Drainage and SUDS Statement

Land East of Ugley Village Hall, Ugley

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Introduction

This Drainage and SUDS Statement has been prepared to support the full planning application of 16no. proposed new dwellings, Land to the East of Ugley Village Hall, Ugley. The proposed development can be seen on drawing 596 x PL00 (Appendix A).

The aim of this statement is to identify any potential flood risks and to propose any necessary mitigation measures, as well as propose new SUDS features and the drainage design for the proposed development. This statement is to be read in conjunction with the Flood Risk Assessment provided by Base Energy 7th November 2023. Given that the site is larger than 1.0ha, a flood risk assessment is required to support the application.

Site Details
The site is 1.05ha in area, the site was previously used as a gravel pit.

The topographical survey (Appendinx B) of the site shows that the site slopes inwards in a bowl like shape towards the centre of the site. Highpoints are around the perimeter of the site and range between 88.65 AOD to the South of the site and 91.24 AOD towards the North. The low points to the centre of the site are 87.08 AOD.

Relevant Policies
The site is situated within the district of Uttlesford, therefore the policy and guidance from then Essex County Council Lead Local Flood Authority, Uttlesford Local Plan and the National Planning Policy Framework apply to this development proposal.

National Planning Policy Framework
The NPPF states that innapropriate development in areas at risk of flooding should be avoided by directing development away from areas at high risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account advice from the environment agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

Uttlesford Local Plan
The Uttlesford Local Plan states that surface water disposal from new developments is the responsibility of the developer. Surface water disposal must, where practicable take place on the site using appropriate and acceptable methods, including soakaways. New connections must not pose an unacceptable threat of surcharge, flooding or pollution. Surface water must not be allowed to drain to the foul sewer as this is the major contributer to sewer flooding.

Essex County Council Lead Local Flood Authority
Essex County Council LLFA became a statutory consultee on all major developments in regard to surface water drainage on 15th April 2015. In the sustainable Drainage Systems Design Guide 2020, it is stated that to assist local planning authorities in their determination of an application as to whether their prior approval is required for a change of use of agricultural buildings, or a change from office to dwelling houses in an area at risk of flooding, the applicant should provide with their application an assessment of flood risk. This should demonstrate how the flood risks to the development will be managed so that it remains safe through its lifetime. Major developments include one or more of the following:

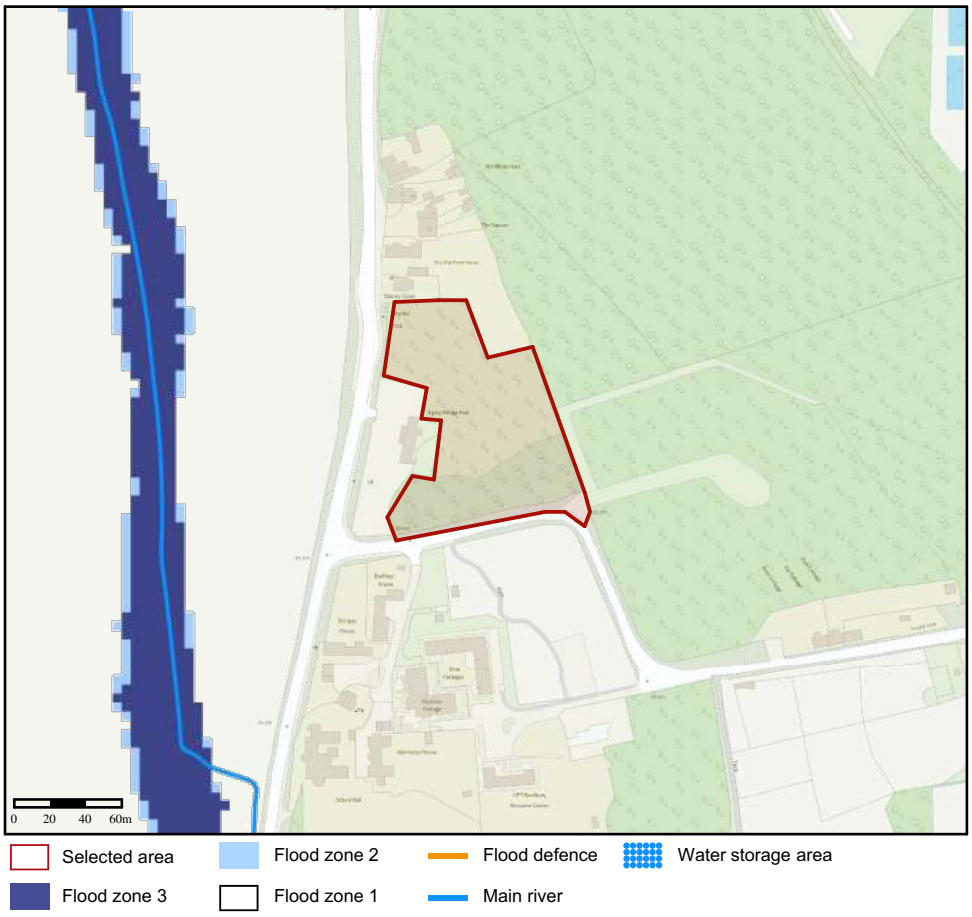
1. The winning and working of minerals or the use of land for mineral-working deposits
2. Waste development
3. The provision of dwelling houses where
   i) the number of dwellings to be provided is 10 or more
   ii) the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within subparagraph 3i)
4. The provision of a building or buildings where the floor space is to be created by the development is 1,000 square metres or more
5. Development carried out on a site having an area of 1 hectare or more

