Report Title	# Drainage Report
Property Address	Land adj Belvedere, Cleator Moor, CA23 3AE
Client	Ashwood Design Associates
Our Reference	23-041r001
Date	February 2023
Prepared by	Colin Aimers BEng Hons CEng MICE CEnv **Kingoor Consulting Ltd** 6B Clifford Court Parkhouse Carlisle CA3 0JG

Contents

Introduction

The purpose of this report is to provide technical design for the proposed drainage at a new dwelling on land adjacent to Belvedere, Cleator, Copeland, Cumbria, CA23 3AE. This follows the detailed site review by Kingmoor Consulting Ltd.

Research has been undertaken on the site and observations made regarding the existing site and the drainage servicing the site.

Calculations associated with the drainage have been performed by software packages from a recognised resource. Where appropriate copies of calculations are provided in the Appendices of this report.

Proposed Development

It is proposed that a new dwelling be constructed on the site. New drainage shall be installed for both foul and surface water drainage around the property and this shall include infrastructure drainage.

The development shall also replace the existing septic tank which services the existing Belvedere property adjacent to the site.

The Site

Existing Drainage Network

The existing site is not serviced by a United Utilities mains sewer but the adjacent properties adopt a traditional septic tank located near the site which discharges to the River Ehen nearby.

The surface water relies on existing drainage around the site which drains to the River Ehen.

Geology

Superficial Deposits

The published superficial geology by The British Geological Survey shows the site is composed of River Terrace deposits.

Trial pitting on the site indicated that the site has granular materials consistent with the published geology.

Solid Geology

The solid geology as published by the British Geological Survey shows the site to be underlain by the Buttermere Formation comprising of mudstones and siltstones.

Solid geology was not encountered during the fieldworks.

Groundwater

No ground water was encountered in the exploratory works undertaken on the site.

Percolation tests undertaken on the site indicate that the site has potential for direct drainage. Test results are presented in the Appendices of this report.

Drainage Strategy

Foul Drainage

It is proposed that the site and the adjacent property drain to a new replacement packaged treatment plant, removing the former septic tank from the site.

The existing outfall to the River Ehen shall be adopted by the replacement packaged plant.

Surface Water Drainage

It is proposed to discharge the surface water from the development to soakways present on site. Percolation test results indicate that soakaways would be suitable for use and there is sufficient space to allow the installation of soakways.

Existing formal outfalls from the site associated with the surface water shall be capped off, at the site boundary.

Hydraulic Design

Foul Drainage

Calculations have been undertaken on the foul network and are presented in the Appendices of this report.

The foul drainage shall be managed and treated via a Clearwater BTAU 12 person packaged plant as indicated on drawing 23-041 DWG001. Details of the proposed packaged plant are appended to this report.

Surface Water Drainage

Principally the surface water drainage has been calculated on the impermeable areas of the development.

Modelling has been conducted on the following rainfall events:

- 1 in 30 years
- 1 in 100 years + 40% increase due to climate change

An assessment of the proposed network has been undertaken to identify the requirements of the soakways on the site.

The following parameters were adopted in the analysis. These were obtained from UK SUDS based on the site location and data held by HR Wallingford.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.650
CV	0.750	Include Intermediate Ground	x
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Detailed Engineering

The detailed model presented in this report adopts the following engineering aspects specific to the site. Drawing 23-041 DWG001 indicates the location of the key elements.

Soakaway

Soakaways for the areas to be drained have been designed to prevent flooding occuring within and outside the site for the 1 in 100 year + 40% climate change event.

Node 99 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.04100	Invert Level (m)	71.400	Depth (m)	1.260
Side Inf Coefficient (m/hr)	0.04100	Time to half empty (mins)	594	Inf Depth (m)	1.200
Safety Factor	1.0	Pit Width (m)	4.200	Number Required	1
Porosity	0.95	Pit Length (m)	7.200		

Summary

The following summary associated with the critical storm event is offered.

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	73.082	0.082	5.4	0.0058	0.0000	OK
15 minute winter	2	10	73.011	0.199	10.4	0.0142	0.0000	SURCHARGED
600 minute winter	3	570	72.831	0.114	1.2	0.0081	0.0000	SURCHARGED
15 minute winter	4	12	73.326	0.326	3.0	0.0000	0.0000	SURCHARGED
15 minute winter	5	12	73.324	0.368	5.2	0.0000	0.0000	SURCHARGED
15 minute winter	6	12	73.312	0.312	3.0	0.0000	0.0000	SURCHARGED
15 minute winter	7	12	73.310	0.435	5.3	0.0000	0.0000	SURCHARGED
15 minute winter	8	12	73.295	0.449	8.5	0.0319	0.0000	SURCHARGED
15 minute winter	9	12	73.067	0.418	12.3	0.0296	0.0000	SURCHARGED
15 minute winter	10	10	73.019	0.019	0.6	0.0000	0.0000	OK
15 minute winter	11	10	72.970	0.026	1.2	0.0000	0.0000	OK
15 minute winter	12	12	72.896	0.313	12.4	0.0000	0.0000	SURCHARGED
600 minute winter	13	585	72.831	0.499	2.6	0.0354	0.0000	SURCHARGED
600 minute winter	14	585	72.834	0.605	3.8	0.0000	0.0000	SURCHARGED
600 minute winter	15	570	72.831	0.231	0.1	0.0164	0.0000	SURCHARGED
600 minute winter	16	570	72.831	0.340	0.3	0.0242	0.0000	SURCHARGED
600 minute winter	99	570	72.831	0.615	3.8	36.2116	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	1	5.000	2	5.1	0.696	0.644	0.0820
15 minute winter	2	5.001	3	10.0	1.303	1.269	0.0408
600 minute winter	3	5.002	14	1.2	0.928	0.105	0.0258
15 minute winter	4	1.000	5	2.6	0.595	0.326	0.0201
15 minute winter	5	1.001	7	3.8	0.705	0.481	0.0373
15 minute winter	6	2.000	7	2.5	0.734	0.188	0.0203
15 minute winter	7	1.002	8	6.0	0.765	0.757	0.0133
15 minute winter	8	1.003	9	8.0	1.029	1.024	0.0915
15 minute winter	9	1.004	12	11.3	1.442	1.434	0.0306
15 minute winter	10	3.000	11	0.6	0.455	0.076	0.0044
15 minute winter	11	3.001	12	1.2	0.728	0.151	0.0046
15 minute winter	12	1.005	13	12.1	1.542	0.995	0.0495
600 minute winter	13	1.006	14	2.6	0.875	0.329	0.0244
600 minute winter	14	1.007	99	3.8	0.804	0.215	0.0230
600 minute winter	15	4.000	16	0.1	0.013	0.013	0.0504
600 minute winter	16	4.001	13	0.3	0.182	0.038	0.0737
600 minute winter	99	Infiltration		0.7			

We consider that no flooding occurs on or off the site during the 1 in 30 year, and 1 in 100 year + 40% CC storm event.

Maintenance of Drainage

Operation and Maintenance Requirements

As with all traditional drainage systems, SuDS need to be inspected and maintained regularly to ensure that they operate correctly and efficiently. If SuDS are not properly maintained then there is a risk that the systems will become overloaded during periods of prolonged heavy rainfall, potentially resulting in localised flooding of the development. Recommendations for the SuDS maintenance activities for the privately maintained areas are detailed below.

All maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken in accordance with CDM regulations.

Inlets, Outlets, Controls and Inspection Chambers

- Inlets and outlets structures may be surface structures or conveyance pipes with guards or headwalls. They must be free from obstruction at all times.
- SuDS flow control structures can be protected orifices, slots weirs or other controls at or near the surface to be accessible and easy to maintain. They may be in baskets, in small chambers or in the open.
- Inspection Chambers and rodding eyes are used on bends or where pipes come together and allow cleaning of the system if necessary. They should be designed out of the system where possible.

Inlets, Outlets, Controls and Inspection Chambers	Frequency
Regular Maintenance • Inspect surface structures removing obstructions and silt as necessary. • Check there is no physical damage. • Strim vegetation 1m min. surround structures and keep hard aprons free from silt and debris. • Remove cover and inspect ensuring water is flowing freely and that the exit route for water is unobstructed. • Remove debris and silt.	Monthly

• Undertake inspection after leaf fall in autumn	
Occasional Tasks Check topsoil levels are 20mm above edges of manholes and chambers to avoid mower damage	Annual
Remedial Works Monitor effectiveness of the system and advise / inspect / clean and test if water is standing in the system. This may require specialist cleaning.	As Required

Planning Conditions

Planning consent granted by Copeland Borough Council under application reference 4/22/2078/0F1 conditioned a number of the drainage elements of the project. These are :

3. No development must commence until a surface water drainage scheme, based on the hierarchy of drainage options in the National Planning Practice Guidance with evidence of an assessment of the site conditions (inclusive of how the scheme shall be managed after completion) has been submitted to and approved in writing by the Local Planning Authority.

   The surface water drainage scheme must be in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacement national standards and unless otherwise agreed in writing by the Local Planning Authority, no surface water shall discharge to the public sewerage system either directly or indirectly.

   The development must be completed, maintained and managed in accordance with the approved details.

4. Details of all measurements to be taken by the applicant/developer to prevent surface water discharging onto or off the highway must be submitted to the Local Planning Authority for approval prior to development being commenced. Any approved works must be implemented prior to the development being completed and must be maintained operational thereafter.

5. No development must commence until details of works for the disposal of sewage have been submitted to and approved in writing by the Local Planning AUthority.

   The development must not be occupied until the approved works for the disposal of sewage have been provided on the site to serve the development.

   The approved works must be retained of the lifetime of the development thereafter.

Other Conditions

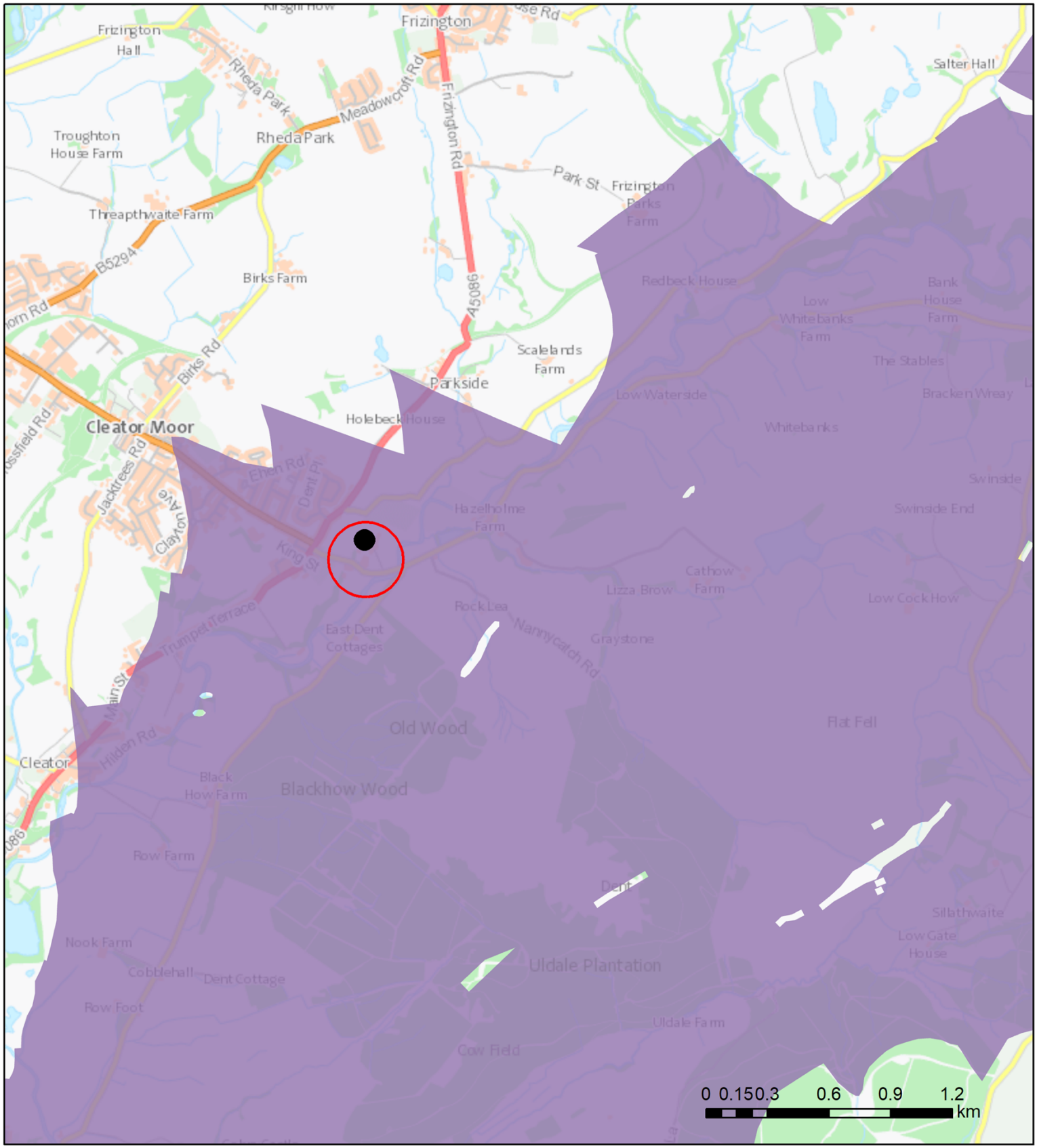
13. Foul and surface water shall be drained on separate systems.

We consider, in respect to the above conditions, this report addresses all of the above requirements alongside the inclusions.

Appendices

BGS Geological Records

Solid Geology



Map Key

Bedrock geology 1:50,000 scale

- LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - MICRODIORITE
- KIRK STILE FORMATION - MUDSTONE AND SILTSTONE
- FIRST SHALE MEMBER - SANDSTONE, SILTSTONE AND MUDSTONE
- PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- FIRST LIMESTONE (CUMBRIA) - LIMESTONE
- MILLYEAT MEMBER - MUDSTONE, SANDSTONE AND LIMESTONE
- MARSETT SANDSTONE FORMATION - CONGLOMERATE
- DEVOKE WATER TUFF MEMBER - VOLCANICLASTIC-BRECCIA
- BUTTERMERE FORMATION - MUDSTONE AND SANDSTONE
- PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- STAINMORE FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- ST BEES SANDSTONE MEMBER - SANDSTONE
- OREBANK SANDSTONE - SANDSTONE
- ENNERDALE INTRUSION - GRANITE, GRANOPHYRIC
- LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - FELSITE
- LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - ANDESITE
- ST BEES SHALE FORMATION - SILTSTONE AND MUDSTONE, INTERBEDDED
- WHITEHAVEN SANDSTONE FORMATION - SANDSTONE
- ST BEES EVAPORITE FORMATION - DOLOMITIC LIMESTONE, MUDSTONE AND ANHYDRITE-STONE
- LATTERBARROW SANDSTONE FORMATION - SANDSTONE
- HENSINGHAM GRIT - SANDSTONE
- BROCKRAM - BRECCIA

