

Foul and Surface Water Drainage Report

Horns Lane, Pagham

Planning Ref: P/139/22/RES

For

Hampshire Homes

Rev - P

Reference C3961

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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 Horns Lane, Pagham.
- 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 This drainage report has been prepared in accordance with the National Standards for Sustainable Drainage Systems (SuDS) and demonstrates compliance with the relevant requirements set out therein.
- 1.1.4 The existing site comprises a 4.3 ha field containing an existing building and associated outbuildings located in the north-western part of the site. The proposed development will comprise the construction of 65 residential dwellings with associated access, parking, and landscaping. The site is located at OS Grid Reference SZ 88592 98188 and has the postcode PO21 4NZ.
- 1.1.5 The proposed site layout can be found in Appendix A.

Fig 1. Site Location



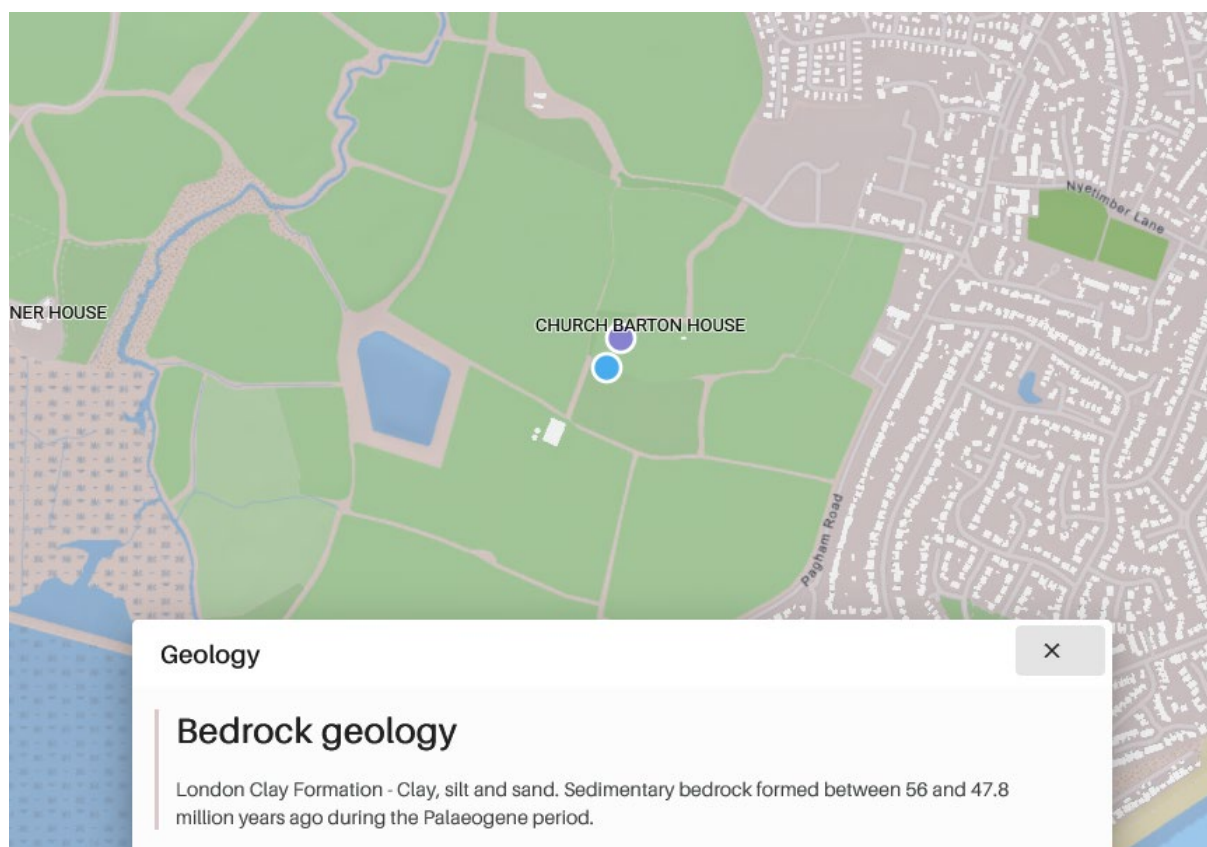
2 Executive Summary:

- 2.1.1 Surface water will be discharged into the existing ditch located within the proposed development site. Surface water runoff will be attenuated on site within three attenuation ponds and discharged into the existing ditch at a combined restricted flow rate of 12.9 L/s. The proposed surface water drainage network has been designed to accommodate the 1 in 100-year storm event, with a 45% allowance for climate change and an additional 10% allowance for urban creep. The proposed connections into the existing ditch will be subject to an Ordinary Watercourse Consent application.
- 2.1.2 Foul water will be discharged into the approved foul water drainage network located on the neighbouring site. This connection will be subject to approval by Southern Water under a Section 106 agreement.

3 Site Geology

3.1 British Geological Survey information

- 3.1.1 The British Geological Survey confirms the bedrock geology to be made up London Clay Formation- Clay, silt and sand. The BGS website confirms the superficial deposits on site to be made up of River Terrace Deposits- Sand, silt and clay.
- 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 SZ89NE5 (Located approx. 260m North of the site) – Ground geology (Clay, Sand, Sandstone , Clay.)
- 3.1.3 The Borehole Logs can be found in **Appendix B**.



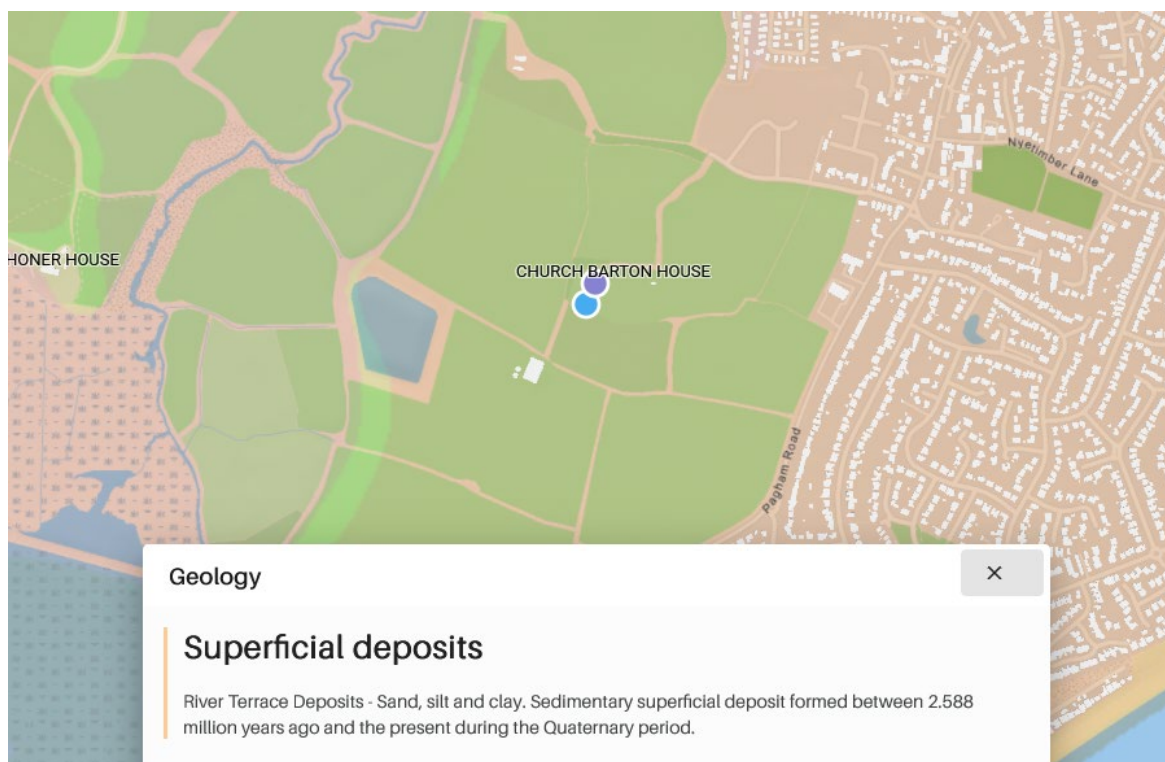


Fig 2. British Geological Survey

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

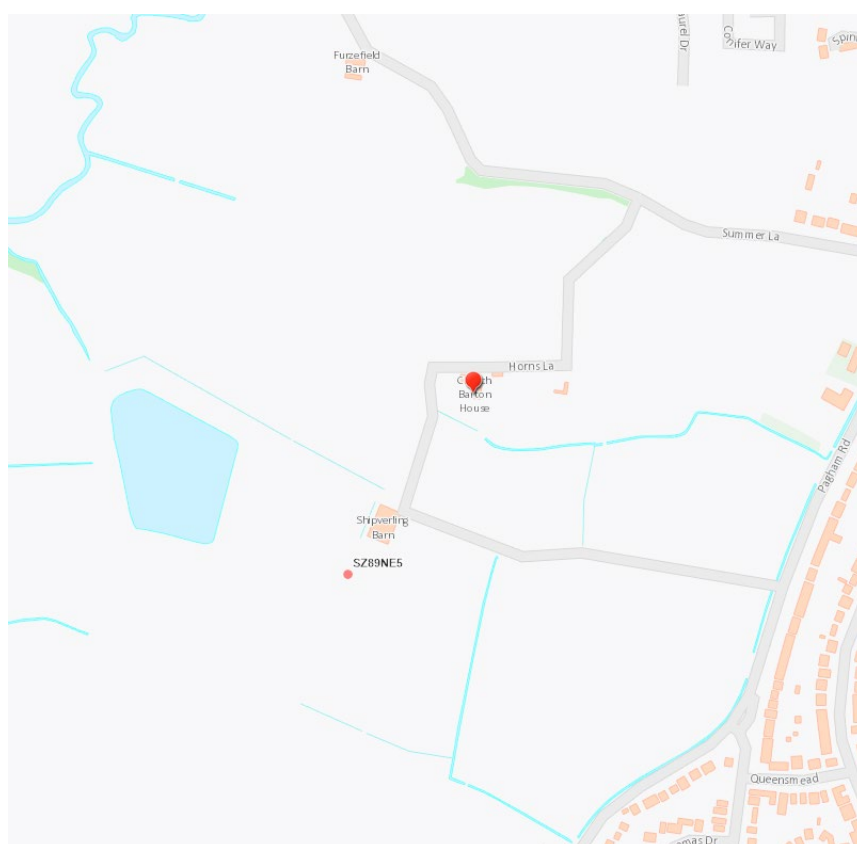


Fig 3. British Geological Survey

Snippet from BGS Website showing the Historical Borehole Log location

3.2 Geological Assessment

- 3.2.1 The site investigation report was undertaken by FORGE Environmental Management Ltd in June 2025. The report confirmed that two of the three trial pits excavated for soakaway testing failed to demonstrate adequate infiltration performance, while one trial pit achieved an infiltration rate of 3.99×10^{-6} m/s, representing the worst-case viable result. The investigation also confirmed the presence of a high winter groundwater table, with groundwater encountered at depths of less than 1.0 m below ground level during testing.
- 3.2.2 Winter groundwater level monitoring was undertaken by Constructive Evaluation Company, with the report prepared in March 2019. Five windowless sampling boreholes were installed to a maximum depth of 4.0 m below ground level. Groundwater monitoring was carried out between October 2018 and April 2019 to determine winter groundwater conditions at the site. The peak groundwater level recorded during the monitoring period was 0.55 m below ground level, measured in March.

