Katherine Colby
HYDROLOGISTS

Surface Water Management Plan

Dilwyn Ménage, Leominster

Date 07/04/2020

Katherine Colby
HYDROLOGISTS

Prepared by …Claire Hollingworth..……..

Date ……07/04/2020……..

Version ……1.0……..

Katherine Colby Hydrologists Limited is a Limited Company registered in England and Wales, number 10266262. Registered office: 8 Castlemead Road, Stroud, Gloucestershire, GL5 3SF

Table of Contents

Blank Page

1.0 Introduction

1.1 Introduction

1.1.1 Katherine Colby Hydrologists Limited has been commissioned by Mr A Davies (Small Fleet Farming) to undertake a Surface Water Management Plan for land at Small Feet Farming, Dilwyn. A Surface Water Management Plan is required for a Change of Use Planning Application to construct an open air Ménage for the schooling, training and exercise of horses stabled at the site.

1.2 Location

1.2.1 The Ménage, herein after referred to as the proposed development, is located within land at The Stables, Small Feet Farming to the north east of Dilwyn. The village of Dilwyn is approximately 9 km south west of Leominster, just over 10 km east of Kington and approximately 18 km north west of Hereford.

1.2.2 Small Feet Farming, herein after referred to as the proposed development site, is an Agricultural Unit and Enterprise and is predominantly Greenfield land. A number of buildings are located within the proposed development site including a stables and commercial holiday let chalets as shown in Figure 1 and Appendix A, and, as described in the separate covering letter (Leada Archiectural Ltd).

1.2.3 The proposed development site is accessed from the A4112 to the south; the A4112 connects Dilwyn to the A44 into Leominster. Land adjacent to the proposed development site is largely Greenfield with small clusters of residential properties or individual farms. The centre of Dilwyn village is approximately 1 km south west along the A4112.

1.2.4 Tippets Brook is a tributary of the River Arrow and flows in a west to east direction approximately 60 m north of the proposed development site. Tippets Brook flows into the River Arrow which continues east of the proposed development site to Leominster and its confluence with the River Lugg.

1.2.5 A National Grid Reference for the site is SO 42305 56139 and a post code is HR4 8JG.

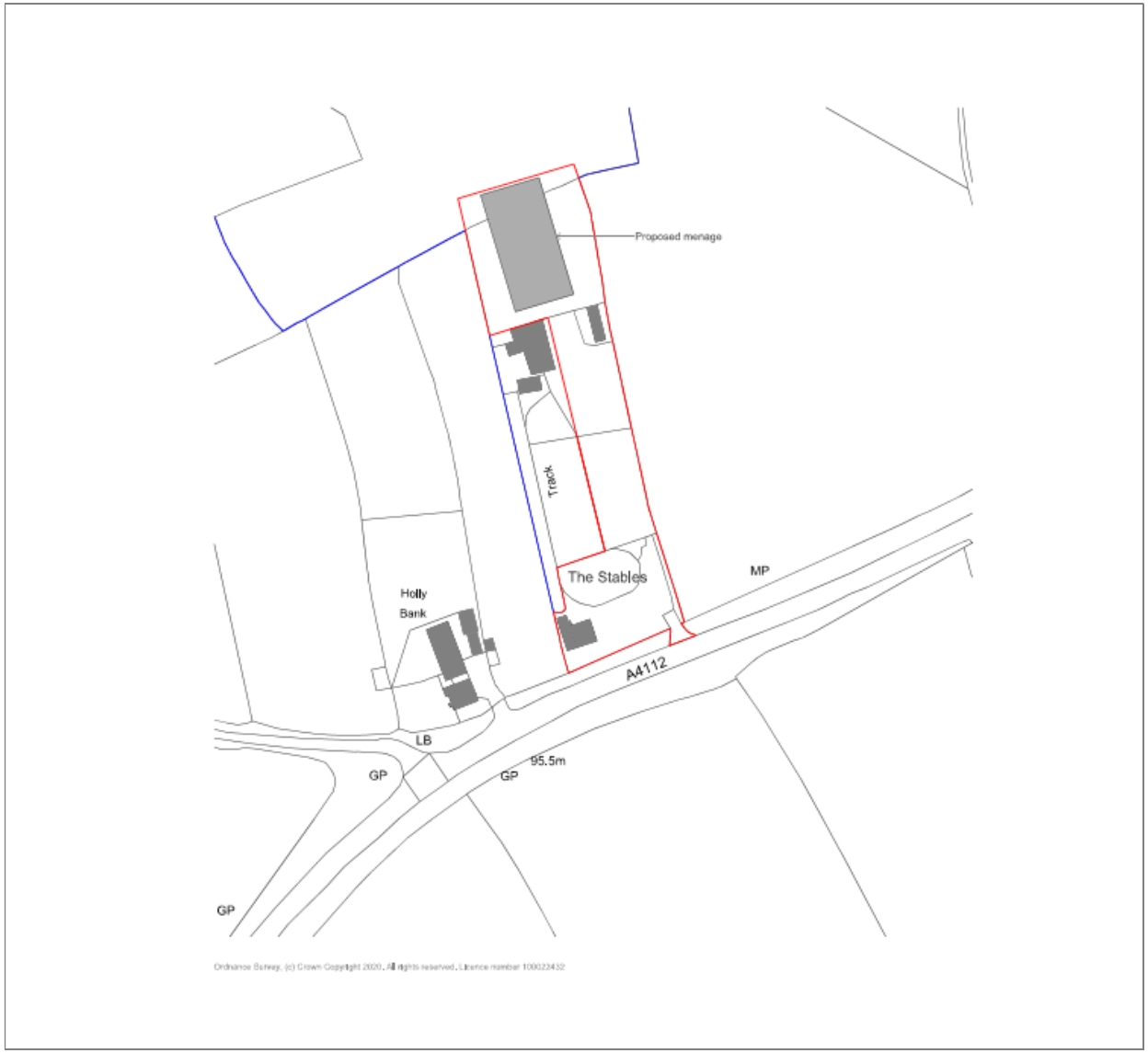


Figure 1: Location Plan (Leada Archietcural Ltd - April 2020);
The proposed development site is outlined in red (termed application site in the Planning Application) and the location of the proposed development is shaded in grey.

1.3 Aims and Objectives

1.3.1 This report aims to provide a Surface Water Management Plan for a Change of Use Planning Application for the proposed development on land at The Stables, Small Feet Farming.

