

320180500P

DRAINAGE STRATEGY

for

REILLY DEVELOPMENTS

PROPOSED RESIDENTIAL DEVELOPMENT

(PHASE 3)

at

CLITHEROE ROAD

BARROW

JUNE 2018

REFORD

Consulting Engineers Limited

7 Hall Road, Fulwood, Preston, PR2 9QD

Mobile: 07970 265334 Email: r.e.ford@virginmedia.com

Company number: 09620365 VAT Reg. 215 5638 12

CONTENTS

SECTION	TITLE	PAGE
1	INTRODUCTION	3
2	BASE INFORMATION	4
3	DRAINAGE STRATEGY	5
4	SUMMARY AND CONCLUSIONS	7

APPENDICES

- A Location plan
- B Proposed drainage layout
- C Preliminary surface water drainage design

1. INTRODUCTION

- 1.1** This drainage strategy has been produced on behalf of Reilly Developments in support of a planning application for Phase 3 of the proposed residential development at Clitheroe Road, Barrow. A location plan is included within Appendix A.
- 1.2** The site lies to the east of Clitheroe Road. Phase 2 of the development lies to the south of the site and the rear gardens to the residential properties fronting Whiteacre Lane lie to the north. Access to the site is via Clitheroe Road, through Phase 2.
- 1.3** The site is approx. 0.94 hectare and comprises rough grassland.
- 1.4** Foul and surface water drainage systems drain Phase 2 and connection points have been identified to drain Phase 3 through these systems.

2. BASE INFORMATION

Topographical survey

- 2.1 A topographical survey of the site has been carried out. The site is generally flat with a fall at its western end enabling a connection to Phase 2.

Site geology

- 2.2 The online Soilscales Viewer has identified the site lying in a region characterised by slowly permeable seasonally wet acid loamy and clayey soils, which are not conducive to infiltration.

Existing watercourses and features

- 2.3 Along the eastern and part of the southern boundary to Phase 2 boundary of the site is a watercourse that flows to the southwest to ultimately discharge into the River Calder.
- 2.4 An attenuated surface water runoff from Phase 2 of the development site discharges into this watercourse.

Existing drainage

- 2.5 Connection points into the existing foul and surface water drainage systems for Phase 2 have been identified to drain Phase 3. It has been identified that the surface water drainage for Phase 2 has been designed to accept a surface water discharge of 5 l/s from Phase 3.

3. DRAINAGE STRATEGY

3.1 A layout of the proposed drainage is included within Appendix B.

Surface water drainage

- 3.2** Guidance for the disposal of surface water from a development site is for soakaways to be considered as the primary solution. If this is not practical, discharge to a waterbody or watercourse is to be considered as the next available alternative. Only if neither of these options is available, and other sustainable drainage methods not possible, should the use of the public sewerage system be considered.
- 3.3** The online Soilsmap Viewer has identified the site lying in a region characterised by slowly permeable seasonally wet acid loamy and clayey soils, which are not conducive to infiltration.
- 3.4** It has been identified that the surface water drainage for Phase 2 has been designed to accept a surface water discharge of 5 l/s from Phase 3.
- 3.5** It is therefore intended that surface water runoff from the developed Phase 3 site will use the existing connection to discharge into the Phase 2 drainage and the watercourse that lies along the eastern and part of the southern boundary of the Phase 2 site.
- 3.6** New surface water drainage will be constructed, appropriately sized to take all surface water runoff from the Phase 3 development, and will be attenuated to 5 l/s prior to discharge.
- 3.7** Attenuation will be provided for rainfall events up to the 100 year critical rain storm plus 30% on stored volumes. The additional 30% is to allow for climate change and has been included in the surface water volume. As such there will be no change to the flood risk upstream or downstream of this location.
- 3.8** A preliminary surface water drainage design has been carried out for the 100 year critical rain storm plus 30% on stored volumes. Below ground attenuation is provided. The design is included within Appendix C.

