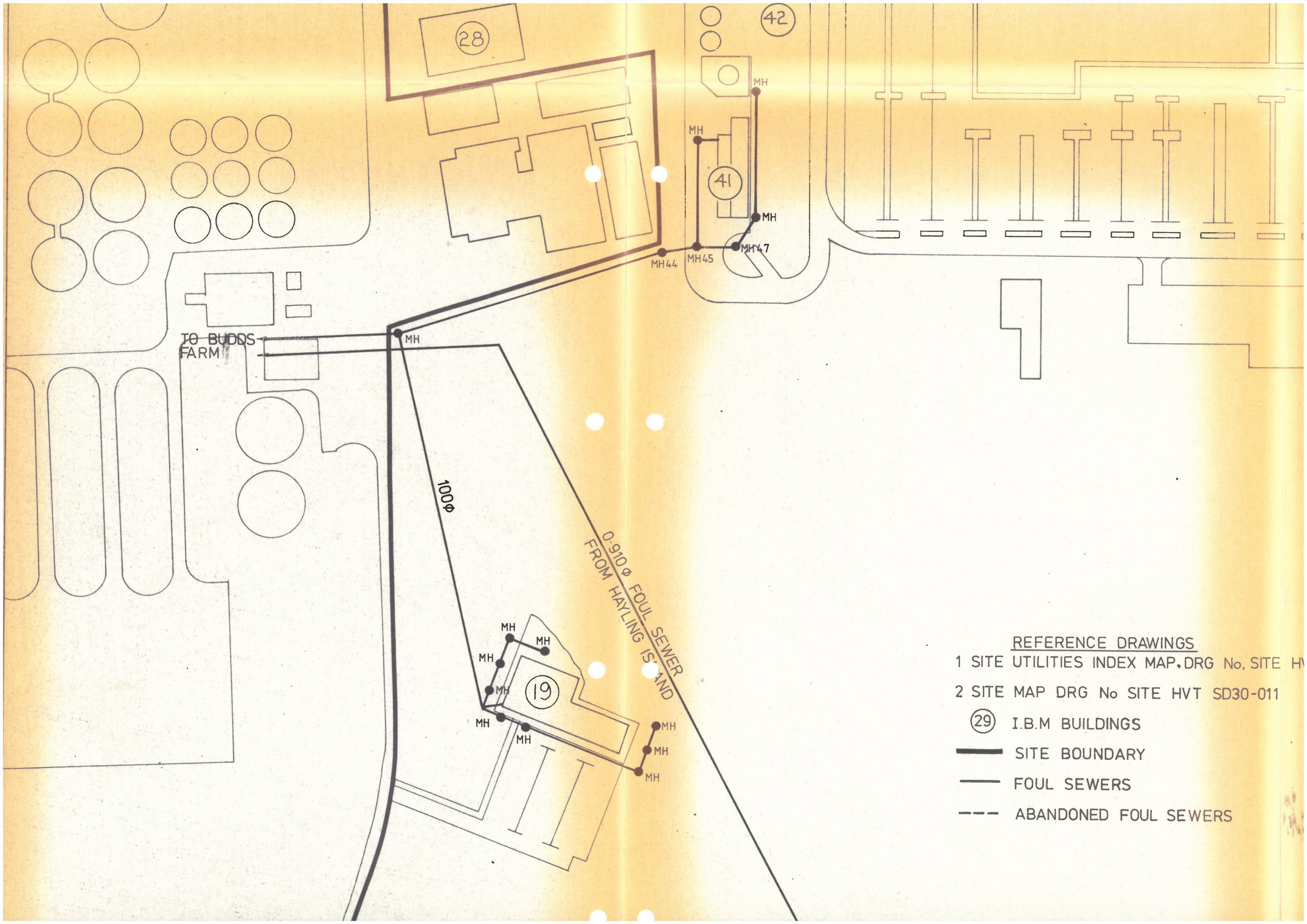




REFERENCE DRAWINGS

1 SITE UTILITIES INDEX MAP, DRG No, SITE HVT

2 SITE MAP DRG No SITE HVT SD30-011

②9 I.B.M BUILDINGS

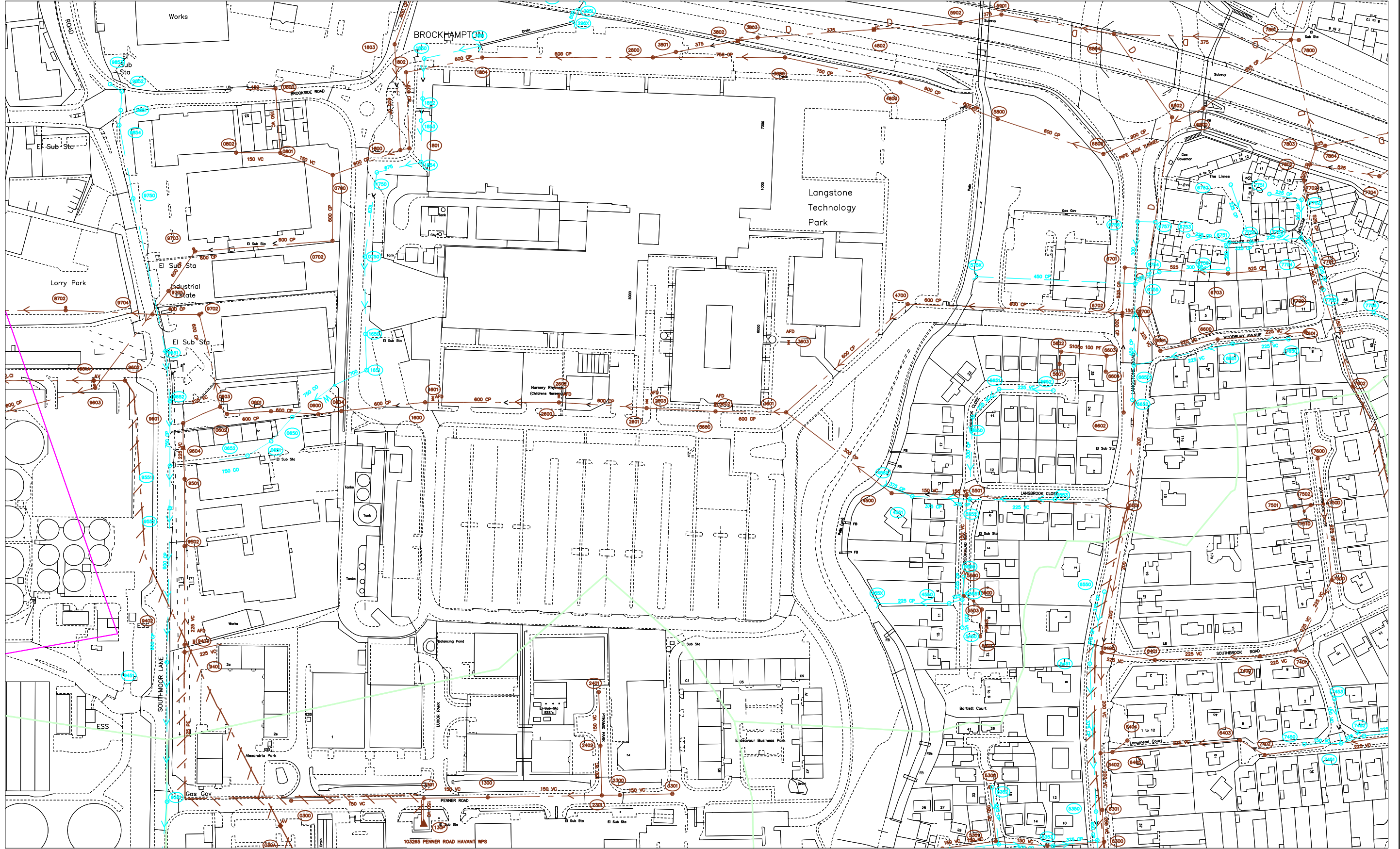
— SITE BOUNDARY

— FOUL SEWERS

--- ABANDONED FOUL SEWERS

SEWER RECORDS PAGE 1 OF 2

105916



105338

470855

[illegible]