1.3.2 The objectives of this report are to assess the risk of flooding from surface water to the proposed development and, third parties as a result of the proposed development. Then to undertake surface water runoff calculations to define the pre- and post- development runoff rates and volumes. Recommendations will be made regarding the implementation of a SuDS scheme at the proposed development site in line with best practice and current guidelines.

2.0 Development Description and Background

2.0.1 The following section provides a description of the existing and proposed development site layout. Background information about the topography, geology and hydrology of the proposed development site and surrounding area are also detailed to provide a baseline to the Surface Water Management Plan.

2.1 Development Site Description

2.1.1 The proposed development site is bounded by the A4112 to the south; the land adjacent to the north, east and west of the proposed development site is predominantly Greenfield. The current site is used as an Agricultural Unit and Enterprise and is also predominantly Greenfield land. There are a number of existing buildings on proposed development site including a stables and commercial holiday let chalets. A Christmas tree business is also stated as being run from the proposed development site (Figure 1, Appendix A covering letter from Leada Archiectural Ltd).

2.1.2 The proposed development site will continue to operate as an Agricultural Unit and the buildings, including the stables will remain as per the current Location Plan (Figure 1, Appendix A). The only proposed change is the addition of an open air Ménage on the Greenfield land to school, exercise and train horses stabled at the site.

2.1.3 The footprint of the proposed development will be excavated to incorporate a drainage system; drainage of the open air structure will be required to operate year round. The separate covering letter from Leada Archiectural Ltd details the proposed drainage scheme which reflects the principles of a filter drain design.

"..a series of slotted surface water drainage pipes set in a layer of free draining stone [pea gravel] would be in set in a "herringbone" pattern passing from the centre of the Ménage and extending to the margins of the structure on all sides."

2.1.4 The covering letter further states that free draining stone overlain by geotextile material will be placed on top of the drainage pipes and the floor will be completed with a variety of finishing materials. The external perimeter will be created from an upstand of timber.

2.1.5 The proposed development site is accessed from the A4112 to the south which leads directly on to a graveled entrance area by the existing stables. A track runs along the western proposed development site boundary connecting the stables to remaining site buildings which are adjacent to the proposed development.

2.1.6 LiDAR data is available for the proposed development site (Figure 2). The proposed development is located within a localised low point with higher land to the north, south and west. Beyond the northern site boundary, the LiDAR data indicates that land levels increase slightly in the adjacent area of the neighbouring field, before decreasing again towards Tippets Brook (Figure 2).

2.1.7 The area of the proposed development is 800 m^2 (40 m by 20 m) and will be constructed on existing Greenfield land.

2.3 Development Site Background

2.3.1 Topography

2.3.2 LiDAR data is available for the proposed development site as shown in Figure 2 (DEFRA, https://environment.data.gov.uk/DefraDataDownload/?Mode=survey, downloaded March 2020, Appendix B). The elevations stated in the following paragraphs of this section have been extracted from this LiDAR dataset.

2.3.3 The level of the A4112 at the site entrance is approximately 93.5 mAOD. Land levels increase slightly on entering the graveled entrance area to the existing stables to an elevation of approximately 93.7 mAOD.

2.3.4 The level of the land increases further into the proposed development site to a topographic high of approximately 94.9 mAOD located across Greenfield land immediately north of the site entrance. Land levels then decrease again towards the proposed development and the northern site boundary. The land levels across the footprint of the proposed development are approximately 90.5 mAOD.

2.3.5 Beyond the northern site boundary, the LiDAR data indicates that land levels increase slightly in the adjacent area of the neighbouring field to approximately 90.8 mAOD, before then decreasing towards Tippets Brook. Land levels around the southern bank of Tippets Brook are approximately 81 mAOD.

2.3.6 In summary, the footprint of the proposed development is located within a localised low point with higher land to both the north and south. Land levels also decrease west to east across the proposed development site. The overall gradient is relatively consistent with higher land to the west of the proposed development and lower land to the east.

2.3.7 As land to the north, south and west of the proposed development is raised, surface runoff is considered to flow in an easterly direction rather than directly north to Tippets Brook. The distance between the eastern site boundary and Tippets Brook is approximately 190 m (Figure 2).

2.3.8 The overall gradient of the proposed development site will remain largely the same as the existing site. The footprint of the proposed development will be excavated for the construction of the underlying drainage system, however it is assumed that the finished floor level will be broadly consistent with the surrounding topography.

