

BARROW HILL QUARRY, MILL LANE, EARL SHILTON
FLOOD RISK ASSESSMENT AND DRAINAGE STATEMENT
JUNE 2023
REF: 26726-01-TN-01 REV B

01530 264 753
group@m-ec.co.uk
www.m-ec.co.uk

Introduction

Mewies Engineering Consultants Ltd (M-EC) has been commissioned by AT Contracting and Plant Hire to undertake a Flood Risk Assessment (FRA) and a Drainage Strategy Drawing to support a planning application for a proposed leisure development at Barrow Hill Quarry, Mill Lane, Earl Shilton. A site location plan is provided in Appendix A.

The proposed development will take place in the Greenfield area west of Mill Lane, refer to Appendix B for site layout. The total site area covers approximately 2.85ha.

Revision A of this report was for a proposed leisure development for up to 21 holiday let lodges with associated infrastructure, parking and access to Mill Lane. Having achieved consent for 21 lodges (application reference 21/01390/FUL), revision B is for a proposed development of up to 36 lodges with a site management building and associated infrastructure, parking and access to Mill Lane.

The assessment has been undertaken to ascertain the constraints of the development to the site and assess the impact of the design, concerning flood risk.

This Flood Risk Assessment has been carried out in accordance with the requirements of the National Planning Policy Framework (Ref. 4) and its companion document the National Planning Practice Guidance (Ref. 17). See Appendix C for policies and references.

The assessment has been prepared using our best engineering judgement however there are levels of uncertainty implicit in the historical data and methods of analysis. The report is based on the following information:

- British Geological Survey (BGS);
- Flood Zone Maps from the Environment Agency and .gov.uk websites; and
- Topographical Survey

All comments and opinions contained in this report, including any conclusions, are based on the information available to M-EC at the time of writing the report. The conclusions drawn by M-EC could, therefore, differ if the information is found to be inaccurate, incomplete or misleading. M-EC accepts no liability should this prove to be the case, or, if additional information exists or becomes available with respect to this site.

M-EC has completed this report for the benefit of the organisations/individuals referred to in the Introduction section; and any relevant Statutory Authority which may require a reference in relation to approvals for the proposed redevelopment of the site. Other third parties should not use or rely upon the contents of the report unless written approval has been gained from M-EC.

M-EC accepts no responsibility or liability for:

- the consequences of this documentation being used for any purpose or project other than that for which it was commissioned, and
- this document to any third party with whom approval for use has not been agreed.

Site Description

The Ordnance Survey National Grid Reference for the centre of the site is E:448790, N:297136. The entire site measures approximately 2.85ha and currently consists of a former quarry. The M69 is to the south of the development. The site location is shown in Figure 1.

Figure 1: Site Location Plan



Topographic Data

Full details of the topographical survey are included in Appendix D. The information indicates the site generally slopes from the northwest to southeast with levels ranging from around 88.41m AOD to 80.31m AOD.

Flood Zone Maps & Flood Defence Data

Information relating to the current flood risk to the application site has been obtained from the Environment Agency and .gov.uk websites. There is no recorded evidence of flood defences in the vicinity of the site.

Watercourses & Hydrology

The closest watercourse is an unnamed ditch network situated approximately 150m south of the site.

Historic Flooding

There are no known historic flood incidences in the vicinity of the site.

Geological Data

Information published by the BGS indicates that the site's bedrock geology comprises of the South Leicestershire Diorite Complex consisting of Quartz Diorite and the Edwalton Member consisting of mudstone. Superficial deposits overlie the bedrock consisting of Diamicton from the Thrussington member.

