Consulting Civil Engineers

Foul and Surface Water Drainage Report

Woodhouse Farm, Billingshurst

Planning Ref: DC/23/1188

For

Joanna Moyers

Rev - **P**

Reference **C3077**

Date **28th May 2024**

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P	28/05/2024	Initial Issue	MR	CS
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1 Introduction

1.1.1 CGS Civils Ltd has been appointed to undertake a drainage strategy report for a proposed development at Woodhouse Farm, Billingshurst

1.1.2 The purpose of this drainage strategy is to demonstrate how the development area can be satisfactorily drained without increasing flood risk onsite and elsewhere in order to clear Pre-Commencement Condition 3. The condition is in place on Decision Notice from **15/06/2023**, with the planning reference: **DC/23/1188.** The condition requires:

- *No development shall commence until a drainage strategy detailing the proposed means of foul and surface water disposal has been submitted to and approved in writing by the Local Planning Authority. The development shall be carried out in accordance with the approved scheme.*

1.1.3 The existing site consists undeveloped greenfield land. The proposed development will consist of an erection of 1no. rural worker's dwelling. The proposed development is located as OS Grid Reference **TQ 10747 26537** and has the post code **RH14 9DS.**

1.1.4 The proposed site layout can be found in Appendix A.

Fig 1. Site Location



2 Executive Summary:

2.1.1 The surface water will be discharged into an existing watercourse adjacent to the southern boundary of the site. All roof areas are to be collected into a positive drainage network before discharging into an existing watercourse at a restricted rate of 1.0l/s whilst all hard paved areas are to be constructed from permeable surface to allow runoff to freely drain to ground via infiltration, and to be constructed with an overflow connection into the proposed raingarden for a higher rainfall events. The network will make use of a raingarden in order to cater for the 1 in 100-year +45% storm. This connection is subject to Ordinary Watercourse Consent Approval.

2.1.2 The foul water runoff will be discharged into on-site proposed treatment plant prior being discharged into an existing watercourse. This connection is subject to Ordinary Watercourse Consent Approval.

3 Site Geology

3.1 British Geological Survey information

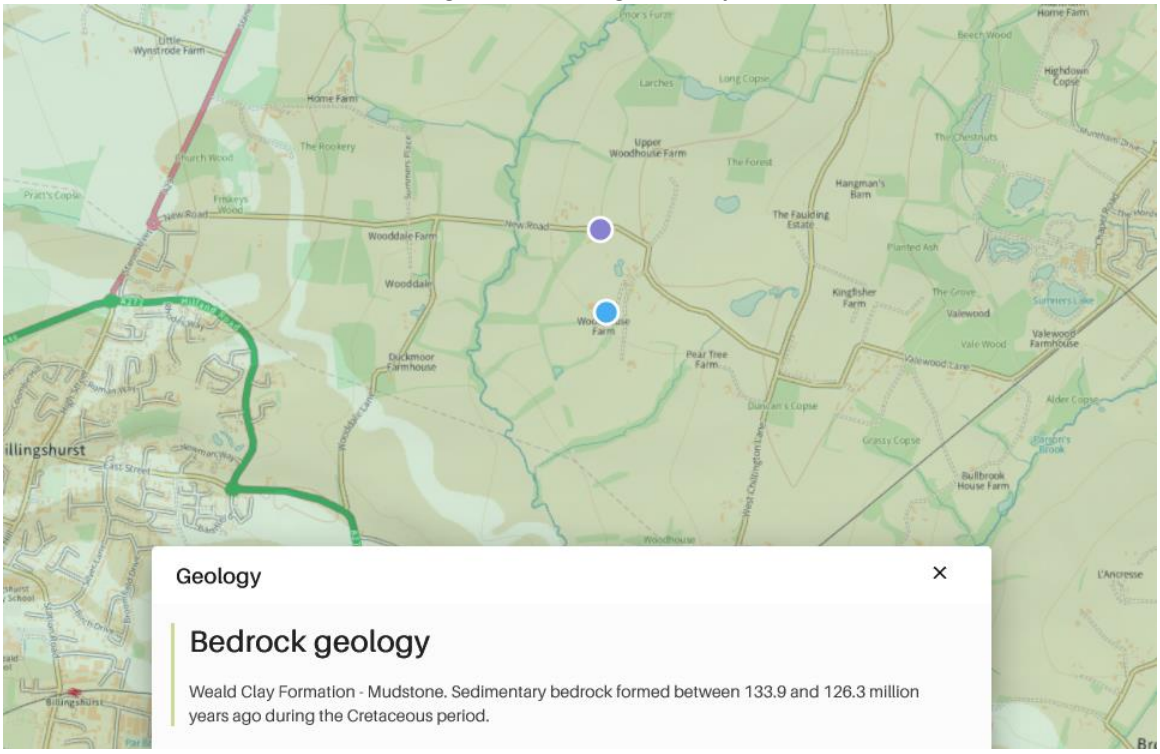
3.1.1 The British Geological Survey confirms the bedrock geology to be made up Weald Clay Formation - Mudstone. At the time of writing the British Geological Survey website does not have any recorded information of the Superficial deposits on site.

3.1.2 The British Geological survey also holds records of historical boreholes near the site which give some insight into the ground geology.

- Borehole TQ12NW10 (Located approx. 650m South-East of the site) – Ground geology (Wealden Clay)

3.1.3 The Historical Borehole Log can be found in Appendix B.

Fig 2. British Geological Survey



Snippet from BGS Website showing Bedrock geology http://mapapps.bgs.ac.uk/geologyofbritain/home.html?

Fig 3. British Geological Survey



Snippet from BGS Website showing Borehole Location

3.2 Geological Assessment

3.2.1 No intrusive ground investigation testing has been carried out and therefore based on the available BGS historical borehole logs and Desktop Study, it is proposed that following surface water runoff discharge hierarchy a restricted discharge to an existing watercourse is proposed.

3.2.2 A preliminary onsite infiltration test was conducted using the BRE365 method to a total depth of 1m below ground level (BGL). Due to the very low permeability, only one test was performed. The infiltration results indicated a 155mm drop within 4 hours, classifying the infiltration as failed. The infiltration rate was calculated to be 1.96 x 10^{-6} m/s. The time for the water level to drop from 75% to 25% was approximately 46,800 seconds (13 hours). These results indicate that, even with a factor of safety applied, the infiltration elements will not achieve the 24-hour half-empty time. Therefore, an overflow connection will be required.

4 Existing Drainage

4.1.1 The site is an undeveloped area (greenfield), and therefore, there is no evidence of existing drainage.

4.1.2 The existing watercourse is a 0.5m shallow depression flowing from east to west and then south towards an existing pond located to the south of the site. Surface water runoff is subsequently discharged into the River Adur. The area of the existing ditch is fully overgrown with foliage and hedges, and from the site walkover, it appears there are no headwalls present up to the existing pond.

5 Proposed Drainage Strategy

5.1 SuDS Hierarchy

5.1.1 All options for the destination of run-off generated on site have been assessed in line with the SuDS hierarchy as set out in Building Regulations Part H document and DEFRA's Draft National Standards for SuDS.