Church Barton Farm		FIRST PHASE - 2017-2018							
		15/12/2017		09/01/2018		16/02/2018		19/04/2018	
		08:30:00		09:00:00		09:15:00		13:15:00	
	GL to ToP	DTW from ToP	DTW from GL	DTW from ToP	DTW from GL	DTW from ToP	DTW from GL	DTW from ToP	DTW from GL
WS01	0.28	2.09	1.81	1.29	1.01	1.14	0.86	1.25	0.97
WS02	0.29	2.11	1.82	1.19	0.90	1.09	0.80	1.23	0.94
WS03	0.40	2.65	2.25	1.38	0.98	1.08	0.68	1.35	0.95
WS04	0.00								
WS05	0.00								

SECOND PHASE 2018-2019											
24/10/2018		15/11/2018		13/12/2018		16/01/2019		15/02/2019		13/03/2019	
17:35:00		09:00:00		08:30:00		08:30:00		08:00:00		08:00:00	
DTW from ToP	DTW from GL	DTW from ToP	DTW from GL	DTW from ToP	DTW from GL	DTW from ToP	DTW from GL	DTW from ToP	DTW from GL	DTW from ToP	DTW from GL
3.30	2.90	3.13	2.73	2.51	2.11	1.69	1.29	1.25	0.85	1.15	0.75
3.65	3.25	3.50	3.10	3.04	2.64	1.72	1.32	1.23	0.83	1.12	0.72
3.92	3.42	3.79	3.29	3.46	2.96	2.29	1.79	1.48	0.98	1.17	0.67
N/A	1.60	N/A	1.24	N/A	0.77	N/A	0.90	N/A	0.70	N/A	0.55
N/A	1.85	N/A	1.49	N/A	0.90	N/A	1.07	N/A	0.85	N/A	0.85

- 3.2.3 The ground investigation report (extracts) and winter groundwater level monitoring report can be found in **Appendix C**.

4 Existing Drainage

- 4.1.1 It is not currently known how surface water runoff from the existing building is discharged. However, taking into account the high groundwater levels, the presence of clay soils, and the location of ditches on and adjacent to the site, it is presumed that runoff from the existing building roof areas is directed into the existing ditch located to the south of the building.

Fig 4. Existing ditches on site locations



Snippet from Environment Agency Statutory Main River Map

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	YES - The proposed dwellings will be equipped with 1,500-litre rainwater harvesting tanks, providing a total of approximately 50 rainwater harvesting units for water reuse across the development.
Discharge to Ground	NO - Due to the recorded high groundwater levels during the winter groundwater monitoring.
Discharge to Watercourse	YES – all surface water runoff from the site will be discharged into the existing ditch at a combined restricted discharge rate of 12.9 L/s. This discharge rate accords with Arun District Council guidance of 3.0 L/s per hectare, based on the proposed development site area of 4.3 ha.
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
CV Winter and Summer	1
Additional Storage (m ³ / ha)	0.0
Maximum Rainfall (mm/hr)	75
Additional Area (A %) Urban Creep	10%

5.3 Surface Water Drainage

- 5.3.1 Based on the information obtained from the Combined Desk Study and Interpretative Site Investigation Report prepared by FORGE, together with the Winter Groundwater Level Monitoring Report prepared by Constructive Evaluation, it is confirmed that, due to high groundwater levels encountered on site infiltration is deemed not viable. It is therefore proposed that all surface water runoff will be attenuated on site via the proposed attenuation ponds and lined permeable paving. The attenuated runoff will be discharged into the existing watercourse located on site along the south-eastern boundary at a combined restricted flow rate of **12.9 L/s**. This discharge rate is in accordance with Arun District Council guidance of 3 L/s per hectare, based on the proposed development site area of 4.3 ha.
- 5.3.2 The proposed drainage network will incorporate rainwater harvesting tanks, bioretention planter systems, lined permeable paving, and attenuation ponds, all designed to accommodate the 1 in 100-year storm event with a 45% allowance for climate change and an additional 10% allowance for urban creep.
- 5.3.3 All surface water will be stored in three attenuation ponds lined with impermeable geomembrane, each of which will have a direct connection to the existing ditch. The ponds are designed with restricted discharge flow rates as follows: Pond 1 – 5.0 L/s, Pond 2 – 5.0 L/s, and Pond 3 – 2.9 L/s. Each pond has side slopes of 1:3, with steeper slopes of 1:2 used where space is constrained. Pond depths will range from 1.6 m to 2.0 m. To ensure safety around the ponds, protective railings will be installed around each pond with access for the maintenance.