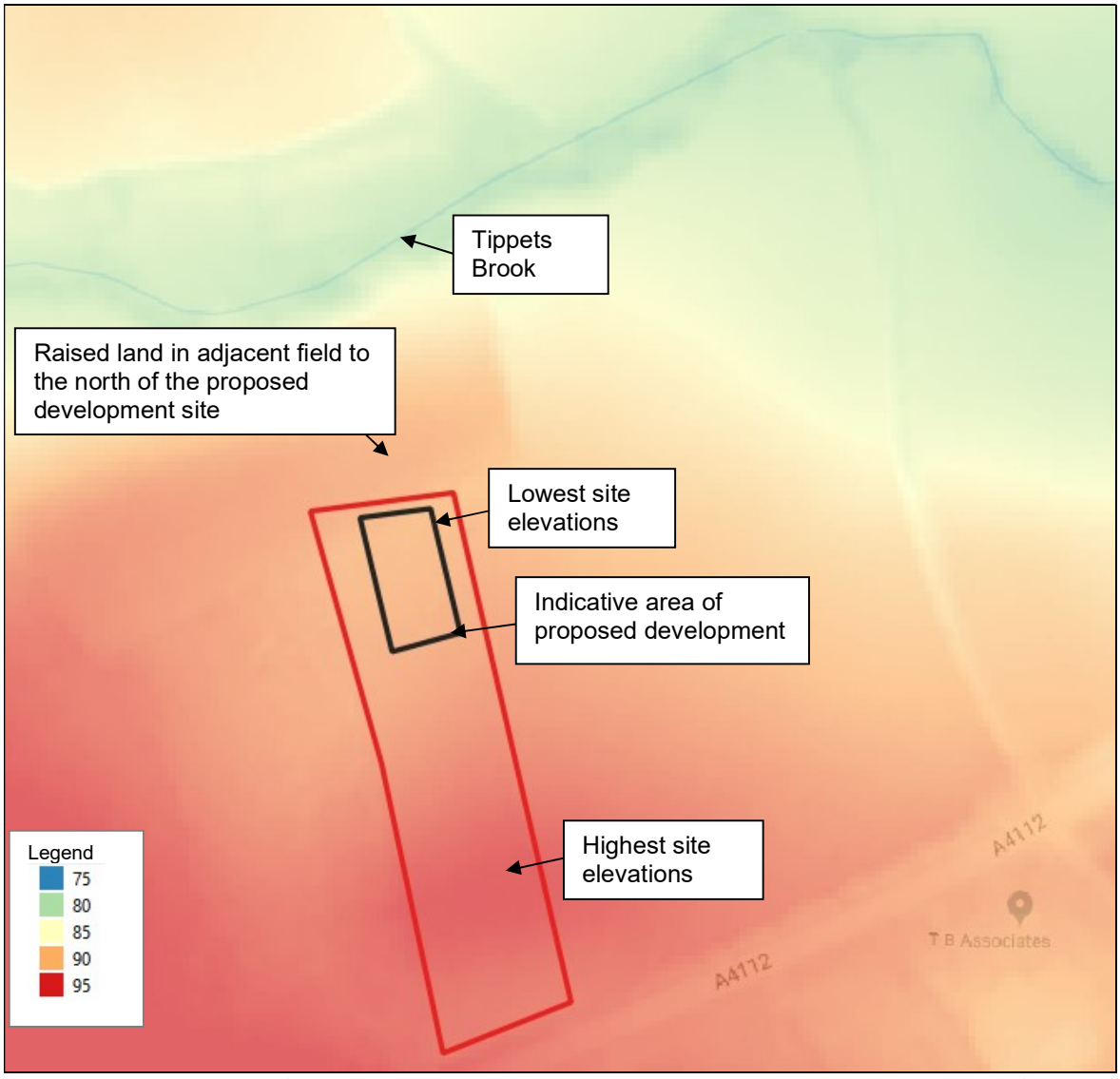


Figure 2: LiDAR data for the proposed development site and surrounding land (DEFRA, https://environment.data.gov.uk/DefraDataDownload/?Mode=survey, downloaded March 2020, Appendix B).

2.3.9 **Hydrological Setting**

2.3.10 As stated above, the nearest watercourse to the proposed development site is Tippets Brook, located approximately 60 m to the north at its closest point, and approximately 190 m to east of the proposed development site.

2.3.11 Tippets Brook flows in a west to east direction and is a tributary of the River Arrow. The River Arrow continues east of the proposed development site to Leominster and its confluence with the River Lugg.

2.3.12 No further water features were observed to be marked on Ordnance Survey mapping on or around the proposed development site.

2.3.13 It is noted that no site visit has been undertaken to confirm the absence/presence of water features, at or in the vicinity of the site.

2.3.14 **Geology**

2.3.15 Available mapping for the area of interest was reviewed, namely the British Geological Survey, online GeoIndex, 1:50,000. This map indicates that the proposed development site is underlain by “Raglan Mudstone Formation” bedrock and “Till, Devensian” superficial deposits (Contains British Geological Survey materials © UKRI 2019; accessed 12/03/2020).

2.3.16 The wider hydrogeology of the area was reviewed from the British Geological Survey, online GeoIndex, 1:625,000. The rock unit is stated as “Pridoli Rocks (undifferentiated)” and is characterised as a “Low productivity aquifer”, summarised as “Highly indurated argillaceous rocks with limited groundwater” (Contains British Geological Survey materials © UKRI 2019; accessed 04/12/2019).

2.3.17 The proposed development site is not within a Groundwater Source Protection Zone as shown on the MagicMap database (accessed March 2020). The nearest Source Protection Zone is located in Leominster to the north east of the proposed development site.

3.0 Surface Water

3.1 Surface Water Sources

3.1.1 The risk of flooding from surface water runoff has been assessed using levels derived from available LiDAR data (DEFRA, downloaded March 2020) as well as a review of readily available information from the Environment Agency.

3.1.2 The Environment Agency's Risk of Flooding from Surface Water flood map (Figure 3, accessed March 2020) indicates an area of Low risk of surface water flooding towards the northern boundary of the proposed development site and within the northern edge of the proposed development.

3.1.3 An area classed as being at Low risk of surface water flooding has between a 0.1% and 1% annual probability of occurrence.

3.1.4 The lowest land levels from the LiDAR data are in the area of the mapped surface water flooding shown in Figure 3. As described previously, this area is a low point between higher land to the south and the slightly raised land to the north. Land levels in this area also decrease in a west to east direction creating a subtle depression in the area of mapped flooding.

3.1.5 The Environment Agency's Risk of Flooding from Surface Water flood map does not indicate any further areas at risk of surface water flooding in the immediate vicinity of the site.

3.1.6 The footprint of the proposed development will encroach into the western area of the Low risk surface water flood extent, from the Environment Agency's Risk of Flooding from Surface Water flood map.

