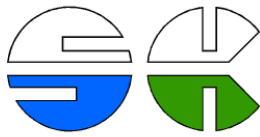


SUPERSEDED



SIMPKINS KENNY LTD
CONSULTING CIVIL AND STRUCTURAL ENGINEERS

11b Market Place, Brigg, North Lincolnshire DN20 8ES

Telephone: (01652) 650450
Facsimile: (01652) 409026
e-mail: info @simpkinskenney.co.uk
Web site: www.simpkinskenney.co.uk

Drainage Calculations

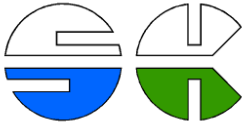
**Proposed Residential Development at
Almond Grove, Brigg, North Lincolnshire**

Prepared for: **Shirecare Property Company Ltd**
c/o John Derbyshire Design Partnership
Chalkwood
6a St Mary's Lane,
Louth
Lincolnshire,
LN11 0DT

Date: **November 2017**

Job No: **17:087**

Revision: **A**



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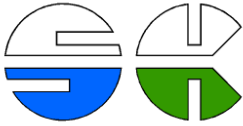
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11b Market Place . Brigg . North Lincolnshire . DN20 8ES
Telephone: (01652) 650450 Facsimile (01652) 409026 e-mail: info@simpkinskenny.co.uk

Calculation Sheet

Client: Shirecare Property Company Limited		Sheet No: S/01	
Project: Proposed Housing Development @ Almond Grove, Brigg, North Lincolnshire		Job No: 17:087	
		Date: November 2017	
Prepared by: M.R.	Checked by: J.K.	Revision	A

Reference		Comments
	<p><u>Drainage Design</u></p> <p><u>Design Brief</u></p> <p>The proposed development is to be constructed on land to the west of Almond Grove formerly occupied by a single bungalow and out buildings. The site has an area of 0.37 Hectares and slopes to the south west corner from an existing access road to Almond Grove on the east of the site.</p> <p>SUDS has been considered, however, due to the size of the development and site constraints the proposed use of swales, ponds or filter drains would not be viable. Infiltration tests have not been carried out, however, previous experience in this area would suggest the ground to be a clay soil with relatively high water table and therefore not suitable for soakaways. Prior to the commencement on site an infiltration test will be carried out in accordance with the Building Regulations to substantiate this.</p> <p>Based on the above it is proposed that an attenuated drainage system be adopted using oversized pipes located beneath the private roads within the development with the flow rate being regulated by a pump.</p> <p><u>Design</u></p> <p>It is proposed to limit the discharge from the development to that generated by the former bungalow, outbuildings and access road which had an area of 226m² and would have produced a flow rate of 3.1 litres/second (Section 1).</p> <p>The proposed development has an impermeable area made up as follows:-</p> <p>Houses/Garages : 672 New Shared Access Road : 143</p> <p><u>Total</u> : <u>815m² + 30% Climate Change</u></p> <p>The proposed area above together with an additional 30% for future climate change would give a site run-off of 14.4 litres/second (Section 2).</p> <p>It is proposed to discharge to the existing public sewer located in Almond Grove to the east of the site.</p>	



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11b Market Place . Brigg . North Lincolnshire . DN20 8ES
Telephone: (01652) 650450 Facsimile (01652) 409026 e-mail: info@simpkinskenny.co.uk

Calculation Sheet


Client: Shirecare Property Company Limited		Sheet No: S/02	
Project: Proposed Housing Development @ Almond Grove, Brigg, North Lincolnshire		Job No: 17:087	Date: November 2017
		Revision	A
Prepared by: M.R.	Checked by: J.K.		

Reference		Comments
	<p><u>Conclusion</u></p> <p>It is proposed that a new manhole be constructed on the public sewer located in Almond Grove and the attenuated storm water pumped from the start of the shared access road within the site to this location at a rate of no more than 3.0 ltrs/sec. The above figure will be achieved by providing additional capacity in pipe runs 1.000 & 1.001 (see Simpkins Kenny Ltd drawing No. 17:087:0001), the use of 900mm diameter pipes for these (35.0m in total) will provide the storage required (Section 3).</p> <p>The foul water flow from the proposed development is 1.4 litres/second (Section 4) and will also be pumped separately to the same location within Almond Grove.</p>	

The dimensions adopted in these calculations are for design purposes only and should be verified on site.

