SURFACE WATER DRAINAGE STRATEGY

INCORPORATING AN ASSESSMENT OF FLOOD RISK

for

Mr N FORSHAW

PROPOSED COMMERCIAL UNITS

BOLTON FOLD FARM, ALSTON LANE, ALSTON, LONGRIDGE

NOVEMBER 2023

REFORD

Consulting Engineers Limited

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[redacted]

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1. INTRODUCTION

1.1 This surface water drainage strategy with an assessment of flood risk has been produced on behalf of Mr N Forshaw in support of a retrospective planning application for three buildings for commercial use at Bolton Fold Farm, Alston Lane, Alston, Longridge, PR3 3BN. A location plan is included within Appendix A.

1.2 This surface water drainage strategy describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing drainage and includes a proposed strategy for the provision of new drainage to serve the proposed development.

2. BASE INFORMATION

Existing site

2.1 The proposal relates to a piece of land that lies to the east of the B6243 Preston Road, from which access is taken via Alston Lane.

2.2 The area of the site is approx. 3,440m^2, excluding the existing access into the site area from Alston Lane.

Understanding of existing drainage local to the site

2.3 United Utilities sewer records identify no sewers local to the area. The sewer records are included within Appendix B.

2.4 A watercourse, a tributary of the Tun Brook, lies along the eastern boundary of the development site and drains to the south to ultimately discharge into the River Ribble approx. 3.8km to the south of the site.

2.5 A private drainage system has been installed to allow a discharge of surface water runoff into the watercourse that lies along the eastern boundary of the development.

2.6 To the west of the site exists a stone culvert that lies to the south of the main farm buildings and runs across the fields to the southeast to also discharge into the watercourse.

Site geology

2.7 The online Soilscapes viewer has identified the geology of this parcel of land as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

Flood risk

2.8 The flood map for planning identifies the site lying within Flood Zone 1, the lowest risk, and is identified as land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%).

2.9 The Long Term Flood Risk map on the GOV.uk website shows the site is at a very low risk of surface water flooding. A very low risk means that each year, this area has a chance of flooding of less than 1 in 1000 (0.1%).

2.10 There are no canals or artificial sources local to the development site.

2.11 The Alston reservoirs lie approx. 900m to the north of the site. The Environment Agency risk of flooding from reservoirs map identifies the site is at risk when river levels are normal. All large reservoirs are regularly inspected by reservoir panel engineers and the Environment Agency ensures that reservoirs are regularly inspected and essential safety work is undertaken as appropriate. As such the risk of failure of the reservoirs is considered to be low.

2.12 United Utilities sewer records identify no sewers local to the area.

2.13 The application site is identified as lying within an area with a 25% to 50% risk of groundwater flooding. Groundwater flooding is not raised as a major issue in either the Wyre or Ribble Catchment Management Plans. Groundwater flooding is not considered to be a significant flood risk factor.

2.14 The development has increased the area of roofs and impermeable hardstanding on site and has, therefore, the potential to significantly alter the surface water runoff regime of the site, and to have an adverse effect on flood risk elsewhere in the wider catchment. Surface water runoff from the site will be controlled prior to a discharge being made into the watercourse that lies along the eastern boundary of the development.

Proposed development

2.15 The proposal is for the erection of three buildings for commercial use and associated hardstanding areas.

3. PROPOSED DRAINAGE STRATEGY

Surface water drainage

3.1 In accordance with the National Standards for Sustainable Drainage, the drainage strategy should incorporate the use of Sustainable Drainage (SUDS) where possible. The approach promotes the use infiltration features in the first instance. If drainage cannot be achieved solely through infiltration due to site conditions or contamination risks, the preferred options are (in order of preference):

(i) a controlled discharge to a local waterbody or watercourse, or

(ii) a controlled discharge into the public sewer network (depending on availability and capacity).

3.2 The rate and volume of discharge should strive to provide betterment and be restricted to the pre-development values as far as practicable.

