



**MICHAEL EVANS
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Civil and Structural Engineers
& Design Consultants

FLOOD RISK ASSESSMENT

For Proposed Re-development of land at:
Hillmoren
Altar Stones Lane
Markfield
Leicester

Job No: 23-161
Prepared by: Michael Evans & Associates Ltd
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CONTRACT

This report describes work commissioned by Hillmoren Ltd following written (e-mail) instruction on 27 June 2023 by Mr Ravi Dhir. Dale Radford of rp+g was the main contact for the project. Mrs Nicola Dibble of Michael Evans & Associates Ltd carried out the work.

Date: 26th September 2023

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REVISIONS

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1 INTRODUCTION

1.1 General

1.1.1 Michael Evans & Associates Ltd have been commissioned to undertake a Flood Risk Assessment (FRA), on behalf of Hillmoren Ltd relating to the proposed demolition of existing buildings and erection of buildings to be used for the purposes of car sales, with associated landscaping and access works, Halls Farm, Altar Stones Lane, Markfield, Leicester.

1.1.2 This report sets out the findings of the FRA required by the Local Planning Authority in support of the planning application for the development. The assessment has been carried out in accordance with the guidance set out in the National Planning Policy Framework (NPPF).

1.2 Background Information

1.2.1 The Department for Communities and Local Government (DCLG) published the NPPF and the Technical Guidance to the National Planning Policy Framework (Technical Guidance) in March 2012, with the most recent updates being published in August 2023. The NPPF and the accompanying Technical Guidance explain how flood risk should be taken into consideration during the planning process. The guidance specifies a sequential test which local planning authorities should apply to all future proposed development sites. The following Table 1: Flood Zones, extracted from Table 1 of the Technical Guidance, defines the levels of flood risk within England.

Table 1: Flood Zones		
Flood Zone	Flood zone Classification	Description
Flood Zone 1	Low Probability	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any one year (<0.1%).
Flood Zone 2	Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.
Flood Zone 3a	High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in

		200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3b	Functional Floodplain	The zone comprises land where water has to flow or be stored in times of flood.

- 1.2.2** As part of its general obligations under the Water Resources Act 1991, the Environment Agency has carried out surveys of its existing flood defences and has published a series of nationwide 'Indicative Floodplain Maps' based upon information from historic flood events and basic hydraulic modelling. In general terms, these maps give a good indication of the areas likely to be affected by flooding. More recently the Environment Agency have published the 'Flood Map' on their website which is based on improved hydraulic modelling and detailed local data. The Flood Map indicates areas which may be affected by a 1 in 100 year fluvial flood or a 1 in 200 year tidal/coastal flood (ie Zone 3 as defined in the NPPF). It also indicates which areas may be affected by an extreme flood (ie Zone 2 as defined in the NPPF).
- 1.2.3** The Flood Map for the site area of Markfield, Leicester shows that the proposed development is located within Flood Zone 1. The extent of the indicative floodplain is shown in Appendix 1 – 'Environment Agency Flood Map for Planning'.
- 1.2.4** The NPPF stipulates that all proposed development sites which are located outside of Flood Zone 1 and/or are greater than 1ha in area must be accompanied by a Flood Risk Assessment as part of the planning process. For site located within Flood Zone 1 which are less than 1ha in area, the main flood risk consideration is the management of surface water runoff from the site.

2 STRUCTURE OF THE REPORT

- 2.1** The report has been structured to follow the general principles set out in the Site Specific Flood Risk Assessment Checklist, included as Section 26 of the PPG.
- 2.2** Reference has also been made to relevant plans, including mapping and report produced as part of the Hinckley and Bosworth Strategic Flood Risk Assessment (2019)¹ in the compilation of this report.
- 2.3** This report has been undertaken as a desk based exercise, supplemented by a site walkover inspection. No new hydraulic modelling has been produced as part of this report.

¹ JBA Consulting (2019) *Strategic Flood Risk Assessment for Hinckley and Bosworth Borough Council* available online at: [accessed 08.08.2023]

3 SITE SETTING

3.1 Site Description and Location

- 3.1.1 A summary of the site and its characteristics is provided in Table 2: 'Site Location Summary', below.

Table 2: Site Location Summary	
Site Name	Hillmoren
Site Address	Halls Farm Altar Stone Lane Markfield Leicester
Site Area (ha)	1.42ha
National Grid Reference	448068 E, 311014 N
Existing Land Use	Residential farmhouse, outbuildings, access and gardens/ landscaping
Proposed Land Use	Commercial
Local Planning Authority	Hinckley and Bosworth
Environment Agency Area	East Midlands
Lead Local Flood Authority	Leicestershire County Council
Sewer Undertaker	Severn Trent Water

- 3.1.2 A site location plan can be found in the drawings section at the end of this report.

- 3.1.3 The proposed development site is located at Halls Farm, Altar Stones Lane, Markfield, Leicester. The site is located at approximate National Grid Reference (NGR) 448068 E, 311014 N, and the site postcode is LE67 9PX. The site is roughly triangular in shape and is bounded by Altar Stones Lane to the north, a private access drive to Altar Stones Lane Cattery to the west, and the M1 motorway to the west.

- 3.1.4 The development site has a total area of approximately 1.42ha. The impermeable area of the existing site is approximately 940m² (0.09ha) comprising of building roof areas and tarmac/ concrete external hardstanding. The existing impermeable area equates to approximately on the site is approximately 6% of the total site area. The remaining areas of the site include approximately 575m² of natural ponds, plus a

20m² ornamental pond, external shelters and stores and a large glasshouse. Other areas of the site comprise planting, grassland, mature trees and walkways.

3.1.5 There are no statutory Main Rivers within the vicinity of the site. The nearest Main River is the Rothley Brook, which is approximately 3.6km south-south-west of the site, and become a main river as it exits Thornton Reservoir. There are a number of ordinary watercourses, of varying scales within the vicinity of the site, which could have a bearing on the flood risk setting of the site. Unnamed land drains/ ditches run along the eastern and western boundary of the site, and along part of the site's northern boundary. These ditches merge at a point just outside of the southern tip of the site, and flow in a generally southerly direction. These ditches are understood to contain fluvial flows as well as some runoff from the adjacent M1 motorway, although details of the upstream network and catchment has not been confirmed.

3.1.6 The site topography survey confirms that the site has a slight, general fall from north to south. Other than around the pond/ basin areas, there are no significant slopes or highly retained areas of the site. A copy of the site topographical survey can be found in the drawings section at the end of this report.

