General Principals

The Training Facility is a 2 storey building together with associated roads, service areas and car parks to be constructed on part of the BAE Systems site at Samlesbury. The Samlesbury site was formerly a World War 2 airfield which was subsequently developed for aircraft component manufacture and assembly.

The total development iste area is approximately 2.89 hectares. The impermeable area associated with the first phase development is approximately 1.04hectares.

The site was undeveloped open farmland prior to the war as confirmed by reference to historic Ordnance Survey mapping. The site is currently large open grass land with a section of existing tarmac runway in the south west corner. The site area is serves by a land drainage system dating back to construction of the wartime airfield.

The ground conditions on the site, comprising generally clay soils, are such that infiltration systems are unlikely to be effective or practical. It is therefore proposed that surface water drainage from the site should discharge to the existing surface water network with flows limited to the equivalent green field run off. Copies of trial pit logs and soakaway test results are included in appendix B.

The design should where possible adopt the principles of SUDS as set out in CIRIA Best Practice Manual C523 and Design Manual C522, and as summarised in PPS25.

QBAR has been calculated using the IH124 method based on a site area of 50 hectares giving an equivalent run off of 6.6 litres/second/hectare. Preliminary design of the surface water drainage systems has been based on a permissible discharge of 5.5 litres/second/hectare. A copy of the calculation for QBAR is included in Appendix A.

Attenuation in the form of below ground cellular tanks will be incorporated in design of the surface water drainage system with a hydobrake in the final manhole to restrict flow. In addition approximately 45 linear metres of dray swale has been incorporated with the car park area to provide a SUDS element to the scheme which should provide a degree of retention but it is not anticipated that there will be any significant infiltration.

All discharge from car park areas should be passed through a class 1 bypass interceptor prior to discharge to surface water sewers.

The following criteria should be adopted for design of the surface water drainage system.

- The drainage network is to be designed as a gravity system to accommodate run off from a 1 in 2 year storm event with no surcharge.
- The network is to be checked for a 1 in 30 year storm event with surcharge permitted but with no surface flooding
- The network is to be checked for a 1 in 100 year storm event with surface flooding permitted providing that there is no risk of flooding to buildings and there is no off site overland flow.
- An allowance to be made for a 20% increase in peak rainfall intensity to account for climate change.

- The discharge from the system will be limited to the peak rural run off rate of 5.5 l/sec/hectare.

Surface water from the prosed development will be collects and discharged to the existing 450mm diameter surface water sewer which crosses the site. Flow from the site will be restricted to 6 litres/second by use of a hydrobrake in the final manhole. The design of the surface water drainage system incorporates 600m3 of cellular storage located in the car park to the north of the building.

Copies of Micro Drainage simulation output is included in appendix C for reference

All car park drainage will pass through a Class 1 by pass separator prior to discharge to the site sewers.

The surface water drainage system and attenuation has been designed to accept run off from the first phase of the Training Centre development. It has been assumed that the Training Centre extension and additional car parking will be provided with its own attenuation in the form of below ground cellular storage located at the northern end of the site.

APPENDIX A

GREEN FIELD RUN OFF QBAR

TRP Consulting		Page 1
The Landmark 21 Back Turner Street Manchester		
Date 20/01/2015 08:14 File QBAR.SRCX	Designed by timr Checked by	
Micro Drainage	Source Control 2014.1	