SU7105NW

Title: Langstone Technology Park 2B

Drawn by: ghoshri

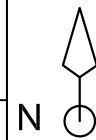
Scale: 1:2500

Date: 12/10/2015

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

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Southern
Water

474707

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape
0300X	4.118	1.693	150	VC	CIRC	5501X	5.05	3.41	150	VC	CIRC	7650X	7.23	6.55	225	VC	CIRC						
030AX			900	UNK	CIRC	5503X			UNK	UNK	CIRC	7700X	7.09	3.94	150	VC	CIRC						
0600X	4.04	1.19	600	CP	CIRC	550DX			UNK	UNK	CIRC	7701X	7.34		525	CP	CIRC						
0601X	3.95		600	CP	CIRC	5550X	5.03	4.26	225	CP	CIRC	7702X	7.92	4.02	525	CP	CIRC						
0602X	3.9	0.94	600	CP	CIRC	5551X	4.91		225	VC	CIRC	7704Y	8.767		525	UNK	CIRC						
0603X	3.89		600	CP	CIRC	5552X	5.15	4.37	375	CP	CIRC	7750X	7.8		225	CP	CIRC						
0604X			UNK	UNK	CIRC	5553X	6.12	5.23	225	VC	CIRC	7751X	8.01	6.44	225	CP	CIRC						
0650X			750	CO	CIRC	5601X			100	PF	CIRC	7752X	7.87	6.27	225	CP	CIRC						
0651X			750	CO	CIRC	5602X			100	PF	CIRC	7753X	7.6		225	CP	CIRC						
0652X			750	CO	CIRC	5650X	5.37	4.62	300	CP	CIRC	7754X	7.47	6.2	225	CP	CIRC						
065ZX		4.346	750	CO	CIRC	5651X	5.77	4.98	225	VC	CIRC	7755X	7.36	6.38	225	CP	CIRC						
0700X	4.64		600	CP	CIRC	5652X	6.57	5.71	225	VC	CIRC	7756X	6.852	5.972	UNK	UNK	CIRC						
0702X	4.41	1.26	600	CP	CIRC	5800X	5.02	2.52	600	CP	CIRC	7800X	8.2	3.7	525	CP	CIRC						
0750X	5.1	3.7	UNK	UNK	CIRC	5901X	7.48	3.228	375	UNK	CIRC	7801Y	8.12		525	CP	CIRC					*	
0800X	4.51		150	VC	CIRC	5902X	7.583	3.124	375	UNK	CIRC	7801Y	8.12		375	UNK	CIRC					*	
0801X	4.8		150	VC	CIRC	6300X	5.37		200	VC	CIRC	7801X	8.12	3.47	UNK	UNK	CIRC					*	
0802X	4.75	3.44	150	VC	CIRC	6301X	5.52	3.78	200	VC	CIRC	7802X	8.53		525	CP	CIRC						
1300X	4.232	0.803	150	VC	CIRC	6400X	6.05		200	VC	CIRC	7803X	8.274		UNK	UNK	CIRC						
1301X	4.244	0.309	150	VC	CIRC	6401X	6.12	4.73	225	VC	CIRC	7804X	8.172	4.107	525	UNK	CIRC						
130PX			125	PE	CIRC	6402X	5.62		200	VC	CIRC	8702X	4.51	0.36	600	CP	CIRC						
1600X	5.09	1.14	600	CP	CIRC	6403X	5.76	4.37	225	VC	CIRC	9351X	3.04	1.54	900	CP	CIRC						
1650X	5.416	3.516	UNK	UNK	CIRC	6404X			UNK	UNK	CIRC	9401X	3.14	1.96	225	VC	CIRC						
1651X	5.426		700	UNK	CIRC	6405X			225	VC	CIRC	9402X	3.04	1.94	225	VC	CIRC						
1750X			675	UNK	CIRC	6501X	6.486	5.557	200	UNK	CIRC	9451X	2.84	1.69	900	CP	CIRC						
1800X	5.54	1.61	600	CP	CIRC	6501Y	6.486	5.078	200	UNK	CIRC	9501X	3.4	1.61	225	VC	CIRC						
1801X	5.35	1.45	600	CP	CIRC	6501Y	6.486		UNK	UNK	CIRC	9502X	3.39	1.88	225	VC	CIRC						
1802X	5.3	1.7	600	CP	CIRC	6550X	6.3	4.5	375	CP	CIRC	9551X	3.59	1.98	750	CP	CIRC						
1803X	4.96	2.1	600	CP	CIRC	6600X	7.02	5.59	225	VC	CIRC	9552X	3.33	1.76	900	CP	CIRC						
