

Foul and Surface Water Drainage Report

Highfields, Warninglid

For

Isabella Mears

Rev – **P2**

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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 Highfields, Warninglid.
- 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.
- 1.1.3 The existing site consists of a greenfield area. The proposed development will consist of the erection of a travellers caravan site consisting of a residential mobile home and dayroom. The proposed development is located as OS Grid Reference **TQ 26687 25330** and has the post code **RH17 5SY**.
- 1.1.4 The proposed site plan can be found in **Appendix A**.



Fig 1. Site Location

2 Executive Summary:

- 2.1.1 The Surface water will be discharged to ground through the use of geocellular soakaways. All roof areas are to be collected into a positive drainage network. The proposed access road area is to be constructed from permeable surface to allow runoff to freely drain to ground via infiltration. The network will make use of a geocellular soakaway for the 1 in 100-year +45% storm.
- 2.1.2 Based on the site walkover and information provided by the Client, it has been confirmed that the existing watercourse follows its historical route, ultimately discharging into the existing pond located to the west of the site. It was established that the existing pond overtops towards to the south into the existing shallow ditch.
- 2.1.3 Foul sewer is proposed to be treated using package treatment plant and discharged into the existing watercourse using pumped discharge.

3 Site Geology

3.1 British Geological Survey information

- 3.1.1 The British Geological Survey confirms the bedrock geology to be made up Cuckfield Stone Bed- Sandstone, calcareous. 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 TQ22NE18 (Located approx. 415m North of the site) – Ground geology (Sandy Clay, clay.)
 - Borehole TQ22SE47 (Located approx. 610m South of the site) – Ground geology (Clay.)
- 3.1.3 The Borehole Logs can be found in **Appendix B**.

