Report for

Drainage and FRA

relating to an

Outline Planning Application

for proposed Commercial Development

of B1, B2 and B8 uses

6th August 2020

1 Introduction

1.1 Summary of requirements

To undertake a Flood Risk Assessment (FRA) and preparation of outline Drainage Strategy to support an Outline Planning Application for a proposed commercial development on land south of Blackburn Road, Longridge, PR3 2YJ

1.2 Policy Background and aims

1.2.1 The National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG) set out Government policy aims on development and flood risk for England. The aim is to ensure flood risk is taken into account at all stages of the planning process, to avoid inappropriate developments in areas at risk of flooding, and to direct development away from areas of highest risk.

1.2.2 This FRA is site specific and will consider the following:-

- The flood risk to the proposed development and whether it could be appropriately designed such that any residual flood risk to either the development, or its users, would be acceptable.
- The potential impact of the proposed development on flood risk elsewhere and whether it could be designed so as not to increase flood risk elsewhere.

2 Local information and description of the proposal

2.1 Location

2.1.1 The site is located to the east of Longridge, Lancashire. The National Grid reference is 361692E 437181N.

2.1.2 A site location plan is included as Location Plan 1.

2.2 Site Details

2.2.1 The site currently comprises of agricultural land to the south of Blackburn Road (B6243). The application site is in a semi-rural area, with Spade Mill Reservoirs to the north, existing commercial development to the west at Higher College Farm with housing, a public house and a school to the east.

2.2.2 The application site is approximately 1.2 ha and comprises one field of meadow/grazing land. The is near level and broadly square set back circa 50m from Blackburn Road and extending circa 100m south. A pond is located in the southwest corner and the field is enclosed by hedgerows and trees.

2.2.3 An existing ditch runs south from the site boundary of the south of the field and the ditch outfalls into a stream approximately 200m south of the application site. The ditch and the stream are indicated on Location Plan 1.

2.3 Outline Planning Proposal

The Indicative Plan attached for the proposed development is for the construction of three blocks of Class B1, Class B2 & B8 industrial use/storage, with associated car parking and infrastructure. Access to the site will be taken from a private access drive from Blackburn Road.

3. Flood Risk Assessment

3.1. Flood Zone Classification

3.1.1. Reference to the online Environment Agency flood mapping shows the site falls within Flood Zone 1, well away from any Flood Zone 2 or 3 areas. Flood Zone 1 comprises land that has a low annual probability of flooding (less than 1 in 1000 (<0.1%) from rivers in any year.

3.1.2. Under the requirements of Planning Practice Guidance (PPG) "Flood Risk & Coastal Change," the Local Authority is required to apply a risk-based sequential test to new developments. This allows them to direct development to areas which are at the lowest probability of flooding.

3.1.3. With reference to Table 2 from PPG, a development consisting of "offices/general industry/storage & distribution" falls into the "Less Vulnerable" category.

3.1.4. Therefore, in accordance with Table 3, the site proposals would be deemed "appropriate" within Flood Zone 1.

3.1.5. There will therefore be no requirement for a Sequential Test or Exception Test to be carried out for this development

3.2. Surface Water Flooding

3.2.1. Attached is an extract of the Environment Agency's surface water flood map which shows that the majority of the development site is not at risk. There is a small area of land in the southwest corner highlighted as "Low Risk". The applicant who has owned the land for many years and farmed the land for much longer has not observed any surface water flooding on the land. Whilst the impacts of any small risk would be considered negligible, it is recommended that any units in this area have a slightly higher finished floor level above the existing ground level.

3.2.2. Surface water associated with the development itself is addressed in more detail in Section 4 below.

3.3. Source protection zones

3.3.1. According to the Environment Agency's latest groundwater designation maps the site lies outside a source protection zone.

3.4. Flooding from other sources

3.4.1. The Environment Agency mapping shows the area at potential risk of flooding from the reservoirs immediately north of the site. The Environment Agency's flood risk from reservoirs map has been reviewed. The reservoirs present a risk to the surrounding area should the embankments fail or be overtopped.

3.4.2. As stated on the Environment Agency website, reservoirs have a good safety record with no incidents resulting in the loss of life since 1925. The Environment Agency act as the enforcing authority for the Reservoirs Act 1974 in England and Wales.

All large reservoirs must be inspected an supervised by reservoir panel engineers. The Environment Agency ensures that reservoirs are regularly inspected and essential safety work is carried out. Given the high standard of maintenance required, flooding from the reservoirs is considered very unlikely.