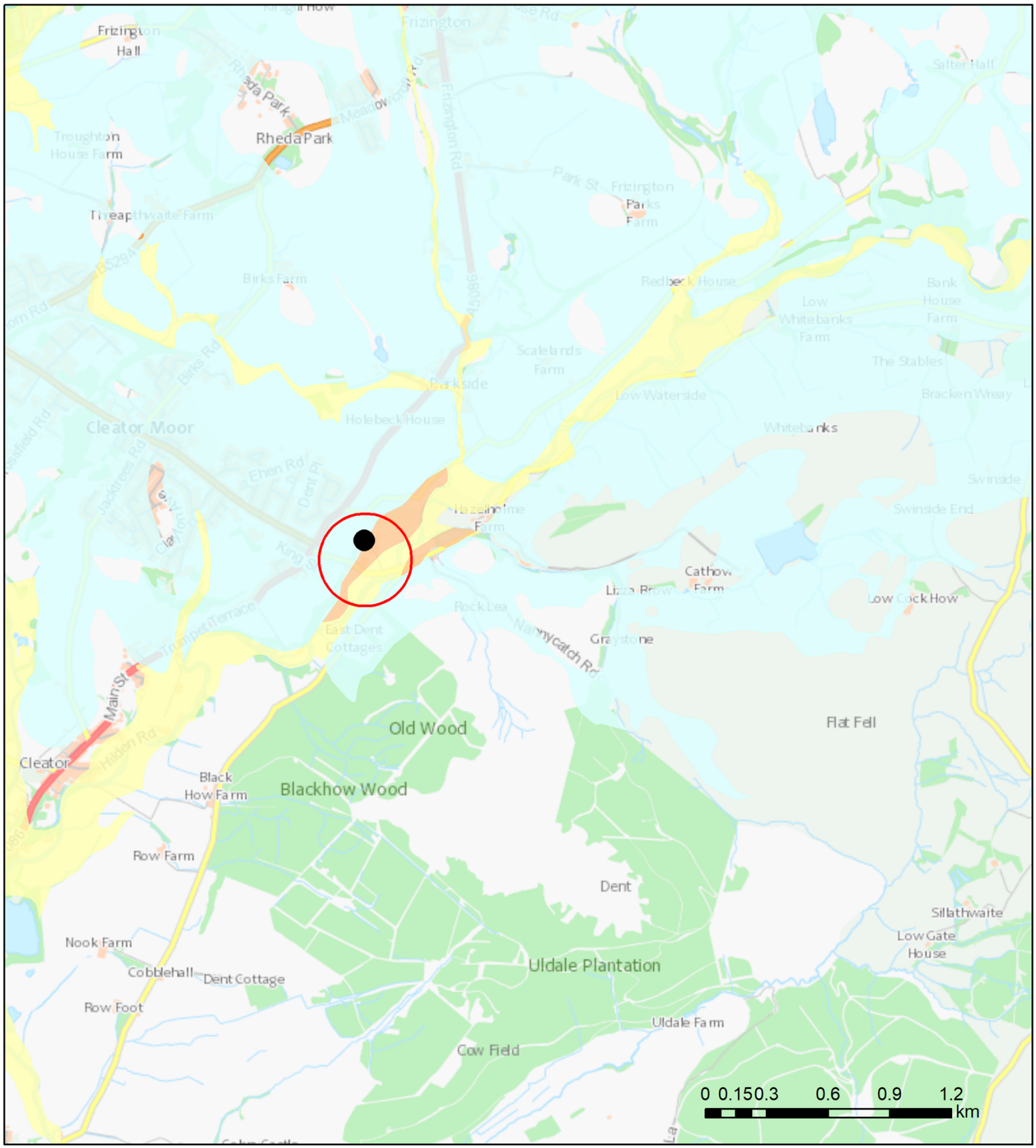
Selection Results

Bedrock geology 1:50,000 scale

Description	Details
BUTTERMERE FORMATION - MUDSTONE AND SANDSTONE	More Information

Superficial Deposits

British Geological Survey



Map Key

Superficial deposits 1:50,000 scale

- GLACIOFLUVIAL DEPOSITS, DEVENSIAN - SAND AND GRAVEL
- TILL, DEVENSIAN - DIAMICTON
- TALUS - ROCK FRAGMENTS, ANGULAR, UNDIFFERENTIATED SOURCE ROCK
- HUMMOCKY (MOUNDY) GLACIAL DEPOSITS, DEVENSIAN - CLAY, SAND AND GRAVEL
- ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
- HEAD - CLAY, SILT, SAND AND GRAVEL
- RIVER TERRACE DEPOSITS, 1 - CLAY, SAND AND GRAVEL
- ALLUVIAL FAN DEPOSITS - SAND AND GRAVEL
- PEAT - PEAT
- SUPERFICIAL THEME NOT MAPPED [FOR DIGITAL MAP USE ONLY] - UNKNOWN/UNCLASSIFIED ENTRY

Selection Results

Superficial deposits 1:50,000 scale

Description	Details
RIVER TERRACE DEPOSITS, 1 - CLAY, SAND AND GRAVEL	More Information
RIVER TERRACE DEPOSITS, 1 - CLAY, SAND AND GRAVEL	More Information
TILL, DEVENSIAN - DIAMICTON	More Information
ALLUVIUM - CLAY, SILT, SAND AND GRAVEL	More Information
TILL, DEVENSIAN - DIAMICTON	More Information

Percolation Test Results

PERCOLATION TESTS

Project : Belvedere, Cleator Moor
Project No : 23-041
Test Date : 8th December to 10th December
Weather :

Equipment **Hand Dug**
Wide **300 mm**
Long **1000 mm**
Deep **1000 mm**

Hole No.	Test	Depth (mm)	Fill Time	TIME @ 75%	TIME @ 25%	Finish	TIME 75-25 (sec)	Volume m3	Area m2	Infiltration Rate m/sec	Percolation Rate (sec/mm)
1	1	**1000**					**8280**	**1.50E-01**	**1.60E+00**	**1.13E-05**	**16.6**
1	2	**1000**					**8100**	**1.50E-01**	**1.60E+00**	**1.16E-05**	**16.2**
1	3	**1000**					**8340**	**1.50E-01**	**1.60E+00**	**1.12E-05**	**16.7**
									AVERAGE	**1.14E-05**	**16.48**

Drawings

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CLIENT

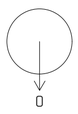
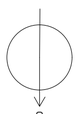
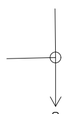
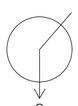
PROJECT

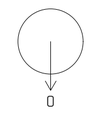
PROPOSED NEW DWELLING, LAND ADJ BELVERDERE, CLEATOR MOOR, CA23 3AE

TITLE

PROPOSED FOUL AND SURFACE DRAINAGE LAYOUT

SCALE	STATUS	
AS NOTED	FOR BUILDING CONTROL	
PAPER SIZE	DRAWN BY	CHECKED AND APPROVED
A1	C AIMERS	C AIMERS
PROJECT PHASE	DATE	DATE
BUILD	JAN 2023	JAN 2023
DRAWING NUMBER		REVISION
23-041-DWG001		A

Manhole Number	Cover Level	Connections	Pipe			Manhole Size	Types	
Coordinates	Depth To Soffit		Code	Inverts	Diams		Manhole	Cover
S1	73.750					300	4	A15
E. 140.036	0.650		0	5.000	73.000	100		
N. 164.271								
S2	73.750		1	5.000	72.812	100	4	A15
E. 150.312	0.838		0	5.001	72.812	100		
N. 159.976								
S3			1	5.002	72.717	100	JUNCTION	
E. 155.500			0					
N. 157.861								
S4							JUNCTION	
E. 134.208			0	1.000	73.000	100		
N. 159.240								
S5			1	1.000	72.956	100	JUNCTION	
E. 136.600			0	1.001	72.956	100		
N. 158.308								
S6							JUNCTION	
E. 132.380			0	2.000	73.000	100		
N. 154.860								
S7			1	1.001	72.875	100	JUNCTION	
E. 134.785			2	2.000	72.875	100		
N. 153.900			0	1.002	72.875	100		
S8	73.750		1	1.002	72.846	100	4	A15
E. 134.120	0.804		0	1.003	72.846	100	300	
N. 152.332								
S9	73.750		1	1.003	72.649	100	4	A15
E. 144.900	1.001		0	1.004	72.649	100	300	
N. 147.790								
S10							JUNCTION	
E. 149.000			0	3.000	73.000	100		
N. 155.050								
S11			1	3.000	72.944	100	JUNCTION	
E. 148.273			0	3.001	72.944	100		
N. 151.800								
S12			1	3.001	72.896	100	JUNCTION	
E. 148.620			2	1.004	72.583	100		
N. 149.000			0	1.005	72.583	100		
S15	73.350						4	A15
E. 149.132	0.650		0	4.000	72.600	100	300	
N. 136.600								
S16	73.350		1	4.000	72.491	100	4	A15
E. 151.590	0.759		0	4.001	72.491	100	300	
N. 142.551								

Manhole Number	Cover Level	Pipe Code Connections	Pipe			Manhole Size	Types	
Coordinates	Depth To Soffit		Code	Inverts	Diams		Manhole	Cover
F1	73.750					300	4	A15
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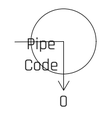
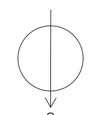
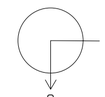
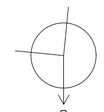
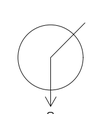
N. 162.412								
F2	73.750		1	1.000	73.122	100	4	A15
E. 149.470	0.528		0	1.001	73.122	100	300	
N. 160.040								
F3	73.750		1	1.001	73.067	100	4	A15
E. 147.780	0.583		0	1.002	73.067	100	300	
N. 156.000								
F4	73.750					300	4	A15
E. 137.100	0.450		0	2.000	73.200	100		
N. 158.450								
F5	73.750		1	2.000	73.119	100	4	A15
E. 134.600	0.531		0	2.001	73.119	100	300	
N. 152.555								
F6	73.750		1	1.002	72.964	100	3	A15
E. 144.631	0.686		2	2.001	72.964	100	300	
N. 148.400			0	1.003	72.964	100		
F7	73.550		1	1.003	72.781	100	3	A15
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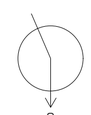
N. 134.430								
F8	73.300		1	1.004	72.549	100	3	A15
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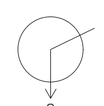
N. 118.070								
F9	73.240		1	1.005	72.329	100	3	A15
E. 150.500	0.811		0	1.006	72.329	100	300	
N. 100.600								
F10	73.000		1	1.006	72.107	100	3	A15
E. 167.050	0.793						300	
N. 94.175								

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CLIENT

PROJECT

PROPOSED NEW DWELLING, LAND ADJ BELVERDERE, CLEATOR MOOR, CA23 3AE

TITLE

PROPOSED FOUL AND SURFACE SCHEDULES

SCALE	STATUS	
AS NOTED	FOR BUILDING CONTROL	
PAPER SIZE	DRAWN BY	CHECKED AND APPROVED
A1	C AIMERS	C AIMERS
PROJECT PHASE	DATE	DATE
BUILD	JAN 2023	JAN 2023
DRAWING NUMBER		REVISION
23-041-DWG002		A

Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.650
CV	0.750	Include Intermediate Ground	x
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.009	4.00	73.750	300	140.036	164.271	0.750
2	0.009	4.00	73.750	300	150.312	159.976	0.938
3	0.000		73.750	300	155.500	157.861	1.033
4	0.005	4.00	73.750		134.208	159.240	0.750
5	0.005	4.00	73.750		136.600	158.308	0.794
6	0.005	4.00	73.750		132.380	154.860	0.750
7	0.000		73.750		134.785	153.900	0.875
8	0.009	4.00	73.750	300	134.120	152.332	0.904
9	0.009	4.00	73.750	300	144.900	147.790	1.101
10	0.001	4.00	73.750		149.000	155.050	0.750
11	0.001	4.00	73.750		148.273	151.800	0.806
12	0.000		73.750		148.620	149.000	1.167
13	0.000		73.450	300	154.420	151.540	1.118
14	0.000		73.350		155.116	154.584	1.121
15	0.000	4.00	73.350	300	149.132	136.600	0.750
16	0.005	4.00	73.350	300	151.590	142.551	0.859
99			73.350		156.414	154.443	1.134

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)
5.000	1	2	11.137	0.600	73.000	72.812	0.188	59.2	100	4.19	50.0
5.001	2	3	5.603	0.600	72.812	72.717	0.095	59.0	100	4.28	50.0
5.002	3	14	3.299	0.600	72.717	72.600	0.117	28.2	100	4.32	50.0
1.000	4	5	2.567	0.600	73.000	72.956	0.044	58.3	100	4.04	50.0
2.000	6	7	2.590	0.600	73.000	72.875	0.125	20.7	100	4.03	50.0
1.001	5	7	4.767	0.600	72.956	72.875	0.081	58.9	100	4.12	50.0
1.002	7	8	1.703	0.600	72.875	72.846	0.029	58.7	100	4.15	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
5.000	1.002	7.9	1.7	0.650	0.838	0.009	0.0	32	0.800
5.001	1.005	7.9	3.4	0.838	0.933	0.018	0.0	46	0.966
5.002	1.458	11.5	3.4	0.933	0.650	0.018	0.0	37	1.268
1.000	1.010	7.9	0.9	0.650	0.694	0.005	0.0	23	0.673
2.000	1.704	13.4	0.9	0.650	0.775	0.005	0.0	18	0.991
1.001	1.006	7.9	1.9	0.694	0.775	0.010	0.0	33	0.824
1.002	1.007	7.9	2.8	0.775	0.804	0.015	0.0	42	0.928

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)
1.003	8	9	11.698	0.600	72.846	72.649	0.197	59.4	100	4.34	50.0
3.000	10	11	3.330	0.600	73.000	72.944	0.056	59.5	100	4.06	50.0
3.001	11	12	2.821	0.600	72.944	72.896	0.048	58.8	100	4.10	50.0
1.004	9	12	3.912	0.600	72.649	72.583	0.066	59.3	100	4.41	50.0
1.005	12	13	6.332	0.600	72.583	72.332	0.251	25.2	100	4.48	50.0
4.000	15	16	6.439	0.600	72.600	72.491	0.109	59.1	100	4.11	50.0
4.001	16	13	9.424	0.600	72.491	72.332	0.159	59.3	100	4.26	50.0
1.006	13	14	3.123	0.600	72.332	72.279	0.053	58.9	100	4.53	50.0
1.007	14	99	1.306	0.600	72.229	72.216	0.013	100.4	150	4.55	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.003	1.001	7.9	4.6	0.804	1.001	0.024	0.0	54	1.035
3.000	1.000	7.9	0.2	0.650	0.706	0.001	0.0	11	0.404
3.001	1.006	7.9	0.4	0.706	0.754	0.002	0.0	15	0.518
1.004	1.002	7.9	6.3	1.001	1.067	0.033	0.0	68	1.112
1.005	1.543	12.1	6.6	1.067	1.018	0.035	0.0	53	1.577
4.000	1.004	7.9	0.0	0.650	0.759	0.000	0.0	0	0.000
4.001	1.002	7.9	0.9	0.759	1.018	0.005	0.0	24	0.681
1.006	1.005	7.9	7.6	1.018	0.971	0.040	0.0	79	1.143
1.007	1.002	17.7	11.0	0.971	0.984	0.058	0.0	86	1.056

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	11.137	59.2	100	Circular	73.750	73.000	0.650	73.750	72.812	0.838
5.001	5.603	59.0	100	Circular	73.750	72.812	0.838	73.750	72.717	0.933
5.002	3.299	28.2	100	Circular	73.750	72.717	0.933	73.350	72.600	0.650
1.000	2.567	58.3	100	Circular	73.750	73.000	0.650	73.750	72.956	0.694
2.000	2.590	20.7	100	Circular	73.750	73.000	0.650	73.750	72.875	0.775
1.001	4.767	58.9	100	Circular	73.750	72.956	0.694	73.750	72.875	0.775
1.002	1.703	58.7	100	Circular	73.750	72.875	0.775	73.750	72.846	0.804
1.003	11.698	59.4	100	Circular	73.750	72.846	0.804	73.750	72.649	1.001
3.000	3.330	59.5	100	Circular	73.750	73.000	0.650	73.750	72.944	0.706
3.001	2.821	58.8	100	Circular	73.750	72.944	0.706	73.750	72.896	0.754
1.004	3.912	59.3	100	Circular	73.750	72.649	1.001	73.750	72.583	1.067

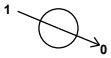
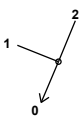
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	1	300	Manhole	Adoptable	2	300	Manhole	Adoptable
5.001	2	300	Manhole	Adoptable	3	300	Manhole	Adoptable
5.002	3	300	Manhole	Adoptable	14		Junction	
1.000	4		Junction		5		Junction	
2.000	6		Junction		7		Junction	
1.001	5		Junction		7		Junction	
1.002	7		Junction		8	300	Manhole	Adoptable
1.003	8	300	Manhole	Adoptable	9	300	Manhole	Adoptable
3.000	10		Junction		11		Junction	
3.001	11		Junction		12		Junction	
1.004	9	300	Manhole	Adoptable	12		Junction	

