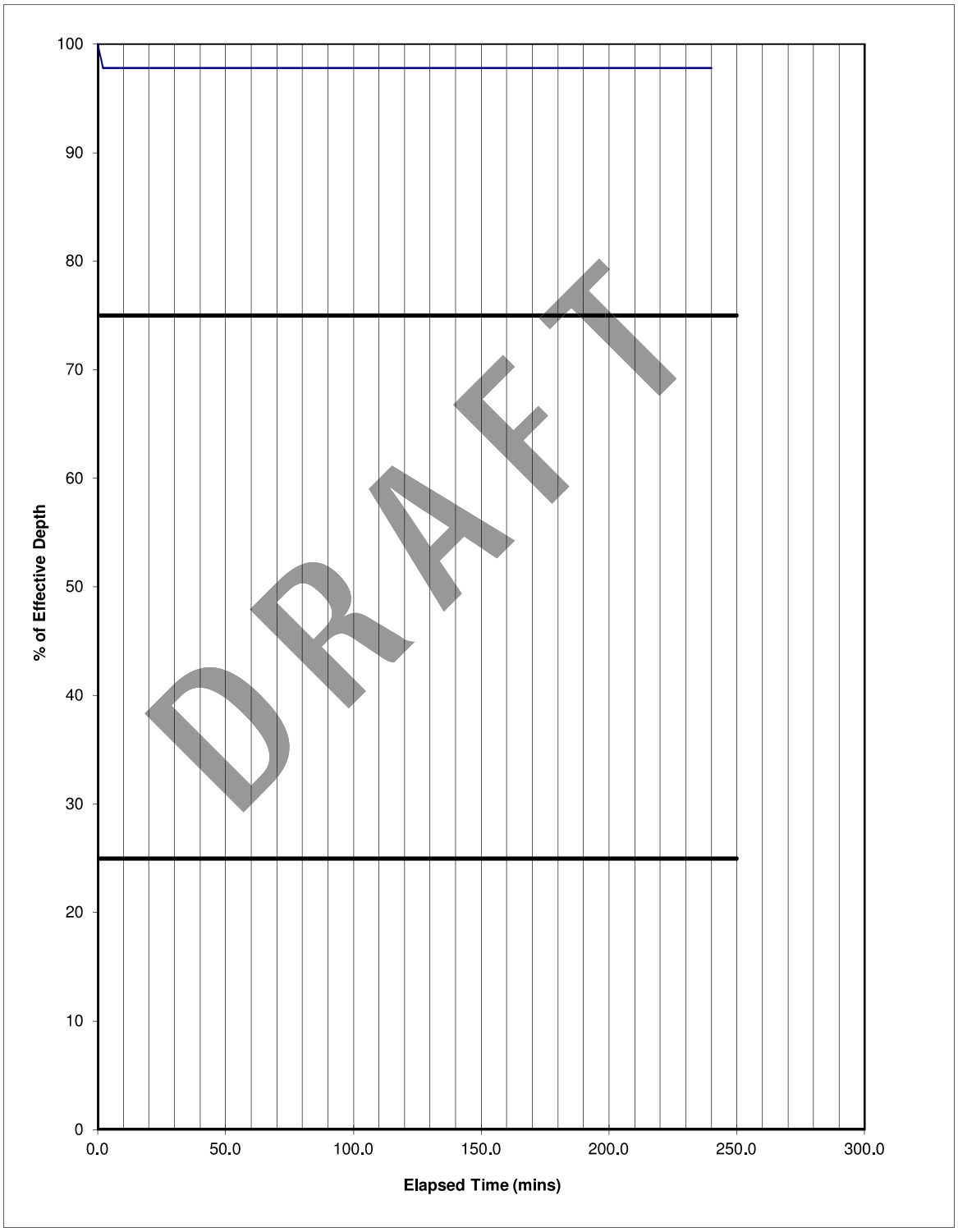
Remarks *Unable to estimate infiltration rate due to very low drop in water level.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP813
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	14/07/2020



tp75	=
tp25	=

Sheet 2

Remarks *Unable to estimate infiltration rate due to very low drop in water level.

GEOTECHNICS

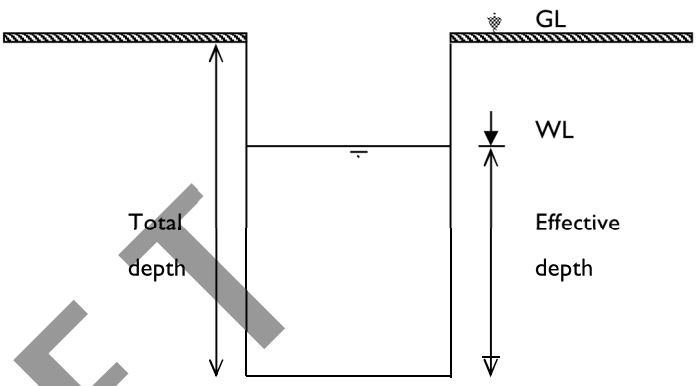
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP814
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	14/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.52	0.98	100.00
1.00	1.52	0.98	100.00
2.00	1.52	0.98	100.00
3.00	1.52	0.98	100.00
4.00	1.52	0.98	100.00
5.00	1.52	0.98	100.00
10.00	1.52	0.98	100.00
15.00	1.52	0.98	100.00
20.00	1.52	0.98	100.00
30.00	1.52	0.98	100.00
45.00	1.52	0.98	100.00
60.00	1.52	0.98	100.00
90.00	1.52	0.98	100.00
120.00	1.52	0.98	100.00
180.00	1.52	0.98	100.00
240.00	1.52	0.98	100.00

TRIAL PIT SOAKAWAY



Trial pit length	=	2.500	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.500	m
Effective depth (Head of Water)	=	0.980	m

Initial depth from GL	=	1.520m		
% of effective depth	Head (m)	Depth from GL (m)		Time (mins)
75%	0.735	1.765		0.00
25%	0.245	2.255		0.00
Vp75-25	=	0.735	m3	
ap50	=	4.538	m2	
tp75-25	=	0.000	min	
Soil Infiltration, f	=	*	m/sec	

DRAFT

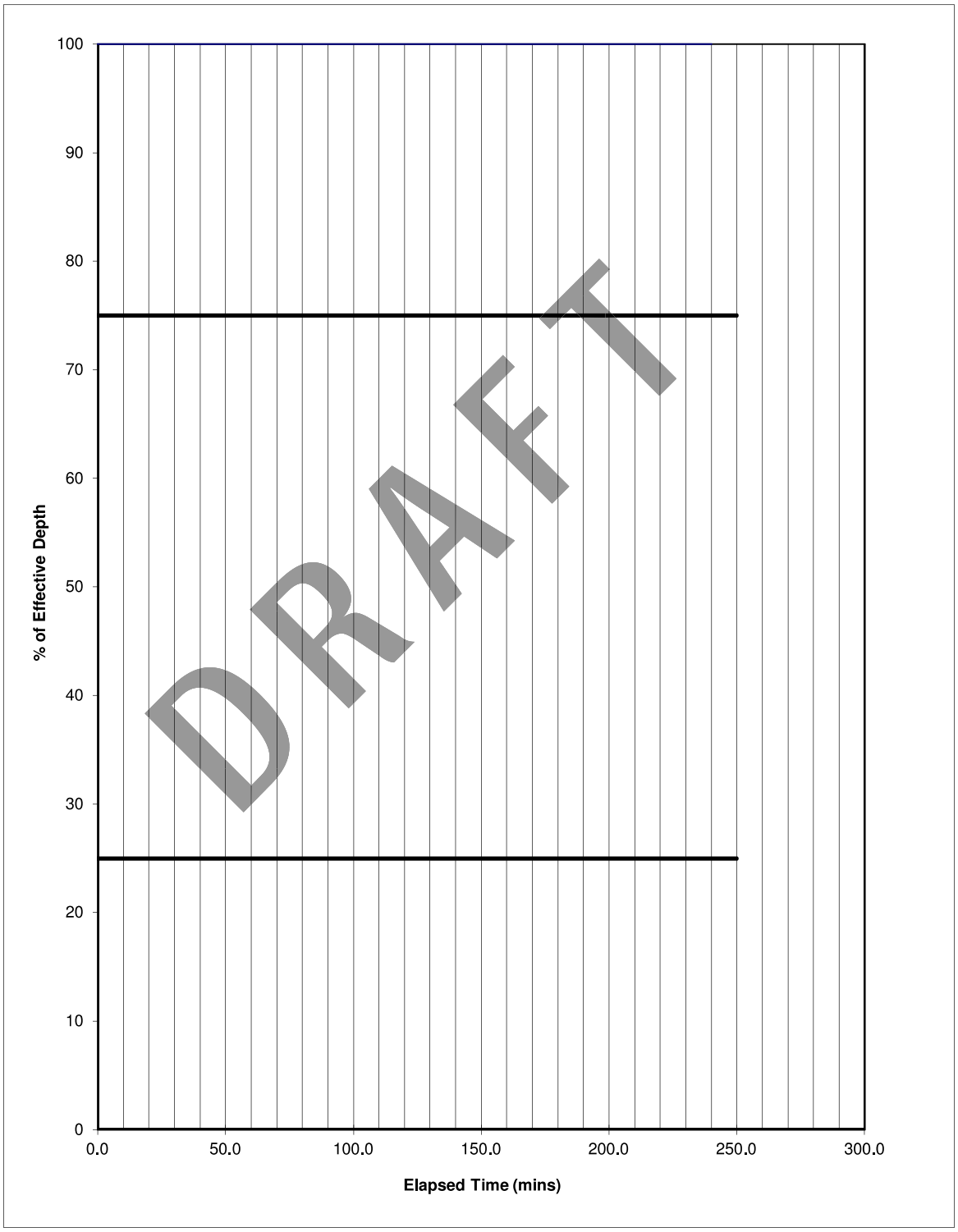
Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP814
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	14/07/2020



tp75	=
tp25	=

Sheet 2

Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

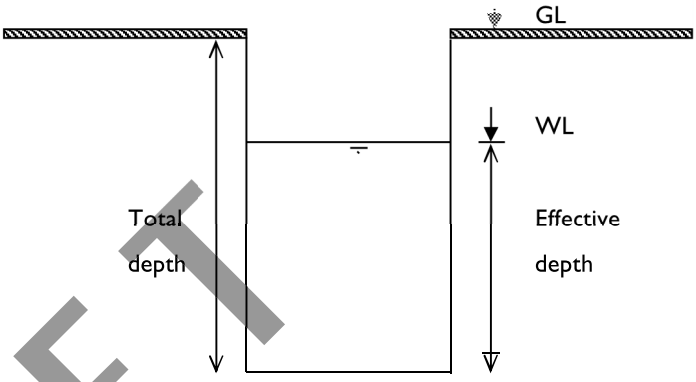
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP815
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	15/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.75	0.95	100.00
1.00	1.75	0.95	100.00
2.00	1.75	0.95	100.00
3.00	1.75	0.95	100.00
4.00	1.75	0.95	100.00
5.00	1.75	0.95	100.00
10.00	1.75	0.95	100.00
15.00	1.75	0.95	100.00
20.00	1.75	0.95	100.00
30.00	1.75	0.95	100.00
45.00	1.75	0.95	100.00
60.00	1.75	0.95	100.00
90.00	1.75	0.95	100.00
120.00	1.75	0.95	100.00
180.00	1.75	0.95	100.00
240.00	1.75	0.95	100.00

TRIAL PIT SOAKAWAY



Trial pit length	=	2.700	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.700	m
Effective depth (Head of Water)	=	0.950	m

Initial depth from GL	=	1.750m		
% of effective depth	Head (m)	Depth from GL (m)		Time (mins)
75%	0.713	1.988		0.00
25%	0.238	2.463		0.00
Vp75-25	=	0.770	m3	
ap50	=	4.755	m2	
tp75-25	=	0.000	min	
Soil Infiltration, f	=	*	m/sec	

DRAFT

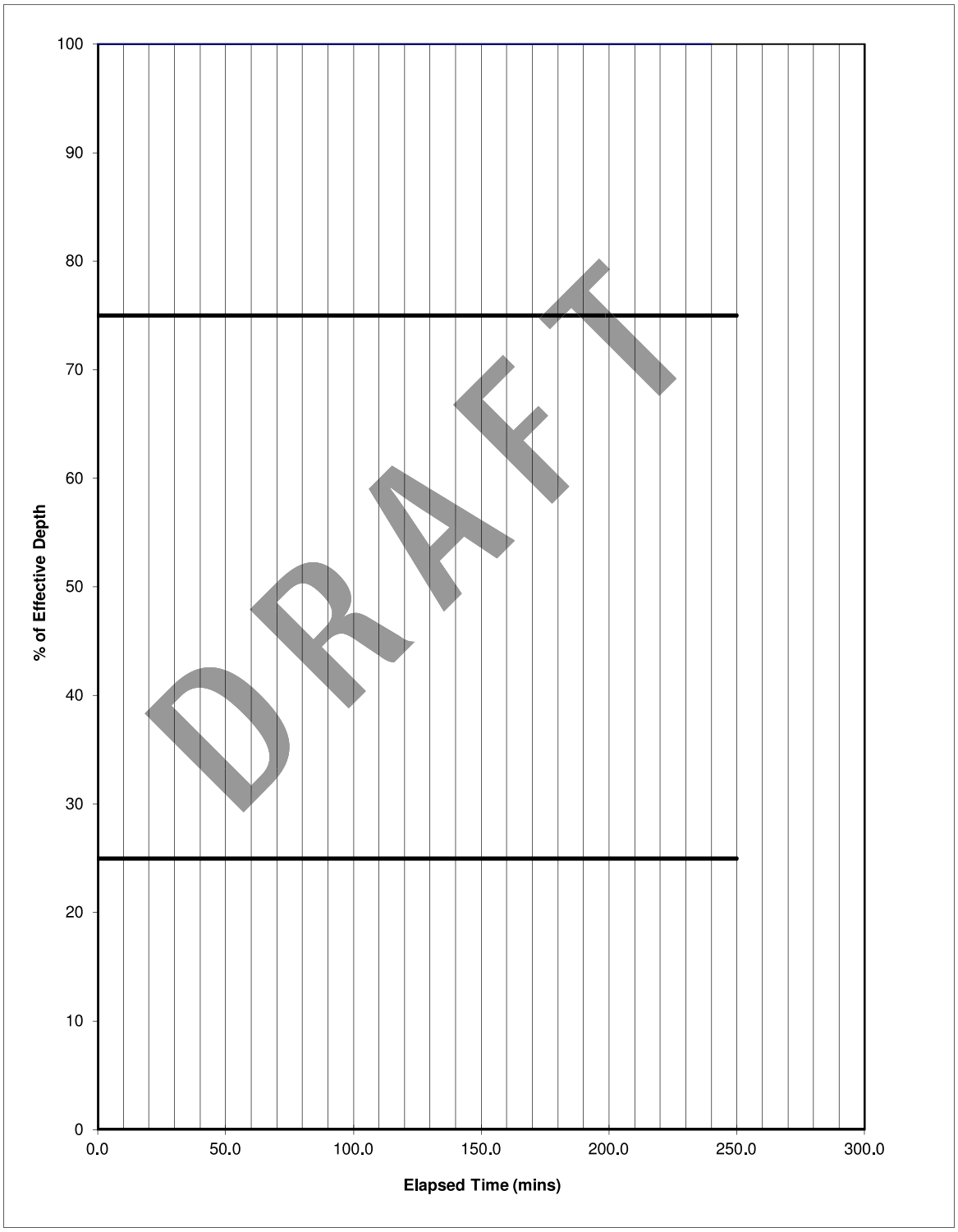
Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP815
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	15/07/2020



tp75	=
tp25	=

Sheet 2

Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

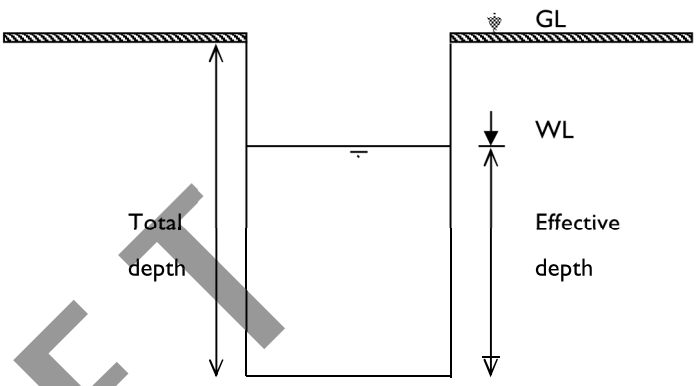
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP817
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	17/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.81	0.89	100.00
1.00	1.81	0.89	100.00
2.00	1.81	0.89	100.00
3.00	1.81	0.89	100.00
4.00	1.81	0.89	100.00
5.00	1.81	0.89	100.00
10.00	1.81	0.89	100.00
15.00	1.81	0.89	100.00
20.00	1.81	0.89	100.00
30.00	1.81	0.89	100.00
45.00	1.81	0.89	100.00
60.00	1.81	0.89	100.00
90.00	1.81	0.89	100.00
120.00	1.81	0.89	100.00
180.00	1.81	0.89	100.00
240.00	1.81	0.89	100.00

TRIAL PIT SOAKAWAY



Trial pit length	=	2.400	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.700	m
Effective depth (Head of Water)	=	0.890	m