The Sustainable Drainage Systems Guide forms the local standards for Essex and, together with the National Standards, strongly promotes the use of SuDS to help reduce surface water runoff and mitigate flood risk. It also strongly promotes the use of SuDS as they greatly benefit:

Water quality – SuDS can help prevent and treat pollution in surface water runoff, protecting and enhancing the environment and contributing towards Water Framework Directive objectives.
Amenity – SuDS can have visual and community benefits for the community.
Biodiversity – SuDS can provide the opportunity to create and improve habitats for wildlife, enhancing biodiversity, and enable multi-functional green infrastructure.

Flood Risk Assessment

Fluvial Flooding
According to the Environment Agency, fluvial flooding occurs when waterways such as rivers, streams or brooks overflow their banks into surrounding areas, which is most likely to happen following periods of intense rainfall and will become more frequent as a result of climate change. As shown on the Environment Agency Flood Map for Plannig as below, the site is within flood zone 1. The closest water course is shown to the East of the site which is in excess of 150m away from the site. The flood map also indicates that the site is not located in an area that benefits from flood defenses. Therefore the site is considered to be at low risk of fluvial flooding.

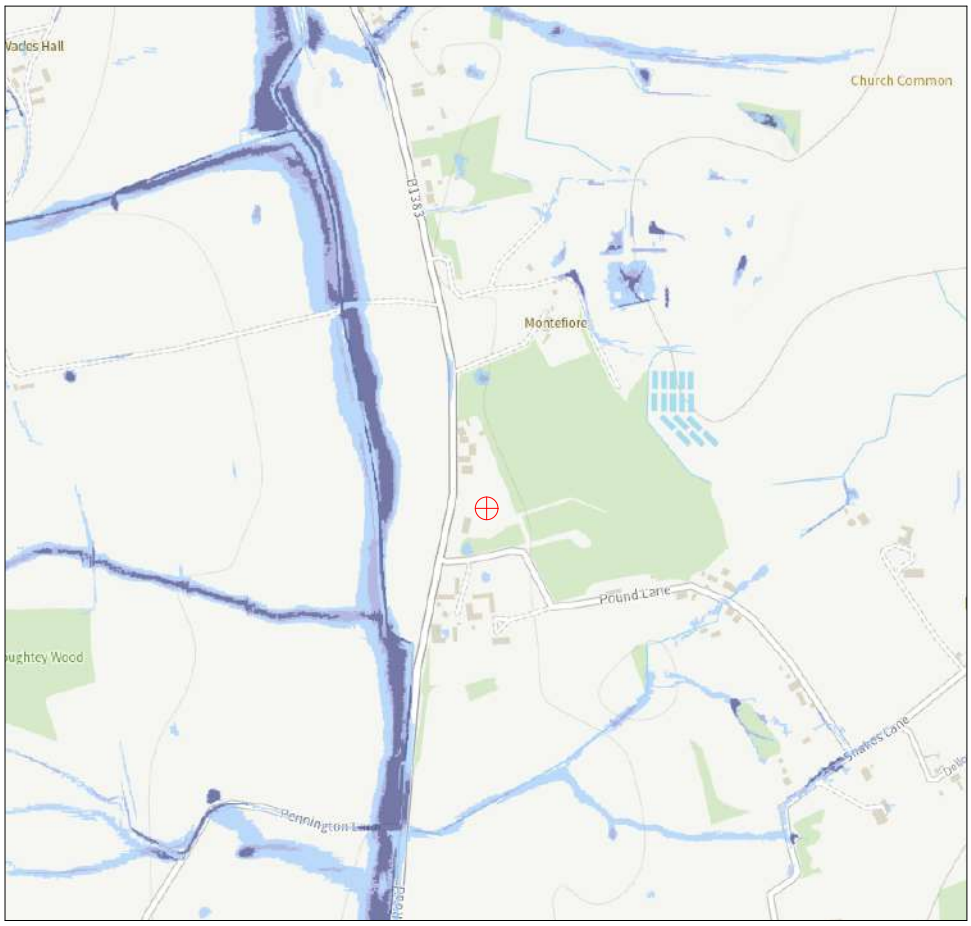


Groundwater Flooding
As stated by the Enironment Agency, groundwater flooding occurs when water levels in the ground rise above the sruface levels. It is most likely to occur in areas underlain aquifers, which are permeable rocks such as chalk or sandstone for example. The Base Energy FRA references the British Geological Survey maps and states that the site is underlain by Glaciofluvial Deposits, Mid Pleistocene - Sand and Gravel. Further site investigation has determined that