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Drainage Strategy Report

PLOTS 4 AND 5, LAND TO SOUTH OF SOUTHRIGG, NETHERTOWN ROAD, ST BEES

22-C-16767

Rev A

November 2022

Contents

1.0 INTRODUCTION

A L Daines & Partners LLP (ALD) have been engaged to undertake a Surface and Foul Water Drainage Strategy, in accordance with the National Planning Policy Framework (NPPF) [1] for the proposed creation of two dwellings at St Bees, Cumbria.

The location details of the proposals are detailed below:

- land south of Southrigg, Nethertown Road, St Bees, Cumbria. CA27 0AY
- National Grid Reference: Eastings 329723 Northings 510912

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).

2.0 PLANNING POLICY

NPPF footnote 50 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 165 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, buy 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 minor development under the above criteria due to the proposals having fewer than 10 dwellinghouses.

3.0 PLANNING POLICY IN SITE CONTEXT

The site covers 0.34Ha of greenfield land and according to the most recent Environment Agency (EA) flood risk maps, lies entirely within Flood Zone 1.

The NPPF site categorisation Table 1.1 puts a residential development of this nature within the 'More vulnerable' category. Developments in the 'More vulnerable' 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.

4.0 SITE PLAN

The proposed development is located on an existing area of greenfield land to the south of South Rigg, Nethertown Road, St Bees as shown on red line bordered plan in *Figure 1*. It should be noted that a previously approved development (4/21/2369/0R1) is located to the northwest of the development site and consists of 3 detached dwellings. The previously approved development is illustrated within *Figure 1* in white,

Figure 1: Aerial photo of site - Google Maps

5.0 DEVELOPMENT DESCRIPTION

The proposed development will utilise a previously approved shared access created off the adopted highway network (Nethertown Road), leading to two serviced self-build plots of 210m^2. If the plot sizes are amended from those stated above it should be noted that the surface water calculations are to be amended accordingly.

The existing ground is generally open grassed landscape, currently used for grazing land. The development splits a green field and covers approximately 0.34Ha, with each dwelling having its own double garage and driveway off a shared tarmac access road.

The topography of the site is generally sloping from a highpoint in the northeast corner (approx. 37.1m AOD) to the low point adjacent to Nethertown Road in the southwest corner (approx. 36.1m AOD).

6.0 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: St Bees Sandstone
- Superficial drift: Glaciofluvial deposits, Devensian – Sand and gravel
- Soil: Soilscape 6 – Freely draining slightly acidic loamy soils.

This soilscape is similar to that observed during trial hole excavations which show a 300-600mm topsoil generally underlain by gravely, cobbled sand becoming larger boulders.

The trial hole excavation locations can be seen on drawing 22-C-16767-01 submitted as part of the planning application.

Two trial pits were dug to a depth of 2m below ground level to determine the infiltration rate of the ground at the location of the proposed dwellings. These tests were carried out in accordance with the guidance in document BRE 365 Soakaway Design.

1No. trial pit was excavated towards the front of each proposed plot on 14 September 2022. Both trial holes were filled to a depth of 1000mm above the base of the pit and monitored to record infiltration rates. The infiltration rate is calculated as per the BRE 365 requirements.

The percolation tests results were as follows:

- Plot 4 - 0.06050m/hr
- Plot 5 and Access - 0.02941m/hr

The infiltration testing results are shown in Appendix A along with calculated infiltration rates for each pit.

7.0 CURRENT FOUL AND SURFACE WATER DRAINAGE PROVISION

Existing watercourses

There are no open watercourse features within the site, with the nearest one being Pow Beck running north to south approximately 220m beyond the western site boundary. To access this beck from the site would require routes across greenfield, highways, residential plots and the Cumbrian Coast Line railway and is not seen as a feasible route.

Existing sewers

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

There are no UU sewer assets shown close to the site; however, approximately 54m to the north along Nethertown Road there is a previously approved extension to the combined sewer network. The invert level of the extension is 36.100m AOD.

The UU search records are shown in Appendix B.

8.0 FLOOD RISK ASSESSMENT

As described earlier in the report, the current Environment Agency Flood Map for Planning shows the site to be located wholly within Flood Zone 1.