Pipeline Schedule

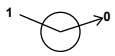
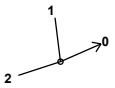
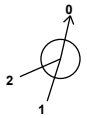
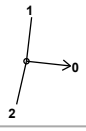
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.005	6.332	25.2	100	Circular	73.750	72.583	1.067	73.450	72.332	1.018
4.000	6.439	59.1	100	Circular	73.350	72.600	0.650	73.350	72.491	0.759
4.001	9.424	59.3	100	Circular	73.350	72.491	0.759	73.450	72.332	1.018
1.006	3.123	58.9	100	Circular	73.450	72.332	1.018	73.350	72.279	0.971
1.007	1.306	100.4	150	Circular	73.350	72.229	0.971	73.350	72.216	0.984

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.005	12		Junction		13	300	Manhole	Adoptable
4.000	15	300	Manhole	Adoptable	16	300	Manhole	Adoptable
4.001	16	300	Manhole	Adoptable	13	300	Manhole	Adoptable
1.006	13	300	Manhole	Adoptable	14		Junction	
1.007	14		Junction		99		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	140.036	164.271	73.750	0.750	300	 0	5.000	73.000	100
2	150.312	159.976	73.750	0.938	300	1  0	5.000 5.001	72.812 72.812	100 100
3	155.500	157.861	73.750	1.033	300	1  0	5.001 5.002	72.717 72.717	100 100
4	134.208	159.240	73.750	0.750		 0	1.000	73.000	100
5	136.600	158.308	73.750	0.794		1  0	1.000 1.001	72.956 72.956	100 100
6	132.380	154.860	73.750	0.750		 0	2.000	73.000	100
7	134.785	153.900	73.750	0.875		1 2  0	2.000 1.001 1.002	72.875 72.875 72.875	100 100 100
8	134.120	152.332	73.750	0.904	300	1  0	1.002 1.003	72.846 72.846	100 100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
9	144.900	147.790	73.750	1.101	300		1 0	1.003 1.004	72.649 72.649	100 100
10	149.000	155.050	73.750	0.750			0	3.000	73.000	100
11	148.273	151.800	73.750	0.806			1 0	3.000 3.001	72.944 72.944	100 100
12	148.620	149.000	73.750	1.167			1 2 0	3.001 1.004 1.005	72.896 72.583 72.583	100 100 100
13	154.420	151.540	73.450	1.118	300		1 2 0	4.001 1.005 1.006	72.332 72.332 72.332	100 100 100
14	155.116	154.584	73.350	1.121			1 2 0	5.002 1.006 1.007	72.600 72.279 72.229	100 100 150
15	149.132	136.600	73.350	0.750	300		0	4.000	72.600	100
16	151.590	142.551	73.350	0.859	300		1 0	4.000 4.001	72.491 72.491	100 100
99	156.414	154.443	73.350	1.134			1	1.007	72.216	150

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	0.0
Ratio-R	0.300	Check Discharge Rate(s)	✓
Summer CV	0.750	100 year (l/s)	0.8
Winter CV	0.840	Check Discharge Volume	✓
Analysis Speed	Normal	100 year 360 minute (m³)	16

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 %)
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	10
Greenfield Method	IH124	Growth Factor 100 year	2.08
Positively Drained Area (ha)	0.050	Betterment (%)	0
SAAR (mm)	1406	QBar	0.4
Soil Index	3	Q 100 year (l/s)	0.8
SPR	0.40		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.050	Storm Duration (mins)	360
Soil Index	3	Betterment (%)	0
SPR	0.40	PR	0.451
CWI	126.015	Runoff Volume (m^3)	16

Node 99 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.04100	Invert Level (m)	71.400	Depth (m)	1.260
Side Inf Coefficient (m/hr)	0.04100	Time to half empty (mins)	594	Inf Depth (m)	1.200
Safety Factor	1.0	Pit Width (m)	4.200	Number Required	1
Porosity	0.95	Pit Length (m)	7.200		

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m^3)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 15 minute summer	243.818	68.992	100 year +40% CC 15 minute summer	441.486	124.925
30 year 15 minute winter	171.101	68.992	100 year +40% CC 15 minute winter	309.815	124.925
30 year 30 minute summer	166.387	47.082	100 year +40% CC 30 minute summer	304.460	86.152
30 year 30 minute winter	116.763	47.082	100 year +40% CC 30 minute winter	213.656	86.152
30 year 60 minute summer	116.589	30.811	100 year +40% CC 60 minute summer	214.603	56.713
30 year 60 minute winter	77.459	30.811	100 year +40% CC 60 minute winter	142.577	56.713
30 year 120 minute summer	73.902	19.530	100 year +40% CC 120 minute summer	135.791	35.885
30 year 120 minute winter	49.099	19.530	100 year +40% CC 120 minute winter	90.216	35.885
30 year 180 minute summer	57.313	14.749	100 year +40% CC 180 minute summer	104.615	26.921
30 year 180 minute winter	37.255	14.749	100 year +40% CC 180 minute winter	68.003	26.921
30 year 240 minute summer	45.598	12.050	100 year +40% CC 240 minute summer	82.776	21.875
30 year 240 minute winter	30.295	12.050	100 year +40% CC 240 minute winter	54.994	21.875
30 year 360 minute summer	35.178	9.053	100 year +40% CC 360 minute summer	63.377	16.309
30 year 360 minute winter	22.867	9.053	100 year +40% CC 360 minute winter	41.197	16.309
30 year 480 minute summer	27.920	7.379	100 year +40% CC 480 minute summer	50.006	13.215
30 year 480 minute winter	18.550	7.379	100 year +40% CC 480 minute winter	33.223	13.215
30 year 600 minute summer	23.001	6.291	100 year +40% CC 600 minute summer	40.997	11.214
30 year 600 minute winter	15.716	6.291	100 year +40% CC 600 minute winter	28.011	11.214
30 year 720 minute summer	20.598	5.520	100 year +40% CC 720 minute summer	36.560	9.799
30 year 720 minute winter	13.843	5.520	100 year +40% CC 720 minute winter	24.571	9.799
30 year 960 minute summer	17.043	4.488	100 year +40% CC 960 minute summer	30.041	7.911
30 year 960 minute winter	11.289	4.488	100 year +40% CC 960 minute winter	19.900	7.911
30 year 1440 minute summer	12.485	3.346	100 year +40% CC 1440 minute summer	21.775	5.836
30 year 1440 minute winter	8.390	3.346	100 year +40% CC 1440 minute winter	14.634	5.836

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	73.043	0.043	3.0	0.0030	0.0000	OK
15 minute winter	2	10	72.884	0.072	6.0	0.0051	0.0000	OK
15 minute winter	3	10	72.772	0.055	6.0	0.0039	0.0000	OK
15 minute summer	4	10	73.032	0.032	1.7	0.0000	0.0000	OK
15 minute summer	5	10	73.002	0.046	3.4	0.0000	0.0000	OK
15 minute summer	6	10	73.024	0.024	1.7	0.0000	0.0000	OK
15 minute winter	7	11	73.000	0.125	5.1	0.0000	0.0000	SURCHARGED
15 minute winter	8	11	72.987	0.141	7.6	0.0100	0.0000	SURCHARGED
15 minute winter	9	11	72.811	0.162	10.1	0.0115	0.0000	SURCHARGED
15 minute summer	10	11	73.013	0.013	0.3	0.0000	0.0000	OK
15 minute summer	11	11	72.963	0.019	0.6	0.0000	0.0000	OK
15 minute winter	12	11	72.697	0.114	10.1	0.0000	0.0000	SURCHARGED
15 minute winter	13	10	72.514	0.182	11.3	0.0129	0.0000	SURCHARGED
15 minute winter	14	10	72.347	0.118	17.2	0.0000	0.0000	OK
15 minute summer	15	1	72.600	0.000	0.0	0.0000	0.0000	OK
15 minute winter	16	10	72.523	0.032	1.7	0.0022	0.0000	OK
600 minute winter	99	465	72.025	-0.191	2.0	17.9411	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	1	5.000	2	3.0	0.645	0.381	0.0516
15 minute winter	2	5.001	3	6.0	1.138	0.760	0.0294
15 minute winter	3	5.002	14	6.0	1.412	0.522	0.0140
15 minute summer	4	1.000	5	1.7	0.599	0.215	0.0073
15 minute summer	5	1.001	7	3.4	0.693	0.431	0.0269
15 minute summer	6	2.000	7	1.7	0.624	0.127	0.0119
15 minute winter	7	1.002	8	4.6	0.730	0.582	0.0133
15 minute winter	8	1.003	9	7.1	0.916	0.897	0.0915
15 minute winter	9	1.004	12	9.5	1.296	1.202	0.0306
15 minute summer	10	3.000	11	0.3	0.371	0.038	0.0027
15 minute summer	11	3.001	12	0.6	0.595	0.076	0.0028
15 minute winter	12	1.005	13	9.9	1.271	0.819	0.0495
15 minute winter	13	1.006	14	11.2	1.434	1.421	0.0242
15 minute winter	14	1.007	99	17.0	1.150	0.962	0.0196
15 minute summer	15	4.000	16	0.0	0.000	0.000	0.0068
15 minute winter	16	4.001	13	1.7	0.451	0.216	0.0468
600 minute winter	99	Infiltration		0.5			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	73.082	0.082	5.4	0.0058	0.0000	OK
15 minute winter	2	10	73.011	0.199	10.4	0.0142	0.0000	SURCHARGED
600 minute winter	3	570	72.831	0.114	1.2	0.0081	0.0000	SURCHARGED
15 minute winter	4	12	73.326	0.326	3.0	0.0000	0.0000	SURCHARGED
15 minute winter	5	12	73.324	0.368	5.2	0.0000	0.0000	SURCHARGED
15 minute winter	6	12	73.312	0.312	3.0	0.0000	0.0000	SURCHARGED
15 minute winter	7	12	73.310	0.435	5.3	0.0000	0.0000	SURCHARGED
15 minute winter	8	12	73.295	0.449	8.5	0.0319	0.0000	SURCHARGED
15 minute winter	9	12	73.067	0.418	12.3	0.0296	0.0000	SURCHARGED
15 minute winter	10	10	73.019	0.019	0.6	0.0000	0.0000	OK
15 minute winter	11	10	72.970	0.026	1.2	0.0000	0.0000	OK
15 minute winter	12	12	72.896	0.313	12.4	0.0000	0.0000	SURCHARGED
600 minute winter	13	585	72.831	0.499	2.6	0.0354	0.0000	SURCHARGED
600 minute winter	14	585	72.834	0.605	3.8	0.0000	0.0000	SURCHARGED
600 minute winter	15	570	72.831	0.231	0.1	0.0164	0.0000	SURCHARGED
600 minute winter	16	570	72.831	0.340	0.3	0.0242	0.0000	SURCHARGED
600 minute winter	99	570	72.831	0.615	3.8	36.2116	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	1	5.000	2	5.1	0.696	0.644	0.0820
15 minute winter	2	5.001	3	10.0	1.303	1.269	0.0408
600 minute winter	3	5.002	14	1.2	0.928	0.105	0.0258
15 minute winter	4	1.000	5	2.6	0.595	0.326	0.0201
15 minute winter	5	1.001	7	3.8	0.705	0.481	0.0373
15 minute winter	6	2.000	7	2.5	0.734	0.188	0.0203
15 minute winter	7	1.002	8	6.0	0.765	0.757	0.0133
15 minute winter	8	1.003	9	8.0	1.029	1.024	0.0915
15 minute winter	9	1.004	12	11.3	1.442	1.434	0.0306
15 minute winter	10	3.000	11	0.6	0.455	0.076	0.0044
15 minute winter	11	3.001	12	1.2	0.728	0.151	0.0046
15 minute winter	12	1.005	13	12.1	1.542	0.995	0.0495
600 minute winter	13	1.006	14	2.6	0.875	0.329	0.0244
600 minute winter	14	1.007	99	3.8	0.804	0.215	0.0230
600 minute winter	15	4.000	16	0.1	0.013	0.013	0.0504
600 minute winter	16	4.001	13	0.3	0.182	0.038	0.0737
600 minute winter	99	Infiltration		0.7			

Design Settings

Frequency of use (kDU)	1.00	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	1500	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	0.450
Additional Flow (%)	0	Include Intermediate Ground	x

Nodes

Name	Dwellings	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
1	1	73.750	Adoptable	143.716	162.412	0.550
2		73.750	Adoptable	149.470	160.040	0.628
3	1	73.750	Adoptable	147.780	156.000	0.683
4	1	73.750	Adoptable	137.100	158.450	0.550
5		73.750	Adoptable	134.600	152.555	0.631
6	1	73.750	Adoptable	144.631	148.400	0.786
7		73.550	Adoptable	140.400	134.430	0.769
8		73.300	Adoptable	149.075	118.070	0.751
9		73.240	Adoptable	150.500	100.600	0.911
10		73.000	Adoptable	167.050	94.175	0.893

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	1	2	6.224	1.500	73.200	73.122	0.078	79.8	100
1.001	2	3	4.379	1.500	73.122	73.067	0.055	79.6	100
1.002	3	6	8.227	1.500	73.067	72.964	0.103	79.9	100
2.000	4	5	6.403	1.500	73.200	73.119	0.081	79.1	100
2.001	5	6	10.857	1.500	73.119	72.964	0.155	70.0	100
1.003	6	7	14.597	1.500	72.964	72.781	0.183	79.8	100
1.004	7	8	18.518	1.500	72.781	72.549	0.232	79.8	100
1.005	8	9	17.528	1.500	72.549	72.329	0.220	79.7	100
1.006	9	10	17.753	1.500	72.329	72.107	0.222	80.0	100

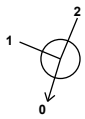
Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.100	0.745	5.8	0.0	0.450	0.528	0.000	1	0.0	0.0	4	0.146
1.001	0.100	0.746	5.9	0.0	0.528	0.583	0.000	1	0.0	0.0	4	0.147
1.002	0.124	0.744	5.8	0.0	0.583	0.686	0.000	2	0.0	0.0	6	0.187
2.000	0.101	0.748	5.9	0.0	0.450	0.531	0.000	1	0.0	0.0	4	0.147
2.001	0.107	0.795	6.2	0.0	0.531	0.686	0.000	1	0.0	0.0	4	0.157
1.003	0.167	0.745	5.9	0.1	0.686	0.669	0.000	4	0.0	0.0	8	0.241
1.004	0.167	0.745	5.8	0.1	0.669	0.651	0.000	4	0.0	0.0	8	0.241
1.005	0.168	0.745	5.9	0.1	0.651	0.811	0.000	4	0.0	0.0	8	0.242
1.006	0.167	0.744	5.8	0.1	0.811	0.793	0.000	4	0.0	0.0	8	0.241

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	6.224	79.8	100	Circular	73.750	73.200	0.450	73.750	73.122	0.528
1.001	4.379	79.6	100	Circular	73.750	73.122	0.528	73.750	73.067	0.583
1.002	8.227	79.9	100	Circular	73.750	73.067	0.583	73.750	72.964	0.686
2.000	6.403	79.1	100	Circular	73.750	73.200	0.450	73.750	73.119	0.531
2.001	10.857	70.0	100	Circular	73.750	73.119	0.531	73.750	72.964	0.686
1.003	14.597	79.8	100	Circular	73.750	72.964	0.686	73.550	72.781	0.669
1.004	18.518	79.8	100	Circular	73.550	72.781	0.669	73.300	72.549	0.651
1.005	17.528	79.7	100	Circular	73.300	72.549	0.651	73.240	72.329	0.811
1.006	17.753	80.0	100	Circular	73.240	72.329	0.811	73.000	72.107	0.793

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	300	Manhole	Adoptable	2	300	Manhole	Adoptable
1.001	2	300	Manhole	Adoptable	3	300	Manhole	Adoptable
1.002	3	300	Manhole	Adoptable	6	300	Manhole	Adoptable
2.000	4	300	Manhole	Adoptable	5	300	Manhole	Adoptable
2.001	5	300	Manhole	Adoptable	6	300	Manhole	Adoptable
1.003	6	300	Manhole	Adoptable	7	300	Manhole	Adoptable
1.004	7	300	Manhole	Adoptable	8	300	Manhole	Adoptable
1.005	8	300	Manhole	Adoptable	9	300	Manhole	Adoptable
1.006	9	300	Manhole	Adoptable	10	300	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	143.716	162.412	73.750	0.550	300				
						0	1.000	73.200	100
2	149.470	160.040	73.750	0.628	300		1.000	73.122	100
									
