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96 Green Lane
Buxton
SK17 9DJ
Tel 01298 71761
07973 711589
enquiries@structech.co.uk

SuDS analysis and drainage statement for works at land to rear of Hallsteads Dove Holes

Following an analysis in the Flood Risk assessment by Morgan Tucker (see Appendix A) it is recommended that the surface water is all dealt with via infiltration.

As there are no watercourses in the immediate vicinity this infiltration will negate the requirement for water attenuation.

The houses will each go to their separate soakaways as designed in BRE Digest 365 or similar. The drives will either be permeable or more likely have channel drains to prevent any water running onto the main road area (see Photograph 1 in Appendix A). In this way the only water in the road drains will be collected off the main road and footpath area.

The main road drainage will all lead down with 225 diameter pipes to Surface Water Manhole 6 as shown in Drawings No's 0106Road1 Rev C , 0106Road2 Rev C and 0106Road3 Rev A as attached.

From manhole S6 the water will be taken to a soakaway system at the edge of the quarry in an area shown in Photograph 2 (Appendix A). At all times any drains not running under roads will have an agreed easement for possible future access over the top. The ground will be tested to ensure it is sufficiently permeable and then the water will discharge via the soakaway system or via soakaway and swales at the bottom of the quarry floor. This detail will be in accordance to the details given in Appendix A and agreed with the Highways Authority during the reserved matters application.

S F Wherry

S. F.Wherry B.Sc.(Civ.Eng.), FCABE, MRaPS

CONSULTANT STRUCTURAL ENGINEERS & SURVEYORS

PROJECT MANAGERS

CDM CO-ORDINATORS

Appendix A

Proposals for surface water drainage for new site at Hallsteads, Dove Holes, Buxton

Photograph 1

Photograph 2

5 MITIGATION MEASURES

5.1 Flood Risk

5.1.1 The Environment Agency Flood Map and information gathered through site investigations and other enquiries suggest that the site is located within Flood Zone 1, an area which has a low probability of flooding i.e. land having a less than 1 in 1000 year annual probability of river flooding in any year (0.1%).

5.2 Surface Water Drainage Strategy

5.2.1 The standard requirement for the Environment Agency is that the drainage flow from the developed site in a 1 in 100 yr Event (+ an allowance for Climate Change) does not exceed the existing Greenfield run-off rate.

5.2.2 The development proposal consists of approximately 58 dwelling houses and associated infrastructure, such as access roads

5.3 Proposed Surface Water Drainage Methodology

5.3.1 In accordance with Part H of the Building Regulations (Rainwater Drainage, H3);-

> *"....(3) Rainwater from a system.....shall discharge to one of the following, listed in order of priority:*
> *(a) An adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable,*
> *(b) A watercourse; or, where that is not reasonably practicable,*
> *(c) A sewer."*

5.3.2 Desktop research on the British Geological Survey website (www.bgs.ac.uk) has been undertaken and it is believed that the site consists of Monsal Dale Limestone Formation bedrock geology. **Figure 3** refers:

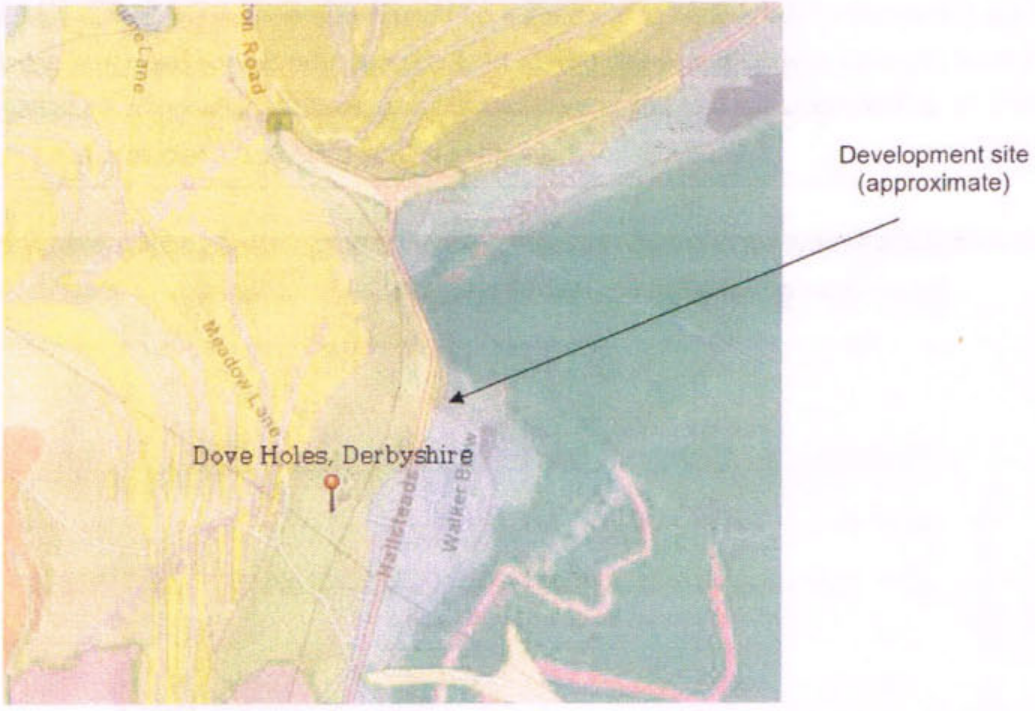


Figure 3 – Geology
(Source: British Geological Survey Website 2012)

5.3.3 Monsal Dale Limestone Formation is expected to have good permeability, allowing water to enter the water table slowly.

5.3.4 Therefore, initial appraisals suggest some of the ground conditions may be suitable for infiltration techniques. To ensure the soakaways or similar are sized accordingly to accommodate proposed development flows, they will need to be designed in accordance with Part H of the Building Regulations and BRE 365 and/or as swales utilising appropriate SuDS techniques.

5.3.5 This is of course subject to obtaining suitable infiltration rates on the site through further ground investigation / percolation testing, and subject to confirmation that there are no ground contamination issues associated the site, where the use of infiltration techniques would introduce a pollution pathway from the contamination to a sensitive receptor.

5.3.6 If due to poor percolation results or adverse contaminated ground conditions, the infiltration techniques suggested above are shown to be unsuitable, then in accordance with the hierarchy

shown in **5.3.1** above, the surface water runoff from the dwelling houses will be attenuated at source to an existing greenfield run-off rate (storage for 1 in 100 years plus Climate Change) through the use of small-scale attenuation facilities, and the outfalls directed to a watercourse. (i.e. all drainage would be kept at or above the existing ground surface).

5.3.7 The exact volume will be dependent on a number of factors relating to the type of attenuation facility used, the efficiency of any flow control device, and the efficacy of the facility as a whole.

6 SUMMARY & CONCLUSIONS

6.1 Morgan Tucker Ltd was commissioned by Jalo Enterprises Co. Ltd. to prepare a Flood Risk Assessment (FRA) to support a planning application for an outline planning application for residential development at Land to rear of Hallsteads, Dove Holes, Derbyshire

6.2 This Flood Risk Assessment has been developed based on information provided by the Client, the Level 1 Strategic Flood Risk Assessment and Environment Agency.

6.3 The Environment Agency Flood Map indicates that the development site is categorised as Flood Zone 1 by the Environment Agency.

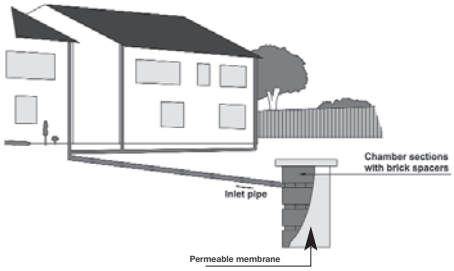
6.4 Residential Development is categorised as 'more vulnerable' development, and this is an appropriate use in Flood Zone 1.