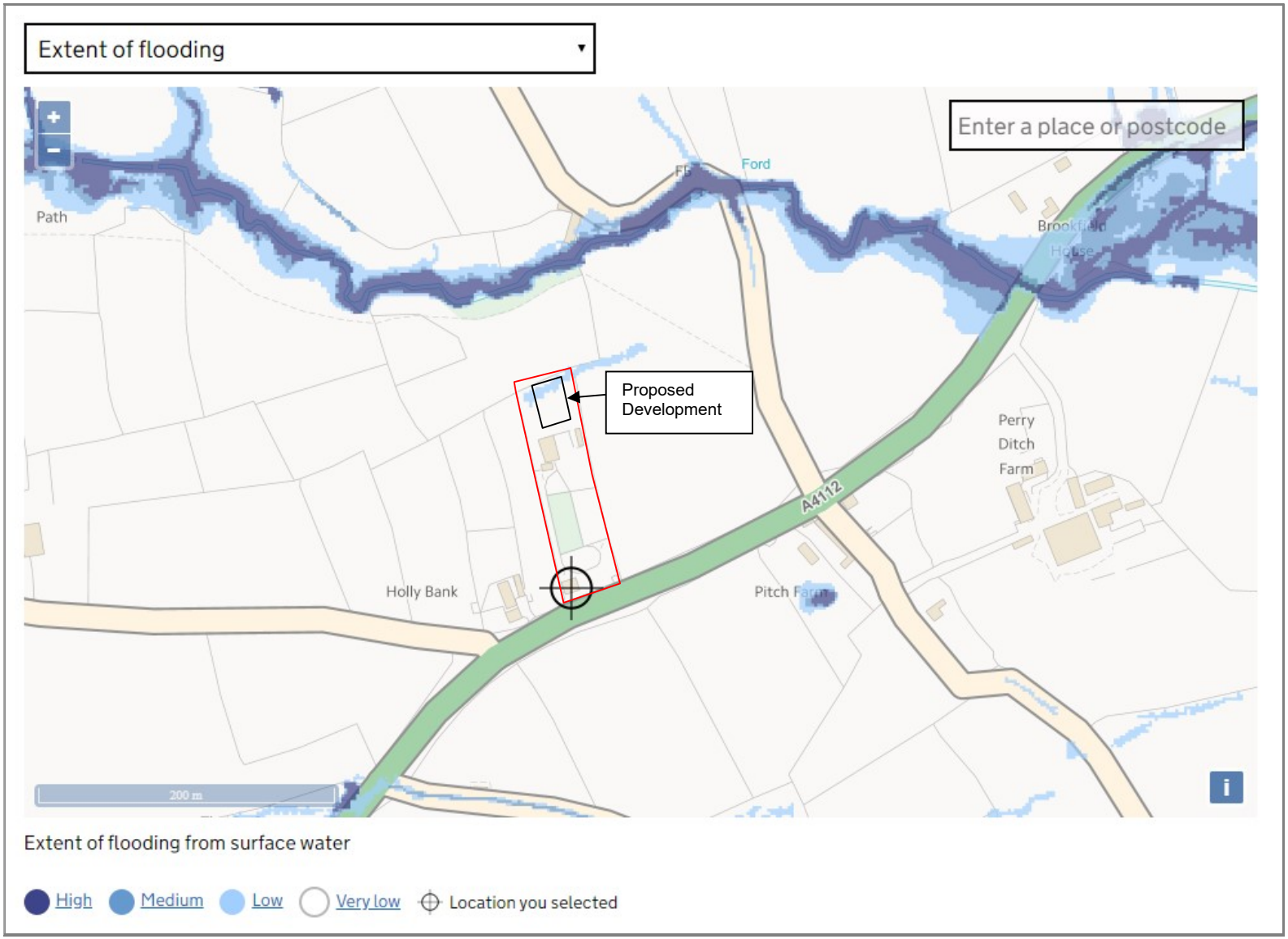


Figure 3: Environment Agency map illustrating the Flood Risk from Surface Water (accessed March 2020); the proposed development site is outlined in red and the footprint of the proposed development outlined in black.

Contains Environment Agency information © Environment Agency copyright and database rights 2019; Contains Ordnance Survey data © Crown copyright and database rights Ordnance Survey 100024198, 2019.

3.1.7 **Existing Surface Water Drainage Arrangements**

3.1.8 The existing arrangement for surface water drainage from the current buildings at the proposed development site is not known, however will remain unchanged. It is considered likely that there is no existing field drainage across the Greenfield land.

3.1.9 **Flood Management and Mitigation Measures**

3.1.10 The proposed development is shown on the Environment Agency Flood Map for Planning as being located within Flood Zone 1 for fluvial flood risk. This is defined by the Environment Agency as an area with a Low probability of fluvial flooding.

3.1.11 To manage the risk of surface water flooding to the site and third parties, a Surface Water Management proposal has been detailed in the covering letter from Leada Architectural Ltd.

3.1.12 The footprint of the proposed development will be excavated and a series of slotted surface water drainage pipes constructed in a trench of free draining stone. A filter aggregate depth of 850 mm is recommended (CIRIA, 2015). The drainage pipes will be laid in a “herringbone” pattern passing from the centre of the structure and extending to the margins of the structure on all sides.

3.1.13 A second layer of free draining stone approximately 100-150 mm deep will cover the full extent of the proposed development followed by a geotextile membrane material. The floor will be covered with silica sand and a variety of available finishing materials including shredded carpet.

3.1.14 The design essentially reflects the principles of a filter drain system which creates temporary storage for attenuation within the voids of the aggregates, conveyance and in this instance filtration of surface water to ground.

3.2 Existing rates and volumes of runoff generated by the development

3.2.1 Calculations have been undertaken using Institute of Hydrology 124 methodology for Greenfield runoff. Climate change has been allowed for in the Institute of Hydrology 124 method by addition of 35% to the 1 in 100 year runoff.

3.2.2 The calculated peak runoff and runoff volume from the Greenfield proposed development area for a 6 hour storm is provided in the table below (Table 1 and Appendix C).

Return Period Event (Years)	Greenfield Surface Runoff Qp (l/s)	Runoff Volume from Greenfield Area (m^3)
2	0.137	2.96
50	0.286	6.18
100	0.322	6.95
100+Climate Change	0.434	9.38

Table 1: Peak runoff and runoff volume from the existing development area

3.2.3 The **peak runoff** from a 1 in 100 year storm with allowance for climate change that would be generated by the existing Greenfield proposed development area is calculated as **0.434 l/s**. The **volume of runoff** generated by this storm with the **existing Greenfield area** has been calculated to as **9.38 m^3** (Table 1).

3.3 Proposed rates and volumes of runoff generated by the development

3.3.1 The proposed development requires the construction of an open air structure on Greenfield land. The footprint of the proposed development will be excavated and reconstructed. Whilst the constructed surface will comprise a permeable geotextile membrane and silica sand, it has been assumed to be impermeable for the purpose of calculating potential runoff from the newly constructed surface.

3.3.2 The Modified Rational Method (HR Wallingford) has been used to calculate peak runoff and runoff volumes. Climate change has been allowed for in the Modified Rational Method by addition of 40% to the 1 in 100 year rainfall depth.

3.3.3 The calculated peak runoff and runoff volume from the constructed surface area for a 6 hour storm is provided in the table below (Table 2 and Appendix C).