						0	1.001	73.122	100
3	147.780	156.000	73.750	0.683	300		1.001	73.067	100
									
						0	1.002	73.067	100
4	137.100	158.450	73.750	0.550	300				
						0	2.000	73.200	100
5	134.600	152.555	73.750	0.631	300		2.000	73.119	100
									
						0	2.001	73.119	100
6	144.631	148.400	73.750	0.786	300		2.001	72.964	100
							2	1.002	72.964	100
						0	1.003	72.964	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
7	140.400	134.430	73.550	0.769	300		1	1.003	72.781	100
							0	1.004	72.781	100
8	149.075	118.070	73.300	0.751	300		1	1.004	72.549	100
							0	1.005	72.549	100
9	150.500	100.600	73.240	0.911	300		1	1.005	72.329	100
							0	1.006	72.329	100
10	167.050	94.175	73.000	0.893	300		1	1.006	72.107	100

Simulation Settings

Analysis Speed	Normal	Drain Down Time (mins)	240
Skip Steady State	x	Foul Event Duration (mins)	15

Storm Durations

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	10
Greenfield Method	IH124	Growth Factor 100 year	2.08
Positively Drained Area (ha)	0.050	Betterment (%)	0
SAAR (mm)	1406	QBar	0.4
Soil Index	3	Q 100 year (l/s)	0.8
SPR	0.40		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.050	Storm Duration (mins)	360
Soil Index	3	Betterment (%)	0
SPR	0.40	PR	0.451
CWI	126.015	Runoff Volume (m^3)	16

Results for Foul Event Critical Storm Duration. Lowest mass balance: 100.00%

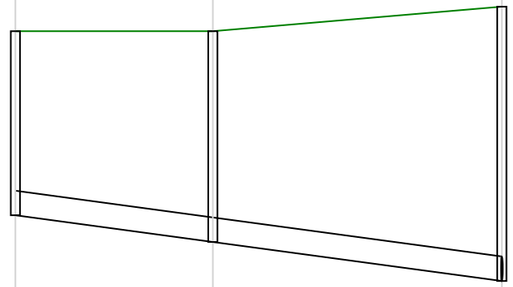
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
Foul Event	1	1	73.200	0.000	0.0	0.0000	0.0000	OK
Foul Event	2	1	73.122	0.000	0.0	0.0000	0.0000	OK
Foul Event	3	1	73.067	0.000	0.0	0.0000	0.0000	OK
Foul Event	4	1	73.200	0.000	0.0	0.0000	0.0000	OK
Foul Event	5	1	73.119	0.000	0.0	0.0000	0.0000	OK
Foul Event	6	1	72.964	0.000	0.0	0.0000	0.0000	OK
Foul Event	7	1	72.781	0.000	0.0	0.0000	0.0000	OK
Foul Event	8	1	72.549	0.000	0.0	0.0000	0.0000	OK
Foul Event	9	1	72.329	0.000	0.0	0.0000	0.0000	OK
Foul Event	10	1	72.107	0.000	0.0	0.0000	0.0000	OK

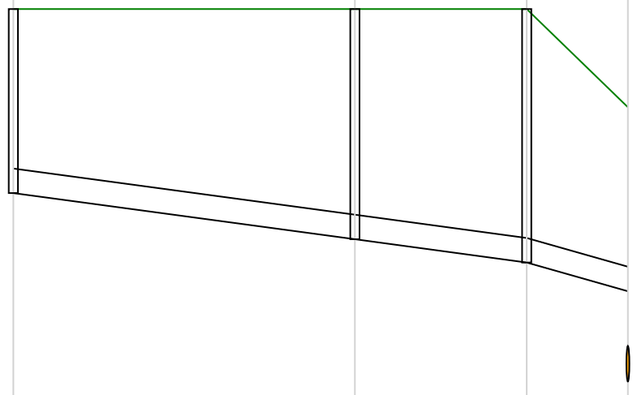
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
Foul Event	1	1.000	2	0.0	0.000	0.000	0.0000	
Foul Event	2	1.001	3	0.0	0.000	0.000	0.0000	
Foul Event	3	1.002	6	0.0	0.000	0.000	0.0000	
Foul Event	4	2.000	5	0.0	0.000	0.000	0.0000	
Foul Event	5	2.001	6	0.0	0.000	0.000	0.0000	
Foul Event	6	1.003	7	0.0	0.000	0.000	0.0000	
Foul Event	7	1.004	8	0.0	0.000	0.000	0.0000	
Foul Event	8	1.005	9	0.0	0.000	0.000	0.0000	
Foul Event	9	1.006	10	0.0	0.000	0.000	0.0000	0.0

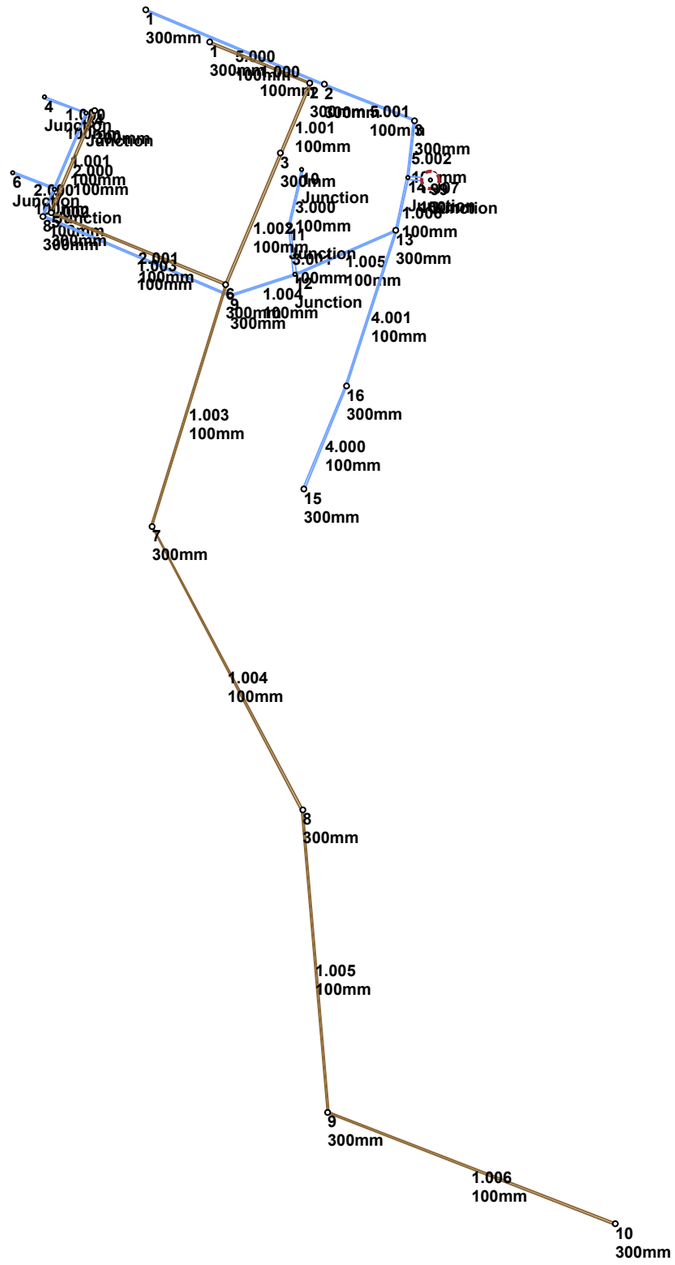
Node Name		4	5	7	8	9	12	13	14	99
A3 drawing Hor Scale 200 Ver Scale 25 Datum (m) 70.000										
Link Name		1.000	1.001	1.002	1.003	1.004	1.005	1.006	1.00	
Section Type		100mm	100mm	100m	100mm	100mm	100mm	100mm	150r	
Slope (1:X)		58.3	58.9	58.7	59.4	59.3	25.2	58.9	100.	
Cover Level (m)		73.750	73.750	73.750	73.750	73.750	73.750	73.450	73.350	73.350
Invert Level (m)		73.000	72.956	72.956	72.875	72.875 72.846	72.846	72.649	72.649 72.583	72.583	72.332	72.332	72.279	72.229 72.216	
Length (m)		2.567	4.767	1.703	11.698	3.912	6.332	3.123	1.30	

Node Name		6	7
A3 drawing Hor Scale 200 Ver Scale 25 Datum (m) 71.000			
Link Name		2.000	
Section Type		100mm	
Slope (1:X)		20.7	
Cover Level (m)		73.750	73.750
Invert Level (m)		73.000	72.875
Length (m)		2.590	

Node Name		10	11	12
A3 drawing Hor Scale 200 Ver Scale 25 Datum (m) 71.000				
Link Name		3.000	3.001	
Section Type		100mm	100mm	
Slope (1:X)		59.5	58.8	
Cover Level (m)		73.750	73.750	73.750
Invert Level (m)		73.000 72.944	72.944 72.896	
Length (m)		3.330	2.821	

Node Name		15	16	13
A3 drawing Hor Scale 200 Ver Scale 25 Datum (m) 70.000				
Link Name		4.000	4.001	
Section Type		100mm	100mm	
Slope (1:X)		59.1	59.3	
Cover Level (m)		73.350	73.350	73.450
Invert Level (m)		72.600 / 72.491	72.491 / 72.332	
Length (m)		6.439	9.424	

Node Name		1		2		3	14
A3 drawing Hor Scale 200 Ver Scale 25 Datum (m) 70.000							
Link Name			5.000		5.001	5.002	
Section Type			100mm		100mm	100mm	
Slope (1:X)			59.2		59.0	28.2	
Cover Level (m)		73.750		73.750		73.750	73.350
Invert Level (m)		73.000	72.812	72.812	72.717	72.717	72.600
Length (m)			11.137		5.603	3.299	



Packaged Plant Details

Clearwater
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Wastewater Solutions

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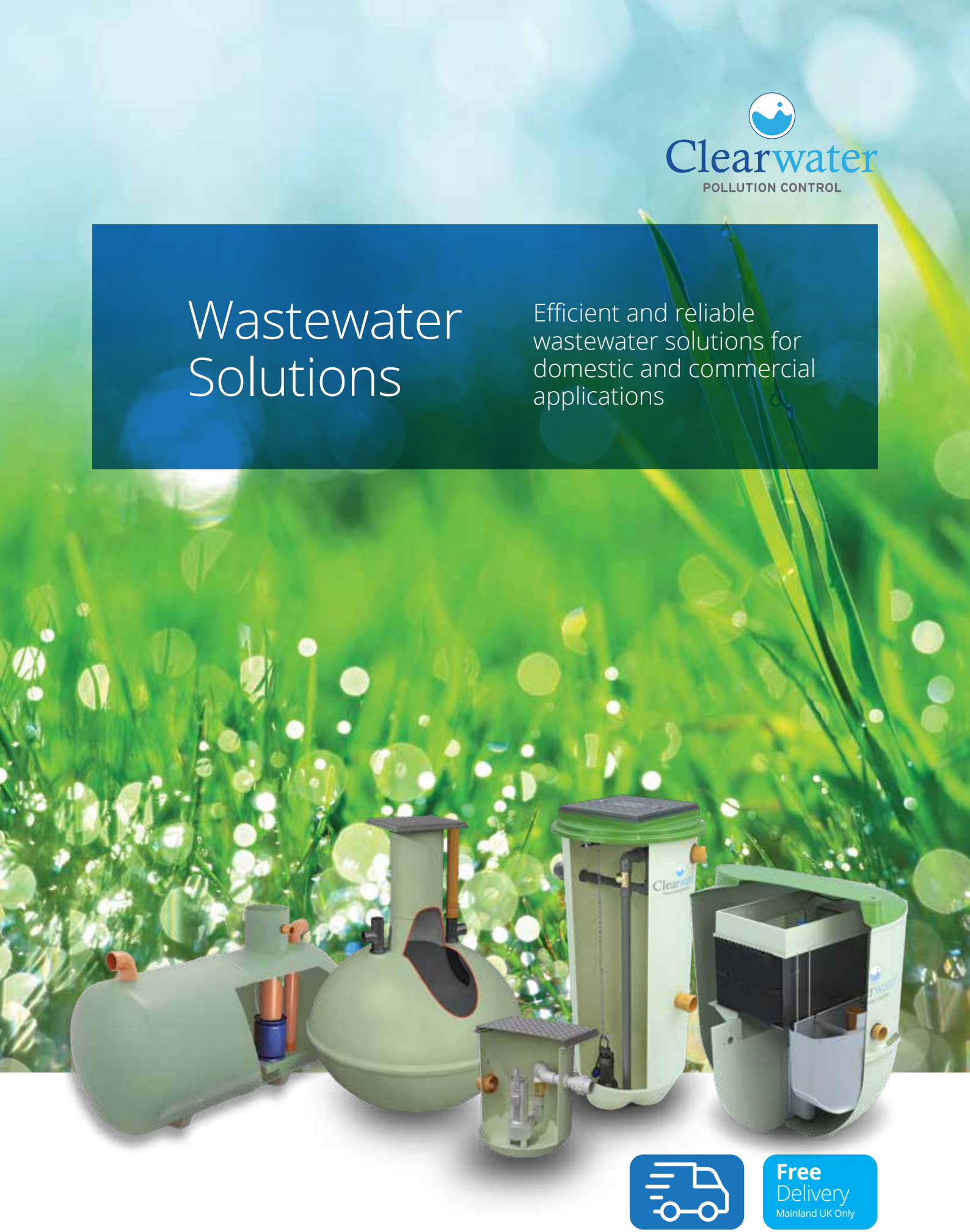

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*Calls to 0844 numbers are broken down into two parts: the access charge and the service charge. Access charges vary per network (between 10p-60p per minute) as do service charges (up to 7p per minute) so please check this with your network provider.

Contents

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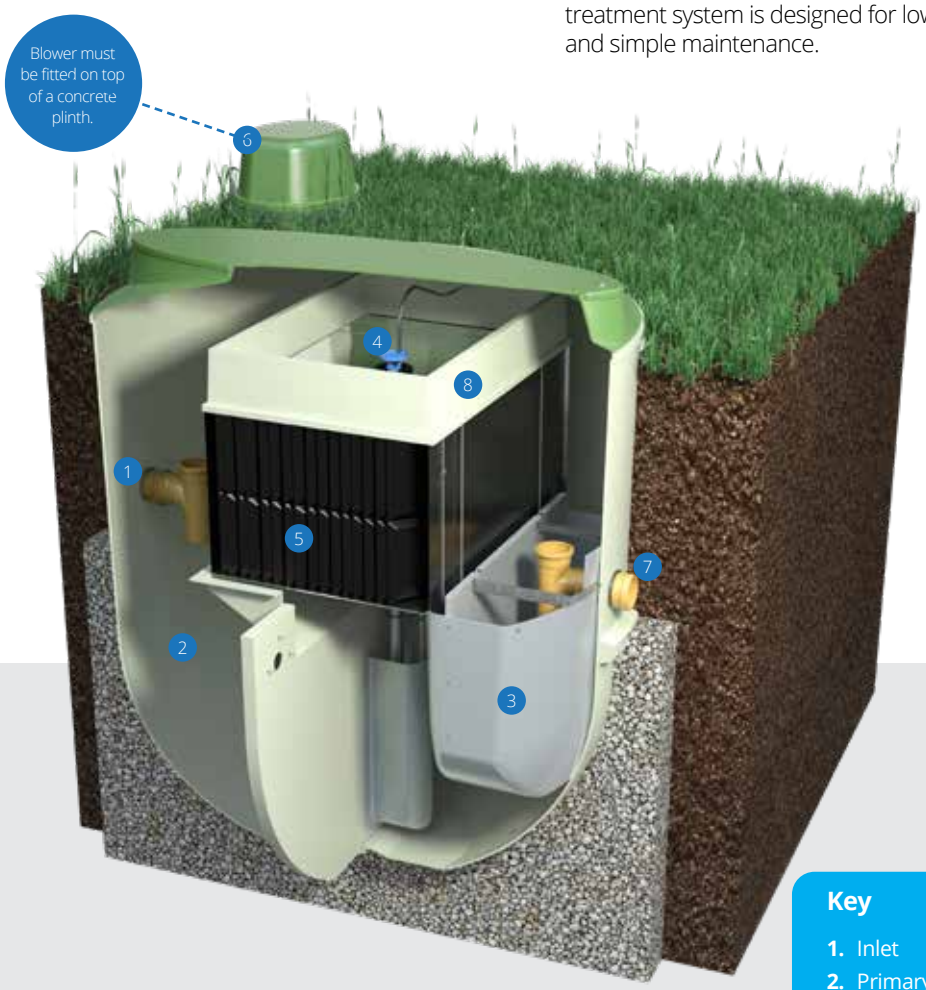
Domestic Sewage Treatment systems

BTA E-Range Sewage Treatment System

Clearwater sewage treatment systems are a versatile and cost effective solution. Using trusted aerobic biological processes for the treatment of sewage, the BTA E-Range treatment system makes for an affordable and environmentally responsible solution.