6.5 The new dwellings and associated infrastructure will result in an increase to the site's impermeable area. It is proposed that this will be discharged to infiltration drainage systems designed in accordance with BRE 365 and/or swales utilising Sustainable Urban Drainage Systems (SUDS) techniques.

6.6 Should infiltration techniques prove impracticable dues to poor infiltration rates, or the presence of contaminated ground that might be adversely affected, then surface water run-off will be attenuated at source to an existing greenfield run-off rate (storage for 1 in 100 years plus Climate Change) through the use of small-scale attenuation facilities, and the outfalls directed to a watercourse (i.e. all drainage would be kept at or above the existing ground surface).

6.7 In light of the above, it is considered that the proposed development will be at a low risk of flooding, and it will not exacerbate the risk of flooding to more vulnerable sites downstream.

Soakaways 6.5



Description

Soakaways are square or circular excavations, either filled with rubble or lined with brickwork, pre-cast concrete or polyethylene rings/perforated storage structures surrounded by granular backfill. They can be grouped and linked together to drain large areas including highways. The supporting structure and backfill can be substituted by modular, geocellular units (see Chapter 13). Soakaways provide stormwater attenuation, stormwater treatment and groundwater recharge.

KEY DESIGN CRITERIA

- design to meet site drainage standards – generally 1 in 10 or 1 in 30 year design event
- site infiltration rate assumed for design should be based on appropriate site investigations and should include an appropriate factor of safety
- appropriate pre-treatment is required
- if used, fill material should provide >30 per cent void space
- minimum distance of 1 m from the base to the seasonally high groundwater table
- minimum distance of 5 m from foundations.

ADVANTAGES

- minimal net land take
- provides groundwater recharge
- good volume reduction and peak flow attenuation
- good community acceptability
- easy to construct and operate
- can be retrofitted.

DISADVANTAGES

- not suitable for poor draining soils
- field investigations required to confirm infiltration rates
- not suitable for locations where infiltrating water may put structural foundations at risk, or where infiltrating water may adversely affect existing drainage patterns
- not appropriate for draining polluted runoff
- increased risk of groundwater pollution
- some uncertainty over long-term performance
- possible reduced performance during long wet periods
- where property owner responsible for operation and maintenance, performance difficult to guarantee.

PERFORMANCE

Peak flow reduction:	Good
Volume reduction:	Good
Water quality treatment:	Good
Amenity potential:	Poor
Ecology potential:	Poor

TREATMENT TRAIN SUITABILITY

Source control:	Yes
Conveyance:	No
Site system:	Yes
Regional system:	No

SITE SUITABILITY

Residential:	Yes
Commercial/industrial:	Yes
High density:	Yes
Retrofit:	Yes
Contaminated sites/sites above vulnerable groundwater	No

COST IMPLICATIONS

Land-take:	Low
Capital cost:	Low
Maintenance burden:	Low

POLLUTANT REMOVAL

Total suspended solids:	Medium
Nutrients:	Low
Heavy metals:	Medium

KEY MAINTENANCE REQUIREMENTS:

- removal of sediments/debris from pre-treatment device
- monitoring performance (using observation well).

6.5.1 General description

Soakaways are the most commonly used type of infiltration device in the UK. They store rapid runoff from a single house or from a development and allow its efficient infiltration into the surrounding soil. Drainage from individual properties are often connected to over-sized square or rectangular, rubble-filled voids sited beneath lawns without formal provision for access and inspection.