Initial depth from GL	=	1.810m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.668	2.033	
25%	0.223	2.478	
Vp75-25	=	m3	
ap50	=	m2	
tp75-25	=	min	
Soil Infiltration, f	=	*	m/sec

DRAFT

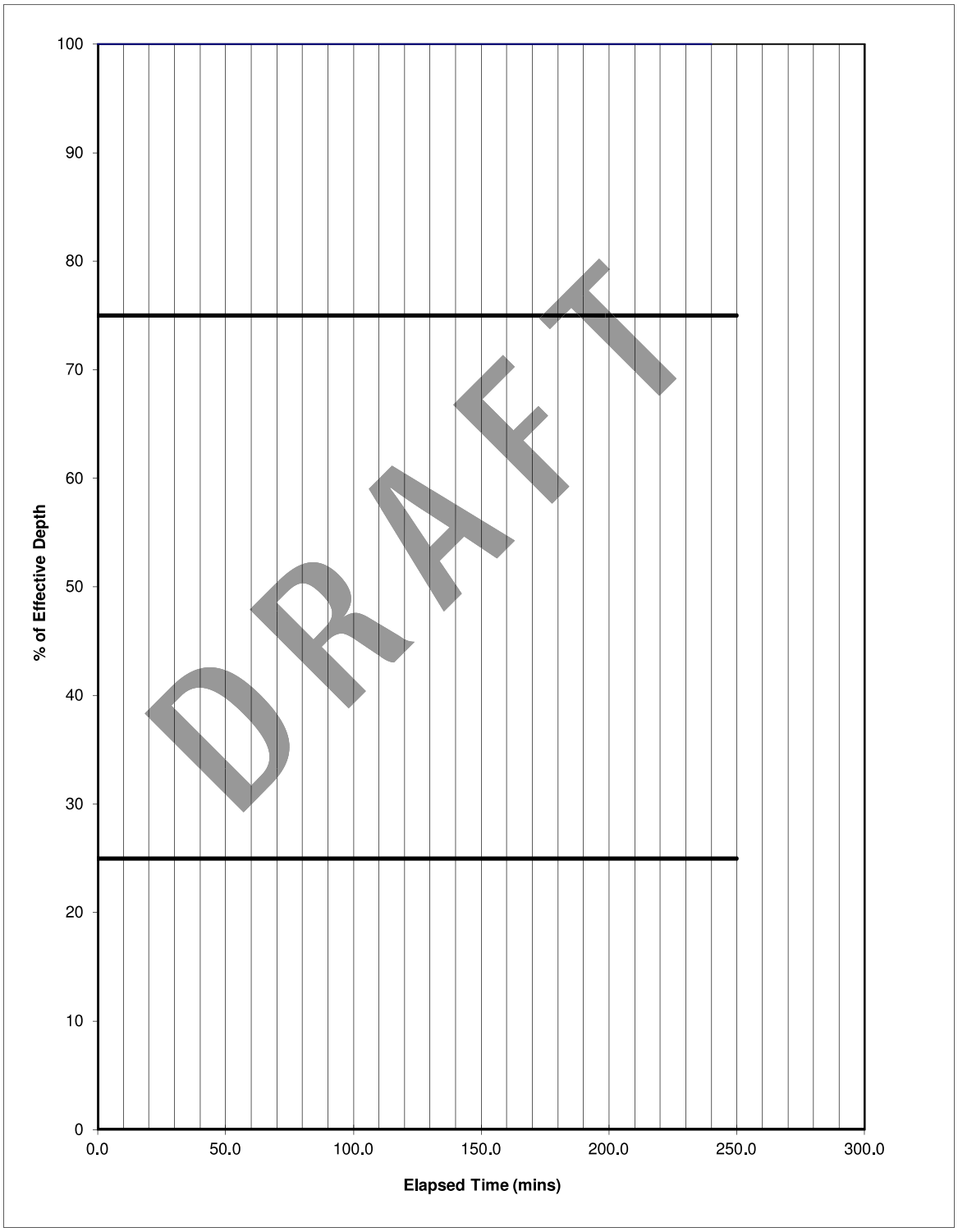
Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP817
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	17/07/2020



tp75	=
tp25	=

Sheet 2

Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

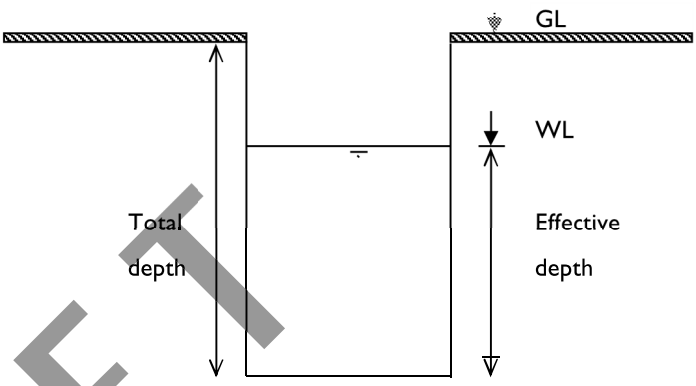
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP818
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	16/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.50	1.00	100.00
1.00	1.50	1.00	100.00
2.00	1.50	1.00	100.00
3.00	1.50	1.00	100.00
4.00	1.50	1.00	100.00
5.00	1.51	0.99	99.00
10.00	1.51	0.99	99.00
15.00	1.51	0.99	99.00
20.00	1.51	0.99	99.00
30.00	1.51	0.99	99.00
45.00	1.51	0.99	99.00
60.00	1.51	0.99	99.00
90.00	1.52	0.98	98.00
120.00	1.52	0.98	98.00
180.00	1.52	0.98	98.00
240.00	1.52	0.98	98.00

TRIAL PIT SOAKAWAY



Trial pit length	=	2.400	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.500	m
Effective depth (Head of Water)	=	1.000	m

Initial depth from GL	=	1.500m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.750	1.750	
25%	0.250	2.250	
Vp75-25	=	m3	
ap50	=	m2	
tp75-25	=	min	
Soil Infiltration, f	=	*	m/sec

DRAFT

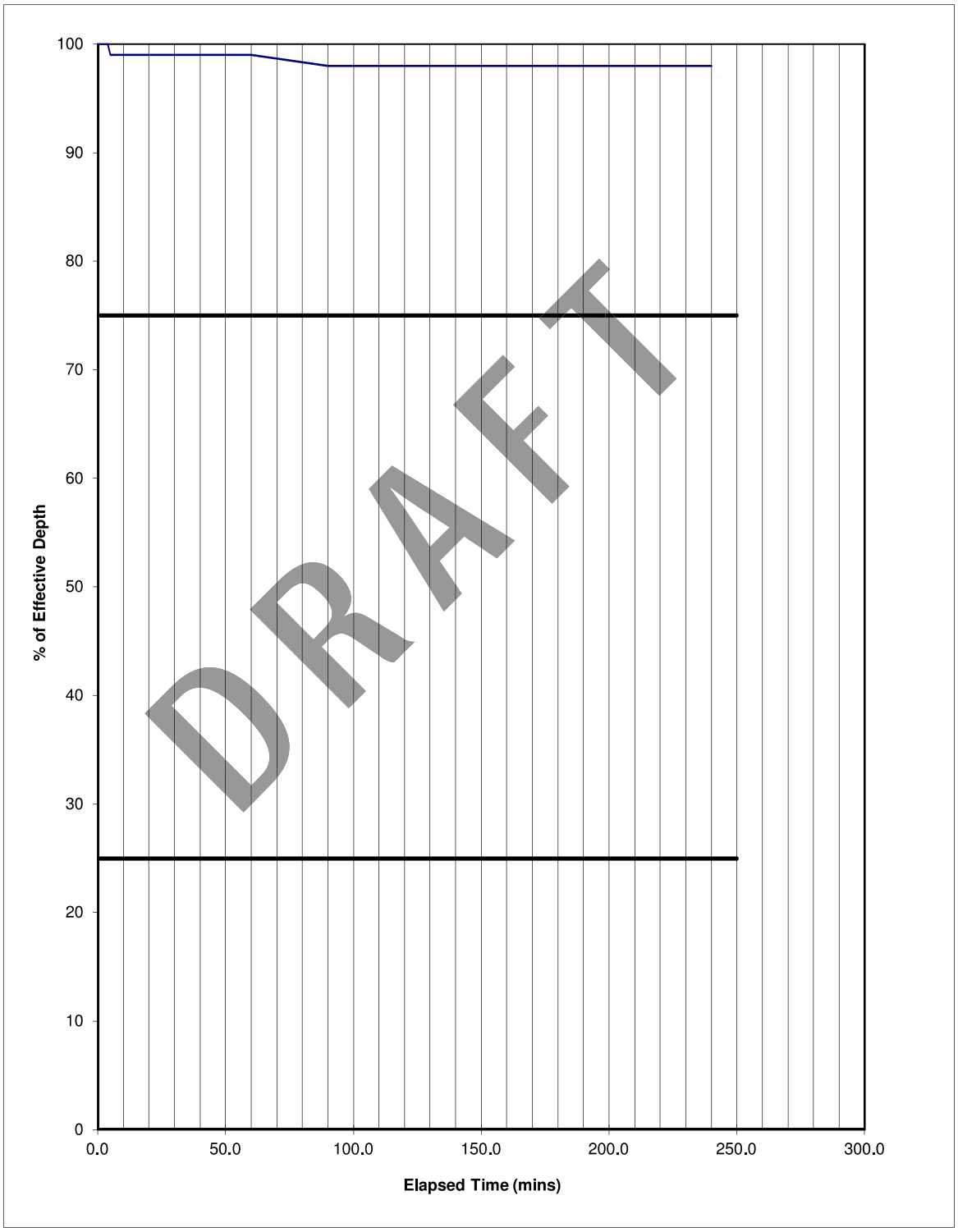
Remarks *Unable to estimate infiltration rate due to very low drop in water level.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP818
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	16/07/2020



tp75	=
tp25	=

Sheet 2

Remarks *Unable to estimate infiltration rate due to very low drop in water level.

GEOTECHNICS

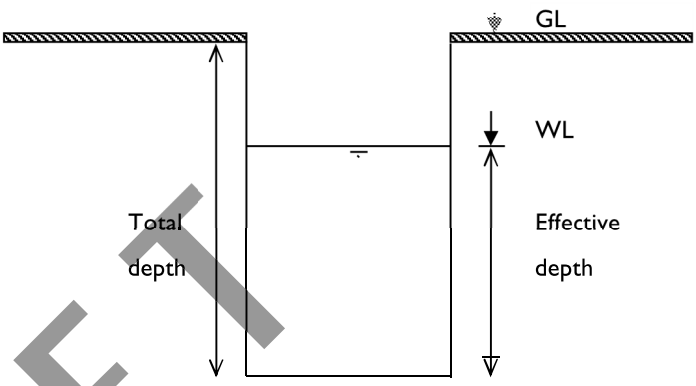
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP825
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	15/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.65	0.85	100.00
1.00	1.65	0.85	100.00
2.00	1.65	0.85	100.00
3.00	1.65	0.85	100.00
4.00	1.65	0.85	100.00
5.00	1.65	0.85	100.00
10.00	1.65	0.85	100.00
15.00	1.65	0.85	100.00
20.00	1.65	0.85	100.00
30.00	1.65	0.85	100.00
45.00	1.65	0.85	100.00
60.00	1.65	0.85	100.00
90.00	1.65	0.85	100.00
120.00	1.65	0.85	100.00
180.00	1.65	0.85	100.00
240.00	1.65	0.85	100.00

TRIAL PIT SOAKAWAY



Trial pit length	=	2.700	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.500	m
Effective depth (Head of Water)	=	0.850	m

Initial depth from GL	=	1.650m		
% of effective depth	Head (m)	Depth from GL (m)		Time (mins)
75%	0.638	1.863		0.00
25%	0.213	2.288		0.00
Vp75-25	=	0.689	m3	
ap50	=	4.425	m2	
tp75-25	=	0.000	min	
Soil Infiltration, f	=	*	m/sec	

DRAFT

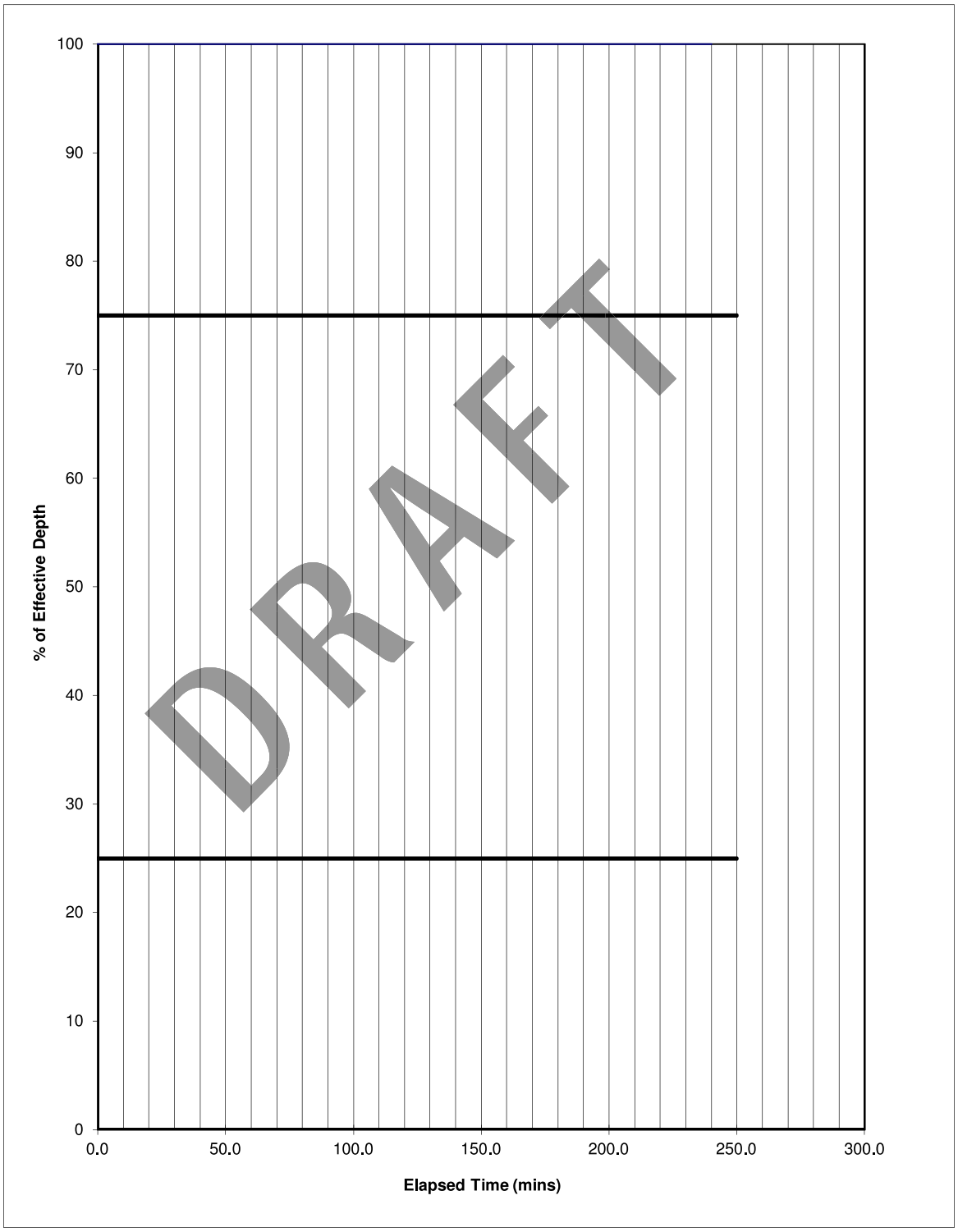
Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP825
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	15/07/2020



tp75	=
tp25	=

Sheet 2

Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

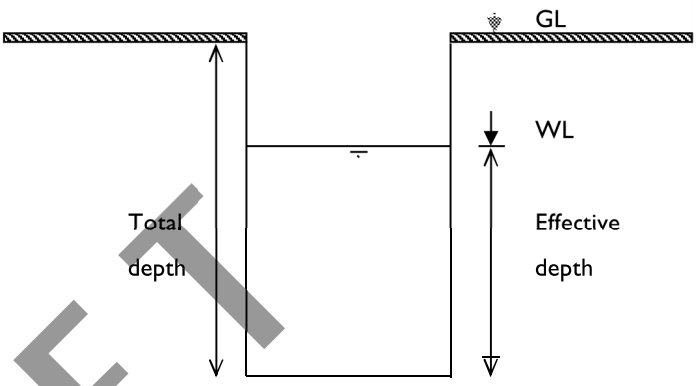
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP835
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	16/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.63	0.87	100.00
1.00	1.63	0.87	100.00
2.00	1.63	0.87	100.00
3.00	1.63	0.87	100.00
4.00	1.63	0.87	100.00
5.00	1.63	0.87	100.00
10.00	1.63	0.87	100.00
15.00	1.63	0.87	100.00
20.00	1.63	0.87	100.00
30.00	1.63	0.87	100.00
45.00	1.63	0.87	100.00
60.00	1.63	0.87	100.00
90.00	1.63	0.87	100.00
120.00	1.63	0.87	100.00
180.00	1.63	0.87	100.00
240.00	1.63	0.87	100.00

TRIAL PIT SOAKAWAY



Trial pit length	=	2.500	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.500	m
Effective depth (Head of Water)	=	0.870	m