3.3 The online Soilscapes viewer has identified the geology of this parcel of land as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils. As such infiltration techniques for the discharge of surface water back into the ground are unlikely to be viable.

3.4 A watercourse, a tributary of the Tun Brook, lies along the eastern boundary of the development and drains to the south to ultimately discharge into the River Ribble approx. 3.8km to the south of the site.

3.5 A private drainage system has been installed to allow a discharge of surface water runoff into the watercourse that lies along the eastern boundary of the development.

3.6 The whole development site area comprises building roofs and hardstanding areas.

3.7 It is therefore intended that surface water runoff from the developed site will be controlled to the existing pre-development Greenfield runoff rate, Qbar, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to discharge into the watercourse that lies along

the eastern boundary of the development. The additional 50% is to allow for climate change and has been included in the surface water volume.

3.8 To determine the restricted surface water discharge rate from the developed site, the pre-development Greenfield runoff rates have been calculated using the 'Causeway Flow' programme. The calculations are based upon the developed site area of 0.344ha. The existing pre-development Greenfield runoff rates have been calculated as below:

Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	0.344
SAAR (mm)	1094
Soil Index	4
SPR	0.47
Region	10
Betterment (%)	0
	Calc
QBar (l/s)	2.8

Return Period (years)	Growth Factor	Q (l/s)
1	0.87	2.4
30	1.70	4.8
100	2.08	5.8

3.9 A surface water drainage design has been carried out for the site development for all events up to the 100 year critical rain storm plus 50% on stored volumes. The design takes all surface water runoff from the proposed development's buildings roofs and hardstanding areas, and is attenuated to the pre-development Greenfield runoff rate, Qbar, 2.8 l/s, prior to a controlled discharge made into the watercourse that lies along the eastern boundary of the development. Attenuation will be provided within land owned by the applicant utilising a surface pond that is to be located within an adjacent field. The surface water drainage design is included within Appendix C.

