



Consulting Civil Engineers

Foul and Surface Water Drainage Report

Prince Albert, Copthorne

For

Westcoast Developments Ltd

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 Prince Albert, Copthorne.
- 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 public house with associated car park and pub garden to the side and rear. The proposed development will consist of the erection of convenience store and 2 no. residential dwellings with associated vehicular crossing and car parking area. The proposed development is located as OS Grid Reference TQ 31302 39398 and has the post code RH10 3RE.

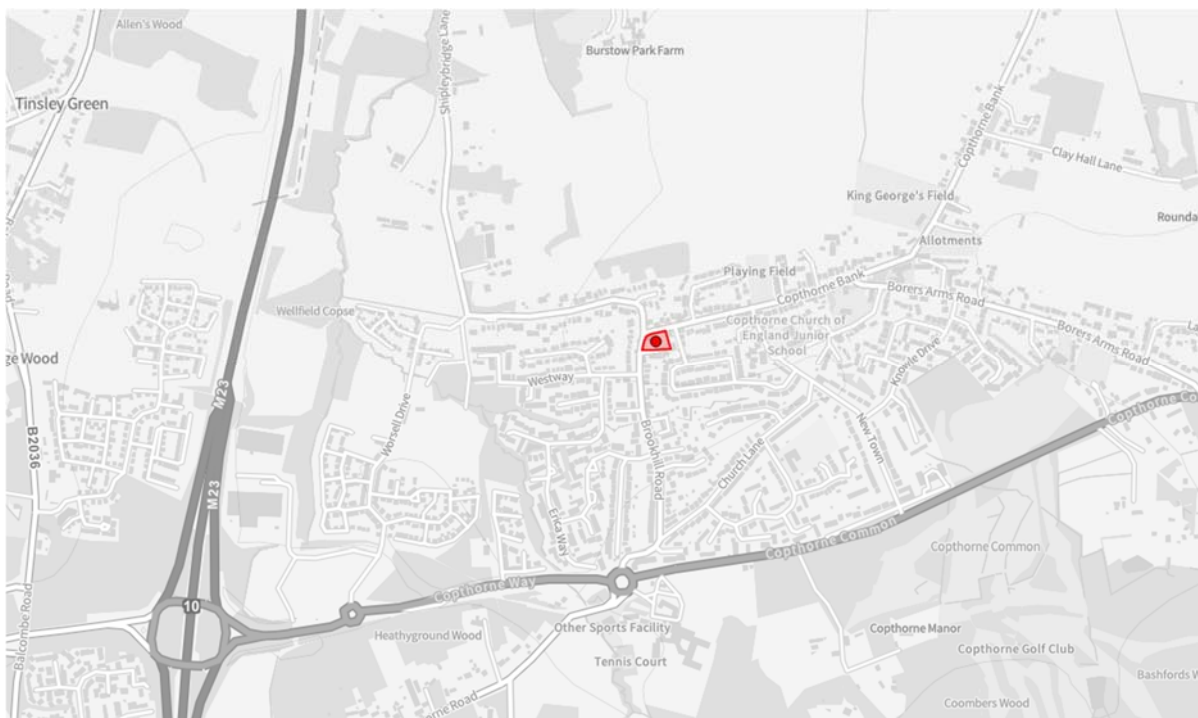


Fig 1. Site Location

- 1.1.4 The Proposed Site Plan can be found at Appendix A.

2 Executive Summary:

- 2.1.1 Surface water runoff will be discharged into the ground via shallow infiltration. Surface water runoff from the roof areas will be collected and discharged into the onsite geocellular soakaways, while all hard paved areas will be designed to freely drain into the ground using porous construction.
- 2.1.2 If infiltration is confirmed to be unfeasible for traditional soakaways, surface water runoff from the proposed roof areas will be attenuated and discharged into the onsite combined sewer. The proposed discharge rate is to be restricted to 1 l/s for the residential dwellings and 1 l/s for the new commercial building (2l/s in total).
- 2.1.3 The foul water will discharge to the existing onsite combined drainage prior to being discharged into public sewers. This connection is subject to Thames Water approval 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 with Upper Tunbridge Wells Sand – Sandstone and Siltstone, Interbedded soils. 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 TQ33NW49 (Located approx. 1000m East of the site) – Ground geology (Sand layer underlain by Silt, Clay and Silty Sand)
 - Borehole TQ33NW44 (Located approx. 600m South of the site) – Ground geology (grey mottled shaley silty Clay)
 - Borehole TQ33NW110 (Located approx. 1000m West of the site) – Ground geology (Sand, Gravel, Siltstone)