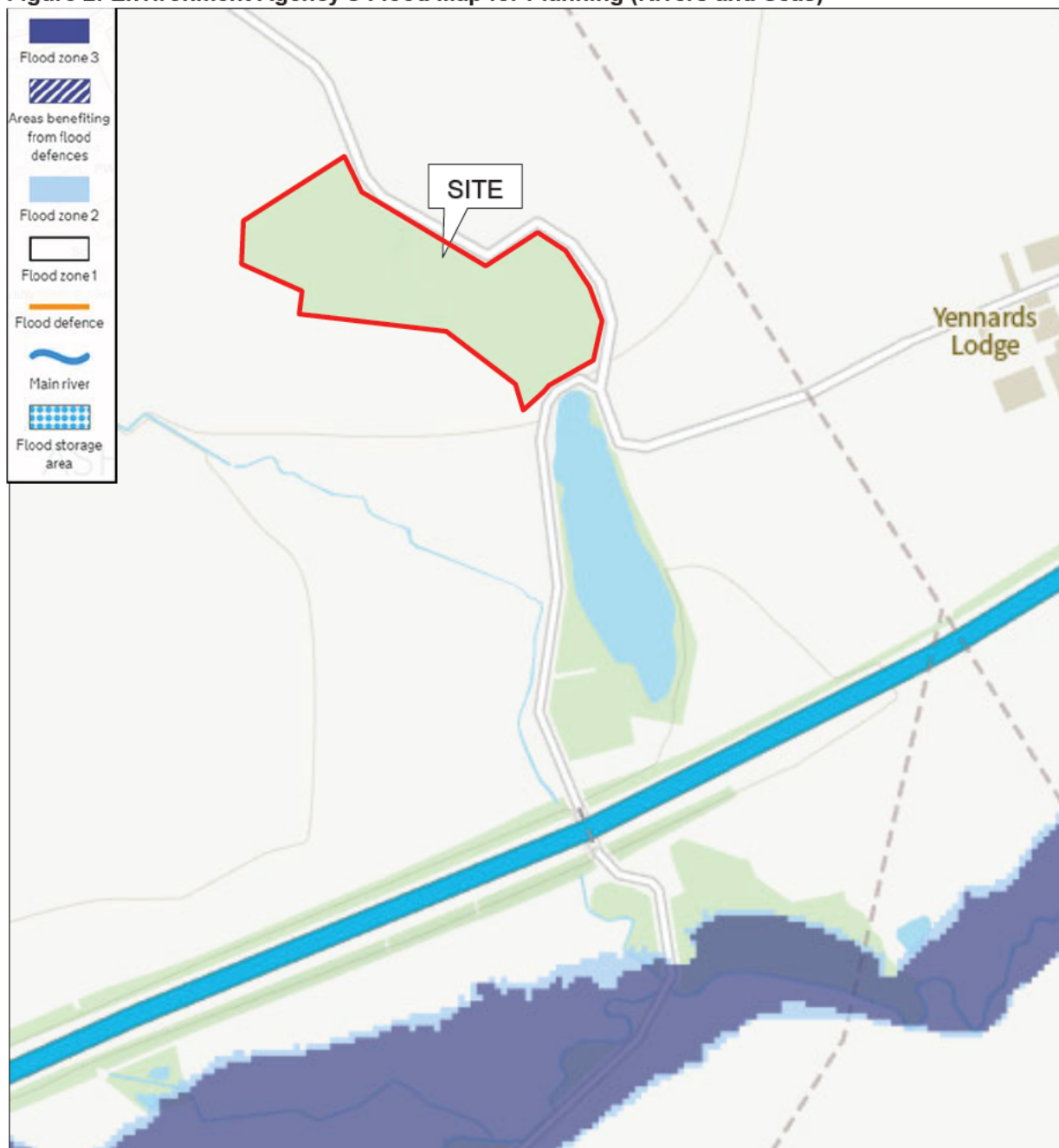
Sewers

Sewer records have been obtained from Severn Trent Water, see Appendix E. The sewer records state that there are no sewers within the vicinity of the site.

River and Seas Flood Zone Allocation

The Flood Map for Planning is shown in Figure 2. The map shows the site lies within Flood Zone 1 (FZ1). This means that each year this area has a chance of flooding of less than 0.1%. There are no flood defences in the area.

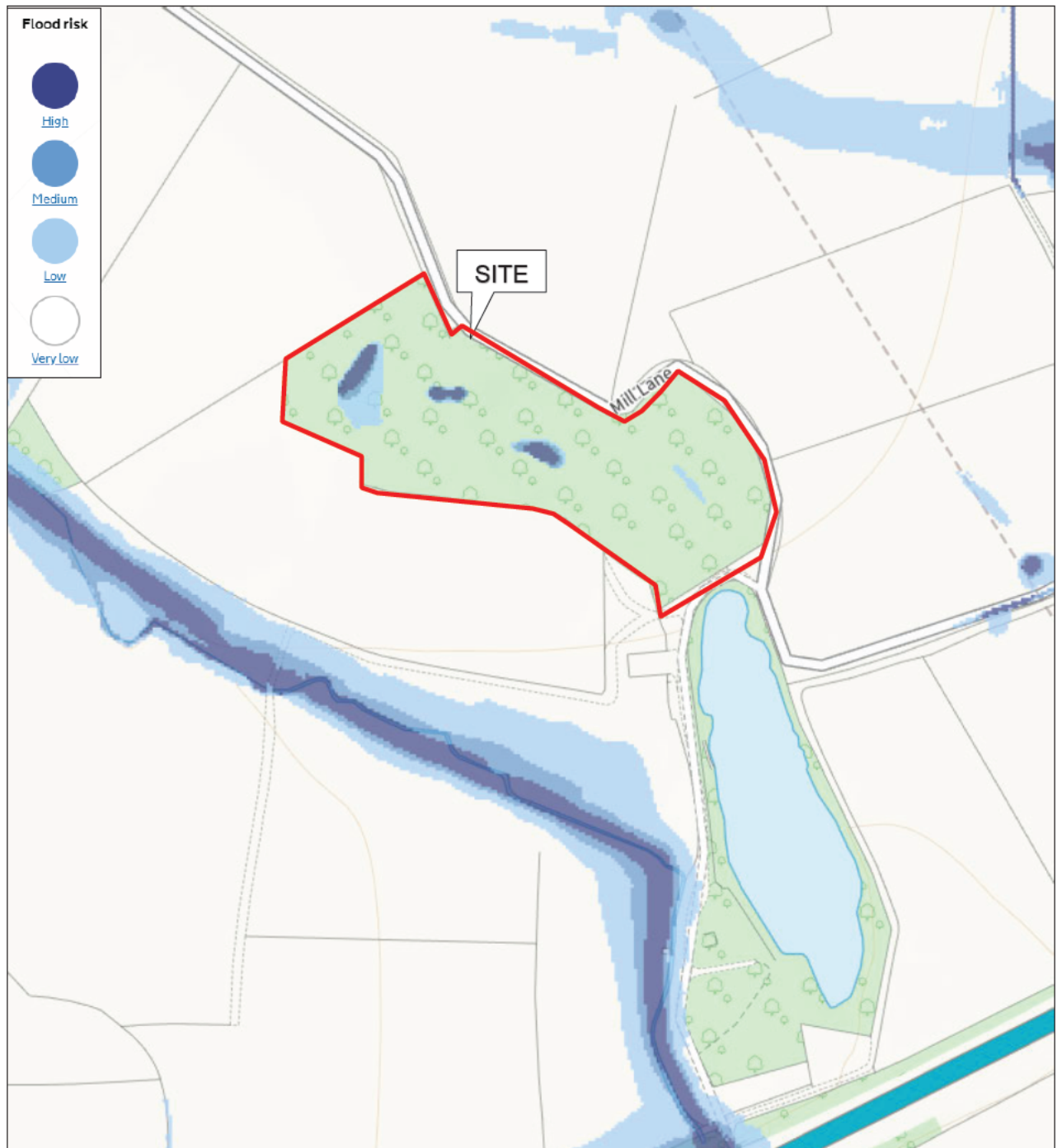
Figure 2: Environment Agency's Flood Map for Planning (Rivers and Seas)