4. SUMMARY AND CONCLUSIONS

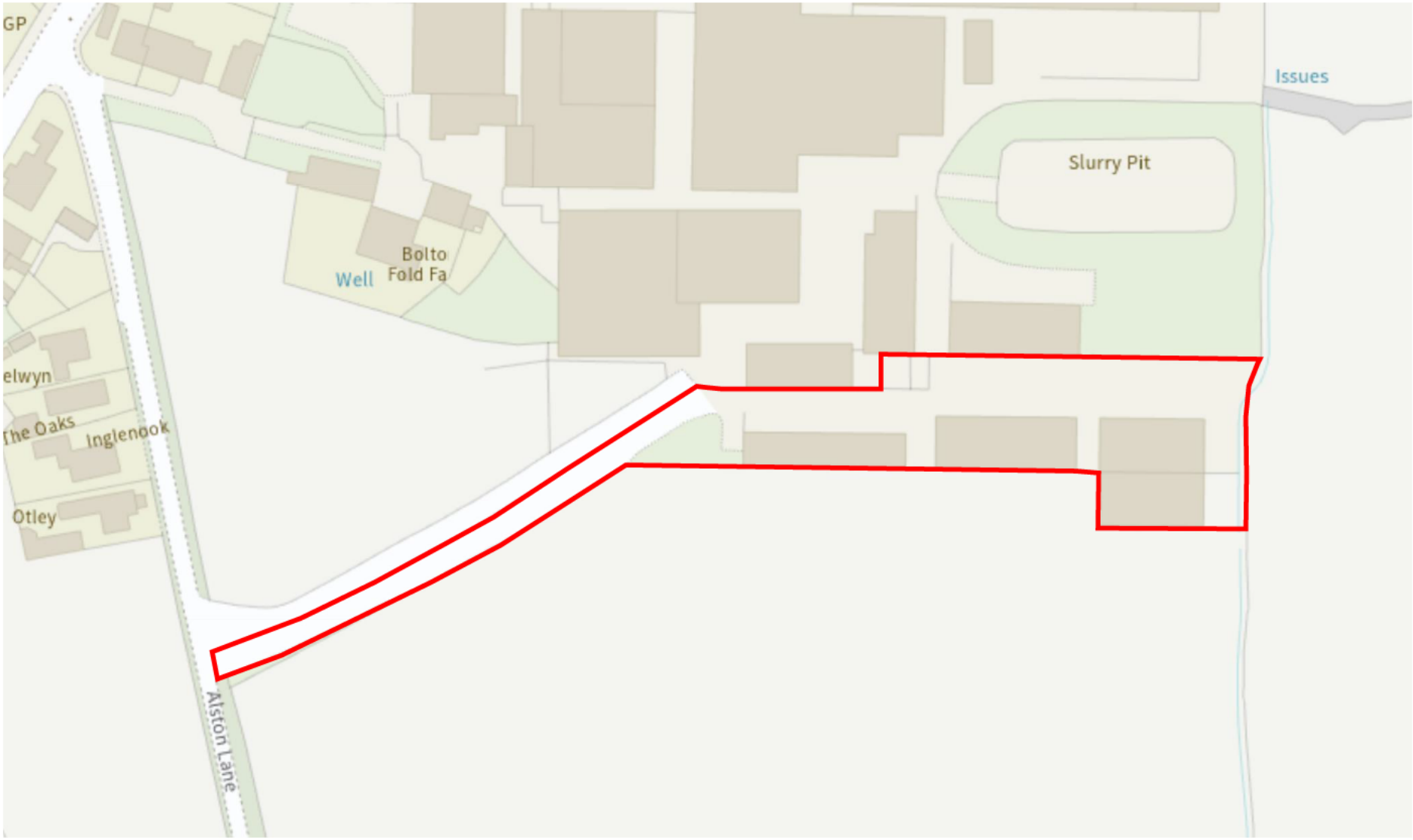
4.1 This surface water drainage strategy with an assessment of flood risk has been produced on behalf of Mr N Forshaw in support of a retrospective planning application for three buildings for commercial use at Bolton Fold Farm, Alston Lane, Alston, Longridge, PR3 3BN.

4.2 The risk of flooding to the development site is low.

4.3 A private drainage system has been installed to allow a discharge of surface water runoff into the watercourse that lies along the eastern boundary of the development.

4.4 Surface water runoff from the developed site will be controlled to the existing pre-development Greenfield runoff rate, Qbar, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to discharge into the watercourse that lies along the eastern boundary of the development. Attenuation will be provided within land owned by the applicant utilising a surface pond that is to be located within an adjacent field.