IH 124 Mean Annual Flood

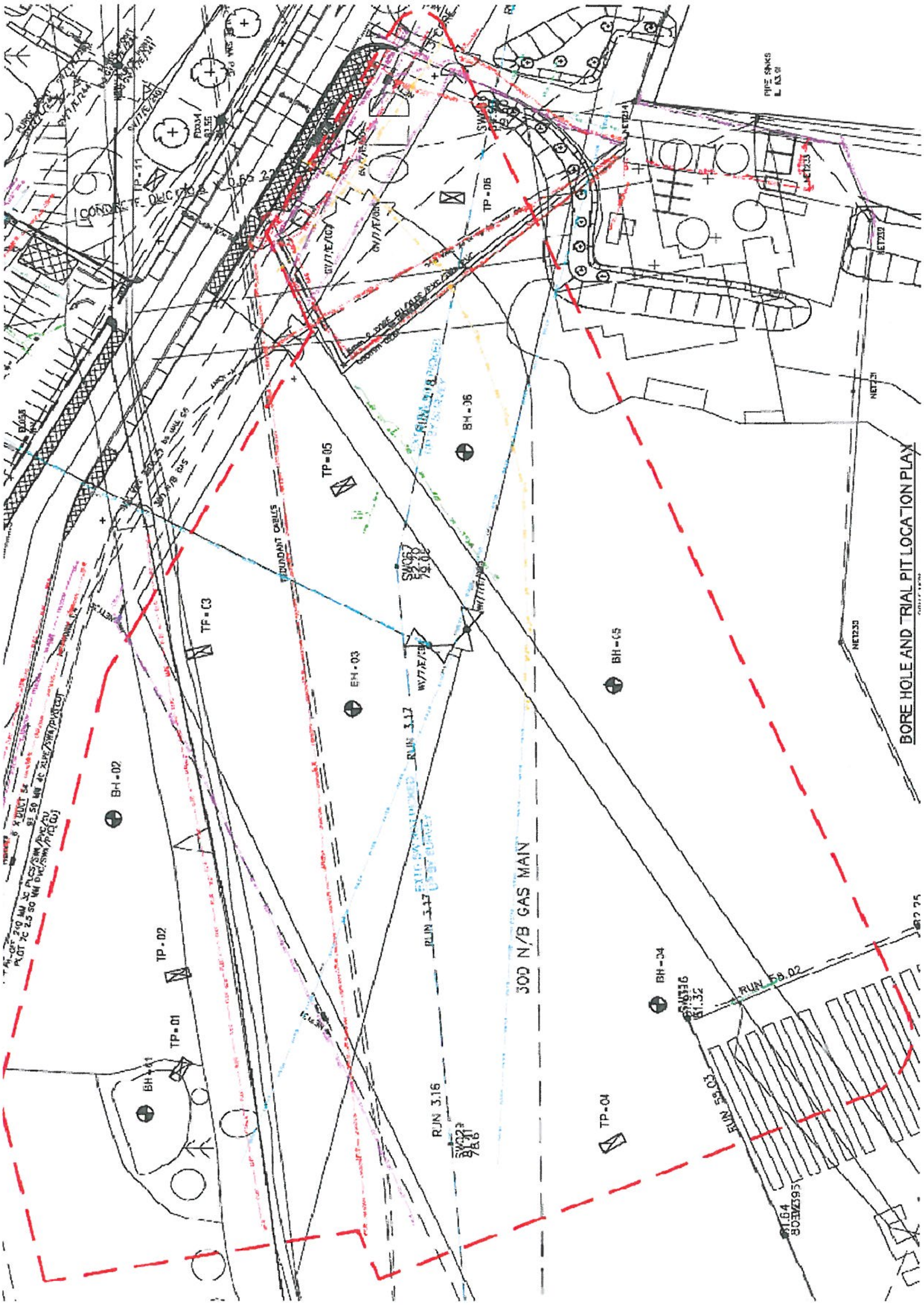
Input

Return Period (years)	2	SAAR (mm)	1000	Urban	0.000
Area (ha)	50.000	Soil	0.450	Region Number	Region 10

Results	**l/s**
QBAR Rural	333.4
QBAR Urban	333.4
Q2 years	310.5
Q1 year	290.1
Q2 years	310.5
Q5 years	396.8
Q10 years	460.1
Q20 years	524.2
Q25 years	546.8
Q30 years	565.3
Q50 years	616.8
Q100 years	693.5
Q200 years	786.8
Q250 years	816.9
Q1000 years	1013.6

APPENDIX B

SOAK AWAY TEST RESULTS AND TRIAL HOLE LOGS



SUB SURFACE SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS 3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907	Site location & Positions of Boreholes and Trial Pits			
Site ENTERPRISE ZONE, TRAINING FACILITY, BAE SAMLESBURY, LANCASHIRE	Date Drawn 12-Sep-14	Date Checked	Orientation	Job No. 5887
Client WILSON MASON LLP	Drawn By DJ	Checked By	Scale –	Figure No. 2

SUB SURFACE
SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Site	ENTERPRISE ZONE, TRAINING FACILITY, BAE SAMLESBURY, LANCASHIRE			**Trial Pit Number** TP4
Excavation Method MECHANICAL EXCAVATOR	**Dimensions** 0.50m x 1.40m x 1.20m	**Ground Level (mOD)**	**Client** WILSON MASON LLP	**Job Number** 5887
	Location AS PLAN	**Dates** 02/07/2014	**Engineer** TRP CONSULTING	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.30 0.10-0.30	B D*				(0.30) 0.30	Long grasses over dark grey and orange brown mottled gravelly slightly sandy CLAY with medium roots and rootlets (topsoil). Gravel is subangular to rounded fine to coarse quartz		
0.30-0.50	B		HV@0.30m, c=105kPa HV@0.60m, c=115kPa HV@0.80m, c=89kPa HV@1.00m, c=117kPa		(0.90)	Stiff high strength brown and grey and occasional grey brown and green brown mottled slightly gravelly slightly sandy CLAY with low cobble content of quartz. Gravel is subangular to rounded fine to coarse quartz, sandstone and siltstone becoming brown and light grey mottled with depth		
1.10 1.10 1.10	D D D		02/07/2014:DRY		1.20	Complete at 1.20m		

Plan

Remarks

D* = 1 Plastic Jar Sample, 1 Amber Glass Jar Sample, 1 Vial Sample, taken for chemical testing.
Pit sides remained stable and vertical.
Trial Pit remained dry.
HV = Hand Shear Vane test.
Soakaway tests undertaken on completion.