Surface Water Flooding Risk Allocation

The Environment Agency Flood Risk from Surface Water Map, refer to Figure 3, indicates that the site is designated to be at very low risk from surface water flooding. There are small areas at medium to high risk from surface water flooding on-site, likely due to low points.

Figure 3: Environment Agency's Flood Risk from Surface Water Map



Other Flooding Risk and other Allocation

The Environmental Agency mapping also shows that the site is not at risk of reservoir flooding, as such, the risk of flooding from reservoirs is low.

There is no historic evidence of groundwater flooding and active groundwater abstractions within 500m of the site. It is therefore considered that the risk from groundwater flooding is low.

There are no sewers within the vicinity of the site as such the risk of flooding from public sewers can be considered as very low.

Flood Risk Assessment Methodology & Objectives

It is recognised that developments that are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. Current guidance on development and flood risk identifies several key aims for development to ensure that it is sustainable in flood risk terms.

These aims are as follows:

- The development should not be at significant risk of flooding and should not be susceptible to damage due to flooding;
- The development should not be exposed to flood risk such that the health, safety and welfare of the users of the development, or the population elsewhere, are threatened;
- Safe access to and from the development should be possible during flood events;
- The development should not increase flood risk elsewhere;
- The development should not prevent safe maintenance of watercourses or maintenance and operation of flood defences;
- The development should not be associated with an onerous or difficult operation and maintenance regime to manage flood risk. The responsibility for any operation and maintenance required should be clearly defined;
- Future users of the development should be made aware of any flood risk issues relating to the development;
- The development should not lead to the degradation of the environment; and
- The development should meet all of the above criteria for its entire lifetime, including consideration of the potential effects of climate change.

This Flood Risk Assessment is undertaken with due consideration of these sustainability aims and has been prepared to inform the proposed scheme.

Project Scope

In order to achieve the aims outlined above, this Flood Risk Assessment has been undertaken in accordance with current best-practice guidance, including the National Planning Practice Guidance. A scoping study was initially undertaken to identify all potential sources of flooding at the site, which may warrant further consideration. Any potential flooding issues identified in the scoping study have subsequently been considered within this FRA. The aim of the scoping study is to review all available information and provide a qualitative assessment of the flood risk to the site and the impact of the site on flood risk elsewhere. The report has been undertaken with due regard to the EA's National Standing Advice on Development and Flood Risk.

Scoping Study

All potential sources of flooding must be considered for any proposed development. Using the EA Flood Zone mapping, topographical survey and Ordnance Survey maps, a summary of the potential sources of flooding and a review of the potential risk posed by each source on the development area of the application site is presented in Table 1.

Table 1: Potential Risks posed by Flooding Sources

Source	Risk			
	High	Medium	Low	Very low
Fluvial				✓
Tidal				✓
Surface Water			✓	
Groundwater				✓
Sewer				✓
Artificial water bodies				✓

Fluvial Flood Risk Mitigation

The proposed development at Barrow Hill Quarry, Earl Shilton falls entirely in Flood Zone 1. Given the site is in Flood Zone 1 and at very low risk of fluvial flooding, there would be no requirements to provide any further formal mitigation at this development site.

Surface Water Flood Risk Mitigation

The Environment Agency Flood Risk from the Surface Water Map shows that there is generally a very low risk from surface water flooding. There are small areas at medium to high risk from surface water flooding on-site, likely due to low points. Detailed mapping shows that the only areas at risk from surface water flooding will likely see flows enter from the northwest at a velocity of less than 0.25m/s, with depths of up to 300mm.