3.4.3. Review of United Utilities apparatus in the area shows that there are no surface or foul sewers in the area of the proposed development. There is a 27" (675mm) feed from the Spade Mill Reservoir which runs north to south through the site. United Utilities mapping indicates the required easement. This pipeline will be covered by the same maintenance regime set out above for the reservoir and flooding from this pipeline is considered very unlikely.

3.4.4. Review of online aerial and ordnance survey mapping shows no lakes or canals that could be of any risk to the site.

4. Surface Water Drainage Strategy

4.1. The Environment Agency state that in order to demonstrate that the development is of low risk the FRA should show:

- That it will be feasible to balance surface water run-off to the Greenfield run-off rate (or existing run-off rate in terms of brownfield development) for all events up to the 1 in 100 year storm (including a 30% allowance for climate change) and set out how this will be achieved.

- How sustainable drainage techniques (SuDS) will be used with any obstacles to their use clearly justified.

4.2. The primary flood risk generated by the new development is most likely to be the risk posed to by surface water runoff.

4.3. The surface water drainage arrangements for any development site should aspire to be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development.

4.4. For new development, it may be necessary to provide surface water storage and/or infiltration to limit and reduce both the peak rate of discharge from the site and the total volume discharged from the site.

4.5. The Environment Agency require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100 year event) the developed rate of runoff into a watercourse should be no greater than the undeveloped rate of run-off for the same event. (In the case of brownfield sites, drainage proposals will be measured against the existing performance of the site). Water Authorities take a similar approach to that of the Environment Agency, however they ask that flows be restricted to include up to the 3.33% annual probability (1 in 30 year event), whilst demonstrating that the 1 in 100 year event does not pose a threat to the locality (known as designing for exceedance).

4.6. Climate change (CC) will be taken into account by increasing the rainfall intensity by 20% in line with Environment Agency best practice guidelines for commercial development.

5. Site Drainage & Hydrology

5.1. The existing site located east of the settlement of Longridge. As previously discussed, the development site is currently comprised of grassland. Therefore, for the purpose of surface water drainage calculations the site will be treated as greenfield.

5.2. The site has a topography that generally falls in a southerly direction. A site walkover determined that the ditch line which runs from the southern border of the site, eventually outfalls into an open watercourse to the south.

6 Options for Sustainable Drainage Systems

6.1 There are a number of options for the provision of surface water drainage for the proposed development:

- Soakaways for roof run-off and permeable surfacing for car parking and ancillary areas.
- Discharge to local watercourse.
- Discharge to surface water sewer, highway drain or another drainage system.
- Discharge to combined sewer.
- Discharge to adjacent land drains and ponds.

6.2 The first option to be considered for surface water disposal for all proposed development must be infiltration into the ground. Even when there are alternative sewer connections or watercourses available infiltration must still be utilised unless it is proved to be unfeasible. Normally to identify the suitability of the ground for infiltration, percolation testing is carried out to calculate the soil's infiltration potential. Where the underlying soil conditions are relatively impermeable, for example clay, the infiltration rate may be too low for soakaways to be designed to adequately cope with large storm events from the entire site.

6.3 Given the current stage of development no intrusive surveys have been carried out to date. Following a successful outline application and as part of the detailed design process for a reserved matters application, percolations tests will be carried out as part of the ground investigation to identify the grounds infiltration potential.

6.4 Reference to BGS mapping indicates that it would be highly unlikely that infiltration would be appropriate at this site.

6.5 This is also supported upon review of online "Soilscapes Mapping" which indicates the soil is "Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils" with "Impeded Drainage".

6.6 Therefore, until such time that further ground investigation is to be carried out it is assumed that soakaways will not be a viable means of dealing with surface water run-off from the entire site.

6.7 As the next logical preferred hierarchical solution for dealing with surface water run-off from a development is to watercourse, it is proposed to assess if a sustainable solution is achievable into the ditch/watercourse which runs south from the southern boundary of the site.

6.8 As discussed above, the proposed surface water drainage solution should aspire to ensure the run-off rates and volume will be equal to those of the existing site and where possible provide betterment.

6.9 In order to prevent an increase in flood risk to adjacent land and downstream of the site it will be necessary to restrict the surface water discharge from the development to the equivalent QBAR greenfield run-off rate from the site (mean annual greenfield peak flow). The SuDS Manual recommends the use of Report No.124 'Flood estimation for small catchments', Institute of Hydrology for catchments smaller than 50 hectares. The total site area of the development sites is 1.2 ha.