Return Period Event (Years)	Constructed Surface Runoff Qp (l/s)	Runoff Volume from Constructed Surface Area (m^3)
2	6.24	15.69
50	23.30	39.56
100	28.25	46.22
100+Climate Change	39.56	64.70

Table 2: Peak runoff and runoff volume from the post development area

3.3.4 The **peak runoff** from a 1 in 100 year storm with allowance for climate change that would be generated by the post-development constructed surface area has been calculated as **39.56 l/s**; the **volume of runoff** generated by this storm from the **post-development constructed surface area** has been calculated to a **64.70 m^3** (Table 2).

3.3.5 **Proposed Surface Water Management**

3.3.6 As stated in Section 3.1, the footprint of the proposed development has been designed with drainage to allow for year round use. The detail of the design was submitted in a separate covering letter by Leada Architectural Ltd.

3.3.7 The design comprises drainage pipes set in trenches within the footprint of the proposed development, filled with free drainage stone such as pea gravel. A filter aggregate depth of 850 mm is recommended (CIRIA, 2015). A further 100 - 150 mm depth of permeable suitable drainage stone will overlay the drainage pipes. This will be covered by a geotextile material, silica sand and finishing material.

3.3.8 The drainage pipes will be laid in a “herringbone” pattern passing from the centre of the structure and extending to the margins of the structure on all sides. This will result in the drainage from the footprint of the proposed development being routed to the surrounding land whilst infiltrating to ground along the length of the slotted pipe.

3.3.9 The storage provided by the drainage design has been calculated as 240 m^3 (Appendix C). The calculation is based on the assumption that the proposed filter drain design covers the footprint of the proposed development (800 m^2), with a filter aggregate depth of 850 mm and

stone layer depth of 150 mm. The porosity of the aggregate has been assumed to be 0.3 from recommendations in the SuDS manual (CIRIA, 2015).

3.3.10 The storage provided by the drainage design mitigates the runoff volume from the surface of the proposed development.

3.3.11 Percolation tests are to be completed on site to confirm that infiltration to ground is possible. Should infiltration be restricted, the drainage pipes would need to drain to a further surface water management feature.

3.3.12 River Lugg SAC

3.3.13 The proposed development site is located within the catchment of the River Arrow, a tributary of the River Lugg.

3.3.14 The River Lugg is a tributary of the River Wye SAC; the River Lugg is stated by Herefordshire Council as exceeding its limits for phosphates and as such, a Position Statement has been issued for any future development in the River Lugg Catchment Area (Herefordshire Council, March 2020).

3.3.15 The Position Statement provides an Interim Approach to planning applications which require discharge to drainage fields in the River Lugg catchment (referred to as the "red zone"). The Interim Approach requires an assessment of the potential pathway of phosphates to a watercourse.

3.3.16 The drainage design at the proposed development promotes infiltration to ground and is required to be considered against the same planning requirements.

3.3.17 The potential pathways for impact are defined by a set of five criteria; the criteria are assessed below in the context of the proposed development.

i. The drainage field is more than 50 m from the designated site boundary or sensitive interest feature:

The proposed development is 60 m from Tippets Brook tributary and is 9 km west of the confluence with the River Lugg.

ii. The drainage field is more than 50 m from any surface water feature:

The only surface water feature identified from Ordnance Survey mapping is Tippets Brook 60 m to the north of the proposed development at its closest point. It is noted that a site walkover has not been completed.

iii. The drainage field is in an area with a slope no more than 15%:

The proposed development does not slope directly north to Tippets Brook but is separated by an area of raised land north of the proposed development site boundary as detailed in this Surface Water Management Plan. The flow path to the east of the proposed development to Tippets Brook is on gently sloping ground of less than 15%.

iv. The drainage field is in an area where the high water table groundwater depth is at least 2 m below the surface at all times:

A desk based review of the geology as detailed in this report describes the wider rock unit as having limited groundwater. The height of the groundwater table would need to be confirmed through on site investigations including a percolation test as stated previously.

v. There are no other hydrological pathways which would expedite the transport of phosphorus:

A desk based review of the geology and Environment Agency fluvial flood maps as detailed in this report, has not identified any additional hydrological pathways to the watercourse.

3.3.18 The main pathway for phosphates to reach Tippets Brook is from the eastern boundary of the proposed development site as overland flow. However, the distance from the eastern development site boundary to the watercourse is a notable distance of 190 m.

3.3.19 Towards the northern boundary of the site the Environment Agency Flood Risk Map (Figure 3) illustrates an area as being at Low risk of surface water flooding. The flood extent does not reach Tippets Brook, or within 50 m of Tippets Brook. There is no mapped flow path from the proposed development to Tippets Brook to the north (approximately 60 m north), considered to be due to the raised land between the proposed development site boundary and the watercourse. There are no areas mapped as being at Medium or High risk of surface water flooding in the vicinity of the proposed development site.

3.3.20 Surface water runoff from the proposed development will be managed through the filter drain design detailed within this report and the covering letter by Leada Architectural Ltd. A percolation test will be completed to confirm that water can infiltrate to ground at this site.

3.3.21 The geotextile membrane and top layer of silica sand is proposed to provide a level of treatment to water infiltrating to ground.

3.3.22 There are no proposals to store manure within this area and it is considered that any waste will be removed and managed as per the existing stables at the proposed development site.

4.0 Conclusions

4.0.1 A Surface Water Management Plan has been completed for a Change of Use Planning Application for the proposed construction of an open air Ménage (the proposed development) on land at Small Feet Farming (the proposed development site).

4.0.2 The proposed development site is located to the north east of the centre of Dilwyn. The village of Dilwyn is approximately 9 km south west of Leominster, just over 10 km east of Kington and approximately 18 km north west of Hereford.

4.0.3 The proposed development site is an Agricultural Unit and Enterprise and is predominantly Greenfield land. There are a number of existing buildings on site including a stables and commercial holiday let chalets as shown in Figure 1 and Appendix A (Leada Architectural Ltd).

4.0.4 Access is from the A4112 to the south; the A4112 connects Dilwyn to the A44 into Leominster. Land adjacent to the proposed development site is largely Greenfield with small clusters of residential properties or individual farms in the vicinity. The centre of Dilwyn village is approximately 1 km south west along the A4112.

4.0.5 Tippets Brook is a tributary of the River Arrow and flows in a west to east direction approximately 60 m north of the proposed development site boundary. Downstream of proposed development site, the River Arrow flows south of Leominster into the River Lugg.