Initial depth from GL	=	1.630m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.653	1.848	
25%	0.218	2.283	
Vp75-25	=	m3	
ap50	=	m2	
tp75-25	=	min	
Soil Infiltration, f	=	*	m/sec

DRAFT

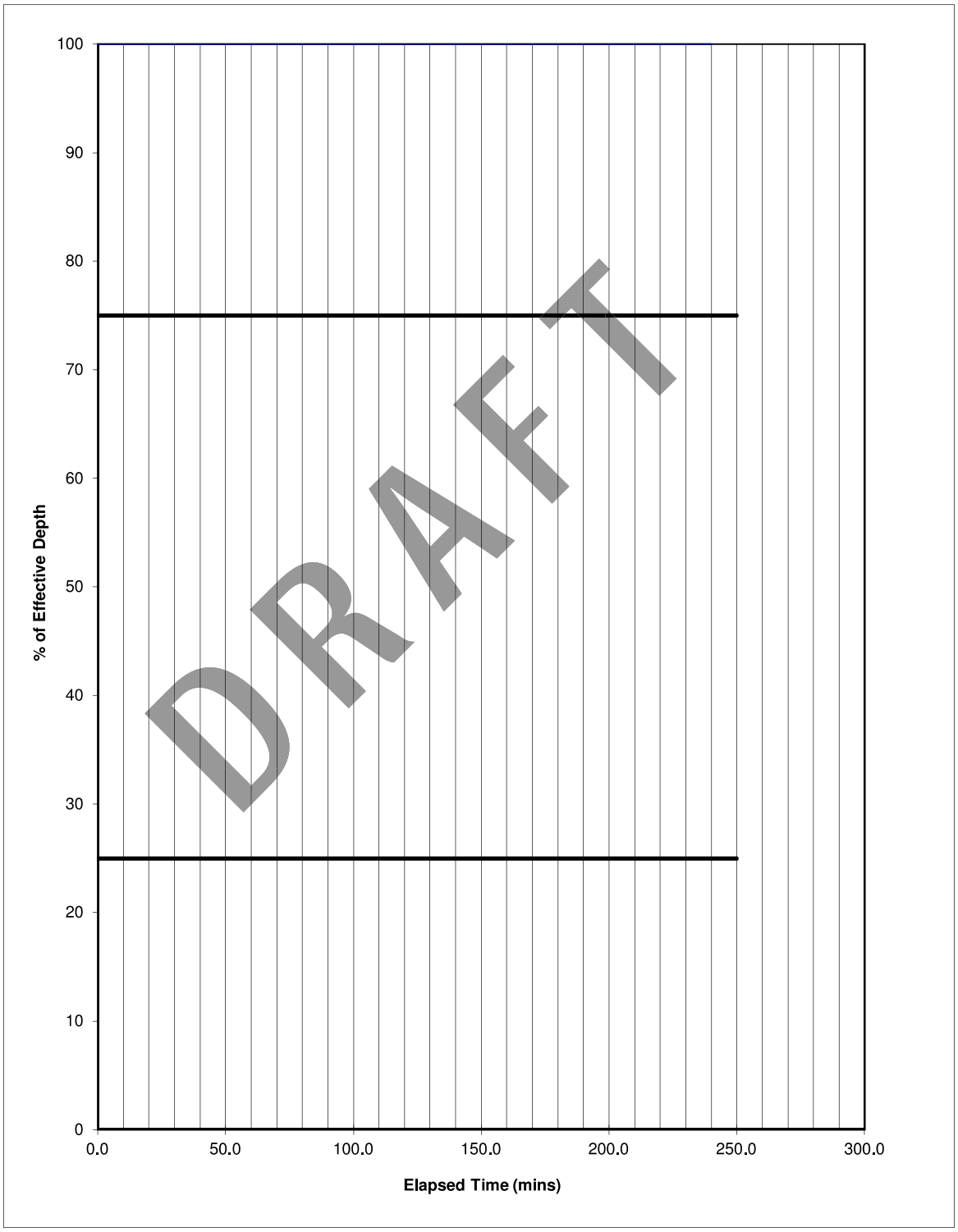
Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP835
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	16/07/2020



tp75	=
tp25	=

Sheet 2

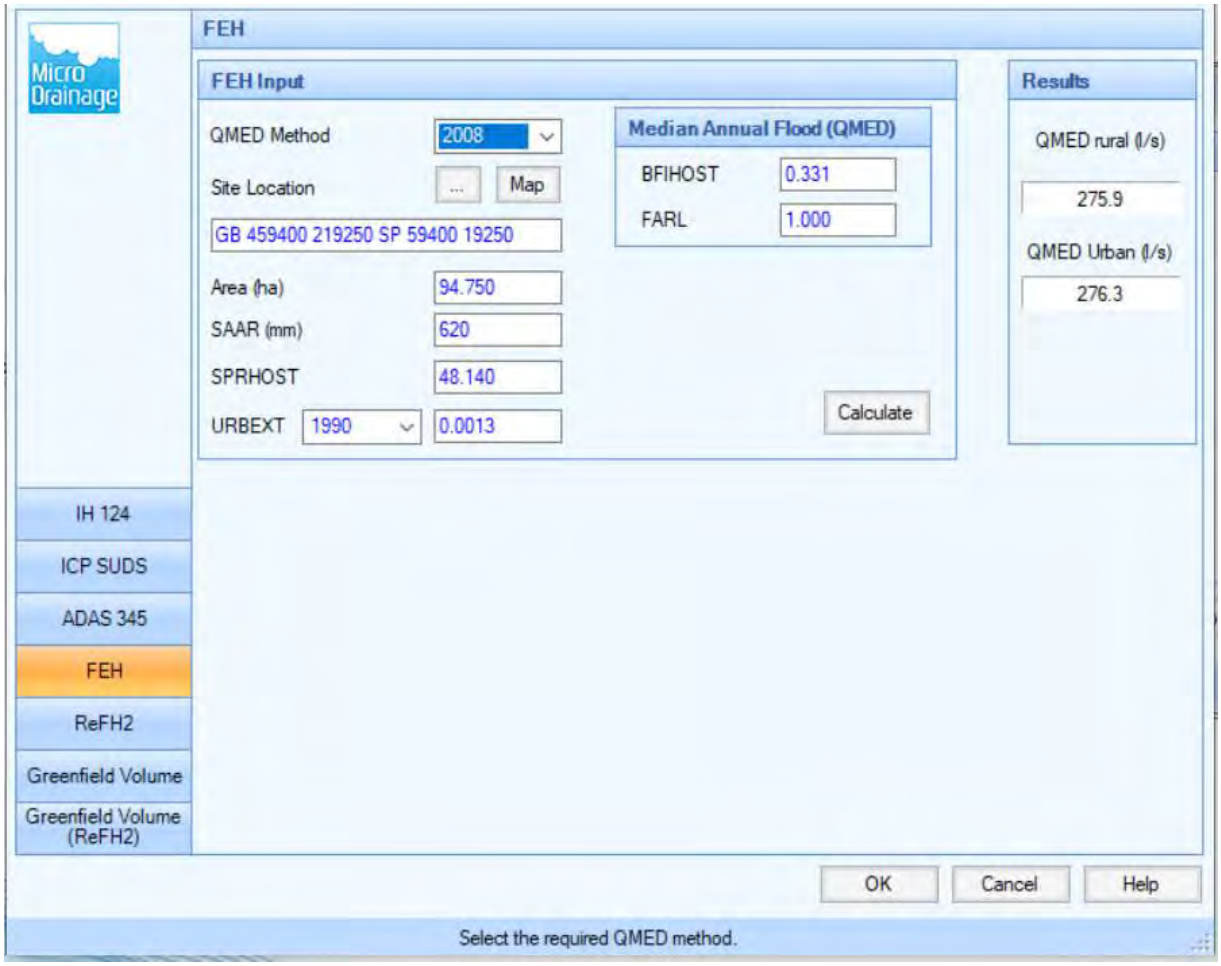
Remarks *No infiltration rate calculated as no fall in the water level recorded.

GEOTECHNICS

Appendix C

Drainage Modelling Outputs

QMed from MicroDainage



Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	David Bowles
Site name:	Graven Hill
Site location:	Bicester

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:	51.87294° N
Longitude:	1.14111° W
Reference:	1608573202
Date:	Apr 04 2022 10:59

Runoff estimation approach FEH Statistical

Site characteristics

Total site area (ha): 94.75 Catchement from FEH

Methodology

Q_{MED} estimation method: Specify QMed manually

Q_{MED} (l/s): 275.9 From MD based on FEH

Q_{BAR} / Q_{MED} factor: 1.14

Hydrological characteristics	Default	Edited
SAAR (mm):	616	616
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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.

(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.

(3) Is SPR/SPRHOST ≤ 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):	204.34	313.42	QBar (per Ha) = 313.42/94.75= 3.3 l/s/Ha
1 in 1 year (l/s):	173.69	266.41	Q1 (per Ha) = 266.41 / 94.75 = 2.81 l/s/Ha
1 in 30 years (l/s):	469.99	720.87	Q30 (per Ha) = 720.87 / 94.75 = 7.60 l/s/Ha
1 in 100 year (l/s):	651.85	999.82	Q100 (per Ha) = 999.82 / 94.75 = 10.55 l/s/Ha
1 in 200 years (l/s):	764.24	1172.2	

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.

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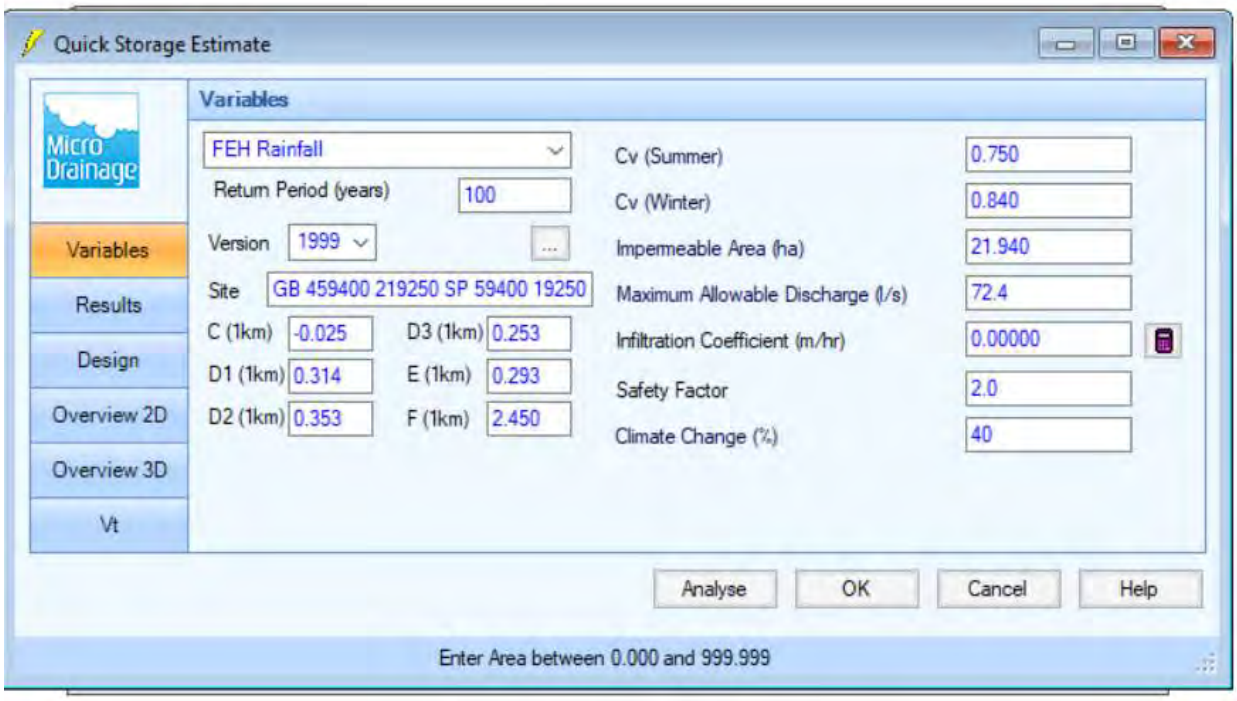
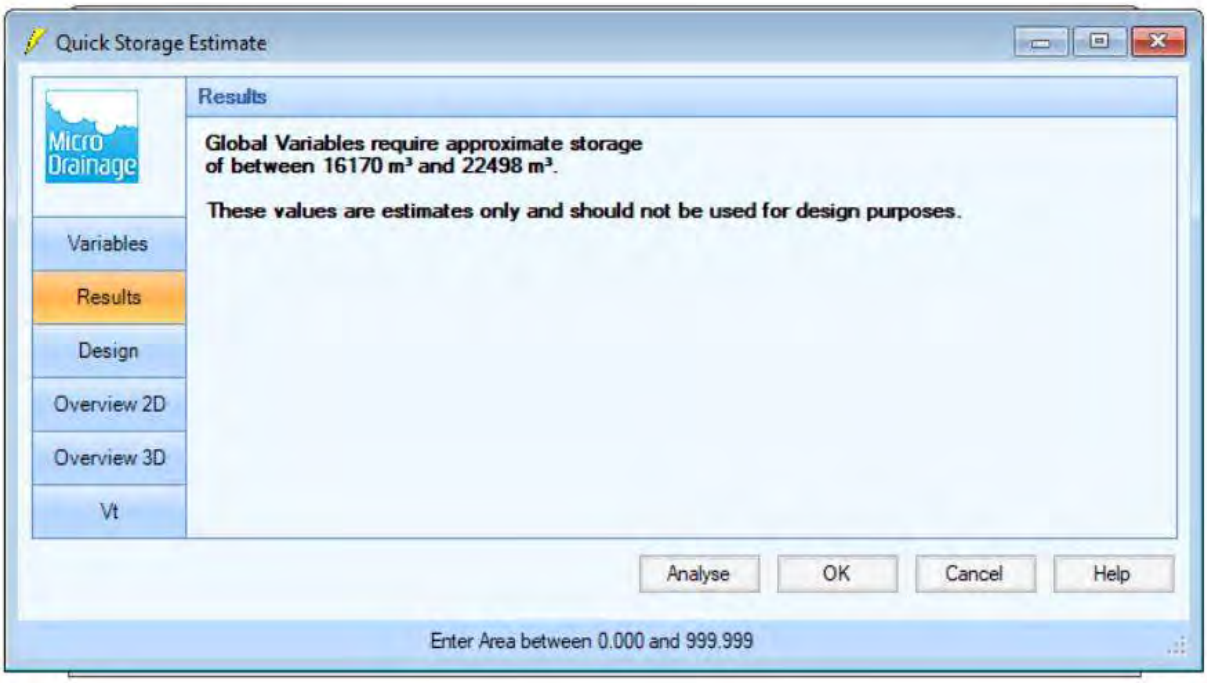
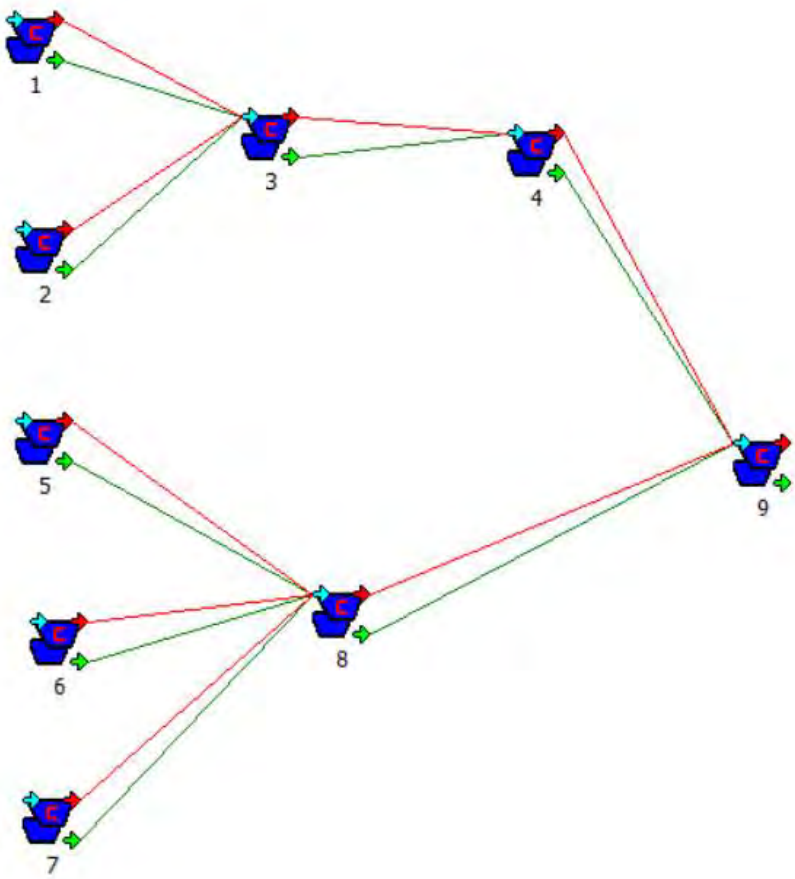
Outline Overall Attenuation Estimate





PROPOSED CASCADE MODEL



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notes

job
GRAVEN HILL SITE
D1, BICESTER

title
SUMMARY OF IMPERMEABLE AREAS MODELLED

drawn
DB

checked

date
APR '22

scale (original - A3)
NTS

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Cascade Summary of Results for 1.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	3.SRCX	3.SRCX