3.2 Existing Drainage

3.2.1 Since the majority of the site is undeveloped/ permeable it is anticipated that majority of surface water will discharge naturally to the underlying ground, where the ground capacity allows, be taken up by the natural vegetation, or where there runoff volumes exceed these amounts, be discharged to land drainage/ ditch network surrounding the site. A drainage network consisting of downpipes serves the main property, however the connectivity of this network is not known. This network may be a separate surface water network or may connect into a combined surface and foul water network. In addition, a formal drainage channel is present within the external yard area between the existing building. This channel enters a gully close to the wall, which could also connect into the foul drainage tank, based on the proximity within the site.

3.2.2 There are two significant ponds on the site, one located to the west of the main buildings, close to the sites western boundary. At the time of the site walkover this pond was wet, and it appears that this is a permanently wet feature. There were two small inlets observed to the north of the pond, and one outlet to the south-western edge of the pond. Based on the location of this outlet, it is likely that the pond overflows to the drainage ditch along the western site boundary, although due to access restraints this has not been proven.

- 3.2.3** A second pond feature is noted on the topographical survey. At the time of the site walkover, this feature was dry, although some areas appeared slightly boggy, and a pontoon was noted along the western edge of the pond, suggesting that this depression is a water feature, as noted on the survey and on OS mapping. One inlet to this pond was noted, close to ground levels, at the north-western corner of the pond. No outlets were visible, so it is possible that this is an infiltration basin.
- 3.2.4** Existing surface water runoff rates for the site have been calculated using the IH124 calculations on the UKSUDS website. Calculations for the whole 1.42ha site indicative that the QBAR (Average Annual Rainfall Event) greenfield runoff from the site is 7.02l/s, and the 1 in 100 year runoff is 18.03l/s. A copy of the greenfield runoff rate calculations can be found in Appendix 2 at the end of this report.
- 3.2.5** Foul water on the site is connected to an onsite network. It is unclear at this stage, what form of treatment is carried out with respect of the foul water drainage, but due to the nature and age of the site is likely that this would be septic tank, with no formal treatment other than settlement. From the site walkover, it appears that flows from then tank could discharge into the larger pond on the site, which was dry at the time of the walkover, but an incoming pipe from the direction of the tank was visible. Due the nature of the proposals, this tank will not be reused to serve the new development, and so it is not considered necessary to confirm the existing connectivity by way of survey.
- 3.2.6** There are no public sewers within the immediate vicinity of the site.

3.3 Flooding History

- 3.3.1** The site is shown to lie within Flood Zone 1 – ‘low probability of fluvial flooding’ of the Environment Agency’s Indicative Flood Map for Planning. This mapping indicates flooding from main river sources only, so does not include flooding from non-main river sources. A copy of the Environment Agency’s Floodmap can be seen in Appendix 1 – ‘Environment Agency Flood Map for Planning’.
- 3.3.2** The Strategic Flood Risk Assessment for Leicestershire includes mapping indicating areas at risk of fluvial flooding from non-main river sources (ie ordinary watercourses). This mapping indicates that areas along the sites eastern and western boundary, along the line of the drainage ditches, are susceptible to flooding from ordinary watercourses. The flood extents on the site are all indicates to be to the southern areas of the site and along the eastern and western perimeters. The site layout should, and has, therefore been developed to ensure that there is no loss

of floodplain storage, and development within areas indicated to be at risk of fluvial flooding is avoided.

3.3.3 There are no records of historical flooding affecting the site.

3.4 Ground Conditions

3.4.1 Geological information made available for the site shows that the site is underlain by slowly permeable, seasonally wet, acid loamy and clayey soils with impeded drainage. It is therefore likely that the ground at this location is largely impermeable. However, due to the presence of what is believed to be an infiltration basin on the site, it is recommended that detailed infiltration testing is undertaken to confirm if infiltration would be suitable in full or in part for the disposal of surface water from the site.

3.4.2 There are no BGS borehole records on the site itself. However, nearby boreholes along the line of the M1 extension immediately to the west of the site suggest that the area is underlain by 'sandy clay & gravel'. Approximately 300m west of the site is Old Cliffe Hill Quarry, a former granite quartz quarry, suggesting that the lower ground may have a low permeability. The presence of ordinary watercourse/ drainage ditches surrounding the site also suggests that the permeability may be low.

3.4.3 Table 3, below outlines the groundwater vulnerability at this location. The information has been gathered from the Environment Agency website.

Table 3: Summary of Groundwater Information	
Groundwater Source Protection Zone	None
Superficial Deposits Designation	Secondary (undifferentiated)
Bedrock Designation	Secondary B
Groundwater Vulnerability Zone	Medium/ Medium-Low

4 PROPOSED DEVELOPMENT

4.1 Description of Site Proposals

4.1.1 The proposed development will be used for the purposes of car sales, with associated landscaping and access works, consisting of two main buildings, one housing a car showroom and offices, and the other housing the car soft preparation and washdown. The external areas of the site will include an amended access from the north of the site, the retained access from the east of the site, external parking and display areas to the north of the buildings, and retained/ improved landscaping areas to the south of the buildings.

4.1.2 The proposed impermeable area of the finished development will be approximately 1950m², comprising of building footprint. In addition, the access and parking area of the site covers approximately 2600m² of the site. It is anticipated that this will be constructed using block paving, which is permeable surfacing, however due to the nature of the site and the unknown underlying ground infiltration rates, this area may also contribute to the surface water runoff from the site. Therefore, for the purposes of this report, the impermeable/ contributing area of the site is taken to be 4550m² (0.455ha).

4.1.3 A copy of the proposed site development plan is shown in the drawings section at the end of this report.

4.2 Vulnerability Classification

4.2.1 The Environment Agency Indicative Flood Map shows that the site lies within Flood Zone 1, with respect to Table 1 of the Technical Guidance. Parts of the site are shown to be within Flood Zone 2/3 of the SFRA ordinary watercourse mapping, however the development footprint is all located entirely within Flood Zone 1 areas.

4.2.2 The vulnerability class for the proposed development, with respect to Table 2 of the Technical Guidance, is 'less vulnerable'.

4.2.3 Table 3 of the Technical Guidance, 'Flood Risk Vulnerability and Flood Zone Compatibility', shows that site within Flood Zone 1 are suitable for all types of development. Less vulnerable developments are suitable for siting within Flood Zone 2 and Flood Zone 3a, but not within the functional floodplain (Flood Zone 3b). The site is therefore considered to be suitable for the type of development proposed.

