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Drainage Strategy Report

PROPOSED HOUSING DEVELOPMENT, LAND NORTH OF STATION ROAD, DRIGG,
CUMBRIA

22-C-16573

Rev 0

April 2022

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1. INTRODUCTION

A L Daines & Partners LLP (ALD) have been engaged by Sunshine Properties Ltd to undertake a Surface and Foul Water Drainage Strategy, in accordance with the National Planning Policy Framework (NPPF) [1] for the proposed housing development at Land north of Station Road, Drigg, Cumbria.

The purpose of this report is to provide a strategy to manage surface and foul water flows from the site, in support of the planning application, while fulfilling the requirements of the Local Planning Authority (LPA) and the Lead Local Flood Authority (LLFA).

2. PLANNING CONTEXT

2.1. PLANNING POLICY

NPPF footnote 55 states that *“a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.”*

Paragraph 169 reads *“Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:*

- a) take account of advice from the lead local flood authority;*
- b) have appropriate proposed minimum operational standards;*
- c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and*
- d) where possible, provide multifunctional benefits.”*

A major development, as per The Town and Country Planning Order 2015, is partly, but not wholly, categorised as development involving the provision of dwellinghouses where the number of dwellinghouses to be provided is 10 or more and a development carried out on a site having an area of 1 hectare or more.

The Cumbria Minerals and Local Waste Plan – Strategic Flood Risk Assessment (June 2018) references the same criteria for local planning policy.

The site is therefore to be classed as a major development under the above criteria.

2.2. PLANNING POLICY IN SITE CONTEXT

The site covers 0.694ha and covers existing greenfield agricultural land. According to the most recent Environment Agency (EA) flood risk maps, the site lies entirely within Flood Zone 1.

The NPPF site categorisation Table 1.1 puts a residential development of this nature within the 'Highly vulnerable' category. Developments in this category are acceptable within Flood Zone 1 and therefore the site-specific Flood Risk Assessment (FRA) need only be brief.

The FRA statement is included within this report.

3. SITE INFORMATION

3.1. SITE PLAN

The proposed development is located to the north of a section of the B5344 between Station Road and Old Shore Road as shown on red line bordered plan in Figure 1.



Figure 1 Aerial photo of site - Bing Maps

The proposed layout of the development is shown on Ashwood Design Associates Site Layout Plan drawing 2406-001 in Appendix A.

3.2. SITE TOPOGRAPHY

The site generally runs from high ground on the northern boundary to the low point at the centre of the southern boundary adjacent to the B5344.

The eastern boundary of the site adjoins an unsurfaced rural single-track lane, while the northern and western boundaries adjoin open pastureland. The southern boundary adjoins the B5344 which runs approximately east-west.

3.3. EXISTING LAND USE

The existing site is agricultural open pastureland. The site is approximately 0.694ha in land area, all of which is currently greenfield.

3.4. DEVELOPMENT DESCRIPTION

The proposed development will see a new access formed off the north side of the B5344. This access will adjoin a spine road running north to south from which 9No proposed properties are served. The remaining land area is retained as landscaped gardens.

4. SURFACE WATER MANAGEMENT

The existing flow paths are likely north to south towards the low point on the site through the higher levels of strata, with a small strip of land area draining towards the eastern boundary due to a slight fall in level.

The proposed development drained areas are split as follows:

0.059ha for access road

0.125ha for dwelling houses (inc. 10% urban creep)

0.038ha for driveways.

0.472ha is to remain as greenfield managed garden areas.

The majority of the garden areas will retain existing flow paths (north to south generally) and shall be considered in the design of the drainage network.

A plan of the proposed and existing hardstanding areas, 22-C-16573/01, is given in Appendix B.

4.1. PERMEABILITY AND SOIL PROFILE

British Geological Survey (BGS) and Land Information Systems (LandIS) mapping services have been used determine the following land make-up:

Bedrock: Sellafield Member - Sandstone.

Superficial drift: Till, Devensian - Diamicton

Soil: Soilscape 6 – Freely draining slightly acid loamy soils.

This soilscape is similar to that observed during trial hole excavations which show a 250-300mm topsoil generally underlain by silty clay soils becoming denser with depth.

Excavations were carried out on 25 March 2022 in clear, dry conditions. The locations and profiles of the trial holes can be seen on drawing 22-C-16573/02 in Appendix C.

The trial holes were excavated to a minimum depth of 1.5m below ground level to enable percolation tests to proceed to determine the infiltration rate of the ground. These tests were carried out in accordance with the guidance document BRE 365 Soakaway Design.

The trial holes were filled to an average depth of 1m above the base level and monitored to record infiltration rates. After 6 hours, all pits showed low reduction in water levels and the tests were abandoned. No infiltration rate was able to be calculated.

Both BRE365 and The SuDS Manual indicate that each pit must drain to at least half depth within 24 hours to be suitable for consideration with an infiltration rate above 1×10^{-5} m/s. The tests did not achieve these thresholds and therefore infiltration should not be considered as a means of wastewater disposal on this site.

The tests did however show that initially there was some infiltration in the upper layers of less dense soils which could be utilised for local restriction of flows at source – such as permeable paving.

The percolation tests results are shown in Appendix C along with photos of the excavations.

4.2. CURRENT SURFACE WATER DRAINAGE PROVISION

Existing watercourses

Excavations along the southern site boundary identified a culverted stone drain which leaves the site beneath the highway. The site currently drains to this location and this is the preferred method of surface water disposal.

Beyond this the closest open watercourse is the River Irt approximately 500m south east of the site.

Existing sewers

There are no existing United Utilities (UU) owned sewer systems present on or near the site.

To the south of the site there are existing UU sewers within Wray Head residential development (approx. 135m from site) and further down Station Road (approx. 270m from site). These are both combined sewers.

Wray Head is not an adopted highway and would therefore require third party landowner consent to install any drainage pipes.

The United Utilities sewer records are shown in Appendix D.

4.3. FLOOD RISK ASSESSMENT

As described earlier in the report, the current Environment Agency Flood Map for Planning shows the whole of the site within Flood Zone 1, as can be seen in the figure below.