It is recommended that no dwellings be built on the areas identified as being at high risk of surface water flooding. Post-development the site levels should be re-profiled to remove any surface water ponding caused by localised low points. Given the above, surface water is likely to be collected by the proposed site-wide drainage infrastructure and conveyed to a proposed discharge point on site. Therefore, the risk of flooding will be managed at the development site post-development and the remaining risk will be very low.

Vulnerability Classification of Proposed Development

The National Planning Practice Guidance: Flood Zone and Flood Risk Tables provide information on the vulnerability classification of various developments. The proposed residential development end use of this site falls in the "more vulnerable" classification. Comparison of the 'more vulnerable' use with the development proposals within Flood Zone 1 areas shows development proposals are acceptable and in accordance with NPPF, as shown in Table 2.

Table 2: Flood risk vulnerability and flood zone 'compatibility' from Flood Risk and Coastal Change - Planning Practice Guidance

Flood Risk Vulnerability classification		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test required	✓	x	Exception Test Required	✓
	Zone 3b 'Functional Floodplain'	Exception Test Required	✓	x	x	x

Key:

✓ Development is appropriate x Development should not be permitted

Sequential Test

According to National Planning Practice Guidance: Flood Zone and Flood Risk, the Sequential Test gives preference for locating new development in low-risk areas from all sources of flooding. However, if there is no allocated land within low-risk areas which meets the policy aims of the published Local Authority Local Plan or Local Development Framework then other sites in higher flood risk categories can be considered for that development.

The proposed site lies wholly within Flood Zone 1 and is at low risk of surface water flooding, as such the sequential test is not required.

Exception Test

The proposed development is in accordance with NPPF and the exception test is not required

Surface Water Drainage Strategy

The Drainage Strategy has been carried out in accordance with the requirements of the National Planning Policy Framework and its companion document the National Planning Practice Guidance.

The site is a former quarry, with no existing positive drainage noted on site. It is essential that the proposed development does not increase flood risk to land adjacent or downstream of the site, as well as protecting the development from flooding itself. To ensure that the flood risk is minimised, the drainage design will incorporate the following flood mitigation measures:

- Site levels will be designed to direct all overland surface water flows to follow the natural topography of the land.
- The proposed development will include a surface water drainage system that will intercept runoff generated within the development. This will minimise the risk of flooding to the new buildings and also reduce the incidence of overland flows.
- The surface water drainage system will convey flows to two attenuation basins on site. The surface water flows generated from the development up to and including a 1%AEP40CC event, will be stored on-site and discharged at a rate of 8.6l/s.

Surface water arising from developed sites should, as far as practical, be managed in a sustainable manner to mimic the surface water flows arising from the undeveloped site. When considering the surface water discharge the SuDS hierarchy needs to be adhered to. The SuDS hierarchy states that the top option has to be adhered to or evidenced otherwise before moving down the hierarchy. Each option is considered below:

- **Discharge to a source (soakaway):** The bedrock geology comprises of the South Leicestershire Diorite Complex consisting of Quartz Diorite and the Edwalton Member consisting of mudstone. Superficial deposits overlie the bedrock consisting of Diamicton from the Thrussington member. Soakage testing has not been undertaken on-site. In due course, soakage testing will be undertaken on-site as part of any future detailed GI. Soakage testing should be conducted to BRE365 standards. Should infiltration prove to be acceptable at the site, this will be the preferred method of discharge.
- **Watercourse:** There is a pond to the southeast of the site. There is an unnamed ditch network 150m to the south of the site. In accordance with the drainage hierarchy, surface water will discharge into this network.
- **Public Sewer:** Severn Trent Water Sewer maps indicate there are no surface or foul water sewers within the vicinity of the site. In accordance with the drainage hierarchy, surface water flows will discharge into the existing ditch network.

Land Use

In order to calculate the drainage requirements, an understanding of the land use on-site needs to be known. Table 1 below summarises the proposed land uses with the site. The site currently consists of a disused quarry. The current land use has been calculated using the existing site plan and the post-development land use has been measured from the proposed layout.

Table 1: Land Use Summary

Land Use Type	Existing Site Areas		Proposed Site Areas	
	Ha	%	Ha	%
Impermeable Areas	0	0	0.86	42
Green Landscape / Permeable areas	2.03	100	1.17	58
TOTAL	2.03	100	2.03	100

Urban Creep Allowances

Urban creep is the conversion of permeable surfaces to impermeable ones over time, e.g., extensions to existing buildings. It has been shown that, over the lifetime of development, urban creep can increase impermeable areas by as much as 10%. However, as this is a leisure development and the proposal is for holiday let lodges, urban creep allowances have not been included.

Climate Change Allowances

The influence of climate change on rivers and watercourses is likely to increase the frequency of flood events and the overall volume of water that passes the site. When considering surface water runoff from the site, the increase in peak rainfall intensity varies over the lifetime of the development. Where residential developments with a lifetime beyond the 2070's are proposed, the Flood Risk Assessments: Climate Change Allowances Guidance requires the use of the Upper-End Allowance for the 2070's epoch (2061 to 2125), the upper end gives an expected increase of 40%, refer to Table 2.