4.3 Sequential and Exception Test

- 4.3.1** The Sequential Test, as set out in the Technical Guidance, aims to steer development to areas with the lowest risk of flooding (ie to steer developments to Flood Zone 1 where possible). Since the development is located wholly within Flood Zone 1, and following the guidance in Table 3 of the Technical Guidance, the Sequential Test is deemed to have been passed and there is, therefore, no requirement for the Exception Test to be carried out.

5 FLOOD RISK

5.1 Flood Risk – To the Development

5.1.1 The main sources of flooding are from rivers, tidal waters, high land/ overland runoff, high water tables, sewers/drains, and from artificial sources such as canals or reservoirs.

5.1.2 The presence of a potential flooding source within the vicinity of the site does not necessarily translate into a high risk of flooding. Table 4 (below) summarises the potential flood sources and the related flood risks poses to the site by the various sources.

Table 4: Sources of Flood Risk			
Flood Source	Presence at site?	Potential risk at site (high/ medium/ low)	Description
Fluvial	✓	Low	No main river flooding Minor extents of ordinary watercourse flooding along site boundaries.
Tidal	✗		
Groundwater	✗		
Sewers	✗		
Canals	✗		
Other Artificial Sources	✗		
Pluvial	✓	Low	
Other	✗		

5.1.3 The site is not near to the coast or within the tidal reaches of any watercourses, and therefore, flooding from this source has been discounted. Similarly, there are no canals or artificial sources of water within the vicinity of the site and so flooding from these sources has also been discounted.

5.1.4 Fluvial Flooding

The site is shown on the Environment Agency's Flood Map for planning to be within Flood Zone 1, and so it considered to be at low risk of fluvial flooding from main river sources. The site is in excess of 3.5km upstream of any main rivers, and so the risk of flooding from this source is considered to be negligible.

Ordinary watercourse flooding is shown on the SFRA mapping to cover a portion of the site along the western boundary. No modelled flood levels have been made available to support the flood map outlines, and so the outlines have been compared to the site topographical survey to determine the extents and estimate approximate corresponding flood levels.

Flood extents for Flood Zone 2 (1 in 1000 year), Flood Zone 3a (1 in 100 year) and Flood Zone 3b (1 in 20 year), and all confined to the area within denser woodland which has not been picked up on the topographical survey. Therefore, the level where it intersects with the eastern channel which is included on the survey, and the maximum level is estimated to be approximately 183.64mAOD.

The lowest existing ground level around the proposed building footprint is shown on the topographical survey to be approximately 186.5mAOD, so it considered unlikely that the building would be affected by fluvial flooding for events up to the 1 in 1000 year event.

Modelled 1 in 100 year + climate change to the 2080's level for the lower, middle and upper end allowances have also been provided. The lower and middle allowance outlines are similar to the Flood Zone 2 outlines, but the upper end allowance encroaches further into the site. The outlines does not encroach as far as the existing buildings, and based on the topographical survey are estimated to be approximately 185.5mAOD, ie approximately 1m below the ground levels around the proposed building footprint. Therefore, it is not anticipated that the proposed development would be impact by fluvial flooding even in the upper end 2080's climate change scenario.

The risk posed to the development by fluvial flooding is, therefore, considered to be low.

5.1.5 Groundwater

Groundwater flooding can occur anywhere where groundwater levels rise above the ground level. Susceptibility to groundwater flooding is indicated on the SFRA mapping, which suggests that the site is at low risk of groundwater flooding. There is no proposed development below ground level, and so the risk posed by high groundwater levels is also low.

5.1.6 Sewers

There are no public sewers crossing, serving or within the vicinity of the site, and therefore, sewer flooding is not considered to pose any risk to the site.

5.1.7 Pluvial/ Overland Flow

On land where there is impermeable surfacing or where the ground infiltration capacity is exceeded, there is the potential for surface water runoff to occur.

The 30 year (3.3%) surface water flood outline does not encroach onto the site, and is not anticipated to impact on the site in any way.

The 100 year (1%) outline is similar to the fluvial Flood Zone 3b outline, which impacts only on a small portion of the site along the western boundary. It is therefore, not anticipated that pluvial flooding from the 1% event would impact on the proposed development

The 1000 year (0.1%) outline is very similar to the upper end 1 in 100 year + climate change fluvial flood outline, although the pluvial outline extend slightly further to cover the pond areas of the site. Since the ponds will be retained within the site proposed site layout, and there is no proposed buildings within the pluvial flood outline, it is not anticipated that this event would impact on the proposed development.

The risk posed to the proposed development from pluvial flooding is, therefore, considered to be low.

5.2 Flood Risk – From the Development

5.2.1 Floodplain Storage

There is no land raising or building footprint proposed within the modelled flood outlines, and the existing ground levels around the proposed development platforms are all already above the estimated flood levels. Therefore, there is no loss of floodplain storage as a result of the proposed development, and no floodplain compensation will be required.

5.2.2 Flood Flow Routes

There are no flood flow routes crossing the area of the proposed development, and therefore, there should be no disruption to existing flow routes on the site and no mitigation will be required.

5.2.3 Culverts

There are no culverted watercourses crossing the site and it is not proposed to install any new culverts over existing open watercourses.

The eastern access to the site, which is at an existing access point, crosses the land drainage ditch along the western boundary. Some minor modifications to this cross may be required to ensure that the crossing is suitable for the proposed traffic loadings, in terms of the structural capacity and the width of the crossing. Any changes to the existing culvert should ensure that there is no loss of capacity within the existing drainage channel.

5.3 Climate Change

5.3.1 In assessing the potential flood risk at the site over the lifetime of the development climate change has been taken into account. Climate change allowances have been based on the guidance provided by the Environment Agency (Published in April 2016) which has been reproduced as Table 6 (below) for the Soar Management Catchment which covers the site. In line with Government Guidance, the central allowance should be used for less vulnerable developments.

Table 6: Recommended national precautionary sensitivity ranges			
Parameter	2020s	2050s	2070s
Peak rainfall intensity (upper end)		40%	40%
Peak river flow (central allowance)	14%	+16%	+28%

5.3.2 In assessing the likelihood of flood risk to the site from the ordinary watercourses surrounding the site, the 1 in 100 year + climate change information provided within the SFRA has been used. In assessing the volume of storage needed to attenuate surface water flows from the site estimated peak rainfall intensities have been increase by 40% to allow for climate change during the lifespan of the development.

5.4 Drainage Proposals

5.4.1 The discharge of surface water from the site has been assessed in line with the surface water drainage hierarchy, which states that surface water should be discharged preferentially via the following paths:

- Discharge to ground (ie soakaway)
- Discharge to watercourse
- Discharge to surface water drain/sewer
- Discharge to combined water drain/sewer.