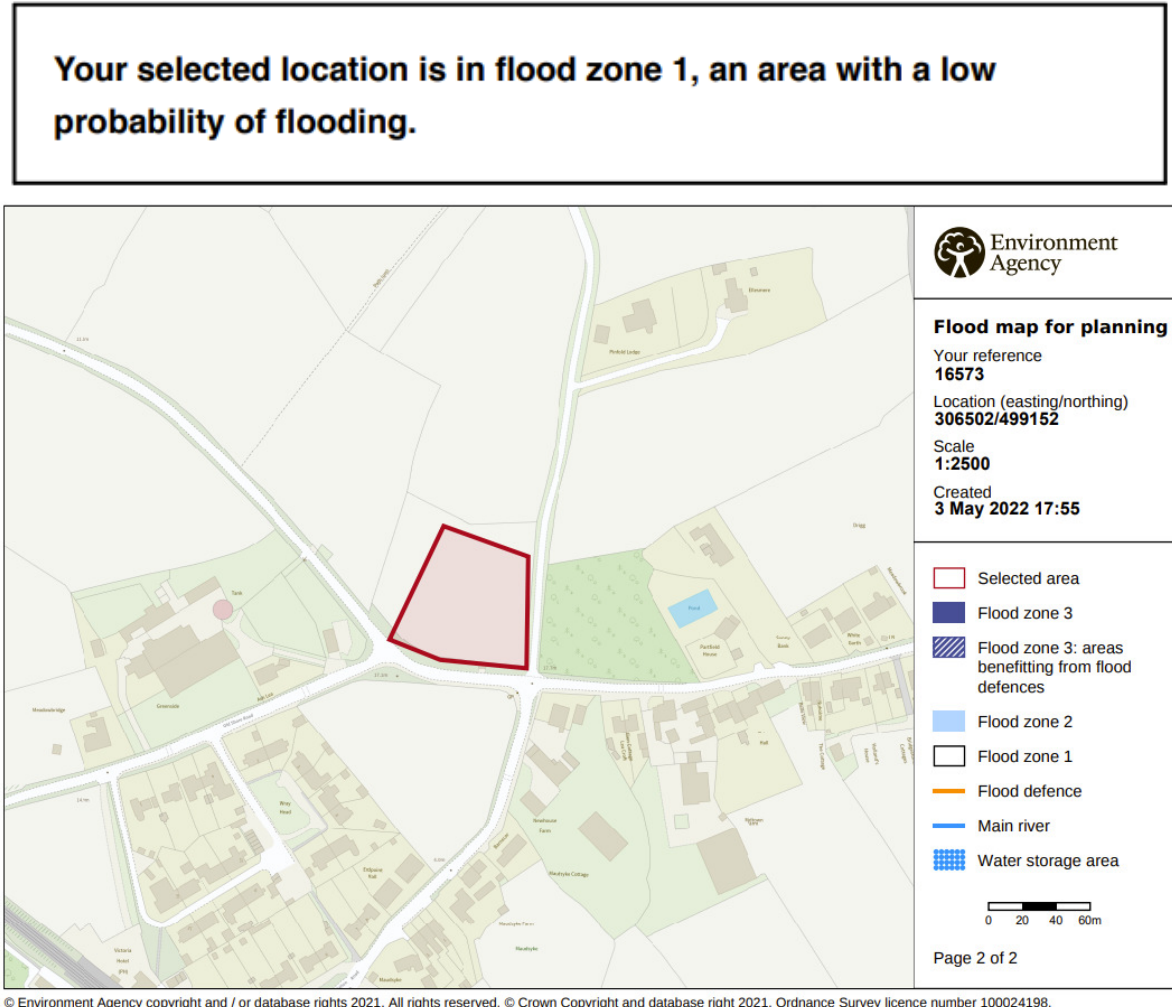
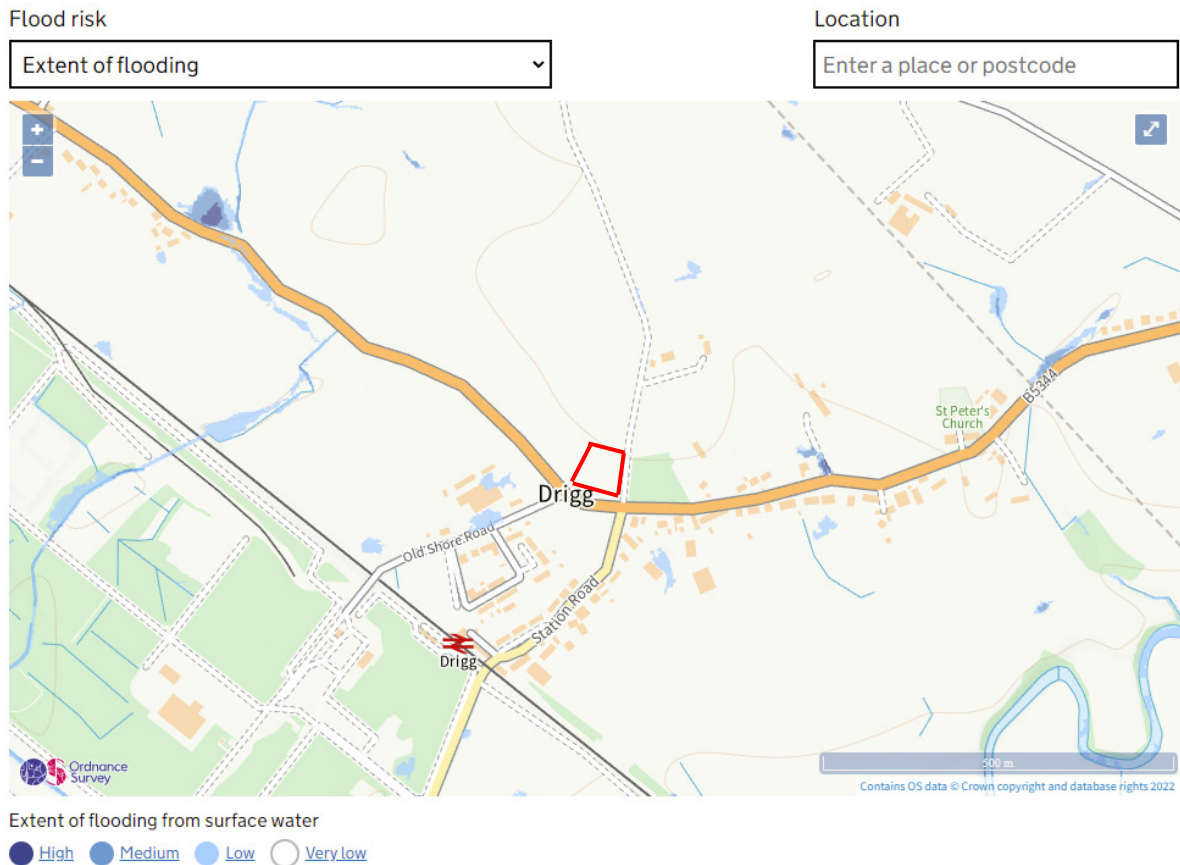


Figure 2 Flood map for planning

A full FRA is therefore not required, although the Environment Agency long term flood risk maps are included below to further inform this report.



The long-term surface water flood risk map shows no areas of flood risk within or near the site.

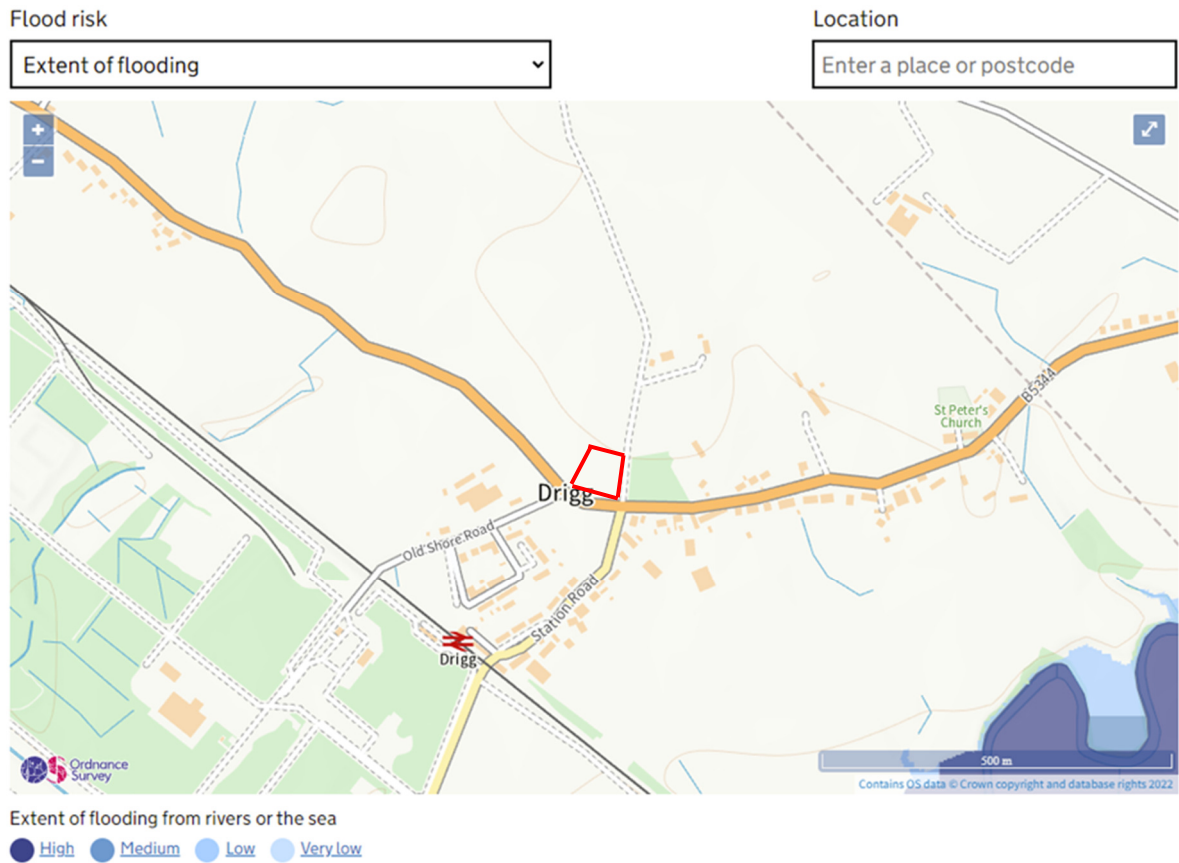


Figure 4 EA long term river and seas flood risk map

There is no perceived risk of flooding from rivers or seas within the site.