Quick and easy to install, the BTA E-Range treatment system is designed for low-cost and simple maintenance.



Key

1. Inlet
2. Primary settlement
3. Final settlement
4. Distributor
5. Media
6. Blower
7. Outlet
8. Splash Guard

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POLLUTION CONTROL

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Features:

- Third party certified to EN12566-3 standard.
- No mechanical or electrical components within the system (Gravity option only)
- Affordable running and maintenance costs.
- Improved effluent quality, with better BOD_5 and TSS removal.
- Low level visibility in the garden with a lockable child-proof cover.
- Controlled ventilation - minimises risk of odour nuisance.
- Easy to install and maintain with annual desludging / emptying.
- Isolator and failure lights for peace of mind.

- Third party certified to EN12566-3 standard

- BOD_5 – 96.2%
  SS – 97%
  Ammonia – 82.4%

- Fully CE marked in line with the CPR 2013

Model	BTAUE-1 Gravity	BTAUE-1 IPS	BTAUE-2 Gravity	BTAUE-2 IPS	BTAUE-3 Gravity	BTAUE-3 IPS	BTAUE-4 Gravity	BTAUE-4 IPS	BTAUE-5 Gravity	BTAUE-5 IPS
PE	6	6	9	9	12	12	18	18	25	25
Outside Diameter (m)	1.8	1.8	1.8	1.8	1.8	1.8	2.6	2.6	2.6	2.6
BOD_5 Load (kg/day)	0.36	0.36	0.54	0.54	0.72	0.72	1.08	1.08	1.5	1.5
Weight Empty (kg)	250/270	260/280	275/295	285/305	275/295	285/305	390/435	420/455	430/475	450/495
Depth (m)	2.2/2.7	2.2/2.7	2.7/3.2	2.7/3.2	2.7/3.2	2.7/3.2	2.1/2.6	2.1/2.6	2.6/3.1	2.6/3.1
Inlet Invert (m)	1.0*	1.0*	1.0*	1.0*	1.0*	1.0*	0.875**	0.875**	1.0*	1.0*
Inlet Invert to Base (m)	1.2	1.2	1.7	1.7	1.7	1.7	1.233	1.233	1.615	1.615
Outlet Invert (m)	1.1	0.55	1.1	0.55	1.1	0.55	0.975	0.5	1.15	0.6
Blower (kW)	0.04	0.04	0.04	0.04	0.04	0.04	0.115	0.115	0.115	0.115

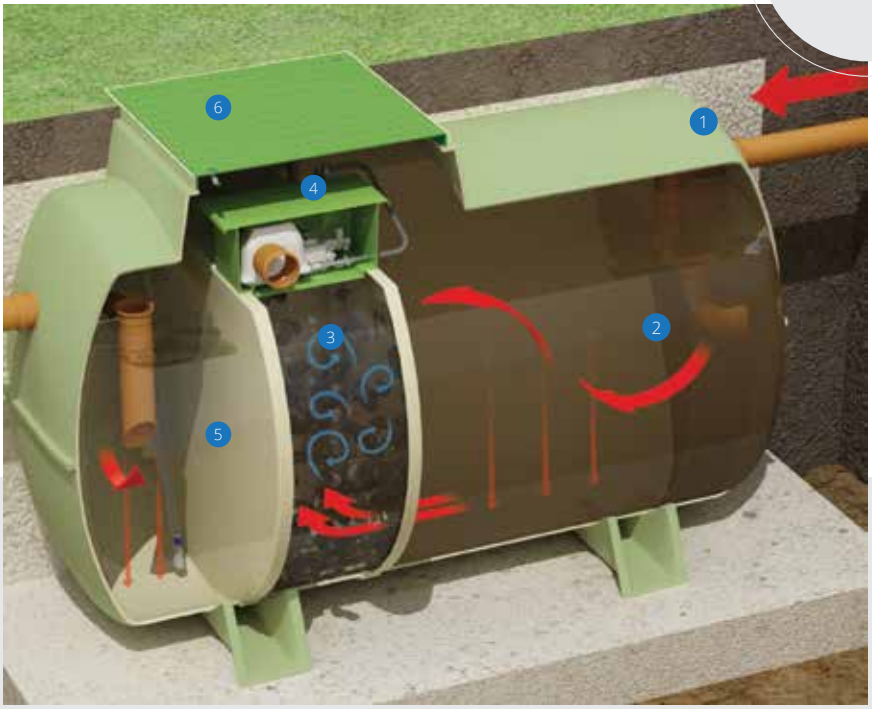
Note: * There are two depths of Inlet Invert 1.0m and 1.5m
** There are two depths of Inlet Invert 0.875m and 1.375m

Domestic Sewage Treatment systems

Delta Sewage Treatment System

The simple design of the Delta sewage treatment system from Clearwater offers an efficient solution for the off-mains homeowner. Fluidised, fixed film Biozones are used as the operating process, helping to ensure a quiet and reliable wastewater treatment solution.

INCLUDES PPFDS ALARM AS STANDARD



Key

1. Inlet
2. Primary settlement tank
3. Biozone treatment process
4. Blower housing
5. Final settlement tank
6. Cover

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Features:

- Unobtrusive below ground installation.
- Suitable for varying invert levels.
- Low profile results in shallow depth excavation.
- Simple maintenance with easy desludging.
- Sludge recycle pump in the final settlement tank.
- Certified to EN-12566 Part 3.
- Includes Power Pressure Failure Detection System (PPFDS) Alarm.

- Third party certified to EN12566-3 standard

- Standards of discharge - 20mg/l BOD, 30mg/l S.S. and 20mg/l ammonia in domestic applications.

	Number of Turrets	Inlet Invert (mm)	Outlet (mm)	Overall Length (mm)	Height (inc. feet) (mm)	Overall Diameter (mm)	Invert & Outlet Diameter (mm)
Delta 1 6PE	1	450	550	2720	1727	1530	110
	1	750	850	2720	2027	1530	110
	1	1000	1100	2720	2277	1530	110
Delta 2 12PE	3	750	850	3244	2470	1916	110
	3	1000	1100	3244	2720	1916	110
Delta 3 18PE	3	750	850	3976	2470	1916	110
	3	1000	1100	3976	2720	1916	110
Delta 4 25PE	3	750	850	5550	2470	1916	160
	3	1000	1100	5550	2720	1916	160

Septic Tanks

Clearwater STS Septic Tank

Clearwater septic tanks are designed to meet both the installation requirements and the standards of discharge specified by EN 12566 Part 1

Clearwater tanks are used for domestic sewage disposal where connection to a mains sewer is not practical. In some cases, a septic tank may not be the best choice for managing your wastewater and a sewage treatment plant may be the preferred option. Please ask our team for advice, specific to your site.

Features:

- Manufactured from GRP - strong, light and watertight.
- Suitable for homes with between 5-17 occupants.
- Performance tested to EN 12566 Part 1.

Ordering Code	Capacity (Ltrs)	No. People (150 Ltrs/ head/day)	Width (mm)	Inlet Level to Base (mm)	Height (mm)
STS02810	2800	5	1905	1565	2599
STS03810	3800	12	2070	1795	2810
STS04610	4600	17	2080	2035	2984

This is a basic guide. For product selection you will also need to know the depth of inlet required. This is the distance between sewage drain pipe and ground level. For further advice on product selection please contact our team.

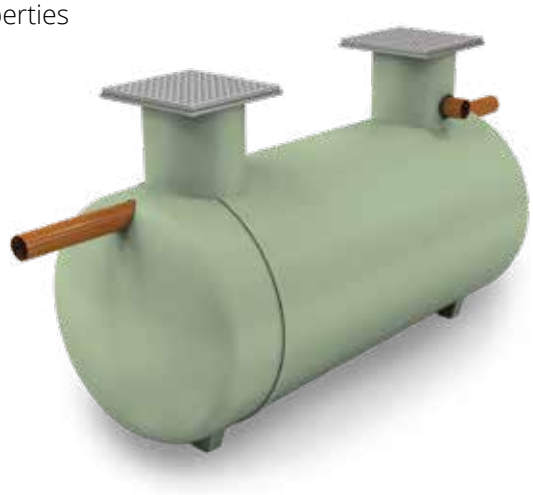
Free
Delivery
Mainland UK Only

Clearwater STH Septic Tank

Clearwater STH septic tanks provide a reliable and economic solution for homes not connected to mains drainage. It is ideal for shallow dig applications. Manufactured from robust GRP, it is suitable for properties with up to 47 people.

Features:

- Reduced installation costs - less soil disposal and excavation costs.
- Manufactured from GRP and EN approved. 99.7% efficient.
- Suitable for pea shingle gravel backfill for dry sites.



Ordering Code	Capacity (Ltrs)	Empty Weight (kg)	No. People (150 Ltrs/ head/day)	Diameter (mm)	Length (mm)	Standard Invert Height (mm)
STH028	2800	165	5	1225	3020	500
STH038	3800	185	12	1225	3900	500
STH048	4800	195	18	1425	3775	500
STH057	5700	205	24	1425	4275	500
STH071	7150	280	34	1920	3230	500
STH091	9150	325	47	1920	3965	500

Clearwater
POLLUTION CONTROL

Commercial Sewage Treatment Systems

Clearwater sewage treatment plants are a reliable and effective solution for a range of commercial applications.

The plant is designed for large domestic and commercial applications such as campsites, hotels or industrial units. It employs a plug flow combination of aerobic and anoxic processes in a fluidised bed arrangement.

This operates in conjunction with an advanced system of air diffusers and selected media to deliver optimum levels of purification.

Typical Applications

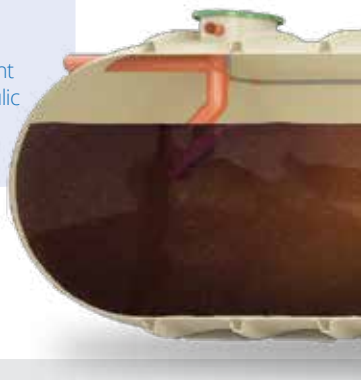
1. Public sector
2. Leisure
3. Transport
4. Hospitality
5. Campsites
6. Offices
7. Multi-housing developments

Performance and Compliance

› Compliant with EN12255 and EN12566- 3 (up to 50 PE).
› Designed and sized in accordance with British Water Code of Practice Flows and Loads but can be sized to suit local site conditions.

Features:

- Minimal footprint area.
- Single piece tank, modular systems up to 1000 PE available
- Bespoke units available in almost any configuration.
- Flow management to both stabilise influent volume variations and to minimise hydraulic impact on the final settlement process.



	6	17	23	34H	38H	42H	47H	55H	67H	80H
Max Flow (ltrs/day)	4.5	8	11	15	20	25	30	40	50	60
Overall Length (m)	6220	7381	9312	7376	8150	8917	9684	11222	13528	15833
Height (m)										
500mm inlet / 650m outlet invert	2275 (630 O.I.)	2275 (600 O.I.)	2275 (600 O.I.)	2960	2960	2960	2960	2960	2960	2960
800mm inlet/950mm outlet invert	N/A	N/A	N/A	3260	3260	3260	3260	3260	3260	3260
1000mm inlet/1100mm outlet invert	2775 (1130 O.I.)	2775	2775	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1500mm inlet/1650mm outlet invert	3275 (1630 O.I)	3275 (1600 O.I.)	3275 (1600 O.I.)	3960	3960	3960	3960	3960	3960	3960
2000mm inlet/2150mm outlet invert	N/A	3775 (2100 O.I.)	3775 (2100 O.I.)	4460	4460	4460	4460	4460	4460	4460
Volume (m^3)	6	17	23	34	38	42	47	55	67	80
Weight approx (kg)	700	1200	1450	3000	3200	3400	3800	4200	4700	5400

Note: * This relates to max. hydraulic flow. Do not use to calculate PE

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Treatment Process

1. Primary Settlement Chamber
   This is the initial stage of treatment and simply involves the retention of coarse solids present in raw sewage and wastewater for subsequent gradual breakdown. The system features two chambers to ensure efficient operation with a flow balancing facility.

2. Biozone 1
   The liquor enters the fist stage of Biological treatment where the active bacteria within the fluidized bed begin to break down organic solids, majority of BOD removal occurs here.

3. Biozone 2
   Within the second stage of Biological treatment the second fluidized bed continues to clean the liquor giving further BOD reduction along with removal of nitrogen.

4. Final Settlement Tank
   A natural by-product of biological treatment is humus sludge and this is separated for further treatment. The treated effluent is discharged via the outlet or to disinfection stage.

Clearwater
POLLUTION CONTROL

Water Storage Tanks, Silage Tanks and Cesspools

Water storage tanks, silage tanks and cesspools

Clearwater below ground storage tanks provide a reliable solution for the collection and retention of sewage (cesspool), surface water, veterinary / animal waste, firefighting reservoirs and rainwater harvesting reservoirs.

The tanks are easy to install and delivered as a complete unit ready for installation. Every storage tank is factory tested to ensure that it is watertight and structurally sound.

Features:

- Available in various sizes.
- Easy installation.
- High level alarm option.
- Lockable manhole cover.

Nominal Litres	Length (mm)	Diameter (mm)
2800	3020	1225
3800	3900	1225
4800	3775	1425
5700	4275	1425
7150	3230	1920
9150	3965	1920
10000	3960	1917
12000	4750	1917
15000	5780	1917
18,000	4317	2620
22,000	5073	2620
26,000	5837	2620
34,000	7376	2620
46,000	9684	2620
54,000	11,222	2620
59,000	11,991	2620
63,000	12,760	2620
71,000	14,295	2620
79,000	15,833	2620

Pumping Stations

Free
Delivery
Mainland UK Only

Clearwater pumping systems are designed for homes that are built below the level of the mains sewage system.

Pump Stations are used in connection with sewage treatment systems, septic tanks and rainwater harvesting systems.

The unique design of our pump station range allows for easier installation, with low maintenance ongoing. To find out more about Clearwater Pumping Systems and how one could be used for your next on or off-mains project, talk to one of our team.

Features:

- Available in various sizes to suit application type: effluent, sewage or rainwater.
- Manufactured from GRP.
- Pre-fabricated systems ready for installation are available, dependent on distance from mains and height required to pump.

Domestic Pumping Station

Compact Pumping Statiom

Chamber Size (mm)	Capacity (Ltrs)	Tank Material	Control Panel	Alarm	Pump Type
610 x 700	200	GRP	N/A	Optional	Single
560 x 1,650	400	GRP	N/A	Optional	Single

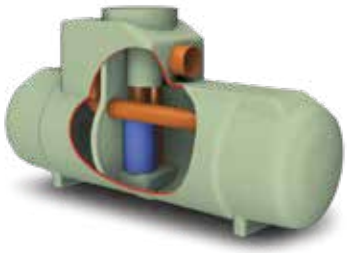
Chamber Size	Capacity	Tank Material	Control Panel	Alarm	Pump Type
900 x 1580	900	GRP	Included	Optional	Single/Twin
900 x 2160	1250	GRP	Included	Optional	Single/Twin
900 x 2670	1600	GRP	Included	Optional	Single/Twin

Clearwater
POLLUTION CONTROL

Fuel and Oil Separators

Bypass Separators

Designed to cover 99% of all rainfall events, our Bypass Separators are suitable for situations where the likelihood of heavy rain and the risk of large spillages are unlikely.