Table 1. SuDS Hierarchy

Discharge Destination	
Discharge to Ground	YES- All hard paved area is to be made porous and self-draining to mimic current site hydrology. The proposed land drainage and ACO have been designed to capture any exceedance runoff from the proposed driveway area.
Discharge to Watercourse	YES- The storm water runoff from roof area at restricted rate of 1.0 l/s)
Discharge to Surface Water Sewer	N/A
Discharge to Other Sewer	N/A

5.2 Proposed Hydraulic Calculation Specifications:

Table 2. SuDS Hierarchy

Hydraulic Calculations Settings:	
Rainfall Methodology	**FEH-22**
Volumetric Run-off Coefficient Cv	**1.00**
CV Winter and Summer	**1.00 / 1.00**
Additional Storage (m^3 / ha)	**0.0**
Orifice Flow Control	**0.410m Head @ 1l/s discharge**
Raingarden Design	Base Coefficient (m/hr): **0.00706**
	Side Coefficient (m/hr): **0.00706**
	Factor of Safety: **2**
	Porosity: **100%**
	Time to Half Empty (mins): 0

Hydraulic Calculations Settings:	
Rainfall Methodology	**FEH-22**
Volumetric Run-off Coefficient Cv	**1.00**
CV Winter and Summer	**1.00 / 1.00**
Additional Storage (m^3 / ha)	**0.0**
Permeable Paving	Base Coefficient (m/hr): **0.00706**
	Side Coefficient (m/hr): **0.00706**
	Factor of Safety: **2**
	Porosity: **30%**
	Time to Half Empty (mins): **7**

5.3 Surface Water Drainage

5.3.1 Based upon the information gathered from the British Geological Survey website, it is deemed that discharge to ground via infiltration is not viable due to the site being underlain by soils with low-very low infiltration characteristics. Therefore, it is proposed that all surface water runoff is to be discharged to the existing watercourse adjacent the southern boundary of the site at a restricted discharge rate of 1.0 l/s. All roof areas are to be collected into a positive drainage network before being discharged into the existing watercourse.

5.3.2 The proposed drainage network will make use of rain garden and permeable paving, which have been designed to cater for the 1 in 100 year + 45% storm event.

5.3.3 Using Causeway Flow hydraulic calculations, the required storage has been calculated as 52.970m^3, the total storage available is 66.150m^3 which was calculated beneath the 150mm freeboard.

5.3.4 It is proposed that all hard paved areas be constructed using a permeable gravel surface. This will allow surface water runoff to be partially discharged into the ground, with a recorded infiltration rate of 1.96 x 10^{-6} m/s, thereby mimicking the existing situation. Additionally, these areas will be constructed with an overflow connection into the proposed raingarden to accommodate higher rainfall events.

5.3.5 An onsite preliminary infiltration test was conducted to BRE365 method to a total depth of 1m below ground level (BGL). Due to the very low permeability, only one test was performed. The infiltration results indicated a 155mm drop within 4 hours, classifying the infiltration as failed. The infiltration rate was calculated to be 1.96 x 10^-6 m/s. The time for water to drop between 75% - 25% was calculated as approximately 46,800 seconds (13 hours). These results indicate that when applying a factor of safety, infiltration elements will not achieve the 24-hour half-empty time, and therefore an overflow connection will be required.

5.3.6 Proposed Drainage Strategy, Contributing Area Plan, Exceedance Flow Routes and Hydraulic calculations have been carried out which can be found at Appendix C.

5.4 Water Quality

5.4.1 A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution.

5.4.2 Frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals, and various organic and inorganic contaminants) Therefore the first 5-10mm of rainfall should be adequately treated with SuDS.

5.4.3 The new SuDS Manual (Ciria C753, November 2015) introduces slightly different approach compared to the previous version for the water quality management of surface water. The Manual describes risks posed by the surface water runoff to the receiving environment as a function of:

- The pollution hazard at a particular site (i.e., the pollution source)
- The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels
- The sensitivity of the receiving environment

5.4.4 The EA website indicates that the site does not lie within a Source Protection Zone.

5.4.5 The recommended approaches for water quality risk management are given in the SuDS Manual Table 26.1.

Table 26.1 from SuDS manual. Approaches to Water Quality Risk Management

Table 26.1 Approaches to Water Quality Risk Management			
Design method	**Hazard Characterisation**	**Risk Reduction**	
		For Surface Water	**For Groundwater**
Simple Index Approach	Simple pollution hazard indices based on land use (Table 26.2)	Simple SuDS hazard mitigation indices (Table 26.3)	Simple SuDS hazard mitigation indices (Table 26.4)
Risk Screening	Factors characterising traffic density and extent of infiltration likely to occur (Table 26.5)	N/A	Factors characterising unsaturated soil depth and type, and predominant flow type through the soils (Table 26.5)
Detailed Risk Assessment	Site specific information used to define likely pollutants and their significance	More detailed, component specific performance information used to demonstrate that the proposed SuDS components reduce the hazard to acceptable levels	
Process-based treatment modelling	Time series rainfall used with generic pollution characteristics to determine statistical distributions of likely concentrations and loadings in the runoff	Models that represent the treatment processes in the proposed SuDS components give estimates of reductions in even mean discharge concentrations and total annual load reductions delivered by the system	

5.4.6 As per Table 26.1 Simple Index approach will be used as a design method for this site.

5.4.7 Table 26.2 will provide hazard classification of different land uses. The land uses for the surface water drainage for this site are.

- Residential Roofs
- Individual Property driveways and residential car parks

5.4.8 To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index for each contaminant type that equals or exceeds the pollution hazard index for each contaminant type. Therefore, the following must be achieved for the surface running off the site.

Total SuDS mitigation index >=pollution hazard index

5.4.9 Pollution Hazard Indices are given for different land uses in Table 26.2 of the SuDS manual;

Table 26.2 from SuDS manual. Pollution Hazard Indices for Different Land Use Classifications

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 (e.g., cul-de-sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g., schools, offices) i.e., < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g., hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g., 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	High	0.8	0.8	0.9

5.4.10 From Table 26.2 the following information is tabulated in Table 1

Table 3: **Pollution hazard index and destination of runoff for the proposed site**

Table 3: Pollution Hazard Index and Destination of runoff for the proposed Site					
Land Use	**Destination of Runoff**	**Pollution Hazard Level**	**Total Suspended Solids**	**Metals**	**Hydrocarbons**
Residential Roof	Surface Water	Very Low	0.2	0.2	0.05
Individual driveways, residential car parks	Ground water	Low	0.5	0.4	0.4

5.4.11 The SuDS mitigation index will be obtained from Table 26.4 (for groundwater) of the SuDS manual.

Table 26.4 from SuDS manual. Indicative SuDS Mitigation Indices for discharges to ground waters.

5.4.12 SuDS mitigation index are tabulated in Table 5 as followed.

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	**TSS**	**Metals**	**Hydrocarbons**
A layer of dense vegetation underlain by a soil with good containment attenuation potential of at least 300mm in depth	0.6	0.5	0.6
A soil with good contaminant attenuation potential of at least 300mm in depth	0.4	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, i.e., graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20mm gravel) underlain by a soil with good contaminant attenuation potential of at least 300mm in depth.	0.4	0.4	0.4
Constructed permeable pavement (where a suitable filtration later 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 of at least 300mm in depth	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential of at least 300mm in depth	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area		

Table 26.4 Indicative SuDS mitigation indices for discharges to surface waters			
	Mitigation Indices		
Type of SuDS Components	**TSS**	**Metals**	**Hydrocarbons**
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	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/ Raingarden	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area		

Table 4: SuDS mitigation index

Table 4 Mitigation Indices						
Runoff Source	**Destination of Runoff**	**Mitigation Index Source**	**Type of SuDS Component**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Residential Roof	Surface Water	Table 26.3 (for surface waters)	Raingarden	0.7	0.7	0.5
Individual driveways, residential car parks	Ground water	Table 26.4 (for ground waters)	Permeable surface	0.7	0.7	0.7

5.4.13 The above analysis demonstrates that the SuDS devices within the design will mitigate any pollution present within the surface water system.