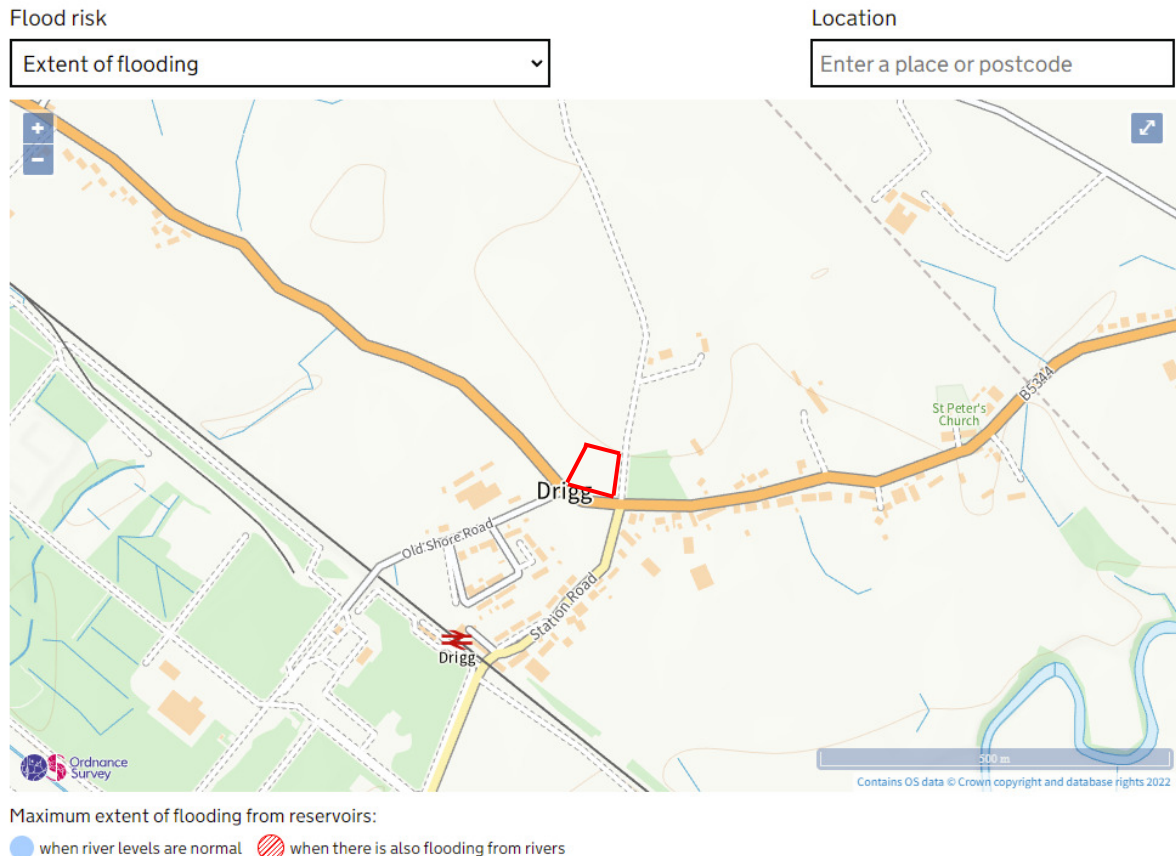


Figure 5 EA long term reservoir flood risk map

There is no perceived risk of flooding from reservoirs within the site.

From analysis of the above flood maps it is clear the existing flood risk to the site is very low and further flood risk assessment is not warranted.

4.4. SURFACE WATER DRAINAGE STRATEGY

The aim of the strategy is to provide a design which will avoid, reduce and delay the discharge of surface water flows into public sewers and watercourses. This will aid in the protection of watercourses but will also ensure that no knock-on effects are seen beyond the site and that the risk of localised flooding and pollution within the site are reduced as far as possible.

To satisfy these criteria, surface water flows shall be subject to assessment via the hierarchy of drainage in accordance with the LASOO Non-Statutory Technical Standards for Sustainable Drainage: Practice Guidance. The hierarchy is as follows:

Hierarchy options:

1. Drain into the ground (infiltration);
2. To a surface water body;
3. To a surface water sewer, highway drain or another drainage system;

4. To a combined sewer.

The drainage strategy for the site is to be developed using the second level on the above hierarchy for the following reasons:

1. Drain into the ground (infiltration) – proved not possible for site as a whole.

The site has been shown through trial hole excavation and percolation tests to be unsuitable for site wide infiltration. There is however capacity in the upper levels of substrata to provide storage and retention of flows prior to discharge at lower site levels.

2. Drain to a surface water body – highest viable drainage method.

There is an existing culverted outfall to a watercourse to the southern site boundary which is currently draining the majority of the site surface water flows. It is therefore intended to use this outfall for surface water discharge.

3. To a surface water sewer, highway drain or another drainage system.

Site to drain to existing watercourse – not applicable.

4. To a combined sewer.

Site to drain to existing watercourse – not applicable

4.5. SURFACE WATER PROPOSED DESIGN

It is therefore proposed to utilise a combination of permeable paving and positive drainage to route the site flows to an attenuation basin/structure to the south end of the site prior to outfall to the existing culverted watercourse.

The greenfield run off calculations, via the ICP SuDS Mean Annual Flood method, for the site are summarised below and shown in Appendix E.

Event	Q1	Qbar	Q30	Q100
Site greenfield runoff	4.1	4.7	8.0	9.8

In accordance with the earlier mentioned hierarchy of drainage full site infiltration is not feasible and as such the system will be designed to utilise storage-based SuDS components prior to outfall to the watercourse.

As per the LASOO guidance, the peak runoff rate from the development for the 1 in 1yr rainfall event and the 1 in 100yr rainfall event should not exceed the peak greenfield runoff for the same event.

The design is also required to prevent flooding to any part of the site for storms up to and including the 1:30yr rainfall event, while any exceedance for the 6 hour

1:100yr event should be controlled within the site and should not flood any properties or service areas.

In this case, it is proposed to restrict all flows off the site to a maximum of QBar, 4.7l/s for all storm events up to 1:100yr +40%.

Climate change

Environment Agency guidance issued in 2016 estimates that peak rainfall intensity will increase due to climate change over the next 100 years. There is therefore an allowance of 40% attributed to the 30yr and 100yr storm event calculations in line with the Upper End estimate of rainfall increases for small and urban catchments.

Percentage impermeability (PIMP)

All impermeable area are modelled as 100% PIMP. This will allow for sufficient capacity for all hardstanding areas to be positively drained.

Volumetric Runoff Coefficient (Cv)

Industry standard Cv values vary for summer and winter and account for water volumes which do not enter the drainage system i.e. that is lost through infiltration, depression storage, evaporation, initial wetting etc. Standard values are 0.75 for summer and 0.84 for winter.

Given the site layout, it is foreseen that due to the poor infiltration rates available on the site, 80% of the land area will contribute to the drainage system and should therefore be accounted for in the design.

In accordance with section 24.8 of The SuDS Manual, the areas to be retained as grassed permeable space provide interception through evapotranspiration and storage within the soil which can be assumed to account for 75% of rainfall volumes. An allowance of 25% rainfall volume is therefore included within the run-off calculations for this drained area.

The remainder of the drained network comprises a combination of permeable and impermeable hardstanding areas. The standard Cv values have therefore been uplifted to 0.80 and 0.90 respectively for both summer and winter storms.

Surface water quality

The SuDS Manual provides best industry practice for assessing the pollutant potential of developments and providing mitigation methods to increase run off water quality through the use of SuDS components.

The simple index approach has been utilised here to assess the pollutant hazard indices and proposed treatment components. Note, this has been carried out in conjunction with the above SuDS component suitability assessment for the site and as such many features have already been discounted.

Table 26.2 from The SuDS Manual below outlines the pollution hazard indices for different land uses.

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Figure 6 SuDS Manual Table 26.2 Pollution hazard indices

This development is to be classed as a mix of 'Very low' and 'low' risk land uses due to the presence of residential roofs and individual property driveways and access roads.