the site is made up of well draining soil (Appendix C). The soil conditions encountered in the proposed soakaway location were sandy gravel. The test results show an infiltration rate of $3.05x10^{-4}$, which is typical of what would be expected of the soil type on site, as indicated in the table below.

Typical infiltration coefficients based on soil texture (after Bettess, 1996)		
Soil type/texture	**ISO 14688-1 description (after Blake, 2010)**	**Typical infiltration coefficients (m/s)**
Good infiltration media		
▪ gravel	Sandy GRAVEL	$3 \times 10^{-4} – 3 \times 10^{-2}$
▪ sand	Slightly silty slightly clayey SAND	$1 \times 10^{-5} – 5 \times 10^{-5}$
▪ loamy sand	Silty slightly clayey SAND	$1 \times 10^{-4} – 3 \times 10^{-5}$
▪ sandy loam	Silty clayey SAND	$1 \times 10^{-7} – 1 \times 10^{-5}$
Poor infiltration media		
▪ loam	Very silty clayey SAND	$1 \times 10^{-7} – 5 \times 10^{-6}$
▪ silt loam	Very sandy clayey SILT	$1 \times 10^{-7} – 1 \times 10^{-5}$
▪ chalk (structureless)	N/A	$3 \times 10^{-8} – 3 \times 10^{-6}$
▪ sandy clay loam	Very clayey silty SAND	$3 \times 10^{-10} – 3 \times 10^{-7}$
Very poor infiltration media	–	
▪ silty clay loam	–	$1 \times 10^{-8} – 1 \times 10^{-6}$
▪ clay	Can be any texture of soil	$< 3 \times 10^{-8}$
▪ till	described above	$3 \times 10^{-9} – 3 \times 10^{-6}$
Other		
▪ rock* (note mass infiltration capacity will depend on the type of rock and the extent and nature of discontinuities and any infill)	N/A	$3 \times 10^{-9} – 3 \times 10^{-5}$

Flood Risk Assessment

Surface Water Flooding
According to the Environment Agency, surface water flooding occurs when heavy rainfall overwhelms the drainage capacity of the local area, which is more diffucult to pinpoint than fluvial flooding. The Environment Agency Risk of Flooding from Surface Water map is used to indicate which are at risk from surface water flooding. As shown below, the site is regarded as very low risk.