6.10 Given the outline nature of the application the Environment Agency standard advice is to calculate the existing greenfield run-off from the entire developable area of the site. Therefore, for the purpose of this assessment the developable area has been calculated at 1.2 ha. HR Wallingford Greenfield runoff estimation tool has been used to calculate this figure. The results and output are attached. The calculated QBAR rate is 10.73 l/s. The sites drainage strategy should therefore be developed to ensure that a maximum final discharge rate of 10.71 l/s is not exceeded.

6.11 When calculating the final allowable discharge rate from the site's impermeable areas it is important that the QBAR rate is based solely on the proposed impermeable area introduced to the site, not the entire site as the other areas of internal landscaping and porous pavement within the development will still contribute to the total greenfield surface water run-off.

6.12 Whilst taking cognisance of the outline planning stage of the application an assessment has been made of the impermeable areas associated with the proposed development. It will be necessary to readdress these calculations once a final site layout has been agreed. However, for the purpose of this report, this approach is considered sensible and should enable us to identify if a viable and sustainable solution is deliverable.

6.13 The impermeable areas have been calculated and are shown in the Table 1 below.

	Area (m_2)
Total Developable Area	**12,000**
Buildings	**3,888**
Roads (est area incl car parks/footways)	**4,032**
Total Impermeable	**7,920**

Table 1: Impermeable Areas

6.14 Existing greenfield run-off rates and subsequent attenuation requirements will be calculated for these areas. The results and output are attached, with the predicted rates summarised in Table 2 below.

Event	**Existing Run-off (litres/sec)**
Area	7,920 m_2
QBAR	10.73 l/s
1 in 30 yr	18.2 l/s
1 in 100 yr	22.3 l/s

Table 2: Greenfield run-off rates

6.15 Surface water flows from the site's positively drained areas to be restricted to the equivalent QBAR rate 10.73 l/s. This figure will of course be dependent on the final site layout and should therefore be readdressed at detailed design stage.

6.16 The Draft National Standards for Sustainable Drainage Systems cover the whole range of sustainable approaches to surface water drainage management including:

- source control measures including rainwater recycling and drainage.
- infiltration devices to allow water to soak into ground, that can include individual soakaways and communal facilities.
- filter strips and swales, which are vegetated features that hold and drain water downhill mimicking natural drainage patterns.
- filter drains and porous pavements to allow rainwater and run-off to infiltrate into permeable material below ground and provide storage if needed.
- basins and ponds to hold excess water after rain and allow controlled discharge that avoids flooding, and
- Underground storage to hold excess water after rain and allow controlled discharge that avoids flooding.

6.17 Each of the six SuDS approaches listed above are discussed within Table 3 below with reference to their suitability for the proposed development.

SuDS Group	Technique	Suitability	Reasoning
Source Control	Rainwater Harvesting	Yes	Could not feasibly accommodate the full volume of runoff created by the proposed development but would work alongside any SuDS system. Rainwater butts can also be used to reduce run-off and water use.
Infiltration Devices	Permeable Paving	Yes	Certainly an option for private parking areas and possibly roads. Could be used in conjunction with swales / infiltration trenches. Further investigation required
	Infiltration trenches and basins	Unlikely	Unlikely to be a viable but could be used to slow the movement of water down and deal with some run-off at source. Further investigation required
Filtration	Soakaways	Unlikely	Unlikely to be viable but could be used to slow the movement of water down and deal with some run-off at source. Further investigation required.
	Open Swales	Yes	Use for attenuation, evaporation, water quality and slowing water movement down.
	Filter Strips	Possibly	Could be used to slow the movement of water down and subject to further investigation dealing with run-off at source
Retention/ Detention	Basin / Ponds	Yes	Suitable for controlling discharge to watercourse via a piped outfall, evaporation and treatment of run-off.
Underground Storage	Culverts / Tanks / Oversized Pipes	Yes	Suitable for controlling discharge to watercourse or sewer via a piped outfall Adoption and future maintenance should be discussed with Sewerage Undertaker and/or SuDS Approving Body.

Table 3: SuDS Techniques Review

7 Proposed Drainage Strategy – Surface Water

7.1 As previously discussed, until such time the ground investigation is undertaken to formally assess the infiltration potential of the site, it is proposed that surface water drainage from the development will be discharged into the ditch/watercourse to the south of the site

7.2 It is important when designing drainage systems for new developments that a scheme be considered to deal with the first 5mm of rainfall to fall on the site. Around 50% of rainfall events in the UK are less than 5mm and cause no measurable runoff from greenfield areas into receiving waters. In contrast, runoff from a development takes place for virtually every rainfall event. This difference means that watercourses receive frequent discharges with polluted wash off from urban surfaces (hydrocarbons, suspended solids, metals etc). Replication of the greenfield runoff from small events will result in fewer polluted discharges and therefore limit the potential for damaging impacts on the receiving environment. This concept is known as interception and the volume of rainfall required to replicate the event known as Interception Storage.