Scale (approx)	Logged By	Figure No.
1:25	DM/DK	5887.TP4

SUB SURFACE
SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

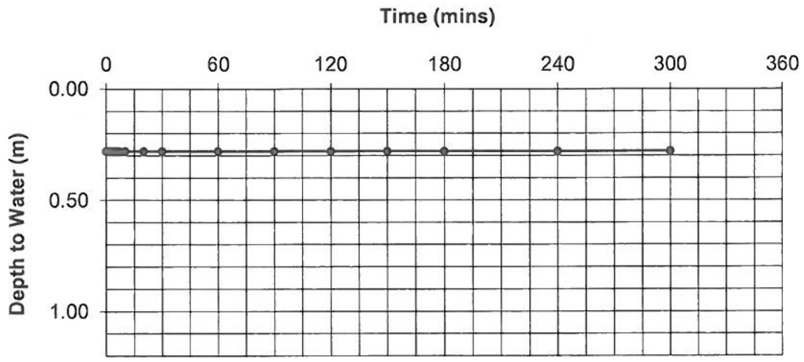
Insitu Test Results

Site:	ENTERPRISE ZONE TRAINING FACILITY, BAE SYSTEMS, SAMLESBURY	Job Number 5887
Client:	WILSON MASON LLP	Sheet: 1/2
Engineer:	TRP CONSULTING	

Soakaway Test

Hole No: TP4

TEST NO: 1
DATE: 02/07/14



Time (min)	Depth (m)
0	0.28
1	0.28
2	0.28
3	0.28
4	0.28
5	0.28
7	0.28
10	0.28
20	0.28
30	0.28
60	0.28
90	0.28
120	0.28
150	0.28
180	0.28
240	0.28
300	0.28

Length of pit:	L =	1.40	m
Width of pit:	W =	0.50	m
Depth of pit	D =	1.20	m
Base area of pit:	A =	0.70	m^2
100% effective depth	D100 =	0.28	m
75% effective depth	D75 =	0.51	m
50% effective depth	D50 =	0.74	m
25% effective depth	D25 =	0.97	m
time to D75	T75 =	_	sec
time to D25	T25 =	_	sec
time from D75 to D25 (T25 - T75)	t_{p75-25} =	N/A	sec
volume between D75 & D25 (A x (D25 - D75))	V_{p75-25} =	0.32	m^3
surface area to D50 inc. base ((2x(D-D50)x(W+L)) + A)	a_{p50} =	2.45	m^2

SOIL INFILTRATION RATE $f = \dfrac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

f = N/A* m/sec

Test Strata: 0.28 - 0.30m: Dark grey and orange brown mottled gravelly slightly sandy CLAY (Topsoil).
(see Trial Pit) 0.30 - 1.20m: Brown, grey and occasional grey brown and green brown mottled slightly gravelly slightly sandy silty CLAY.

Remarks: *Soil infiltration rate unable to be determined due to relative impermeability of the test strata.

SUB SURFACE
SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Site	Trial Pit Number
ENTERPRISE ZONE, TRAINING FACILITY, BAE SAMLESBURY, LANCASHIRE	TP5

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
MECHANICAL EXCAVATOR	0.50m x 1.30m x 1.40m		WILSON MASON LLP	5887
	Location	**Dates**	**Engineer**	**Sheet**
	AS PLAN	02/07/2014	TRP CONSULTING	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.05-0.20	B				(0.20)	TOPSOIL: grass over dark grey brown and orange brown mottled slightly gravelly slightly sandy clay with roots and rootlets. Gravel is subangular to rounded fine to coarse stone		
0.05-0.20	D*				0.20			
0.30-0.50	B		HV@0.40m, c=130kPa			Stiff high strength brown light grey and occasional green grey mottled gravelly slightly sandy CLAY with low cobble content of quartz. Gravel is subangular to rounded fine to coarse quartz, sandstone and siltstone		
			HV@0.70m, c=121kPa		(1.20)	....below 0.70m: occasional lenses of green silty sand ....below 0.80m: fissured		
1.00	D		HV@1.00m, c=130kPa			....at 1.00m: large quartz boulder		
1.40	D		HV@1.40m, c=115kPa 02/07/2014:DRY		1.40	Complete at 1.40m		

Plan

Remarks

D* = 1 Plastic Jar Sample, 1 Amber Glass Jar Sample, 1 Vial Sample, taken for chemical testing.
Pit sides remained stable and vertical.
Trial Pit remained dry.
HV = Hand Shear Vane test.
Soakway test undertaken on completion.