Sewer flooding
As stated by the Enironment Agency, sewer flooding occurs when sewers are overwhelmed by heavy rainfall or when they become blocked. The likelihood of flooding depends on the capacity of the local sewage system. The Base Energy FRA states that there are no known records of sewer flooding at the site location. In order not to contribute to the risk of sewer flooding, the drainage design of the development will be utilising infiltration techniques. This will mean no increase in surface water run off entering the public sewer.

Surface Water and SUDS

Existing Site Run-off rates
The Base Energy FRA includes theoretical run off rates from the existing site. Within the existing site, all land slopes to a low point within the middle of the site. All test holes (5 in total) showed sand and gravel for the entire depth (please note that the site was previously a gravel pit). It is considered that the existing run-off rate of the site is close to zero.

Surface Water Run-off from Redeveloped Site
As previously stated, the proposed development is for 16no. dwellings, including 6no. affordable dwellings, with garages to the market housing and associated driveways and landscaping. Of the 1.05ha area of the site, the impermeable areas are shown below, with the rest of the site being permeable materials and green spaces:

Roof Areas	1,476m²
Access Road	1,323m²
Total Impermable Areas	**3,069m²**

SUDS Design
Due to the contouring of the site, and the high inflitration rate of the ground, the drainage proposals for the development aim to use SUDS features to discharge surface water via infiltration with zero run-off. The SUDS features are shown on the proposed drainage layout (Aappendix E) and consist of the following:

Filter Strip - The surface water from each plot will discharge into the ditches which run alongside the road within the site. The surface water run off from the road will also discharge into the ditches via low maintenance kerb gaps. The ditches will act as filtration as well as infiltration , allowing pollutants to settle and filter out.

Wetland - The ditches will discharge any excess water which hasnt been infiltrated into the soil into the wetland plateau. The plateau has been positioned towards the lowest area of the site and makes use of contouring to enable the excess storage of surface water run-off if required.

Swale - The swale, with reed bed, is to aid the wetland in storage before infiltration and will also act as further filtration in aid of the filter strips.

Soakaway - The soakaway is to sit directly below the plataeu as shown on the drainage layout. Any surface water from the swale will enter the soakaway via a silt trap / swirl chamber to catch any final polluants. The soakaway has been sized approprately according to the soakaway calculations as shown (Appendix D).

Permeable Paving - Permeable paving to the rear patios and gravel driveways will mean these do not contribute to the area of impermeable hardstanding and can allow surface water to infiltrate into the ground.

The soakaway has been designed with a capacity to store all surface water to achive a run-off rate of zero. The other suds features proposed, not only provide sufficient means of filtration, but will also provide an additional 205m³ of extra storage. As well as this, due to the high infiltration rate of the site, it is estimated that the surface water within the site will have fully discharged via infiltration before reaching the soakaway.

Filtration
The Sustainable Drainage Systems Design Guide for Essex states that a well designed SUDS network and treatment train should incorporate treatment from all sources of pollution, including rooftops. As shown on the drainage design (Appendix E), all surface water, including from rooftops is chanelled first into the filter strips which run alongside the road, before reaching the wetland and swale and reed bed. These features provide substantial filtration qualities (as shown in the table below), before finally reaching the soakaway via the silt trap / swirl chamber.

Pollution Mitigation
The table below shows the identified pollution hazard indicies and the mitigation indices of the proposed SUDS features. The table below excludes the the use of the swirl chamber from the mitigation proposals, however the swirl chamber will also aid in the filtration process.