Table 2: Peak Rainfall intensity allowance in small and urban catchments from the Flood Risk Assessments: Climate Change Allowances Guidance- Soar Management Catchment Peak Rainfall allowances

	Total potential change anticipated for the '2050s' (2022 to 2060)		Total potential change anticipated for the '2070s' (2061 to 2125)	
Annual Exceedance Probability	Central	Upper End	Central	Upper End
3.3 % AEP	20%	35%	25%	35%
1 % AEP	20%	40%	25%	40%

Discharge Rate and Attenuation Storage

Existing runoff conditions have been calculated using the IH124 method within the UK SuDS website to calculate the Greenfield Discharge rate for the developable site area of 2.03ha, the QBAR Greenfield rate has been calculated at 8.6l/s. The calculation of the Greenfield rate is included in Appendix F.

Contributing Drainage Area

When designing the proposed drainage strategy for a site, the incoming volume of water to the drainage system needs to be quantified. The contributing drainage area considers both the impermeable and permeable areas generated by the development. Permeable areas will likely enter the drainage system during higher return events as the ground will already be saturated.

With a proposed developable area of 2.03ha and an impermeable area of 0.86ha, the permeable area for the site is 1.17ha. The amount of direct surface water runoff generated within permeable areas has been estimated by applying the SPR coefficient for the respective area. As such, an SPRHOST of 34% leads to an effective permeable area of 0.39ha.

In total, the contributing drainage area for the proposed site is 1.25ha, which comprises of 0.86ha for the impermeable area and 0.39ha for the effective permeable area.

Drainage Strategy

The overall drainage strategy has been based on the land use, discharge rates and storage requirements table and the current site layout presented in Appendix B. In accordance with the National SuDS Standards, the strategy involved conveying surface water flows to two attenuation basins on-site, which will discharge into the existing ditch network to the south of the development at a QBAR rate of 8.6l/s.

Surface water flows for a contributing area of 0.549ha will be conveyed to the proposed Attenuation Basin 1 on-site. A storage volume of 375.50m³ is required within the proposed basin to allow sufficient water to discharge at the restricted rate of 3l/s into Attenuation Basin 2 and cater for all events up to the 1%AEP40CC.

Surface water flows for an impermeable area of 0.702ha and discharge from Attenuation Basin 1 will be conveyed to the proposed Attenuation Basin 2 on-site. A storage volume of 439.80m³ is required within the proposed basin to allow sufficient water to discharge into the existing ditch network at the Greenfield rate of 8.6l/s and cater for all events up to the 1%AEP40CC event.

A total volume of 814.80m³ will be available within the proposed attenuation basins on site. A summary of storage requirements is provided in Table 3.

Table 3: Discharge Rates and Storage Requirements

	Contributing Area	Design Flow	Max Storage Requirements (1 in 100 year +40%)
Attenuation Basin 1	0.55ha	3l/s	375.50m ³
Attenuation Basin 2	0.70ha	8.6l/s	439.80m ³
Total	1.25ha	-	815.30m ³

In addition to the proposed basin, permeable material should be utilised for the parking areas to ensure surface water flows are controlled before entering the basin. These features will provide extra storage on-site, act as a first treatment stage for any run-off and will ensure surface water treatment is provided. These features have been excluded from the calculations at this stage.

Detailed calculations for the proposed drainage can be seen in Appendix F and a drainage strategy based on the principles above is shown in drawing 26726_01_230_01c in Appendix G.

Applicable SuDS Techniques

The National Standards for Sustainable drainage systems (Ref. 16) that deals with SuDS cover a whole range of sustainable approaches to surface water drainage management including:

- source control measures including rainwater recycling and drainage;
- 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; and
- basins and ponds to hold excess water after rain and allow controlled discharge that avoids flooding.

Each of the five SuDS considerations listed above is discussed below in Table 4, with reference to their suitability for the proposed development.

Table 4: Suitability of SuDS techniques

	COMPONENT	SUITABILITY	REASON
Source Control	Rainwater Harvesting	Yes	Water butts could be used to store run-off from roofs before discharge into the drainage system. Any storage is not to be included in calculations.
	Green Roofs	No	This would not be appropriate given the scope and scale of the development.
	Bio-retention Systems/ Rain Gardens	No	Unsuitable as standalone SuDS due to the scale of the site and the limited attenuation capacity.
Proprietary Systems	Proprietary bio-retention systems	No	More appropriate SuDS features can be accommodated within the development and are preferred.
Infiltration Devices	Permeable Paving	Yes	Permeable paving is suitable for the proposed development on private car parking areas.
	Infiltration trenches/ Soakaways	No	Infiltration is unlikely to be feasible but still needs to be proven.
Filtration	Open Swales, Filter Strips/ Drains	No	This would not be appropriate given the scope and scale of the development.
Retention/ Detention	Detention Basin, Attenuation Pond/ Tanks	Yes	The attenuation basin will provide surface water storage before discharging from the site.

Surface Water Quality

The SuDS Manual CIRIA document C753 (Ref. 10), indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant) that equals or exceeds the pollution hazard index (see Table 4).

Surface water runoff from residential roofs will have a very low pollution hazard level, while the residential parking areas will have a low pollution hazard level. The exact pollution hazard levels are shown in Table 5.

