Roger Casey Associates
Consulting Civil & Structural Engineers

Ty Mansel, 6 Mansel Street, Carmarthen, Carmarthenshire SA31 1PX
T: 01267 222 646

Units 10 & 11, Merlin's Court, Winch Lane, Haverfordwest, Pembrokeshire SA61 1SB
T: 01437 762 795

E: office@rca-eng.co.uk
W: www.rca-eng.co.uk

Job No.	:	**19784**
Sheet	:	**S1**
Made by	:	GWP
Date	:	23-Jun-17
Checked	:	
Revision	:	-

Ref:	CALCULATIONS	Output.

PROPOSED COLD STORE FOR PUFFIN PRODUCE, WITHYBUSH INDUSTRIAL ESTATE, HAVERFORDWEST, PEMBROKESHIRE

Client: Puffin produce Ltd

RCA Brief: Drainage Design Description.

Design Data:
1 Percolation Test Results.
2 BRE 365.
3 Building Regulations Approved Document Part H.
4 Sewers for Adoption 7th Edition.
5 Site Location Co-Ordinates:
E 196318
N 218057
6 Site Grid Reference: SM963180
7 Time of Entry = 4 minutes.
8 Welsh Ministers Standards.

Information Provided:
Architectural Site Plan.
Percolation Test Result.
Land Survey.

Drainage Design By:
Micro Drainage Network - Version 2016.1
Micro Drainage Source Control - Version 2016.1
Micro Drainage Simulation- Version 2016.1

Revisions:

Revision Version:	Description:	Date:

Calculations Prepared By:		Calculations Checked By:	
Gavin Phillips		Phil Lawrence	
Signed:	Date:	Signed:	Date:
	09/08/2017		09/08/2017

Template Issue Date: 21/03/2016

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)	1	PIMP (%)	100
M5-60 (mm)	17.800	Add Flow / Climate Change (%)	0
Ratio R	0.270	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.824	4-8	0.270

Total Area Contributing (ha) = 1.094

Total Pipe Volume (m³) = 30.911

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	83.250	1.189	70.0	0.064	1.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	35.500	0.507	70.0	0.064	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	82.250	1.300	63.3	0.065	1.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	12.641	0.090	140.5	0.065	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	24.837	0.723	34.4	0.048	1.00	0.0	0.600	o	375	Pipe/Conduit	

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)
1.000	50.00	1.89	30.510	0.064	0.0	0.0	0.0	1.56	62.2	8.7
1.001	50.00	2.26	29.321	0.128	0.0	0.0	0.0	1.56	62.2	17.3
2.000	50.00	1.83	30.110	0.065	0.0	0.0	0.0	1.65	65.5	8.8
1.002	49.86	2.46	28.810	0.258	0.0	0.0	0.0	1.10	43.8	34.8
3.000	50.00	1.13	29.452	0.048	0.0	0.0	0.0	3.10	342.4	6.5

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)	Section Type	Auto Design
4.000	33.200	1.660	20.0	0.015	1.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	15.082	0.754	20.0	0.023	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	18.820	2.235	8.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	29.613	0.212	139.7	0.087	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	26.000	0.186	139.8	0.058	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	26.000	0.186	139.8	0.062	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	5.637	0.040	140.9	0.082	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.007	7.703	0.055	140.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.008	19.048	0.136	140.0	0.361	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.009	82.202	7.159	11.5	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.010	5.000	0.025	200.0	0.100	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.011	5.000	0.025	200.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

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)
4.000	50.00	1.19	33.373	0.015	0.0	0.0	0.0	2.94	116.9	2.0
4.001	50.00	1.27	31.713	0.038	0.0	0.0	0.0	2.94	116.9	5.1
4.002	50.00	1.34	30.959	0.038	0.0	0.0	0.0	4.54	180.4	5.1
1.003	47.72	2.90	28.724	0.431	0.0	0.0	0.0	1.10	43.9«	55.7
1.004	46.01	3.30	28.512	0.489	0.0	0.0	0.0	1.10	43.9«	60.9
1.005	44.45	3.69	28.326	0.551	0.0	0.0	0.0	1.10	43.9«	66.3
1.006	44.22	3.75	28.140	0.633	0.0	0.0	0.0	1.52	168.4	75.8
1.007	43.91	3.83	28.100	0.633	0.0	0.0	0.0	1.53	168.9	75.8
1.008	43.16	4.04	28.045	0.994	0.0	0.0	0.0	1.53	168.9	116.2
1.009	42.28	4.30	27.909	0.994	0.0	0.0	0.0	5.37	593.4	116.2
1.010	42.07	4.36	20.750	1.094	0.0	0.0	0.0	1.28	141.1	124.6
1.011	41.85	4.43	20.725	1.094	0.0	0.0	0.0	1.28	141.1	124.6