5.5 Foul water drainage

5.5.1 Due to the proposed development being located within the area not served by public foul sewer network, it is proposed that foul sewer will discharge into the onsite treatment plant with the treated effluent then being discharged into the existing watercourse. Loading for sewage treatment is 900l/ day (6P x 150l/day), based on 'British Water Flows and Loads-4'.

5.6 Construction Phase Drainage

5.6.1 It is an offence to cause or knowingly permit the entry of any polluting, poisonous or noxious material in the water environment. If the pollution is serious enough to lower the ecological status of the water body as set out in terms by the Water Framework Directive (2000/60/EC) than prosecution may occur.

5.6.2 Remediation of any damage caused will not require the polluter to be prosecuted first. If the water pollution is serious enough to be classed an environmental damage, the damage will require to be remediated such that the area is returned to the condition it would have been in if the damage had not occurred.

5.6.3 If any pollution has not been reported or the polluter has not taken actions to prevent any further damage; they would then be causing an offence. Third parties (e.g., Private water supply users, landowners, recreation users and the public) who may be affected by possible damage may also report the risk of any environmental damage to the enforcing authority.

5.6.4 The principles of SuDS (Sustainable Drainage Systems) shall be applied to all components of design and construction regarding surface water management. Any design or site works that may impact on the site drainage or the water quality shall:

- Soakaway where soils allow
- Consider and manage erosion
- Remove pollutants in surface water
- Retain any silts on site and prevent silts from discharging to watercourses or drains
- Keep runoff rates at existing greenfield runoff
- Prevent accidental spillages reaching watercourse

5.6.5 Pollution will be controlled via the use of catchpit manholes and geotextiles.

5.6.6 Any potential hazardous substances will be within a controlled compound with a separate drainage system that will contain a penstock valve / containment kit in the event of a spillage.

6 Maintenance

6.1 Introduction

6.1.1 During construction, the Contractor will be responsible for maintaining the drainage and SuDS (Sustainable Drainage Systems). Upon handover, the occupier will take on the responsibility of these duties as laid out in this report.

6.1.2 The maintenance schedule for the proposed development will be split down into two separate categories; SuDS features and regular private drainage.

6.2 SuDS at Woodhouse Farm, Billingshurst

6.2.1 As listed above, in section 5.1.2, the SuDS features used on site will be **Permeable Surface and Attenuation Pond/ Raingarden**

6.2.2 The SuDS features have been designed for easy maintenance and comprise:

- Regular Day-to-Day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS features
- Occasional tasks – checking the SuDS features and removing any silt that builds up in the SuDS feature
- Remedial work – repairing damage where necessary

6.3 SuDS Drainage Maintenance Specification

6.3.1 Permeable Paving

In order to maintain the functioning of the permeable paving, the following maintenance requirements should be adhered to:

Table 21.3 Operation and maintenance requirements for permeable paving

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 glyphosate 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 50mm of 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, 48h after large storms in first six months
	Inspect silt accumulation rate and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

6.3.2 **Rain Garden**

In order to maintain the functioning of the infiltration basins, the following maintenance requirements should be adhered to:

Table 13.2 Operation and maintenance requirements for rain garden

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter, debris and trash	Monthly
	Cut grass- for landscaped areas and routes	Monthly (during growing season) or as required
	Cut grass- meadow grass in and around basin	Half yearly: spring (before nesting season) and autumn
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
Occasional maintenance	Reseed areas of poor vegetation growth	Annually, or as required
	Prune and trim trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required
Remedial Actions	Repair erosion or other damage by reseeding or returfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets , outlets and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surface and reinstate design levels	As required
Monitoring	Inspect inlets , outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Inspect infiltration surfaces for compaction and ponding	Monthly

6.4 General Drainage Maintenance Specification

6.4.1 Inlet Structures and Inspection Chambers

- Inlet structures such as rainwater downpipes, road gullies and channel drains should be free from obstruction at all times to all free flow through the SuDS
- Inspection Chambers and Rodding Eyes are used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

Inlet Structures and Inspection Chambers	
Regular Maintenance	**Frequency**
Inlet Structures **Inspect rainwater downpipes, channel drains and road gullies, removing obstructions and silt as necessary. Check that there is no physical damage.** **Strim vegetation 1m min surround to structures and keep area free from silt and debris**	Monthly
Inspections Chambers and below ground control chambers. **Remove cover and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt.** **Undertake inspection after leaf fall in Autumn**	Annually
Occasional Maintenance **Check topsoil levels are 20mm above edges of chambers to avoid mower damage.**	As necessary
Remedial Work **Repair physical damage if necessary**	As required

6.4.2 Below ground drainage pipes

- Below ground drainage pipes convey water to the SuDS system. They should always be free from obstruction to allow free flow.

Below Ground Drainage Pipes	
Regular Maintenance	**Frequency**
Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months then annually
Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks.	Monthly or as required
Remedial Work **Repair physical damage if necessary**	As required
Monitoring **Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed.**	Annually
Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

7 Summary and Conclusions

7.1.1 CGS Civils has been instructed to produce a Drainage statement under National Planning Policy Framework (NPPF) to support the Planning Application for the construction of a new dwelling.

7.1.2 The Surface Water will discharge to existing watercourse at restricted discharge rate of 1.0 l/s. Proposed connection is subject to OWC agreement.

7.1.3 The Foul water will discharge into existing watercourse via onsite private treatment plant.

7.1.4 The report has demonstrated that the proposed drainage measures ensure that suitable means of surface water and foul drainage can be achieved for the proposed development.

8 Appendices

8.1 Appendix A – Site Plan



PROPOSED SITE PLAN
1:500@A3

This drawing and its design are the copyright property of Solo Timber Frame Ltd.

SOLO
TIMBER FRAME HOMES

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Client :Joanna Moyers

PLANNING DRAWINGS

PROPOSED SITE PLAN
Scale 1:500@A3
Drawing No : PR-01

A3

8.2 Appendix B – Borehole Log

TQ 12 NW 10

WELL BORING at Billingshurst County Sussex TQ12/7

Geol. map 1 in. map New Series 301 6 in. map 24 NW/W

Made by Duke & Ockenden Date 192

Sunk ——— feet. Bored 11 ... 302 315 GR. 1133 2617

Communicated by Duke & Ockenden

Height above Ordnance Datum 162.00 Rest level of water 25 ft.; depresses to 53 ft. when pumping at 540 g.p.h.

Yield

Quality (with copy of analysis on separate sheet)

66

GEOLOGICAL FORMATION.	NATURE OF STRATA.	THICKNESS. Feet.	Inches.	TH.	Inches.
	Wealden Clay			117	—
	Lined 6" tubes to 79 ft.				
	4½" " " 117 ft.				
	perforated 89 — 99 ft.				
	At Hill Brow, 1 mile S. of Barns Green for R.W. Ludgater, Esq.				

Billingshurst. Hill Brow. Sussex
for R.W. Ludgater Esq DEC 1928
O.D. 162.00 1 m. S of Barns Green

Bored to .. .. 117'0"
Lined 6" Tubes to 79'0"
" 4½" " " 117'0"
perforated .. 89' to 99'
Water level .. .. 25'0"
depresses to 53' when pumping at 540 g.p.h

Stratum
Wealden Clay

WJB 4/368.

M. of H. notified 1/2/29

Disused
Visited S. Buchan 27.5.40.

Filed 2.6.47.
B.M.C.

GEOLOGICAL SURVEY AND MUSEUM,
JERMYN STREET, LONDON, S.W. 1.

(B10619). Wt. 15824—S123. 2500. 11/25. Gp. 160. O.A.