1804X	5.39	1.79	600	CP	CIRC	6601X	6.94	5.29	225	VC	CIRC	9601X	3.81		225	VC	CIRC						
1850X			UNK	UNK	CIRC	6602X			300	CP	CIRC	9602X			UNK	UNK	CIRC						
1852X	5.528	3.958	UNK	UNK	CIRC	6603X			100	PF	CIRC	9603X	4.42	0.64	600	CP	CIRC						
1853X	5.415	3.975	UNK	UNK	CIRC	6650X	7.02		450	CP	CIRC	9604X	3.49	1.54	225	VC	CIRC						
1854X	6.59	3.905	675	UNK	CIRC	6651X	7.11	6.4	225	VC	CIRC	961AX	3.99	1.56	900	CI	CIRC						
185IX	-1		UNK	UNK	CIRC	6652X	6.842	5.322	UNK	UNK	CIRC	9651X	3.95	2.26	750	CP	CIRC						
2300X	4.149	1.549	150	VC	CIRC	6700Y	7.12	4.52	UNK	UNK	CIRC	9652X	3.76	2.11	750	CP	CIRC						
2301X	4.165	1.456	150	VC	CIRC	6700X	7.12		150	CP	CIRC	9702X	4.14	0.57	600	CP	CIRC						
2401X	4.057	1.981	150	VC	CIRC	6701X	7.23	3.28	525	CP	CIRC	9703X	4.73	0.85	600	CP	CIRC						
2402X	3.976	1.7	150	VC	CIRC	6702X	7.07		600	CP	CIRC	9704X	3.96	0.52	600	CP	CIRC						
2600X	4.72	1.48	600	CP	CIRC	6703X	7.84	3.58	525	UNK	CIRC	9705X	4.54	0.87	600	CP	CIRC						
2601X	5.64		600	CP	CIRC	6750X	7.88	5.5	300	CP	CIRC	9750X	4.59		750	CP	CIRC						
2800X	5.69		600	CP	CIRC	6751X	7.97		300	CP	CIRC	9851X			600	CP	CIRC						
295IX	-1		600	UNK	CIRC	6752X	8.31	6.71	225	CP	CIRC	9852X			600	CP	CIRC						
3301X	4.2	1.816	150	VC	CIRC	6753X	7.98	6.05	225	CP	CIRC	9853X			675	CP	CIRC						
3600X	4.701	1.711	UNK	UNK	CIRC	6754X	7.92	5.31	300	CP	CIRC	9854X			750	CP	CIRC						
3601X	6.13		600	CP	CIRC	6755X	7.429		450	CP	CIRC												
3800X	6.1	2.7	750	CP	CIRC	6756X	7.64	6.795	300	UNK	CIRC												
3801Y	5.383		UNK	UNK	CIRC	6757X	7.354	6.869	UNK	UNK	CIRC												
3801X	5.383	1.939	375	UNK	CIRC	6800X	8.23	3.18	900	CP	CIRC												
3803X	5.913	2.161	375	UNK	CIRC	6804X	9.101	3.514	UNK	UNK	CIRC												
4500X	4.6	2.43	300	CP	CIRC	6805X	6.53	2.58	600	CP	CIRC												
4550X	4.78	4.03	225	CP	CIRC	7400X	6.01	5.01	225	VC	CIRC												
4551X	4.95	4.34	375	CP	CIRC	7401X	5.92	5.12	225	VC	CIRC												
4700X	5.18	2.18	600	CP	CIRC	7402X	5.694	4.499	UNK	UNK	CIRC												
4800X	5.84		750	CP	CIRC	7450X	5.48	4.56	150	VC	CIRC												
5300X	5.15	4.61	150	VC	CIRC	7451X	5.26		225	VC	CIRC												
5301X	5.42		150	VC	CIRC	7452X	5.45	4.18	225	VC	CIRC												
5350X	5.58	3.78	450	CP	CIRC	7453X	5.17	4.42	150	VC	CIRC												
5351X	5.43		450	CP	CIRC	7500X	6.16	5.2	225	VC	CIRC												
5352X	5.19	4.34	225	CP	CIRC	7501X			UNK	UNK	CIRC												
5353X	5.56	3.67	375	CP	CIRC	7502X			UNK	UNK	CIRC												
5354X	5.42		300	CP	CIRC	750DX			225	VC	CIRC												
5401X			UNK	UNK	CIRC	751DX			UNK	UNK	CIRC												
5450X	4.86	4.29	225	VC	CIRC	7600X	6.72	5.71	225	VC	CIRC												
5451X	6.33	4.27	375	CP	CIRC	7601X	7.15	5.9	225	VC	CIRC												
5500X	4.6	3.71	150	VC	CIRC	7602X	7.01	5.11	150	VC	CIRC												