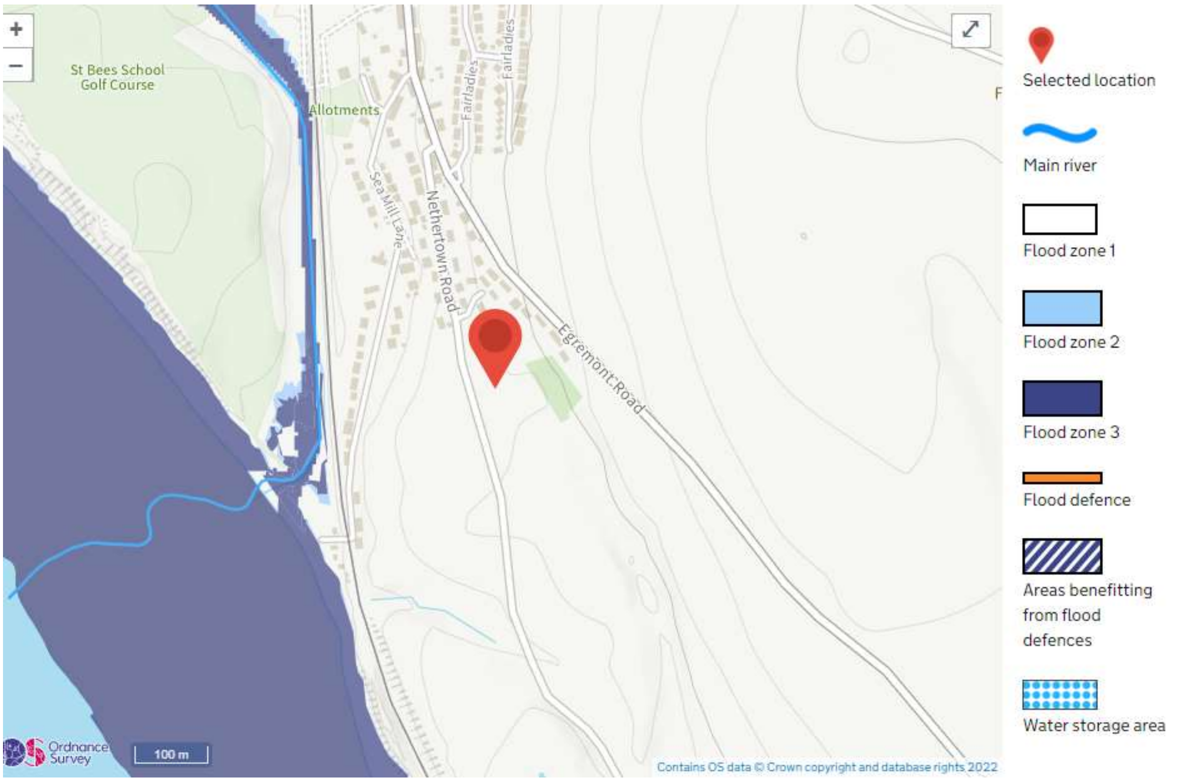

Figure 2: Flood map for planning

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 following flood mechanisms have been identified as potential flood hazards: -

1. Flooding from Land.

Flooding from Land

Flooding from Land (pluvial flooding) often occurs because of intense rainfall, which can be of short duration, and which is unable to soak into the ground or enter drainage systems. This can result in quick overland flows cumulating at the lowest parts of a site.

The long-term flood risk from surface water is predominantly low risk (0.1% chance of flooding per year) for Plots 4 and 5. However, it is noted that to the rear of Plot 5 is an area of high risk of surface water flooding (3.3% chance of flooding per year). Also, at the frontage of Plot 5 is an area of low risk of flooding (0.1 – 1% chance of flooding per year). The areas of high-risk flooding are located within a depression in the topography of the ground at 35.825m AOD. The Environment Agency Flood Risk mapping details that the flooding in this location is less than 300mm in depth, and as such the finished flood level associated within Plot 5 is to be a minimum of 300mm above this lowest ground level (minimum of 36.125m AOD) to mitigate against the potential for surface water flooding.

In this instance the proposed design level is actually 36.400m which is 575mm above the lowest point of the field.