7.3 The concept of interception storage to prevent any runoff from rainfall depths up to 5mm should therefore be provided. Certain SuDS features such as swales and pervious pavements provide runoff characteristics that reflect this behaviour depending on their design. These will be considered and designed in to the proposed layout at detailed design stage once final volumes are calculated. An estimation of the Interception storage requirements for the outline proposal is calculated to be 81.85 m^3. Rainwater harvesting is also an effective means of attaining the volume requirements and will also be considered as appropriate in tandem with the above techniques.

7.4 Above and beyond the interception storage requirements there are the more intense storms to consider. Attenuation will be required within the system to accommodate the volume of surface water created by restricting the outfall rates to the existing calculated 10.73 l/s equivalent.

7.5 There are a number of options available for attenuating the proposed flows from the development. The storage could be in the form of underground tanks or via detention/retention basins or possibly a combination of both. At detailed design the scheme will be progressed following guidance outlined within the SuDS Manual.

7.6 As the scheme is at outline planning stage, a proposed outline drainage strategy rather than a final solution has been prepared.

7.7 The outline proposal would be to utilise the existing outfall into the watercourse possibly via the existing pond on site, if necessary increasing the ponds size and volume potential. This could be done in combination with online piped storage or via the introduction of an additional wetland area. As previously mentioned, all SuDS techniques will be fully appraised at detailed design stage, however this section of the report simply stands to ensure a sustainable solution is theoretically deliverable.

7.8 The existing pond is approximately 170sqm in area. Combine this with the potential for upstream oversized pipes and an offline wetland/detention basin and it is immediately apparent that there is significant storage/attenuation potential on site. It is also clear that this could be delivered within the constraints of the proposed layout.

7.9 In calculating the proposed run-off at this stage, to ensure robustness, we have assumed the following:-

- **No infiltration** – If this was available then it would significantly reduce surface water run-off from the site.
- **No Rainwater Harvesting / Water Butts** – Suitably designed rainwater harvesting tanks can significantly reduce the volume of run-off and form an integral part of the attenuated system. A carefully designed system may ensure that no run-off from roof areas is experienced up to the 1 in 1 yr event.
- **No storage within swales** – Swales have a combined advantage of providing a volume of storage, flowing the rate at which water enters the downstream system and providing a certain amount of infiltration into the ground.

7.10 Within the analysis it has also been assumed that 100% of the rainwater falling on the proposed impermeable areas enters the system. It is therefore considered that the analysis undertaken is robust. At detailed design stage, and following further ground investigation it may also be viable to propose a porous pavement solution for the roads as well as the driveways.

7.11 In order to comply with Environment Agency requirements, peak rates of run-off will be restricted to the existing greenfield run-off rate and storage will be provided up to and including the 1 in 100yr storm event plus an allowance of 20% increase for climatic change. This is above and beyond the requirements of a United Utilities adopted drainage system which requires storage up to and including the 1 in 30yr storm event. Flows would be restricted by the introduction of a Hydro-brake flow control manhole or similar immediately downstream of the pond outlet and upstream of the outfall in to the ditch.

7.12 HR Wallingford "Surface Water Storage Requirements for Sites" has been used to calculate the various predicted attenuation requirements attached. The results are combined and illustrated in Table 4 below :

	QBAR Storm	1 in 30yr Storm	1 in 100yr Storm
Existing Run-Off (l/s)	10.73 l/s	18.23 l/s	22.31 l/s
Run-off Restriction	Max 10.73 l/s		
Proposed Run-Off (l/s)	10.73 l/s	10.73 l/s	10.73 l/s
Run-off Rate Reduction Compares to Existing	+/- 0.00 l/s	-7.50 l/s	11.58 l/s
Interception Storage			81.85 m^3
Total Storage Required			1240 m^3

Table 4: Existing & Proposed Run-off & Attenuation Requirements

7.13 What the above table shows is that by restricting proposed run-off rates to the existing QBAR Greenfield run-off rates, there are benefits to the run-off rates experienced during more severe storm events.

7.14 It is generally accepted that surface water systems are designed to accommodate the 1 in 30yr + cc event and anything above and beyond that could be allowed to flood the system. This is known as designing for exceedance.

At detailed design it may be possible to arrange the layout so that flood waters above and beyond the 1 in 30yr storage requirement are directed to and maintained within landscaped areas, carriageways and parking areas and route water away from property thresholds both on and surrounding the site. If this is not achievable then it will be necessary to accommodate the full 1240m³ within the drainage network.