LINE STYLES / COLOURS

Brown

Red

Orange

Dark Blue

Purple

Light Blue

Yellow

Green

Foul

Foul Syphon Sewer

Foul Vacuum Main

Foul Rising Main

Combined

Combined Syphon Sewer

Combined Rising Main

Lateral Drain

Building Over Agreement Area

Treated Effluent

Sludge

Sewer Catchment

Section 104 Area

Surface Water

Surface Water Rising Main

Private

Access Shaft

Decommissioned

MATERIALS

AK

BAC

BRC

BRE

CC

CI

CO

CP

CSB

CSU

DI

GRC

GRP

MAR

PE

PF

PP

PVC

RPM

SI

ST

VC

XXX

ZZZ

Alkathene

Bonded Asbestos Cement

Brick (Common)

Brick (Engineering)

Concrete Box Culvert

Cast Iron

Concrete (In-Situ)

Concrete (Pre-Cast)

Concrete Segments (bolted)

Concrete Segments (unbolted)

Ductile Iron

Glass Reinforced Concrete

Glass Reinforced Plastic

Masonry in regular Courses

Masonry in random Courses

Polyethylene

Pitch Fibre

Polypropylene

Polyvinyl Chloride

Reinforced Plastic Matrix

Spun Iron

Steel

Unfilled Clay

Other

Unknown

LEGEND - SEWERS

Manhole (SW)

Manhole (F&C)

Lamp hole (SW)

Lamp hole (F&C)

Pumping Station (SW)

Pumping Station (F&C)

Side entry manhole (SW)

Side entry manhole (F&C)

Blind shaft (SW)

Blind shaft (F&C)

Ejector station (SW)

Ejector station (F&C)

Waterlight door (SW)

Waterlight door (F&C)

Flushing ch. Min-e (SW)

Flushing ch. Min-e (F&C)

Flushing ch. No-e (SW)

Flushing ch. No-e (F&C)

Demarcation Chamber

Washout (SW)

Washout (F&C)

Rodding Eye (SW)

Rodding Eye (F&C)

Gauging point (SW)

Gauging point (F&C)

Intercept chamber (SW)

Intercept chamber (F&C)

Storm Tank (SW)

Storm Tank (F&C)

Vortex chamber (SW)

Vortex chamber (F&C)

Label ellipse

Dummy/S24 manhole

Outfall

Penstock chamber

Damboards

Storm Overflow

Backdrop manhole

Other (s)

Other

Change in sewer (s)