QA/01

SECTION 1

Simpkins Kenny Limited		Page 1
College Chambers	Residential Development	
College Yard	Almond Grove	
North Lincolnshire	Brigg	
Date 15/11/17	Designed By M.Russell	
File 17070 (Existing).SWS	Checked By	
Micro Drainage	System1 W.11.2	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Pipe Size File c:\WinDes\STANDARD.PIP Manhole Size File c:\WinDes\STANDARD.MHS

Location - England & Wales

Return Period (years)	100	Maximum Backdrop Height (m)	0.000
M5-60 (mm)	20.000	Min Cover Depth for Optimisation (m)	0.600
Ratio R	0.400	Min Vel for Auto Design Only (m/s)	0.90
Maximum Rainfall (mm/hr)	50	Min Slope for Optimisation (1:X)	500
Foul Sewage (l/s/ha)	0.00	Minimum Outfall Invert (m)	2.220
O'flow Setting (*Foul only)	0	Ground Level at Outfall (m)	3.400
Volumetric Runoff Coeff.	0.75	Outfall Manhole Name	MH 100
Add Flow / Climate Change (%)	0	Outfall Manhole Dia/Length (mm)	1200
Minimum Backdrop Height (m)	0.000	Outfall Manhole Width (mm)	0

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	10.00	0.125	80.0	0.023	4.00	0.0	0.600	o	100

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	50.0	4.2	2.220	0.023	0.0	0.0	0.0	0.86	6.8	3.1

Time Area Diagram

Time From (mins)	Time To (mins)	Area (ha)
0	4	0.022
4	8	0.001

Total Area Contributing (ha) = 0.023

Total Pipe Volume (m³) = 0.079

College Chambers
College Yard
North Lincolnshire

Residential Development
Almond Grove
Brigg

Date 15/11/17
File 17070 (Existing).SWS

Designed By M.Russell
Checked By

Micro Drainage

System1 W.11.2



PIPELINE SCHEDULES

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	o	100	1	3.400	2.220	1.080	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	10.00	80.0	MH 100	3.400	2.095	1.205	1200

College Chambers
College Yard
North Lincolnshire

Residential Development
Almond Grove
Brigg

Date 15/11/17
File 17070 (Existing).SWS

Designed By M.Russell
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Micro Drainage

System1 W.11.2

MANHOLE SCHEDULES

M/Hole Number	Cover Level (m)	M/Hole Depth (m)	M/Hole Diam.,L*W (mm)	Pipes Out			Pipes In		
				PN	IL.(m)	D (mm)	PN	IL.(m)	D (mm)
1	3.400	1.180	1050	1.000	2.220	100			
MH 100	3.400	1.305	1200		OUTFALL		1.000	2.095	100

SECTION 2

Simpkins Kenny Limited		Page 1
College Chambers	Residential Development	
College Yard	Almond Grove	
North Lincolnshire	Brigg	
Date 15/11/17	Designed By M.Russell	
File 17087 (Proposed) Rev A.SWS	Checked By	
Micro Drainage	System1 W.11.2	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Pipe Size File c:\WinDes\STANDARD.PIP Manhole Size File c:\WinDes\STANDARD.MHS

Location - England & Wales

Return Period (years)	100
M5-60 (mm)	20.000
Ratio R	0.400
Maximum Rainfall (mm/hr)	50
Foul Sewage (l/s/ha)	0.00
O'flow Setting (*Foul only)	0
Volumetric Runoff Coeff.	0.75
Add Flow / Climate Change (%)	30
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Cover Depth for Optimisation (m)	0.600
Min Vel for Auto Design Only (m/s)	0.90
Min Slope for Optimisation (1:X)	500
Minimum Outfall Invert (m)	1.500
Ground Level at Outfall (m)	3.060
Outfall Manhole Name	SWMH 100
Outfall Manhole Dia/Length (mm)	1200
Outfall Manhole Width (mm)	0

Designed with Level Inverts

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	17.80	0.036	494.4	0.012	4.00	0.0	0.600	o	900
1.001	20.20	0.040	505.0	0.014	0.00	0.0	0.600	o	900
2.000	7.70	0.052	148.1	0.014	4.00	0.0	0.600	o	150
2.001	14.10	0.094	150.0	0.014	0.00	0.0	0.600	o	150
2.002	6.10	0.041	148.8	0.014	0.00	0.0	0.600	o	150
1.002	3.50	0.018	194.4	0.014	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	50.0	4.2	0.940	0.012	0.0	0.0	0.5	1.40	892.1	2.1
1.001	50.0	4.5	0.904	0.026	0.0	0.0	1.1	1.39	882.6	4.6
2.000	50.0	4.2	1.075	0.014	0.0	0.0	0.6	0.82	14.6	2.5
2.001	50.0	4.4	1.023	0.028	0.0	0.0	1.1	0.82	14.5	4.9
2.002	50.0	4.6	0.929	0.042	0.0	0.0	1.7	0.82	14.5	7.4
1.002	50.0	4.6	0.864	0.082	0.0	0.0	3.3	0.93	37.1	14.4