- 5.4.2** As outlined in the earlier section of this report, infiltration testing has not currently been completed, and it is unclear if the site will be suitable for the use of formal soakaways. This should be investigated as part of the detailed design phase for the site development, and soakaways should be used where possible. If soakaways are to be used at the site, it is anticipated that surface water falling onto the block paved area could infiltrate directly to the underlying ground, without the need for a separate soakaway facility. For the building roof areas, it may be possible to also direct these to the area underlying the site car parking, or an external soakaway facility could be utilised. It is speculated that the dry 'pond' on site could be a soakaway feature serving the existing development on the site, in which case it may be possible to reuse this existing facility, subject to confirmation by the necessary calculations. It is proposed to use soakaways where possible, however due to the necessary testing being unavailable, for the purposes of this report it is assumed that infiltration will not be viable for use at the site.
- 5.4.3** There are ordinary watercourses/ land drainage networks surrounding the site. Where infiltration is not possible, it should be possible to provide a connection to the land drainage network, subject to the necessary consents from the Lead Local Flood Authority. At this stage it is unclear if there are any existing connections which could be reutilised, or if a new connection would be required. Flows to this point of connection should be restricted and attenuated to ensure that there is no increase in flood risk to offsite areas as a result of the proposed development. Should infiltration not be viable at the site, then discharge to watercourse is proposed.
- 5.4.4** There is no surface water sewer present within the vicinity of the site and so it will not be possible to utilise a public sewer connection for the disposal of surface water from the site. Discharge to sewer is not required since either infiltration or a watercourse connection will be utilised.
- 5.4.5** Due to the nature of the proposed site layout, a significant amount of the site will remain undeveloped and will, therefore, not contribute to the proposed drainage network in any way. The surface water runoff rate from the proposed surface water drainage network should, therefore, be pro-rated to reflect the area contributing to the network. The total QBAR greenfield runoff rate from the 1.42ha site has been calculated as 7.02l/s. The building roof area is measured at 0.195ha, and the total impermeable area if the external hardstanding area is included is measured at 0.4555ha. This results in runoff rates of 0.96l/s and 2.25l/s, respectively. There is no specific local guidance for the minimum recommended flow rates for surface water drainage networks, and so it is anticipated that the general industry recommended

flow rate of 5l/s would be applicable to this site. Therefore, it is recommended that flows from the proposed development should be discharged at the restricted rate of 5l/s.

- 5.4.6** Additional surface water runoff created as a result of the proposed development will be attenuated onsite so as not to increase the flood risk to areas offsite. Surface water attenuation requirements have been calculated and approximately 70m³ of storage will be required to contain the 100 year + climate change rainfall event from the building roof area only, and approximately 225m³ will be required to accommodate flows from the building roof area and the external hardstanding areas. Indicative surface water attenuation calculations can be found within Appendix 3 of this report. The external hardstanding area has a footprint of approximately 2600m², and so storage of 225m³ could be accommodated within the sub-base of approximately 300mm depth with 0.3 void ratio, which is likely to be akin to the standard construction depth without any significant additional storage provision. The existing ponds on the site are also to be retained as part of the landscaping proposals, and may be suitable for use within the surface water drainage network, especially if flows from the existing site are confirmed to contribute to these waterbodies.
- 5.4.7** A detailed site investigation and testing will be undertaken at the design stage to determine whether Sustainable Drainage Systems (SuDS) will be suitable for the disposal of surface water drainage on the site.
- 5.4.8** Table 6 (below) summarises the different SuDS techniques, some of which may be appropriate to the development.

Table 6: Sustainable Drainage System (SuDS) Techniques

Type	SuDS Element/ Device	Description	Potential for Use at the Site
Source Control	Green roof	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation.	Potential for use at the site, subject to detailed design. Solar panels are proposed for use on the building roofs, so the design of any roof system should also be able to accommodate solar panels
	Infiltration devices	Infiltration devices temporarily store runoff from a development and allow it to percolate into the ground.	Potential for use at the site, subject to infiltration rates
	Pervious surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water or sewers.	Pervious paving is proposed for the external hardstanding areas.
	Rainwater harvesting	Rainwater harvesting reduces the amount of runoff from a site by re-using the water for non-potable uses	Potential for use at the site, subject to requirements within the site.

Permeable Conveyance	Filter strips/Rain Gardens	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	Potential for use within the site, either by directing flows to the existing gardens, or to be incorporated into any new landscaping areas. Recommended for further consideration as part of the detailed design.
	Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff, and can infiltrate the water into the ground (if ground conditions allow).	Potential for use at the site, subject to detailed design and infiltration rates.
	Filter drains & perforated pipes	Filter drains are trenches that are filled with permeable material. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site. A slotted or perforated pipe may be built into the base of the trench to collect and convey the water.	Potential for use at the site, subject to detailed design.

Passive treatment/ end of pipe treatment	Infiltration basins	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the ground. They may also be landscaped to provide aesthetic and amenity value.	Potential for use at the site, subject to detailed design and infiltration rates. Potential for re-use of existing dry 'pond' as part of the proposed drainage network.
	Wet ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment. They provide temporary storage for additional storm runoff above the permanent water level. Wet ponds may provide amenity and wildlife benefits.	Potential for use at the site, subject to detailed design. Potential for re-use of existing ponds as part of the proposed drainage network.
	Constructed wetlands	Constructed wetlands are ponds with shallow areas and wetland vegetation to improve pollutant removal and enhance wildlife habitat.	Potential for use at the site, subject to detailed design and infiltration rates.
	Underground attenuation	Underground attenuation can be used where other forms of SuDS are not appropriate for the site. Underground attenuation stores water for volumes above the allowable discharge rate and releases the water into the received at the allowable rate.	Potential for use at the site, subject to detailed design if required.

5.5 Pollution Hazard Index

5.5.1 The table below has been extracted from the SuDS Manual, Table 26.2. The site use as car dealership with associated parking is considered to have a pollution risk of 'low risk' for the roof areas and 'medium risk' for the car parking areas. Mitigation measures will therefore be required to ensure that surface water flows from the site do not present an unacceptable pollution risk to the downstream surface water catchment.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

5.5.2 To ensure that adequate mitigation is provided, the level of treatment must exceed the pollution hazard score. The following table outlines typical levels of treatment provided by various SuDS components. In addition, non-SuDS elements such as bypass separators can also be used as part of the treatment train, however clean roof water should not normally pass through such treatment options.