APPENDIX A

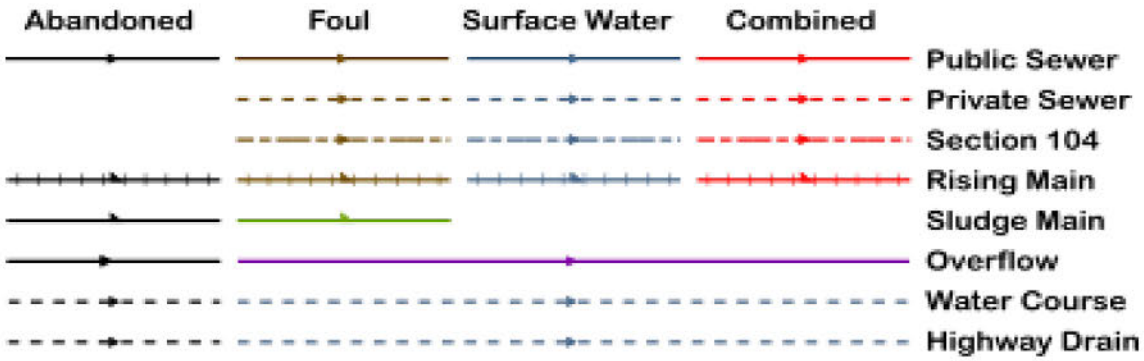


LOCATION PLAN

APPENDIX B

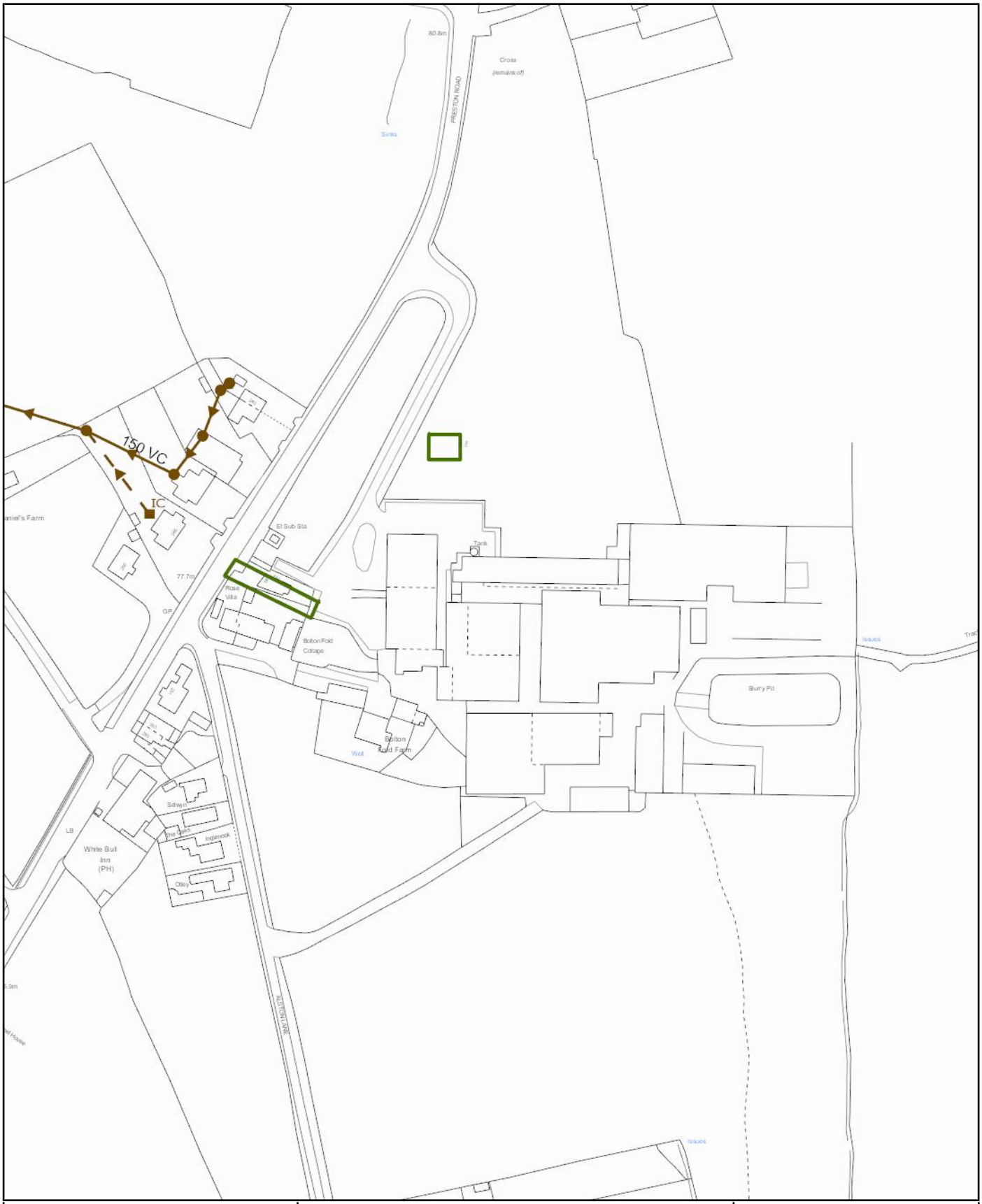
United Utilities
Water for the North West