College Chambers
College Yard
North Lincolnshire

Residential Development
Almond Grove
Brigg

Date 15/11/17

Designed By M.Russell

File 17087 (Proposed) Rev A.SWS

Checked By

Micro Drainage

System1 W.11.2



PIPELINE SCHEDULES

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	o	900	1	3.040	0.940	1.200	1800
1.001	o	900	2	2.985	0.904	1.181	1800
2.000	o	150	3	2.585	1.075	1.360	1050
2.001	o	150	4	2.925	1.023	1.752	1200
2.002	o	150	5	3.085	0.929	2.006	1200
1.002	o	225	6	2.840	0.864	1.751	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	17.80	494.4	2	2.985	0.904	1.181	1800
1.001	20.20	505.0	6	2.840	0.864	1.076	1800
2.000	7.70	148.1	4	2.925	1.023	1.752	1200
2.001	14.10	150.0	5	3.085	0.929	2.006	1200
2.002	6.10	148.8	6	2.840	0.888	1.802	1800
1.002	3.50	194.4	SWMH 100	3.060	0.846	1.989	1200



MANHOLE SCHEDULES

M/Hole Number	Cover Level (m)	M/Hole Depth (m)	M/Hole Diam.,L*W (mm)	Pipes Out			Pipes In		
				PN	IL. (m)	D (mm)	PN	IL. (m)	D (mm)
1	3.040	2.100	1800	1.000	0.940	900			
2	2.985	2.081	1800	1.001	0.904	900	1.000	0.904	900
3	2.585	1.510	1050	2.000	1.075	150			
4	2.925	1.902	1200	2.001	1.023	150	2.000	1.023	150
5	3.085	2.156	1200	2.002	0.929	150	2.001	0.929	150
6	2.840	1.976	1800	1.002	0.864	225	1.001	0.864	900
							2.002	0.888	150
SWMH 100	3.060	2.214	1200		OUTFALL		1.002	0.846	225

SECTION 3

Summary of Results for 100 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m ³)	Status
15 Summer	3.0	3.0	1.4202	0.5452	13.6	O K
30 Summer	3.0	3.0	1.5398	0.6648	17.3	O K
60 Summer	3.0	3.0	1.5923	0.7173	18.8	O K
120 Summer	3.0	3.0	1.5708	0.6958	18.2	O K
180 Summer	3.0	3.0	1.5383	0.6633	17.3	O K
240 Summer	3.0	3.0	1.4838	0.6088	15.6	O K
360 Summer	3.0	3.0	1.3867	0.5117	12.5	O K
480 Summer	3.0	3.0	1.3507	0.4757	11.3	O K
600 Summer	3.0	3.0	1.2727	0.3977	8.8	O K
720 Summer	3.0	3.0	1.2032	0.3282	6.6	O K
960 Summer	3.0	3.0	1.0897	0.2147	3.4	O K
1440 Summer	2.9	2.9	0.9723	0.0973	0.8	O K
2160 Summer	2.1	2.1	0.9458	0.0708	0.4	O K
2880 Summer	1.7	1.7	0.9313	0.0563	0.2	O K
4320 Summer	1.2	1.2	0.9158	0.0407	0.1	O K
5760 Summer	1.0	1.0	0.9078	0.0327	0.1	O K
7200 Summer	0.8	0.8	0.9028	0.0277	0.1	O K
8640 Summer	0.7	0.7	0.8988	0.0238	0.0	O K
10080 Summer	0.6	0.6	0.8963	0.0213	0.0	O K
15 Winter	3.0	3.0	1.4628	0.5877	14.9	O K
30 Winter	3.0	3.0	1.6343	0.7593	19.9	O K
60 Winter	3.0	3.0	1.7958	0.9208	23.1	O K
120 Winter	3.0	3.0	1.7343	0.8593	22.2	O K
180 Winter	3.0	3.0	1.6448	0.7698	20.2	O K
240 Winter	3.0	3.0	1.5568	0.6818	17.8	O K
360 Winter	3.0	3.0	1.4522	0.5772	14.6	O K
480 Winter	3.0	3.0	1.3182	0.4432	10.3	O K
600 Winter	3.0	3.0	1.2012	0.3262	6.6	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	93.28	17
30 Summer	61.30	31
60 Summer	38.41	60
120 Summer	23.28	90
180 Summer	17.15	124
240 Summer	13.73	158
360 Summer	9.97	224
480 Summer	7.95	294
600 Summer	6.66	356
720 Summer	5.76	414
960 Summer	4.58	524
1440 Summer	3.31	736
2160 Summer	2.39	1104
2880 Summer	1.90	1460
4320 Summer	1.37	2184
5760 Summer	1.08	2936
7200 Summer	0.90	3584
8640 Summer	0.78	4384
10080 Summer	0.68	5080
15 Winter	93.28	17
30 Winter	61.30	31
60 Winter	38.41	60
120 Winter	23.28	96
180 Winter	17.15	134
240 Winter	13.73	172
360 Winter	9.97	248
480 Winter	7.95	312
600 Winter	6.66	370