5.5.3 The total mitigation index score is calculated using the following formula:

$$\text{Total mitigation indices score} = \text{Mitigation indices 1} + 0.5(\text{Mitigation indices 2} \dots n)$$

Additional levels of treatment should be provided until the level of treatment provided exceeds the level required.

TABLE 26.3 - Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	Mitigation indices		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Full table notes and references are available in The SuDS Manual

- 5.5.4** The types of treatment used at the site will be determined at the detailed design stage, in order to meet the aforementioned criteria. Table 7 (below) presents a water quality risk assessment and outlines the likely proposal in respect of the required mitigation measures, in line with the SUDS manual and the NPPF.

Table 7: Water Quality Risk Assessment and Mitigation

Pollution Hazard Indices				
	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Commercial yard/ delivery areas... non-residential car parks with frequent change (retail)	Medium	0.7	0.4	0.4
SuDS Mitigation Indices				
Permeable Pavement	First Level X 1.0	0.7	0.6	0.4
<i>Total Mitigation Index</i>		0.7	0.6	0.4
<i>Residual Impact</i>		0	+0.2	0

5.5.5 The exact details of the proposed surface water drainage network has not yet been confirmed, and so additional or alternative levels of treatment may be provided, depending on other factors of the site design and layout. It is considered that, as a minimum, permeable paving will be used for the external areas, which provide sufficient treatment of surface water, as outlined above. Any additional features will provide additional treatment, over and above the required minimum levels. More detailed surface water drainage design proposals for the site should be confirmed at the discharge of conditions/ detailed design stage of the project.

5.5.6 There are no foul or combined sewers within the vicinity of the site, and so it will not be possible to utilise a public sewer connection for the disposal of foul flows from the site. A non-main drainage solution will therefore be required. There are a number of options for non-main drainage as outlined below:

- Package treatment plant with treated flows being discharged to ground or to the adjacent watercourse;
- Septic tank should discharge to a drainage field and infiltration be feasible at the site; or
- Storage and tankering offsite by a licensed carrier

5.5.7 Foul flows from the site will likely include drainage from toilets and kitchen facilities, as well as from vehicle washdown areas. There are no mechanical or bodyshop repairs proposed to take place on the site, so contamination from these processes is

not likely, however there may still be the risk of contaminants due to the nature of the site use. Details of the foul drainage for the proposed site will be confirmed at the discharge of conditions/ detailed design stage, which should include the necessary processes for the treatments of any potential contaminated flows from the site.

6 RESIDUAL RISKS

- 6.1** There is always a possibility of a flood in excess of that allowed for which might conceivably cause some flooding to the development. However, such an event would have a very low probability and the risk of flooding to development would be extremely small. It is therefore considered that the residual risks associated with flooding are not significant.

7 CONCLUSIONS

- 7.1** This report gives details of the Flood Risk Assessment, which has been carried out in relation to the proposed demolition of existing buildings and erection of buildings to be used for the purposes of car sales at Altar Stones Lane, Markfield, Leicestershire.
- 7.2** The site falls entirely within Flood Zone 1 of the Environment Agency's Main River Flood Map, and within Flood Zones 1, 2 and 3 of the SFRA mapping for ordinary watercourses, in accordance with Table 1 of the Technical Guidance, however all of the proposed built development footprint is located within Flood Zone 1. The vulnerability class of the proposed development is 'less vulnerable'. Table 3 of the Technical Guidance indicates that sites classified as less vulnerable are suitable within flood zones 1, 2 and 3 and the site is therefore determined to be suitable for the development proposed.
- 7.3** The Strategic Flood Risk Assessment for the Hinckley and Bosworth Borough Council which covers the proposed development site includes information regarding flooding from all other non-main river sources, including from the ordinary watercourses adjacent to the site. The sources of flooding identified as potentially affecting the site are all confined to areas away from the proposed build development footprint and so are not anticipated to impact on the proposed development.
- 7.4** An outline surface water drainage strategy is present within this report, and should be used as a basis for the detailed drainage design for the site. Surface water flows from the development should be restricted to the industry recommended minimum rate of 5l/s, with surface water attenuation provided up to the 1 in 100 year + climate change event.
- 7.5** There are no local site specific risks that would adversely affect this categorisation. Similarly there are considered to be no significant increased offsite flooding risks as a result of the development. The site is therefore considered suitable for the type of development proposed.

APPENDICES

Appendix 1
Environment Agency Flood Map for Planning

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
448068/311014

Created
6 Sep 2023 8:20

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

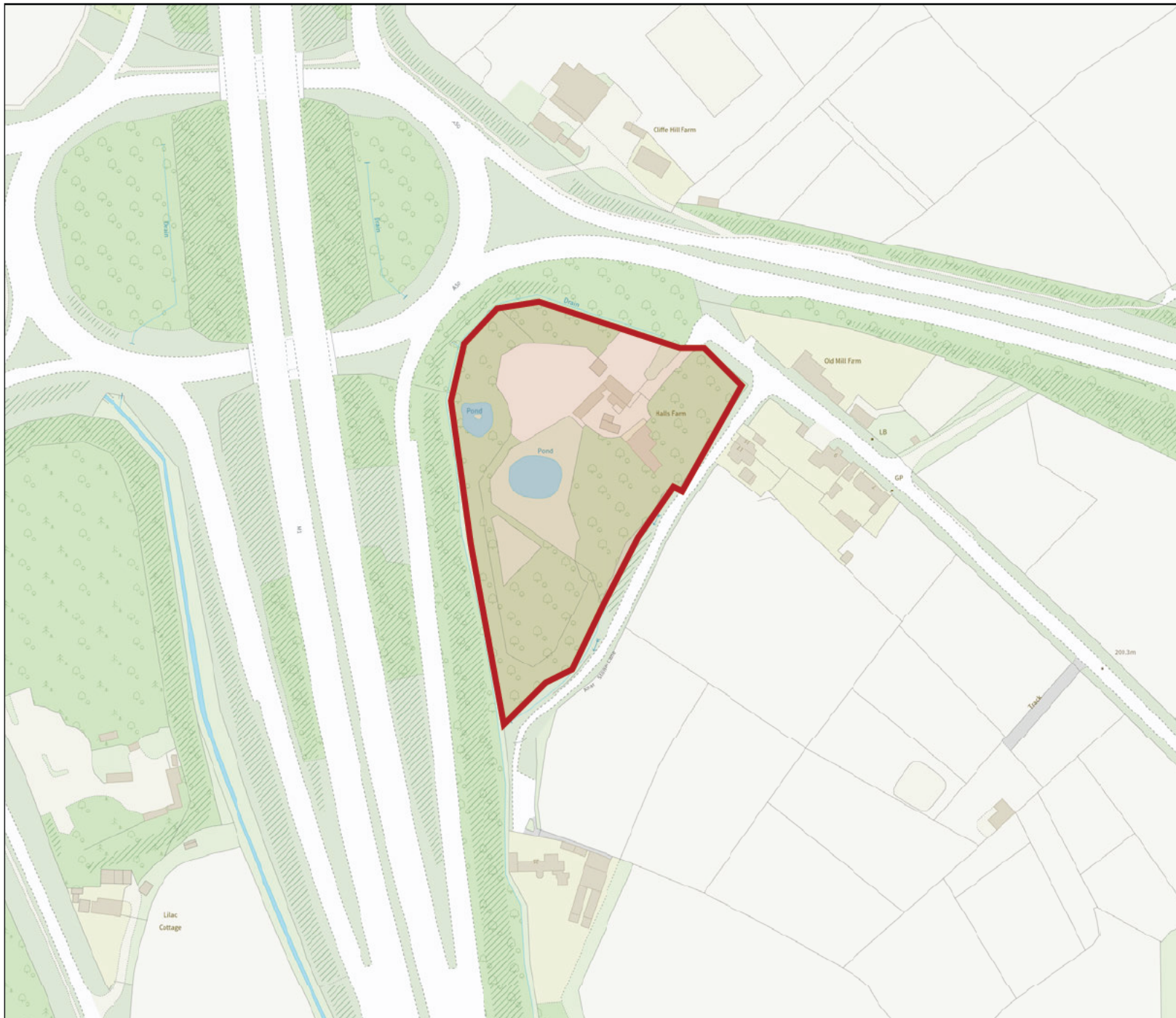
Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference
<Unspecified>