Pollution Mitigation Proposals

Pollution Hazard Indices			
Type of SUDS Component	Total Suspended Solids	Metals	Hydrocarbons
Residential Roofs	0.2	0.2	0.05
Low Traffic Roads	0.5	0.4	0.4

Mitigation Indices			
Type of SUDS Component	Total Suspended Solids	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Wetland	0.8	0.8	0.8
Swale	0.5	0.6	0.6

Surface Water and SUDS

Calculations for Drainage System

Pipe Sizes for Individual Houses - From the provided soakaway calculations (appendix D), the worst case inflow (5 minute storm duration) for the site catchment area of 3,069m² is **61.27m³**.

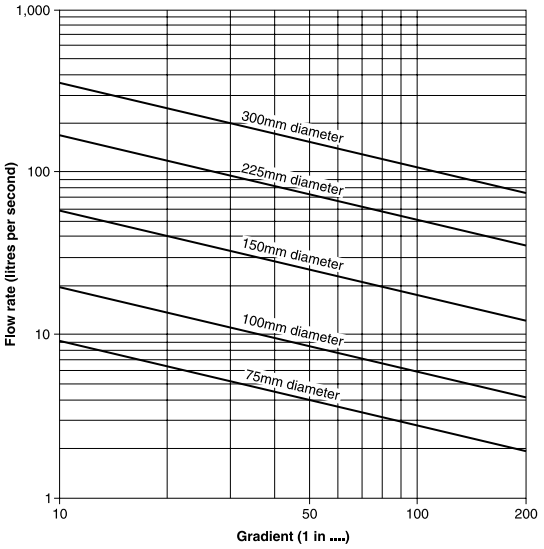
$$\frac{61.27 \times 1000}{5 \times 60 \times 3069}$$

= 0.06655 litres/second/m²

The largest roof area draining to a single 150mm diameter pipe is **172m²**

total flow = 172 x 0.06655 = **11.5l/s**

From Building Regulations Approved document H3, diagaram 3 (shown beside) shows a 150mm diameter pipe laid at a fall of 1:60 will give a flow of 24l/s and is therefore deemed sufficient for the worst case scenario.



Pipe Sizes for Culverts - Maximum catchment area draining into final culvert (marked as C3) is **1,270m²**.

1,270m² at a flow of 0.06655 l/s/m² gives a total maximum flow of **99.825 l/s**.

From Building Regulations Approved document H3, diagaram 3 (shown beside) shows a 300mm diameter pipe laid at a fall of 1:80 will carry 130 l/second therefore deemed sufficient for the worst case scenario.

To allow for silting up between maintenance periods, a 450mm diameter pipe is to be provided at C3, as shown on the drainage layout drawing.

Soakaway Storage Volume Requirements - The soakaway has been designed with a length of 60m, a width of 1.2m and a depth of 1.6m giving a total storage volume of **115.2m³**.

Referring to the provided soakaway storage calculations (appendix D), the capacity needed for a 1 in 100-year storm event plus a 1.4 climate change allowance is **83.69m³** therefore the proposed storage provided is adequate.

50% of the storage capacity will need to be available within 24 hours of a 1 in 30-year storm event plus climate change. The calculations for the soakaway show that the total drain down time for the soakaway after a 1in 100-year storm event is is **0.51 hours**. So the soakaway can in fact accommodate a second 1 in 100-year storm event after less than one hour after the first 1 in 100-year storm event, therefore the soakaway can successfully achieve a half drain down time within 24 hours of a 1 in 30-year storm event.

Due to the sufficient storage capacity and fast drain down time of the soakaway, the 1 in 1-year and 1 in 30-year storm events have not been calculated as this has been deemed unnecessary.

Surface Water and SUDS

Maintenance
The Essex County Council SUDS Design Guide states that a surface water drainage scheme should include a stringent maintenance plan to ensure that the features will work at optimum levels throughout the lifespan of the development. Without this maintenance, the reliability and efficiency of the drainage network will be affected and consequently the risk of flooding and damage to the surrounding environments will be dramatically increased. Therefore, a maintenance plan detailing what maintenance is needed, who will undertake the work, and at what frequency the work will be carried out should be provided.