Where larger systems are required (eg for several buildings or commercial/highway areas), the device tends to be constructed of pre-formed polyethylene or pre-cast concrete rings of between 1 and 2.5 metres in diameter (or other suitable perforated void forming devices) that can be hollow, or filled with rubble, single-sized stone, or plastic high voids media. The hollow, or high voids fill, provides good storage capacity which allows the size of the structure to be minimised. Soakaways can reduce the volume of water that needs to be disposed of by downstream drainage and facilitates groundwater recharge. The time taken for stormwater to exfiltrate through the base and/or sides of the device will depend on the soakaway shape and size, and the infiltration characteristics of the surrounding soil. Modular, geocellular systems are described in detail in Chapter 13, and infiltration trenches, which are a linear soakaway with a high internal surface area are dealt with in Chapter 9.

In bypassing the upper soil layers and decreasing the distance to the water table, there is an increased risk of groundwater pollution. It is important that the source generates water with a low pollutant load or there is appropriate treatment in the system upstream of the soakaway. Depending on the characteristics of the sub-soil, pollution abatement will take place through processes of sedimentation, filtration, bio-degradation and volatilisation. Geotextile layers can also be used for additional trapping of stormwater particulates. Figure 6.5 shows the characteristics of a standard, lined soakaway and pre-treatment device for a typical larger system.

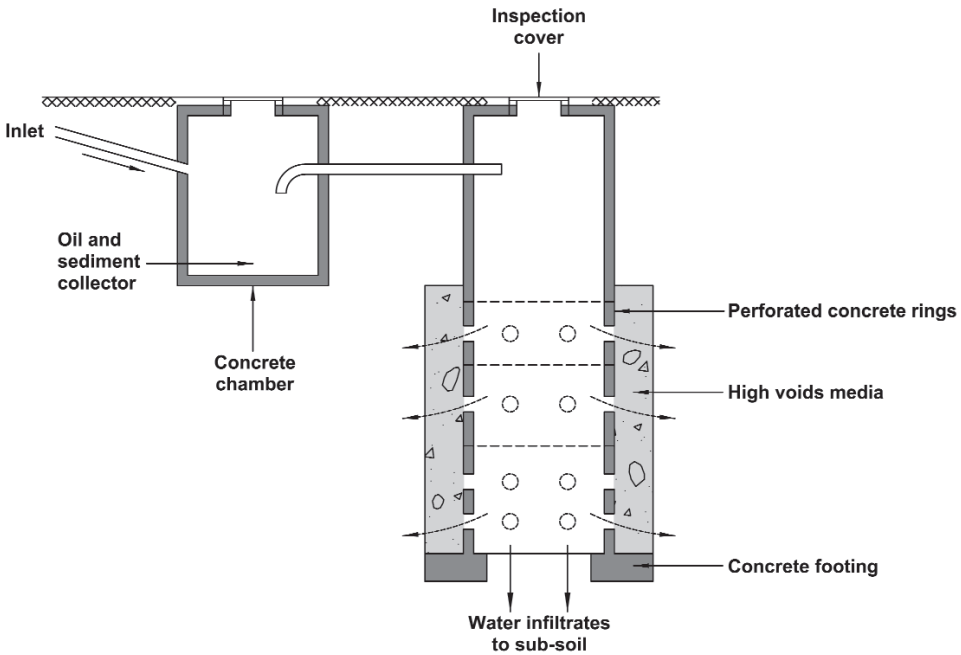


Figure 6.5 *Soakaway details (including a pre-treatment device)*

6.5.2 Selection and siting of soakaways

Soakaways are best-suited to the infiltration of stormwater runoff from small areas such as roofs of residential housing. Provided the runoff is appropriately pre-treated before entering the soakaway, the device can handle stormwater from any impervious

residential and most commercial areas. In general, they are not suitable for draining runoff from pollution hotspots, and only pre-treated roof runoff should be considered for infiltration to sensitive groundwater resources.

The following issues should be considered to ensure the suitability of soakaways at a particular site.