The design of the drainage and road systems shall ensure that no additional peak flows leave the site and therefore no increase in flood risk outside of the development boundary will occur.

Figure 3: EA long term flooding from surface water

9.0 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 first level on the above hierarchy for the following reasons:

Drain into the ground (infiltration) – proved possible.

The site has been shown through trial hole excavation and percolation tests to be suitable for infiltration.

It is therefore proposed to discharge surface water through a combination of permeable paving and below ground infiltration soakaways. This will ensure that drainage will be achieved as close to source as possible, therefore limiting any change to on-site flow paths and that there is no increased risk of flooding beyond the site boundaries.

10.0 SURFACE WATER PROPOSED DESIGN

In accordance with the earlier mentioned hierarchy of drainage the system has been designed to utilise infiltration-based SuDS components to offer the best solution for surface water drainage.

As per the LASOO guidance the design is 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, the infiltration rates of the ground will allow for storage systems to be sized to store the full 1:100yr events without any overland flow or above ground storage.

The slope of the site, from north to south, dictates that the storage structures will be best placed to either the front or rear of the plots of the plots to aid gravity drainage and to keep the storage away from the buildings.

As the previously mentioned surface water flooding occurs to the rear of plot 5, all infiltration systems shall be placed towards the front of both plots to ensure their effectiveness at all times.

Consideration of SuDS components

A range of SuDS components are available and have been considered for use. Their applicability to the site has been addressed below:

- Rainwater harvesting – suitable for use on the site, however there is no guarantee the systems will be able to capture flows if already at capacity from previous events. Discounted for site flow calculations.
- Green roofs – suitable for use on the site, however due to the nature of the properties and low volume control potential these have been discounted for inclusion within the site flow calculations. Plot owners may still choose to use these and should be encouraged to do so where they would be appropriate.

- Soakaways – underlying ground conditions make this a suitable method for providing site drainage close to source and will be used to store and dissipate rainwater from the hardstanding areas. **Viable**
- Water butts – suitable for use but their effectiveness is dependent on homeowner maintenance which cannot be enforced. Discounted for site flow calculations.
- Permeable paving – underlying ground conditions make this a suitable and cost-effective method of drainage for a large portion of the driveway areas. **Viable**
- Swales – Not considered due to their large land uptake and porosity of the ground.
- Filter drains – Not required.
- Detention basins – Not required due to available ground infiltration rates
- Ponds/wetlands –. Not required due to available ground infiltration rates. Plot owners may introduce these if desired but shall not be used for site flow calculations.
- Underground closed storage crate/tank systems – Not required.

Climate change

Environment Agency guidance issued in 2022 estimates that peak rainfall intensity will increase due to climate change over the next 100 years. There is therefore an allowance of 50% 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 areas 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.

In this instance, only areas of impermeable hardstanding are modelled and therefore the standard values have been uplifted to 0.85 and 0.95 respectively for both summer and winter storms. This results in conservative design with no infiltration allowance.

Surface water quality

In the absence of statutory requirements and prescriptive standards, 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.

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

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
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 4: 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.

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

Land use	Suspended solids	Metal	Hydrocarbons
Residential roofs	0.2	0.2	0.05
Driveways	0.5	0.4	0.4

Table 26.4 from the SUDS Manual, shown below, details pollution mitigation indices for various SUDS components when discharging to groundwater.

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater			
Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates[1]	**TSS**	**Metals**	**Hydrocarbons**
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.6[4]	0.5	0.6
A soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.8[4]	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 inflow concentrations relevant to the contributing drainage area.		

Figure 5: SuDS Manual Table 26.4 SuDS mitigation indicies

Given the small size of the development and the low-risk land use, a balanced view of risk versus reward should be pursued to ensure that while pollution risks are minimized, there are not onerous requirements imposed.

The highest risk elements (albeit still categorised as ‘low’) originate from the parking and driveways of each plot. It is proposed to provide permeable block paving throughout each plot access and parking, with only the access off the highway and turning head being provided in impermeable tarmac.

The permeable paving mitigation is shown below to exceed the potential risk factors and is therefore deemed satisfactory.