Table 5: Pollution Hazard Indices (Extract from CIRIA 753 Table 26.2)

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential Roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low-traffic roads	Low	0.5	0.4	0.4

To provide the correct level of treatment, an assessment needs to be made of the mitigation provided by each SuDS feature. This is shown in Table 6 below;

Table 6: SuDS Mitigation Indices (Extract from CIRIA 753 Table 26.3)

Type of SuDS component	Mitigation indices		
	Total Suspended Solids	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7
Attenuation Basin	0.7	0.7	0.5

For the very low and low pollution hazard levels generated at the site, the proposed attenuation basins would provide sufficient treatment in accordance with the Simple Index Method. Should further treatment be required appropriate devices will be selected to ensure the pollution to the receiving watercourse has no increased impact as a result of development.

Maintenance and Management

A proposed maintenance plan is shown in Table 7 below and breaks down the maintenance requirements of the various proposed assets in accordance with the CIRIA C753 SuDS Manual guidance.

Table 7: Proposed Maintenance Regime

Drainage Asset	Responsible Organisation	Maintenance Work	Frequency
Pipework / Manholes	Private Ownership / Management Company	Inspect pipework and clear blockages	Annually or after severe storms.
		Inspect manholes and clear blockages	
		Repair any defects in the network	
		Inspect flow control, ensure operating freely and pivoting bypass door and penstock valve operating correctly	
Headwalls	Private Ownership / Management Company	Inspect the structure and remove any debris/litter on the structure.	Annually or after severe storms
		Replace malfunctioning parts or structures	As required
Flow Control Chamber	Private Ownership / Management Company	Inspect structure and remove excessive silt build-up	Monthly during construction and then annually or after severe storms
		Inspect pipework and manholes also clear blockages	Annually or after severe storms
		Inspect manholes and clear blockages	
		Inspect flow control, ensure operating freely and pivoting bypass door and penstock valve operating correctly	
		Replace malfunctioning parts or structures	
		Inspect for evidence of poor operation	6 monthly
		Inspect sediment accumulation rates and establish appropriate removal frequencies	
		Test control structure to ensure operating as per original design	5 yearly

Permeable Pavements	Private Ownership / Management Company	Brushing and vacuuming (standard cosmetic sweep over the whole surface)	Once a year after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging of manufacturer's recommendations.
		Stabilise and mow contributing and adjacent areas	As required
		Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than sweeping	
		Remediate any landscaping which, through vegetation maintenance of soil slip, has been raised to within 50 mm of the level of the paving	
		Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users and replace lost jointing material	
		Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
		Initial inspection	Monthly for 3 months after installation
		Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	3 monthly, 48 hours after large storms in first 6 months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	
Attenuation/Detention Basins	Private Ownership / Management Company	Remove litter and debris	Monthly
		Cut grass – for spillways and access routes	
		Cut grass – meadow grass in and around the basin	
		Manage other vegetation and remove nuisance plants	
		Inspect inlets, outlets and overflows for blockages, and clean if required	
		Inspect banksides, structures for silt accumulation. Establish appropriate silt removal frequencies	
		Check any penstocks and other mechanical devices	Annually
		Tidy all dead growth before the start of the growing season	
		Remove the sediment from inlets, outlets and forebay	
		Manage wetland plants in outlet pool – where provided	
		Replant, where necessary	
		Aerate pond when signs of eutrophication are detected	
		Realign rip-rap or repair other damage	
		Repair/rehabilitate inlets, outlets and overflows	

Foul Water Strategy

According to the Building Regulations (2010), foul water drainage from new developments should be discharged into the following in order of priority:

- A public sewer
- A private sewer communicating with a public sewer
- A septic tank which has an appropriate form of secondary treatment
- A cesspool

There are no known records of sewers within the vicinity of the site that would accommodate a gravity connection from the development.

Therefore, foul water will discharge into a cesspool on-site and be removed at regular intervals.

Summary

To summarise the key points outlined above:

- All development is located within Flood Zone 1 and is therefore compatible with a “more vulnerable” development in line with policy guidance.
- The site is at very low risk from surface water flooding.
- The risk of flooding from all other sources is low.
- Surface water runoff from the site will be conveyed, stored and treated within the proposed attenuation basins on site. Surface water stored within the basins will discharge into the existing ditch network to the south of the site at a Greenfield QBAR rate of 8.6l/s.
- A total storage volume of 815.30m³ will be split between the two basins to manage flows generated for events up to and including the 1%AEP40CC event.
- Foul water will discharge into a cesspool on-site and be removed at regular intervals.

Report Prepared By:



.....
Zoe Jordan BSc (Hons)
Assistant Flood Risk Engineer

Report Checked By:



.....
Ryan Chafer BSc (Hons)
Flood Risk Engineer

Report Approved By:



.....
Tim Rose BA (Hons) MCIHT MTPS
Director

Appendix:

- A. Site location Plan
- B. Proposed Site Layout
- C. Policies & References
- D. Topographical Survey
- E. Severn Trent Water Correspondence
- F. QBAR and Surface Water Attenuation Calculations 26726-01-CALC-01b
- G. Drainage Strategy Drawing 26726_01_230_01c

COPYRIGHT

The contents of this document must not be copied or reproduced in whole or part without the written consent of Mewies Engineering Consultants Ltd.