Foul water drainage

- 3.9 It is intended that foul water discharges from the site will be to the existing foul drainage system within Phase 2.
- 3.10 Two 110mm diameter connection points have been provided, one on either side of the access road.
- 3.11 Each of these drainage runs will be extended on either side of the access road into Phase 3 to collect foul water discharges from the properties that will lie on either side of the access road. As such there will be no more than ten residential dwellings connecting to each connection point thus complying with the requirements of Building Regulations.

4. SUMMARY AND CONCLUSIONS

- 4.1** This drainage strategy has been produced on behalf of Reilly Developments in support of a planning application for Phase 3 of the proposed residential development at Clitheroe Road, Barrow.
- 4.2** The nature of the local geology means that infiltration of surface water runoff back into the ground is not feasible on this site.
- 4.3** It has been identified that the surface water drainage for Phase 2 has been designed to accept a surface water discharge of 5 l/s from Phase 3.
- 4.4** It is therefore intended that surface water runoff from the developed Phase 3 site will use the existing connection to discharge into the Phase 2 drainage and the watercourse that lies along the eastern and part of the southern boundary of the Phase 2 site. The discharge will be attenuated to 5 l/s and attenuation provided within the proposed drainage system below ground.
- 4.5** It is intended that foul water discharges from the site will be to the existing foul drainage system within Phase 2.

APPENDIX A



CLITHEROE ROAD, BARROW, WHALLEY – LOCATION PLAN

APPENDIX B



Sheet
Proposed Development at
Clitheroe Road, Barrow
Phase 3

PRELIMINARY DRAINAGE LAYOUT

— SURFACE WATER
— FOUL WATER

APPENDIX C

Drainage Design Report

Flow

v7.0

Copyright © 1988-2018 Causeway Software Solutions Limited

Network	Storm Network
Filename	C:\Users\Bob\Documents\reford\18.4.16 Clitheroe Road, Barrow, Whalley\drainage design\barrow 900.pfd
Username	Bob Ford (r.e.ford@virginmedia.com)
Last analysed	05/06/2018 12:58:18
Report produced on	05/06/2018 13:01:13

Causeway Sales

Tel:	+44(0) 1628 552000
Fax:	+44(0) 1628 552001
Email:	marketing@causeway.com
Web:	www.causeway.com

Technical support web portal:

<http://support.causeway.com>



Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	18.900
Ratio-R	0.280
CV	0.750
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	75.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	1.000
Preferred Cover Depth (m)	1.200
Enforce best practice design rules	

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Diameter (mm)	Depth (m)
1	0.031	5.00		77.500	Manhole	1200	1.425
2	0.051	5.00		77.900	Manhole	1200	1.884
3	0.075	5.00		77.850	Manhole	1200	1.964
4	0.078	5.00		77.750	Manhole	1200	2.000
5	0.064	5.00		77.000	Manhole	1200	2.150
6	0.051	5.00		76.200	Manhole	1800	2.575
7	0.014	5.00		75.750	Manhole	1800	2.625
8	0.024	5.00		75.350	Manhole	1800	2.525
9				74.650	Manhole	1200	2.425



Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Min DS IL (m)	Lateral Area (ha)	Lateral Inlet Point (%)	Lateral T of E (mins)
1.000	1	2	10.000	76.075	76.016	0.059	169.5	225	Circular	5.17	54.6				
1.001	2	3	22.000	76.016	75.886	0.130	169.2	225	Circular	5.53	53.2				
1.002	3	4	23.000	75.886	75.750	0.136	168.1	225	Circular	5.91	51.8				
1.003	4	5	27.000	75.750	75.075	0.675	40.0	225	Circular	6.13	51.1				
1.004	5	6	17.000	74.850	74.075	0.775	21.9	450	Circular	6.20	50.8				
1.005	6	7	11.000	73.625	73.125	0.500	22.0	900	Circular	6.22	50.7				
1.006	7	8	14.000	73.125	72.825	0.300	46.7	900	Circular	6.28	50.6				
1.007	8	9	26.000	72.825	72.225	0.600	43.3	225	Circular	6.49	49.9				