- 5.3.4 The drainage strategy demonstrates that during the 1% AEP (1 in 100-year) rainfall event, including an allowance of 45% for climate change and 10% for urban creep, a minimum freeboard of 300 mm is maintained between the maximum water level within each attenuation pond and the finished floor levels of the proposed buildings. Accordingly, the proposed development will not result in an increased risk of flooding to the site or to off-site receptors.
- 5.3.5 The proposed bioretention planters are designed to intercept the first 5 mm of rainfall where appropriate, providing additional water treatment and reducing the volume of runoff entering the attenuation ponds. The inlets to the planters are positioned higher than the outlet pipes to ensure effective flow control. The bioretention planters deliver both biodiversity and water management benefits, whilst incorporate native planting to attract pollinators, enhance structural diversity, and improve ecological connectivity across the site. They also slow, filter, and temporarily store surface water runoff.
- 5.3.6 As part of the proposed private drainage network around each dwelling, a rainwater harvesting tank is included to facilitate the reuse of rainwater. The rainwater tank locations have been optimised based on rainwater pipe routing, resulting in a total of approximately 50 rainwater harvesting tanks across the development.
- 5.3.7 Proposed Drainage Plan, Contributing Area Plan, Exceedance Flow Routes, Proposed Surface Finishes and Levels, Exceedance Flow Routes, Typical Construction Details, Greenfield Runoff 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
- 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	Surface Water	Very Low	0.2	0.2	0.05
Individual driveways, residential car parks and low traffic roads	Surge water	Low	0.5	0.4	0.4

5.4.11 The SuDS mitigation index will be obtained from Table 26.3 (for surface water) of the SuDS manual.

Table 26.3 from SuDS manual. Indicative SuDS Mitigation Indices for discharges to surface waters.

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

Table 26.4 Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS Components	Mitigation Indices		
	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	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)	Bioretention Planters System	0.8	0.8	0.8
Individual driveways, residential car parks and low traffic roads	Surface water	Table 26.3 (for surface waters)	Permeable Pavement/ Pond	0.7+ 0.7	0.6 + 0.7	0.7 + 0.5

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 Foul water will be discharged into the foul water drainage system on the neighbouring site, where the drainage scheme was approved under planning application **P/49/25/DOC**.

5.5.2 The proposed foul water connection will be subject to approval under a Section 106 agreement with Southern Water.

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 is not feasible, temporary surface water drainage during the construction phase will be managed by a system of land drains with runoff pumped into the existing ditch. The discharge will be controlled to prevent flooding and siltation, with appropriate pollution control measures (including silt traps and settlement tanks) installed in accordance with the CIRIA SuDS Manual (C753) and CIRIA C532 guidance.
- 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 Summary and Conclusions

- 6.1.1 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 65 residential dwellings with associated access, parking, and landscaping.
- 6.1.2 The Surface Water will discharge into the existing ditches located within the proposed development site. Surface water runoff will be attenuated on site within three attenuation ponds and discharged into the existing ditch at a combined restricted flow rate of **12.9L/s**. The proposed surface water drainage network has been designed to accommodate the 1 in 100-year storm event, with a 45% allowance for climate change and an additional 10% allowance for urban creep. The proposed connections into the existing ditch will be subject to an Ordinary Watercourse Consent application.
- 6.1.3 The Foul water will discharge into the foul water drainage system on the neighbouring site, where the drainage scheme was approved under planning application **P/49/25/DOC**. This connection is to be agreed under S106 application with Southern Water.
- 6.1.4 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.
- 6.1.5 A maintenance schedule has been written up for the drainage network including the SuDS features and can be found within Appendix E.