Consulting Civil Engineers

Foul and Surface Water Drainage Report

Woodhouse Farm, Billingshurst

Planning Ref: DC/23/1188

For

Joanna Moyers

Rev - **P**

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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 0.5l/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 attenuation tank for a higher rainfall events. The network will make use of an attenuation tank 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

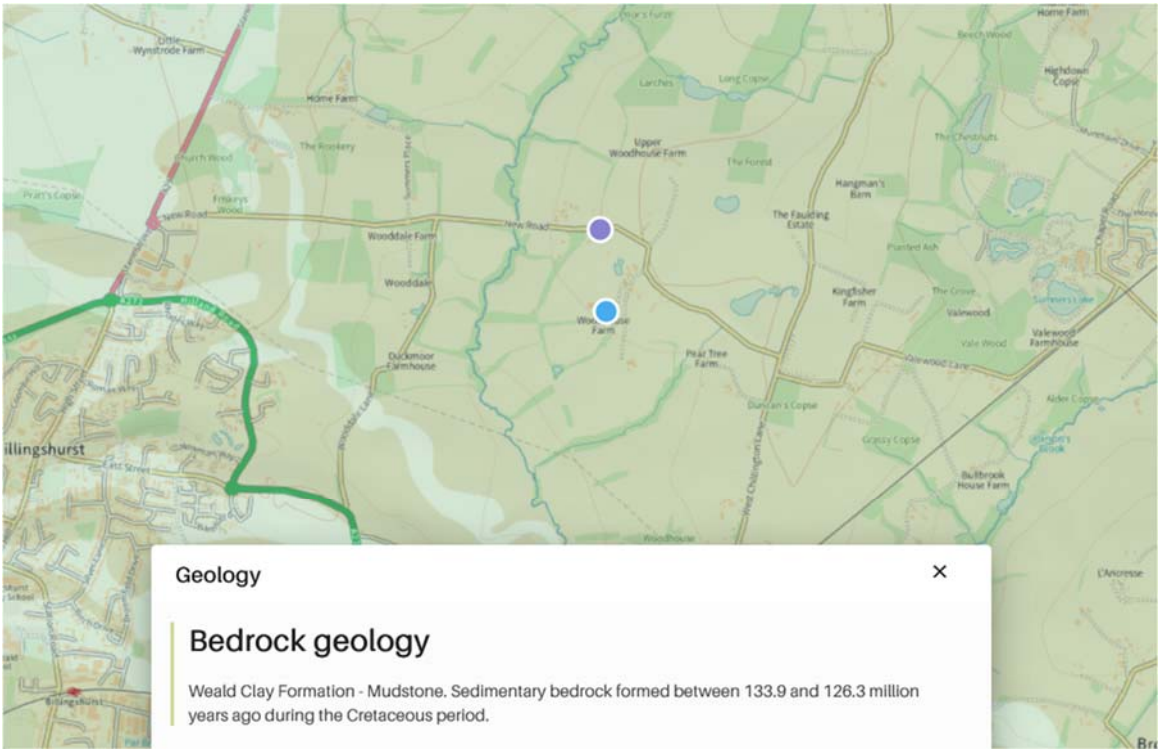
3.1.1 The British Geological Survey confirms the bedrock geology to be made up Weald Clay Formation - Mudstone. At the time of writing the British Geological Survey website does not have any recorded information of the Superficial deposits on site.