Half Drain Time : 1602 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	66.067	1.067	0.0	4.2	0.0	4.2	446.4	O K
30 min Summer	66.154	1.154	0.0	4.2	0.0	4.2	510.2	O K
60 min Summer	66.243	1.243	0.0	4.2	0.0	4.2	580.3	Flood Risk
120 min Summer	66.331	1.331	0.0	4.2	0.0	4.2	654.8	Flood Risk
180 min Summer	66.377	1.377	0.0	4.2	3.7	8.0	695.2	Flood Risk
240 min Summer	66.395	1.395	0.0	4.3	8.2	12.5	712.3	Flood Risk
360 min Summer	66.400	1.400	0.0	4.3	9.6	13.9	717.0	Flood Risk
480 min Summer	66.400	1.400	0.0	4.3	9.6	13.9	716.8	Flood Risk
600 min Summer	66.400	1.400	0.0	4.3	9.6	13.9	716.7	Flood Risk
720 min Summer	66.400	1.400	0.0	4.3	9.5	13.7	716.4	Flood Risk
960 min Summer	66.402	1.402	0.0	4.3	10.0	14.3	718.1	Flood Risk
1440 min Summer	66.400	1.400	0.0	4.3	9.5	13.7	716.4	Flood Risk
2160 min Summer	66.393	1.393	0.0	4.3	7.5	11.8	709.8	Flood Risk
2880 min Summer	66.385	1.385	0.0	4.2	5.6	9.9	702.9	Flood Risk
4320 min Summer	66.357	1.357	0.0	4.2	0.5	4.7	677.9	Flood Risk
5760 min Summer	66.281	1.281	0.0	4.2	0.0	4.2	611.6	Flood Risk
7200 min Summer	66.205	1.205	0.0	4.2	0.0	4.2	549.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	189.567	0.0	318.7	0.0	27
30 min Summer	108.802	0.0	314.2	0.0	42
60 min Summer	62.447	0.0	591.6	0.0	72
120 min Summer	35.841	0.0	660.6	0.0	130
180 min Summer	25.902	0.0	673.5	9.0	188
240 min Summer	20.571	0.0	695.7	31.8	244
360 min Summer	14.866	0.0	730.8	68.9	342
480 min Summer	11.807	0.0	753.1	93.3	396
600 min Summer	9.874	0.0	767.0	109.0	456
720 min Summer	8.533	0.0	775.3	118.7	522
960 min Summer	6.853	0.0	793.2	137.0	652
1440 min Summer	5.031	0.0	805.8	142.1	930
2160 min Summer	3.694	0.0	1265.3	118.2	1364
2880 min Summer	2.967	0.0	1351.3	92.5	1796
4320 min Summer	2.092	0.0	1209.8	6.5	2860
5760 min Summer	1.632	0.0	1492.4	0.0	3752
7200 min Summer	1.347	0.0	1539.0	0.0	4552

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Cascade Summary of Results for 1.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	66.131	1.131	0.0	4.2	0.0	4.2	492.8	O K
10080 min Summer	66.058	1.058	0.0	4.2	0.0	4.2	440.5	O K
15 min Winter	66.141	1.141	0.0	4.2	0.0	4.2	500.5	O K
30 min Winter	66.234	1.234	0.0	4.2	0.0	4.2	572.3	Flood Risk
60 min Winter	66.328	1.328	0.0	4.2	0.0	4.2	651.7	Flood Risk
120 min Winter	66.409	1.409	0.0	4.3	12.1	16.4	725.0	Flood Risk
180 min Winter	66.431	1.431	0.0	4.3	19.7	24.0	746.0	Flood Risk
240 min Winter	66.435	1.435	0.0	4.3	21.0	25.3	749.1	Flood Risk
360 min Winter	66.439	1.439	0.0	4.3	22.7	27.0	753.7	Flood Risk
480 min Winter	66.442	1.442	0.0	4.3	23.7	28.0	755.9	Flood Risk
600 min Winter	66.441	1.441	0.0	4.3	23.3	27.6	755.1	Flood Risk
720 min Winter	66.439	1.439	0.0	4.3	22.5	26.8	753.0	Flood Risk
960 min Winter	66.435	1.435	0.0	4.3	21.2	25.5	749.9	Flood Risk
1440 min Winter	66.426	1.426	0.0	4.3	17.9	22.2	741.1	Flood Risk
2160 min Winter	66.413	1.413	0.0	4.3	13.6	17.8	729.1	Flood Risk
2880 min Winter	66.403	1.403	0.0	4.3	10.5	14.7	719.5	Flood Risk
4320 min Winter	66.382	1.382	0.0	4.2	4.8	9.1	699.9	Flood Risk
5760 min Winter	66.359	1.359	0.0	4.2	0.8	5.0	679.6	Flood Risk
7200 min Winter	66.264	1.264	0.0	4.2	0.0	4.2	597.1	Flood Risk
8640 min Winter	66.160	1.160	0.0	4.2	0.0	4.2	514.5	O K
10080 min Winter	66.054	1.054	0.0	4.2	0.0	4.2	437.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.151	0.0	1578.1	0.0	5368
10080 min Summer	1.008	0.0	1611.8	0.0	6160
15 min Winter	189.567	0.0	315.1	0.0	27
30 min Winter	108.802	0.0	317.0	0.0	41
60 min Winter	62.447	0.0	654.0	0.0	70
120 min Winter	35.841	0.0	702.8	36.9	124
180 min Winter	25.902	0.0	749.0	83.9	178
240 min Winter	20.571	0.0	783.2	119.3	226
360 min Winter	14.866	0.0	830.0	168.5	278
480 min Winter	11.807	0.0	859.7	200.6	350
600 min Winter	9.874	0.0	879.3	222.2	424
720 min Winter	8.533	0.0	892.2	236.8	496
960 min Winter	6.853	0.0	919.1	264.6	638
1440 min Winter	5.031	0.0	945.5	283.2	918
2160 min Winter	3.694	0.0	1417.3	266.4	1344
2880 min Winter	2.967	0.0	1512.5	230.1	1784
4320 min Winter	2.092	0.0	1351.6	112.2	2768
5760 min Winter	1.632	0.0	1671.5	11.7	3968
7200 min Winter	1.347	0.0	1723.7	0.0	4968
8640 min Winter	1.151	0.0	1767.5	0.0	5800
10080 min Winter	1.008	0.0	1805.3	0.0	6656

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Cascade Rainfall Details for 1.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 459400 219250 SP 59400 19250
C (1km)	-0.025
D1 (1km)	0.314
D2 (1km)	0.353
D3 (1km)	0.253
E (1km)	0.293
F (1km)	2.450
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.270

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.424	4	8	0.423	8	12	0.423

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Cascade Model Details for 1.SRCX

Storage is Online Cover Level (m) 66.500

Complex Structure

Tank or Pond

Invert Level (m) 65.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	190.0	1.500	1000.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0092-4200-1350-4200
Design Head (m)	1.350
Design Flow (l/s)	4.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	65.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.350	4.2
Flush-Flo™	0.401	4.2
Kick-Flo®	0.820	3.3
Mean Flow over Head Range	-	3.7

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)
0.100	2.9	1.200	4.0	3.000	6.1	7.000	9.1
0.200	3.8	1.400	4.3	3.500	6.5	7.500	9.4
0.300	4.1	1.600	4.5	4.000	7.0	8.000	9.7
0.400	4.2	1.800	4.8	4.500	7.4	8.500	10.0
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.2
0.600	4.0	2.200	5.3	5.500	8.1	9.500	10.5
0.800	3.4	2.400	5.5	6.000	8.4		
1.000	3.7	2.600	5.7	6.500	8.8		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 0.500 Invert Level (m) 66.350

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Cascade Summary of Results for 2.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	3.SRCX	3.SRCX

Half Drain Time : 2236 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	68.960	0.160	0.0	1.8	0.0	1.8	200.9	O K
30 min Summer	68.983	0.183	0.0	1.8	0.0	1.8	229.9	O K
60 min Summer	69.009	0.209	0.0	1.8	0.0	1.8	262.2	O K
120 min Summer	69.037	0.237	0.0	1.8	0.0	1.8	297.7	O K
180 min Summer	69.055	0.255	0.0	1.8	0.0	1.8	319.2	O K
240 min Summer	69.067	0.267	0.0	1.8	0.0	1.8	334.5	O K
360 min Summer	69.083	0.283	0.0	1.8	0.0	1.8	355.5	O K
480 min Summer	69.095	0.295	0.0	1.8	0.0	1.8	369.3	O K
600 min Summer	69.102	0.302	0.0	1.8	0.0	1.8	379.0	O K
720 min Summer	69.108	0.308	0.0	1.8	0.0	1.8	386.0	O K
960 min Summer	69.119	0.319	0.0	1.8	0.0	1.8	399.7	O K
1440 min Summer	69.129	0.329	0.0	1.8	0.0	1.8	412.9	O K
2160 min Summer	69.130	0.330	0.0	1.8	0.0	1.8	414.2	O K
2880 min Summer	69.127	0.327	0.0	1.8	0.0	1.8	410.0	O K
4320 min Summer	69.098	0.298	0.0	1.8	0.0	1.8	374.3	O K
5760 min Summer	69.073	0.273	0.0	1.8	0.0	1.8	342.5	O K
7200 min Summer	69.050	0.250	0.0	1.8	0.0	1.8	313.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	189.567	0.0	137.1	0.0	27
30 min Summer	108.802	0.0	147.6	0.0	41
60 min Summer	62.447	0.0	230.7	0.0	72
120 min Summer	35.841	0.0	259.7	0.0	130
180 min Summer	25.902	0.0	275.0	0.0	190
240 min Summer	20.571	0.0	283.5	0.0	250
360 min Summer	14.866	0.0	289.1	0.0	368
480 min Summer	11.807	0.0	286.9	0.0	488
600 min Summer	9.874	0.0	282.4	0.0	606
720 min Summer	8.533	0.0	277.7	0.0	726
960 min Summer	6.853	0.0	267.7	0.0	964
1440 min Summer	5.031	0.0	249.3	0.0	1442
2160 min Summer	3.694	0.0	509.6	0.0	2012
2880 min Summer	2.967	0.0	508.5	0.0	2332
4320 min Summer	2.092	0.0	470.5	0.0	3028
5760 min Summer	1.632	0.0	657.6	0.0	3808
7200 min Summer	1.347	0.0	676.5	0.0	4608

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Cascade Summary of Results for 2.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	69.028	0.228	0.0	1.8	0.0	1.8	286.1	O K
10080 min Summer	69.008	0.208	0.0	1.8	0.0	1.8	261.2	O K
15 min Winter	68.980	0.180	0.0	1.8	0.0	1.8	225.1	O K
30 min Winter	69.006	0.206	0.0	1.8	0.0	1.8	257.7	O K
60 min Winter	69.035	0.235	0.0	1.8	0.0	1.8	294.2	O K
120 min Winter	69.067	0.267	0.0	1.8	0.0	1.8	334.2	O K
180 min Winter	69.086	0.286	0.0	1.8	0.0	1.8	358.7	O K
240 min Winter	69.100	0.300	0.0	1.8	0.0	1.8	376.4	O K
360 min Winter	69.120	0.320	0.0	1.8	0.0	1.8	400.9	O K
480 min Winter	69.133	0.333	0.0	1.8	0.0	1.8	417.5	O K
600 min Winter	69.143	0.343	0.0	1.8	0.0	1.8	429.6	O K
720 min Winter	69.150	0.350	0.0	1.8	0.0	1.8	438.5	O K
960 min Winter	69.164	0.364	0.0	1.8	0.0	1.8	455.8	O K
1440 min Winter	69.178	0.378	0.0	1.8	0.0	1.8	473.7	O K
2160 min Winter	69.182	0.382	0.0	1.8	0.0	1.8	479.5	O K
2880 min Winter	69.178	0.378	0.0	1.8	0.0	1.8	473.4	O K
4320 min Winter	69.141	0.341	0.0	1.8	0.0	1.8	427.8	O K
5760 min Winter	69.104	0.304	0.0	1.8	0.0	1.8	380.9	O K
7200 min Winter	69.069	0.269	0.0	1.8	0.0	1.8	337.4	O K
8640 min Winter	69.037	0.237	0.0	1.8	0.0	1.8	297.2	O K
10080 min Winter	69.008	0.208	0.0	1.8	0.0	1.8	260.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.151	0.0	691.1	0.0	5368
10080 min Summer	1.008	0.0	700.0	0.0	6152
15 min Winter	189.567	0.0	146.5	0.0	27
30 min Winter	108.802	0.0	152.1	0.0	41
60 min Winter	62.447	0.0	255.2	0.0	70
120 min Winter	35.841	0.0	281.9	0.0	128
180 min Winter	25.902	0.0	291.9	0.0	188
240 min Winter	20.571	0.0	294.2	0.0	246
360 min Winter	14.866	0.0	289.5	0.0	362
480 min Winter	11.807	0.0	283.3	0.0	480
600 min Winter	9.874	0.0	276.9	0.0	598
720 min Winter	8.533	0.0	271.2	0.0	714
960 min Winter	6.853	0.0	260.7	0.0	946
1440 min Winter	5.031	0.0	245.1	0.0	1404
2160 min Winter	3.694	0.0	528.9	0.0	2064
2880 min Winter	2.967	0.0	508.1	0.0	2684
4320 min Winter	2.092	0.0	468.0	0.0	3336
5760 min Winter	1.632	0.0	736.1	0.0	4160
7200 min Winter	1.347	0.0	757.1	0.0	4984
8640 min Winter	1.151	0.0	773.3	0.0	5800
10080 min Winter	1.008	0.0	784.4	0.0	6560

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Cascade Rainfall Details for 2.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 459400 219250 SP 59400 19250
C (1km)	-0.025
D1 (1km)	0.314
D2 (1km)	0.353
D3 (1km)	0.253
E (1km)	0.293
F (1km)	2.450
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.570

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.190	4	8	0.190	8	12	0.190

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Cascade Model Details for 2.SRCX

Storage is Online Cover Level (m) 69.500

Complex Structure

Cellular Storage

Invert Level (m) 68.800 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.33
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	3800.0	0.0	0.401	0.0	0.0
0.400	3800.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0071-1800-0500-1800
Design Head (m)	0.500
Design Flow (l/s)	1.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	71
Invert Level (m)	68.800
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	1.8
Flush-Flo™	0.148	1.8
Kick-Flo®	0.341	1.5
Mean Flow over Head Range	-	1.5

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)
0.100	1.8	1.200	2.7	3.000	4.1	7.000	6.1
0.200	1.8	1.400	2.9	3.500	4.4	7.500	6.4
0.300	1.7	1.600	3.1	4.000	4.7	8.000	6.6
0.400	1.6	1.800	3.2	4.500	4.9	8.500	6.8
0.500	1.8	2.000	3.4	5.000	5.2	9.000	7.0
0.600	2.0	2.200	3.5	5.500	5.4	9.500	7.2
0.800	2.2	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.8	6.500	5.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 69.300

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Cascade Summary of Results for 3.SRCX

Upstream Structures	Outflow To	Overflow To
1.SRCX 2.SRCX	4.SRCX	4.SRCX

Half Drain Time : 1102 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	65.398	0.898	0.0	19.3	0.0	19.3	1407.9	O K
30 min Summer	65.506	1.006	0.0	19.3	0.0	19.3	1611.2	O K
60 min Summer	65.620	1.120	0.0	19.3	0.0	19.3	1835.6	O K
120 min Summer	65.738	1.238	0.0	19.3	0.0	19.3	2076.1	Flood Risk
180 min Summer	65.807	1.307	0.0	19.3	0.0	19.3	2221.8	Flood Risk
240 min Summer	65.858	1.358	0.0	19.4	5.1	24.5	2331.7	Flood Risk
360 min Summer	65.881	1.381	0.0	19.5	37.7	57.2	2381.9	Flood Risk
480 min Summer	65.881	1.381	0.0	19.5	36.8	56.3	2380.8	Flood Risk
600 min Summer	65.880	1.380	0.0	19.5	35.9	55.4	2380.4	Flood Risk
720 min Summer	65.880	1.380	0.0	19.5	35.9	55.4	2379.9	Flood Risk
960 min Summer	65.882	1.382	0.0	19.5	39.5	59.0	2384.5	Flood Risk
1440 min Summer	65.882	1.382	0.0	19.5	39.5	59.0	2384.5	Flood Risk
2160 min Summer	65.878	1.378	0.0	19.5	31.5	51.0	2375.0	Flood Risk
2880 min Summer	65.873	1.373	0.0	19.5	23.4	42.8	2364.0	Flood Risk
4320 min Summer	65.832	1.332	0.0	19.3	0.0	19.3	2276.4	Flood Risk
5760 min Summer	65.728	1.228	0.0	19.3	0.0	19.3	2055.6	Flood Risk
7200 min Summer	65.633	1.133	0.0	19.3	0.0	19.3	1860.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	189.567	0.0	1586.5	0.0	27
30 min Summer	108.802	0.0	1533.1	0.0	42
60 min Summer	62.447	0.0	2623.5	0.0	72
120 min Summer	35.841	0.0	2935.7	0.0	130
180 min Summer	25.902	0.0	3065.0	0.0	190
240 min Summer	20.571	0.0	3086.0	5.6	250
360 min Summer	14.866	0.0	3215.0	152.8	354
480 min Summer	11.807	0.0	3300.1	258.7	410
600 min Summer	9.874	0.0	3347.8	327.6	474
720 min Summer	8.533	0.0	3370.3	370.7	534
960 min Summer	6.853	0.0	3414.4	451.5	658
1440 min Summer	5.031	0.0	3386.5	478.9	928
2160 min Summer	3.694	0.0	5703.4	396.7	1360
2880 min Summer	2.967	0.0	6007.6	302.8	1796
4320 min Summer	2.092	0.0	5373.1	0.0	2944
5760 min Summer	1.632	0.0	6836.9	0.0	3752
7200 min Summer	1.347	0.0	7046.9	0.0	4608