Change in sewer

Reflex valve

Flap valve

Cascade

Anode

Valve

Closed Valve

Air Valve

Hatch box (SW)

Hatch box (F&C)

Direction arrow

Emptying valve

Catchpit

Soakaway

Inlet

Balancing Pond

Wastewater treatment works

Marine treatment works

Outfall headworks

Vent

Vent column

Tidal storage tank

Blank end

Head of Public Sewer

Micro Pumping Station

SHAPES (S)

A

B

C

E

H

Arched

Barrel

Circular

Egg

Horseshoe

NODE REFERENCING SYSTEM

1st digit:

2nd digit:

3rd digit:

4th digit:

hundred metre easting identifier

hundred metre northing identifier

sewer type identifier

0-4 = Foul/Combined

5-9 = Surface Water

next sequential node

Drawn by:

ghoshri

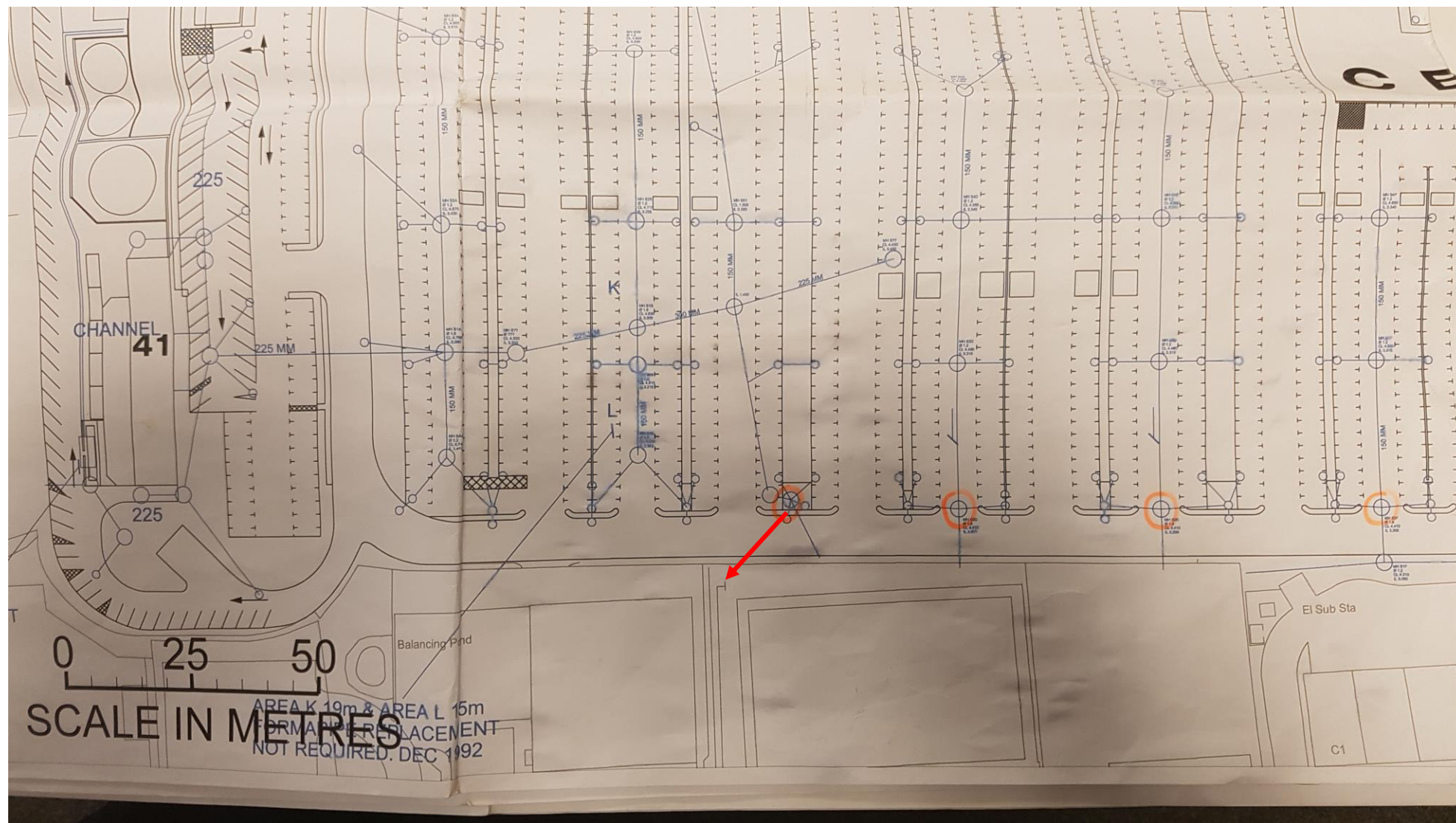
Title:

Langstone Technology Park 2B

Date:

12/10/2015





APPENDIX D

Drainage Calculations



Clancy Consulting Ltd

19 Upper King Street,
Norwich,
NR3 1RB.

Project

LANGSTONE TECHNOLOGY PARK

Job no.