8.3 Appendix C – Proposed Drainage Strategy, Contributing Area, Exceedance Flow Routes and Hydraulic Calculations

DESIGN SUBJECT TO THE APPROVAL OF:
PLANNING AUTHORITY
BUILDING CONTROL
WATER AUTHORITY

DESIGN SUBJECT TO THE CONFIRMATION OF:
EXTERNAL LEVELS DESIGN
ORDINARY WATERCOURSE APPROVAL
LOCATION AND DEPTH OF EXISTING UTILITIES

PROPOSED RAINGARDEN
for surface water attenuation.
Designed based on recorded infiltration rate of 1.96 x 10^{-6} m/s

Top of banking 41.600- 42.260
IL 41.100
Max water level 41.449
Freeboard: 151mm
Rain garden base area: 133.0m²
Rain garden depth: 0.5m
Total storage required: 52.970m³
Total storage available beneath 150mm freeboard: 66.150m³
Rain garden designed to cater for the 1 in 100 year storm + 45%
Final attenuation Raingarden location to be confirmed by the Client

All hard paved parking areas to be constructed using permeable self-draining gravel surface to mimic current situation. Constructed with an overflow connection into the proposed raingarden for a higher rainfall events.
The permeable surface designed based on recorded infiltration rate of 1.96x10^{-6} m/s and all area being included in the proposed Raingarden calculations.

Proposed Land Drainage 100Ø pipe

FFL 42.150*

S1
CL 42.000
IL 41.500
450Ø IC
B125

S2
CL 42.000
IL 41.407
450Ø IC
B125

S3
CL 42.000
IL 41.220
450Ø IC
B125
Constructed within non-return valve

S4
Orifice - 500Ø Flow Control Chamber with foul air trap
Restricted to 1l/s
Flow control constructed with an overflow to existing ditch
CL 41.550
IL 41.050
Water Level: 41.463
500Ø CP
B125

RE1
CL 42.000
IL 41.550

F1
CL 42.000
IL 41.550
450Ø IC
B125

F2
CL 42.000
IL 41.450
450Ø IC
B125

F3
CL 41.650
IL 41.200
450Ø IC
B125
Constructed within non-return valve.

F4
Sampling Chamber
CL 41.550
IL 41.070
450Ø IC
B125

C1
CL 41.550
IL 41.020
450Ø IC
B125

Headwall Inlet
IL: 41.100

Headwall Outlet
IL: 41.150

Proposed ACO SuDS Swale Inlet

Proposed Treatment Plant
Marsh Ultra Polylok L package sewage treatment plant (or equivalent)
CL 41.570
Inc IL 41.165
Out IL 41.090
BL Subject to manufacturer

Treated effluent to be discharged into the existing watercourse. Final treatment plant type and size to be confirmed at detail design. Treatment plant size based on 6 persons (6P)

Loading for Sewage Treatment System (based on *British Water Flows and Loads - 4*) :
6P x 150l/day = 900l/day
900l/day: 86400 sec = 0.01 l/s x 5 (peak factor)= 0.05 l/s

Proposed treated effluent to be connected into SW discharge via proposed combined manhole.

Proposed bagwork headwall. 100Ø combined IL: **40.705**
Proposed headwall apron level 40.577
Flap valve required during high-tide events.
Final headwall design subject to OWC Application

WARNING
Discharge to the existing watercourse via concrete bag headwall.
Subject to OWC Application.

Ditch downstream to be cleared of all debris before commencement of works

Existing watercourse

SWD 100Ø 2.2m 1:11 2.000
SWD 100Ø 9.7m 1:32 2.001
SWD 150Ø 3.3m 1:70 1.002
SWD 150Ø 1.0m 1:20 1.003
FWD 100Ø 2.3m 1:80
FWD 100Ø 2.3m 1:46
CWD 100Ø 24m 1:80 1.004
SWD 100Ø 14.7m 1:83 1.001
FWD 100Ø 16.2m 1:80
SWD 100Ø 9.3m 1:100 1.000
FWD 100Ø 8.1m 1:80

ex: 42.260
ex: 41.920
ex: 42.950
ex: 42.445
ex: 42.205
ex: 41.600
ex: 42.100
ex: 41.400
ex: 41.367
ex: 41.597
ex: 41.142
ex: 40.957
ex: 41.122
ex: 40.513
ex: 40.456
ex: 40.577
ex: 40.699
ex: 40.765
ex: 40.900
ex: 41.280
ex: 40.937
ex: 41.170
ex: 41.382
ex: 41.073
42.000

control point X=510728.2555 Y=126520.8137 Z=42.158
control point X=510745.2011 Y=126512.4708 Z=42.363

post and rail fencing
gravel track
grass
dense vegetation
dense hedging
gravel track
road gully
top of wall
top of pipe
ditch
TREE

DRAINAGE LEGEND

PROPOSED FEATURES

- SWD — Surface Water Drainage
- Storm water inspection chamber (450Ø)
- Storm water rodding eye
- Extent of permeable surface subject to Client's specifications with flat subbase of 350mm
- Storm water orifice flow control chamber (500Ø)
- ACO — ACO drain
- Proposed Land Drainage
- FWD — Foul Drainage
- Foul water inspection chamber (450Ø)
- Combined water inspection chamber (450Ø)
- CS — Combined Treated Effluent and SW drain
- 42.000 + — Proposed surface level (indicative only for drainage purposes - tbc by others at detail design stage)
- 00.000 — Finished floor level (indicative only for drainage purposes - tbc by Architect at detail design stage)
- 100Ø 4.5m 1:100 Z BED — Pipe info - diameter, length, gradient, bedding type

ABBREVIATIONS

MH	- MANHOLE
IC	- INSPECTION CHAMBER
AC	- ACCESS CHAMBER
CP	- CATCHPIT
BC	- BRAKE CHAMBER
RE	- RODDING EYE
IL	- INVERT LEVEL
SL	- SUMP LEVEL
RA	- RESTRICTED ACCESS COVER
CL	- COVER LEVEL
TL	- TOP OF CELLULAR SA
BL	- BASE OF CELLULAR SA
FL	- FORMATION LEVEL

Site Specific Notes

1. Proposed storm water drainage design based on the BGS website available information and desktop study. Infiltration method for SW discharge has been ruled out due to the site confirmed to be underlain by Weald Clay soils with poor infiltration characteristics.
2. An onsite preliminary infiltration test was conducted to BRE365 method to a total depth of 1m below ground level (BGL). Due to the very low permeability, only one test was performed. The infiltration results indicated a 155mm drop within 4 hours, classifying the infiltration as failed. The ifiltration rate was calculated to be 1.96 x 10^-6 m/s. The time for water to drop between 75% - 25% was calculated as approximately 46,800 seconds (13 hours). These results indicate that when applying a factor of safety, infiltration elements will not achieve the 24-hour half-empty time, and therefore an overflow connection will be required.
3. The proposed attenuation pond/ raingarden has been designed to cater for the Critical 1 in 100 year + 45 % climate change event.
4. It is proposed that surface water runoff from the roof area is to be collected and discharged into the adjacent watercourse at a restricted discharge rate of 1.0l/s
5. Proposed foul water runoff to be discharged into on-site proposed treatment plant prior being discharged into the existing watercourse. This discharge will not require Environment Agency Approval.
6. All proposed hard paved areas to be constructed using permeable surface allowing for surface water runoff being partially discharged into the ground with recorded infiltration rate of 1.96 x 10-6m/s mimicing the existing situation and for higher rainfall events into the proposed raingarden.
7. The proposed Raingarden has been designed with a permeable geotextile allowing for infiltration. The proposed pond has been designed for a Critical 1 in 100 year +45%CC event.
8. Discharge into the existing watercourse subject to OWC Application.