This level of risk demands the following level of pollution control:

Land use	Suspended solids	Metal	Hydrocarbons
Residential roofs	0.2	0.2	0.05
Parking/access road	0.5	0.4	0.4

Table 26.3 from the SUDS Manual, shown below, details pollution mitigation indices for various SUDS components.

TABLE 26.3	Indicative SuDS mitigation indices for discharges to surface waters			
		Mitigation indices ¹		
	Type of SuDS component	TSS	Metals	Hydrocarbons
	Filter strip	0.4	0.4	0.5
	Filter drain	0.4 ²	0.4	0.4
	Swale	0.5	0.6	0.6
	Bioretention system	0.8	0.8	0.8
	Permeable pavement	0.7	0.6	0.7
	Detention basin	0.5	0.5	0.6
	Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8	
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.			

Figure 7 SuDS Manual Table 26.3 SuDS mitigation indices

The highest risk element comes from the access roads and parking areas, which are to be constructed using permeable paving. As can be seen below, this mitigation provides sufficient treatment for these elements.

Land use	Suspended solids	Metal	Hydrocarbons
Parking/access road	0.5	0.4	0.4
Permeable pavement mitigation	0.7	0.6	0.7

Land use	Suspended solids	Metal	Hydrocarbons
Residential roof areas	0.2	0.2	0.05
Detention basin	0.5	0.5	0.6

Residential roofs are seen as very low risk, however a detention basin is proposed to the southern end of the site which will provide sufficient treatment mitigation.

Surface water drainage proposals

Max site outflow: 4.7l/s

Storage provision: Permeable paving, grassed areas and detention basin

Treatment systems: Permeable paving and detention basin

Storage requirements

Utilising the figures above, the system will be designed using Microdrainage software to store all storm flows up to 1:100yr +40%.

The calculations of approximate storage volume required for the largest rainfall events have been provided in Appendix G for reference and show that for a 100yr event including 40% climate change a minimum storage volume of 186m³ will be required.

Outline layout of the proposed drainage arrangement proposals are shown on drawing 22-C-16573/01 in Appendix F.

5. FOUL WATER DRAINAGE STRATEGY

Foul water from the new development will be positively drained to a new package treatment plant within the site boundaries.

The closest accessible UU system is approximately 360m from the site boundary along Station Road to the south of the site.

An additional UU system is located in Wray Head, approximately 200m from the site boundary, however this is inaccessible across third party land.

There are 9No. proposed houses, giving a total number of people served as 6x9 = 54P.

54P x 0.8 = 43P (0.8 factor taken from British Flows & Loads 4).

At 150litres/day on average this equates to a discharge rate of 0.075litres/second for the full site. Giving a total load of 6.450m³ or 6,450 litres per day.

The treatment plant specified is a Graf one2clean +P system. The performance characteristics can be seen in Appendix H.

As the discharge to surface water is over 2m³ per day, an environmental permit ***'Part B6.5 – Discharging treated domestic sewage effluent (no trade) of up to 15m³ a day into ground or up to 20m³ a day to surface water'*** will be required.

A plan of the proposed foul water system is shown in Appendix F drawing 22-C-16573/02.

6. MANAGEMENT

All separate surface and foul water drainage systems within the site are proposed to remain private and managed through a site management company.

7. APPENDICES

Appendix A – Ashwood Design Associates Site Layout 2046-001A.

Appendix B – Drained areas plan 22-C-16573/01.

Appendix C – Percolation test results and images.

Appendix D – United Utilities Sewer Records.

Appendix E – Proposed site greenfield run-off calculations.

Appendix F – Proposed drainage plan 22-C-16573/02.

Appendix G – Microdrainage calculations for est. storage volume for 100yr + 40% storm.

Appendix A



NOTES AND AMENDMENTS
This drawing is copyright ©. Figured dimensions are to be followed in preference to scaled dimensions and particulars are to be taken from the actual work where possible. Any discrepancy must be reported to the architect immediately and before proceeding.

REVISIONS			
Rev	Description	Drawn	Date



Solway House Business Centre,
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Purpose:
Planning

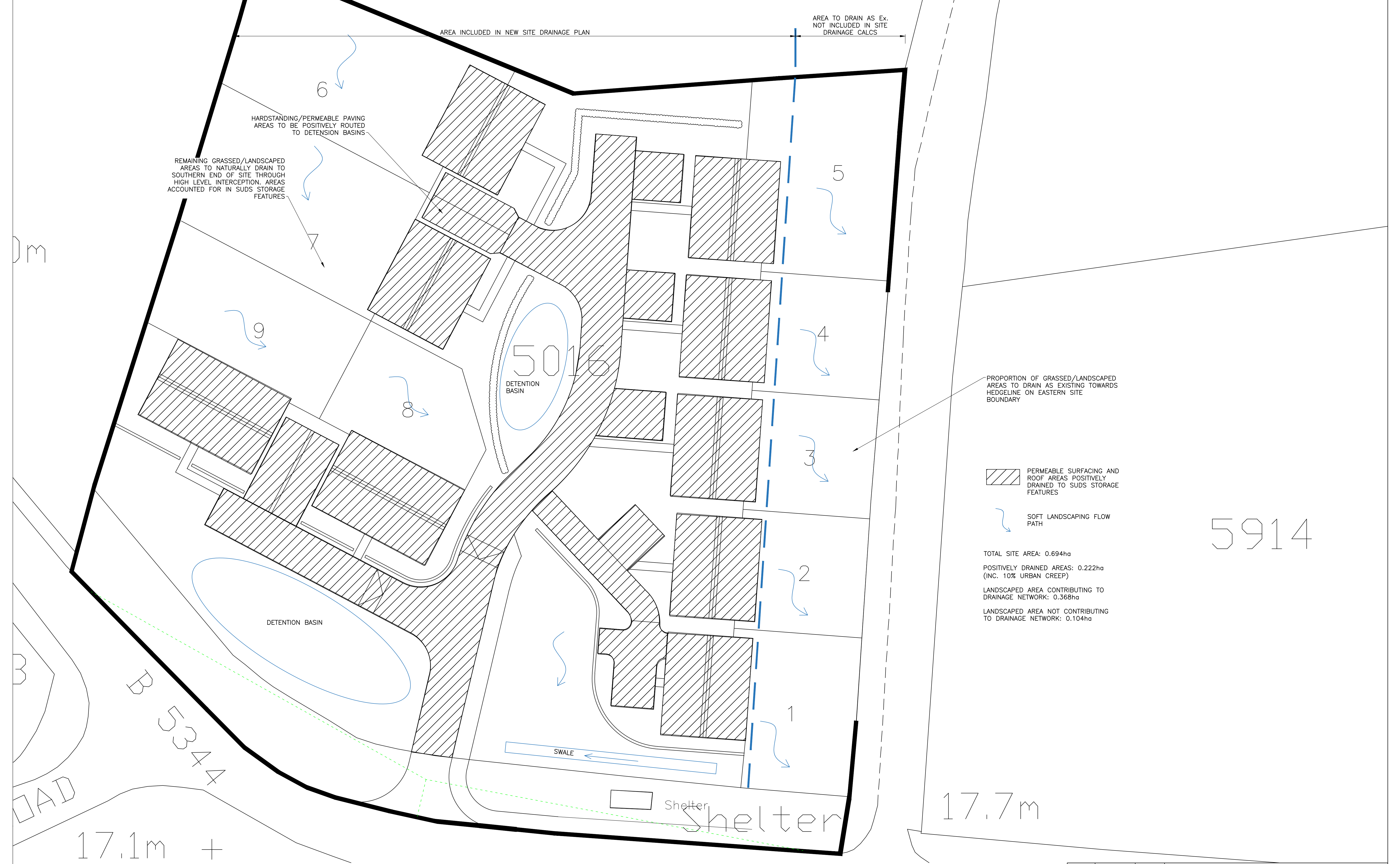
Client:
Sunshine Properties West Coast Ltd

Project:
Land to the North of Station Road,
Drigg

Title:
Site Layout

Scale: 1/500	Sheet Size: A3	Drawn: jc	Date: 01-22
Project No: 2046	Drawing No: 001	Revision: A	

Appendix B



REV	DATE	AUTHOR	NOTES
DRAWING STATUS		PRELIMINARY	
AD A L DAINES & PARTNERS CONSULTING CIVIL & STRUCTURAL ENGINEERS		CLIENT SUNSHINE PROPERTIES LTD	
28 Castle Street, Carlisle, Cumbria CA3 8TP TEL 01228 527428 EMAIL mail@aldaines.co.uk WEB www.alldaines.co.uk		TITLE LAND TO NORTH STATION RD, DRIGG DRAINED AREAS PLAN	
DRAWN	SM	DATE MAY 22	SCALE 1:200 @A1
DRAWING NO. 22-C-I6573/01		-	

Appendix C

Drigg Percolation Test – 25/03/22

Tests carried out during dry, sunny weather.