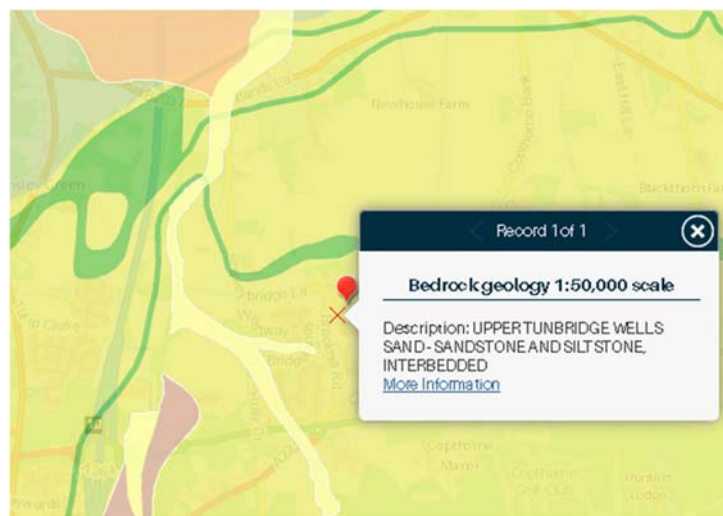


Fig 2. British Geological Survey

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

3.2 Geological Assessment

- 3.2.1 No intrusive ground investigation has been carried out. However, it is noted that surface water runoff from the existing site currently discharges partially into the ground and partially into the public foul sewers. Based on this, it is presumed that infiltration may be possible. Nevertheless, considering the site's geology and underlying clay soils, low to moderate infiltration rates should be expected.
- 3.2.2 The underground soil infiltration rate has been assumed based on the CIRIA report C753, table 25.1, which indicates a typical infiltration rate of 1×10^{-5} – 5×10^{-5} m/s for slightly silty, slightly clayey sand soils.
- 3.2.3 An assumed infiltration rate of 4.5×10^{-5} m/s has been used for soakaway and permeable paving calculations. An onsite infiltration test, following the BRE365 method, will be required to confirm the actual infiltration rates.
- 3.2.4 If infiltration is confirmed to be unfeasible, surface water runoff will be attenuated and discharged into the existing onsite combined sewers.
- 3.2.5 The BGS Historical Borehole Logs can be found at Appendix B.

4 Existing Drainage

- 4.1.1 Based on the CCTV Survey information it is confirmed that surface water runoff from the existing site is partially discharged into the ground via infiltration and partially into the onsite combined sewers.
- 4.1.2 The existing drainage CCTV Survey can be found at Appendix C.

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	Water butts proposed for residential dwellings
Discharge to Ground	Based on assumed infiltration rate of 4.5×10^{-5} m/s
Discharge to Watercourse	N/A – no existing watercourses located in close proximity to the proposed development.
Discharge to Surface Water Sewer	N/A – no surface water sewers available
Discharge to Other Sewer	If infiltration is confirmed to be unviable for surface water discharge, surface water runoff will be attenuated and discharged into the existing onsite combined sewers at a restricted rate of 2 l/s, 1l/s for residential buildings and 1l/s for commercial building. This connection is subject to an agreement with Thames Water.

5.2 Proposed Hydraulic Calculation Specifications:

Table 2. SuDS Hierarchy

Hydraulic Calculations Settings:	
Rainfall Methodology	FEH-22
Volumetric Run-off Coefficient Cv	1.0
CV Winter and Summer	1.0 / 1.0
Additional Storage (m ³ / ha)	0.0
Flow Control	n.a
Attenuation Tank Design	Base Coefficient (m/hr): 0.162
	Side Coefficient (m/hr): 0.162
	Factor of Safety: 2
	Porosity: 95%
	Time to Half Empty (mins): 125

- 5.2.1 It should be noted that the proposed soakaways are designed to serve only the surface water runoff from the roof areas. No discharge from the hard paved areas will be connected to the proposed soakaways. This, along with the proposed catchpit manholes and access chambers for maintenance located on both sides of the geocellular soakaway, will result in a low risk of siltation. Therefore, the same infiltration rate has been applied to both the base and sides of the soakaway.