Rainfall Methodology	FSR	Return Period (years)	Climate Change (%)
FSR Region	England and Wales	1	0
M5-60 (mm)	18.900	30	0
Ratio-R	0.280	100	0
Summer CV	0.750	100	30
Winter CV	0.840		
Analysis Speed	Normal		
Drain Down Time (mins)	240		
Additional Storage (m ² /ha)	20.0		
Storm Durations (mins)	15		
	30		
	60		
	120		
	180		
	240		
	360		
	480		
	600		
	720		
	960		
	1440		
Check Discharge Rate(s)	x		
1 year (l/s)			
30 year (l/s)			
100 year (l/s)			
Check Discharge Volume	x		
100 year 360 minute (m ³)			

Node	Flap Valve	Online / Offline	Replaces Downstream Link	Loop to Node	Invert Level (m)	Design Depth (m)	Design Flow (l/s)	Objective	Sump Available	Product Number	Min Outlet Diameter (m)	Min Node Diameter (mm)
8	x	Online	x		72.825	2.500	5.0 (HE)	Minimise upstream storage		CTL-SHE-0087-5000-2500-5000	0.100	1200

Hydro-Brake®

Depth/Area/Inf Area

Node	Base Inf Coefficient (m/hr)	Side Inf Coefficient (m/hr)	Safety Factor	Porosity	Invert Level (m)	Time to half empty (mins)	Depth (m)	Area (m ²)	Inf. Area (m ²)
7	0.00000	0.00000	2.0	0.95	73.125		0.000	100.0	0.0
							0.200	100.0	0.0
							0.400	100.0	0.0
							0.600	100.0	0.0
							0.800	100.0	0.0
							1.000	100.0	0.0
							1.200	100.0	0.0
							1.400	100.0	0.0
							1.600	100.0	0.0
							1.800	100.0	0.0
							1.801	0.0	0.0



Flow v7.0 Design Report: 1 year Critical

Results for 1 year Critical Storm Duration. Lowest mean balance: 35.63%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	FlowCap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	10	76.121	0.046	3.7	0.0716	0.0000OK		1.000	2	3.6	0.430	0.091	0.0854	
15 minute winter	2	10	76.090	0.074	9.6	0.1235	0.0000OK		1.001	3	9.4	0.617	0.236	0.3962	
15 minute winter	3	10	75.996	0.110	18.3	0.2081	0.0000OK		1.002	4	18.0	1.048	0.452	0.3959	
15 minute winter	4	11	75.842	0.092	26.9	0.1753	0.0000OK		1.003	5	27.0	1.825	0.327	0.3994	
15 minute winter	5	11	74.921	0.071	34.1	0.1218	0.0000OK		1.004	6	34.2	2.238	0.049	0.2601	
15 minute winter	6	10	73.690	0.065	39.9	0.1921	0.0000OK		1.005	7	40.5	2.328	0.010	0.3761	
180 minute winter	7	140	73.392	0.267	23.5	26.1192	0.0000OK		1.006	8	19.5	0.134	0.007	4.0446	
180 minute winter	8	144	73.392	0.567	20.4	1.5498	0.0000SURCHARGED		1.007	9	3.7	1.014	0.046	0.0837	61.0
60 minute summer	9	110	72.258	0.033	3.7	0.0000	0.0000OK								