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10. ROAD GULLY OUTLET PIPES ARE TO BE 150mm DIA. WITH CONCRETE SURROUND AND FLEXIBLE JOINTS. ALL GULLIES SHALL BE FITTED WITH GRADE D400 GRATINGS AND FRAMES TO BS EN124, UNLESS OTHERWISE STATED.
11. ALL ADOPTABLE SEWERS SHALL BE CONSTRUCTED TO THE STANDARDS AND SPECIFICATION LAID DOWN DOWN IN 'SEWERS FOR ADOPTION' 6th EDITION, WITH A VIEW TO ADOPTION UPON COMPLETION OF WORKS.
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REV	DATE	DESCRIPTION	BY	CHK	APP
PL1	26.07.24	UPDATED TO LLFA COMMENTS	MR	TZ	CS
P-	28.05.24	PRELIMINARY ISSUE	MR	TZ	CS

FOR PLANNING ONLY

cgs civils
Consulting Civil Engineers

CLIENT: JOANNA MOYERS

ARCHITECT: SOLO TIMBER FRAME HOMES

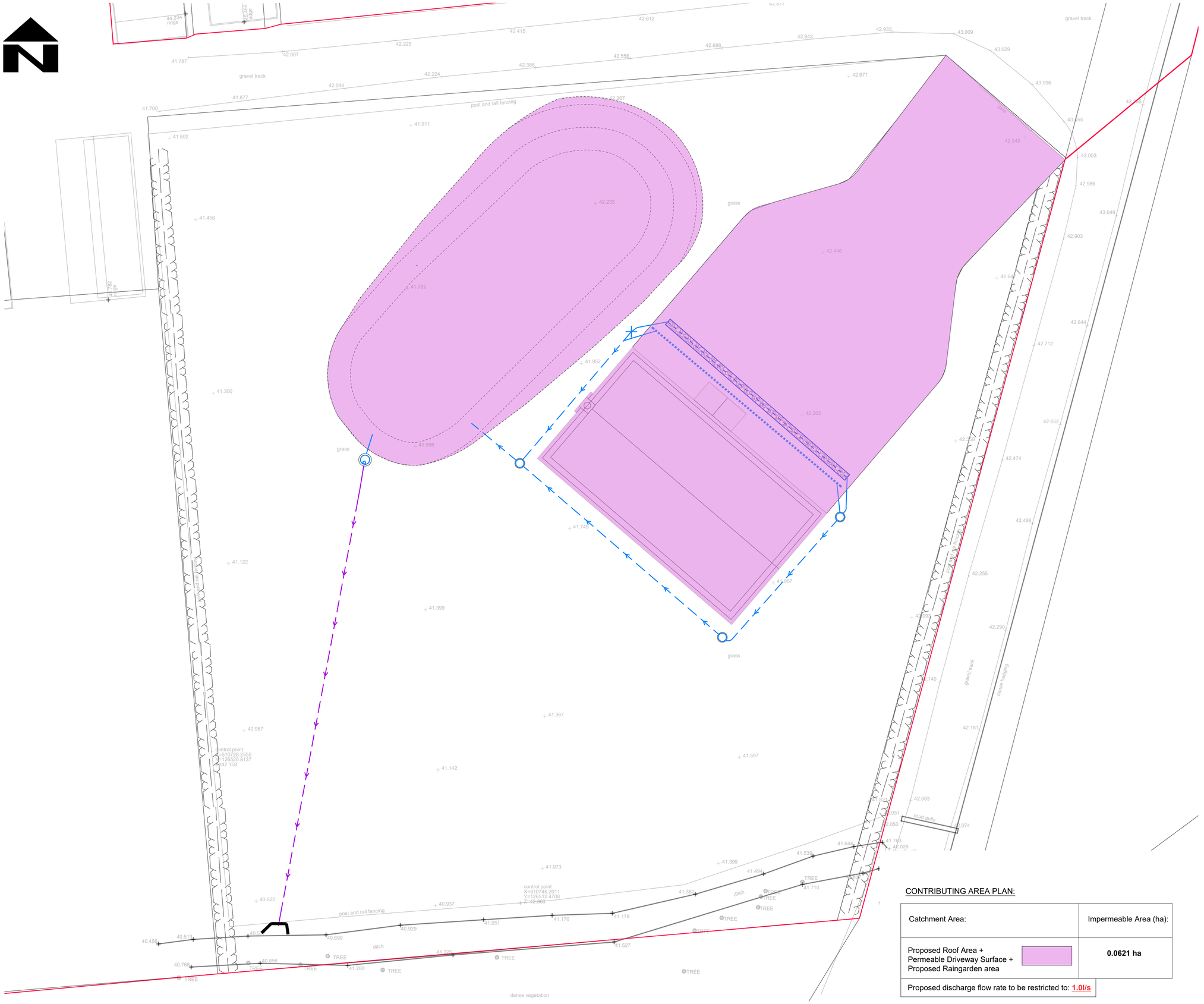
JOB TITLE: WOODHOUSE FARM, BILLINGHURST, RH14 9DS

DRAWING TITLE: PROPOSED DRAINAGE STRATEGY

DRAWN	ENGINEER	CHECKED	APPROVED
MR	TZ	LH	CS

DATE	SCALE @ A1
MAY 2024	1:100

JOB No.	STATUS	DRAWING No.	REV.
C3077	PL	101	PL1



CONTRIBUTING AREA PLAN:

Catchment Area:	Impermeable Area (ha):
Proposed Roof Area + Permeable Driveway Surface + Proposed Raingarden area	**0.0621 ha**
Proposed discharge flow rate to be restricted to: **1.0l/s**	

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P-	28.05.24	PRELIMINARY ISSUE	MR	TZ	CS