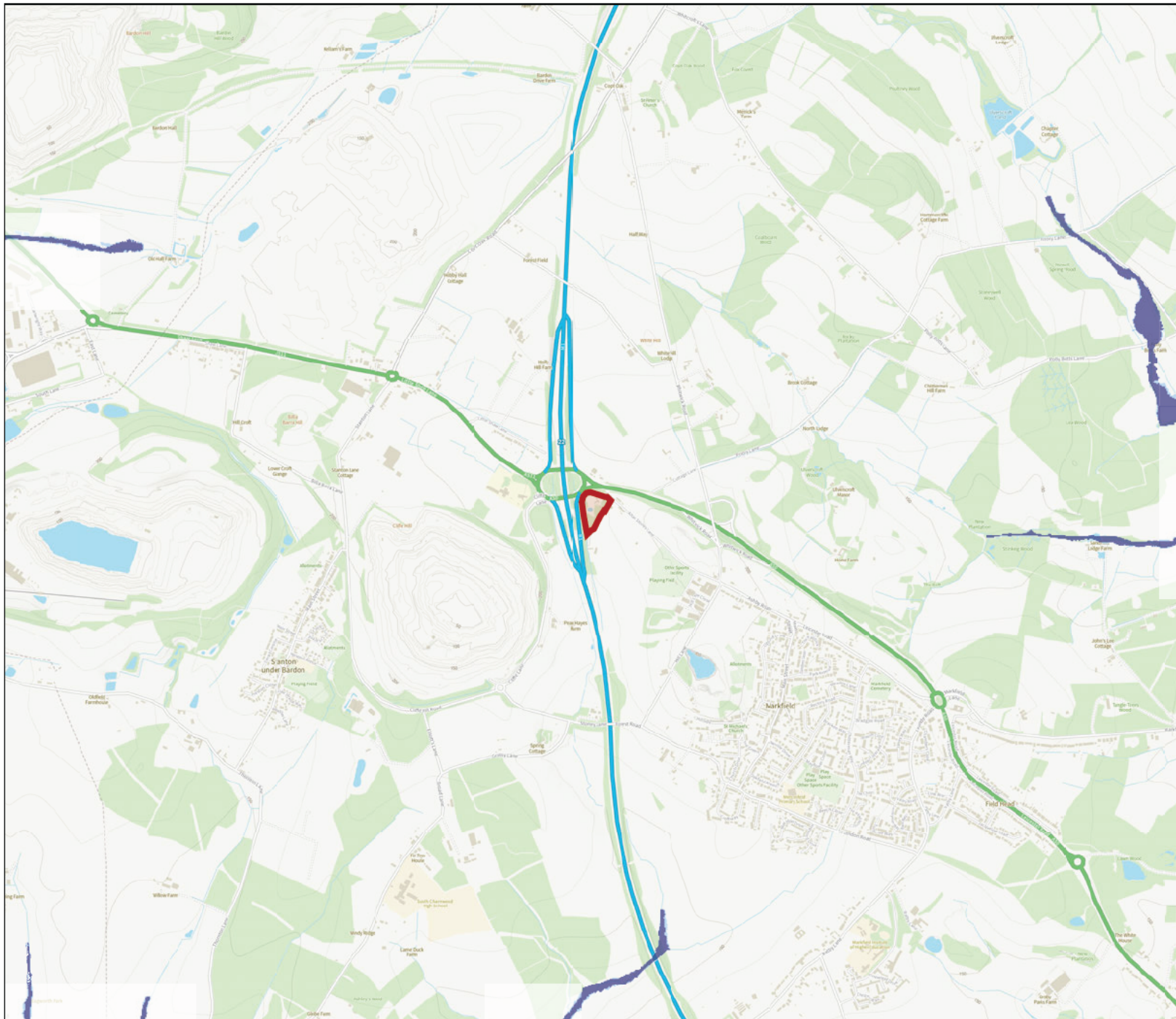
Location (easting/northing)
448068/311014

Scale
1:2500

Created
6 Sep 2023 8:20

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area

0 20 40 60m



Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
448068/311014

Scale
1:25000

Created
6 Sep 2023 8:21

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area


0 200 400 600m

Appendix 2

Greenfield Runoff Calculations

Calculated by:	Nicola Dibble
Site name:	Hillmoren
Site location:	Markfield, Leicester

Site Details

Latitude:	52.69490° N
Longitude:	1.29064° W
Reference:	3683596425
Date:	Sep 06 2023 11:51

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.

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1.42
-----------------------	------

Methodology

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

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.

Soil characteristics

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

(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.