Wastewater Symbology



All point assets follow the standard colour convention: red – combined, brown - foul, blue – surface water, purple - overflow

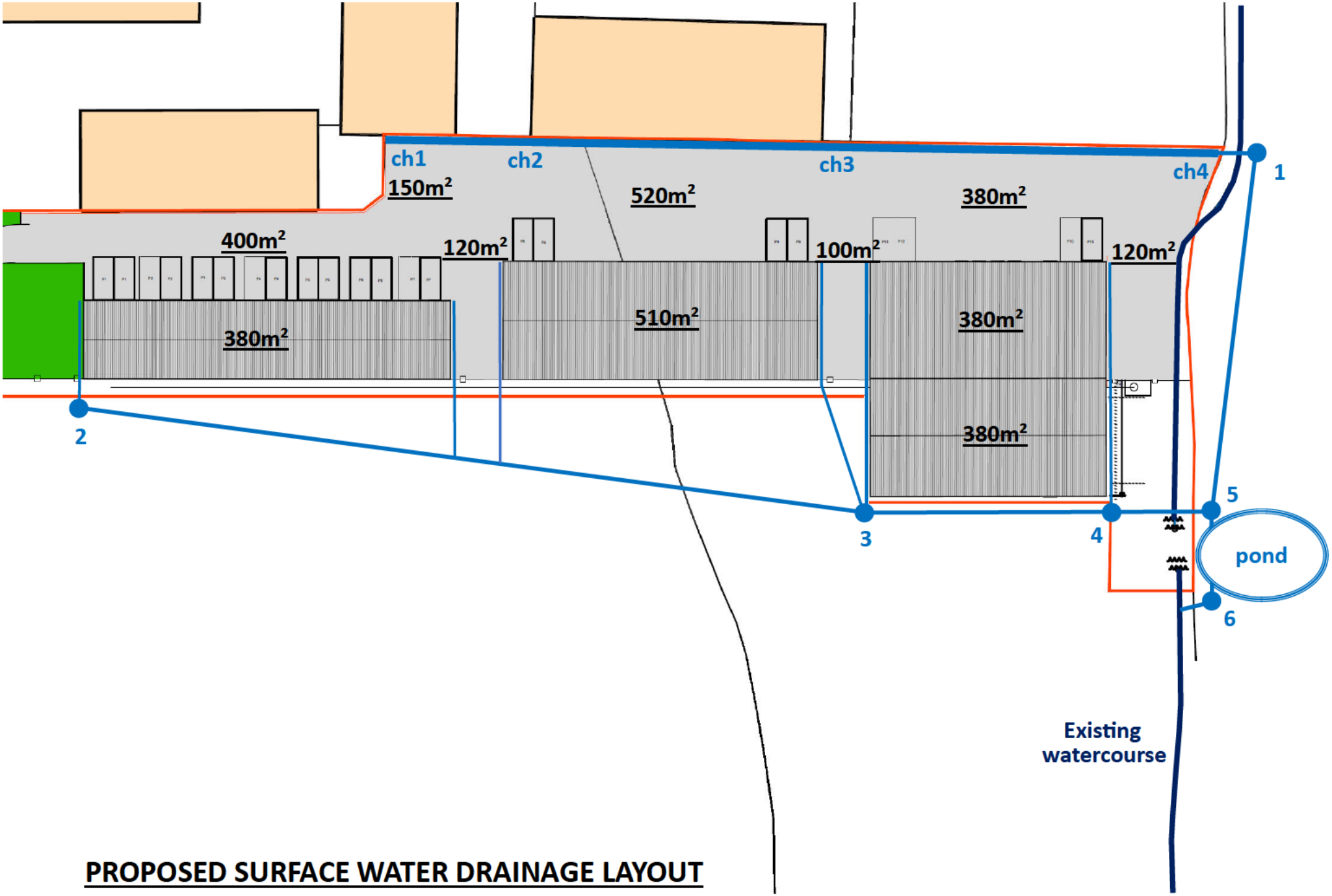
- Manhole
- HS Head of System
- ES Extent of Survey
- RE Rodding Eye
- IN Inlet
- DP Discharge Point
- HY Vortex
- PE Penstock
- WO Washout Chamber
- VA Valve
- AV Air Valve
- NRV Non Return Valve
- SO Soakaway
- GU Gully
- CA Cascade
- FM Flow Meter
- HA Hatch Box
- OI Oil Interceptor
- SM Summit
- DS Drop Shaft
- OP Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- IC Inspection Chamber
- Bifurcation Chamber
- LH Lamp Hole
- T Junction / Saddle
- CA Catchpit
- VC Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- T Network Storage Tank
- V Sewer Overflow
- WwTW Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- CK Control Kiosk
- Change of Characteristic