Results for 30 year Critical Storm Duration. Lowest excess balance: 98.86%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	D/S Node ID	Outflow (l/s)	Velocity (m/s)	FlowCap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	10	76.152	0.077	9.0	0.1204	0.0000OK		1.000	2	8.8	0.517	0.221	0.1761	
15 minute winter	2	11	76.144	0.128	23.5	0.2144	0.0000OK		1.001	3	22.7	0.738	0.570	0.8940	
15 minute winter	3	11	76.111	0.225	44.4	0.4266	0.0000SURCHARGED		1.002	4	42.9	1.249	1.076	0.8061	
15 minute winter	4	11	75.911	0.161	64.7	0.3073	0.0000OK		1.003	5	64.5	2.218	0.782	0.7850	
15 minute winter	5	11	74.962	0.112	81.9	0.1933	0.0000OK		1.004	6	82.1	2.830	0.119	0.4939	
240 minute winter	6	232	74.034	0.409	24.0	1.2029	0.0000OK		1.005	7	24.0	1.379	0.006	5.0262	
240 minute winter	7	232	74.034	0.908	28.7	88.7727	0.0000SURCHARGED		1.006	8	18.9	0.153	0.006	8.8723	
240 minute winter	8	232	74.033	1.208	19.8	3.3027	0.0000SURCHARGED		1.007	9	3.7	1.014	0.046	0.0937	91.2
360 minute summer	9	1170	72.258	0.053	3.7	0.0000	0.0000OK								



Results for 300 year Critical Storm Duration. Lowest mass balance: 99.98%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	11	76.295	0.224	11.5	0.3507	0.0000OK		1.000	2	11.1	0.520	0.279	0.3975	
15 minute winter	2	11	76.295	0.279	28.2	0.4664	0.0000SURCHARGED		1.001	3	27.7	0.740	0.694	0.8750	
15 minute winter	3	11	76.216	0.332	53.3	0.6283	0.0000SURCHARGED		1.002	4	52.5	1.323	1.318	0.8836	
15 minute winter	4	11	75.948	0.198	79.8	0.3789	0.0000OK		1.003	5	79.2	2.266	0.961	0.9474	
15 minute winter	5	11	74.976	0.126	101.6	0.2176	0.0000OK		1.004	6	101.6	2.985	0.147	0.5791	
360 minute winter	6	344	74.421	0.796	23.3	2.3411	0.0000OK		1.005	7	21.5	1.344	0.005	6.7488	
360 minute winter	7	344	74.421	1.296	22.4	126.5597	0.0000SURCHARGED		1.006	8	18.4	0.147	0.006	8.8728	
360 minute winter	8	344	74.421	1.596	19.1	4.3652	0.0000SURCHARGED		1.007	9	4.0	1.044	0.051	0.1002	126.5
360 minute winter	9	344	72.259	0.034	4.0	0.0000	0.0000OK								



Flow v7.0 Design Report: 100 year +30% Critical

Results for 100 year +30% Critical Storm Duration. Lowest mass imbalance: 99.89%

Event	US Node ID	Peak (m/s)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	12	76.823	0.748	15.0	1.1709	0.0000	SURCHARGED	1.000	2	14.0	0.518	0.353	0.3977	
15 minute winter	2	12	76.814	0.798	33.6	1.3335	0.0000	SURCHARGED	1.001	3	34.0	0.855	0.853	0.8750	
15 minute winter	3	12	76.704	0.818	63.6	1.5499	0.0000	SURCHARGED	1.002	4	62.2	1.565	1.562	0.9147	
15 minute winter	4	12	76.295	0.545	95.1	1.0412	0.0000	SURCHARGED	1.003	5	93.3	2.346	1.131	1.0734	
360 minute winter	5	344	75.246	0.398	26.1	0.6841	0.0000	OK	1.004	6	26.1	2.073	0.038	2.6039	
360 minute winter	6	344	75.243	1.618	30.6	4.7576	0.0000	SURCHARGED	1.005	7	28.7	1.470	0.007	6.9715	
360 minute winter	7	344	75.243	2.118	29.8	176.8613	0.0000	SURCHARGED	1.006	8	19.3	0.154	0.007	8.8728	
360 minute winter	8	344	75.242	2.417	19.8	6.6109	0.0000	FLOOD RISK	1.007	9	4.9	1.104	0.062	0.1153	142.6
360 minute winter	9	344	72.263	0.038	4.9	0.0000	0.0000	OK							