College Chambers
College Yard
North Lincolnshire

Residential Development
Almond Grove
Brigg

Date 15/11/17
File 17087 rev A.SRC

Designed By M.R.
Checked By



Micro Drainage

Storage Design W.11.2

Summary of Results for 100 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m ³)	Status
720 Winter	3.0	3.0	1.0987	0.2237	3.6	O K
960 Winter	2.9	2.9	0.9728	0.0978	0.8	O K
1440 Winter	2.1	2.1	0.9463	0.0713	0.4	O K
2160 Winter	1.5	1.5	0.9263	0.0513	0.2	O K
2880 Winter	1.2	1.2	0.9158	0.0407	0.1	O K
4320 Winter	0.9	0.9	0.9047	0.0297	0.1	O K
5760 Winter	0.7	0.7	0.8988	0.0238	0.0	O K
7200 Winter	0.6	0.6	0.8953	0.0203	0.0	O K
8640 Winter	0.5	0.5	0.8923	0.0173	0.0	O K
10080 Winter	0.5	0.5	0.8903	0.0153	0.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
720 Winter	5.76	422
960 Winter	4.58	490
1440 Winter	3.31	736
2160 Winter	2.39	1096
2880 Winter	1.90	1468
4320 Winter	1.37	2160
5760 Winter	1.08	2816
7200 Winter	0.90	3672
8640 Winter	0.78	4416
10080 Winter	0.68	4984

College Chambers
College Yard
North Lincolnshire

Residential Development
Almond Grove
Brigg

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Micro Drainage

Storage Design W.11.2

Rainfall Details

Region	ENG+WAL	Cv (Winter)	0.840
Return Period (years)	100	Shortest Storm (mins)	15
M5-60 (mm)	19.000	Longest Storm (mins)	10080
Ratio-R	0.400	Summer Storms	Yes
Cv (Summer)	0.750	Winter Storms	Yes

Pipe Network

Volume in Pipe Network (m ³)	3	Dia of Outfall Pipe (m)	0.100
Slope of Outfall Pipe (1:x)	80.0	Roughness of Outfall Pipe	0.600

Time / Area Diagram

Total Area (ha) = 0.109

Time	(mins)	Area
from:	to:	(ha)
0	4	0.109

College Chambers
College Yard
North Lincolnshire

Residential Development
Almond Grove
Brigg

Date 15/11/17
File 17087 rev A.SRC

Designed By M.R.
Checked By



Micro Drainage

Storage Design W.11.2

Circular Pipe Details

Diameter (m) 0.900 Length (m) 35.000 Cover Level (m) 2.880
Slope (1:x) 500.0 Invert Level (m) 0.875

Pump Outflow Control

Invert Level of Control 0.875

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	3.0	0.60	3.0	1.60	3.0	2.60	3.0	5.00	3.0	7.50	3.0
0.20	3.0	0.80	3.0	1.80	3.0	3.00	3.0	5.50	3.0	8.00	3.0
0.30	3.0	1.00	3.0	2.00	3.0	3.50	3.0	6.00	3.0	8.50	3.0
0.40	3.0	1.20	3.0	2.20	3.0	4.00	3.0	6.50	3.0	9.00	3.0
0.50	3.0	1.40	3.0	2.40	3.0	4.50	3.0	7.00	3.0	9.50	3.0