8-1982

Calcs for

AREA 1 - 1 IN 1 YEAR

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 2044 m ²
Percentage of area that is impermeable	p = 46 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 7.5 l/s



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Job no.

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AREA 1 - 1 IN 30 YEAR

Start page no./Revision

1

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CH

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area

Bournemouth

Storm duration

D = **15** min

Return period

Period = **30** yr

Ratio 60 min to 2 day rainfall of 5 yr return period

r = **0.350**

5-year return period rainfall of 60 minutes duration

M5_60min = **19.0** mm

Increase of rainfall intensity due to global warming

p_{climate} = **0** %

Factor Z1 (Wallingford procedure)

Z1 = **0.62**

Rainfall for 15min storm with 5 year return period

M5_15min_i = Z1 × M5_60min = **11.7** mm

Factor Z2 (Wallingford procedure)

Z2 = **1.50**

Rainfall for 15min storm with 30 year return period

M30_15min = Z2 × M5_15min_i = **17.6** mm

Design rainfall intensity

I_{max} = M30_15min / D = **70.4** mm/hr

Maximum surface water runoff

Catchment area

A_{catch} = **2044** m²

Percentage of area that is impermeable

p = **46** %

Maximum surface water runoff

Q_{max} = A_{catch} × p × I_{max} = **18.4** l/s



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LANGSTONE TECHNOLOGY PARK

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1

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Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.94
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × M5_15min _i = 22.7 mm
Design rainfall intensity	I _{max} = M100_15min / D = 90.8 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 2044 m ²
Percentage of area that is impermeable	p = 46 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 23.7 l/s



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LANGSTONE TECHNOLOGY PARK

Job no.

8-1982

Calcs for

AREA 2 - 1 IN 1 YEAR

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 25439 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 203.2 l/s



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NR3 1RB.

Project

LANGSTONE TECHNOLOGY PARK

Job no.

8-1982

Calcs for

AREA 2 - 1 IN 30 YEAR

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area

Bournemouth

Storm duration

D = **15** min

Return period

Period = **30** yr

Ratio 60 min to 2 day rainfall of 5 yr return period

r = **0.350**

5-year return period rainfall of 60 minutes duration

M5_60min = **19.0** mm

Increase of rainfall intensity due to global warming

p_{climate} = **0** %

Factor Z1 (Wallingford procedure)

Z1 = **0.62**

Rainfall for 15min storm with 5 year return period

M5_15min_i = Z1 × M5_60min = **11.7** mm

Factor Z2 (Wallingford procedure)

Z2 = **1.50**

Rainfall for 15min storm with 30 year return period

M30_15min = Z2 × M5_15min_i = **17.6** mm

Design rainfall intensity

I_{max} = M30_15min / D = **70.4** mm/hr

Maximum surface water runoff

Catchment area

A_{catch} = **25439** m²

Percentage of area that is impermeable

p = **100** %

Maximum surface water runoff

Q_{max} = A_{catch} × p × I_{max} = **497.6** l/s



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LANGSTONE TECHNOLOGY PARK

Job no.

8-1982

Calcs for

AREA 2 - 1 IN 100 YEAR

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.94
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × M5_15min _i = 22.7 mm
Design rainfall intensity	I _{max} = M100_15min / D = 90.8 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 25439 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 641.6 l/s

Calculated by:

Site name:

Site location:

Site coordinates

Latitude:

Longitude:

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Reference:

Date:

Methodology

IH124

Site characteristics

Total site area (ha)	0.1822
----------------------	--------

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	3	3
HOST class	---	---
SPR/SPRHOST	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	719	719
Hydrological region	7	7
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

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

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

Where flow rates are less than 5.0 l/s consents are usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

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

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	0.54	0.54
1 in 1 year (l/s)	0.46	0.46
1 in 30 years (l/s)	1.24	1.24
1 in 100 years (l/s)	1.72	1.72



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Calcs by CH	Calcs date 27/06/2019	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 531 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 4.2 l/s



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8-1982

Calcs for

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Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

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DESIGN RAINFALL

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Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 1694 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 13.5 l/s



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LANGSTONE TECHNOLOGY PARK

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8-1982

Calcs for

AREA 4 NORTH CAR PARK AREA 2655.6M²

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

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Checked date

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 2656 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 21.2 l/s



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8-1982

Calcs for

AREA 4 NORTH CAR PARK AREA 5212.5M²

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

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DESIGN RAINFALL

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Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 5213 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 41.6 l/s



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8-1982

Calcs for

AREA 4 NORTH CAR PARK AREA 530.7M²

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

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In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 531 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 10.4 l/s



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LANGSTONE TECHNOLOGY PARK

Job no.

8-1982

Calcs for

AREA 4 NORTH CAR PARK AREA 1693.5M²

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

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In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 1694 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 33.1 l/s



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8-1982

Calcs for

AREA 4 NORTH CAR PARK AREA 2655.6M²

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

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In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 2656 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 51.9 l/s



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LANGSTONE TECHNOLOGY PARK

Job no.