The SUDS features being proposed for the site have also been considered for their ease of maintenance qualities. Maintenance and upkeep will be performed by a private management company in order to keep a high standard of operation, individual homeowners will not be responsible for the individual upkeep of any drainage system within the site. As the SUDS and drainage features are incorporated into the landscaping design of the site, maintenance and upkeep of both the SUDS and the overall landscaping can simultaneously be handled by the employed managament company resulting in no extra time or cost of operation. The proposed drainage and SUDS design is not proposed to be adopted.

Filter strip - Filter strips will require regular maintenance for optimal performance. According to the CIRIA SUDS Manual (C753) 2015, the maintenance of filter strips is relatively straightforward for landscape contractors and the same mehtods for maintenance as typical public open space. The most typical form of maintance to perform on filter strips is mowing to keep grass lengths at 75 - 150mm across the treatment surface. Regular inspection and removal of sediment is also required.

Low maintenance Kerb Gaps - The kerb gaps have been proposed in place of traditional road gulles. An example of these kerb gaps are shown in the Essex SUDS Design Guide 2020 having been used at Beaulieu Park, Chelmsford (see photographs below). The kerb gaps are being proposed as opposed to traditional road gullies. The kerb gaps can easily be swept and kept clear of debris and other materials to ensure no blockages.

Images of kerb gaps constructed at Beaulieu Park, Chelmsford - Images courtesy of ECC SUDS Design Guide 2020

Swales - Similar to filter strips, the maintenance of swales is relatively straightforward for landscape contractors and the same methods for maintenance as typical public open space. regular inspection and maintenance can be performed alongside landscaping upkeep operations. The swale proposed on site is within public realm with open access. Litter and debris removal should always be performed prior to mowing to retain grass lengths to 75 - 150mm across the main treatment surface. Sediment can be removed once deposits exceed 25mm in depth.

Wetland - Once again the maintenance of the wetland will be straightforward and can be implented into the regular operations of the management company. While being sympathetic to to the requirements of any wildlife, litter and debris can be removed intermittently. With the presense of wildlife, operation of maintenance should take into account habitats and breeding and nesting seasons of target species. Maintenance can be carried out during September to October.

Soakaway and Silt Trap - Maintenance on the soakaway and silt trap will be undertaken to remove excess sediment buildup and to ensure there is no risk of blockages.

All grass clippings, derbis and litter will be removed from site and disposed of.

Surface Water and SUDS

Construction and Drainage Implementation

Typically the construction of the drainage layout and infrastructure will commence during the initial phases of the build. While the proposed SUDS features can be implemented on site during the earthworks phase, adequate provision wil be made to ensure any silt deposits are cleared during the operations of construction and remedial and refurbishment works will be carried out throughout the construction. The final finishes and soft landscaping of the SUDS features will be completed during the final phases of the programme to ensure sediment from construction vehicles does not make its way into the system.

Construction access - The construction access will be the first activity that will disturb the land. Care will be taken to not damage infiltration surfaces or any valuable trees. Any designated buffer zones or natural hydrological features will also be protected. Trees will be protected according to BS 5873:2012 and no activity that compact the root zone will be allowed within the designted root protection area.

Sediment Basins and Traps - Will be installed before any major site groundworks will take place. As the works progress, furher sediments traps and silt fences will be installed as necessary in order to keep sediment contained at appropriate locations.

Runoff Control Measures - These will be used in conjunction with sediment traps to divert water around planned earthworks and to remove silt. Any surface water runoff from upstream will be diverted around any disturbed areas prior to groundwork operations. Perimeter drains will be installed with stable outfalls vefore opening major areas up for development. Additional runoff control facilities will be implemented as necessary during the construction process.

Main Runoff Conveyance System - Inlet protection for surface water drains will be installed as soon as the system in functional. Outlet protection will also be installed.

Clearing and Groundworks - This will take place once adequate erosion and sediment control measures have been implemented. Once the site area is cleared, earthworks will commence immediately so that protective groundcover can be establised quiuckly and areas will not be left bare or exposed for extended periods.