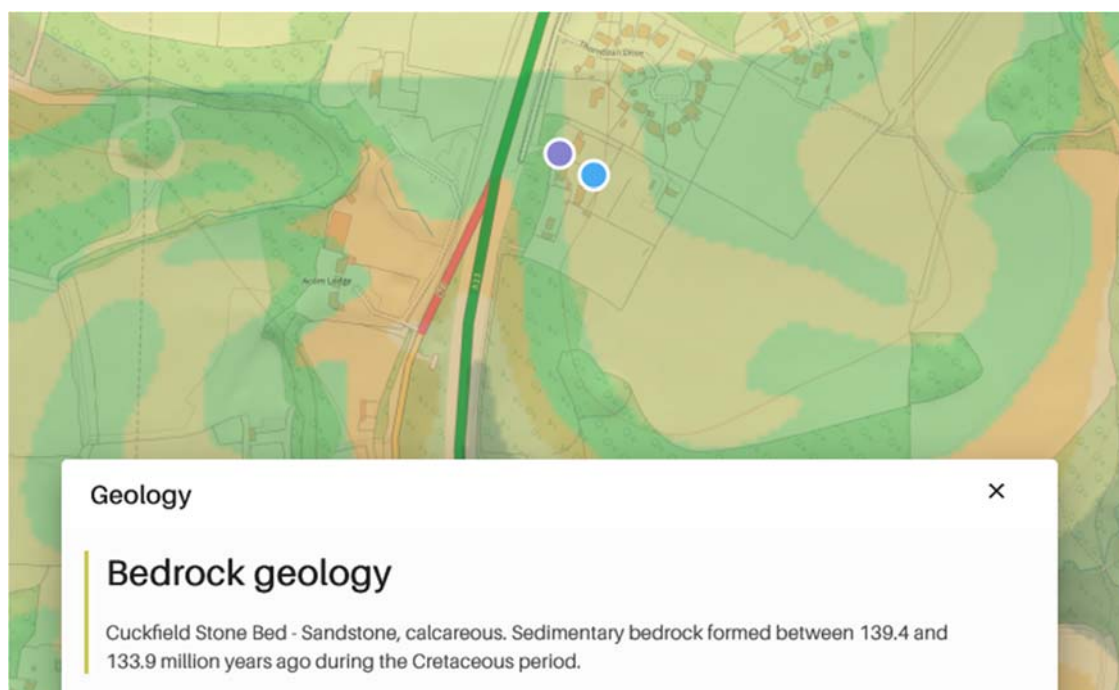


Fig 2. British Geological Survey

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

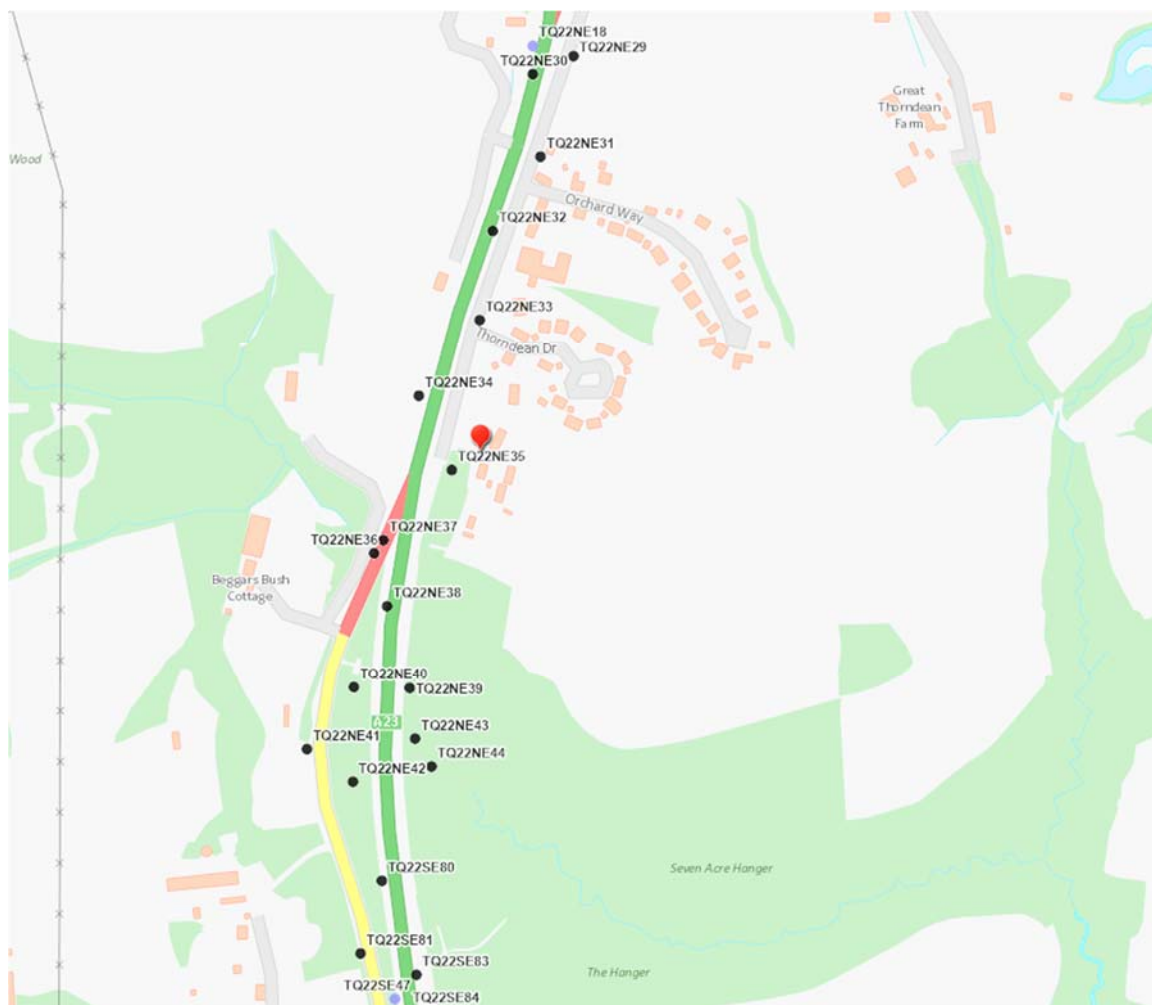


Fig 3. British Geological Survey

Snippet from BGS Website showing the Historical Borehole Log location

3.2 Geological Assessment

- 3.2.1 An infiltration test to BRE365 method was carried out to a total depth of 1.2m BGL which indicated the worst-case infiltration rate as 1.69×10^{-5} m/s. This was adopted for the drainage calculations and the size of the proposed soakaway was updated accordingly.
- 3.2.2 Although infiltration test results indicate that both surface water and foul water could be discharged into the ground via infiltration, the limited available space has ruled out the use of a drainage field for this purpose. Surface water runoff is to be discharge into the ground via infiltration.
- 3.2.3 The Infiltration test can be found in **Appendix C**.