Scale:	1:2472	**SEWER RECORDS**	United Utilities Water for the North West
Date:	13/07/2023		
Address or Site Reference:	bolton fold farm		
Printed by:	Property Searches		

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

APPENDIX C



PROPOSED SURFACE WATER DRAINAGE LAYOUT

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	3.000
Ratio-R	0.300	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
ch1	0.055	5.00	100.000	300	0.300
ch2	0.069	5.00	100.000	300	0.314
ch3	0.055	5.00	100.000	300	0.352
ch4			100.000	300	1.066
1			100.000	1200	1.166
2	0.064	5.00	100.000	1200	0.825
3	0.063	5.00	100.000	1200	1.355
4	0.038	5.00	100.000	1200	1.532
5			100.000	1200	1.666
pond			100.000	1200	1.691
6			100.000	1200	1.740

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	ch1	ch2	14.000	0.600	99.700	99.686	0.014	1000.0	300	5.35	55.5
1.001	ch2	ch3	38.000	0.600	99.686	99.648	0.038	1000.0	300	6.31	51.9
1.002	ch3	ch4	38.000	0.600	99.648	99.610	0.038	1000.0	300	7.27	48.8
1.003	ch4	1	10.000	0.600	98.934	98.834	0.100	100.0	300	7.37	48.5
1.004	1	5	50.000	0.600	98.834	98.334	0.500	100.0	300	7.91	47.0
2.000	2	3	90.000	0.600	99.175	98.645	0.530	169.8	225	6.50	51.2
2.001	3	4	30.000	0.600	98.645	98.468	0.177	169.5	225	7.00	49.6
2.002	4	5	10.000	0.600	98.468	98.409	0.059	169.5	225	7.17	49.1
1.005	5	pond	5.000	0.600	98.334	98.309	0.025	200.0	300	7.98	46.8
1.006	pond	6	5.000	0.600	98.309	98.260	0.049	102.0	150	8.06	46.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	0.661	79.3	8.3	0.000	0.014	0.055	0.0
1.001	0.661	79.3	17.4	0.014	0.052	0.124	0.0
1.002	0.661	79.3	23.7	0.052	0.090	0.179	0.0
1.003	1.572	111.1	23.5	0.766	0.866	0.179	0.0
1.004	1.572	111.1	22.8	0.866	1.366	0.179	0.0
2.000	1.000	39.8	8.9	0.600	1.130	0.064	0.0
2.001	1.001	39.8	17.1	1.130	1.307	0.127	0.0
2.002	1.001	39.8	22.0	1.307	1.366	0.165	0.0
1.005	1.108	78.3	43.6	1.366	1.391	0.344	0.0
1.006	0.994	17.6	43.4	1.541	1.590	0.344	0.0

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	England and Wales	Winter CV	0.840	Additional Storage (m³/ha)	20.0
M5-60 (mm)	18.800	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.300	Skip Steady State	x	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	100	0	0	0
30	0	0	0	100	50	0	0