7.15 It is also important to note that this system takes no account of the peripheral storage that will be available within the remainder of the proposed drainage network and therefore, notwithstanding the techniques outlined in para 7.9, the storage attenuation requirements will inevitably be less.

Proposed maintenance of SuDS systems.

7.16 It is important during any development process to consider the long term maintenance of the proposed drainage system. The way this is processed will largely depend on how the system is taken forward at detailed design.

7.17 The SuDS will be reviewed and approved by the Local Planning Authority (LPA) in consultation with the Lead Local Flood Authority (LLFA) to ensure it meets the relevant standards. Although approved by both the LPA and the LLFA the SuDS would remain private and be maintained and managed by the land owner in accordance with the SuDS management plan. This plan could also be secured through a suitably worded planning condition.

7.18 It has therefore been demonstrated that a SuDS solution that meets with the requirements of current legislation is deliverable within the constraints of the site and will ensure that flood risk both on and off site will not be exacerbated.

8. Foul Drainage

8.1 As noted in Section 3 above there are no foul sewers at this location. The nearest foul sewer is some 350m from the western edge of the site on Lower Lane in Longridge. Therefore, with a connection to that sewer impractical, the site could be drained via a modern sewage treatment plant with an outfall into the local watercourse. Any such system will be subject to approval and relevant permits from the Environment Agency and consents will need to be approved and granted. It is recommended, as with the surface water drainage, a maintenance agreement is put in place to ensure the plant receives regular checks in line with the manufacturer's guidelines.

8.2 In accordance with British Water Code of Practice – Flows and Loads – 4, the predicted flow are calculated as follows:-
Office/Factory without canteen - 50 l/day
Full time staff – 90 l/day
Assume average 5 No. staff per unit
Total flow = (50x9) + (9x5x90) = 4500 l/day – Equivalent to 30P

8.3 This figure is purely for estimation only and will need to be recalculated following the drafting of the site final site layout.

8.4 Specification and detail of the plant will also be undertaken once a final layout has been agreed. Based on current proposals an example which could be used is a WPL Diamond DMC7 Sewage Treatment Plant is capable of serving up to 35P.

8.5 The treatment plant should be located a minimum of 7m away from any habitable room and located within 30m of a hardstanding area that can be accessed by a HGV.

8.6 Therefore it has been demonstrated that there is a means of dealing with foul drainage from the proposed site.

9 Conclusions of FRA and SuDS analysis

9.1 The Site
The proposed development will include the construction of buildings incorporating 9 new light industrial and industrial/storage units for B1(b,c), B2 and B8 use

9.2 Flood Category
The site is located in Flood Zone 1 with an annual probability of river flooding of 1 in 1000 (<0.1%)

9.3 Sequential Test
With reference to Table 2 from PPG, the development falls within the "Less Vulnerable" category.
From the EA flood zones maps, the site is identified as being in Flood Zone 1
Table 3 of PPG indicates where the proposed land is 'Less Vulnerable,' development is appropriate for Flood Zone 1. Therefore the Sequential Test is not required.

9.4 Exception Test
Table 3 of PPG indicates where the proposed land use is 'Less Vulnerable,' development is considered appropriate in Flood Zone 1 and the Exception Test is not required.

9.5 Flood Risk
Fluvial – Very Low
Tidal – Very Low
Surface Water – Low
Sewers – Very Low
Ground Water – Very Low
Infrastructure Failure (reservoir and pipework) – Low

9.6 Flood Risk Mitigation
None required – Sustainable surface water drainage solution is achievable.

9.7 Geological Layers
The site's geology is likely to have a low to very low permeability and consequently soakaways are unlikely to be feasible.

9.8 Environmental Impacts
The site **is not** located in any of the following: Ground Source Protect Zone Conservation area or SSSI

9.9 Surface Water Drainage
A SuDS solution is deliverable within the constraints of the site which will ensure that there is no increase in surface water run-off during peak storm events. Run-off from the proposed development no greater than the calculated existing QBAR greenfield rate of 10.73 l/s.

The findings of this report are that there are no material flood risks attributable to the outline proposal for development and the drainage strategy has demonstrated that a viable sustainable drainage solution can be delivered within the constraints of the site.
A detailed design of the system, if outline planning is approved, can be submitted as a final scheme layout submitted for a later reserved matters planning application which can be delivered to meet with National Policy, EA regulations, UU requirements, and Local Lead Flood Authority requirements.