4 Existing Drainage

- 4.1.1 The proposed development is classified as a Greenfield runoff surface water runoff is discharged into the ground via infiltration.

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	
Rainwater Harvesting	N/A
Discharge to Ground	Surface Water and porous paving based on infiltration rate of 1.69×10^{-5} m/s.
Discharge to Watercourse	N/A
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 (Soakaway):	
Rainfall Methodology	FEH-22
Volumetric Run-off Coefficient C_v	1.0
CV Winter and Summer	1.0
Additional Storage (m^3 / ha)	0.0
Infiltration	Recorded worst-case infiltration
Soakaway Design	Base Coefficient (m/hr): 0.00720
	Side Coefficient (m/hr): 0.06084
	Factor of Safety: 1.5
	Porosity: 95%
	Time to Half Empty (mins): 1031

5.3 Surface Water Drainage

- 5.3.1 Based upon the results of the onsite soakage testing, which yielded an infiltration rate of **1.69×10^{-5} m/s**, it is proposed for surface water runoff to be discharged into the ground via infiltration. All roof areas are to be collected into a positive drainage network before being discharged into the ground. The soakaway has been designed to cater for the 1 in 100 year +45% storm.
- 5.3.2 All hard paved areas are to be freely drained to ground via porous construction. All infiltration features on site have been designed to recorded infiltration rate of **1.69×10^{-5} m/s** and to cater for the 1 in 100-year +45% storm.
- 5.3.3 Proposed Contributing Area Plan, Proposed Surface Water Drainage Plan, Proposed Construction Details and Hydraulic calculations can be found at **Appendix D**.
- 5.3.4 EA Magic Maps can be found at **Appendix E**.

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
 - Low traffic roads
- 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 $\geq$ 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	Ground Water	Very Low	0.2	0.2	0.05
Individual driveways, residential car parks and low traffic roads	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 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 and low traffic roads	Ground water	Table 26.4 (for ground waters) Table 26.3 (for surface waters)	Raingarden	0.7	0.6	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 A foul water sewer is located approximately 180m to the west of the site, however this is deemed as being too far from the site to enable a practical connection. Building Regulations Document H requires a sewer connection for any developments within 30m of any foul sewer per plot. The site will consist of two residential units i.e. 60m and thus is three times further away than the nearest available sewer.
- 5.5.2 On this basis, a modern sewage treatment plant with a connection into an adjacent drainage ditch to the north of the access track is proposed. Whilst the subsoil would be conducive to a drainage field, there is insufficient space on site and therefore a connection to the ditch would be deemed as most appropriate.
- 5.5.3 The existing ditch depth has been confirmed between 0.6m – 0.9m. It is proposed that treated effluent is discharged via a pumped discharge. The proposed package treatment plant is to be installed with an internal pump.

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) then 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 as 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 As infiltration on site is viable, the temporary drainage for the development will be in the form of land drains which will discharge into the ground.
- 5.6.6 Pollution will be controlled via the use of catchpit manholes and geotextiles.
- 5.6.7 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). 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 Highfields, Warninglid

- 6.2.1 As listed above, in section 5.1.2, the SuDS features used on site will be **soakaway, porous paving, bio-retention planters**.
- 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 Soakaway

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

6.3.2 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

6.3.3 Bio retention systems

In order to maintain the functioning of the bio retention systems, the following maintenance requirements should be adhered to:

Table 18.3 Operation and maintenance requirements for bio retention systems		
Maintenance Schedule	Required Action	Typical Frequency
Regular Inspections	Inspection infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockages	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

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 allow 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.	Monthly
Trim vegetation 1m min surround to structures and keep area free from silt and debris	
Inspection 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.	Annually
Undertake inspection after leaf fall in Autumn	
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 erection of a traveller's caravan site consisting of a residential mobile home and dayroom.
- 7.1.2 The Surface Water will discharge to a geo-cellular soakaway sized to cater for the 1 in 100 + 45% storm.
- 7.1.3 The Foul water will discharge into the adjacent drainage ditch via a modern sewage treatment plant. The treated effluent will be directed into the existing ditch using an internal pump.
- 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.