SECTION 4

FOUL SEWERAGE DESIGN

Global Variables

Pipe Size File C:\Program Files\Micro Drainage Ltd\WinDes\STANDARD.PIP
 Manhole Size File C:\Program Files\Micro Drainage Ltd\WinDes\STANDARD.MHS

Industrial Flow (l/s/ha)	0.00	Maximum Backdrop Height (m)	1.500
Industrial Peak Flow Factor	0.00	Min Cover Depth for Optimisation (m)	1.200
Flow Per Person (l/per/day)	500.00	Min Vel for Auto Design Only (m/s)	0.75
Persons per House	8.00	Min Slope for Optimisation (1:X)	500
Domestic (l/s/ha)	0.00	Minimum Outfall Invert (m)	1.272
Domestic Peak Flow Factor	6.00	Ground Level at Outfall (m)	3.000
O'flow Setting (*Foul only)	0	Outfall Manhole Name	
Add Flow / Climate Change (%)	0	Outfall Manhole Dia/Length (mm)	1050
Minimum Backdrop Height (m)	1.000	Outfall Manhole Width (mm)	0

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Hse	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	12.60	0.162	77.8	0.000	1	0.0	1.500	o	100
1.001	22.00	0.275	80.0	0.000	1	0.0	1.500	o	100
2.000	12.90	0.161	80.1	0.000	1	0.0	1.500	o	100
2.001	13.90	0.174	79.9	0.000	2	0.0	1.500	o	100
2.002	4.30	0.059	72.9	0.000	0	0.0	1.500	o	100
1.002	3.60	0.045	80.0	0.000	0	0.0	1.500	o	100

Network Results Table

PN	US/IL (m)	E.Area (ha)	E.DWF (l/s)	E.Hse	Infil. (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	1.750	0.000	0.0	1	0.0	15	0.37	0.75	5.9	0.3
1.001	1.588	0.000	0.0	2	0.0	21	0.46	0.74	5.8	0.6
2.000	1.707	0.000	0.0	1	0.0	15	0.37	0.74	5.8	0.3
2.001	1.546	0.000	0.0	3	0.0	26	0.52	0.74	5.8	0.8
2.002	1.372	0.000	0.0	3	0.0	25	0.54	0.78	6.1	0.8
1.002	1.313	0.000	0.0	5	0.0	33	0.61	0.74	5.8	1.4

College Chambers
College Yard
North Lincolnshire

Residential Development
Almond Grove
Brigg

Date 30/11/17
File 17087.FWS

Designed By M.R
Checked By

Micro Drainage

System1 W.11.2



PIPELINE SCHEDULES

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	o	100	1	3.050	1.750	1.200	1050
1.001	o	100	2	3.035	1.588	1.347	1050
2.000	o	100	6	2.525	1.707	0.718	1050
2.001	o	100	6	2.890	1.546	1.244	1050
2.002	o	100	6	3.025	1.372	1.553	1200
1.002	o	100	6	2.900	1.313	1.487	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	12.60	77.8	2	3.035	1.588	1.347	1050
1.001	22.00	80.0	6	2.900	1.313	1.487	1050
2.000	12.90	80.1	6	2.890	1.546	1.244	1050
2.001	13.90	79.9	6	3.025	1.372	1.553	1200
2.002	4.30	72.9	6	2.900	1.313	1.487	1050
1.002	3.60	80.0		3.000	1.268	1.632	1050

College Chambers
College Yard
North Lincolnshire

Residential Development
Almond Grove
Brigg

Date 30/11/17
File 17087.FWS

Designed By M.R
Checked By



Micro Drainage

System1 W.11.2

MANHOLE SCHEDULES

M/Hole Number	Cover Level (m)	M/Hole Depth (m)	M/Hole Diam.,L*W (mm)	Pipes Out			Pipes In		
				PN	IL.(m)	D (mm)	PN	IL.(m)	D (mm)
1	3.050	1.300	1050	1.000	1.750	100			
2	3.035	1.447	1050	1.001	1.588	100	1.000	1.588	100
6	2.525	0.818	1050	2.000	1.707	100			
6	2.890	1.344	1050	2.001	1.546	100	2.000	1.546	100
6	3.025	1.653	1200	2.002	1.372	100	2.001	1.372	100
6	2.900	1.587	1050	1.002	1.313	100	1.001	1.313	100
							2.002	1.313	100
	3.000	1.732	1050		OUTFALL		1.002	1.268	100