Registration of Amendments

Revision	Comments	Prepared By:	Checked By	Approved By:
October 2021	Initial submission	ZJ	RC	TR
February 2022	Updates to report to add Flood Risk Assessment sections	RC	TR	TR
June 2023	Updated to include increased number of holiday lodges from 21 to 36.	ZJ	RC	TR

APPENDIX A

M-EC
The Old Chapel
Station Road
Hugglescote
Leicestershire
LE67 2GB

M-EC
Consulting Development Engineers

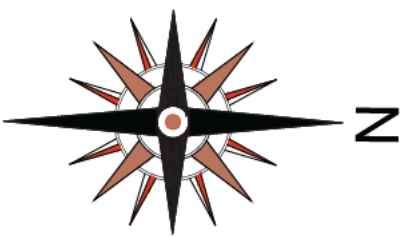
SITE LOCATION PLAN

Project: Barrow Hill Quarry, Mill Lane, Earl Shilton
File Ref: 26726
O.S. Grid Ref: 448809 297112
Postcode: LE9 7TR



APPENDIX B

This drawing is protected under the copyright design and patents and should not be reproduced or copied in any form without the written permission of the author. The author is not responsible for any errors or omissions in this drawing. The author is not responsible for any errors or omissions in this drawing. The author is not responsible for any errors or omissions in this drawing.



Schedule
36 x lodges.
Plus management Building
Site area 28500sqm, 7 acres

DRAFT

Barrow Hill Quarry
Earl Shilton

Plans

Scale 1:500 @ A1 Date Oct 2021
Dwg No. 2001 Revision -

Brook House Consulting

BHC
72 Boston Road
Leicester
LE4 1TB

Tel: 0116 2716661 E-mail: mail@brookhouseconsulting.com



APPENDIX C

Policies and References

National Planning Policy Framework

The National Planning Policy Framework (Ref. 4) sets out the Government's objectives for the planning system and how there should be a 'Presumption in Favour of Sustainable Development and the planning system should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change.

The document seeks to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Reference should also be made to the Planning Practice Guidance (Ref. 17) which provides additional guidance on flood risk.

For the purposes of applying the National Planning Policy Framework, areas at risk from all sources of flooding are included. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. It can also include an area within Flood Zone 1 in which the Environment Agency has notified the local planning authority of having critical drainage problems.

Key elements from the document include

"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk..."

"Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding."

"When determining any planning applications, local planning authorities should ensure flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific risk assessment. Development should only be allowed in areas at risk of flooding where in light of this assessment (and the sequential and exception tests) it can be demonstrated that:

- a) Within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
- b) The development is appropriately flood resistant and resilient*
- c) It incorporates sustainable drainage systems unless there is clear evidence that this would be inappropriate;*
- d) Any residual risk can be safely managed; and*
- e) Safe access and escape plan routes are included where appropriate, as part of an agreed emergency plan."*

Flood and Water Management Act 2010

The Flood and Water Management Act 2010 (Ref. 19) gained Royal Assent on the 8th April 2010. The Flood and Water Management Act is the government's newest legislation to help improve flood risk management and ensure the security of water supplies in England and Wales. The Act updates legislation to ensure better protection from flooding, manage water more sustainably, improve public services and secure water resources during periods of drought. The Flood and Water Management Act helps to reduce flood risk by:

- Clarifying who is responsible for managing all sources of flood risk.
- Encourage more sustainable forms of drainage in new developments.
- Makes it easier to resolve misconnections to sewers.

The Flood and Water Management Act imparts significant new roles and responsibilities on local authorities. County or unitary authorities are now classed as lead local flood authorities (LLFAs) who have responsibilities for managing local flood risk. The responsibilities of a LLFA include:

- Prepare and maintain a strategy for local flood risk management in their areas, coordinating views and activity with other local bodies and communities through public consultation and scrutiny, and delivery planning.
- Maintain a register of assets – these are physical features that have a significant effect on flooding in their area.
- Investigate significant local flooding incidents and publish the results of such investigations.
- Issue consents for altering, removing or replacing certain structures or features on ordinary watercourses.
- Play a lead role in emergency planning and recovery after a flood event.

Planning Practice Guidance on Flood Risk & Coastal Change – March 2014, updated August 2021

The Government's new planning policy on sustainable drainage systems came into effect on 6 April 2015. It expects local planning policies and decisions on planning applications relating to major development (those of 10 dwellings or more; or equivalent non-residential or mixed development) to ensure that sustainable drainage systems for the management of run-off are put in place unless demonstrated to be inappropriate. Lead Local Flood Authorities (LLFAs) have also been made statutory consultees and new non-statutory guidance has been published under the changes.