Table 6.6 *Considerations for using soakaways*

Drainage area	Soakaways are often used to drain individual residential properties. However they can be applied as a single large unit or linked group of units to drain a group of houses. They may also be used to drain roads and parking areas (via linked soakaways or infiltration trenches), but greater care is needed to ensure that sediment and pollutant levels are reduced to acceptable levels before passing flow to the device. They can often be retrofitted into existing developments, for small areas such as private driveways and roof drainage. They can also be used to manage overflows from water butts and other rainwater collection systems.
Space required	As a sub-surface infiltration device, a soakaway requires no net land take. They can be built in many shapes and can often be accommodated within high-density urban developments.
Siting	Soakaways should not be used: ♦ within 5 m of a building or road ♦ in an area of unstable land without full consideration of the impact of the infiltrating water ♦ in ground where the water table reaches a level within 1 m below the base of the soakaway at any time of the year ♦ near any drainage field, drainage mound or other soakaway which would result in the overall soakage capacity of the ground being exceeded and the effectiveness of any drainage field impaired ♦ where the risk of contamination in the runoff could result in pollution of groundwater. Soakaways should not be used to drain landscaped or similar areas due to risk of sediment blockage and clogging of the soils surrounding the device.
Site slope and stability	Soakaways should not be sited on unstable ground, and ground stability should be verified by assessing site soil and groundwater conditions. They should not be considered within or over waste fill materials, uncontrolled fill or non-engineered fill. On sloping sites, an assessment should also be made to ensure that infiltrating water will not cause raised groundwater levels and/or waterlogging of downhill areas, and that slopes are not made unstable.
Subsurface soils and groundwater	Where modular systems are designed for infiltration, the seasonally high groundwater table must be more than 1 m below the base of the facility and the design must comply with the environmental regulator's policy on infiltration and groundwater protection. Infiltration design methods are described in Chapter 4. In areas containing contaminated soils or contaminated groundwater, soakaways are not acceptable. Any excavation or earthmoving processes required must be assessed to ensure that mobilisation of contamination does not occur.

6.5.3 Hydraulic and water quality design

Soakaways should be designed to manage storms up to the standard of service required. This is generally the 1 in 10 or 1 in 30 year storm for a house, group of houses or commercial building. As discharge criteria from a development is usually based on a 100 year event, the performance of the soakaways under such conditions needs to be known. For ease of design, this may result in the soakaways being designed to the 100 year event. The impact of flooding in excess of the design event will need to be assessed and floodwater may need to be conveyed safely to downstream drainage components.

The soakaway should discharge from full to half-volume within 24 hours so that sufficient capacity is available to receive runoff from subsequent storms. The procedures outlined in Chapter 4 should be followed for the design of infiltration devices.

6.5.4 Physical specifications

Geometry

With adequate void support, soakaways can be designed to suit any available geometry. Deep soakaways (ie >4 m) will require approval by the environmental regulator.

Materials

Soakaways can be built as simple excavations that are backfilled with high voids media, or excavations supported by storage modules of pre-cast concrete or plastic with holes/perforations that maximise infiltration to the surrounding ground. If infiltration modules are used, these can remain hollow or be filled with high void space material.

Granular material can be separated from the surrounding soil through the use of a suitable geotextile to prevent migration of fines into the soakaway. The migration of fines can cause ground settlement around the soakaway and also cause risks of blockage. The top surface should be protected to prevent the ingress of backfill material during and after surface reinstatement. Characteristics of the geotextile should suit the surrounding soil particle size and permeability. The geotextile should be placed so that it can be cleaned or removed and replaced if it becomes blocked (ie not wrapped around the outside of ring units). Additional detail on suitable geotextile specifications is given in Appendix C.

Soakaways must be of sufficient strength to cater for the loads acting on them, especially where they are required to be traffic bearing.

Material sustainability principles are addressed in Section 3.6.

6.5.5 Design for maintenance and safety

Implementation of the CDM Regulations 1994 and generic health and safety criteria are presented in Sections 2.5.10 and 3.4.2 respectively.