Third party certified to EN 858-1. Our bypass separator range offers flow rates from 3-125 litres per second.

Full Retention Separators

Our Full Retention Separators are designed to manage rain flow of up to 65mm/hr in sites where short term flooding can occur.

Third party certified to EN 858-1. Our full retention separator range offers flow rates from 7-285 litres per second.

Forecourt Separators

Our range of Forecourt Separators are designed with safety and environmental protection in mind, for applications where full pollution prevention is needed. Typical applications include petrol and diesel filling stations.

Third party certified to EN 858-1. Our forecourt separator range offers flow rates from 10- 20 litres per second.

Range	Storage Requirements	Applications	Tank Material	Oil Alarm Probe Tube	Fitted Inlet/Outlet Connectors	Vent Points within Necks	Maintenance from Ground Level	Automatic Closure Device
Bypass (NSB)	Oil separation, Oil storage, Silt storage, Coalescer (Class 1)	Surface car parks, Roadways, Lightly contaminated commercial areas	GRP or PE dependent on model	Optional Extra	✓	✓	✓	
Full Retention (NSF)	Oil separation, Oil storage, Silt storage, Coalescer (Class 1)	Fuel distribution depots, Vehicle workshops, Scrap yards	GRP or PE dependent on model	Optional Extra	✓	✓	✓	✓
Washdown	Oil separation, Silt storage	Car wash, Tool hire depots, industrial cleansing points	GRP	Optional Extra	✓	✓	✓	
Car Wash Silt Trap	Silt removal before separation	Car wash, Tool hire depots, industrial cleansing points	GRP				✓	
Forecourt	Oil separation, Oil storage, Silt storage	Petrol station forecourts	GRP	Optional Extra	✓	✓	✓	✓

This is a basic guide. For further advice on product selection please contact Clearwater.

Grease Separators

Free
Delivery
Mainland UK Only

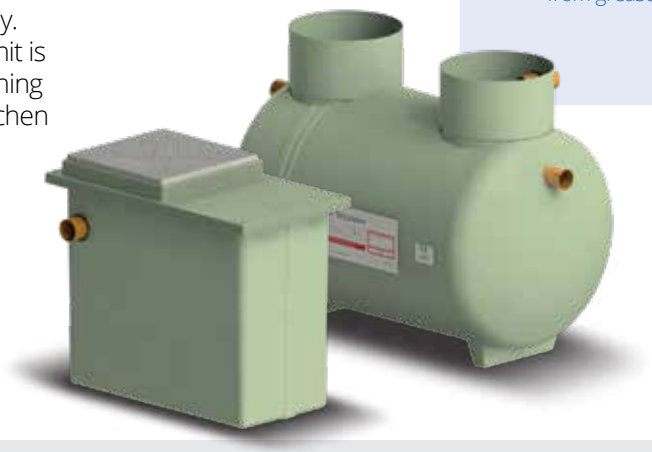
Grease Separators

Clearwater grease separators are designed for commercial and industrial applications such as restaurants and hotels. It is an effective and hygienic method of separating fat and grease from wastewater flow.

The units are sized based on the site's advised number of meals per day. The waste discharged into the unit is expected to come from pot washing sinks, dishwashers and other kitchen wash sinks.

Features:

- Greatly reduces drain blockages, for maximum operational efficiency.
- Helps improve performance of septic tanks and field drains for best results.
- Manhole cover for easy access for maintenance.
- Protects mains drainage system from grease blockages.



Separator Model	Width of Unit	Length of Unit	Capacity	Approx Weight		Shipping Height	Fall Across The Unit
				Empty	Full		
NSG01	700	1300	500L	70kg	570kg	1100	75
NSG02	1000	1600	1000L	90kg	1090kg	1175	75

Separator Model	Length of Tank Body	Distance Between Necks	Capacity	Approx Weight		Shipping Height	Fall Across The Unit
				Empty	Full		
NSG04	2072	872	2000L	120kg	1860kg	1570	70
NSG06	3018	1818	3000L	160kg	2820kg	1570	70
NSG09	3895	2690	4000L	190kg	3760kg	1570	70
NSG14	4418	3173	6000L	211kg	5480	1745	70
NSG18	3231	1931	8000L	300kg	7162kg	2120	70
NSG24	4386	3086	11000L	380kg	9885kg	2120	70

We're here to help!

Clearwater Pollution Control

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HP22 9NN

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Clearwater
POLLUTION CONTROL

08/2022_v2_5289

BioTec
BTA-1 to BTAU5 Treatment Plants Installation & Operation Guidelines

Enclosed Documents

DS1380B	BTA-1 Gravity Treatment Plant
DS1381B	BTA-1 IPS Treatment Plant
DS1384B	BTAU2 & BTAU3 Gravity Treatment Plant
DS1385B	BTAU2 & BTAU3 IPS Treatment Plant
DS1386B	BTAU4 Gravity Treatment Plant
DS1387B	BTAU4 IPS Treatment Plant
DS1401B	BTAU5 Gravity Treatment Plant
DS1402B	BTAU5 IPS Treatment Plant
DS1342B	Gravity & IPS System Isolator Wiring Diagram

Part Code	1011358
Issue	03
Description	ECN 1624
Date	September 2022

5628.01

Clearwater
POLLUTION CONTROL

HEALTH AND SAFETY

These warnings are provided in the interest of safety. You must read them carefully before installing or using the equipment.

It is important that this document is retained with the equipment for future reference. Should the equipment be transferred to a new owner, always ensure that all relevant documents are supplied in order that the new owner can become acquainted with the functioning of the equipment and the relevant warnings.

Installation should only be carried out by a suitably experienced contractor, following the guidelines supplied with the equipment.

We recommend the use of relevant PPE when working with GRP components.

A qualified electrician should carry out electrical work.

Sewage and sewage effluent can carry micro-organisms harmful to human health. Any person carrying out maintenance on the equipment should wear suitable protective clothing, including gloves. Good hygiene practice should also be observed.

Covers must be kept locked.

Observe all hazard labels and take appropriate action to avoid exposure to the risks indicated.

The correct ongoing maintenance is essential for the proper operation of the equipment. Service contracts are available and recommended. Please contact our Sales department for details of your local service provider.

Should you wish to inspect the operation of the equipment, please observe all necessary precautions, including those listed below, which apply to maintenance procedures.

Ensure that you are familiar with the safe working areas and accesses.

Ensure that the working area is adequately lit.

The power supply to the equipment should be isolated at the main RCD before lifting the blower cover.

Take care to maintain correct posture, particularly when lifting. Use appropriate lifting equipment when necessary. Keep proper footing and balance at all times. Avoid any sharp edges.

Desludging must be carried out by a licensed waste disposal contractor holding the relevant permits to transport and dispose of sewage sludge. The contractor must refer to the desludge instructions contained in these guidelines.

Contents

1 Introduction

1.1 Engineering & Process

Our Packaged Sewage Treatment Plants are designed to treat domestic sewage to an average final effluent of less than 20mg/l Biochemical Oxygen Demand (BOD), 30 mg/l Suspended Solids, and 20mg/l Ammonia when the incoming flow and biological loads are within the limits for the plant as specified by us.
These units are exclusively for the treatment of sewage from domestic properties. Contact our sales team for other non-domestic applications.

As a general guide the BTA1 is suitable for 6 PE, BTA2 is designed to treat 9 PE, BTA3 suitable for 12 PE, BTA4 is designed to treat 18 PE and BTA5 is designed to treat 25 PE.
The Treatment Plant is based on an improved form of trickling biological treatment, which continuously recycles the settled liquor by airlift. Process takes place in 3 distinct stages.

Primary Screening & Settlement
Sewage enters the primary section where the solids separate from the liquid forming a scum or a sludge.
The settled liquor is then passed on through a dividing baffle into the secondary settlement stage.
Biological Treatment

From this secondary settlement stage the liquor is lifted and distributed over the media bale by an airlift.
The biological filter bale consists of a composite plastic media of high specific surface area. This is where the biological process takes place with biomass forming on the surface of the media. The biomass consumes the major part of the incoming biological load.

The air lift is driven by a blower mounted within a weatherproof housing which should be located in a shaded position above possible flood levels. The supply of air from the blower provides adequate oxygen to the plant. Air from the plant can be vented by either the soil vent pipe or by a separate vent.

Final Settlement
The treated sewage passes through the biological filter bale to the final settlement stage where humus solids settle out and clarified liquor passes through the final zone. It is then discharged via the outlet, which is fitted with a v-notched weir or pump arrangement. This provides flow control and increases retention time throughout the wastewater system to a watercourse or soakaway.

1.2 Applications

	BTA1	BTA2	BTA3	BTA4	BTA5
Domestic Population Equivalent	Up to 6	Up to 9	Up to 12	Up to 18	Up to 25
Total BOD Loading	0.36kg/day	0.54 kg./day	0.72 kg./day	1.08 kg./day	1.50 kg./day
Maximum Flow	0.9m³/day	1.35m³/day	1.8m³/day	2.7m³/day	3.75m³/day
Peak Flow Rate	0.18 m³/hr	0.27 m³/hr	0.36 m³/hr	0.54 m³/hr	0.75 m³/hr

2 Installation Guidelines

2.1 Siting

It is essential that all surface water be segregated and excluded from entering the treatment plant.
We do not recommend a pumped feed to a Treatment plant without special reference to our Sales team.
Sink waste disposal units should **not** be used in conjunction with a Treatment plant. Please contact us for further guidance.

We do not recommend the use of air admittance valves with W.C systems connected to the plant. Tile vents should not be used as the sole drainage ventilation facility but if this cannot be avoided the Unit should be independently ventilated. All inspection points within the drain system should be sealed to enable ventilation at high level.

If the plant is remote from buildings, ventilation of the inlet drain will be required.
In hard water areas a softener may be required, where one is fitted, the spent regenerant must be routed to a separate small soakaway.

2.2 Population Equivalent

Refers to normal family residents, some of whom have daytime occupations or schooling away from the house and includes overnight guests who may stay for periods of more than one night. Contact us for advice regarding non-standard situations.

2.3 Flow Balancing

Our package plant can deal with influent surges. The plant holds a large volume of treated effluent, which provides a significant dilution of influent surges, thereby minimizing any shock to treatment. It also has a surge control outlet arrangement.

2.4 Installation

These guideline instructions apply to the BTA1 -BTA5 Range of plant and should be read in conjunction with the section on Electrical Guidelines.

Before beginning the installation, the whole of these instructions must be read and understood. It is essential that you comply with all the given instructions.

Adherence to good Working Practices and the Health & Safety at Work act on site should be observed.
Prior to installation, check the tank for damage and always handle with care, avoiding heavy impact or contact with sharp objects.

On no account should the specified maximum drain invert depth be exceeded.

Never fill a freestanding tank with water or back fill an empty tank. Always fill the tank with water at the same time as the back fill material is placed. The water level inside the tank is to be maintained within 200mm of The Concrete Specification given below is not a site specific installation design. the concrete level during backfilling. This avoids the risk of flotation and minimizes the applied loads to the tank.

These instructions assume no more than pedestrian duty loadings will be applied to the final installation. Traffic or other heavy superimposed loads must not be transferred through the walls of the tank.
Select the unit location in accordance with building regulations, required distances from buildings, water supplies and irrigation systems.

2.5 Site Planning

The following points should be considered before installation of the equipment:

The discharge from a treatment plant may require the permission of the relevant Environmental Regulator and the complete installation, including the specified irrigation system should have Planning and Building Control approval.

In many cases, the effluent discharge is to an irrigation system. A soil porosity test should be carried out, please refer to current guidelines in place at plant's location e.g. or Building Regulations pt. H2. EN12566 part 2, or EPA Single house manual (Ireland).

There must be at least 1 metre of clear, level ground all around the unit to allow for routine servicing.

Wherever practicable, the unit should be installed as far as possible from any habitable building. Many Local Authorities will insist on a minimum distance of 15 metres from any building (7 metres Eire) and 10 metres (same distance for Eire) from any watercourse. Further information can be obtained through your Local Authority and in the Building Regulations in the UK and though the EPA in Eire.

Care should be taken not to place the unit in close proximity to any openings from the building.

Adequate access must be provided for routine de-sludging and maintenance. Usually, the unit should be sited within 30 metres of a hard standing area suitable for a vacuum tanker. Vehicles should not be permitted within a distance equal to the depth of the unit unless suitable structural protection is provided to the installation.

Treatment units must be installed at a level, which will allow connection to the incoming drain and a free discharge at the system outlet (excepting units with an integral discharge pump). Effluent pumping stations are available to lift the discharge to a higher level and/or pump to remote discharge points. The location should not be subject to flooding.

If the unit has to be recessed, measures must be taken to ensure that it cannot be flooded by surface water run-off.

Where necessary the treatment unit should be fenced off or otherwise protected. Maintenance access must be maintained as above. Always keep the system locked. An open treatment plant must not be left alone

The drainage system connecting to the treatment unit must be adequately vented in accordance with the Building Regulations. The head of the drainage system should be connected to a stack pipe, open at high level, so as to draw foul air from the system and sited with consideration to prevailing wind direction. Tile vents & air admittance valves should not be used as the sole drainage ventilation facility, but if this cannot be avoided, the treatment unit should be independently ventilated. All inspection points within the drain system should be sealed so as to enable ventilation at high level.

Acceptable tolerance for installation of the Treatment Plant is +/- 20mm.

Our domestic treatment plants are structurally tested in accordance with EN 12566-3, which specifies structural stability testing for both wet and dry sites using granular backfill 3-8mm. However in GB it would be typical for our tanks to be installed in concrete due to rising water table, and it can generally be assumed that buoyancy prevention of concrete backfill is more advantageous than the granular backfill materials used in testing.

GENERAL CONCRETE SPECIFICATION IN ACCORDANCE WITH BS EN 206-1 (BS 8500-1)		
TYPE OF MIX		(DC) DESIGN
PERMITTED TYPE OF CEMENT		BS 12 (OPC): BS 12 (RHPC): BS 4027 (SRPC)
PERMITTED TYPE OF AGGREGATE (coarse & fine)		BS 882
NOMINAL MAXIMUM SIZE OF AGGREGATE		20 mm
GRADES: C25 /30 C25 /30 C16 /20		REINFORCED & ABOVE GROUND WITH HOLDING DOWN BOLTS REINFORCED (EG. FOR HIGH WATER TABLE) UNREINFORCED (NORMAL CONDITIONS)
MINIMUM CEMENT CONTENT	C30 C20	270 - 280 Kg/M^3 220 - 230 Kg/M^3
SLUMP CLASS		S1 (25mm)
RATE OF SAMPLING		READY MIX CONCRETE SHOULD BE SUPPLIED COMPLETE WITH APPROPRIATE DELIVERY TICKET IN ACCORDANCE WITH BS EN 12350-1
NOTE: STANDARD MIXES SHOULD NOT BE USED WHERE SULPHATES OR OTHER AGGRESSIVE CHEMICALS EXIST IN GROUND WATER		

Having excavated, if the base is excessively wet or unstable, lay 200mm of hard-core and line with polythene, prior to laying the 200mm level base of concrete. If necessary, make a sump hole to one corner of the excavation to accommodate a suction hose from a site pump, thereby keeping the excavation as dry as possible.

Lower the tank on to the levelled concrete, ensuring the top of the tank is completely level and that all connections line up. With the tank in position commence filling with water and at the same time back fill with concrete to just below the inlet/outlet levels. The water level inside the tank is to be maintained within 200mm of the concrete level during backfilling. It is important that these two operations are carried out simultaneously to avoid the risk of flotation. When back filling with concrete it is essential that the underside of the tank is evenly supported without voids.

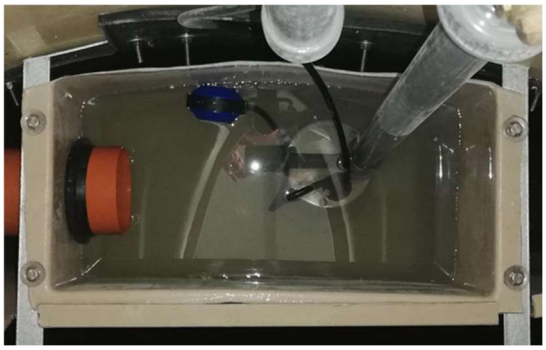
Concrete backfill must be manually compacted - we do not recommend the use of vibrating lances. Make the inlet/outlet and air duct connection. Continue back filling with concrete to 50mm below the cover flange, completing the installation to ground level with free flowing soil.