8-1982

Calcs for

AREA 4 NORTH CAR PARK AREA 5212.5M²

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

DESIGN RAINFALL

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Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 5213 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 102.0 l/s



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Project LANGSTONE TECHNOLOGY PARK				Job no. 8-1982	
Calcs for AREA 4 NORTH CAR PARK AREA 530.7M^2				Start page no./Revision 1	
Calcs by CH	Calcs date 27/06/2019	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.94
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × M5_15min _i = 22.7 mm
Design rainfall intensity	I _{max} = M100_15min / D = 90.8 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 531 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 13.4 l/s



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Job no.

8-1982

Calcs for

AREA 4 NORTH CAR PARK AREA 1693.5M²

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

Approved by

Approved date

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Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.94
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × M5_15min _i = 22.7 mm
Design rainfall intensity	I _{max} = M100_15min / D = 90.8 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 1694 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 42.7 l/s



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Calcs for AREA 4 NORTH CAR PARK AREA 2655.6M^2				Start page no./Revision 1	
Calcs by CH	Calcs date 27/06/2019	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

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Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.94
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × M5_15min _i = 22.7 mm
Design rainfall intensity	I _{max} = M100_15min / D = 90.8 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 2656 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 67.0 l/s



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8-1982

Calcs for

AREA 4 NORTH CAR PARK AREA 5212.5M²

Start page no./Revision

1

Calcs by

CH

Calcs date

27/06/2019

Checked by

Checked date

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DESIGN RAINFALL

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Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area

Bournemouth

Storm duration

D = **15** min

Return period

Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period

r = **0.350**

5-year return period rainfall of 60 minutes duration

M5_60min = **19.0** mm

Increase of rainfall intensity due to global warming

p_{climate} = **0** %

Factor Z1 (Wallingford procedure)

Z1 = **0.62**

Rainfall for 15min storm with 5 year return period

M5_15min_i = Z1 × M5_60min = **11.7** mm

Factor Z2 (Wallingford procedure)

Z2 = **1.94**

Rainfall for 15min storm with 100 year return period

M100_15min = Z2 × M5_15min_i = **22.7** mm

Design rainfall intensity

I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area

A_{catch} = **5213** m²

Percentage of area that is impermeable

p = **100** %

Maximum surface water runoff

Q_{max} = A_{catch} × p × I_{max} = **131.5** l/s

Contract Title Langstone Technology Park			Contract No.	
Part of Structure Attenuation tank sizing			Calculation Sheet No: Rev	
Drawing ref:	Check By:	Date	Calcs By: CH	Date 27/06/2019

South West Car park and industrial area

As there will be heavy vehicle access to this area, permeable paving has been considered unsuitable for use in the car park. Therefore the surface water will be captured and attenuated before draining off site at the current discharge location.

Total impermeable area 25439 m²

Unit 01 489 m²

Unit 02 349 m²

Unit 03 420 m²

Unit 04 349 m²

Unit 05 700 m²

Unit 06 1115 m²

Unit 07 766 m²

Unit 08 929 m²

Unit 09 1301 m²

Unit 10 838 m²

Unit 11 1557.0 m²

Unit 12 2300 m²

Total unit area 11113 m²

Parking area 14326 m²

Assuming a mixture of oversized pipes and attenuation storage for the site,
Designing for a 1 in 100 + 40% CC storm event

Existing pipe leaving site is 375mm diameter
Pipe has unknown gradient. Assume 1:300

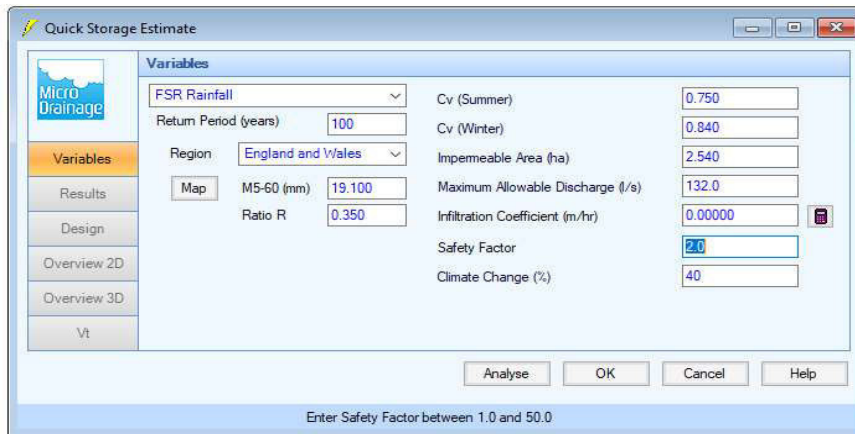
Pipe Data Height = 0.375 m Width = 0.375 m Ks = 0.15 Gradient = 1 in 300 Viscosity = 1.143e-06 m ² /s	Geometry Area of Flow = 0.110 m ² Wetted Perimeter = 1.178 m Hydraulic Radius = 0.094 m
Calculation Type ☒ Full bore ☐ Proportional Depth (given flow) ☐ Proportional Flow (given depth)	Flow Data Discharge = 0.132 m ³ /s Velocity = 1.192 m/s

Maximum flow through pipe is 132 l/s

This is lower than the run off rate and will be used as the flow control limit.