TP 1

Hole excavated 2000mm x 1500 x 300. No groundwater was encountered during excavation.

	Test 1	Test 2	Test 3
Depth (mm)	Time (mins)	Time (mins)	Time (mins)
1100	0		
950	120		
950	390		
t_{p75-25}	N/A	N/A	N/A

Test was abandoned after 6.5hours as no further movement in water level was visible.

TP 2

Hole excavated 2000mm x 1500 x 300. No groundwater was encountered during excavation.

	Test 1	Test 2	Test 3
Depth (mm)	Time (mins)	Time (mins)	Time (mins)
1000	0	0	0
250	2	2	2
250	120	240	
t_{p75-25}	2	2	2

Upon filling on all three occasions water level very quickly dropped to 250mm above the base of the excavation. This was very different to performance of other excavations and therefore further investigation warranted. Upon investigation, an existing clay pipe was discovered to have been severed in the pit. This has been assumed to have caused the rapid loss of water from the excavation rather than good infiltration characteristics of the ground itself.



TP 3

Hole excavated 2000mm x 1500 x 300. No groundwater was encountered during excavation.

	Test 1	Test 2	Test 3
Depth (mm)	Time (mins)	Time (mins)	Time (mins)
1000	0		
900	180		
900	360		
t_{p75-25}	N/A	N/A	N/A

Test was abandoned after 6 hours as no further movement in water level was visible.



TP 4

Hole excavated 2000mm x 1500 x 300. No groundwater was encountered during excavation.

	Test 1	Test 2	Test 3
Depth (mm)	Time (mins)	Time (mins)	Time (mins)
1000	0		
550	180		
450	270		
450	360		
t_{p75-25}	N/A	N/A	N/A

Test was abandoned after 6 hours as no further movement in water level was visible.

TP 5

Hole excavated 2000mm x 1500 x 300. No groundwater was encountered during excavation.

	Test 1	Test 2	Test 3
Depth (mm)	Time (mins)	Time (mins)	Time (mins)
1000	0		
600	60		
600	360		
t_{p75-25}	N/A	N/A	N/A

Test was abandoned after 6 hours as no further movement in water level was visible.

Appendix D



Water for the North West

A L Daines & Partners LLP

**28
Castle Street,
Carlisle,
CA3 8TP**

FAO:

How to contact us:

**United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP**

**Your Ref: 16573 Drigg
Our Ref: UUPS-ORD-382013
Date: 31/03/2022**

Dear Sirs

Location: Land to north station road Drigg

I acknowledge with thanks your request dated 30/03/2022 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,

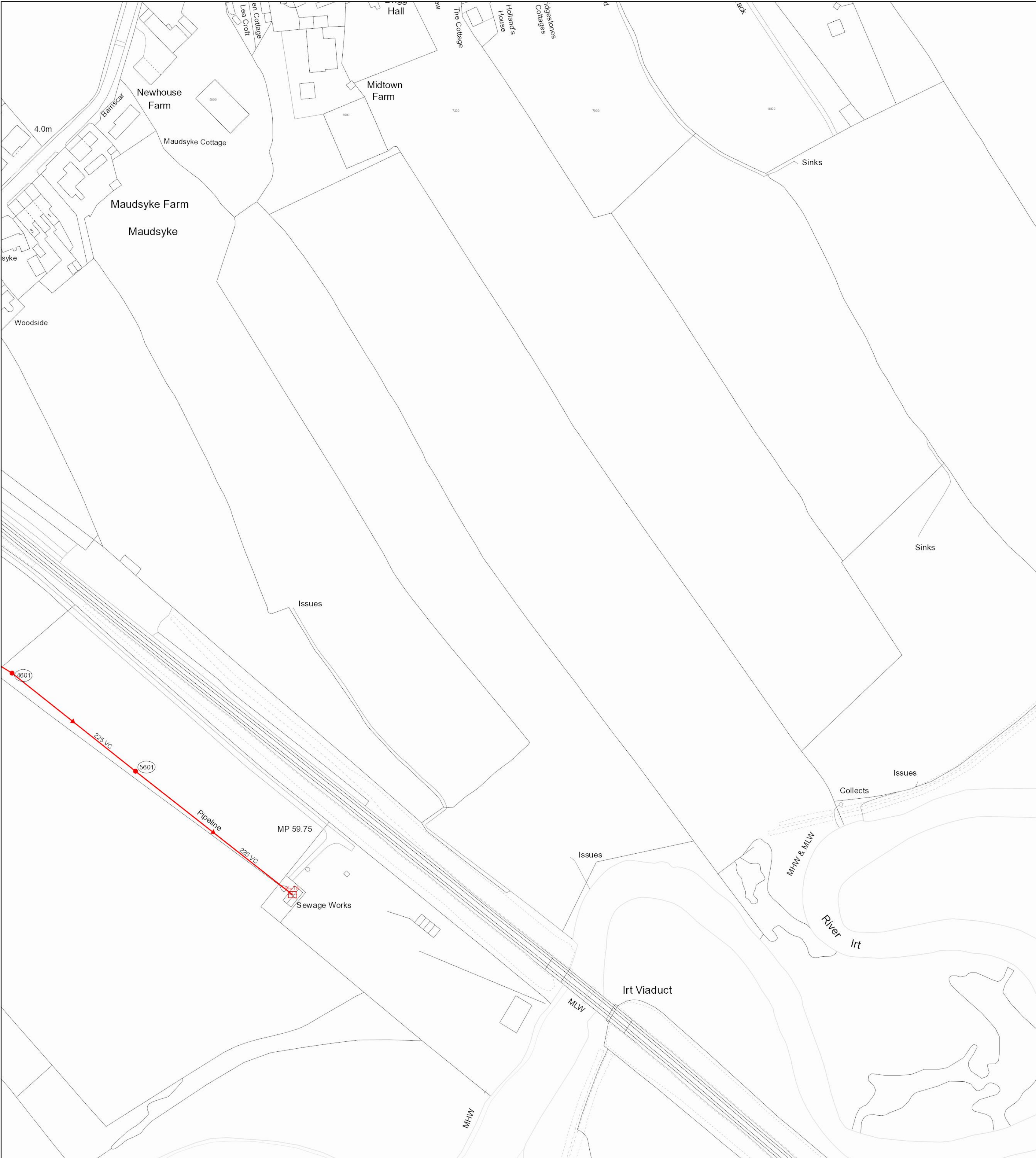
Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



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

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Reho	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
3701	10.9	CO	8.92	225			VC	99.97261	1 in 285
5601	8.78	CO	2.66	225			VC	109.9251	
4601	9.68	CO	8.56	225			VC	86.77837	1 in 15
4601	9.68	CO	8.56	225			VC	86.77837	1 in 15

Reho	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
------	-------	------	--------	--------	--------	-------	------	--------	------