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Cascade Summary of Results for 3.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	65.539	1.039	0.0	19.3	0.0	19.3	1675.8	O K
10080 min Summer	65.440	0.940	0.0	19.3	0.0	19.3	1485.9	O K
15 min Winter	65.489	0.989	0.0	19.3	0.0	19.3	1578.5	O K
30 min Winter	65.606	1.106	0.0	19.3	0.0	19.3	1806.5	O K
60 min Winter	65.730	1.230	0.0	19.3	0.0	19.3	2059.1	Flood Risk
120 min Winter	65.863	1.363	0.0	19.4	9.8	29.2	2341.9	Flood Risk
180 min Winter	65.902	1.402	0.0	19.7	81.4	101.1	2428.7	Flood Risk
240 min Winter	65.905	1.405	0.0	19.7	88.5	108.2	2434.8	Flood Risk
360 min Winter	65.909	1.409	0.0	19.7	98.3	118.0	2443.4	Flood Risk
480 min Winter	65.912	1.412	0.0	19.7	104.6	124.3	2449.4	Flood Risk
600 min Winter	65.912	1.412	0.0	19.7	104.6	124.3	2449.0	Flood Risk
720 min Winter	65.910	1.410	0.0	19.7	100.8	120.5	2445.7	Flood Risk
960 min Winter	65.908	1.408	0.0	19.7	94.6	114.3	2440.8	Flood Risk
1440 min Winter	65.901	1.401	0.0	19.6	79.1	98.7	2426.1	Flood Risk
2160 min Winter	65.892	1.392	0.0	19.6	59.2	78.8	2406.5	Flood Risk
2880 min Winter	65.885	1.385	0.0	19.5	45.1	64.6	2391.5	Flood Risk
4320 min Winter	65.871	1.371	0.0	19.4	20.4	39.8	2359.0	Flood Risk
5760 min Winter	65.837	1.337	0.0	19.3	0.0	19.3	2286.0	Flood Risk
7200 min Winter	65.700	1.200	0.0	19.3	0.0	19.3	1997.5	O K
8640 min Winter	65.566	1.066	0.0	19.3	0.0	19.3	1728.3	O K
10080 min Winter	65.407	0.907	0.0	19.3	0.0	19.3	1423.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.151	0.0	7220.6	0.0	5448
10080 min Summer	1.008	0.0	7361.1	0.0	6256
15 min Winter	189.567	0.0	1547.2	0.0	27
30 min Winter	108.802	0.0	1499.4	0.0	41
60 min Winter	62.447	0.0	2888.3	0.0	70
120 min Winter	35.841	0.0	3116.2	14.0	128
180 min Winter	25.902	0.0	3301.2	203.6	178
240 min Winter	20.571	0.0	3442.7	353.6	226
360 min Winter	14.866	0.0	3631.9	562.3	274
480 min Winter	11.807	0.0	3747.4	697.9	346
600 min Winter	9.874	0.0	3818.8	789.6	416
720 min Winter	8.533	0.0	3861.2	851.8	488
960 min Winter	6.853	0.0	3944.1	969.6	626
1440 min Winter	5.031	0.0	3975.5	1051.7	902
2160 min Winter	3.694	0.0	6342.9	989.8	1324
2880 min Winter	2.967	0.0	6667.5	853.8	1760
4320 min Winter	2.092	0.0	5930.5	377.9	2736
5760 min Winter	1.632	0.0	7656.5	0.0	4096
7200 min Winter	1.347	0.0	7891.4	0.0	4976
8640 min Winter	1.151	0.0	8085.3	0.0	5880
10080 min Winter	1.008	0.0	8246.4	0.0	6768

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Cascade Rainfall Details for 3.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 459400 219250 SP 59400 19250
C (1km)	-0.025
D1 (1km)	0.314
D2 (1km)	0.353
D3 (1km)	0.253
E (1km)	0.293
F (1km)	2.450
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.000

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.333	4	8	1.333	8	12	1.334

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Cascade Model Details for 3.SRCX

Storage is Online Cover Level (m) 66.000

Complex Structure

Tank or Pond

Invert Level (m) 64.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1300.0	1.500	2275.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0191-1930-1350-1930
Design Head (m)	1.350
Design Flow (l/s)	19.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	191
Invert Level (m)	64.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.350	19.3
Flush-Flo™	0.414	19.3
Kick-Flo®	0.907	16.0
Mean Flow over Head Range	-	16.6

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)
0.100	6.6	1.200	18.2	3.000	28.3	7.000	42.5
0.200	17.6	1.400	19.6	3.500	30.4	7.500	44.0
0.300	19.0	1.600	20.9	4.000	32.5	8.000	45.4
0.400	19.3	1.800	22.1	4.500	34.4	8.500	46.7
0.500	19.2	2.000	23.3	5.000	36.1	9.000	48.0
0.600	18.9	2.200	24.4	5.500	37.9	9.500	49.3
0.800	17.7	2.400	25.4	6.000	39.5		
1.000	16.7	2.600	26.4	6.500	41.0		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 4.000 Invert Level (m) 65.850

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Cascade Summary of Results for 4.SRCX

Upstream Structures	Outflow To	Overflow To
3.SRCX	9.SRCX	9.SRCX
1.SRCX		
2.SRCX		

Half Drain Time : 117 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	63.966	0.666	0.0	36.1	2340.8	2377.0	280.8	Flood Risk
30 min Summer	63.929	0.629	0.0	35.2	1870.2	1905.4	280.8	Flood Risk
60 min Summer	63.885	0.585	0.0	33.9	1353.0	1387.0	280.8	Flood Risk
120 min Summer	63.842	0.542	0.0	32.7	914.1	946.9	280.8	Flood Risk
180 min Summer	63.818	0.518	0.0	32.0	692.8	724.9	280.8	Flood Risk
240 min Summer	63.804	0.504	0.0	31.6	573.5	605.1	280.8	Flood Risk
360 min Summer	63.785	0.485	0.0	31.5	420.4	451.4	272.0	Flood Risk
480 min Summer	63.773	0.473	0.0	31.5	337.8	368.5	265.5	Flood Risk
600 min Summer	63.765	0.465	0.0	31.5	284.0	314.4	261.1	Flood Risk
720 min Summer	63.759	0.459	0.0	31.5	245.7	276.0	257.6	Flood Risk
960 min Summer	63.751	0.451	0.0	31.5	194.8	224.9	252.8	Flood Risk
1440 min Summer	63.741	0.441	0.0	31.5	140.2	170.5	247.2	Flood Risk
2160 min Summer	63.732	0.432	0.0	31.5	98.7	129.2	242.4	Flood Risk
2880 min Summer	63.727	0.427	0.0	31.5	76.6	107.2	239.7	Flood Risk
4320 min Summer	63.721	0.421	0.0	31.5	50.9	81.6	236.1	Flood Risk
5760 min Summer	63.717	0.417	0.0	31.5	38.6	69.4	234.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	189.567	0.0	2818.4	1071.8	19
30 min Summer	108.802	0.0	2957.7	1257.1	21
60 min Summer	62.447	0.0	4332.8	1460.6	36
120 min Summer	35.841	0.0	4879.8	1676.3	72
180 min Summer	25.902	0.0	5151.2	1803.2	96
240 min Summer	20.571	0.0	5289.8	1892.4	124
360 min Summer	14.866	0.0	5610.5	2136.4	188
480 min Summer	11.807	0.0	5842.2	2312.4	248
600 min Summer	9.874	0.0	6009.9	2424.8	308
720 min Summer	8.533	0.0	6134.5	2493.4	368
960 min Summer	6.853	0.0	6382.3	2623.1	484
1440 min Summer	5.031	0.0	6669.6	2655.7	736
2160 min Summer	3.694	0.0	9387.1	2496.3	1088
2880 min Summer	2.967	0.0	9926.9	2323.8	1468
4320 min Summer	2.092	0.0	9483.0	1728.9	2160
5760 min Summer	1.632	0.0	11202.6	1471.6	2864

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Cascade Summary of Results for 4.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	63.714	0.414	0.0	31.5	29.0	59.8	232.7	Flood Risk
8640 min Summer	63.713	0.413	0.0	31.5	24.5	55.4	231.6	Flood Risk
10080 min Summer	63.711	0.411	0.0	31.5	19.0	49.8	230.6	Flood Risk
15 min Winter	63.950	0.650	0.0	35.7	2133.0	2168.7	280.8	Flood Risk
30 min Winter	63.948	0.648	0.0	35.7	2107.5	2143.2	280.8	Flood Risk
60 min Winter	63.876	0.576	0.0	33.7	1260.7	1294.5	280.8	Flood Risk
120 min Winter	63.824	0.524	0.0	32.2	746.2	778.5	280.8	Flood Risk
180 min Winter	63.801	0.501	0.0	31.5	544.9	576.4	280.7	Flood Risk
240 min Winter	63.786	0.486	0.0	31.5	431.6	462.7	272.7	Flood Risk
360 min Winter	63.769	0.469	0.0	31.5	310.5	341.1	263.4	Flood Risk
480 min Winter	63.759	0.459	0.0	31.5	245.7	276.0	257.6	Flood Risk
600 min Winter	63.752	0.452	0.0	31.5	203.5	233.6	253.7	Flood Risk
720 min Winter	63.748	0.448	0.0	31.5	180.6	210.7	251.4	Flood Risk
960 min Winter	63.746	0.446	0.0	31.5	169.5	199.7	250.2	Flood Risk
1440 min Winter	63.741	0.441	0.0	31.5	140.2	170.5	247.3	Flood Risk
2160 min Winter	63.734	0.434	0.0	31.5	105.6	136.1	243.5	Flood Risk
2880 min Winter	63.728	0.428	0.0	31.5	80.9	111.5	240.2	Flood Risk
4320 min Winter	63.717	0.417	0.0	31.5	36.9	67.7	233.7	Flood Risk
5760 min Winter	63.712	0.412	0.0	31.5	23.1	53.9	231.6	Flood Risk
7200 min Winter	63.710	0.410	0.0	31.5	17.7	48.5	230.1	Flood Risk
8640 min Winter	63.709	0.409	0.0	31.5	13.9	44.8	229.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
7200 min Summer	1.347	0.0	11548.3	1243.0	3552
8640 min Summer	1.151	0.0	11835.2	1044.7	4320
10080 min Summer	1.008	0.0	12071.2	892.4	5024
15 min Winter	189.567	0.0	2935.0	1229.6	19
30 min Winter	108.802	0.0	3107.0	1439.5	23
60 min Winter	62.447	0.0	4789.3	1671.4	44
120 min Winter	35.841	0.0	5266.3	1926.1	64
180 min Winter	25.902	0.0	5637.7	2244.6	96
240 min Winter	20.571	0.0	5921.5	2499.7	126
360 min Winter	14.866	0.0	6326.1	2851.9	186
480 min Winter	11.807	0.0	6605.7	3078.9	248
600 min Winter	9.874	0.0	6811.4	3229.6	308
720 min Winter	8.533	0.0	6968.2	3329.5	476
960 min Winter	6.853	0.0	7279.0	3520.5	612
1440 min Winter	5.031	0.0	7662.4	3644.8	894
2160 min Winter	3.694	0.0	10468.9	3525.5	1320
2880 min Winter	2.967	0.0	11058.5	3275.4	1756
4320 min Winter	2.092	0.0	10545.5	2425.7	2728
5760 min Winter	1.632	0.0	12546.0	1685.5	2848
7200 min Winter	1.347	0.0	12932.7	1335.9	3608
8640 min Winter	1.151	0.0	13253.3	1036.2	4400

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Cascade Summary of Results for 4.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	63.707	0.407	0.0	31.5	10.5	41.4	228.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Winter	1.008	0.0	13522.3	839.9	5072

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Cascade Rainfall Details for 4.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 459400 219250 SP 59400 19250
C (1km)	-0.025
D1 (1km)	0.314
D2 (1km)	0.353
D3 (1km)	0.253
E (1km)	0.293
F (1km)	2.450
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.720

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.240	4	8	1.240	8	12	1.240

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Cascade Model Details for 4.SRCX

Storage is Online Cover Level (m) 64.000

Complex Structure

Cellular Storage

Invert Level (m) 63.300 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.33
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1700.0	0.0	0.501	0.0	0.0
0.500	1700.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0248-3150-0500-3150
Design Head (m)	0.500
Design Flow (l/s)	31.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	248
Invert Level (m)	63.300
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	31.5
Flush-Flo™	0.328	31.5
Kick-Flo®	0.453	30.1
Mean Flow over Head Range	-	22.3

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)
0.100	8.1	1.200	48.0	3.000	74.8	7.000	112.5
0.200	25.4	1.400	51.7	3.500	80.6	7.500	116.6
0.300	31.4	1.600	55.1	4.000	86.0	8.000	120.5
0.400	31.0	1.800	58.4	4.500	91.1	8.500	124.2
0.500	31.5	2.000	61.4	5.000	95.9	9.000	127.9
0.600	34.4	2.200	64.3	5.500	99.5	9.500	131.4
0.800	39.5	2.400	67.1	6.000	104.0		
1.000	43.9	2.600	69.8	6.500	108.4		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 10.000 Invert Level (m) 63.700

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Cascade Summary of Results for 5.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	8.SRCX	8.SRCX

Half Drain Time : 630 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	64.931	1.431	0.0	21.5	1888.6	1910.2	1362.8	Flood Risk
30 min Summer	64.929	1.429	0.0	21.5	1864.1	1885.7	1360.0	Flood Risk
60 min Summer	64.912	1.412	0.0	21.4	1666.1	1687.5	1337.4	Flood Risk
120 min Summer	64.877	1.377	0.0	21.2	1266.1	1287.3	1290.5	Flood Risk
180 min Summer	64.851	1.351	0.0	21.0	1002.3	1023.2	1257.2	Flood Risk
240 min Summer	64.834	1.334	0.0	20.8	833.4	854.3	1234.1	Flood Risk
360 min Summer	64.810	1.310	0.0	20.7	619.5	640.2	1203.8	Flood Risk
480 min Summer	64.795	1.295	0.0	20.5	496.9	517.5	1184.6	Flood Risk
600 min Summer	64.785	1.285	0.0	20.5	420.4	440.8	1171.4	Flood Risk
720 min Summer	64.777	1.277	0.0	20.4	362.3	382.7	1161.2	Flood Risk
960 min Summer	64.766	1.266	0.0	20.3	290.5	310.9	1148.0	Flood Risk
1440 min Summer	64.753	1.253	0.0	20.2	209.4	229.6	1131.8	Flood Risk
2160 min Summer	64.742	1.242	0.0	20.1	148.0	168.1	1118.3	Flood Risk
2880 min Summer	64.736	1.236	0.0	20.1	115.2	135.3	1110.2	Flood Risk
4320 min Summer	64.727	1.227	0.0	20.0	74.5	94.6	1099.3	Flood Risk
5760 min Summer	64.722	1.222	0.0	20.0	54.7	74.6	1093.1	Flood Risk
7200 min Summer	64.718	1.218	0.0	20.0	42.0	62.0	1088.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	189.567	0.0	1954.0	855.9	18
30 min Summer	108.802	0.0	2244.9	1135.0	26
60 min Summer	62.447	0.0	2590.7	1440.7	40
120 min Summer	35.841	0.0	2974.3	1763.4	70
180 min Summer	25.902	0.0	3224.5	1951.2	98
240 min Summer	20.571	0.0	3414.5	2078.3	128
360 min Summer	14.866	0.0	3701.5	2238.7	188
480 min Summer	11.807	0.0	3919.5	2329.8	248
600 min Summer	9.874	0.0	4097.2	2380.5	308
720 min Summer	8.533	0.0	4248.3	2404.6	370
960 min Summer	6.853	0.0	4548.4	2450.6	490
1440 min Summer	5.031	0.0	5003.4	2408.8	732
2160 min Summer	3.694	0.0	5523.0	2276.2	1092
2880 min Summer	2.967	0.0	5913.8	2154.3	1460
4320 min Summer	2.092	0.0	6250.9	1752.4	2200
5760 min Summer	1.632	0.0	6510.0	1413.6	2888
7200 min Summer	1.347	0.0	6713.2	1109.9	3672