cgs civils
Consulting Civil Engineers

CLIENT: JOANNA MOYERS

ARCHITECT: SOLO TIMBER FRAME HOMES

JOB TITLE: WOODHOUSE FARM, BILLINGHURST, RH14 9DS

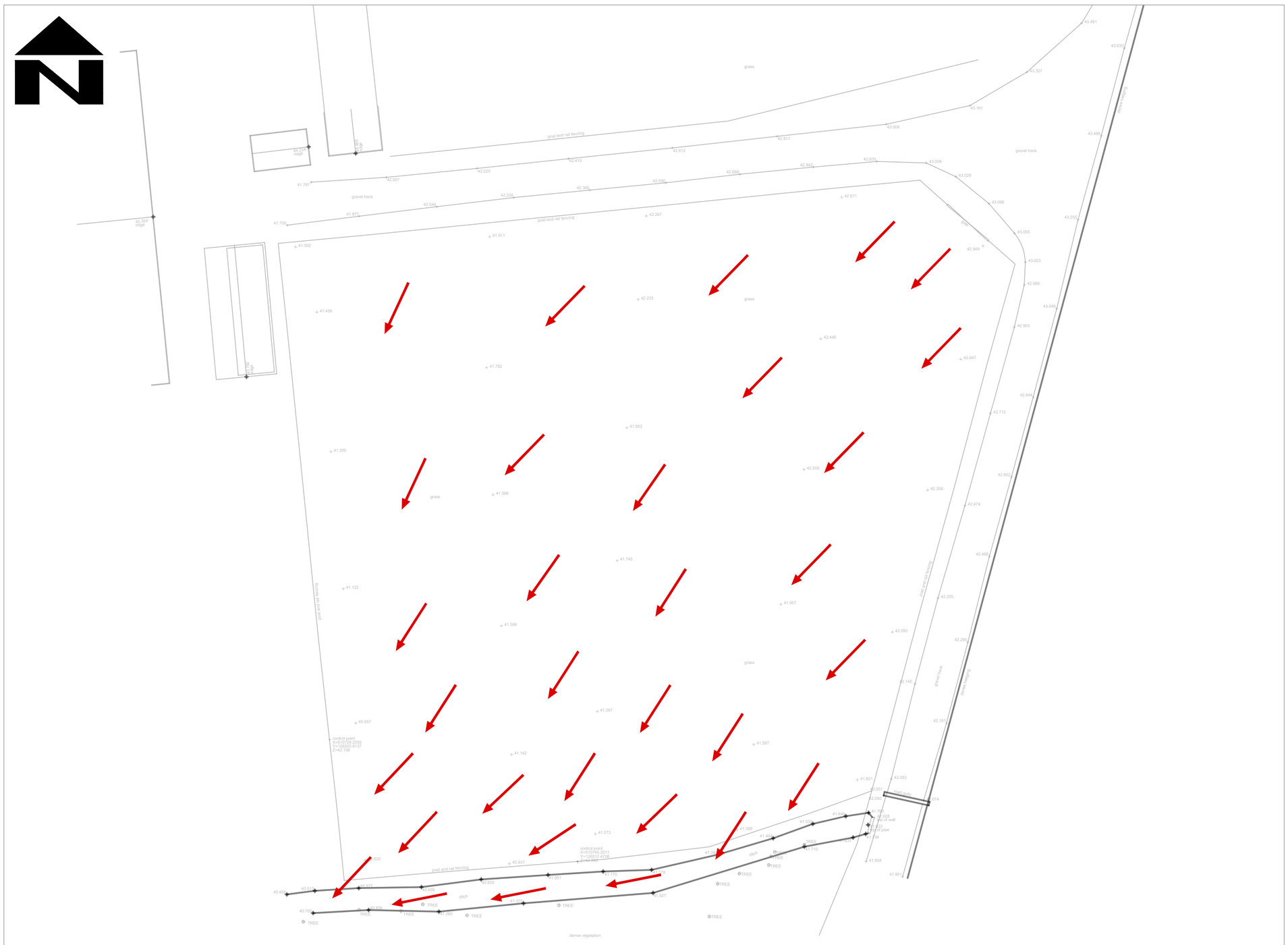
DRAWING TITLE: CONTRIBUTING AREA PLAN

DRAWN	ENGINEER	CHECKED	APPROVED
MR	TZ	LH	CS

DATE: MAY 2024 | SCALE @ A1: 1:100

JOB No.	STATUS	DRAWING No.	REV.
C3077	PL	201	PL1

FOR PLANNING ONLY



CURRENT EXCEEDANCE FLOW ROUTES (scale 1:200)

RED ARROWS SHOW ROUTE OF EXCEEDANCE FLOWS FROM CURRENT SITE SITUATION.



PROPOSED EXCEEDANCE FLOW ROUTES (scale 1:200)

BLUE ARROWS SHOW ROUTE OF EXCEEDANCE FLOWS FROM PROJECTED POINTS OF EMERGENCE TOWARDS DIRECTION OF FALL.

ALL STRUCTURES DESIGNED TO ACCOMMODATE BELOW GROUND THE CRITICAL 1 IN 100 YEAR STORM EVENT PLUS 45%. EXCEEDANCE WOULD ONLY OCCUR IN STORMS OF GREATER INTENSITY THAN THIS.

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P-	28.05.24	PRELIMINARY ISSUE	MR	TZ	CS

cgs civils
Consulting Civil Engineers

CLIENT: JOANNA MOYERS

ARCHITECT: SOLO TIMBER FRAME HOMES

JOB TITLE: WOODHOUSE FARM
BILLINGHURST, RH14 9DS

DRAWING TITLE: EXISTING AND PROPOSED EXCEEDANCE FLOW ROUTES

DRAWN	ENGINEER	CHECKED	APPROVED
MR	TZ	CS	CS

DATE	SCALE @ A1
MAY 2024	1:200

JOB No.	STATUS	DRAWING No.	REV.
C3077	PL	301	PL1

PRELIMINARY

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Raingarden	0.036	4.00	41.600	450	510735.236	126541.885	0.500
Carpark	0.026	4.00	42.205		510754.034	126544.445	0.450
RE1			42.000	180	510751.306	126543.856	0.450
S3			42.000	450	510745.175	126536.627	0.800
S1		4.00	42.000	450	510762.775	126533.681	0.500
S2			42.000	450	510756.299	126527.068	0.593
S4			41.550	500	510736.986	126538.538	0.500
DITCH			41.150	450	510730.994	126510.837	0.445

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	9.256	0.600	41.500	41.407	0.093	99.5	100	4.20	50.0
1.001	S2	S3	14.667	0.600	41.407	41.250	0.157	93.4	100	4.51	50.0
2.001	RE1	S3	9.479	0.600	41.550	41.250	0.300	31.6	100	4.13	50.0
1.002	S3	Raingarden	3.500	0.600	41.200	41.150	0.050	70.0	150	4.56	50.0
1.003	Raingarden	S4	1.000	0.600	41.100	41.050	0.050	20.0	150	4.56	50.0
1.004	S4	DITCH	27.600	0.600	41.050	40.705	0.345	80.0	100	5.10	0.0
2.000	Carpark	RE1	2.200	0.600	41.755	41.550	0.205	10.7	100	4.02	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)
1.000	0.771	6.1	0.0	0.400	0.493	0.000	0.0	0	0.000
1.001	0.796	6.2	0.0	0.493	0.650	0.000	0.0	0	0.000
2.001	1.377	10.8	4.7	0.350	0.650	0.026	0.0	46	1.324
1.002	1.203	21.3	4.7	0.650	0.300	0.026	0.0	48	0.967
1.003	2.262	40.0	11.2	0.350	0.350	0.062	0.0	54	1.945
1.004	0.861	6.8	0.0	0.400	0.345	0.062	0.0	0	0.000
2.000	2.372	18.6	4.7	0.350	0.350	0.026	0.0	34	1.971

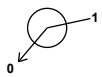
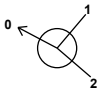
Flow+ v10.7 Copyright © 1988-2024 Causeway Technologies Ltd

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	9.256	99.5	100	Circular	42.000	41.500	0.400	42.000	41.407	0.493
1.001	14.667	93.4	100	Circular	42.000	41.407	0.493	42.000	41.250	0.650
2.001	9.479	31.6	100	Circular	42.000	41.550	0.350	42.000	41.250	0.650
1.002	3.500	70.0	150	Circular	42.000	41.200	0.650	41.600	41.150	0.300
1.003	1.000	20.0	150	Circular	41.600	41.100	0.350	41.550	41.050	0.350
1.004	27.600	80.0	100	Circular	41.550	41.050	0.400	41.150	40.705	0.345
2.000	2.200	10.7	100	Circular	42.205	41.755	0.350	42.000	41.550	0.350

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	450	Manhole	Adoptable	S2	450	Manhole	Adoptable
1.001	S2	450	Manhole	Adoptable	S3	450	Manhole	Adoptable
2.001	RE1	180	Manhole	Adoptable	S3	450	Manhole	Adoptable
1.002	S3	450	Manhole	Adoptable	Raingarden	450	Manhole	Adoptable
1.003	Raingarden	450	Manhole	Adoptable	S4	500	Manhole	Adoptable
1.004	S4	500	Manhole	Adoptable	DITCH	450	Manhole	Adoptable
2.000	Carpark		Junction		RE1	180	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Raingarden	510735.236	126541.885	41.600	0.500	450	1	1.002	41.150	150
									
						0	1.003	41.100	150
Carpark	510754.034	126544.445	42.205	0.450					
						0	2.000	41.755	100
RE1	510751.306	126543.856	42.000	0.450	180	1	2.000	41.550	100
									