Scale (approx)	Logged By	Figure No.
1:25	ALM/DK	5887.TP5

SUB SURFACE
SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

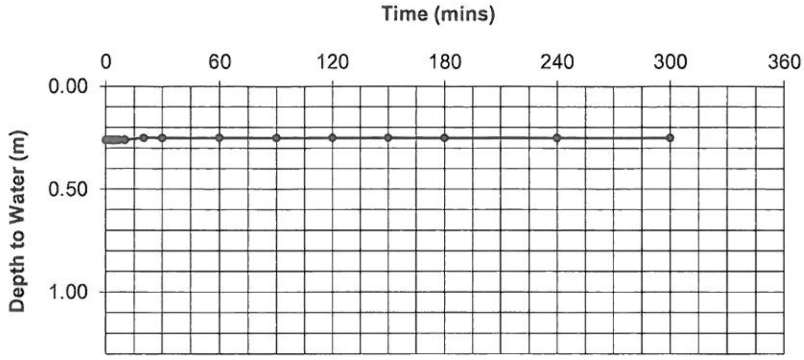
Insitu Test Results

Site:	ENTERPRISE ZONE TRAINING FACILITY, BAE SYSTEMS, SAMLESBURY	Job Number	5887
Client:	WILSON MASON LLP	Sheet:	2/2
Engineer:	TRP CONSULTING		

Soakaway Test

Hole No: TP5

TEST NO: 1
DATE: 02/07/14



Time (min)	Depth (m)
0	0.26
1	0.26
2	0.26
3	0.26
4	0.26
5	0.26
7	0.26
10	0.26
20	0.25
30	0.25
60	0.25
90	0.25
120	0.25
150	0.25
180	0.25
240	0.25
300	0.25

Length of pit:	L =	1.40	m
Width of pit:	W =	0.50	m
Depth of pit	D =	1.30	m
Base area of pit:	A =	0.70	m^2
100% effective depth	D100 =	0.26	m
75% effective depth	D75 =	0.52	m
50% effective depth	D50 =	0.78	m
25% effective depth	D25 =	1.04	m
time to D75	T75 =	_	sec
time to D25	T25 =	_	sec
time from D75 to D25 (T25 - T75)	t_{p75-25} =	N/A	sec
volume between D75 & D25 (A x (D25 - D75))	V_{p75-25} =	0.36	m^3
surface area to D50 inc. base ((2x(D-D50)x(W+L)) + A)	a_{p50} =	2.68	m^2

SOIL INFILTRATION RATE $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

f = N/A* m/sec

Test Strata:
(see Trial Pit) 0.25 - 1.40m: Brown, light grey and occasional green grey mottled gravelly slightly sandy silty CLAY.

Remarks: *Soil infiltration rate unable to be determined due to relative impermeability of the test strata.

APPENDIX C

MICRO DRAINAGE SIMULATION OUTPUT

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	Add Flow / Climate Change (%)	0
M5-60 (mm)	18.900	Minimum Backdrop Height (m)	0.200
Ratio R	0.300	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	75	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S1.000	58.200	0.625	93.1	0.126	5.00	0.0	0.600	o	225	
S1.001	58.200	0.347	167.7	0.082	0.00	0.0	0.600	o	300	
S1.002	46.081	0.274	168.2	0.071	0.00	0.0	0.600	o	300	
S1.003	72.323	0.299	241.9	0.100	0.00	0.0	0.600	o	300	
S2.000	12.819	0.127	100.9	0.047	5.00	0.0	0.600	o	150	
S2.001	24.133	0.249	96.9	0.073	0.00	0.0	0.600	o	225	
S1.004	44.823	0.185	241.9	0.000	0.00	0.0	0.600	o	300	
S1.005	4.778	0.049	98.0	0.000	0.00	0.0	0.600	o	300	
S3.000	41.446	1.470	28.2	0.029	5.00	0.0	0.600	o	150	
S3.001	36.943	0.500	73.9	0.047	0.00	0.0	0.600	o	225	
S3.002	27.745	0.240	115.6	0.151	0.00	0.0	0.600	o	225	
S3.003	24.848	0.161	154.3	0.072	0.00	0.0	0.600	o	300	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	54.32	5.72	80.902	0.126	0.0	0.0	0.0	1.36	53.9	18.6
S1.001	51.46	6.52	80.202	0.208	0.0	0.0	0.0	1.21	85.6	29.0
S1.002	49.43	7.15	79.855	0.279	0.0	0.0	0.0	1.21	85.5	37.3
S1.003	46.09	8.35	79.581	0.379	0.0	0.0	0.0	1.01	71.1	47.3
S2.000	56.34	5.21	80.900	0.047	0.0	0.0	0.0	1.00	17.7	7.2
S2.001	55.10	5.52	80.698	0.120	0.0	0.0	0.0	1.33	52.8	18.0
S1.004	44.29	9.09	79.282	0.499	0.0	0.0	0.0	1.01	71.1	59.9
S1.005	44.17	9.14	79.097	0.499	0.0	0.0	0.0	1.59	112.3	59.9
S3.000	55.72	5.36	82.100	0.029	0.0	0.0	0.0	1.90	33.6	4.4
S3.001	54.13	5.77	80.555	0.077	0.0	0.0	0.0	1.52	60.6	11.2
S3.002	52.73	6.15	80.055	0.227	0.0	0.0	0.0	1.22	48.3	32.5
S3.003	51.59	6.48	79.740	0.299	0.0	0.0	0.0	1.26	89.3	41.8