When concrete back filling, care should be taken not to concrete in cover fixings. A small amount of soil can be placed on the green curved top, but not on the access panel.

2.6 Options

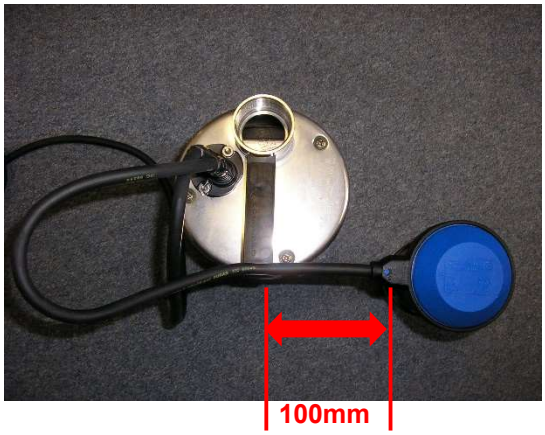
Where installations involve deep inverts on wet sites, concrete back fill in excess of that required for standard depth, should be applied in gentle pours with the tank fully ballasted. This operation should only be completed when the main backfill has set.

These treatment plants are available with a gravity outlet or integral pump set (IPS). The installation procedure for the gravity version is the same, but the pumped outlet is suitable for MDPE pipe work at a shallower invert.



Pump Position

Units with optional discharge pump: Check that the pump float and associated pipework are positioned as shown and that the float is free from obstruction and can move freely.



Float Setting

The float cable length is pre-set during assembly to a dimension of 100mm. Check that this dimension has not been altered. If for any reason the cable becomes disconnected from the retaining clip it should be replaced so that there is 100mm of cable between the clip and the float.

Note: Setting less free cable will cause the pump to operate more frequently and may shorten its working life.

Important: With the pump chamber empty of water the float must hang clear of the chamber floor. The correct float position and distance is essential. The float must not be able to either trap or tangle, as this will prevent its correct operation. The float must not jam.

2.7 Venting & Blower Housing

A 110mm diameter multipurpose air duct is located on the outlet side of the plant. A t-piece must be connected so the unit can be vented, and the air hose connected to the blower housing

Vent side of the T piece to be taken above ground and suitable vent mushroom fitted, cable and hose duct side of the T to be run back to the blower housing and sealed with expanding foam to avoid foul air recirculation into the plant

Installer must ensure adequate venting is provided for the treatment plant to work efficiently.

The ducting for the air hose must connect through an independent concrete base for blower housing location. The duct must be laid with long radius bends to enable the hose to be threaded through.

The blower housing base slab should be located 3 to 13 metres from the outlet end of the plant such that the 15 metres of air hose provided is sufficient. The concrete base should be 150mm thick and must be large enough to accommodate the blower enclosure.

Preferably the location for siting the blower should be shaded. Once the air hose is connected to the blower the duct though which it has entered should be sealed with spray foam.

Where pumped outlets are included, electric cable is provided with the pump. The cable may need to be extended using a junction box to reach the blower housing, via the airline duct (depending on the distance the blower housing is from the treatment plant).

Electrical installation from the supply should be made by a competent electrician in accordance with the appropriate regulations.

It is essential that this treatment plants installation & set up is inspected correctly. This may be completed by the installer; however, it is recommended that the Pre-service Agreement Inspection be completed by us or an approved Service Engineer. This may be undertaken for a modest fee.

2.8 Dimensions

Model No.	Diameter mm	Depth mm
BTA1	1850	2200*
BTA2	1850	2700*
BTA3	1850	2700*
BTA4	2650	2100**
BTA5	2650	2600**

* Depths shown are for standard 1 metre invert unit. Additional 500mm to be added for units with 1.5 metre inverts.

** Depths shown are for standard 0.875 metre invert unit. Additional 500mm to be added for units with 1.375 metre inverts.

2.9 Self Help

In order to minimize the need for dealing with emergency situations we recommend that Treatment Plants have a Pre-service Agreement Inspection, then is regularly serviced by us or an approved Service Engineer. Provided that your plant is installed, operated correctly and serviced, you should not need to get into much – if any – self-help.

However, some of the most likely question and answer situations are listed below. Firstly, any sewage treatment plant, if abused, can become a health hazard. If in any doubt, ask us or an approved Service Engineer.

Blower Stopped:
Check the unit is switched on, the incoming power supply circuit and fuse
Blower works but no water distribution inside the plant: Check hose connections.
Check distributor heads.
If the air lift pipes are suspected to be blocked, call for service.
Check regulating valve is not closed.

Plant Odour:
Check blower working.
If blower working, plant probably needs desludging.
Check vent circuit is clear
Check that the air duct entering the blower housing has been sealed with foam.

Plant Flooding.
Check for blocked outlet system.
If pumped outlet, check for pump operation, check floats and pump power supply.

2.10 Do's and Don'ts

Do take out a service agreement and let the experts look after your plant.
Do contact us for advice if you have any cause for concern.
Don't pump feed the plant without reference to us.
Don't use a waste disposal unit as you will be adding to the biological load, and your system may not be large enough to cope with the waste. If you are unsure, please refer to our sales team for guidance.
Don't throw any medicines down the toilet.
Don't empty large quantities of bleach or similar cleaning reagents into the system.
Don't empty cooking oil or similar down the sink.
Don't cover the plant with soil material or prevent access for service and desludging.
Don't apply a hose or jet wash to the biological filter unless specifically advised to.
Don't try to enter the plant. Make sure the plant is always locked
Don't put sanitary towels, incontinence pads, nappies, tampons, or other non-biodegradable items down the toilet.
Don't allow backwash from swimming pools or hot tubs to be discharged into the treatment plant.

2.11 Blocked air lifts

Occasionally airlifts block. Usually this is as a result of non-biodegradable products entering the unit, such as sanitary items, rags, J clothes, plastic bags, etc. These items should not be allowed to enter the unit, as they will adversely affect the liquid distribution, the build-up of biomass, overall performance, and effectiveness of the unit.

Sometimes blockages occur as a result of formation of calcium carbonate solids within the air lift pipe.

Calcium carbonate is a gritty white to brown solid. The solid that forms within the pipe varies in colour and consistency depending on the nature of the sewage.

This type of blockage usually occurs because there is too much calcium present within the unit, the solid forms when the water chemistry is altered by the air bubbled through the pipe. This is a very unusual occurrence.

To prevent reoccurrence, you should
Ensure that no ground or surface water is allowed to enter the unit.

Check that where a softener is connected to the water supply of the property, that the regenerate chemicals, (which are high in calcium and magnesium salts) are not being fed into the unit.

Consider a softener to reduce the background level of calcium in the main feed supply.

When these blockages occur, the calcium carbonate formed is insoluble, and heavy. Within the pipe it is also sticky with other sewage solids. When wet the solids are not easily cleared from the pipe.
Should you have a recurring problem, please contact us and we will provide a spare air lift pipe.

2.12 Pre-service Agreement Inspection

We recommend that our Engineers or approved service provider should inspect the equipment. However, in situations where expediency is required for owner/installer to inspect, the following basic instructions may prove useful.

Check blower housing has been securely positioned and has been correctly wired to a suitable electrical supply, protected by an earth leakage circuit breaker, ensuring the equipment is correctly earthed. (refer to Installation Instructions). The electrical equipment must be inspected by a qualified Electrician and installed to the local Electricity Authority regulations.

Ensure the air hose has been securely connected to the hose adapter in the blower housing and the other end is connected to the manifold within the plant, ensuring that there are no sharp bends or kinks causing airflow restrictions.
Make sure construction debris is removed from within the plant.

It is essential that the Tank is filled with clean water to the outlet level. Before switching on the unit, ensure the air filter is correctly fitted and that the air intake is completely free of any obstructions. Switch on the unit. The airflow will activate the air lift pumps distributing the water over the biological filter. Check the

centralisation of the distribution cones and adjust if necessary, to provide an even covering of the biological filters. Adjust the spray of distribution using the individual valves on airlines inside the unit.

Allow sewage to enter the plant as necessary and ensure that the blower is left running continuously. Biomass will build-up naturally over 4 -8 weeks and the plant should then treat sewage naturally.

To ensure the plant is functioning correctly and the final discharge is to the required standard, contact your service provider to arrange a Pre-service Agreement Inspection stating the original start-up date.

In order to get the best from your plant, we recommend that you contact us or one of our approved service providers to both carry out a Pre-service Agreement Inspection and service the plant. **This reduces the risk of non-compliance**. It also avoids unnecessary desludging and minimizes the cost of emergency call out visits.

Taken from 'Clearwater's Terms & Conditions of Sale'

2.13 Warranty

The company will replace or, at its option, properly repair without charge any goods which are found to be defective and which cause failure in normal circumstances of use **within a period of twelve months from the date of delivery.**

This warranty is conditional upon:
(a) the Buyer notifying the Company of any claim within Seven days of the failure becoming discernible.
(b) the Company being allowed a reasonable opportunity to inspect the goods so as to confirm that they are defective.
(c) the goods not having been modified, mishandled or misused and being used strictly in accordance with any relevant instructions issued by the Company.
The Company's liability under this Clause is limited to the repair or replacement of the defective goods, and does not cover costs of transport, installation or associated site costs, if applicable.
The Company's liability to replace or repair the goods is in lieu of and excludes all other warranties and conditions, and in particular (but without limitation) the Company shall have no liability of any kind for consequential loss or damage.
For any further advice, please contact our Service & Warranty department.
A warranty form is included in this package, to register your unit for warranty. Please complete ALL sections of the form and return it at your earliest convenience.
Also within this manual is a **Notice**, describing the necessary maintenance for the plant. This should be fixed within the building.

3 Electrical Installation

3.1 General Electrical Installation Information

It is imperative that the electrical installation of this equipment is entrusted to a competent qualified electrician working to the latest IEE regulations

It is not possible to state a specific installation configuration that would suit all sites. The selection of current protection devices must remain the responsibility of the installer who should select a suitable cable and current overload protection, taking into account the distance from the power source to the unit and any other relevant factors. (In many cases steel wire armoured (SWA) cable, minimum 1.5 sq mm will be suitable).

When installing the electrical supply to the unit, the following points should be considered:
The electric power supply to the tank should be by means of a dedicated circuit with isolation and protection devices consistent with the requirements for fixed equipment and in accordance with the latest regulations of the Institute of Electrical Engineers. This power supply should be independent of all other household protection devices other than the supply authority's main fuse and that provided specifically for the power

supply. In particular, earth leakage devices provided for normal domestic protection must not form part of the supply circuit to the tank.

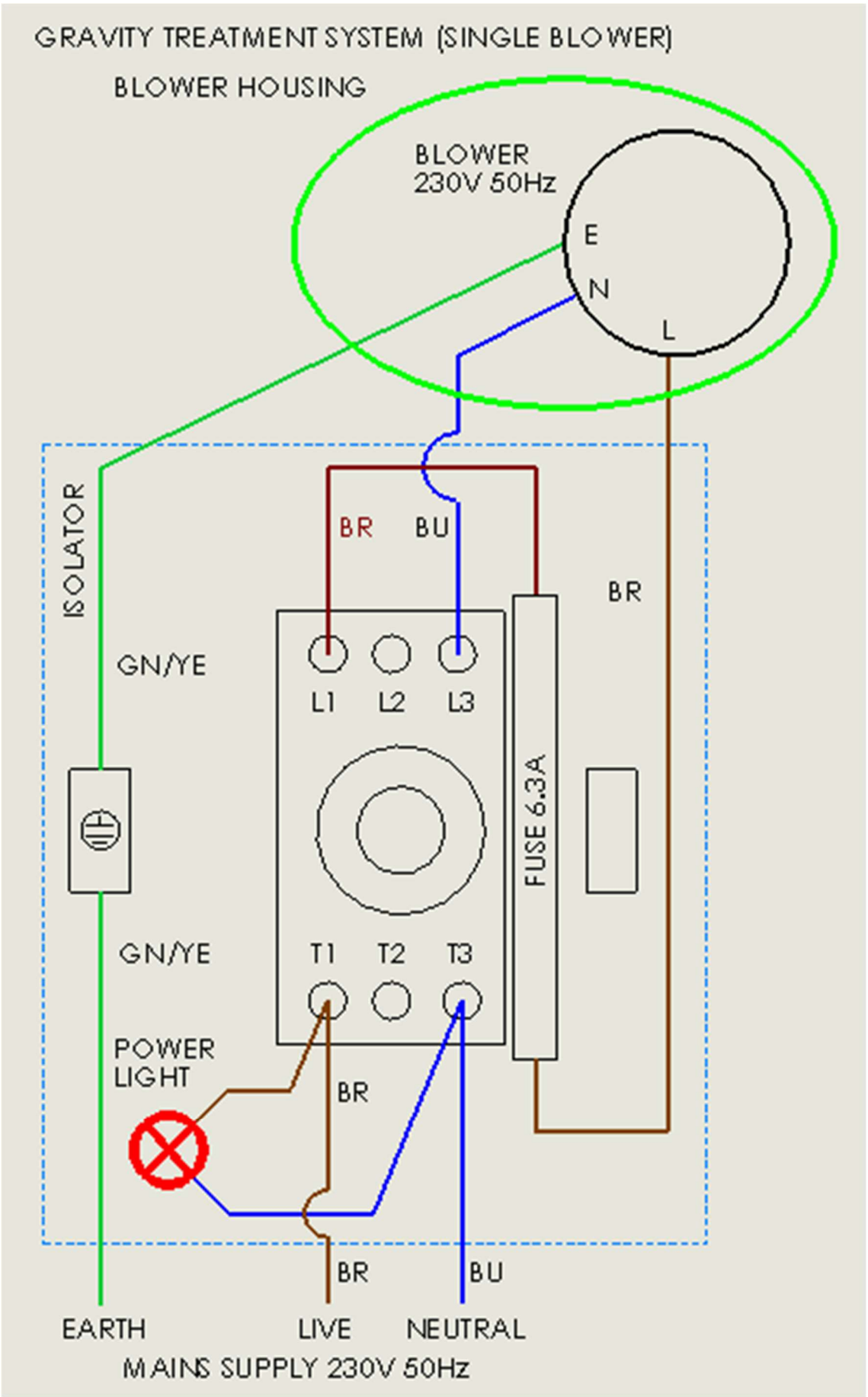
An earth leakage circuit breaker should be incorporated in the supply to the unit. A device with 30mA minimum trip current is recommended.