Hydrological characteristics

	Default	Edited
SAAR (mm):	714	714
Hydrological region:	4	4
Growth curve factor 1 year:	0.83	0.83
Growth curve factor 30 years:	2	2
Growth curve factor 100 years:	2.57	2.57
Growth curve factor 200 years:	3.04	3.04

(3) Is $SPR/SPRHOST \leq 0.3$?

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):	7.02	7.02
1 in 1 year (l/s):	5.82	5.82
1 in 30 years (l/s):	14.03	14.03
1 in 100 year (l/s):	18.03	18.03
1 in 200 years (l/s):	21.33	21.33

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix 3
Indicative Surface Water Attenuation Calculations


Minimum Storage Required: **71 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	5	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.195	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	714	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	5	Volume 3 maps and site location
SOIL:	0.5	Soil Type and Volume 1, Section 7.4
UCWI:	71	SAAR and Volume 1, Figure 9.7
Calculated PR	80.22	
Percentage Runoff =	80.22	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	40

Duration, D (min)	M5-60 (mm)	Z1 for r=0.40	M5-D (mm)	Z2 for M100	M100-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
5	20	0.38	7.6	1.86	14.2	19.8	0.20	80	31.0	0.0	31.0	0.30	1.5	29.5
10	20	0.54	10.8	1.93	20.8	29.1	0.20	80	45.6	0.0	45.6	0.30	3.0	42.6
15	20	0.63	12.6	1.96	24.7	34.5	0.20	80	54.0	0.0	54.0	0.30	4.5	49.5
30	20	0.80	16.0	2.00	32.0	44.8	0.20	80	70.0	0.0	70.0	0.30	9.0	61.0
60	20	1.00	20.0	2.03	40.6	56.8	0.20	80	88.9	0.0	88.9	0.30	18.0	70.9
120	20	1.20	24.0	2.01	48.3	67.7	0.20	80	105.9	0.0	105.9	0.30	36.0	69.9
240	20	1.46	29.2	1.98	57.8	80.9	0.20	80	126.5	0.0	126.5	0.30	72.0	54.5
360	20	1.60	32.0	1.95	62.5	87.5	0.20	80	136.9	0.0	136.9	0.30	108.0	28.9
480	20	1.70	34.0	1.94	65.9	92.2	0.20	80	144.3	0.0	144.3	0.30	144.0	0.3
600	20	1.83	36.6	1.91	70.1	98.1	0.20	80	153.4	0.0	153.4	0.30	180.0	-26.6
720	20	1.85	37.0	1.91	70.8	99.1	0.20	80	155.1	0.0	155.1	0.30	216.0	-60.9
840	20	1.90	38.0	1.91	72.4	101.4	0.20	80	158.6	0.0	158.6	0.30	252.0	-93.4
1440	20	2.28	45.6	1.84	84.0	117.6	0.20	80	184.0	0.0	184.0	0.30	432.0	-248.0
2880	20	2.70	54.0	1.78	96.3	134.8	0.20	80	210.8	0.0	210.8	0.30	864.0	-653.2


Minimum Storage Required: **223 m³** incl cc allowance

FACTOR	VALUE	SOURCE
Return Period (yrs):	100	Environment Agency, Water Authority, etc.
Limiting Discharge (l/s):	5	Environment Agency, Water Authority, etc.
Contributing Area (ha):	0.4555	Site plans
Impervious, PIMP (%):	100	Site plans
M5-60min (mm):	20	Volume 3 maps and site location
SAAR (mm/yr):	714	Volume 3 maps and site location
Ratio, r:	0.4	Volume 3 maps and site location
Soil Type:	5	Volume 3 maps and site location
SOIL:	0.5	Soil Type and Volume 1, Section 7.4
UCWI:	71	SAAR and Volume 1, Figure 9.7
Calculated PR	80.22	
Percentage Runoff =	80.22	

FACTOR	VALUE
Additional Inflow (l/s):	0
Calculate/Specify PR:	Calculate
Specify PR:	100
Climate Change Allowance	40

Duration, D (min)	M5-60 (mm)	Z1 for r=0.40	M5-D (mm)	Z2 for M100	M100-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
5	20	0.38	7.6	1.86	14.2	19.8	0.46	80	72.4	0.0	72.4	0.30	1.5	70.9
10	20	0.54	10.8	1.93	20.8	29.1	0.46	80	106.4	0.0	106.4	0.30	3.0	103.4
15	20	0.63	12.6	1.96	24.7	34.5	0.46	80	126.2	0.0	126.2	0.30	4.5	121.7
30	20	0.80	16.0	2.00	32.0	44.8	0.46	80	163.5	0.0	163.5	0.30	9.0	154.5
60	20	1.00	20.0	2.03	40.6	56.8	0.46	80	207.7	0.0	207.7	0.30	18.0	189.7
120	20	1.20	24.0	2.01	48.3	67.7	0.46	80	247.3	0.0	247.3	0.30	36.0	211.3
240	20	1.46	29.2	1.98	57.8	80.9	0.46	80	295.5	0.0	295.5	0.30	72.0	223.5
360	20	1.60	32.0	1.95	62.5	87.5	0.46	80	319.9	0.0	319.9	0.30	108.0	211.9
480	20	1.70	34.0	1.94	65.9	92.2	0.46	80	337.1	0.0	337.1	0.30	144.0	193.1
600	20	1.83	36.6	1.91	70.1	98.1	0.46	80	358.4	0.0	358.4	0.30	180.0	178.4
720	20	1.85	37.0	1.91	70.8	99.1	0.46	80	362.3	0.0	362.3	0.30	216.0	146.3
840	20	1.90	38.0	1.91	72.4	101.4	0.46	80	370.5	0.0	370.5	0.30	252.0	118.5
1440	20	2.28	45.6	1.84	84.0	117.6	0.46	80	429.7	0.0	429.7	0.30	432.0	-2.3
2880	20	2.70	54.0	1.78	96.3	134.8	0.46	80	492.5	0.0	492.5	0.30	864.0	-371.5

DRAWINGS



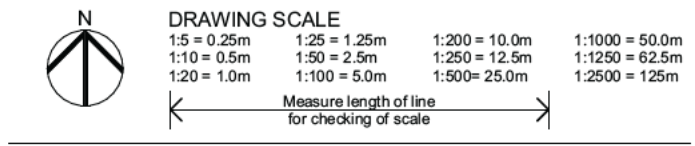
Site Location Plan

1:1250



Existing Site Plan

1:500



SURFACE MATERIAL KEY

- | | |
|----------|-------------------|
| A Grass | B Concrete |
| C Tarmac | D Vegetation |
| E Gravel | F Compacted Stone |