						0	2.001	41.550	100
S3	510745.175	126536.627	42.000	0.800	450	1	2.001	41.250	100
						2	1.001	41.250	100
									
						0	1.002	41.200	150
S1	510762.775	126533.681	42.000	0.500	450				
						0	1.000	41.500	100
S2	510756.299	126527.068	42.000	0.593	450	1	1.000	41.407	100
									
						0	1.001	41.407	100
S4	510736.986	126538.538	41.550	0.500	500	1	1.003	41.050	150
									
						0	1.004	41.050	100

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
DITCH	510730.994	126510.837	41.150	0.445	450	1	1	1.004	40.705	100

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	0	0	0
30	0	0	0
30	45	0	0
100	0	0	0
100	45	10	0

Node DITCH Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to All storms

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.445	1800	0.445	3600	0.445	5400	0.445	7200	0.445	9000	0.445
120	0.445	1920	0.445	3720	0.445	5520	0.445	7320	0.445	9120	0.445
240	0.445	2040	0.445	3840	0.445	5640	0.445	7440	0.445	9240	0.445
360	0.445	2160	0.445	3960	0.445	5760	0.445	7560	0.445	9360	0.445
480	0.445	2280	0.445	4080	0.445	5880	0.445	7680	0.445	9480	0.445
600	0.445	2400	0.445	4200	0.445	6000	0.445	7800	0.445	9600	0.445
720	0.445	2520	0.445	4320	0.445	6120	0.445	7920	0.445	9720	0.445
840	0.445	2640	0.445	4440	0.445	6240	0.445	8040	0.445	9840	0.445
960	0.445	2760	0.445	4560	0.445	6360	0.445	8160	0.445	9960	0.445
1080	0.445	2880	0.445	4680	0.445	6480	0.445	8280	0.445	10080	0.445
1200	0.445	3000	0.445	4800	0.445	6600	0.445	8400	0.445		
1320	0.445	3120	0.445	4920	0.445	6720	0.445	8520	0.445		
1440	0.445	3240	0.445	5040	0.445	6840	0.445	8640	0.445		
1560	0.445	3360	0.445	5160	0.445	6960	0.445	8760	0.445		
1680	0.445	3480	0.445	5280	0.445	7080	0.445	8880	0.445		

Node S4 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.410	Discharge Coefficient	0.650
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	41.050	Diameter (m)	0.026		

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Node Raingarden Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00706	Safety Factor	2.0	Invert Level (m)	41.100
Side Inf Coefficient (m/hr)	0.00706	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	133.0	133.0	0.200	154.2	154.2	0.400	177.0	177.0
0.100	143.4	143.4	0.300	165.4	165.4	0.500	189.0	189.0

Node Carpark Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00706	Invert Level (m)	41.755	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00706	Time to half empty (mins)	7	Depth (m)	0.350
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.30	Length (m)	14.100		

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 (m³)	
Full Bore Velocity	✓		

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Results for 10 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Raingarden	288	41.247	0.147	5.0	20.7304	0.0000	OK
15 minute summer	Carpark	11	41.803	0.048	11.2	1.4422	0.0000	OK
15 minute summer	RE1	11	41.620	0.070	8.3	0.0018	0.0000	OK
15 minute summer	S3	12	41.274	0.074	8.1	0.0117	0.0000	OK
15 minute summer	S1	1	41.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	S2	1	41.407	0.000	0.0	0.0000	0.0000	OK
360 minute summer	S4	296	41.247	0.197	0.7	0.0386	0.0000	SURCHARGED
15 minute summer	DITCH	1	41.150	0.445	0.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute summer	Raingarden	1.003	S4	0.7	0.194	0.018	0.0176	
360 minute summer	Raingarden	Infiltration		0.1				
15 minute summer	Carpark	2.000	RE1	8.3	1.711	0.444	0.0106	
15 minute summer	Carpark	Infiltration		0.1				
15 minute summer	RE1	2.001	S3	8.1	1.450	0.753	0.0534	
15 minute summer	S3	1.002	Raingarden	8.2	1.036	0.387	0.0278	
15 minute summer	S1	1.000	S2	0.0	0.000	0.000	0.0000	
15 minute summer	S2	1.001	S3	0.0	0.000	0.000	0.0105	
360 minute summer	S4	Orifice	DITCH	0.5				10.8

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Raingarden	296	41.285	0.185	6.2	26.4355	0.0000	SURCHARGED
15 minute summer	Carpark	11	41.813	0.058	14.6	1.8528	0.0000	OK
15 minute summer	RE1	12	41.664	0.114	10.8	0.0028	0.0000	SURCHARGED
360 minute summer	S3	288	41.286	0.086	2.5	0.0137	0.0000	OK
15 minute summer	S1	1	41.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	S2	1	41.407	0.000	0.0	0.0000	0.0000	OK
360 minute summer	S4	296	41.285	0.235	0.9	0.0460	0.0000	FLOOD RISK
15 minute summer	DITCH	1	41.150	0.445	0.3	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)
360 minute summer	Raingarden	1.003	S4	0.9	0.171	0.021	0.0176	
360 minute summer	Raingarden	Infiltration		0.1				
15 minute summer	Carpark	2.000	RE1	10.8	1.760	0.581	0.0136	
15 minute summer	Carpark	Infiltration		0.1				
15 minute summer	RE1	2.001	S3	10.5	1.467	0.973	0.0729	
360 minute summer	S3	1.002	Raingarden	3.2	0.683	0.148	0.0475	
15 minute summer	S1	1.000	S2	0.0	0.000	0.000	0.0000	
15 minute summer	S2	1.001	S3	0.0	0.000	0.000	0.0184	
360 minute summer	S4	Orifice	DITCH	0.6				13.2

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Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Raingarden	344	41.368	0.268	7.1	39.4428	0.0000	FLOOD RISK
15 minute summer	Carpark	12	41.842	0.087	21.1	3.0710	0.0000	OK
15 minute summer	RE1	12	41.752	0.202	11.6	0.0051	0.0000	FLOOD RISK
360 minute winter	S3	344	41.368	0.168	2.4	0.0267	0.0000	SURCHARGED
15 minute summer	S1	1	41.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	S2	1	41.407	0.000	0.0	0.0000	0.0000	OK
360 minute winter	S4	336	41.368	0.318	1.1	0.0623	0.0000	FLOOD RISK
15 minute summer	DITCH	1	41.150	0.445	0.4	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)
360 minute winter	Raingarden	1.003	S4	1.1	0.205	0.029	0.0176	
360 minute winter	Raingarden	Infiltration		0.2				
15 minute summer	Carpark	2.000	RE1	11.6	1.794	0.622	0.0166	
15 minute summer	Carpark	Infiltration		0.1				
15 minute summer	RE1	2.001	S3	11.4	1.500	1.057	0.0742	
360 minute winter	S3	1.002	Raingarden	3.7	0.651	0.175	0.0616	
15 minute summer	S1	1.000	S2	0.0	0.000	0.000	0.0000	
15 minute summer	S2	1.001	S3	0.0	0.000	0.000	0.0221	
360 minute winter	S4	Orifice	DITCH	0.7				17.7