3.2 Isolator

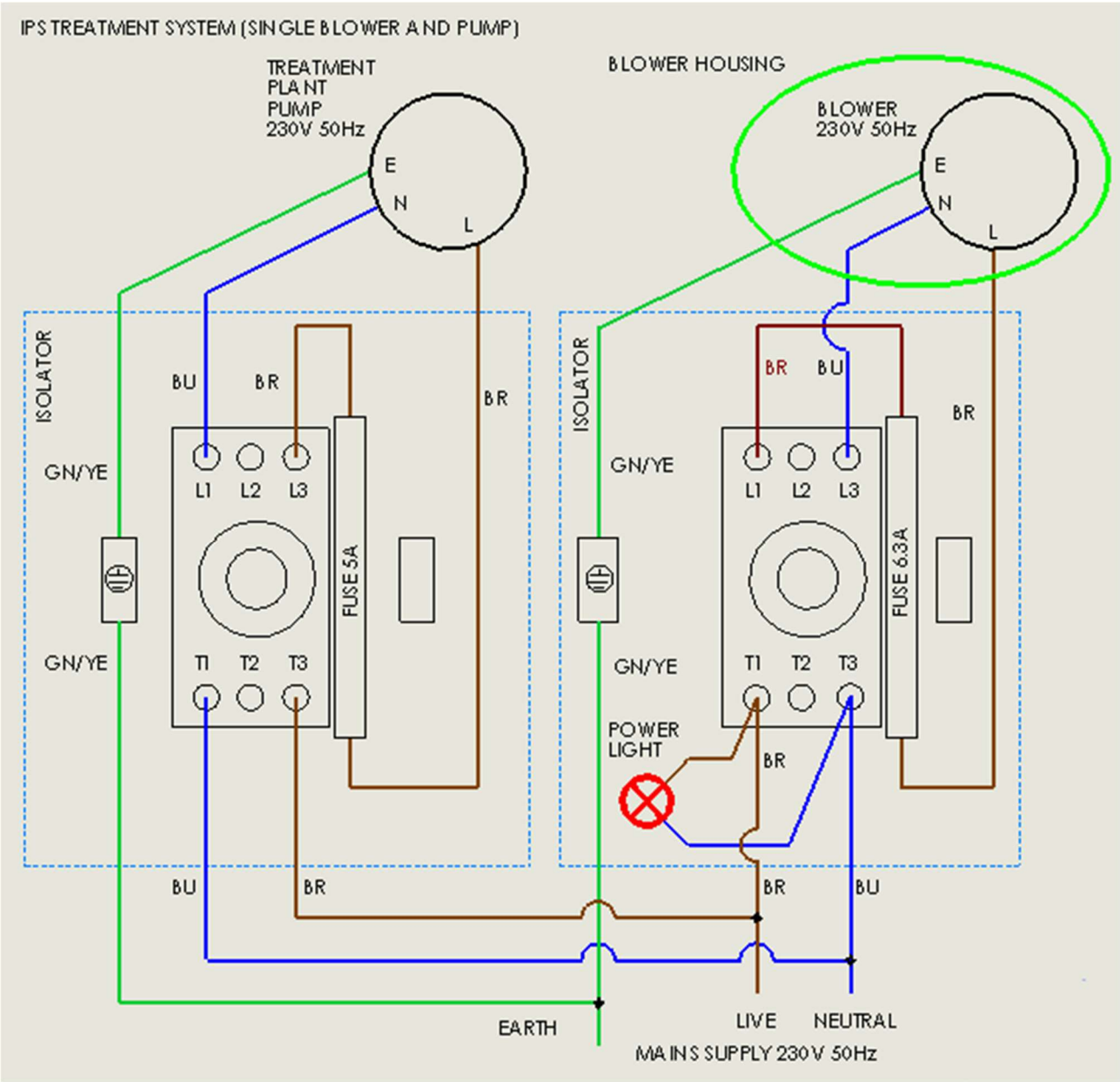
The Isolator with power failure light (in the blower box) can be mounted externally at a point where it is easily visible from the property.

The power supply cable should connect to the IP65 rated isolator socket mounted externally (see sales drawing). Any terminal shrouds removed during the connection of cable cores must be replaced afterwards. A separate duct or conduit should be provided by others.

Isolator Wiring Diagram - Gravity System:



Isolator Wiring Diagram - IPS System:



4 Operations

4.1 Standard Rate Treatment Plants

Model No.	Litres	Gallons
BTA1	2,220	500
BTA2	3,540	800
BTA3	3,540	800
BTA4	4,170	920
BTA5	5,870	1290

4.2 General Maintenance

Sewage Treatment installations will only perform as well as they are maintained. The best way to achieve this is to arrange a service agreement with us or an approved Service Engineer (see below). There will always be situations when a little self-help may be sufficient to avoid call out and we describe here some basic checks, which may prove useful.

Firstly, keep children and pets away from the plant and always wear rubber gloves when inspecting the unit. Never try to climb into the plant.

If in doubt, ask us or an approved Service Engineer for advice. One of the things that will come from routine maintenance is evaluation of the desludging interval.

Having confirmed that the sludge situation is under control, the following basic checks can be made.
Check that the spray is covering the rectangular bale. This can be adjusted by the plastic valve attached to the air hose inside the plant.

Ensure that the airlift in the centre of the bale is not blocked, as this will also affect the spray pattern.

Where pumped outlets are included, check the pump operation, check floats and check pump power supply to the plant.

Emptying and Desludging

All biological treatment plants produce a surplus of sludge, which from time to time have to be removed in order to maintain process efficiency. Applications on purely domestic feed may only require desludging 6-12 months, whereas more heavily loaded installations may require desludging at least 6-9 months.

Desludging must be carried out by a reputable company who may be located by reference to Yellow Pages, your District Council or from your local Water Authority. We may be able to help you with suggesting an

emptying contractor. When ordering a tanker for any desludging you will have to state the capacity of the unit to enable the correct size tanker to be scheduled (see 0).

Emptying and Desludging Procedure

Turn off the unit. First ensure that the hose is placed on the inlet side of the unit, always empty the tank ensuring equilibrium in water levels.

Reduce the water level by about 300mm then place the hose in the outlet side of the tank, also reducing the water level by 300mm.Continue with this process until the tank is completely empty.
Make sure that the hose and end fitting are, as far as practical, kept away from the baffles whilst raising and lowering.

The hose and end fitting must be positioned to draw from the very bottom to collect accumulated settled sledges. Make sure construction debris is removed from within the plant.

Take care not to blow back the wastewater into the treatment plant when lifting the hose from one compartment to another one or removing it from the plant.

Whilst pumping out, check the other compartments to make sure that the water level drops at the same rate. At no time should the difference in water level either side of the screen exceed 300mm. As far as is practical, remove traces of sludge accumulation on the walls and bottom of the chamber.

Check for the presence of any residual solids in the bottom of the final settlement zone, i.e. the last tank compartment, and if there are any present, remove them.

If a clean water hose is available, hose down any residual solids from the interior of the tank. Do not hose off the biomass from the media unless it is blocked.

The tank should be refilled as speedily as is practical using mains supply water. Refill the tank evenly from both sides of the screen, therefore establishing a constant equilibrium. It is advisable to leave the air blowers off until normal water level has been achieved.

BTA1 – BTA5

The foul drainage from this property discharges into a package treatment works

Maintenance is required, the frequency of which depends upon the model installed, its use and application. Please consult your Operation & Maintenance Manual.

* When operating at the normal daily load, emptying should take place every 6-12 months, whereas more heavily loaded installations may require desludging at least 6-9 months.

Maintenance and Desludging should be carried out by the owner in accordance with the Manufactures instructions.

THE OWNER OF THE PROPERTY IS LEGALLY RESPONSIBLE FOR ENSURING THAT THE SYSTEM DOES NOT CAUSE POLLUTION, A HEALTH HAZARD OR A NUISANCE.

We recommend that a separate log is kept of all maintenance and service visits, the log should detail the date and any action taken, e.g. Regular maintenance service, breakdown visit, desludge volume removed, parts replaced.

This notice should be fixed by the owner within the building alerting current and future owners to the maintenance requirement.

(Building regulation H2 (1.57)

Please contact Sales on 0818 544 500 or Service Department Ireland on 0818 543 500 to arrange a maintenance service or to request replacement operating instructions. It would be helpful if you provide your equipment serial number.

Contact Details

Clearwater Pollution Control

PO Box 1035
Aylesbury
HP22 9NN

T: 0844 225 0514
F: 0844 225 0516
E: info@cwpc.co.uk
www.clearwatertanksolutions.com

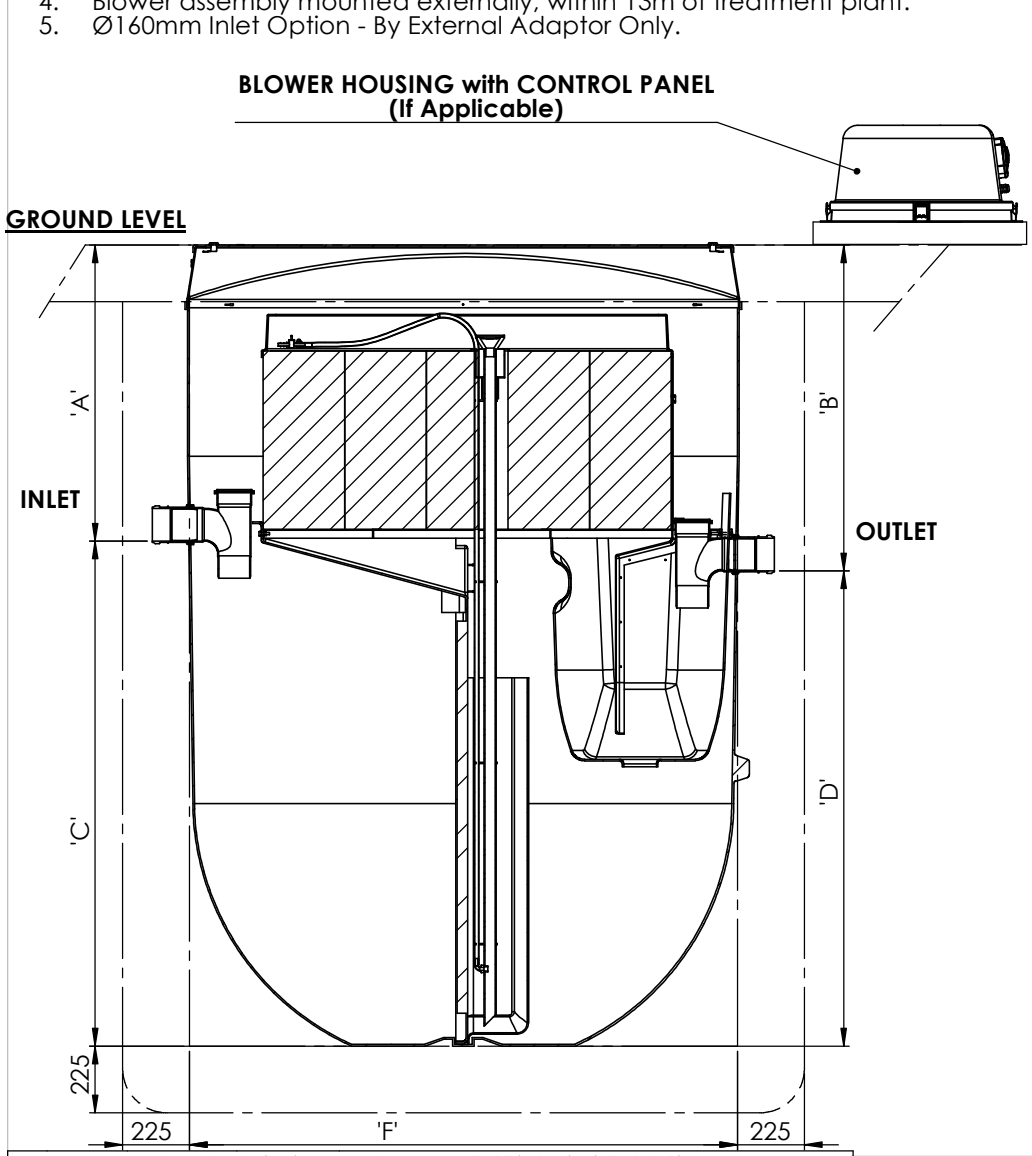
Mktg. Comp. Code (Covers only)
05/2022_v1_5628.01

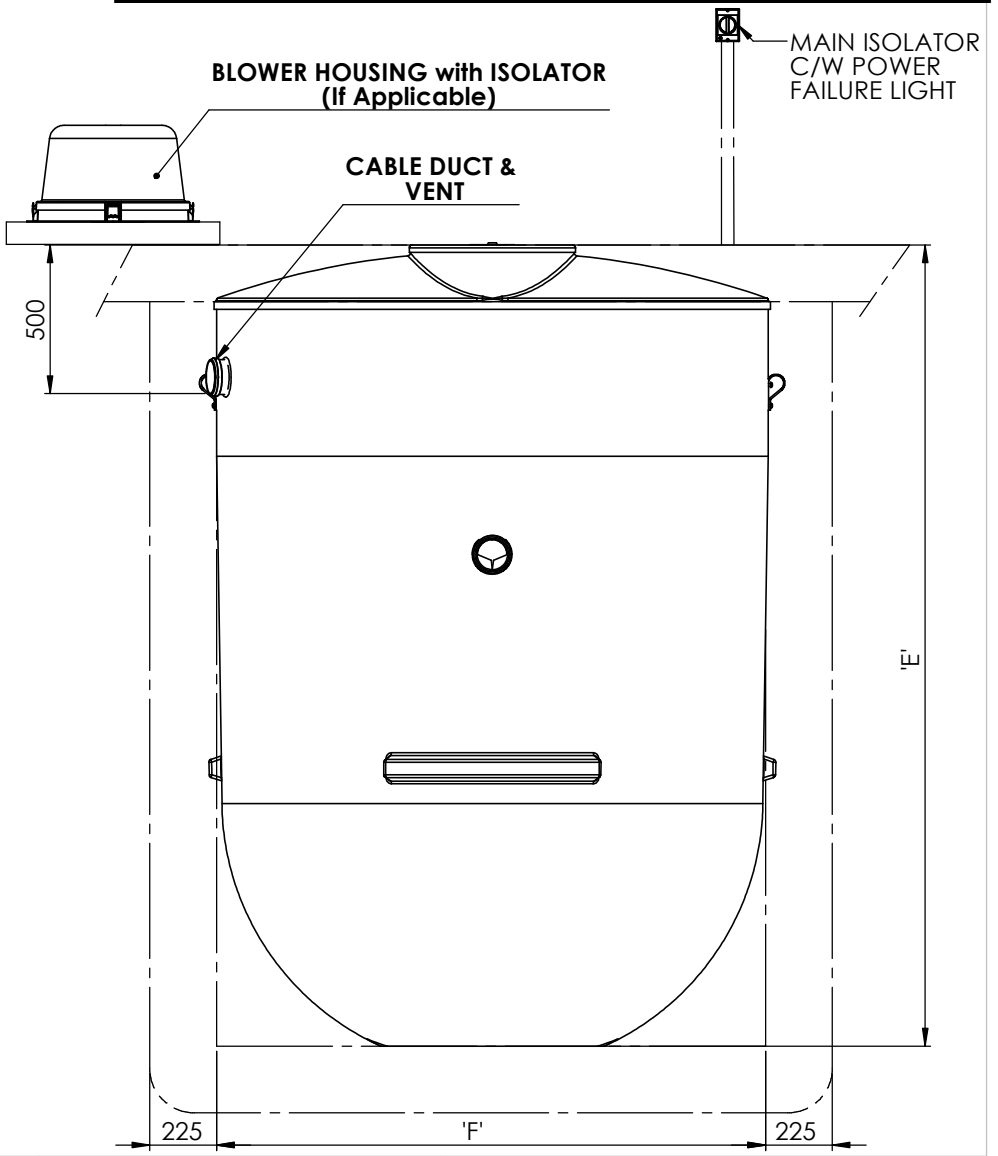
www.cwpc.co.uk

Clearwater
POLLUTION CONTROL

Notes:
1. This drawing is for 'Dimensional Information Only', It is essential that this drawing is read in conjunction with the 'Installation Guidelines' supplied with the unit. (Copies available from our sales department).
2. All Pipe connections are ∅110.0mm PVCu.
3. All units require appropriate 'Cover' & 'Frame' to suit site loadings (standard cover supplied).
4. Blower assembly mounted externally, within 13m of treatment plant.
5. Ø160mm Inlet Option - By External Adaptor Only.

Unit Dimension Chart								
Unit	Dim 'A' (mm)	Dim 'B' (mm)	Dim 'C' (mm)	Dim 'D' (mm)	Dim 'E' (mm)	Dim 'F' (mm)	Dim 'G' (mm)	Unit Weight (Kgs)
BTAU2G2AK	1000	1100	1700	1600	2700	1850	500	275
BTAU2G4AK	1500	1600	1700	1600	3200	1850	500	295
BTAU3G2AK	1000	1100	1700	1600	2700	1850	500	275
BTAU3G4AK	1500	1600	1700	1600	3200	1850	500	295





Please check with Kingspan Water & Energy that this drawing is the latest issue

Issue	Date	Drawn by	Approved by	Description
01	22.08.22	D. Musvaburi	D.M	Initial Issue - ECN 1624

LN Number :	Tolerance (unless stated) :
Finish :	Thickness : n/a
Weight : 1270.55 Kg	Surface Area : m²
Modelled By : Name	Material : Various

Drawing : DS1384

BTAU2 & BTAU3 Treatment Plant (Gravity)

All Dimensions In mm | Scale: Do Not Scale | Third Angle Projection

A:\Dept\Wastewater\Engineering\Drawing Data\02 - Sales Drawings\DS\DS - 13\DS1384

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