Inspection of the soakaway should be possible. This can either be through an inspection well, where the internal space is filled, or through opening of a cover, where the internal space is left as a void. Inspection access should provide a clear view of the soakaway base (even if filled). For small, filled soakaways, a 225 mm perforated pipe is appropriate. The point of discharge of the drain to the soakaway should be visible, and the access should enable debris and sediments to be cleared from the pit. If pre-formed hollow space soakaways with covers are employed, the cover should either be lockable or only be accessible with special keys.

6.5.6 Pre-treatment/inlets

A sedimentation chamber or equivalent treatment device provided before the inlet to a soakaway will facilitate regular maintenance and reduce the risk of blockage.

6.5.7 Outlets

Overflow of excess stormwater can be via a piped outlet/overflow or through the top of the soakaway, if considered necessary. Provision should be made for storms in excess of the design event via overland flood routing or temporary local surface storage areas.

6.5.8 Landscaping and vegetation

Soakaways attract roots of plants that grow in their vicinity. This is, to a certain extent, an advantage as plant roots take up water from the facility and roots provide additional openings in the surrounding soil for water to infiltrate. However, too vigorous root intrusion into backfilled soakaways, especially from larger shrubs and trees, should be kept in check as they can fill a significant percentage of the void space of these devices and can cause structural damage.

6.5.9 Operation and maintenance requirements

The useful life and effective operation of a soakaway is related to the frequency of maintenance and the risk of sediment being introduced into the system. An easement should be considered where multiple properties discharge to a single soakaway, to ensure long-term access for maintenance purposes.

Operation and maintenance requirements for soakaways are described in Table 6.7.

Table 6.7 *Soakaway operation and maintenance requirements*

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove sediment and debris from pre-treatment devices and floor of inspection tube or chamber.	Annually.
	Cleaning of gutters and any filters on downpipes.	Annually.
	Trimming any roots that may be causing blockages.	Annually (or as required).
Occasional maintenance	–	–
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs.	As required.
	Replacement of clogged geotextile.	As required.
Monitoring	Inspect silt traps and note rate of sediment accumulation.	Monthly in the first year and then annually.
	Check soakaway to ensure emptying is occurring.	Annually.

Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal for large systems or in public environments. If maintenance is not undertaken for long periods, deposits can become hard-packed and require considerable effort to remove.

Replacement of the void fill will be necessary if the device becomes blocked with silt. Monitoring will give information on changes in infiltration rate and provide a warning of potential failure in the long-term.

Roads and/or parking areas draining to soakaways should be regularly swept to prevent silt being washed off the surface. This will minimise the need for ongoing maintenance.

Maintenance responsibility should be placed with an appropriate organisation and maintenance schedules should be developed during the design phase. Implementation of the CDM Regulations 1994 and generic health and safety criteria are presented in Sections 2.5.10 and 3.4.2 respectively. Maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken.

6.5.10 Construction requirements

Soakaways should not be used for untreated drainage from construction sites, where runoff is likely to contain large amounts of silt, debris and other pollutants.

Perforated, pre-cast concrete ring soakaways should be installed within a square pit, with side dimensions about twice the selected ring diameter. The need to oversize the soakaway pit for purposes of constructing the ring unit chamber may be used to advantage by incorporating the total excavation volume below the discharge drain invert in the design storage volume (BRE, 1991).

Some, otherwise permeable soils and soft rocks (eg chalk), can have their permeability significantly reduced by smearing of the surface during excavation, especially by mechanical diggers. It is recommended that the exposed surface of the soil is manually cleaned of any smearing before the geotextile and granular fill surrounding the chamber are installed.

Implementation of the CDM Regulations 1994 and generic health and safety criteria are presented in Sections 2.5.10 and 3.4.2 respectively. Soakaways should always be constructed using safe construction methods. Additional information on construction and programming of construction activities is provided in Chapter 21.