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Cascade Summary of Results for 5.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	64.715	1.215	0.0	19.9	32.1	52.0	1085.3	Flood Risk
10080 min Summer	64.713	1.213	0.0	19.9	24.5	44.4	1081.8	Flood Risk
15 min Winter	64.960	1.460	0.0	21.7	2255.6	2277.4	1402.4	Flood Risk
30 min Winter	64.948	1.448	0.0	21.7	2107.5	2129.2	1386.4	Flood Risk
60 min Winter	64.912	1.412	0.0	21.4	1660.2	1681.6	1337.2	Flood Risk
120 min Winter	64.860	1.360	0.0	21.0	1087.9	1108.9	1267.8	Flood Risk
180 min Winter	64.831	1.331	0.0	20.8	805.6	826.4	1230.2	Flood Risk
240 min Winter	64.812	1.312	0.0	20.7	640.8	661.5	1206.9	Flood Risk
360 min Winter	64.790	1.290	0.0	20.5	462.0	482.5	1178.5	Flood Risk
480 min Winter	64.777	1.277	0.0	20.4	365.8	386.2	1161.8	Flood Risk
600 min Winter	64.768	1.268	0.0	20.3	300.5	320.8	1150.5	Flood Risk
720 min Winter	64.761	1.261	0.0	20.3	258.3	278.6	1142.0	Flood Risk
960 min Winter	64.752	1.252	0.0	20.2	203.5	223.7	1130.6	Flood Risk
1440 min Winter	64.742	1.242	0.0	20.1	145.4	165.5	1117.6	Flood Risk
2160 min Winter	64.733	1.233	0.0	20.1	101.0	121.0	1106.7	Flood Risk
2880 min Winter	64.728	1.228	0.0	20.0	78.8	98.8	1100.3	Flood Risk
4320 min Winter	64.720	1.220	0.0	20.0	49.1	69.1	1091.1	Flood Risk
5760 min Winter	64.716	1.216	0.0	19.9	33.7	53.6	1085.9	Flood Risk
7200 min Winter	64.713	1.213	0.0	19.9	24.5	44.4	1082.1	Flood Risk
8640 min Winter	64.710	1.210	0.0	19.9	17.7	37.6	1079.0	Flood Risk
10080 min Winter	64.708	1.208	0.0	19.9	12.8	32.6	1076.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.151	0.0	6883.5	834.9	4400
10080 min Summer	1.008	0.0	7029.2	585.3	5144
15 min Winter	189.567	0.0	2190.3	1091.2	18
30 min Winter	108.802	0.0	2516.1	1405.5	25
60 min Winter	62.447	0.0	2902.1	1752.1	40
120 min Winter	35.841	0.0	3331.7	2122.2	68
180 min Winter	25.902	0.0	3611.9	2341.5	98
240 min Winter	20.571	0.0	3824.8	2492.7	128
360 min Winter	14.866	0.0	4146.3	2690.2	188
480 min Winter	11.807	0.0	4390.5	2809.9	248
600 min Winter	9.874	0.0	4589.6	2884.6	312
720 min Winter	8.533	0.0	4758.9	2929.3	368
960 min Winter	6.853	0.0	5095.2	3016.7	490
1440 min Winter	5.031	0.0	5606.1	3038.4	732
2160 min Winter	3.694	0.0	6186.1	2889.4	1096
2880 min Winter	2.967	0.0	6623.8	2713.4	1448
4320 min Winter	2.092	0.0	7001.0	2169.8	2132
5760 min Winter	1.632	0.0	7291.3	1678.7	2936
7200 min Winter	1.347	0.0	7519.0	1230.9	3600
8640 min Winter	1.151	0.0	7709.9	828.2	4408
10080 min Winter	1.008	0.0	7873.7	472.7	5264

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Cascade Rainfall Details for 5.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 459400 219250 SP 59400 19250
C (1km)	-0.025
D1 (1km)	0.314
D2 (1km)	0.353
D3 (1km)	0.253
E (1km)	0.293
F (1km)	2.450
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.540

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.850	4	8	1.850	8	12	1.840

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Cascade Model Details for 5.SRCX

Storage is Online Cover Level (m) 65.000

Complex Structure

Tank or Pond

Invert Level (m) 63.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	600.0	1.500	1400.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0191-1820-1000-1820
Design Head (m)	1.000
Design Flow (l/s)	18.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	191
Invert Level (m)	63.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	18.2
Flush-Flo™	0.335	18.2
Kick-Flo®	0.716	15.5
Mean Flow over Head Range	-	15.3

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)
0.100	6.6	1.200	19.8	3.000	30.7	7.000	46.2
0.200	17.4	1.400	21.3	3.500	33.1	7.500	47.8
0.300	18.1	1.600	22.7	4.000	35.3	8.000	49.3
0.400	18.1	1.800	24.0	4.500	37.3	8.500	50.8
0.500	17.7	2.000	25.3	5.000	39.3	9.000	52.2
0.600	17.2	2.200	26.5	5.500	41.1	9.500	53.6
0.800	16.3	2.400	27.6	6.000	42.9		
1.000	18.2	2.600	28.7	6.500	44.6		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 10.000 Invert Level (m) 64.700

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Cascade Summary of Results for 6.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	8.SRCX	8.SRCX

Half Drain Time : 327 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	64.465	0.665	0.0	12.1	2321.1	2333.2	412.9	Flood Risk
30 min Summer	64.413	0.613	0.0	11.7	1677.9	1689.6	412.8	Flood Risk
60 min Summer	64.372	0.572	0.0	11.3	1218.1	1229.4	412.9	Flood Risk
120 min Summer	64.335	0.535	0.0	10.9	847.5	858.4	412.9	Flood Risk
180 min Summer	64.308	0.508	0.0	10.7	602.6	613.3	412.9	Flood Risk
240 min Summer	64.293	0.493	0.0	10.6	485.2	495.7	407.1	Flood Risk
360 min Summer	64.277	0.477	0.0	10.6	362.3	372.7	393.5	Flood Risk
480 min Summer	64.266	0.466	0.0	10.6	290.5	300.8	384.8	Flood Risk
600 min Summer	64.259	0.459	0.0	10.6	245.7	255.9	378.7	Flood Risk
720 min Summer	64.254	0.454	0.0	10.6	212.3	222.5	374.1	Flood Risk
960 min Summer	64.246	0.446	0.0	10.6	169.5	179.5	368.1	Flood Risk
1440 min Summer	64.237	0.437	0.0	10.6	122.5	132.4	360.6	Flood Risk
2160 min Summer	64.230	0.430	0.0	10.6	87.4	97.3	354.5	Flood Risk
2880 min Summer	64.225	0.425	0.0	10.6	68.4	78.2	350.8	Flood Risk
4320 min Summer	64.219	0.419	0.0	10.6	45.5	55.3	345.8	Flood Risk
5760 min Summer	64.216	0.416	0.0	10.6	33.7	43.4	343.0	Flood Risk
7200 min Summer	64.213	0.413	0.0	10.6	26.0	35.7	340.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	189.567	0.0	1123.2	785.9	15
30 min Summer	108.802	0.0	1291.2	947.8	24
60 min Summer	62.447	0.0	1492.4	1126.4	32
120 min Summer	35.841	0.0	1713.9	1317.1	72
180 min Summer	25.902	0.0	1858.4	1430.4	100
240 min Summer	20.571	0.0	1968.1	1508.6	128
360 min Summer	14.866	0.0	2133.6	1611.1	188
480 min Summer	11.807	0.0	2259.4	1673.7	248
600 min Summer	9.874	0.0	2361.8	1713.0	308
720 min Summer	8.533	0.0	2448.9	1736.8	366
960 min Summer	6.853	0.0	2621.8	1783.2	488
1440 min Summer	5.031	0.0	2884.3	1796.6	728
2160 min Summer	3.694	0.0	3187.0	1736.0	1104
2880 min Summer	2.967	0.0	3412.2	1672.8	1452
4320 min Summer	2.092	0.0	3604.6	1448.0	2144
5760 min Summer	1.632	0.0	3758.4	1260.3	2896
7200 min Summer	1.347	0.0	3875.2	1091.3	3656

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Cascade Summary of Results for 6.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	64.212	0.412	0.0	10.6	21.7	31.4	339.6	Flood Risk
10080 min Summer	64.210	0.410	0.0	10.6	17.7	27.3	338.4	Flood Risk
15 min Winter	64.430	0.630	0.0	11.8	1882.5	1894.3	412.9	Flood Risk
30 min Winter	64.395	0.595	0.0	11.5	1470.0	1481.5	412.8	Flood Risk
60 min Winter	64.370	0.570	0.0	11.3	1191.6	1202.9	412.9	Flood Risk
120 min Winter	64.313	0.513	0.0	10.7	645.1	655.8	412.9	Flood Risk
180 min Winter	64.291	0.491	0.0	10.6	469.7	480.2	405.0	Flood Risk
240 min Winter	64.278	0.478	0.0	10.6	373.0	383.3	394.3	Flood Risk
360 min Winter	64.263	0.463	0.0	10.6	267.8	278.0	381.9	Flood Risk
480 min Winter	64.254	0.454	0.0	10.6	212.3	222.5	374.3	Flood Risk
600 min Winter	64.248	0.448	0.0	10.6	177.8	187.8	369.2	Flood Risk
720 min Winter	64.243	0.443	0.0	10.6	150.6	160.6	365.3	Flood Risk
960 min Winter	64.237	0.437	0.0	10.6	120.0	130.0	360.2	Flood Risk
1440 min Winter	64.229	0.429	0.0	10.6	85.2	95.1	354.0	Flood Risk
2160 min Winter	64.223	0.423	0.0	10.6	60.4	70.2	349.2	Flood Risk
2880 min Winter	64.220	0.420	0.0	10.6	47.3	57.1	346.2	Flood Risk
4320 min Winter	64.215	0.415	0.0	10.6	30.5	40.2	342.1	Flood Risk
5760 min Winter	64.212	0.412	0.0	10.6	21.7	31.4	339.6	Flood Risk
7200 min Winter	64.210	0.410	0.0	10.6	16.4	26.1	337.9	Flood Risk
8640 min Winter	64.208	0.408	0.0	10.6	12.8	22.4	336.7	Flood Risk
10080 min Winter	64.207	0.407	0.0	10.6	9.4	19.1	335.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.151	0.0	3972.4	934.8	4384
10080 min Summer	1.008	0.0	4053.8	789.8	4968
15 min Winter	189.567	0.0	1259.7	921.8	14
30 min Winter	108.802	0.0	1447.9	1104.0	26
60 min Winter	62.447	0.0	1672.3	1305.9	40
120 min Winter	35.841	0.0	1920.4	1524.0	64
180 min Winter	25.902	0.0	2082.2	1655.1	98
240 min Winter	20.571	0.0	2205.1	1747.2	126
360 min Winter	14.866	0.0	2390.6	1870.6	190
480 min Winter	11.807	0.0	2531.4	1949.4	246
600 min Winter	9.874	0.0	2646.3	2002.0	306
720 min Winter	8.533	0.0	2743.8	2037.4	370
960 min Winter	6.853	0.0	2937.6	2106.9	488
1440 min Winter	5.031	0.0	3232.4	2156.1	716
2160 min Winter	3.694	0.0	3570.1	2120.1	1076
2880 min Winter	2.967	0.0	3822.2	2030.5	1432
4320 min Winter	2.092	0.0	4038.1	1735.4	2140
5760 min Winter	1.632	0.0	4209.7	1470.1	2976
7200 min Winter	1.347	0.0	4340.7	1221.3	3520
8640 min Winter	1.151	0.0	4449.9	988.5	4424
10080 min Winter	1.008	0.0	4542.1	772.3	5032

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Cascade Rainfall Details for 6.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 459400 219250 SP 59400 19250
C (1km)	-0.025
D1 (1km)	0.314
D2 (1km)	0.353
D3 (1km)	0.253
E (1km)	0.293
F (1km)	2.450
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.200

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.066	4	8	1.067	8	12	1.067

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

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Cascade Model Details for 6.SRCX

Storage is Online Cover Level (m) 64.500

Complex Structure

Cellular Storage

Invert Level (m) 63.800 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.33
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	2500.0	0.0	0.501	0.0	0.0
0.500	2500.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0156-1060-0500-1060
Design Head (m)	0.500
Design Flow (l/s)	10.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	156
Invert Level (m)	63.800
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	10.6
Flush-Flo™	0.231	10.6
Kick-Flo®	0.399	9.5
Mean Flow over Head Range	-	8.4

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)
0.100	5.6	1.200	16.0	3.000	24.9	7.000	37.4
0.200	10.5	1.400	17.3	3.500	26.8	7.500	38.8
0.300	10.4	1.600	18.4	4.000	28.6	8.000	40.0
0.400	9.6	1.800	19.5	4.500	30.2	8.500	41.3
0.500	10.6	2.000	20.5	5.000	31.8	9.000	42.5
0.600	11.5	2.200	21.4	5.500	33.1	9.500	43.7
0.800	13.2	2.400	22.3	6.000	34.6		
1.000	14.7	2.600	23.2	6.500	36.1		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 10.000 Invert Level (m) 64.200

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Cascade Summary of Results for 7.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	8.SRCX	8.SRCX

Half Drain Time : 290 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	62.942	0.642	0.0	13.5	2227.1	2240.6	330.4	Flood Risk
30 min Summer	62.930	0.630	0.0	13.4	1984.7	1998.0	330.3	Flood Risk
60 min Summer	62.913	0.613	0.0	13.2	1657.5	1670.8	330.4	Flood Risk
120 min Summer	62.869	0.569	0.0	12.8	901.0	913.7	330.4	Flood Risk
180 min Summer	62.856	0.556	0.0	12.6	710.5	723.1	330.4	Flood Risk
240 min Summer	62.846	0.546	0.0	12.5	574.5	587.0	330.4	Flood Risk
360 min Summer	62.834	0.534	0.0	12.4	424.6	437.0	330.4	Flood Risk
480 min Summer	62.826	0.526	0.0	12.3	338.9	351.2	330.4	Flood Risk
600 min Summer	62.821	0.521	0.0	12.2	285.5	297.7	330.4	Flood Risk
720 min Summer	62.817	0.517	0.0	12.2	240.1	252.3	330.4	Flood Risk
960 min Summer	62.813	0.513	0.0	12.1	202.0	214.1	330.3	Flood Risk
1440 min Summer	62.806	0.506	0.0	12.1	140.8	152.9	330.3	Flood Risk
2160 min Summer	62.801	0.501	0.0	12.0	101.9	113.9	330.3	Flood Risk
2880 min Summer	62.797	0.497	0.0	12.0	77.2	89.2	328.3	Flood Risk
4320 min Summer	62.793	0.493	0.0	12.0	52.0	63.9	325.5	Flood Risk
5760 min Summer	62.791	0.491	0.0	12.0	38.0	49.9	323.9	Flood Risk
7200 min Summer	62.789	0.489	0.0	12.0	30.3	42.2	323.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	189.567	0.0	1285.1	957.5	17
30 min Summer	108.802	0.0	1476.4	1140.3	29
60 min Summer	62.447	0.0	1700.9	1341.6	30
120 min Summer	35.841	0.0	1953.0	1555.4	74
180 min Summer	25.902	0.0	2117.3	1680.9	98
240 min Summer	20.571	0.0	2242.2	1767.0	132
360 min Summer	14.866	0.0	2430.7	1877.4	182
480 min Summer	11.807	0.0	2574.0	1942.6	246
600 min Summer	9.874	0.0	2690.8	1981.3	294
720 min Summer	8.533	0.0	2790.1	2002.5	376
960 min Summer	6.853	0.0	2987.4	2043.8	498
1440 min Summer	5.031	0.0	3288.2	2036.6	714
2160 min Summer	3.694	0.0	3627.7	1953.9	1072
2880 min Summer	2.967	0.0	3884.3	1876.7	1428
4320 min Summer	2.092	0.0	4105.3	1616.8	2176
5760 min Summer	1.632	0.0	4276.5	1397.5	2840
7200 min Summer	1.347	0.0	4409.8	1200.8	3600

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Cascade Summary of Results for 7.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	62.788	0.488	0.0	12.0	23.2	35.1	322.1	Flood Risk
10080 min Summer	62.787	0.487	0.0	12.0	18.9	30.7	321.4	Flood Risk
15 min Winter	62.987	0.687	0.0	13.9	3215.2	3229.1	330.3	Flood Risk
30 min Winter	62.920	0.620	0.0	13.3	1780.3	1793.6	330.3	Flood Risk
60 min Winter	62.902	0.602	0.0	13.1	1447.7	1460.8	330.4	Flood Risk
120 min Winter	62.870	0.570	0.0	12.8	923.9	936.7	330.4	Flood Risk
180 min Winter	62.852	0.552	0.0	12.6	654.9	667.5	330.4	Flood Risk
240 min Winter	62.838	0.538	0.0	12.4	479.1	491.5	330.4	Flood Risk
360 min Winter	62.824	0.524	0.0	12.3	311.8	324.1	330.4	Flood Risk
480 min Winter	62.818	0.518	0.0	12.2	254.9	267.1	330.4	Flood Risk
600 min Winter	62.815	0.515	0.0	12.2	220.7	232.9	330.4	Flood Risk
720 min Winter	62.811	0.511	0.0	12.1	183.8	195.9	330.3	Flood Risk
960 min Winter	62.808	0.508	0.0	12.1	157.5	169.6	330.3	Flood Risk
1440 min Winter	62.800	0.500	0.0	12.0	98.2	110.2	330.1	Flood Risk
2160 min Winter	62.796	0.496	0.0	12.0	67.4	79.3	327.4	Flood Risk
2880 min Winter	62.793	0.493	0.0	12.0	52.0	63.9	325.8	Flood Risk
4320 min Winter	62.790	0.490	0.0	12.0	35.4	47.3	323.5	Flood Risk
5760 min Winter	62.788	0.488	0.0	12.0	23.2	35.1	322.3	Flood Risk
7200 min Winter	62.787	0.487	0.0	12.0	18.9	30.7	321.3	Flood Risk
8640 min Winter	62.786	0.486	0.0	12.0	14.9	26.7	320.6	Flood Risk
10080 min Winter	62.785	0.485	0.0	12.0	11.2	23.0	320.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Summer	1.151	0.0	4521.2	1019.1	4312
10080 min Summer	1.008	0.0	4615.7	852.7	5072
15 min Winter	189.567	0.0	1440.4	1112.6	16
30 min Winter	108.802	0.0	1654.6	1318.4	25
60 min Winter	62.447	0.0	1905.5	1546.2	36
120 min Winter	35.841	0.0	2187.8	1791.1	66
180 min Winter	25.902	0.0	2371.9	1937.3	86
240 min Winter	20.571	0.0	2511.8	2038.9	154
360 min Winter	14.866	0.0	2723.0	2173.5	206
480 min Winter	11.807	0.0	2883.4	2257.3	258
600 min Winter	9.874	0.0	3014.3	2311.6	332
720 min Winter	8.533	0.0	3125.5	2346.1	384
960 min Winter	6.853	0.0	3346.6	2414.4	476
1440 min Winter	5.031	0.0	3683.9	2449.5	722
2160 min Winter	3.694	0.0	4063.4	2378.9	1064
2880 min Winter	2.967	0.0	4350.8	2263.4	1472
4320 min Winter	2.092	0.0	4598.7	1919.7	2152
5760 min Winter	1.632	0.0	4789.9	1606.0	2832
7200 min Winter	1.347	0.0	4939.2	1314.3	3616
8640 min Winter	1.151	0.0	5064.2	1045.3	4296
10080 min Winter	1.008	0.0	5170.7	799.6	5248