Prepared by David Wrigley Planning, 6th August 2020,
the Attached Documents include :

Location Plan 1

Indicative Site Plan

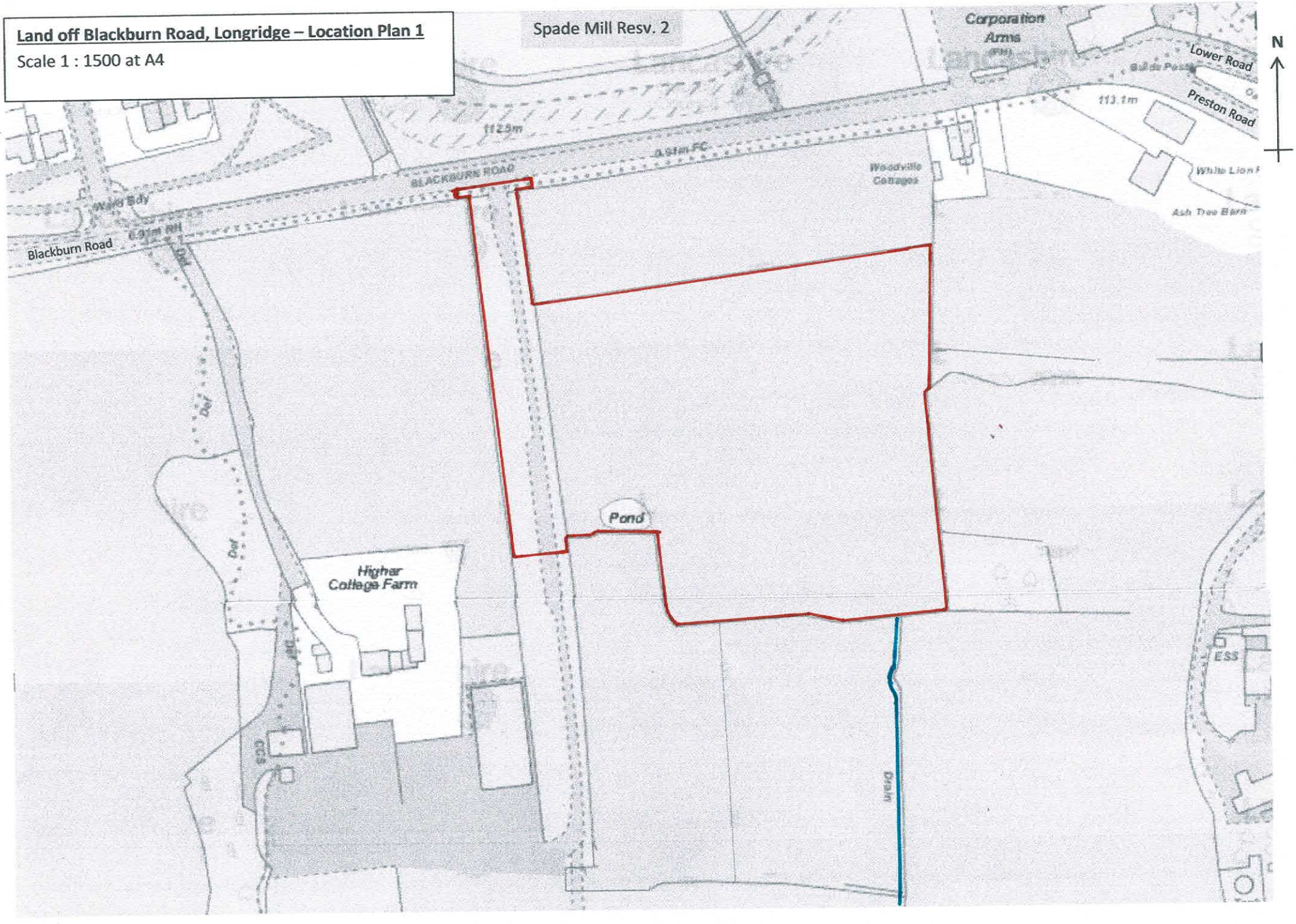
E.A. Surface Water Flood Map (Low Risk)