Surface Stabilisation Measures - These will be implemented to any completed areas, channels, ditches and other disturbed areas after the land is cleared and profiled. Stabilisation measures will take place on any areas where active construction does not take place for more than 60 working days. After final profiling, permanent stabilisation measures will be installed. During extreme weather conditions, permanent vegeation measures will be delayed until a more suitable installation time, and temporary seeding or mulching will be implements where necessary.

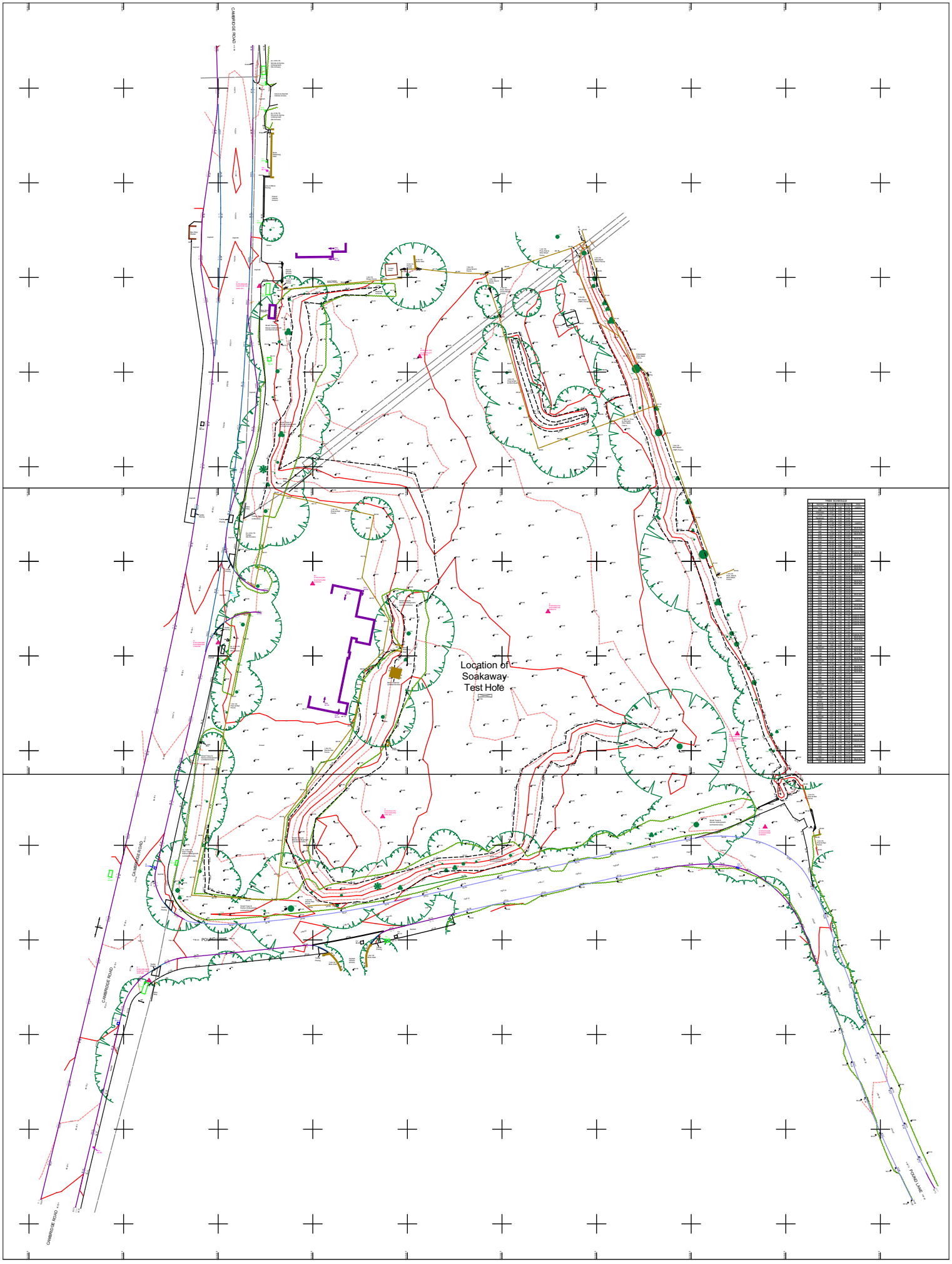
Landscape Works and Final Stabilisation - This will be implemented during the final stages of construction. All disturbed areas on site will have permanent stabilisation measures applied. Any unstable sediments will be removed from basins and traps and incorporated into the topsoil where possible. Once areas have been stabilised, any temporary structures will be removed and borrow and disposal areas will be permanently vegetated. At this stage, any rehabilitation measures will be undertaken as necessary to ensure the SUDS components operate as designed.