	Suspended solids	Metal	Hydrocarbons
Pollution Hazard	0.5	0.4	0.4
Pollution mitigation	0.7	0.6	0.7
Suitability	Acceptable	Acceptable	Acceptable

The remainder of the hardstanding areas are allocated for residential roofs which are in the ‘very low’ risk category. These will be treated using ‘a soil with good contaminant attenuation potential of at least 300mm depth’. The hazard versus mitigation table below shows this to be adequate.

	Suspended solids	Metal	Hydrocarbons
Pollution Hazard	0.2	0.2	0.05
Pollution mitigation	0.4	0.3	0.3
Suitability	Acceptable	Acceptable	Acceptable

Based on the above assessments, it is proposed that a split drainage system will be utilised for the differing surface uses.

Parking/driveways

All driveways and parking areas, except for the turning head off the highway, shall be designed and constructed as permeable paving effectively maintaining drainage to those areas at source.

As the infiltration rates are acceptable, the system is designed to provide full infiltration as per a Type A system as described in The SuDS Manual section 20.1.9.

Dwellings & turning head off highway

The dwellings and access turning head shall be positively drained to geocellular crate infiltration systems positioned within each plot and beneath the access turning head. These will store storm flows and prevent any discharge from the site up to and including the 1:100yr +50% storm event.

The plot infiltration rate has been stated within section 6.0 of this report, with each Plot system based on its relative infiltration rate, as shown in Appendix A.

As per The SuDS Manual, a safety factor of 2.0 has been applied to these infiltration rate to allow for potential reduction in performance over time either through silting up or lack of capacity due to saturation.

Microdrainage calculations in Appendix C are provided to prove the storage systems are sufficient up to a 1:100yr + 50% storm of 6-hour duration.

Using a proprietary system, the crates would be 0.4m deep with a minimum of 0.6m ground cover. This will maintain at least the stipulated minimum 1m cover to the groundwater table. Note: groundwater level was not encountered in any of the 2No. trial holes which were excavated to a depth of 2m.

Details of above SuDS systems and drainage plan proposals are shown in Appendix D drawings 22-C-16767/01.

11.0 MAINTENANCE

All components shall be maintained in accordance with the relative requirements shown in the SuDS Manual. These intervals should be deemed as a minimum frequency and reference should also be made to the manufacturers guidance to ensure all components are maintained correctly.

Table 13.1 from the SuDS Manual for soakaways has been included below for reference.

TABLE 13.1 Operation and maintenance requirements for soakaways

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Figure 6: SuDS Manual table 13.1 Soakaway maintenance

Table 20.15 from the SuDS Manual for permeable paving has been included below for reference.

TABLE 20.15 Operation and maintenance requirements for pervious pavements		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Figure 7: SuDS Manual table 20.15 Permeable paving maintenance

12.0 FOUL WATER DRAINAGE STRATEGY

All foul water from the proposed Plots 4 and 5 is to be pumped into the extended adopted sewer network which is to be installed as part of a previous application.

A plan of the proposed foul sewer is shown in Appendix D drawing 22-C-16767-01.

13.0 MANAGEMENT

All separate surface and foul water drainage systems within the site are proposed to remain private and be maintained by a newly formed management company contributed to by all three plot owners.

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BSc (Hons) MSc MCIWEM C.WEM C.Env
For and on behalf of
A L DAINES & PARTNERS LLP

14.0 APPENDICES

Appendix A – Infiltration Testing Results

Appendix B – United Utilities Sewer Records

Appendix C – Microdrainage calculations

Appendix D – 22-C-16767/01 Proposed drainage plan – see separate document.

APPENDIX A – INFILTRATION TESTING RESULTS

All trial holes on site were 1000mm x 300mm x 2000mm.

Test Number	Date of Test	Time (in mins) from 750mm to 250mm
Plot 4	14/09/22	150 mins
Plot 5 and access road	14/09/22	255 mins

The infiltration rates for each plot have been calculated below:

Plot 4 - 0.06050m/hr
Plot 5 and Access - 0.02941m/hr

APPENDIX B – UNITED UTILITIES SEWER RECORDS

United Utilities
Water for the North West

SEWER RECORDS

Address or Site Reference

SOUTHRIGG NETHERTOWN ROAD, ST. BEES, CA27 0AY

Scale: 1:1250
Date: 17/08/2021

Printed by: Property Searches

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

APPENDIX C – MICRODRAINAGE CALCULATIONS

Plot 4 Soakaway

A L Daines & Partners		Page 1
28 Castle Street Carlisle CA3 8TP	Nethertown Rd, St Bees Plot 3 soakaway	Micro Drainage
Date 03/11/2022 15:13 File Plot 4.MDX	Designed by SM Checked by	
Micro Drainage	Network 2020.1.3	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.274
Region England and Wales Cv (Summer) 0.850
M5-60 (mm) 16.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 50, 50

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	1	+0%	100/15 Summer				37.652
S1.001	S2	240 Winter	1	+0%					36.866

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.098	0.000	0.25			2.3	OK	
S1.001	S2	-0.884	0.000	0.00		128	0.0	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.274
Region	England and Wales	Cv (Summer)	0.850
M5-60 (mm)	16.000	Cv (Winter)	0.950

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 50, 50

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+50%	100/15 Summer				37.715
S1.001	S2	360 Winter	30	+50%					37.123

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.035	0.000	0.92			8.3	FLOOD RISK	
S1.001	S2	-0.627	0.000	0.00		342	0.0	OK	

A L Daines & Partners		Page 3
28 Castle Street Carlisle CA3 8TP	Nethertown Rd, St Bees Plot 3 soakaway	Micro Drainage
Date 03/11/2022 15:13 File Plot 4.MDX	Designed by SM Checked by	
Micro Drainage	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.274
Region England and Wales Cv (Summer) 0.850
M5-60 (mm) 16.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 50, 50

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+50%	100/15 Summer				37.760
S1.001	S2	360 Winter	100	+50%					37.623

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.010	0.000	1.17			10.6	FLOOD RISK	
S1.001	S2	-0.127	0.000	0.05		498	0.5	OK	

Plot 5 Soakaway

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.274
Region England and Wales Cv (Summer) 0.850
M5-60 (mm) 16.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 50, 50

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	1	+0%	100/15 Summer				37.652
S1.001	S2	360 Winter	1	+0%					36.886

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.098	0.000	0.25			2.3	OK	
S1.001	S2	-0.864	0.000	0.00		234	0.0	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.274
Region England and Wales Cv (Summer) 0.850
M5-60 (mm) 16.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 50, 50

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+50%	100/15 Summer				37.715
S1.001	S2	360 Winter	30	+50%					37.177

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.035	0.000	0.92			8.3	FLOOD RISK	
S1.001	S2	-0.573	0.000	0.00		624	0.0	OK	

A L Daines & Partners		Page 3
28 Castle Street Carlisle CA3 8TP	Nethertown Rd, St Bees Plot 3 soakaway	Micro Drainage
Date 03/11/2022 15:15 File Plot 5.MDX	Designed by SM Checked by	
Micro Drainage	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.274
Region England and Wales Cv (Summer) 0.850
M5-60 (mm) 16.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 50, 50

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+50%	100/15 Summer				37.760
S1.001	S2	360 Winter	100	+50%					37.633

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.010	0.000	1.17			10.6	FLOOD RISK	
S1.001	S2	-0.117	0.000	0.11		792	1.0	OK	

Access area for Plots 4 and 5

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.274
Region	England and Wales	Cv (Summer)	0.850
M5-60 (mm)	16.000	Cv (Winter)	0.950

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 50, 50

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	1	+0%					37.648
S1.001	S2	360 Winter	1	+0%					36.976

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.102	0.000	0.22			2.0	OK	
S1.001	S2	-0.774	0.000	0.00			0.0	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.274
Region	England and Wales	Cv (Summer)	0.850
M5-60 (mm)	16.000	Cv (Winter)	0.950

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 50, 50

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+50%					37.703
S1.001	S2	360 Winter	30	+50%					37.632

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.047	0.000	0.79			7.1	FLOOD RISK	
S1.001	S2	-0.118	0.000	0.10			0.9	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.274
Region England and Wales Cv (Summer) 0.850
M5-60 (mm) 16.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 50, 50

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+50%					37.727
S1.001	S2	180 Winter	100	+50%					37.648

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.023	0.000	1.00			9.0	FLOOD RISK	
S1.001	S2	-0.102	0.000	0.23			2.1	OK	