LEGEND

Abandoned

Foul

Surface Water

Combined

Public Sewer

Private Sewer

Section 104

Rising Main

Sludge Main

Overflow

Water Course

Highway Drain

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

Manhole

Head of System

Extent of Survey

Rodding Eye

Inlet

Discharge Point

Vortex

Penstock

Washout Chamber

Valve

Air Valve

Non Return Valve

Soakaway

Gully

Cascade

Flow Meter

Hatch Box

Oil Interceptor

Summit

Drop Shaft

Orifice Plate

Side Entry Manhole

Outfall

Screen Chamber

Inspection Chamber

Bifurcation Chamber

Lamp Hole

T Junction / Saddle

Catchpit

Valve Chamber

Vent Column

Vortex Chamber

Penstock Chamber

Network Storage Tank

Sewer Overflow

Ww Treatment Works

Ww Pumping Station

Septic Tank

Control Kiosk

Change of Characteristic

MANHOLE FUNCTION

FO Foul

SW Surface Water

CO Combined

OV Overflow

SEWER SHAPE

CI Circular

EG Egg

OV Oval

FT Flat Top

RE Rectangular

SQ Square

TR Trapezoidal

AR Arch

BA Barrel

HO HorseShoe

UN Unspecified

SEWER MATERIAL

AC Asbestos Cement

BR Brick

PE Polyethylene

RP Reinforced Plastic Matrix

CO Concrete

CSB Concrete Segment Bolted

CSU Concrete Segment Unbolted

CC Concrete Box Culvert

PSC Plastic / Steel Composite

GRC Glass Reinforced Plastic

DI Ductile Iron

PVC Polyvinyl Chloride

CI Cast Iron

SI Spun Iron

ST Steel

VC Vitrified Clay

PP Polypropylene

PF Pitch Fibre

MAC Masonry, Coursed

MAR Masonry, Random

U Unspecified

Address or Site Reference:

Land to north station road Drigg,

OS sheet Number:

SD0698NE

Scale: 1:1250

Date: 31/03/2022

Nodes: 4

Sheet: 2 of 4

Printed by:

Property Searches

SEWER RECORDS

United Utilities
Water for the North West



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

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Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
3903	CO		150			VC	3.286679		
3903	CO		150			VC	3.286679		
4002	CO		100			VC	21.75924		
4002	CO		100			VC	21.75924		
4001	CO		150			VC	98.61514		
4001	CO		150			VC	98.61514		
3001	CO		100			VC	9.552393		
3902	CO		150			VC	34.43602		
3902	CO		150			VC	34.43602		

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned

Foul

Surface Water

Combined

Public Sewer

Private Sewer

Section 104

Rising Main

Sludge Main

Overflow

Water Course

Highway Drain

All point assets follow the standard colour convention:

red - combined

blue - surface water

brown - foul

purple - overflow

Manhole

Head of System

Extent of Survey

Rodding Eye

Inlet

Discharge Point

Vortex

Penstock

Washout Chamber

Valve

Air Valve

Non Return Valve

Soakaway

Gully

Cascade

Flow Meter

Hatch Box

Oil Interceptor

Summit

Drop Shaft

Orifice Plate

Side Entry Manhole

Outfall

Screen Chamber

Inspection Chamber

Bifurcation Chamber

Lamp Hole

T Junction / Saddle

Catchpit

Valve Chamber

Vent Column

Vortex Chamber

Penstock Chamber

Network Storage Tank

Sewer Overflow

Ww Treatment Works

Ww Pumping Station

Septic Tank

Control Kiosk

Change of Characteristic

MANHOLE FUNCTION

FO Foul

SW Surface Water

CO Combined

OV Overflow

SEWER SHAPE

CI Circular

EG Egg

OV Oval

FT Flat Top

RE Rectangular

SQ Square

TR Trapezoidal

AR Arch

BA Barrel

HO HorseShoe

UN Unspecified

SEWER MATERIAL

AC Asbestos Cement

BR Brick

PE Polyethylene

RP Reinforced Plastic Matrix

CO Concrete

CSB Concrete Segment Bolted

CSU Concrete Segment Unbolted

CC Concrete Box Culvert

PSC Plastic / Steel Composite

GRC Glass Reinforced Plastic

DI Ductile Iron

PVC Polyvinyl Chloride

CI Cast Iron

SI Spun Iron

ST Steel

VC Vitrified Clay

PP Polypropylene

PF Pitch Fibre

MAC Masonry, Coursed

MAR Masonry, Random

U Unspecified

Address or Site Reference:

Land to north station road Drigg,

OS sheet SD0699SW
Number:
Scale: 1:1250 Date: 31/03/2022
Nodes: 9
Sheet: 3 of 4

Printed by: Property Searches

SEWER RECORDS


Water for the North West



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

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Reho Cover Func Invert Size x Size y Shape Mat Length Grad

Reho Cover Func Invert Size x Size y Shape Mat Length Grad

LEGEND

Abandoned	Foul	Surface Water	Combined	Public Sewer
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----

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

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	
Drop Shaft	
Orifice Plate	

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CC	Concrete Box Culverted
PSC	Plastic / Steel Composite
GRC	Glass Reinforced Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Address or Site Reference:

Land to north station road Drigg,

OS sheet Number:	SD0699SE
Scale: 1:1250	Date: 31/03/2022
Nodes: 0	
Sheet: 4 of 4	
Printed by:	Property Searches

Appendix E

A L Daines & Partners		Page 1
28 Castle Street Carlisle CA3 8TP	Land at Drigg Greenfield run off calc	
Date 01/05/2022 File	Designed by SM Checked by	
Micro Drainage Source Control 2020.1.3		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.694	Urban	0.000
SAAR (mm)	1017	Region Number	Region 10

Results 1/s

QBAR Rural	4.7
QBAR Urban	4.7
Q100 years	9.8
Q1 year	4.1
Q30 years	8.0
Q100 years	9.8

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Appendix F



REV	DATE	AUTHOR	NOTES
DRAWING STATUS		PRELIMINARY	
DRAWN		SM	
DATE		MAY 22	
SCALE		1:200 @A1	
DRAWING NO.		22-C-16573/02	

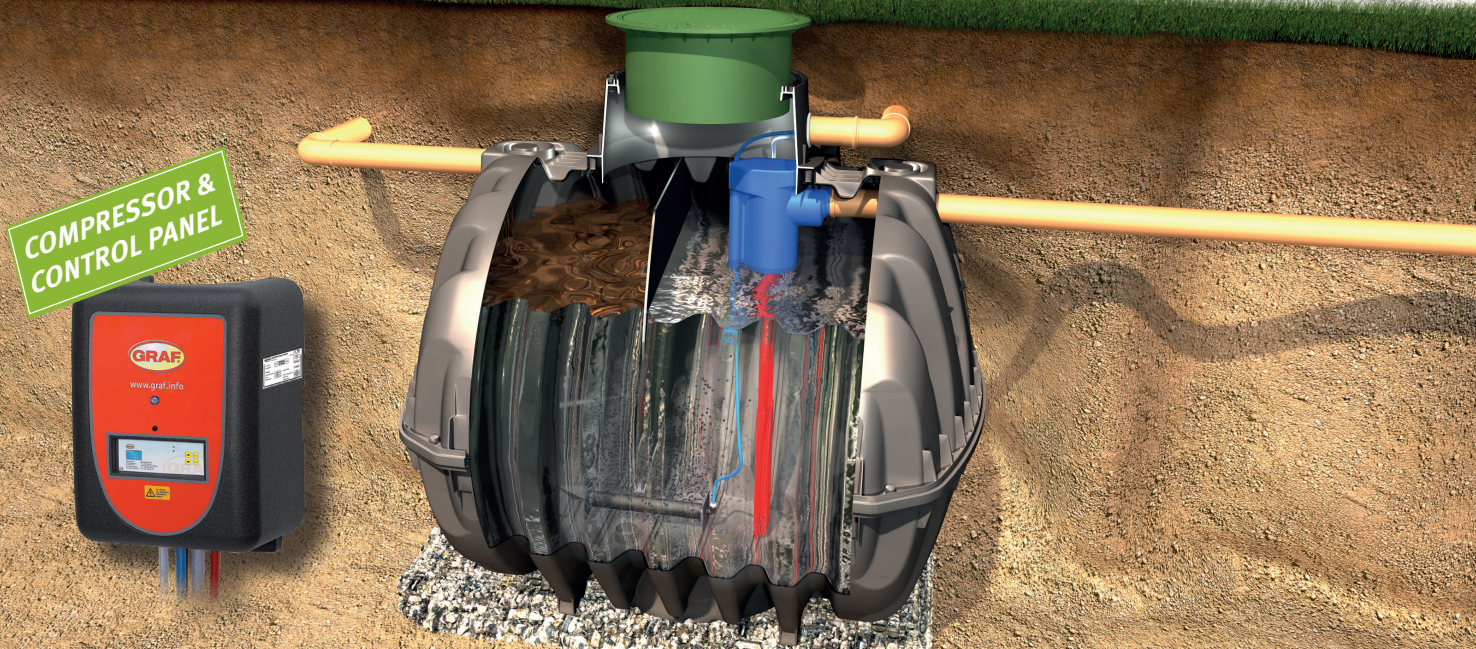
AD A L DAINES & PARTNERS CONSULTING CIVIL & STRUCTURAL ENGINEERS 28 Castle Street, Carlisle, Cumbria CA3 8TP TEL 01228 527428 EMAIL mail@aldaines.co.uk WEB www.alldaines.co.uk	CLIENT SUNSHINE PROPERTIES LTD
	TITLE LAND TO NORTH STATION RD, DRIGG PROPOSED DRAINAGE PLAN
	-