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)

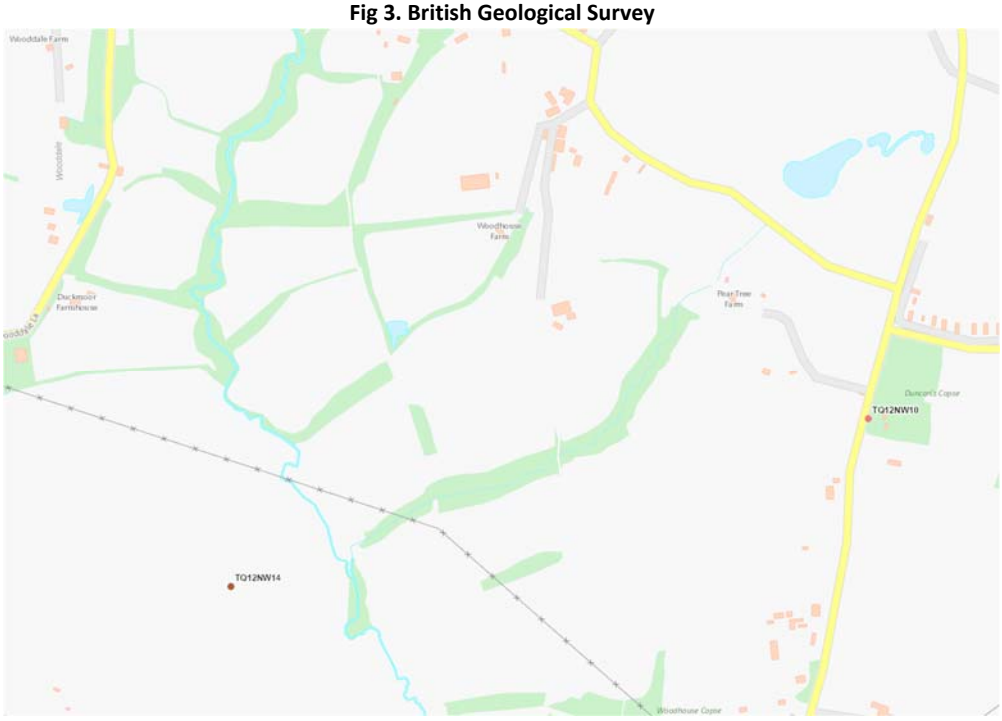
3.1.3 The Historical Borehole Log can be found in Appendix B.

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 1 meter below ground level (BGL). Due to the very low permeability, the infiltration rates varied between 2.23 × 10^-6 m/s and 1.96 × 10^-6 m/s. The time required for the water level to drop from 75% to 25% was approximately 46,800 seconds (13 hours). Consequently, two infiltration tests were conducted, with a third test carried out the following day.

3.2.3 The BRE 365 infiltration test can be found in Appendix C.

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	**0.764m Head @ 0.5l/s discharge**
Attenuation Tank	Base Coefficient (m/hr): **0.00000**
	Side Coefficient (m/hr): **0.00000**
	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): **0.00000**
	Factor of Safety: **3.0**
	Porosity: **30%**
	Time to Half Empty (mins): **96**

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 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 0.5 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 an attenuation tank and permeable paving, which have been designed to cater for the 1 in 100 year + 45% storm event.

5.3.3 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, utilising a recorded infiltration rate of 1.96×10^{-6} m/s applied through the base only.

5.3.4 The original drainage strategy has been updated, replacing the proposed above-ground detention basin with underground storage. This adjustment reduces the total required storage due to the reduced contributing area now considered. The existing landscape area around the plot will discharge across the surface, following the existing site topography toward the existing ditch.

5.3.5 The proposed permeable paving surface will be graded away from the building. Combined with the proposed ACO drainage channel, this will facilitate routing any excess runoff away from the building.

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

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 26.3 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**
Individual driveways, residential car parks	Ground water	Table 26.3 (for ground waters) Table 26.4 (for surface 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'.

5.5.2 To improve the discharge quality after the proposed treatment plant, and facilitate the natural filtration of effluent migrating into the existing watercourse the Klargester Reed Bed Tertiary Filter for 6 persons to be installed.

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 Tank**

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 Attenuation Tank

In order to maintain the functioning of the attenuation tanks, the following maintenance requirements should be adhered to:

Table 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	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
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae, or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from per-treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

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 Surface water will be discharged partially via infiltration through the permeable surface and partially into the existing watercourse at a restricted discharge rate of 0.5 l/s. The 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.