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Cascade Rainfall Details for 7.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 459400 219250 SP 59400 19250
C (1km)	-0.025
D1 (1km)	0.314
D2 (1km)	0.353
D3 (1km)	0.253
E (1km)	0.293
F (1km)	2.450
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.640

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.213	4	8	1.213	8	12	1.214

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Cascade Model Details for 7.SRCX

Storage is Online Cover Level (m) 63.000

Complex Structure

Cellular Storage

Invert Level (m) 62.300 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.33
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	2000.0	0.0	0.501	0.0	0.0
0.500	2000.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0164-1200-0500-1200
Design Head (m)	0.500
Design Flow (l/s)	12.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	164
Invert Level (m)	62.300
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	12.0
Flush-Flo™	0.242	12.0
Kick-Flo®	0.405	10.9
Mean Flow over Head Range	-	9.4

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)
0.100	5.9	1.200	18.2	3.000	28.2	7.000	42.4
0.200	11.9	1.400	19.6	3.500	30.4	7.500	44.0
0.300	11.8	1.600	20.8	4.000	32.4	8.000	45.4
0.400	11.0	1.800	22.1	4.500	34.3	8.500	46.8
0.500	12.0	2.000	23.2	5.000	36.1	9.000	48.2
0.600	13.1	2.200	24.3	5.500	37.6	9.500	49.5
0.800	15.0	2.400	25.3	6.000	39.3		
1.000	16.7	2.600	26.3	6.500	40.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 20.000 Invert Level (m) 62.780

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Cascade Summary of Results for 8.SRCX

Upstream Structures	Outflow To	Overflow To
5.SRCX	9.SRCX	9.SRCX
6.SRCX		
7.SRCX		

Half Drain Time : 656 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	62.977	1.227	0.0	43.8	0.0	43.8	2600.3	Flood Risk
30 min Summer	63.098	1.348	0.0	45.2	520.7	565.9	2957.1	Flood Risk
60 min Summer	63.135	1.385	0.0	45.6	847.5	893.1	3071.2	Flood Risk
120 min Summer	63.151	1.401	0.0	45.8	1002.3	1048.1	3122.0	Flood Risk
180 min Summer	63.153	1.403	0.0	45.8	1017.2	1063.0	3126.3	Flood Risk
240 min Summer	63.148	1.398	0.0	45.8	967.7	1013.5	3111.2	Flood Risk
360 min Summer	63.135	1.385	0.0	45.6	847.5	893.1	3072.3	Flood Risk
480 min Summer	63.124	1.374	0.0	45.5	746.2	791.8	3037.9	Flood Risk
600 min Summer	63.115	1.365	0.0	45.4	662.3	707.7	3009.1	Flood Risk
720 min Summer	63.107	1.357	0.0	45.3	594.3	639.6	2984.2	Flood Risk
960 min Summer	63.096	1.346	0.0	45.2	504.8	550.0	2950.6	Flood Risk
1440 min Summer	63.079	1.329	0.0	45.0	380.1	425.1	2901.8	Flood Risk
2160 min Summer	63.064	1.314	0.0	44.8	274.3	319.1	2855.5	Flood Risk
2880 min Summer	63.053	1.303	0.0	44.7	209.4	254.0	2823.9	Flood Risk
4320 min Summer	63.037	1.287	0.0	44.5	122.5	167.0	2775.4	Flood Risk
5760 min Summer	63.026	1.276	0.0	44.4	72.5	116.8	2743.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	189.567	0.0	3508.2	0.0	42
30 min Summer	108.802	0.0	4073.9	537.3	38
60 min Summer	62.447	0.0	5783.6	1220.8	54
120 min Summer	35.841	0.0	6641.1	1944.2	84
180 min Summer	25.902	0.0	7198.7	2366.4	116
240 min Summer	20.571	0.0	7626.3	2653.6	148
360 min Summer	14.866	0.0	8267.0	3018.2	210
480 min Summer	11.807	0.0	8753.1	3228.0	272
600 min Summer	9.874	0.0	9148.7	3347.7	334
720 min Summer	8.533	0.0	9489.1	3408.0	396
960 min Summer	6.853	0.0	10155.6	3523.9	518
1440 min Summer	5.031	0.0	10349.2	3459.0	764
2160 min Summer	3.694	0.0	12341.9	3186.6	1136
2880 min Summer	2.967	0.0	13210.6	2926.5	1516
4320 min Summer	2.092	0.0	13960.6	2042.9	2304
5760 min Summer	1.632	0.0	14548.0	1303.8	3128

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Cascade Summary of Results for 8.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Summer	63.018	1.268	0.0	44.3	42.0	86.3	2720.3	Flood Risk
8640 min Summer	63.007	1.257	0.0	44.1	10.5	54.6	2687.5	Flood Risk
10080 min Summer	62.862	1.112	0.0	42.3	0.0	42.3	2279.4	O K
15 min Winter	63.092	1.342	0.0	45.1	477.4	522.5	2940.7	Flood Risk
30 min Winter	63.175	1.425	0.0	46.1	1244.7	1290.8	3194.4	Flood Risk
60 min Winter	63.198	1.448	0.0	46.4	1498.3	1544.7	3267.2	Flood Risk
120 min Winter	63.195	1.445	0.0	46.3	1470.0	1516.3	3259.1	Flood Risk
180 min Winter	63.179	1.429	0.0	46.2	1287.7	1333.8	3206.9	Flood Risk
240 min Winter	63.164	1.414	0.0	46.0	1129.0	1175.0	3159.6	Flood Risk
360 min Winter	63.140	1.390	0.0	45.7	890.1	935.8	3086.6	Flood Risk
480 min Winter	63.123	1.373	0.0	45.5	737.2	782.8	3034.7	Flood Risk
600 min Winter	63.111	1.361	0.0	45.4	628.0	673.3	2996.4	Flood Risk
720 min Winter	63.101	1.351	0.0	45.2	544.9	590.1	2966.7	Flood Risk
960 min Winter	63.088	1.338	0.0	45.1	442.9	488.0	2926.1	Flood Risk
1440 min Winter	63.070	1.320	0.0	44.9	317.3	362.1	2874.3	Flood Risk
2160 min Winter	63.056	1.306	0.0	44.7	224.3	269.0	2830.1	Flood Risk
2880 min Winter	63.047	1.297	0.0	44.6	172.2	216.8	2803.5	Flood Risk
4320 min Winter	63.033	1.283	0.0	44.4	103.3	147.7	2763.6	Flood Risk
5760 min Winter	63.024	1.274	0.0	44.3	64.3	108.7	2738.4	Flood Risk
7200 min Winter	63.017	1.267	0.0	44.2	38.6	82.9	2716.9	Flood Risk
8640 min Winter	63.008	1.258	0.0	44.1	11.6	55.8	2689.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
7200 min Summer	1.347	0.0	14991.9	650.9	4040
8640 min Summer	1.151	0.0	15372.1	81.7	5104
10080 min Summer	1.008	0.0	15693.2	0.0	6072
15 min Winter	189.567	0.0	3978.5	439.8	27
30 min Winter	108.802	0.0	4679.8	1140.8	34
60 min Winter	62.447	0.0	6480.0	1915.6	52
120 min Winter	35.841	0.0	7438.3	2745.6	84
180 min Winter	25.902	0.0	8065.6	3238.8	116
240 min Winter	20.571	0.0	8541.3	3579.6	148
360 min Winter	14.866	0.0	9258.5	4027.1	210
480 min Winter	11.807	0.0	9807.1	4300.6	272
600 min Winter	9.874	0.0	10250.1	4473.6	330
720 min Winter	8.533	0.0	10625.8	4579.6	392
960 min Winter	6.853	0.0	11378.4	4787.3	508
1440 min Winter	5.031	0.0	11744.7	4859.8	754
2160 min Winter	3.694	0.0	13821.1	4563.3	1108
2880 min Winter	2.967	0.0	14798.8	4195.2	1484
4320 min Winter	2.092	0.0	15633.2	3008.7	2296
5760 min Winter	1.632	0.0	16285.0	1942.3	3176
7200 min Winter	1.347	0.0	16803.4	981.8	4112
8640 min Winter	1.151	0.0	17232.8	146.7	5352

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Cascade Summary of Results for 8.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	62.815	1.065	0.0	41.7	0.0	41.7	2153.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Winter	1.008	0.0	17588.7	0.0	6568

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Cascade Rainfall Details for 8.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 459400 219250 SP 59400 19250
C (1km)	-0.025
D1 (1km)	0.314
D2 (1km)	0.353
D3 (1km)	0.253
E (1km)	0.293
F (1km)	2.450
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

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Cascade Model Details for 8.SRCX

Storage is Online Cover Level (m) 63.250

Complex Structure

Tank or Pond

Invert Level (m) 61.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1450.0	1.500	3250.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0264-4090-1500-4090
Design Head (m)	1.500
Design Flow (l/s)	40.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	264
Invert Level (m)	61.250
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	40.9
Flush-Flo™	0.485	40.9
Kick-Flo®	1.048	34.4
Mean Flow over Head Range	-	34.8

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)
0.100	8.4	1.200	36.7	3.000	57.1	7.000	86.2
0.200	27.2	1.400	39.6	3.500	61.5	7.500	89.1
0.300	39.3	1.600	42.2	4.000	65.7	8.000	92.0
0.400	40.6	1.800	44.6	4.500	69.5	8.500	94.7
0.500	40.9	2.000	47.0	5.000	73.2	9.000	97.4
0.600	40.6	2.200	49.2	5.500	76.6	9.500	100.0
0.800	39.3	2.400	51.3	6.000	80.0		
1.000	36.1	2.600	53.3	6.500	83.1		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 10.000 Invert Level (m) 63.000

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Cascade Summary of Results for 9.SRCX

Upstream Structures	Outflow To	Overflow To
4.SRCX	(None)	(None)
3.SRCX		
1.SRCX		
2.SRCX		
8.SRCX		
5.SRCX		
6.SRCX		
7.SRCX		

Half Drain Time : 1231 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	62.015	0.265	0.0	54.1	54.1	2655.1	O K
30 min Summer	62.023	0.273	0.0	56.4	56.4	2735.8	O K
60 min Summer	62.049	0.299	0.0	63.3	63.3	3007.8	O K
120 min Summer	62.140	0.390	0.0	71.4	71.4	3951.8	O K
180 min Summer	62.201	0.451	0.0	72.2	72.2	4594.0	O K
240 min Summer	62.245	0.495	0.0	72.4	72.4	5070.3	O K
360 min Summer	62.321	0.571	0.0	72.4	72.4	5881.4	O K
480 min Summer	62.374	0.624	0.0	72.4	72.4	6461.4	O K
600 min Summer	62.412	0.662	0.0	72.4	72.4	6879.8	O K
720 min Summer	62.440	0.690	0.0	72.4	72.4	7185.7	O K
960 min Summer	62.493	0.743	0.0	72.4	72.4	7766.9	Flood Risk
1440 min Summer	62.540	0.790	0.0	72.4	72.4	8299.0	Flood Risk
2160 min Summer	62.552	0.802	0.0	72.4	72.4	8427.4	Flood Risk
2880 min Summer	62.538	0.788	0.0	72.4	72.4	8276.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	189.567	0.0	3673.5	1343
30 min Summer	108.802	0.0	4309.4	1243
60 min Summer	62.447	0.0	8733.1	288
120 min Summer	35.841	0.0	9887.8	276
180 min Summer	25.902	0.0	10513.2	336
240 min Summer	20.571	0.0	10906.6	402
360 min Summer	14.866	0.0	11366.2	548
480 min Summer	11.807	0.0	11344.9	666
600 min Summer	9.874	0.0	11098.5	784
720 min Summer	8.533	0.0	10836.0	904
960 min Summer	6.853	0.0	10291.1	1150
1440 min Summer	5.031	0.0	9447.5	1638
2160 min Summer	3.694	0.0	19952.7	2312
2880 min Summer	2.967	0.0	20042.1	2916

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Cascade Summary of Results for 9.SRCX

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
4320 min Summer	62.402	0.652	0.0	72.4	72.4	6761.7	O K
5760 min Summer	62.312	0.562	0.0	72.4	72.4	5781.7	O K
7200 min Summer	62.233	0.483	0.0	72.3	72.3	4938.6	O K
8640 min Summer	62.164	0.414	0.0	71.8	71.8	4208.9	O K
10080 min Summer	62.135	0.385	0.0	71.3	71.3	3907.3	O K
15 min Winter	62.021	0.271	0.0	55.8	55.8	2719.7	O K
30 min Winter	62.038	0.288	0.0	60.5	60.5	2890.7	O K
60 min Winter	62.125	0.375	0.0	71.0	71.0	3794.0	O K
120 min Winter	62.236	0.486	0.0	72.4	72.4	4972.6	O K
180 min Winter	62.322	0.572	0.0	72.4	72.4	5894.1	O K
240 min Winter	62.387	0.637	0.0	72.4	72.4	6599.3	O K
360 min Winter	62.479	0.729	0.0	72.4	72.4	7617.3	Flood Risk
480 min Winter	62.544	0.794	0.0	72.4	72.4	8335.6	Flood Risk
600 min Winter	62.589	0.839	0.0	72.4	72.4	8851.1	Flood Risk
720 min Winter	62.621	0.871	0.0	72.4	72.4	9214.4	Flood Risk
960 min Winter	62.680	0.930	0.0	72.4	72.4	9885.8	Flood Risk
1440 min Winter	62.735	0.985	0.0	72.4	72.4	10522.0	Flood Risk
2160 min Winter	62.742	0.992	0.0	72.4	72.4	10596.5	Flood Risk
2880 min Winter	62.720	0.970	0.0	72.4	72.4	10344.5	Flood Risk
4320 min Winter	62.591	0.841	0.0	72.4	72.4	8871.1	Flood Risk
5760 min Winter	62.407	0.657	0.0	72.4	72.4	6824.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
4320 min Summer	2.092	0.0	18750.6	3544
5760 min Summer	1.632	0.0	25389.5	4216
7200 min Summer	1.347	0.0	26111.8	4952
8640 min Summer	1.151	0.0	26674.1	5696
10080 min Summer	1.008	0.0	26999.4	6384
15 min Winter	189.567	0.0	4204.2	1277
30 min Winter	108.802	0.0	5006.3	419
60 min Winter	62.447	0.0	9714.8	218
120 min Winter	35.841	0.0	10823.5	290
180 min Winter	25.902	0.0	11467.5	382
240 min Winter	20.571	0.0	11707.1	446
360 min Winter	14.866	0.0	11410.3	574
480 min Winter	11.807	0.0	10915.2	708
600 min Winter	9.874	0.0	10502.9	820
720 min Winter	8.533	0.0	10315.0	918
960 min Winter	6.853	0.0	10160.7	1128
1440 min Winter	5.031	0.0	9851.9	1574
2160 min Winter	3.694	0.0	21227.7	2260
2880 min Winter	2.967	0.0	20452.1	2924
4320 min Winter	2.092	0.0	18435.9	4220
5760 min Winter	1.632	0.0	28424.1	4656

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Cascade Summary of Results for 9.SRCX

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
7200 min Winter	62.286	0.536	0.0	72.4	72.4	5502.4	O K
8640 min Winter	62.182	0.432	0.0	72.0	72.0	4395.3	O K
10080 min Winter	62.137	0.387	0.0	71.3	71.3	3919.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Winter	1.347	0.0	29251.0	5416
8640 min Winter	1.151	0.0	29880.5	6160
10080 min Winter	1.008	0.0	30292.5	6808

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Cascade Rainfall Details for 9.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 459400 219250 SP 59400 19250
C (1km)	-0.025
D1 (1km)	0.314
D2 (1km)	0.353
D3 (1km)	0.253
E (1km)	0.293
F (1km)	2.450
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