5.3 Surface Water Drainage

- 5.3.1 Based on information gathered from the British Geological Survey (BGS) website and the CCTV survey, which confirms that surface water runoff from the existing site is partially discharged into the ground via infiltration and partially into the existing onsite combined sewers, it is presumed that infiltration may be a feasible method for surface water runoff management.
- 5.3.2 Due to the presence of soils with good infiltration potential at shallow depths, it is proposed that all surface water runoff be discharged into the ground via infiltration at an assumed rate of **4.5 x 10⁻⁵ m/s**. The underground soil infiltration rate has been assumed based on CIRIA report C753, table 25.1, which indicates a typical infiltration rate of **1 x 10⁻⁵ – 5 x 10⁻⁵ m/s** for slightly silty, slightly clayey sand soils. All infiltration units are to be located within the top soil layers and will not be deeper than **1.4m** below ground level (BGL).
- 5.3.3 All roof areas are to be collected into a positive drainage network before being discharged into the ground through a geocellular soakaway. Hard paved areas are to be freely drained into the ground using porous construction. All infiltration features on site are designed to accommodate a 1-in-100-year storm event plus 45% for climate change. An onsite infiltration test following the BRE365 method will be required to confirm the actual infiltration rate of the soil.
- 5.3.4 If infiltration is confirmed to be unfeasible for traditional soakaways, surface water runoff from the proposed roof areas will be attenuated and discharged into the onsite combined sewer. The proposed discharge rate is to be restricted to **1 l/s** for the residential dwellings and **1 l/s** for the new commercial building.
- 5.3.5 Based on the drainage calculations, the proposed attenuation tank (AT1) serving the proposed residential dwelling will need to provide 8.5 m³ of storage, while the second attenuation tank (AT2) serving the proposed commercial building will need to provide 26.5 m³ of storage. Both tanks are designed to discharge at a rate of **1 l/s** to effectively manage the surface water runoff from the proposed development.
- 5.3.6 If shallow infiltration test results indicate low potential for infiltration, all hard paved areas will be lined and discharged into the onsite drainage network before being discharged into the public sewers. The overall surface water runoff discharge from the proposed development will be restricted to **2 l/s**.
- 5.3.7 Proposed Drainage Strategy Plans and Hydraulic calculations for both infiltration and attenuation can be found at Appendix D. The proposed Maintenance Schedule can be found in Appendix F.
- 5.3.8 EA Magic maps can be found in 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
 - Commercial Roof
 - 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/Commercial Roof	Ground Water	Very Low	0.2	0.3	0.05
Car park and Low Traffic roads	Ground water	Low	0.5	0.4	0.4
Commercial yard	Ground water	Medium	0.7	0.6	0.7

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
Residential/Commercial Roof	Ground Water	Table 26.4 (for ground waters)	Soakaway with min. 300mm deep soil beneath	0.4	0.3	0.3
Car park and Low Traffic roads	Ground water	Table 26.4 (for ground waters)	Permeable Pavement	0.7	0.6	0.7
Commercial yard	Ground water	Table 26.4 (for ground waters)	Permeable Pavement	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 The foul water will discharge into the local foul water sewer, re-using the existing onsite drainage system. The existing onsite network will need to be diverted to avoid clashes with the proposed residential dwellings. The foul water discharge will be connected into the existing drains via gravity.
- 5.5.2 Based on the total of 2 residential dwellings and a commercial building, the flow rate has been calculated as follows:
- **Dry Weather Flow (DWF) Rate:** $2 \times 4000 / 86,400 = 0.092 \text{ l/s}$
 - **Peak flow rate** (assuming a peak factor of 6): $0.092 \times 6 = 0.55 \text{ l/s}$ for the residential units.
 - **Commercial building peak flow rate:** Based on the number of DU units or the actual m² proposed, calculated at 0.12 l/s peak flow rate.
 - **Total discharge:** 0.77 l/s peak flow.
- 5.5.3 The existing on-site combined drainage is classified as a private sewer, so no Section 185 application is required. Diversion works can be undertaken under Building Regulations requirements.

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 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 Summary and Conclusions

- 6.1.1 CGS Civils has been instructed by to produce a Drainage statement under National Planning Policy Framework (NPPF) to support the Planning Application for erection of convenience store and 2no. residential dwellings with associated access and car park.
- 6.1.2 The Surface Water will discharge to the ground based on an assumed infiltration rate of 4.5×10^{-5} m/s. An onsite infiltration test following the BRE365 method will be undertaken to confirm the actual infiltration rates. If infiltration is confirmed to be unfeasible and the use of traditional soakaways is not possible, surface water runoff will be attenuated and discharged into the existing onsite combined sewers at a restricted discharge rate of **2 l/s** in total. A new connection will need to be agreed upon with Thames Water.
- 6.1.3 The Foul water will discharge into the existing onsite private sewers. The existing sewer will be diverted and upgraded to adequately serve the proposed development.
- 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.