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
S4.000	51.502	0.700	73.6	0.022	5.00	0.0	0.600	o	150	
S4.001	35.673	0.212	168.2	0.147	0.00	0.0	0.600	o	225	
S5.000	18.803	0.186	100.9	0.000	5.00	0.0	0.600	o	150	
S3.004	5.800	0.024	241.6	0.000	0.00	0.0	0.600	o	300	
S3.005	12.778	0.053	241.6	0.000	0.00	0.0	0.600	o	300	
S3.006	14.110	0.061	231.3	0.073	0.00	0.0	0.600	o	375	
S1.006	16.800	0.064	261.9	0.000	0.00	0.0	0.600	o	375	
S1.007	21.422	0.079	271.2	0.000	0.00	0.0	0.600	o	150	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S4.000	54.26	5.73	80.550	0.022	0.0	0.0	0.0	1.17	20.7	3.3
S4.001	52.12	6.32	79.775	0.169	0.0	0.0	0.0	1.01	40.0	23.9
S5.000	55.92	5.31	79.522	0.000	0.0	0.0	0.0	1.00	17.7	0.0
S3.004	51.27	6.57	79.186	0.469	0.0	0.0	0.0	1.01	71.2	65.1
S3.005	50.58	6.78	79.162	0.469	0.0	0.0	0.0	1.01	71.2	65.1
S3.006	49.95	6.98	79.034	0.542	0.0	0.0	0.0	1.19	131.1	73.3
S1.006	43.60	9.39	78.973	1.041	0.0	0.0	0.0	1.11	123.1	122.9
S1.007	54.81	5.59	78.909	0.000	6.0	0.0	0.0	0.61	10.7	6.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	83.150	2.248	Open Manhole	1200	S1.000	80.902	225				
S2	82.315	2.113	Open Manhole	1200	S1.001	80.202	300	S1.000	80.277	225	
S3	82.315	2.460	Open Manhole	1200	S1.002	79.855	300	S1.001	79.855	300	
S4	81.975	2.394	Open Manhole	1200	S1.003	79.581	300	S1.002	79.581	300	
S5	82.315	1.415	Open Manhole	1200	S2.000	80.900	150				
S6	82.380	1.682	Open Manhole	1200	S2.001	80.698	225	S2.000	80.773	150	
S7	82.200	2.918	Open Manhole	1200	S1.004	79.282	300	S1.003	79.282	300	
								S2.001	80.449	225	1092
S8	81.590	2.493	Open Manhole	1200	S1.005	79.097	300	S1.004	79.097	300	
S9	83.650	1.550	Open Manhole	1200	S3.000	82.100	150				
S10	82.200	1.645	Open Manhole	1200	S3.001	80.555	225	S3.000	80.630	150	
S11	81.650	1.595	Open Manhole	1200	S3.002	80.055	225	S3.001	80.055	225	
S12	81.390	1.650	Open Manhole	1200	S3.003	79.740	300	S3.002	79.815	225	
S13	82.190	1.640	Open Manhole	1200	S4.000	80.550	150				
S14	81.300	1.525	Open Manhole	1200	S4.001	79.775	225	S4.000	79.850	150	
S15	81.100	1.578	Open Manhole	1200	S5.000	79.522	150				
S16	81.300	2.114	Open Manhole	1200	S3.004	79.186	300	S3.003	79.579	300	393
								S4.001	79.563	225	302
								S5.000	79.336	150	
S17	81.350	2.188	Open Manhole	1200	S3.005	79.162	300	S3.004	79.162	300	
S18	81.350	2.316	Open Manhole	1350	S3.006	79.034	375	S3.005	79.109	300	
S19	81.540	2.567	Open Manhole	1350	S1.006	78.973	375	S1.005	79.048	300	
								S3.006	78.973	375	
S20	81.540	2.631	Open Manhole	1350	S1.007	78.909	150	S1.006	78.909	375	
S	81.850	3.020	Open Manhole	1200		OUTFALL		S1.007	78.830	150	

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.007	S	81.850	78.830	78.830	1200	0

Simulation Criteria for Storm

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

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

Simulation Criteria for Storm

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.900	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: S19, DS/PN: S1.006, Volume (m³): 5.3

Unit Reference	MD-SHE-0106-6000-1500-6000
Design Head (m)	1.500
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	106
Invert Level (m)	78.973
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.8	Kick-Flo®	0.948	4.7
Flush-Flo™	0.462	5.9	Mean Flow over Head Range	-	5.2

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	3.6	1.200	5.3	3.000	8.1	7.000	12.1
0.200	5.3	1.400	5.7	3.500	8.7	7.500	12.5
0.300	5.7	1.600	6.0	4.000	9.3	8.000	12.9
0.400	5.9	1.800	6.4	4.500	9.8	8.500	13.2
0.500	5.9	2.000	6.7	5.000	10.3	9.000	13.6
0.600	5.9	2.200	7.0	5.500	10.8	9.500	14.0
0.800	5.5	2.400	7.3	6.000	11.2		
1.000	4.8	2.600	7.6	6.500	11.7		