Conclusion

Based on the site analysis, the grounnd is made up of well draining material and surface water drainage can be succesfully achieved by filtration. The proposed drainage design has included a variety of SUDS features which will aid in the infiltration of surface water run off, as well as pollution mitigation. Based on the calculations, the drainage design, is shown to operate surplus to requirements.

Appendicies
Appendix A - Site as Proposed
Appendix B - Existing Topography
Appendix C - Percolation Test Results
Appendix D - Soakaway Calculations
Appendix E - Proposed Drainage Layout


6.429
6m


Location of
Soakaway
Test Hole
CAMBRIDGE ROAD
POUND LANE

Percolation Test Results - BRE 365

Site Information	
Site Location	Land East of Ugley Village Hall, Ugley
Date of Test	16/02/2024
Name of Assessor	W.I. Bampton

Test Hole	
Observed Soil Type	Very Gravelly Sand
Test Hole Depth	2.9m
Test Hole Length	2.8m
Test Hole Width	0.6m
Invert Level	Assumed 0.8m Below Ground Level

Volume Outflowing Between 75% and 25% Full
2.8 * 0.6 * (1.575 - 0.525) = 1.764m³

50% surface area of sides only (assumning base may stiff up)
(2.8 * 1.05 * 2) + (0.6 * 1.05 * 2) = 7.14m³

Time to Empty Between 75% and 20%
13.5 minutes

Soil Infiltration Rate
1.764 / (7.14 * 13.5 * 60) = 0.000305 (3.05×10^{-4})

	Depth (m)	Description	Legend
		Topsoil	
	0.3	Very Gravelly Sand	
	2.9		

Soakaway Design - BRE 365

Catchment Details	
Catchment Area	3069m²
Location	Ugley
City / Town	Bishop's Stortford
M5-60	20
r Ratio	0.42
Runoff Coefficient	100%

Design Storm Details	
Return Period	100 Years
Climate Change Allowance	1.4

Ground Information	
Infiltration Rate	1.08 m/hr

Soakaway Design	
Length	60.00m
Width	1.20m
Effective Depth	1.60m
Backfill Porosity	94%

Results

Storm Duration	Z1	Z2	Rainfall	Inflow	Outflow	Storage Required	%
5	0.38	1.88	19.96	61.27	8.81	52.46	48.4
10	0.53	1.91	28.42	87.21	17.63	69.58	64.3
15	0.64	1.93	34.63	106.28	26.44	79.84	73.7
30	0.81	1.96	44.50	136.56	52.88	83.69	77.3
60	1.00	2.00	56.00	171.86	105.75	66.11	66.1
120	1.20	2.02	68.01	208.71	211.51	0.00	0.0
240	1.42	2.02	80.17	246.05	423.01	0.00	0.0
360	1.57	2.00	88.11	270.42	634.52	0.00	0.0
600	1.74	1.99	96.99	297.67	1,057.54	0.00	0.0
1440	2.16	1.96	118.56	363.88	2,538.09	0.00	0.0

Maximum Storage Volume Required:	83.69 (30 min Storm)	
Storage Volume Provided:	115.2m³	Acceptable
Time of Emptying:	0.51 Hours	Acceptable


Power Cables to be Re-routed
C1
C2
C3
Wetland - With Swale and Reed Bed, and Soakaway Beneath