4.0.6 LiDAR data indicates that the proposed development is located within a low point between the southern site entrance, and a marginally raised area of land to the north of the proposed development site boundary. The level of the A4112 at the site entrance is approximately 93.5 mAOD. Land levels increase slightly on entering the graveled entrance area to the stables to an elevation of approximately 93.7 mAOD. Levels increase further into the site to a high point of approximately 94.9 mAOD across the Greenfield land immediately north of the site entrance. Land levels then decrease again towards the proposed development and the northern site boundary. The land levels across the proposed development are approximately 90.5 mAOD.

4.0.7 The Environment Agency's Risk of Flooding from Surface Water flood map (Figure 3, accessed March 2020) indicates an area at Low risk of surface water flooding towards the northern boundary of the proposed development site and within the northern edge of the proposed development. This is the lowest area of the proposed development site.

4.0.8 The proposed development site is shown on the Environment Agency Flood Map for Planning as being located within Flood Zone 1 for fluvial flood risk. This is defined by the Environment Agency as an area with a Low probability of fluvial flooding.

4.0.9 The **peak runoff** from a 1 in 100 year storm with allowance for climate change that would be generated by the existing Greenfield proposed development area is calculated as **0.434 l/s**. The **volume of runoff** generated by this storm with the **existing Greenfield area** has been calculated to as **9.38 m^3** (Table 1).

4.0.10 The **peak runoff** from a 1 in 100 year storm with allowance for climate change that would be generated by the post-development constructed surface area (800 m^2) has been calculated as

39.56 l/s; the **volume of runoff** generated by this storm from the **post-development constructed surface area** has been calculated to a **64.70 m^3** (Table 2). The calculation assumes that the surface is impermeable.

4.0.11 To manage the risk of surface water flooding to the proposed development site and third parties, a Surface Water Management proposal has been detailed in the supporting Design and Access Statement (Leada Archietcural Ltd's covering letter) that promotes attenuation and infiltration of surface water.

4.0.12 The footprint of the proposed development will be excavated and a series of slotted surface water drainage pipes constructed in a trench of free draining stone. The drainage pipes will be laid in a “herringbone” pattern passing from the centre of the structure and extending to the margins of the structure on all sides.

4.0.13 A second layer of free draining stone will cover the full extent of the proposed development followed by a geotextile membrane material. The floor will be covered with silica sand and a variety of available finishing materials including shredded carpet.

4.0.14 The storage provided by the drainage design has been calculated as 240 m^3. The calculation is based on the assumption that the proposed filter drain design covers the footprint of the proposed development (800 m^2), with a filter aggregate depth of 850 mm and stone layer depth of 150 mm. The porosity of the aggregate has been assumed to be 0.3 from recommendations in the SuDS manual (CIRIA, 2015).

4.0.15 The storage provided by the drainage design mitigates the runoff volume from the surface of the proposed development.

4.0.16 Due to the predominant flow path being 190 m from Tippets Brook, the potential for surface water runoff from the proposed development to reach the watercourse is considered to be low. The Environment Agency surface water flood extent does not connect the proposed development to the watercourse either to the north or to the east.

4.0.17 Any subsurface flow paths would also have to travel 60 m north or 190 m east to connect with the watercourse and would be subject to percolation over this distance. The resulting impact is therefore considered to be low. Surface water infiltrating to ground from the proposed development will have also been subject to filtration through the silica sand and a geotextile membrane included within the drainage design.

5.0 References

Leada Architectural Ltd;s proposed drawing - April 2020

Leada Architectural's covering letter - April 2020

British Geological Survey, Online GeoIndex, http://mapapps2.bgs.ac.uk/geoindex/home.html, accessed March 2020