Storage Structures for Storm

Cellular Storage Manhole: S19, DS/PN: S1.006

Invert Level (m) 78.973 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	500.0	0.0	5.200	0.0	0.0
0.400	500.0	0.0	5.600	0.0	0.0
0.800	500.0	0.0	6.000	0.0	0.0
1.200	500.0	0.0	6.400	0.0	0.0
1.600	0.0	0.0	6.800	0.0	0.0
2.000	0.0	0.0	7.200	0.0	0.0
2.400	0.0	0.0	7.600	0.0	0.0
2.800	0.0	0.0	8.000	0.0	0.0
3.200	0.0	0.0	8.400	0.0	0.0
3.600	0.0	0.0	8.800	0.0	0.0
4.000	0.0	0.0	9.200	0.0	0.0
4.400	0.0	0.0	9.600	0.0	0.0
4.800	0.0	0.0	10.000	0.0	0.0

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.900 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

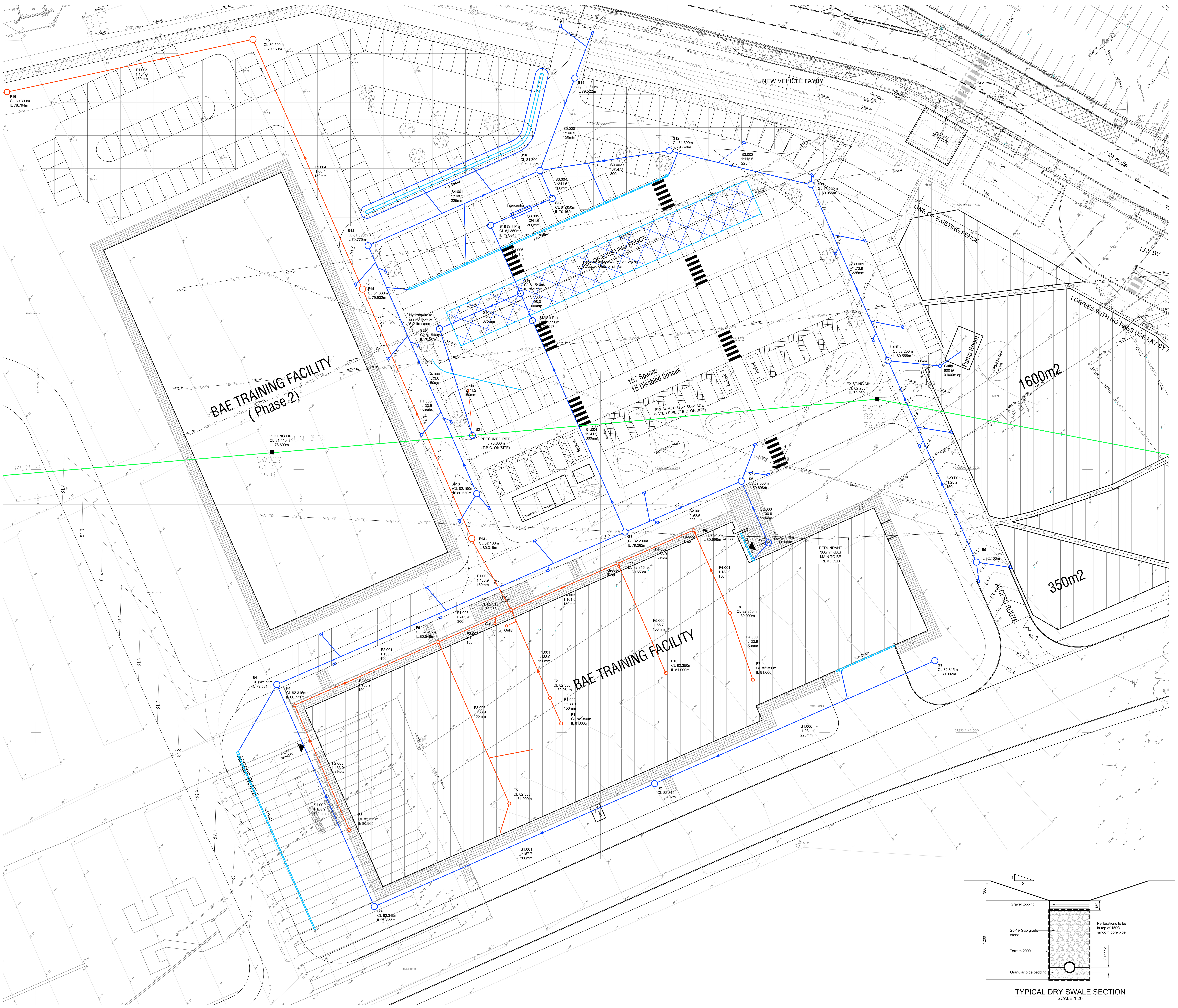
Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 20, 20, 20