BOUNDARY TREATMENTS

- | | |
|-------------------------|----------------|
| EB1 Post and Wire Fence | EB2 Stone Wall |
| EB3 Hedge | |

CHANGE MANAGER

Change Description By

P01	First Issue	16/12/2022	LH	JH
Rev	Issue Status	Date	By	Cr'd

Thinking Buildings

Oxfordshire: 01295 236 246 | Derbyshire: 01332 416 405
email@thinking-buildings.co.uk
www.thinking-buildings.co.uk

Client Name: Ravi and Rishi Dhir

Project Name: Hillmoren

Site Address: Halls Farm Altar Stones Lane Markfield

Drawing Name: Existing Site Plan

CDE File Name: 2237 - THB - ZZ - ZZ - DR - A - 0010 - P01

Print Size: A1 Project No: 2237 Drawing No: 0010 Status: S0 Rev: P01

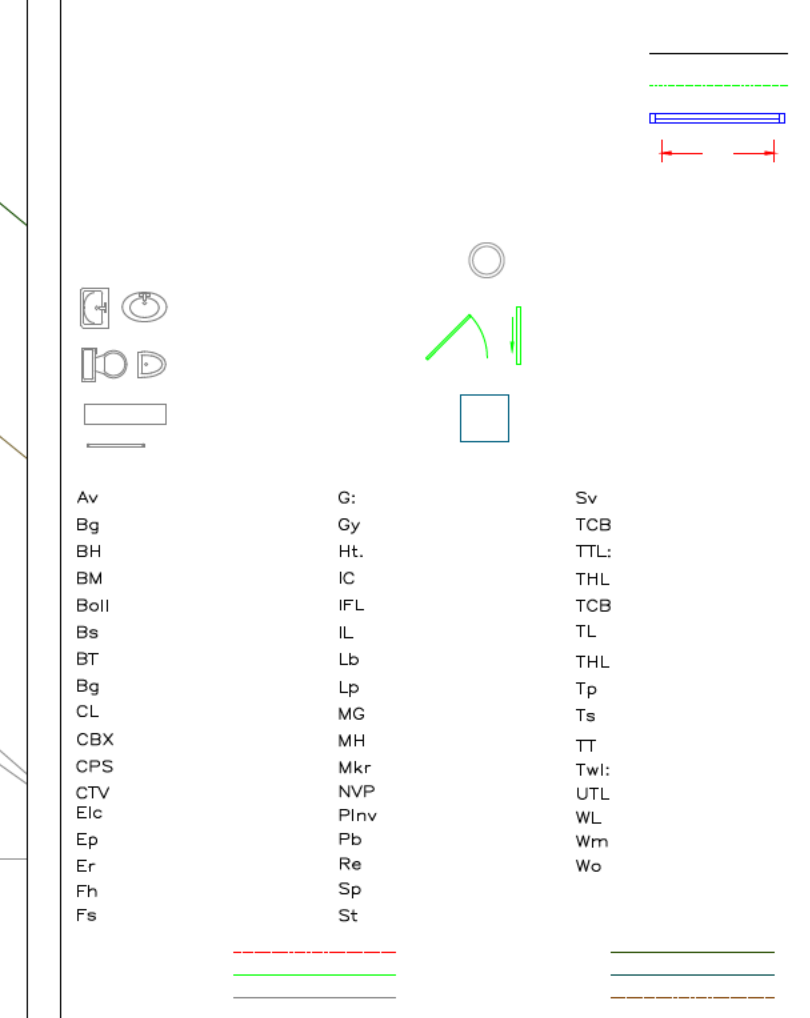
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TB A1 Landscape 2022 Version 1.0 A20



1:500

TB 41, London 2002.



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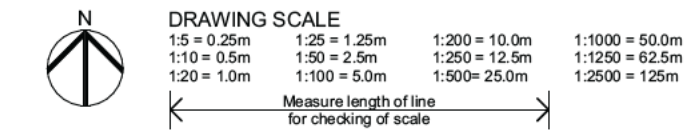
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1

Proposed Site Plan

1:500



GENERAL NOTES

All works to comply with the Building Regulations and completed to the satisfaction of Building Control. All works must be completed to the minimum standard required by Building Control & NHBC except where the standards required on these drawings are higher, in this case the specification on these drawings should be followed.

All works to comply with relevant British Standards and codes of practice including BS 8000. Works to be undertaken in accordance with relevant health and safety legislation, adopting safe methods of working and in accordance with manufacturers' product literature and H&S data sheets.

Drawing should be read in conjunction with relevant Structural and M&E design information, and Contractor to check all levels, dimensions and heights on site before commencing.

- A** Site entrance
- B** External vehicle storage
- C** Staff parking, with EV charging
- D** Detailing / Prep building, 10 cars. Small office and WC etc...
- E** Customer parking - with EV charging
- F** Refuse / bins
- G** Covered secure cycle parking
- E** EV Charging
- Easement to watercourse

TREE SURVEY KEY

- Root Protection Areas
- Category C Trees
- Category B Trees
- Category U Trees
- Tree Canopy
- T40** Tree Tag - refer to tree survey
- W40** Woodland Tag - refer to tree survey
- G40** Mixed Group - refer to tree survey
- H40** Hedgerow Tag - refer to tree survey

SURFACE MATERIALS KEY

- 1** Grass / Landscaping
- 2** Tarmac
- 3** Permeable Block Paving

BOUNDARY TREATMENTS

- B1** Stone wall
- B2** Mixed hedgerow

CHANGE MANAGER

Change	Description	By
Ch 029	Surface and Boundary key added	JM
Ch 030	Site labels amended for planning submission	JM
Ch 031	General key updated	JM

P08	For Comment	05/09/2023	JM	JH
P07	For Comment	14/08/2023	JM	JH
P06	For Comment	10/08/2023	JM	JH
P05	For Comment	08/08/2023	JM	JH
P04	For Comment	03/08/2023	JM	JH
P03	For Comment	24/07/2023	JM	JH
P02	Feasibility	14/07/2023	JM	JH
P01	Feasibility	04/07/2023	JM	JH
Rev	Issue Status	Date	By	Ch'd

Thinking Buildings

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Client Name:	Ravi and Rishi Dhir
Project Name:	Hillmoren
Site Address:	Halls Farm Altar Stones Lane Markfield
Drawing Name:	Proposed Site Plan
CDE File Name:	2237 - THB - ZZ - ZZ - DR - A - 0050 - P08
Project No:	2237
Drawing No:	0050
Sheet No:	S0
Rev:	P08

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