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Raingarden	336	41.331	0.231	6.9	33.5643	0.0000	FLOOD RISK
15 minute summer	Carpark	12	41.828	0.073	18.4	2.4986	0.0000	OK
15 minute summer	RE1	12	41.723	0.173	11.8	0.0043	0.0000	FLOOD RISK
360 minute winter	S3	336	41.331	0.131	2.1	0.0208	0.0000	OK
15 minute summer	S1	1	41.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	S2	1	41.407	0.000	0.0	0.0000	0.0000	OK
360 minute winter	S4	352	41.331	0.281	1.2	0.0550	0.0000	FLOOD RISK
15 minute summer	DITCH	1	41.150	0.445	0.4	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)
360 minute winter	Raingarden	1.003	S4	1.2	0.094	0.030	0.0176	
360 minute winter	Raingarden	Infiltration		0.2				
15 minute summer	Carpark	2.000	RE1	11.8	1.782	0.631	0.0154	
15 minute summer	Carpark	Infiltration		0.1				
15 minute summer	RE1	2.001	S3	10.9	1.456	1.011	0.0742	
360 minute winter	S3	1.002	Raingarden	3.9	0.651	0.185	0.0594	
15 minute summer	S1	1.000	S2	0.0	0.000	0.000	0.0000	
15 minute summer	S2	1.001	S3	0.0	0.000	0.000	0.0203	
360 minute winter	S4	Orifice	DITCH	0.7				15.9

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Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Raingarden	352	41.468	0.368	9.0	56.3047	0.0000	FLOOD RISK
30 minute summer	Carpark	21	41.892	0.137	26.3	5.1854	0.0000	SURCHARGED
30 minute summer	RE1	21	41.773	0.223	11.8	0.0056	0.0000	FLOOD RISK
360 minute winter	S3	352	41.468	0.268	3.4	0.0427	0.0000	SURCHARGED
15 minute summer	S1	1	41.500	0.000	0.0	0.0000	0.0000	OK
360 minute winter	S2	344	41.468	0.061	0.1	0.0097	0.0000	OK
360 minute winter	S4	352	41.468	0.418	1.3	0.0820	0.0000	FLOOD RISK
15 minute summer	DITCH	1	41.150	0.445	0.6	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)
360 minute winter	Raingarden	1.003	S4	1.3	0.165	0.033	0.0176	
360 minute winter	Raingarden	Infiltration		0.2				
30 minute summer	Carpark	2.000	RE1	11.8	1.782	0.634	0.0172	
30 minute summer	Carpark	Infiltration		0.1				
30 minute summer	RE1	2.001	S3	11.8	1.505	1.089	0.0742	
360 minute winter	S3	1.002	Raingarden	4.6	0.651	0.217	0.0616	
15 minute summer	S1	1.000	S2	0.0	0.000	0.000	0.0000	
360 minute winter	S2	1.001	S3	-0.1	-0.012	-0.009	0.0942	
360 minute winter	S4	Orifice	DITCH	0.9				22.0

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Node Name	S1	S2	S3	S4	Rangarden	DITCH
A4 drawing Hor Scale 500 Ver Scale 100 Datum (m) 36.000						
Link Name	1.000	1.001	1.00	1	1.004	
Section Type	100mm	100mm	150r	1	100mm	
Slope (1:X)	99.5	93.4	70.0	2	80.0	
Cover Level (m)	42.000	42.000	42.000	41.600 41.550	41.150	
Invert Level (m)	41.500	41.407 41.407	41.250 41.200 41.150	41.050 41.000 41.000	40.705	
Length (m)	9.256	14.667	3.50(	1	27.600	

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Node Name		Carrier	P51	S3
A4 drawing Hor Scale 500 Ver Scale 100 Datum (m) 36.000				
Link Name		2.0	2.001	
Section Type		100	100mm	
Slope (1:X)		10.	31.6	
Cover Level (m)		42.205	42.000	42.000
Invert Level (m)		41.350	41.550	41.250
Length (m)		2.2	9.479	

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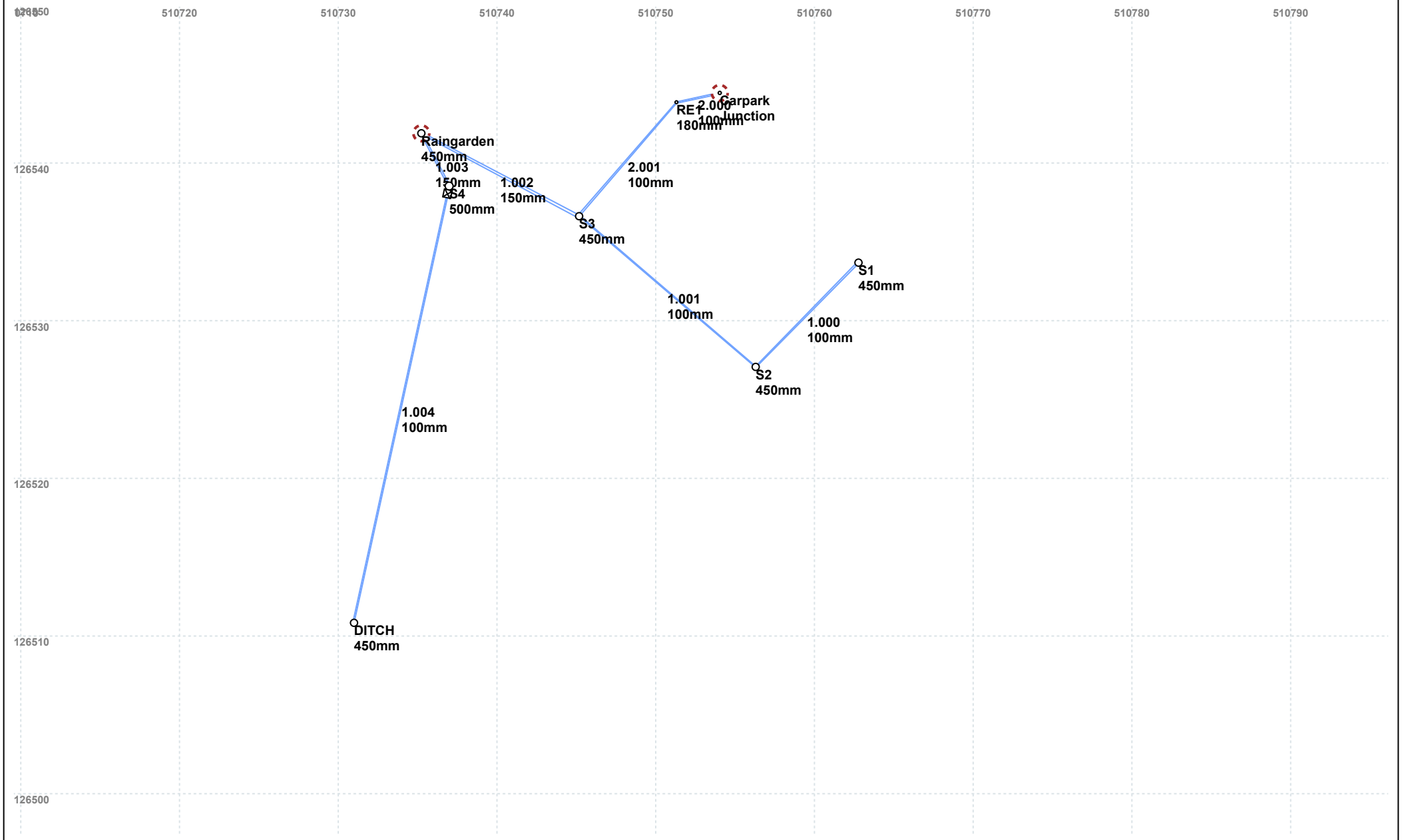

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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Tom Zajac
Site name:	
Site location:	

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.02768° N
Longitude:	0.42187° W
Reference:	868457869
Date:	May 23 2024 09:55

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.2042

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	774	774
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	1.11	1.11
1 in 1 year (l/s):	0.94	0.94
1 in 30 years (l/s):	2.55	2.55
1 in 100 year (l/s):	3.54	3.54
1 in 200 years (l/s):	4.15	4.15

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.