Node pond Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	98.309	Product Number	CTL-SHE-0071-2800-1650-2800
Design Depth (m)	1.650	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.8	Min Node Diameter (mm)	1200

Node pond Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	98.309
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)
0.000	130.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	ch1	11	99.770	0.070	6.6	0.2556	0.0000	OK
15 minute winter	ch2	11	99.767	0.081	14.2	0.3579	0.0000	OK
15 minute winter	ch3	12	99.747	0.099	19.3	0.3148	0.0000	OK
15 minute winter	ch4	12	99.020	0.086	17.5	0.0061	0.0000	OK
15 minute winter	1	13	98.914	0.080	17.4	0.0900	0.0000	OK
15 minute winter	2	11	99.240	0.065	7.7	0.1732	0.0000	OK
15 minute winter	3	11	98.736	0.091	14.5	0.1878	0.0000	OK
15 minute winter	4	11	98.622	0.154	18.2	0.2502	0.0000	OK
15 minute summer	5	11	98.599	0.265	35.1	0.2996	0.0000	OK
360 minute winter	pond	272	98.590	0.281	7.5	36.8809	0.0000	SURCHARGED
15 minute summer	6	1	98.260	0.000	1.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	ch1	1.000	ch2	5.9	0.206	0.075	0.4233	
15 minute winter	ch2	1.001	ch3	13.1	0.388	0.166	1.3661	
15 minute winter	ch3	1.002	ch4	17.5	0.559	0.220	1.1892	
15 minute winter	ch4	1.003	1	17.4	1.112	0.157	0.1573	
15 minute winter	1	1.004	5	17.4	0.762	0.157	1.8873	
15 minute winter	2	2.000	3	7.3	0.599	0.183	1.1004	
15 minute winter	3	2.001	4	13.9	0.757	0.350	0.6596	
15 minute winter	4	2.002	5	22.4	0.969	0.563	0.3095	
15 minute summer	5	1.005	pond	48.5	1.941	0.620	0.1668	
360 minute winter	pond	Hydro-Brake®	6	2.2				60.5

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	ch1	11	99.851	0.151	16.2	0.5522	0.0000	OK
15 minute winter	ch2	11	99.849	0.163	34.6	0.7154	0.0000	OK
15 minute winter	ch3	12	99.824	0.176	47.6	0.5628	0.0000	OK
480 minute winter	ch4	464	99.085	0.151	7.4	0.0107	0.0000	OK
480 minute winter	1	464	99.085	0.251	7.4	0.2842	0.0000	OK
15 minute winter	2	11	99.280	0.105	18.8	0.2820	0.0000	OK
480 minute winter	3	464	99.085	0.440	5.2	0.9075	0.0000	SURCHARGED
480 minute winter	4	464	99.085	0.617	6.5	1.0044	0.0000	SURCHARGED
480 minute winter	5	464	99.085	0.751	13.0	0.8497	0.0000	SURCHARGED
480 minute winter	pond	464	99.085	0.776	12.6	101.7914	0.0000	SURCHARGED
15 minute summer	6	1	98.260	0.000	2.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	ch1	1.000	ch2	14.6	0.250	0.184	0.8775	
15 minute winter	ch2	1.001	ch3	32.4	0.485	0.409	2.5633	
15 minute winter	ch3	1.002	ch4	45.6	0.797	0.575	2.1732	
480 minute winter	ch4	1.003	1	7.4	0.874	0.067	0.4932	
480 minute winter	1	1.004	5	7.4	0.349	0.067	3.3362	
15 minute winter	2	2.000	3	18.0	0.700	0.453	2.4386	
480 minute winter	3	2.001	4	5.0	0.567	0.124	1.1931	
480 minute winter	4	2.002	5	6.1	0.597	0.152	0.3977	
480 minute winter	5	1.005	pond	12.6	0.797	0.161	0.3521	
480 minute winter	pond	Hydro-Brake®	6	2.2				74.4