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Cascade Model Details for 9.SRCX

Storage is Online Cover Level (m) 62.750

Complex Structure

Tank or Pond

Invert Level (m) 61.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	9800.0	1.000	11612.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0344-7240-1000-7240
Design Head (m)	1.000
Design Flow (l/s)	72.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	344
Invert Level (m)	61.750
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	72.4
Flush-Flo™	0.498	72.4
Kick-Flo®	0.816	65.6
Mean Flow over Head Range	-	56.6

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)
0.100	10.0	1.200	79.1	3.000	123.4	7.000	186.8
0.200	34.9	1.400	85.2	3.500	133.1	7.500	193.2
0.300	63.7	1.600	90.9	4.000	142.0	8.000	199.4
0.400	71.5	1.800	96.2	4.500	150.4	8.500	205.4
0.500	72.4	2.000	101.3	5.000	158.4	9.000	211.3
0.600	71.7	2.200	106.1	5.500	166.0	9.500	217.0
0.800	66.4	2.400	110.7	6.000	173.2		
1.000	72.4	2.600	115.1	6.500	180.1		

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Appendix D

Correspondence

File Note

Job	Graven Hill – SuDS	Circ.	
		Job no.	1923/01
		Date	14-02-2022
		From	RM

Drainage Pre-App

Attendees

Oxfordshire County Council (OCC) – Nagina Bawar (Senior LLFA Engineer)

Atelier Gooch – Gooch, Justina
Resolute Property – Mark
ABA – RM, OF

Key Points

- AG ran through the overall scheme, as Nagina was not up to speed with the proposals (she had not read the pre-app note that we had prepared). Mark clarified that we are submitting a new outline planning application

- Nagina advised that **the site should discharge at Q_Bar unless this is proven unfeasible**
    - RM tested whether the previous rates (which had different discharge rates for different events) were still acceptable – firm no
    - In first instance, OCC want the scheme to reduce rates to greenfield

- OCC are happy for below ground tanks/attenuation to be used if there is not sufficient space for open basins on the site

- RPS are pulling together the Flood Risk Assessment, which OCC would like to see as the LLFA

- Nagina suggested we should contact the EA to advise them of the scheme

- Nagina also advised that we do not need to consider urban creep – this will reduce the volume of storage required by 10% (so ~18,000m^3 vs ~20,000 m^3 of attenuation)

Next Steps

- RM to email Nagina with update pre-app note confirming the agreed strategy
- RM to review the impact of the revised storage volume on the masterplan

SEWER IMPACT STUDY

X4503 – 619

SMG 0990

PROPOSED CONNECTION AT
GRAVEN HILL SITE D & E, BICESTER GARRISON, BICESTER

FOUL SYSTEM

V2.0 April 2015

Prepared by: Girija Mulay
Checked by: Amruta Prabhu
Approved by: Fiona Macdonald

Network & Process Modelling Group
Thames Water Utilities Ltd
Power House, Island Road
Reading, Berkshire
RG2 0RP

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4.0 Thames Water Drainage Requirements 4
5.0 Sewer Impact Assessment 4
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6.0 Risks and Issues 5
7.0 Conclusions 6

Appendices

A Site Plan
B Plan Showing Local Sewers

1.0 Introduction

The following report was commissioned by Thames Water's Developer Services to investigate the capacity within the existing foul network and to ascertain the impact of a proposed new connection on the foul network at Bicester Garrison, Bicester.

The scope of the study is to undertake a preliminary desktop study based upon an existing hydraulic model.

The scope of the study includes:

- Carry out a manhole survey, pumping station survey and a short-term flow survey
- Model enhancement with manhole and pumping station survey data
- Verify the model using flow survey data
- Check the current performance of the existing network during both dry and wet weather events.
- Add development flows to the model and check the impact of additional flow to the sewer network during both dry and wet weather events.
- Suggest possible options to allow flows to be accepted into the existing network with no detriment to existing levels of service. It should be noted that these options are indicative and are likely to be subject to change based on site conditions, other utilities and requirements of third parties. However, the options indicate the feasibility of connecting the site to the sewerage system and the ability of the sewerage system to accept the development.

2.0 Background

The proposed new development is on a mixed Greenfield/Brownfield site and the Developer has proposed to accommodate 1750 residential units, a school, employment and general industries. The development area is situated in the town of Bicester, Oxfordshire, approximately 23km to the southeast of Banbury.

The development area is bounded by the A41 to the northeast and a railway line to the southwest.

The foul flow from the development area has been calculated, using the latest Thames Water guidelines, as an average gravity flow of 46.06l/s.

The development site is divided into five catchments. The flow for each catchment and connection manhole provided by Developer is as below,

Catchment 1A - Foul flow of 6.93l/s from catchment 1A has been connected to manhole SP58218201, located upstream of Rodney House Sewage Pumping Station.

Catchment 1B - Foul flow of 2.67l/s from catchment 1B has been connected to manhole SP58218201, located upstream of Rodney House Sewage Pumping Station.

Catchment 1C - Foul flow of 4.66l/s from catchment 1C has been connected to manhole SP59206201, located upstream of Graven Hill Sewage Pumping Station.

Catchment 2A - Foul flow of 1.11l/s from catchment 2A has been connected to manhole SP58200203, located upstream of Graven Hill Sewage Pumping Station.

Catchment 2B (B1a) - Foul flow of 4.01l/s from catchment 2B (B1a) has been connected to Graven Hill Sewage Pumping Station.

Catchment 2B (B2) - Foul flow of 26.68l/s from sub catchment 2B (B2) has been connected to Graven Hill Sewage Pumping Station.

A plan showing the location of the development and connection points is provided in Appendix A.

3.0 Existing Sewerage System

The area in the vicinity of the development site is served by a separate foul and surface water sewer network.

From the development site, flows would drain in a north-easterly direction towards Rodney House Sewage Pumping Station, or in a southerly direction towards Graven Hill Sewage Pumping Station. Flows ultimately arrive at Bicester Sewage Treatment Works (STW), which is located to the northwest of the development site.

Flows travel through sewers ranging from 225mm diameter to 900mm diameter from the development area towards Bicester STW.

The local foul sewers are shown in the plan provided in Appendix B.

4.0 Thames Water Drainage Requirements

It is necessary to provide separate foul and surface water drainage systems and to ensure that each system is connected to an appropriate drainage system.

As the Developer proposes to connect only foul flows into the existing network, this report only covers the impact of the foul sewage flows from the proposed development on the existing foul sewer networks adjacent to and downstream of the proposed development. Surface water flows from the proposed development are not considered in this report and should not be connected to the foul sewer network.

Additional development flows should not cause new or additional flood risk to the existing system in either dry or wet weather.

5.0 Sewer Impact Assessment

Assessment of the hydraulic loading of the foul network was carried out by means of an existing hydraulic model.

The model was enhanced with the results of a manhole and pumping station survey carried out in the study area. A flow survey was also completed to enable a verification exercise to be completed, and to confirm the current flows in the sewer network.

The proposed new development area and connection point details were added to the model and the assessment completed to identify the impact of the proposed new development.

The analysis of the catchment indicates that the foul network is responsive to rainfall, with flooding being a risk in the catchment for extreme events.

The impact of the proposed foul connection manholes was assessed based on the design flows detailed in Section 2.0.

5.1 Foul Sewers

5.1.1 Assessment of Existing Catchment

The hydraulic model indicates that the existing foul network does have available capacity downstream of the proposed connection manholes. The hydraulic model has been used to assess wet weather scenarios of various durations. During these wet weather events, the hydraulic model predicts network surcharge and flooding to occur.

5.1.2 Assessment of Development Catchment

An analysis has been completed to assess the impact of connecting the flows from the development into the public sewer. An allowance of 46.06l/s average gravity flow was used to represent the development.

Table 1: Proposed Development Connection Details

Connection	Manhole	Diameter of Outgoing Sewer
Development Site 1A	SP58218201	225mm
Development Site 1B	SP58218201	225mm
Development Site 1C	SP59206201	225mm
Development Site 2A	SP58200203	375mm
Development Site 2B (B1a)	SP58199701 (Graven Hill SPS)	---
Development Site 2B (B2)	SP58199701 (Graven Hill SPS)	---

5.1.3 Foul System Improvement Works

On removal of existing flows and inclusion of proposed development flows, the hydraulic model indicates that the foul network is able to accept the proposed development flows without causing detriment to the current level of service provided. Therefore, improvements to the existing foul sewer network would not be required.

6.0 Risks and Issues

Current understanding of the hydrology of urban environments recognises that the effective pervious area (the pervious proportion of the catchment that produces surface runoff and generates flow in the sewer) is likely to exhibit a dynamic nature in relation to increasing volumes of rainfall, i.e. the more rainfall the greater the resulting effective pervious area is likely to be.

Whilst the hydrological models deployed attempt to simulate this dynamic behaviour, there is a risk that the model, when extrapolated to storm events, will not accurately predict the flows in the system. Therefore, any potential error is multiplied when the system is tested against a large design storm.

The proposed development site is located within the Environment Agency's Risk of Flooding from Surface Water area, and the drainage of the site is therefore at risk of surface water ingress. The Developer should undertake necessary measures to ensure that the foul sewers are adequately protected against surface water ingress.

7.0 Conclusions

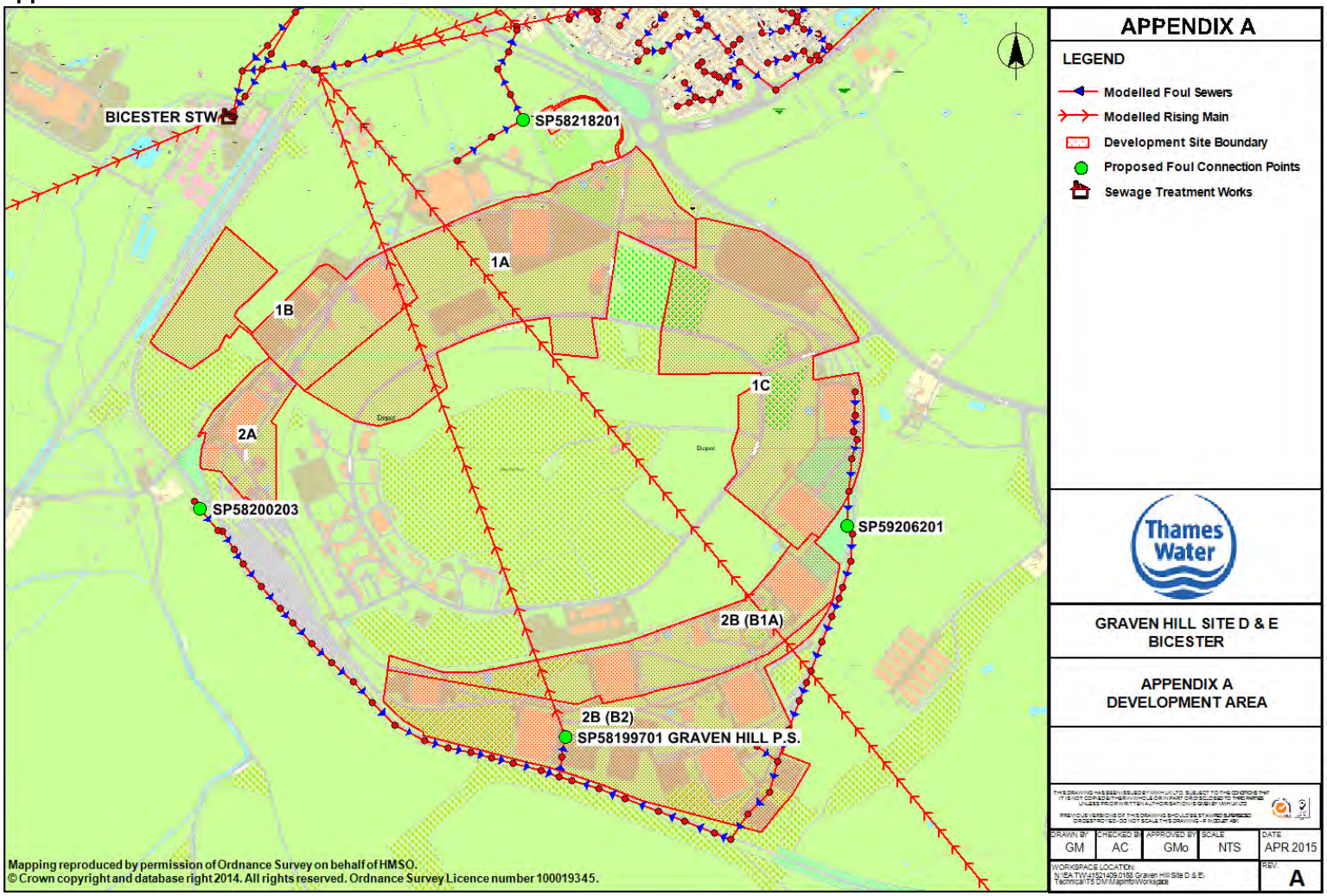
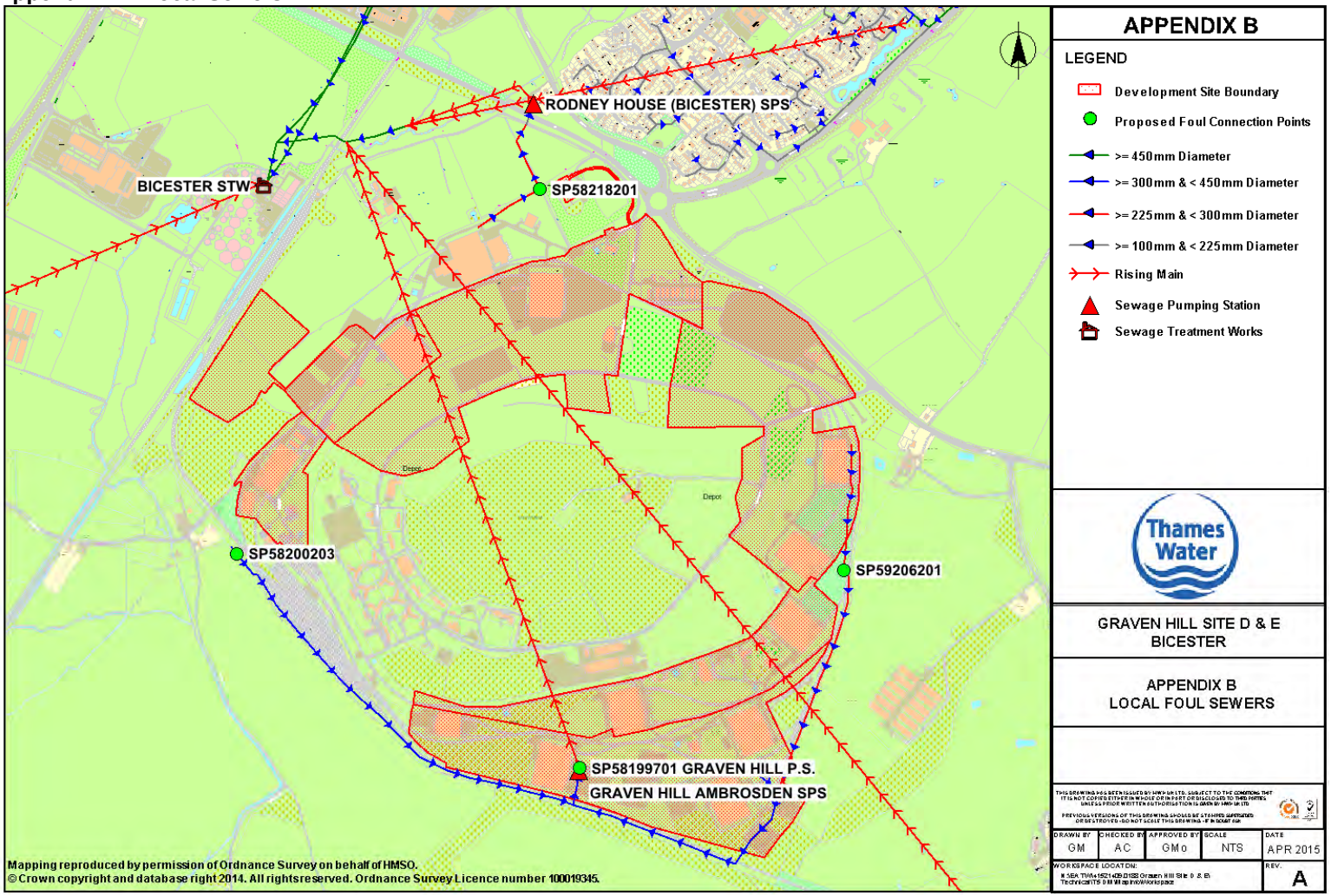
The desktop study has successfully investigated and identified the implications of the proposed new development on a mixed Greenfield/Brownfield site at Bicester Garrison, Bicester to the existing foul network.

The hydraulic model indicates that the foul network does have available capacity downstream of the proposed connection manholes to accept the proposed development flows on removal of the existing flows from the site.

Improvements to the existing foul network are not required to enable the proposed connection to the sewer network, without causing any detriment to the level of service provided.

The issues highlighted and discussed throughout this report are recommendations to Thames Water Utilities and may be altered/added to based upon local operational knowledge of the system.

Appendix A – Site Plan



Appendix B – Local Sewers