Appendix G

A L Daines & Partners		Page 1																																																																																																																																																																					
28 Castle Street Carlisle CA3 8TP	Land at Drigg Surface water storage capacity up to 100yr +40% 6hr storm																																																																																																																																																																						
Date 09/05/2022 17:12 File SOURCE CONTROL BASIN VOL A...	Designed by SM Checked by																																																																																																																																																																						
Micro Drainage																																																																																																																																																																							
Source Control 2020.1																																																																																																																																																																							
Summary of Results for 100 year Return Period (+40%) Critical storm may not be identified, please run longer storm durations. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>98.990</td><td>0.490</td><td>4.7</td><td>68.7</td><td>0 K</td></tr><tr><td>30 min Summer</td><td>99.116</td><td>0.616</td><td>4.7</td><td>93.6</td><td>0 K</td></tr><tr><td>60 min Summer</td><td>99.235</td><td>0.735</td><td>4.7</td><td>120.2</td><td>0 K</td></tr><tr><td>120 min Summer</td><td>99.333</td><td>0.833</td><td>4.7</td><td>144.5</td><td>0 K</td></tr><tr><td>180 min Summer</td><td>99.371</td><td>0.871</td><td>4.7</td><td>154.5</td><td>0 K</td></tr><tr><td>240 min Summer</td><td>99.384</td><td>0.884</td><td>4.7</td><td>158.0</td><td>0 K</td></tr><tr><td>360 min Summer</td><td>99.383</td><td>0.883</td><td>4.7</td><td>157.8</td><td>0 K</td></tr><tr><td>15 min Winter</td><td>99.037</td><td>0.537</td><td>4.7</td><td>77.7</td><td>0 K</td></tr><tr><td>30 min Winter</td><td>99.174</td><td>0.674</td><td>4.7</td><td>106.2</td><td>0 K</td></tr><tr><td>60 min Winter</td><td>99.303</td><td>0.803</td><td>4.7</td><td>136.7</td><td>0 K</td></tr><tr><td>120 min Winter</td><td>99.412</td><td>0.912</td><td>4.7</td><td>165.6</td><td>0 K</td></tr><tr><td>180 min Winter</td><td>99.458</td><td>0.958</td><td>4.7</td><td>178.6</td><td>0 K</td></tr><tr><td>240 min Winter</td><td>99.477</td><td>0.977</td><td>4.7</td><td>184.1</td><td>0 K</td></tr><tr><td>360 min Winter</td><td>99.482</td><td>0.982</td><td>4.7</td><td>185.6</td><td>0 K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>106.285</td><td>0.0</td><td>72.0</td><td>22</td></tr><tr><td>30 min Summer</td><td>73.727</td><td>0.0</td><td>100.0</td><td>37</td></tr><tr><td>60 min Summer</td><td>49.020</td><td>0.0</td><td>133.2</td><td>66</td></tr><tr><td>120 min Summer</td><td>31.526</td><td>0.0</td><td>171.4</td><td>126</td></tr><tr><td>180 min Summer</td><td>23.976</td><td>0.0</td><td>195.5</td><td>184</td></tr><tr><td>240 min Summer</td><td>19.581</td><td>0.0</td><td>212.9</td><td>244</td></tr><tr><td>360 min Summer</td><td>14.620</td><td>0.0</td><td>238.5</td><td>314</td></tr><tr><td>15 min Winter</td><td>106.285</td><td>0.0</td><td>81.1</td><td>22</td></tr><tr><td>30 min Winter</td><td>73.727</td><td>0.0</td><td>112.5</td><td>37</td></tr><tr><td>60 min Winter</td><td>49.020</td><td>0.0</td><td>149.9</td><td>66</td></tr><tr><td>120 min Winter</td><td>31.526</td><td>0.0</td><td>192.8</td><td>124</td></tr><tr><td>180 min Winter</td><td>23.976</td><td>0.0</td><td>220.0</td><td>180</td></tr><tr><td>240 min Winter</td><td>19.581</td><td>0.0</td><td>239.5</td><td>238</td></tr><tr><td>360 min Winter</td><td>14.620</td><td>0.0</td><td>268.3</td><td>344</td></tr></tbody></table>			Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	98.990	0.490	4.7	68.7	0 K	30 min Summer	99.116	0.616	4.7	93.6	0 K	60 min Summer	99.235	0.735	4.7	120.2	0 K	120 min Summer	99.333	0.833	4.7	144.5	0 K	180 min Summer	99.371	0.871	4.7	154.5	0 K	240 min Summer	99.384	0.884	4.7	158.0	0 K	360 min Summer	99.383	0.883	4.7	157.8	0 K	15 min Winter	99.037	0.537	4.7	77.7	0 K	30 min Winter	99.174	0.674	4.7	106.2	0 K	60 min Winter	99.303	0.803	4.7	136.7	0 K	120 min Winter	99.412	0.912	4.7	165.6	0 K	180 min Winter	99.458	0.958	4.7	178.6	0 K	240 min Winter	99.477	0.977	4.7	184.1	0 K	360 min Winter	99.482	0.982	4.7	185.6	0 K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	106.285	0.0	72.0	22	30 min Summer	73.727	0.0	100.0	37	60 min Summer	49.020	0.0	133.2	66	120 min Summer	31.526	0.0	171.4	126	180 min Summer	23.976	0.0	195.5	184	240 min Summer	19.581	0.0	212.9	244	360 min Summer	14.620	0.0	238.5	314	15 min Winter	106.285	0.0	81.1	22	30 min Winter	73.727	0.0	112.5	37	60 min Winter	49.020	0.0	149.9	66	120 min Winter	31.526	0.0	192.8	124	180 min Winter	23.976	0.0	220.0	180	240 min Winter	19.581	0.0	239.5	238	360 min Winter	14.620	0.0	268.3	344
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Appendix H

GRAF Advanced Wastewater Treatment System



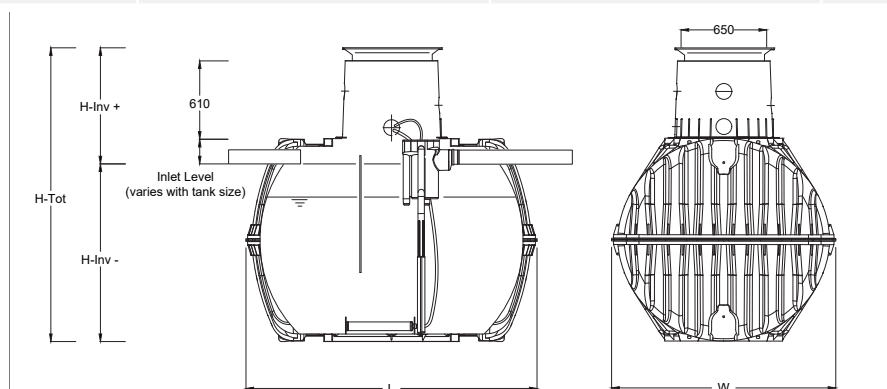
Advanced wastewater treatment system

- Telescopic manhole cover, offers variable invert levels
- Low power consumption
- Self anchoring tank
- No concrete backfill required
- No electrical components inside the tank
- High treatment performance
- Long sludge storage period
- Integrated sampling chamber inside the tank

Scope of supply

- ① GRAF advanced wastewater tank with diffusers, air lifter for clear water extraction and intergrated sampling chamber
- ② Telescopic manhole cover, suitable for either pedestrian or vehicle loading
- ③ 2 number 20m SBR hoses, 19mm used for aeration and 13mm for clear water extraction
- ④ GRAF advanced wastewater treatment control unit with compressor
- ⑤ Optional EPP external housing cabinet for control panel and compressor

Population Equivalent	5 PE	7 PE	9 PE
Tank	3750 litres	4800 litres	6500 litres
Max. Daily inflow	750 l/d	1050 l/d	1350 l/d
Weight with mini tank dome	146kg	181kg	220kg
Weight with maxi tank dome	150kg	185kg	220kg
L	2280mm	2280mm	2390mm
W	1755mm	1985mm	2190mm
H-Inv -	1,370mm	1,600mm	1,840mm
H-Inv +	950 to 1460mm		
H-Tot	2200 to 2790mm	2250 to 3020mm	2530 to 3300mm



How the system works

Untreated waste enters the tank via the inlet on the side of the tank. The wastewater falls directly into the biological zone where the treatment is taking place, this allows the micro-organisms to start the breakdown process without delay.