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	ch1	11	99.886	0.186	20.9	0.6808	0.0000	OK
15 minute winter	ch2	11	99.884	0.198	44.9	0.8693	0.0000	OK
15 minute winter	ch3	12	99.856	0.208	61.9	0.6650	0.0000	OK
480 minute winter	ch4	464	99.351	0.417	9.4	0.0296	0.0000	SURCHARGED
480 minute winter	1	464	99.351	0.517	9.4	0.5847	0.0000	SURCHARGED
480 minute winter	2	464	99.351	0.176	3.4	0.4722	0.0000	OK
480 minute winter	3	464	99.351	0.706	6.7	1.4552	0.0000	SURCHARGED
480 minute winter	4	464	99.351	0.883	7.9	1.4366	0.0000	SURCHARGED
480 minute winter	5	480	99.351	1.017	17.1	1.1504	0.0000	SURCHARGED
480 minute winter	pond	464	99.351	1.042	16.6	136.6234	0.0000	SURCHARGED
15 minute summer	6	1	98.260	0.000	2.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	ch1	1.000	ch2	19.1	0.263	0.240	1.0738	
15 minute winter	ch2	1.001	ch3	42.3	0.525	0.533	3.0832	
15 minute winter	ch3	1.002	ch4	59.6	0.878	0.751	2.5794	
480 minute winter	ch4	1.003	1	9.4	0.934	0.085	0.7042	
480 minute winter	1	1.004	5	9.4	0.375	0.085	3.5210	
480 minute winter	2	2.000	3	3.4	0.460	0.085	3.2900	
480 minute winter	3	2.001	4	5.9	0.579	0.149	1.1931	
480 minute winter	4	2.002	5	7.7	0.595	0.195	0.3977	
480 minute winter	5	1.005	pond	16.6	0.843	0.212	0.3521	
480 minute winter	pond	Hydro-Brake®	6	2.3				82.7

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 98.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	ch1	690	99.966	0.266	3.2	0.9740	0.0000	OK
720 minute winter	ch2	690	99.966	0.280	7.2	1.2289	0.0000	OK
720 minute winter	ch3	690	99.966	0.318	10.4	1.0151	0.0000	FLOOD RISK
720 minute winter	ch4	690	99.966	1.032	10.4	0.0732	0.0000	FLOOD RISK
720 minute winter	1	690	99.966	1.132	10.3	1.2798	0.0000	FLOOD RISK
720 minute winter	2	690	99.966	0.791	3.7	2.1206	0.0000	FLOOD RISK
720 minute winter	3	690	99.966	1.321	7.4	2.7218	0.0000	FLOOD RISK
720 minute winter	4	690	99.966	1.498	8.7	2.4365	0.0000	FLOOD RISK
720 minute winter	5	690	99.966	1.632	18.4	1.8454	0.0000	FLOOD RISK
720 minute winter	pond	690	99.965	1.656	18.3	217.2034	0.0000	FLOOD RISK
15 minute summer	6	1	98.260	0.000	2.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	ch1	1.000	ch2	3.2	0.165	0.040	1.5269	
720 minute winter	ch2	1.001	ch3	7.2	0.285	0.091	4.5395	
720 minute winter	ch3	1.002	ch4	10.4	0.459	0.131	5.1171	
720 minute winter	ch4	1.003	1	10.3	0.911	0.093	0.7042	
720 minute winter	1	1.004	5	10.1	0.379	0.091	3.5210	
720 minute winter	2	2.000	3	3.7	0.417	0.093	3.5794	
720 minute winter	3	2.001	4	6.5	0.506	0.164	1.1931	
720 minute winter	4	2.002	5	8.5	0.522	0.214	0.3977	
720 minute winter	5	1.005	pond	18.3	0.838	0.234	0.3521	
720 minute winter	pond	Hydro-Brake®	6	2.8				131.3