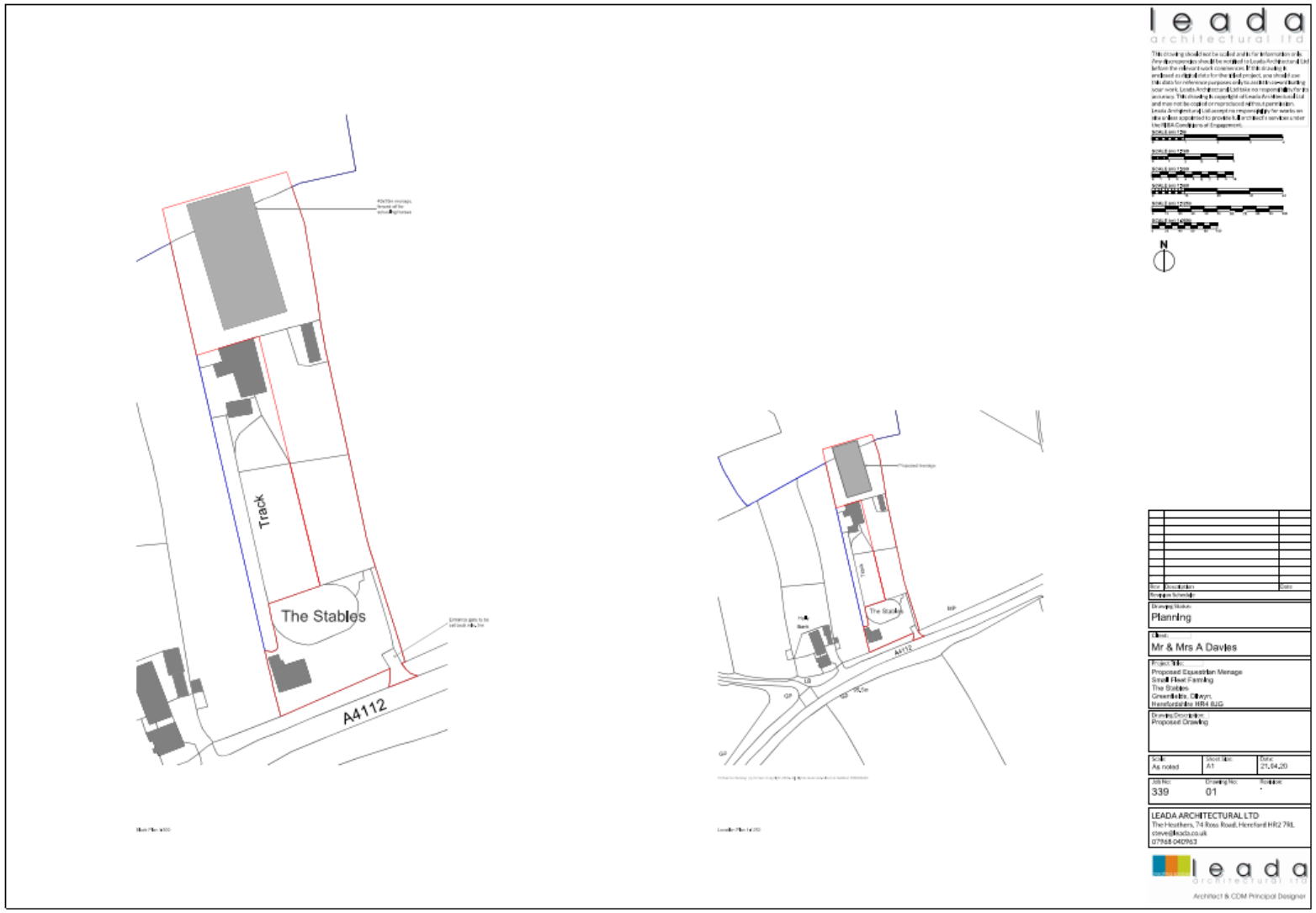
CIRIA, 2015, The SuDS Manual CIRIA C753

DEFRA LiDAR data, https://environment.data.gov.uk/DefraDataDownload/?Mode=survey, downloaded March 2020

Environment Agency, Online Long term flood risk information map, https://flood-warning-information.service.gov.uk/long-term-flood-risk, accessed March 2020

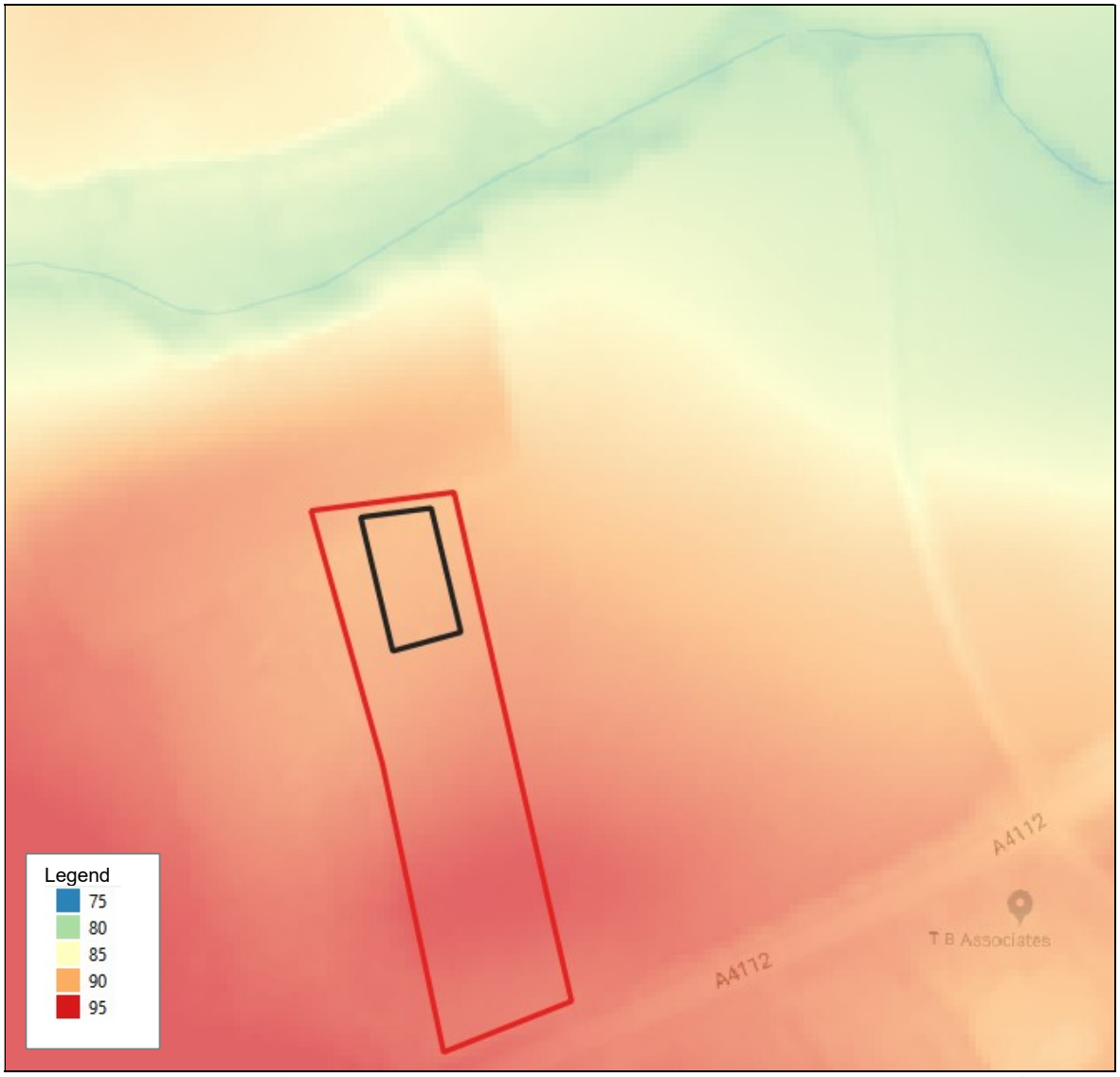
Appendices

Appendix A
Existing and Proposed Site Layout



Existing and Proposed Site Layout Plan (Leada Architectural Ltd - April 2020)

Appendix B
Topographic Data



LiDAR Data for the proposed development site (DEFRA, https://environment.data.gov.uk/DefraDataDownload/?Mode=survey, downloaded March 2020, Appendix B)

Appendix C
Surface Water Runoff Calculations

SURFACE WATER RUNOFF CALCULATION
Dilwyn Menage, Nr Leominster, Herefordshire

DATE: 16/03/2020

SITE INFORMATION

AREA

TOTAL	800 m^2	0.000800 km^2	0.080 ha
EXISTING			
IMPERMEABLE	0.00 m^2	0.000000 km^2	0.000 ha
PERMEABLE	800 m^2	0.000800 km^2	0.080 ha
PROPOSED			
IMPERMEABLE	800.00 m^2	0.000800 km^2	0.080 ha
PERMEABLE	0.00 m^2	0.000000 km^2	0.000 ha
INCREASE IN IMPERMEABLE	800.00 m^2	0.000800 km^2	0.080 ha

CATCHMENT CHARACTERISTICS

SAAR	707 mm
SOIL	0.3
UCWI	130.0

METHODOLOGY

GREENFIELD RUNOFF USING INSTITUTE OF HYDROLOGY 124 (IOH124) METHODOLOGY

RUNOFF FROM IMPERMEABLE SURFACES USING MODIFIED RATIONAL METHODOLOGY

GREENFIELD RUNOFF CALCULATION
Existing Scenario
Dilwyn Menage, Nr Leominster, Herefordshire

DATE: 16/03/2020

Introduction

Greenfield runoff has been calculated for the proposed development site of a Menage in Dilwyn for a range of design events using Institute of Hydrology 124 methodology.