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)
1.011		21.700	20.700	0.000	0	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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.800	Storm Duration (mins)	30
Ratio R	0.270		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S13, DS/PN: 1.011, Volume (m³): 1.9

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	20.725
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)	1.000	5.0	Kick-Flo®	0.637	4.1
Flush-Flo™	0.296	5.0	Mean Flow over Head Range	-	4.3

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	3.6	1.200	5.4	3.000	8.4	7.000	12.5
0.200	4.8	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.0	1.600	6.2	4.000	9.6	8.000	13.3
0.400	4.9	1.800	6.6	4.500	10.1	8.500	13.7
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.1
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.5
0.800	4.5	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.1		

Storage Structures for Storm

Tank or Pond Manhole: POND, DS/PN: 1.010

Invert Level (m) 20.751

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	772.0	1.000	1220.0

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	0.271
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	100.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480
Return Period(s) (years)	100
Climate Change (%)	30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	30 Winter	100	+30%	100/15 Summer	100/15 Summer			31.116
1.001	S2	15 Winter	100	+30%	100/15 Summer	100/15 Summer			31.113
2.000	S3	30 Winter	100	+30%	100/15 Summer	100/15 Summer			31.112
1.002	S4	15 Winter	100	+30%	100/15 Summer	100/15 Summer			31.110
3.000	S16	30 Winter	100	+30%	100/15 Summer	100/15 Summer			30.884
4.000	S13	15 Summer	100	+30%					33.420
4.001	S14	15 Summer	100	+30%					31.780
4.002	S15	15 Summer	100	+30%					31.011
1.003	S5	30 Winter	100	+30%	100/15 Summer	100/15 Summer			30.888
1.004	S6	15 Winter	100	+30%	100/15 Summer				30.705
1.005	S7	15 Winter	100	+30%	100/15 Summer				30.165
1.006	S8	15 Winter	100	+30%	100/15 Summer				29.085
1.007	S9	15 Winter	100	+30%	100/15 Summer				28.970
1.008	S10	15 Winter	100	+30%	100/15 Summer				28.862
1.009	S11	15 Winter	100	+30%					28.100
1.010	POND	480 Winter	100	+30%	100/60 Summer				21.540
1.011	S13	480 Winter	100	+30%	100/30 Winter				21.561

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.381	6.160	0.38		22.9	FLOOD	6
1.001	S2	1.567	3.051	0.46		27.2	FLOOD	6
2.000	S3	0.777	1.900	0.33		21.0	FLOOD	6

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.002	S4	2.075	0.133	1.42		53.5	FLOOD	1
3.000	S16	1.057	7.295	0.16		47.0	FLOOD	7
4.000	S13	-0.178	0.000	0.09		10.2	OK	
4.001	S14	-0.158	0.000	0.18		19.0	OK	
4.002	S15	-0.173	0.000	0.12		19.3	OK	
1.003	S5	1.939	11.067	1.87		76.6	FLOOD	7
1.004	S6	1.968	0.000	1.98		80.5	SURCHARGED	
1.005	S7	1.614	0.000	2.38		96.6	SURCHARGED	
1.006	S8	0.570	0.000	1.24		131.8	SURCHARGED	
1.007	S9	0.495	0.000	1.29		138.0	SURCHARGED	
1.008	S10	0.442	0.000	2.03		285.5	SURCHARGED	
1.009	S11	-0.184	0.000	0.51		286.8	OK	
1.010	POND	0.415	0.000	0.12		10.1	SURCHARGED	
1.011	S13	0.461	0.000	0.06		5.0	SURCHARGED	