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	100	+20%	100/15 Summer				
S1.001	15 Winter	100	+20%	30/15 Summer				
S1.002	15 Winter	100	+20%	30/15 Summer				
S1.003	15 Winter	100	+20%	30/15 Summer				
S2.000	15 Winter	100	+20%	100/15 Summer				
S2.001	15 Winter	100	+20%	100/15 Summer				
S1.004	15 Winter	100	+20%	30/15 Summer				
S1.005	960 Winter	100	+20%	30/15 Summer				
S3.000	15 Winter	100	+20%					
S3.001	15 Winter	100	+20%	30/15 Summer				
S3.002	15 Winter	100	+20%	30/15 Summer				
S3.003	15 Winter	100	+20%	30/15 Summer				
S4.000	15 Winter	100	+20%	100/15 Summer				
S4.001	15 Winter	100	+20%	30/15 Summer				
S5.000	15 Winter	100	+20%	30/15 Summer				
S3.004	15 Winter	100	+20%	30/15 Summer				
S3.005	960 Winter	100	+20%	30/15 Summer				
S3.006	960 Winter	100	+20%	30/15 Summer				
S1.006	960 Winter	100	+20%	30/30 Summer				
S1.007	1440 Summer	30	+20%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	82.028	0.901	0.000	0.91	0.0	47.2	SURCHARGED
S1.001	S2	81.645	1.143	0.000	0.80	0.0	65.3	SURCHARGED
S1.002	S3	81.452	1.297	0.000	0.97	0.0	78.0	SURCHARGED
S1.003	S4	81.191	1.310	0.000	1.47	0.0	100.4	SURCHARGED
S2.000	S5	81.179	0.129	0.000	1.29	0.0	20.8	SURCHARGED
S2.001	S6	80.975	0.052	0.000	1.10	0.0	53.3	SURCHARGED

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.004	S7	80.500	0.917	0.000	2.11	0.0	140.3	SURCHARGED
S1.005	S8	80.285	0.888	0.000	0.29	0.0	17.7	SURCHARGED
S3.000	S9	82.167	-0.083	0.000	0.40	0.0	13.0	OK
S3.001	S10	81.499	0.719	0.000	0.50	0.0	28.6	SURCHARGED
S3.002	S11	81.394	1.114	0.000	1.75	0.0	78.4	FLOOD RISK
S3.003	S12	80.641	0.601	0.000	1.28	0.0	102.3	SURCHARGED
S4.000	S13	80.972	0.272	0.000	0.47	0.0	9.6	SURCHARGED
S4.001	S14	80.900	0.900	0.000	1.57	0.0	59.3	SURCHARGED
S5.000	S15	80.357	0.684	0.000	0.27	0.0	4.5	SURCHARGED
S3.004	S16	80.364	0.878	0.000	3.26	0.0	160.0	SURCHARGED
S3.005	S17	80.288	0.826	0.000	0.30	0.0	17.3	SURCHARGED
S3.006	S18	80.286	0.877	0.000	0.19	0.0	19.9	SURCHARGED
S1.006	S19	80.284	0.936	0.000	0.06	0.0	5.9	SURCHARGED
S1.007	S20	78.992	-0.067	0.000	0.59	0.0	5.9	OK



TYPICAL DRY SWALE SECTION
SCALE 1:20

LEGEND

- FOUL DRAIN EXTG
- SURFACE WATER EXTG
- FOUL DRAIN PROPOSED
- SURFACE WATER PROPOSED

Notes

1. This Drawing is to be read in conjunction with all relevant TRP, Architects, Service Engineers and Subcontractor drawings.
2. Review all drawings and report any discrepancies to TRP Consulting prior to commencement.
3. Do not scale from this drawing. All dimensions and levels including any abutment to existing structures to be checked on site prior to commencement.
4. Work from figured dimensions only.
5. No deviation from details shown on this drawing is allowed without TRP Consultings prior permission in writing.
6. All work is to be carried out in accordance with the relevant specifications issued by TRP Consulting, British Standard Codes of Practice, Statutory requirements and the Contract Documents.
7. All drainage to be installed in accordance with the requirements set out in BS 8301, BS 8005 and the Building Regulations unless noted otherwise.
8. The manhole cover levels shown on the drawing are approximate. Final cover levels are to be adjusted to suit finished paving levels
9. The falls shown on pipe runs are indicative and pipes are to be installed to the invert levels shown on the manhole schedule
10. All pipes are to be laid with soffits level unless noted otherwise All gully connections to be 150mm diameter at a fall of 1 in 80
11. Foul branch connections to ground floor connections to be 100mm diameter at a fall of 1 in 40 unless noted otherwise
12. All sump units to linear drainage channels to be fitted with foul air traps.
13. All surface water gullies to be trapped
14. All drains to be set out to give a minimum clearance of 1.0m to kerb lines
15. All pipes from 100-300mm diameter to be Hepworth SuperSleeve or equivalent
16. All pipes above 300mm diameter to be precast concrete to BS 5911-1 Calss 120
17. All gullies to be precast concrete to Bs 5911-230
18. All manholes to be precast concrete to BS 5911-3
19. Manhole covers in roads and hard paved areas to be Grade D400 double triangle
20. Gully gratings to be Grade D400
21. Drainage channels in car parks to be fitted with Heelguard ductile iron gratings Grade C250