METHODOLOGY

1) The equation used to undertake calculation of $Q_{BAR\ rural}$ was taken from Institute of Hydrology 124:

$$Q_{BAR\ rural} = 0.00108\ AREA^{0.89}.SAAR^{1.17}.SOIL^{2.17}$$

2) The main inputs to the equation, AREA, SAAR, SOIL, were acquired from different sources. AREA is taken from the site topographic survey, SAAR and SOIL are based on Flood Estimation Handbook catchment characteristics and readily available information about the site.

3) For the equation to work correctly, the site must cover an area greater than 50ha/0.5km^2. The site area was less than 50ha/0.5km^2, therefore 0.5km^2 was used in the equation and a scaling ratio applied to the $Q_{BAR\ rural}$ figure.

4) To calculate the Greenfield Runoff for a range of return periods, a regional growth factor was applied to the scaled $Q_{BAR\ rural}$ value.

CALCULATION

$Q_{BAR\ rural}$ =	0.00108	AREA$^{0.89}$.	SAAR$^{1.17}$.	SOIL$^{2.17}$
	0.00108	0.5	707	0.3
$Q_{BAR\ rural}$ =	**0.092**			

$Q_{BAR\ rural}$	0.001600	scaling ratio
$Q_{BAR\ rural}$	0.000148	m^3/s
$Q_{BAR\ rural}$	0.147503	l/s

GROWTH FACTORS FOR A RANGE OF RETURN PERIODS

	Return Period Event (years)					
Hydrometric Area	**2**	**5**	**10**	**25**	**50**	**100**
9	0.93	1.21	1.42	1.71	1.94	2.18

RESULTS

1 hour storm duration

Return Period Event (years)	**2**	**5**	**10**	**25**	**50**	**100**	**100+CC**
Q (l/s)	0.137	0.178	0.209	0.252	0.286	0.322	0.434
Vol (m^3)	0.494	0.643	0.754	0.908	1.030	1.158	1.563

6 hour storm duration

Return Period Event (years)	**2**	**5**	**10**	**25**	**50**	**100**	**100+CC**
Q (l/s)	0.14	0.18	0.21	0.25	0.29	0.32	0.43
Vol (m^3)	2.96	3.86	4.52	5.45	6.18	6.95	9.38

RUNOFF FROM IMPERMEABLE SURFACES
Proposed Scenario
Dilwyn Menage, Nr Leominster, Herefordshire

DATE: 16/03/2020

METHODOLOGY

1) The Modified Rational Method equation used was:

Q = 2.78 Cr Cv i A

2) The area used in the equation is total site area in hectares (ha).

3) Cr for design purposes is a value of 1.3

4) Cv = PR/PIMP; PR = 0.829PIMP + 25SOIL + 0.078UCWI - 20.7; PIMP = Ai / A.

6) Design rainfall is taken from FEH web service DDF model for a 1km grid point at 350750, 252800

CALCULATION

PIMP=Ai/A

100.0 %

PR = 0.829 PIMP + 25 SOIL + 0.078 UCWI -20.7

82.90 7.5 10.14 20.7

PR = 79.8 %

Cv=PR/100

0.798

Rainfall Intensity (mm)
6 hour design rainfall

Return Period Event (years)	2	5	10	30	50	100	100+40%
Design Rainfall (mm)	24.56	34.48	41.90	54.98	61.94	72.36	101.30
Rainfall Intensity (i) (mm/hr)	27.04	46.12	60.72	87.28	100.92	122.40	171.36

Q =	**2.78**	**Cr**	**Cv**	**i**	**A**
	2.78	1.3	0.798	TABLE	0.08

RESULTS: Qp

Return Period Event (years)	2	5	10	30	50	100	100+40%
Q (l/s)	6.24	10.65	14.02	20.15	23.30	28.25	39.56

RESULTS: RUNVOL

RUNVOL=(PR/100)*P*A

Return Period Event (years)	2	5	10	30	50	100	100+40%
vol (m^3)	15.69	22.02	26.76	35.12	39.56	46.22	64.70

Katherine Colby
HYDROLOGISTS

SUDS STORAGE ASSESSMENT

Dilwyn Menage, Nr Leominster, Herefordshire

DATE: 16/03/2020

Non-Vegetated Features

Filter Drains

Specifications (guided by SuDS manual minimums)

Stone Layer Depth	0.150	
SL Porosity	0.300	*from CIRIA SuDS recommendations
Filter Aggregate Depth	0.850	
PS Porosity	0.300	*from CIRIA SuDS recommendations

Zone	Area (m²)	Storage (m³)
FS	800.000	240.000
		0.000
		0.000
		0.000
Total	800.000	240.000

m³ storage per m² 0.300

Total Storage from Features (m³)	**240.000**

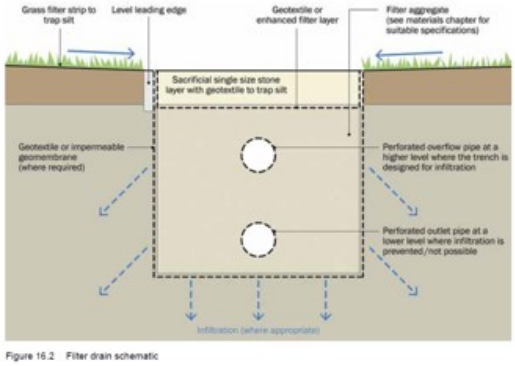


Figure 16.2 Filter drain schematic

Picture from CIRIA SuDS manual (2015)