Contract Title Langstone Technology Park			Contract No.	
Part of Structure Attenuation tank sizing			Calculation Sheet No: Rev	
Drawing ref:	Check By:	Date	Calcs By: CH	Date 27/06/2019

Storage estimate based on total impermeable area



Quick Storage Estimate

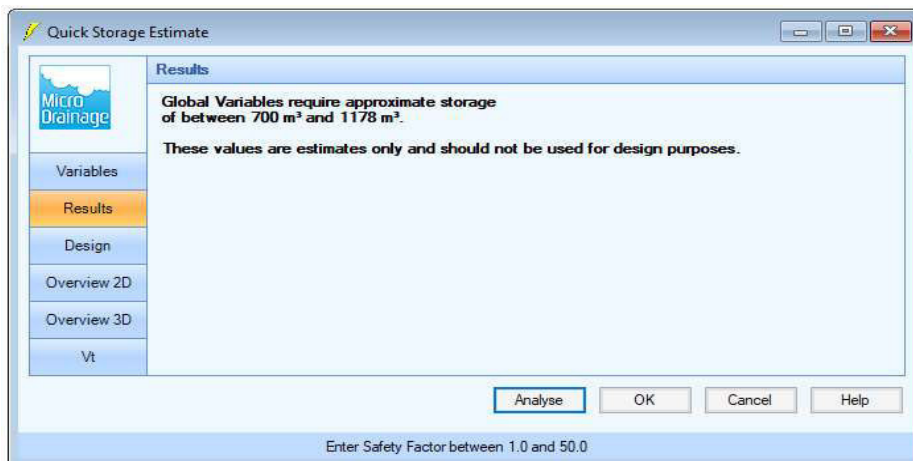
Variables

FSR Rainfall: [Dropdown]
 Return Period (years): 100
 Region: England and Wales [Dropdown]
 Map: M5-60 (mm): 19.100
 Ratio R: 0.350

Cv (Summer): 0.750
 Cv (Winter): 0.840
 Impermeable Area (ha): 2.540
 Maximum Allowable Discharge (l/s): 132.0
 Infiltration Coefficient (m/hr): 0.00000
 Safety Factor: 2.0
 Climate Change (%): 40

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0



Quick Storage Estimate

Results

Global Variables require approximate storage of between 700 m³ and 1178 m³.
 These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Minimum volume required 700 m³
 Maximum volume required 1178 m³

Using oversized pipes for storage on the site

Pipe diameter 0.6 m
 Pipe length 252 m

Total storage volume provided in pipes 71.25 m³

Total storage volume required 1106.75 m³

Assuming tanks will have a depth of 0.8 m

The footprint of storage required is 1383.44 m²

Contract Title Langstone Technology Park			Contract No.	
Part of Structure Attenuation tank sizing			Calculation Sheet No: Rev	
Drawing ref:	Check By:	Date	Calcs By: CH	Date 27/06/2019

Permeable paving

As infiltration is currently not proven viable, a permeable paving design based on impermeable ground conditions will be designed following guidance from inter pave.

Hydraulic design

Surface type **C**

Using Figure 20 in Edition 6 of inter pave's permeable paving guide.

FSR M60 rainfall **20** mm
r' **0.4**

Using Table 5

1 in 100 year +40% CC sub-base thickness **260** mm

The site is very flat and therefore the run off from sloped ground will not be checked.

Additional depth required due to impermeable area drainaing into permeable paving

It has been assumed that the impermeable area is equal the permeable paving.

Using section 6.2.8 from the inter pave permeable paving guide.

$260 \times (11.52 + 11.52) / 11.52$
Sub-base thickness **520** mm

Structural design

Using table 7

Design loading **Category 4**

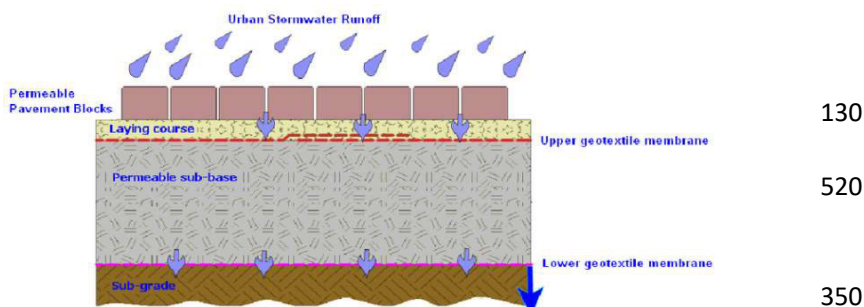
Using figure 24

Block + sufacing **130** mm
Hydraulically bound coarse aggregate **150** mm
Coarse aggregate **150** mm
Capping **150** mm

Adjusting for CBR

Assume CBR **2** %

New capping thickness **350** mm



APPENDIX E

Proposed Drainage Strategy