Compressed air is sent to the treatment plant via the control panel. This air is initially used for aeration through the diffuser. The aeration process is intermittent to achieve the best treatment performance. Aeration

+P Phosphate Removal Package - When would you need it?

Depending on where you live and what watercourse your system is discharging to, your local environment agency may require your wastewater treatment plant to be able to remove phosphates from the effluent.

This is required as too many phosphates can cause irreversible changes to an Eco-system by increasing production of algae, depleting fish stocks and deteriorating the water quality in general. Many UK watercourses have previously had high numbers of untreated septic tanks & treatment plants feed in to them, with no mitigation of the phosphates, and so are now at a critical point where no further untreated

is then stopped to allow for the waste to sink to the bottom of the tank.

Compressed air is then sent to the plant again to extract the cleaned water near the surface, via the red air-lift. This water passes through a sampling chamber before leaving the plant, where samples can be taken to confirm the quality of the effluent. The above process occurs twice per day, each lasting 12 hours.

domestic wastewater can be allowed to enter.

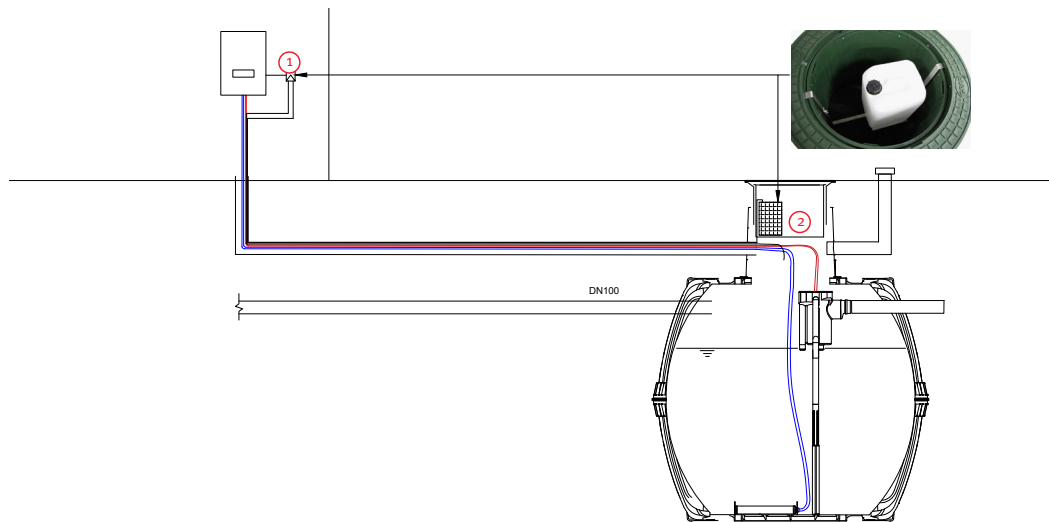
Our system works by adding a polyaluminium chloride solution in to the tank, which is carefully dosed to the correct amounts depending on your system size. This chemical essentially reacts with the phosphates and effectively lowers the levels. The Graf system has been tested independently, and can achieve a market leading phosphate level as low as 0.4 mg/l in the final effluent.

It is important the PAC solution is regularly checked and replaced as necessary to ensure these low levels are maintained

+P Phosphate Removal Package - How does it work?

Systems delivered with the phosphate removal package come with the necessary peristaltic pump in the cabinet. The pump has a suction hose and delivery hose which takes solution from a canister and doses this to the treatment plant. The runtime of the dosing pump is determined by the time set for the pump in the service menu of the treatment plant control panel. The amount of precipitant added is therefore dependent on the set time. The large Compact pump has a potentiometer for

setting delivery rate. In order to start up the precipitant device, the precipitant container must be placed in a frost-proof location. The intake and delivery hoses should also be laid in frost-free areas. The delivery hose is to be routed into the SBR reactor and placed inside the reactor with the outlet located above the reactor basin, ensuring that the precipitant flows directly into the wastewater to be treated and does not dampen any components.



- ① The control panel is preset to dose the required amount of solution, based on the system's requirements

The +P package provides precipitant dosing for the reduction of phosphates in the effluent, which would otherwise damage the environment.

This system is tested and certified according to EN

- ② The precipitant solution is housed in a container in the dome of the tank. The dosing pump draws the solution via a small hose before depositing it back into the SBR reactor. Maxi dome required if canister is located in turret on tank

12566-7 by the notified body PIA GmbH. The systems are additional stages of treatment for Graf wastewater treatment systems, which are fitted with a KL24plus or KLplus control unit.

For further information please call us on 01608 661500
or visit our website www.grafuk.co.uk





Prüfinstitut für
Abwassertechnik
GmbH

PERFORMANCE RESULTS

Otto Graf GmbH

Carl-Zeiss-Str. 2 - 6, 79331 Teningen, Germany

EN 12566-3

Small wastewater treatment systems for up to 50 PT

Small wastewater treatment system one2clean

SBR plant in one two-zone polypropylene tank

Test report PIA2014-216B14.01.e

Nominal organic daily load*	0.27	kg/d	
Nominal hydraulic daily load	0.75	m³/d	
Material	polypropylene		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	COD	94.2 %	43 mg/l
	BOD ₅	98.0 %	7 mg/l
	SS	96.3 %	14 mg/l
	NH ₄ -N**	98.3 %	0.5 mg/l
	N _{tot} **	87.0 %	7.9 mg/l
	P _{tot}	80.2 %	1.6 mg/l
Electrical consumption	0.63	kWh/d	

*at a test influent of ≥ 300 mg/l BOD₅ (mean)

**determined for temperatures $\geq 12^{\circ}\text{C}$ in the bioreactor

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH

(PIA GmbH)

Hergenrath Weg 30

52074 Aachen, Germany

This document replaces neither the declaration
of performance nor the CE marking.



Notified Body
No.: 1739



Certified according to
ISO 9001:2008



Deutsche
Akkreditierungsstelle
D-PL-17712-01-00

Prüfinstitut für Abwassertechnik GmbH

geprüft - tested - testé

Elmar Lancé

November 2014

PERFORMANCE RESULTS

Otto Graf GmbH

Carl-Zeiss-Str. 2 - 6, 79331 Teningen, Germany

EN 12566-3, Annex B

Small wastewater treatment systems for up to 50 PT

Small wastewater treatment system one2clean

Sequencing Batch Reactor (SBR) process

Test report PIA2015-208B15.e

Nominal organic daily load	0.24 kg BOD ₅ /d		
Nominal hydraulic daily load	0.75 m ³ /d		
Material	polypropylene		
Treatment efficiency (nominal sequences)	Efficiency	Effluent	
	COD	94.7 %	36 mg/l
	BOD ₅	98.1 %	6 mg/l
	N _{tot} *	86.8 %	9.1 mg/l
	NH ₄ -N	88.7 %	4.6 mg/l
	P _{tot}	95.1 %	0.4 mg/l
	SS	95.7 %	14 mg/l
Electrical consumption	0.64 kWh/d		

**determined for temperatures $\geq 12^{\circ}\text{C}$ in the bioreactor*

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH

(PIA GmbH)

Hergenrather Weg 30

52074 Aachen, Germany

This document replaces neither the declaration
of performance nor the CE marking.



Notified Body
No.: 1739



Certified according to
ISO 9001:2008



Prüfinstitut für Abwassertechnik GmbH
geprüft - tested - teste

Elmar Lancé

November 2016