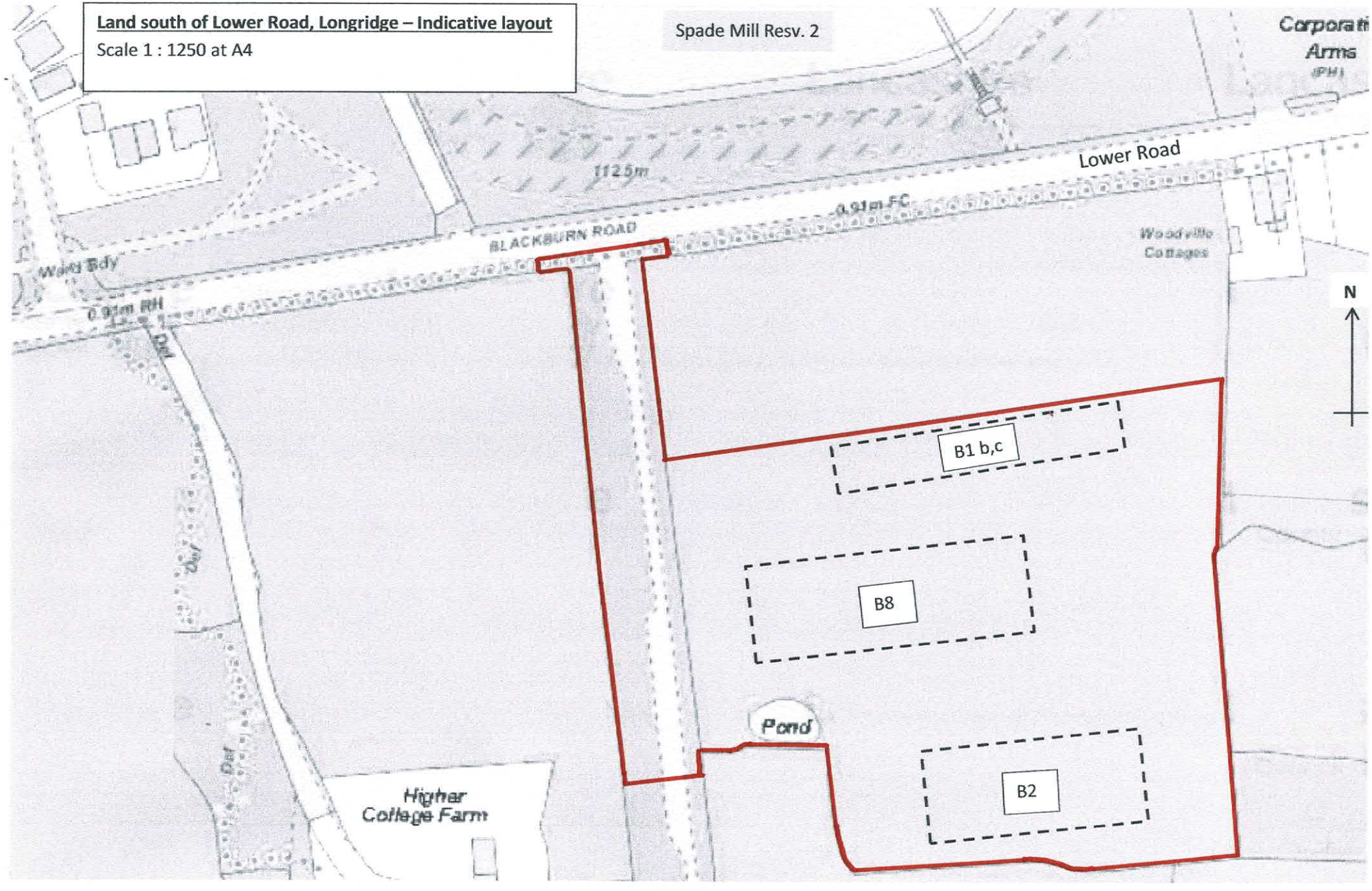
Greenfield Runoff Calculations

Surface Water Storage Requirement Calculations

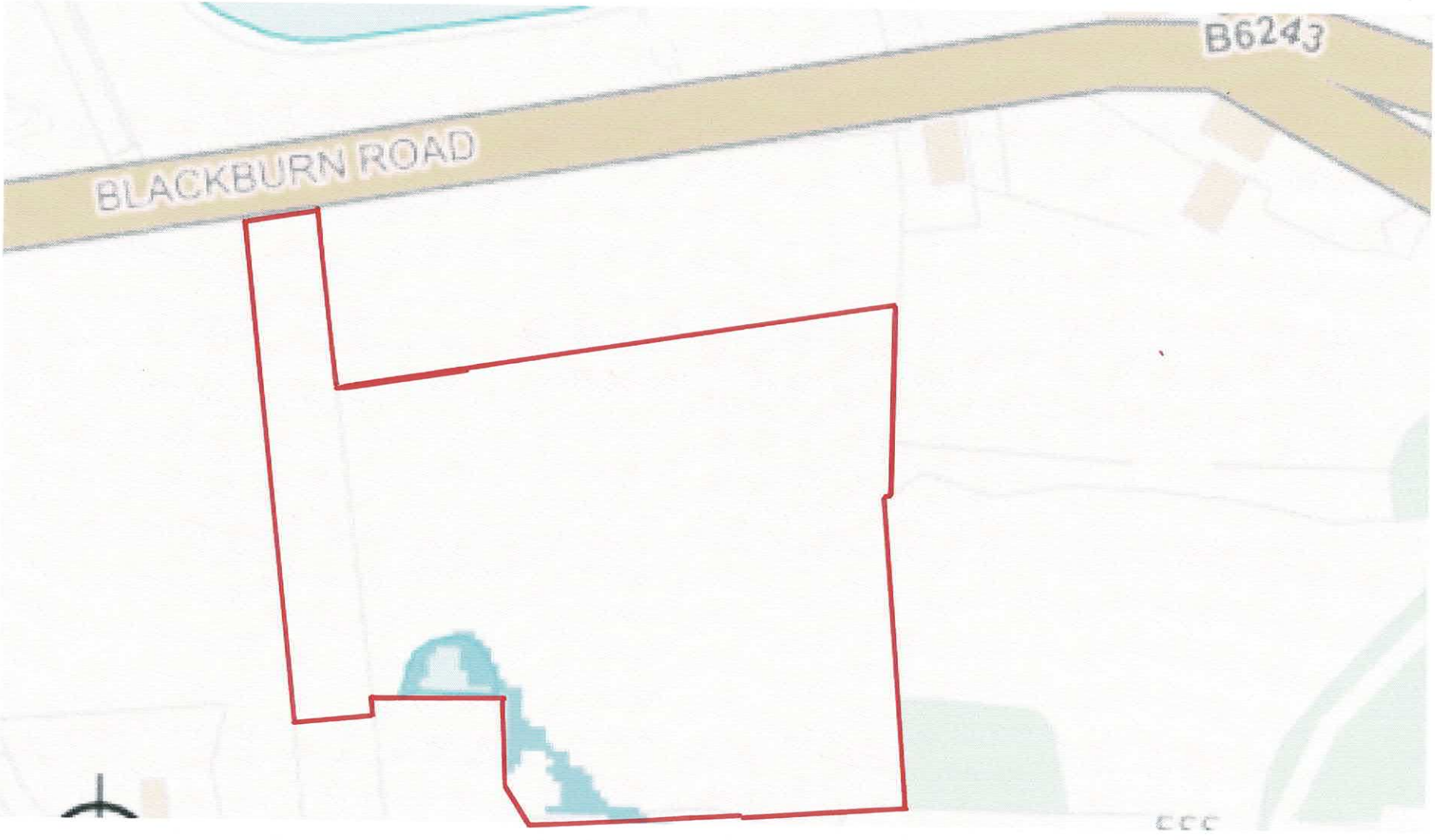
Land off Blackburn Road, Longridge – Location Plan 1

Scale 1 : 1500 at A4




Land south of Lower Road, Longridge – Indicative layout
Scale 1 : 1250 at A4
Spade Mill Resv. 2
Lower Road
BLACKBURN ROAD
Woodville Cottages
N
B1 b,c
B8
B2
Pond
Higher College Farm

Environment Agency Surface Water Flooding Map (Low Risk)



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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	David Wrigley
Site name:	Blackburn Road
Site location:	Longridge

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.82951° N
Longitude:	2.58353° W
Reference:	2895153352
Date:	Aug 12 2020 12:03

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.2

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	1185	1185
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	10.73	10.73
1 in 1 year (l/s):	9.33	9.33
1 in 30 years (l/s):	18.23	18.23
1 in 100 year (l/s):	22.31	22.31
1 in 200 years (l/s):	25.42	25.42

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Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	David Wrigley
Site name:	Blackburn Road
Site location:	Longridge

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.82947° N
Longitude:	2.5835° W
Reference:	1366222223
Date:	Aug 12 2020 12:46

Site characteristics

Total site area (ha):	1.2
Significant public open space (ha):	0
Area positively drained (ha):	1.2
Impermeable area (ha):	1.2
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	1.2
Net impermable area for storage volume design (ha):	1.2
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	70
Rainfall 100 yrs 12 hrs:	--	99.96
FEH / FSR conversion factor:	1.19	1.19
SAAR (mm):	1185	1185
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 10 year:	1.38	1.38
Growth curve factor 30 year:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Q_{BAR} for total site area (l/s):	10.73	10.73
Q_{BAR} for net site area (l/s):	10.73	10.73

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	5

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	9.3	9.3
1 in 30 years (l/s):	18.2	18.2
1 in 100 year (l/s):	22.3	22.3

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	963	963
Long term storage 1/100 years (m^3):	277	277
Total storage 1/100 years (m^3):	1240	1240