FOUL MANHOLE SCHEDULE

Manhole Name	Cover Level (m)	MH Depth (m)	Manhole Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Pipes In Backdrop (mm)
F1	82.350	1.350	600	F1.000	81.000	150				
F2	82.350	1.389	600	F1.001	80.961	150	F1.000	80.961	150	
F3	82.315	1.350	1200	F2.000	80.965	150				
F4	82.315	1.544	1200	F2.001	80.771	150	F2.000	80.771	150	
F5	82.350	1.350	600	F3.000	81.000	150				
F6	82.315	1.767	1200	F2.002	80.548	150	F2.001	80.548	150	
							F3.000	80.750	150	201
F7	82.350	1.350	600	F4.000	81.000	150				
F8	82.350	1.450	600	F4.001	80.900	150	F4.000	80.900	150	
F9	82.315	1.544	1200	F4.002	80.771	150	F4.001	80.771	150	
F10	82.350	1.350	600	F5.000	81.000	150				
F11	82.315	1.662	1200	F4.003	80.653	150	F4.002	80.653	150	
							F5.000	80.653	150	
F12	82.315	1.880	1200	F1.002	80.435	150	F1.001	80.824	150	389
							F2.002	80.435	150	
							F4.003	80.435	150	
F13	82.100	1.781	1200	F1.003	80.319	150	F1.002	80.319	150	
F14	81.380	1.448	1200	F1.004	79.932	150	F1.003	79.932	150	
F15	80.500	1.350	1200	F1.005	79.150	150	F1.004	79.150	150	
F16	80.300	1.506	1200	F1.006	78.794	150	F1.005	78.794	150	
F17	80.000	1.635	1200	F1.007	78.365	150	F1.006	78.365	150	
F18	80.000	2.063	1200	F1.008	77.937	150	F1.007	77.937	150	
F19	78.800	1.350	1200	F1.009	77.450	150	F1.008	77.450	150	
F20	78.500	1.668	1200	F1.010	76.832	150	F1.009	76.832	150	
F21	78.500	1.907	0		OUTFALL		F1.010	76.593	150	

SURFACE WATER MANHOLE SCHEDULE

Manhole Name	Cover Level (m)	MH Depth (m)	Manhole Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Pipes In Backdrop (mm)
S1	83.150	2.248	1200	S1.000	80.902	225				
S2	82.315	2.113	1200	S1.001	80.202	300	S1.000	80.277	225	
S3	82.315	2.460	1200	S1.002	79.855	300	S1.001	79.855	300	
S4	81.975	2.394	1200	S1.003	79.581	300	S1.002	79.581	300	
S5	82.315	1.415	1200	S2.000	80.900	150				
S6	82.380	1.682	1200	S2.001	80.698	225	S2.000	80.773	150	
S7	82.200	2.918	1200	S1.004	79.282	300	S1.003	79.282	300	
							S2.001	80.449	225	1092
S8	81.590	2.493	1200	S1.005	79.097	300	S1.004	79.097	300	
S9	83.650	1.550	1200	S3.000	82.100	150				
S10	82.200	1.645	1200	S3.001	80.555	225	S3.000	80.630	150	
S11	81.650	1.595	1200	S3.002	80.055	225	S3.001	80.055	225	
S12	81.390	1.650	1200	S3.003	79.740	300	S3.002	79.815	225	
S13	82.190	1.640	1200	S4.000	80.550	150				
S14	81.300	1.525	1200	S4.001	79.775	225	S4.000	79.850	150	
S15	81.100	1.578	1200	S5.000	79.522	150				
S16	81.300	2.114	1200	S3.004	79.186	300	S3.003	79.579	300	393
							S4.001	79.563	225	302
							S5.000	79.336	150	
S17	81.350	2.188	1200	S3.005	79.162	300	S3.004	79.162	300	
S18	81.350	2.316	1350	S3.006	79.034	375	S3.005	79.109	300	
S19	81.540	2.567	1350	S1.006	78.973	375	S1.005	79.048	300	
							S3.006	78.973	375	
S20	81.540	2.631	1350	S1.007	78.909	150	S1.006	78.909	375	
S21	81.850	3.020	1200		OUTFALL		S1.007	78.830	150	

Rev	Description	Date / By	
S5	Issued for Tender	19-12-14	DC
S4	Legend Updated	24-11-14	WC
S3	Gullys added to Plant area & sprinkler system pump room	07-11-14	DC
S2	Drainage layout updated to suit location of training facility	04-11-14	DC
S1	Draft issue for Stage C	30-07-14	DC

REVISION STATUS

S - Information issued for feasibility, scheme or tender purposes only.

C - Information issued for Construction

Note - Only C Revision Drawings to be used for Construction.

Project
BAE SAMLESBURY
TRAINING CENTRE

Client
BAE SYSTEMS

Drawing Title
DRAINAGE LAYOUT
SHEET 1 OF 2

TRP Consulting
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Drawn By	Date	Scale	Checked
DC	July 2014	1:250	TR

Project No.	Drawing No.	Revision
6715	D500	S5