The changes follow a joint Defra/DCLG consultation on delivering SuDS published in September 2014 in which the Government dropped all the key provisions of Schedule 3 of the Flood & Water Management Act 2010 and SuDS Approval Bodies (SABs) in favour of passing the oversight of SuDS from county councils (who are also LLFAs) to local planning authorities. According to the new planning policy, local planning authorities are expected, when considering planning applications:

- To consult the relevant lead local flood authority on the management of surface water,
- To satisfy themselves that the proposed minimum standards of operation are appropriate, and
- To ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

The policy also states that the sustainable drainage system should be designed to ensure that the maintenance and operation requirements are economically proportionate.

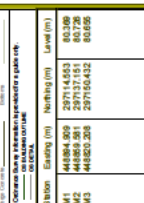
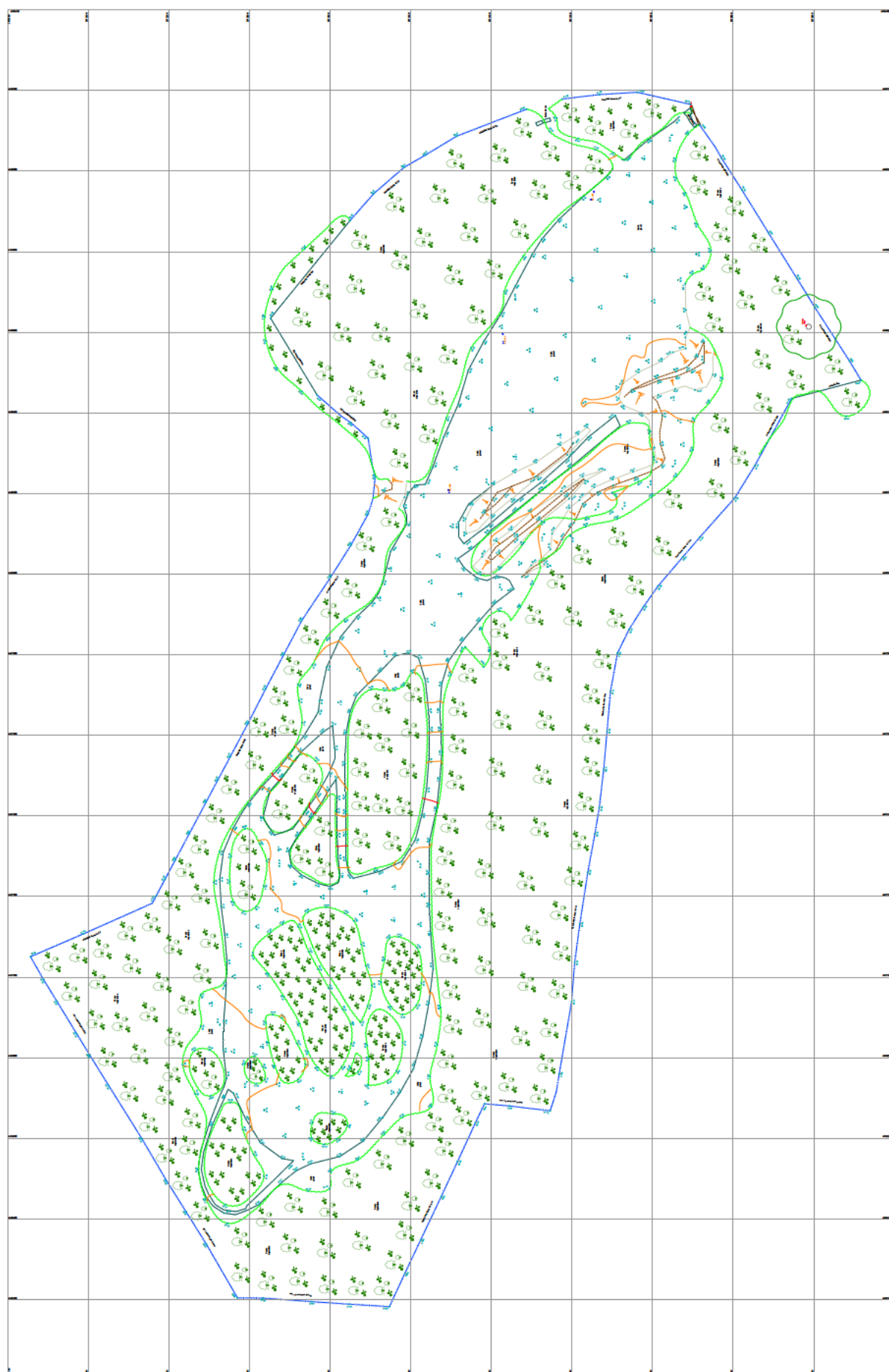
Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems – 2015

The non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems to drain surface water have been published by Defra. The standards apply to systems that drain surface water from housing, non-residential or mixed use developments for the lifetime of the developments. The non-statutory technical standards are to be used in conjunction with the National Planning Policy Framework, and Planning Practice Guidance on Flood Risk & Coastal Change.

The following documents have been referred to in this report:

- 1 The Building Regulations 2015, Approved Document H.
- 2 Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code") - October 2019, updated June 2022.
- 3 Planning Practice Guidance – November 2016, updated August 2022.
- 4 National Planning Policy Framework - March 2012, updated July 2021
- 5 Civil Engineering Specification for the Water Industry, 7th Edition.
- 6 Flood Risk and Coastal Change Guidance – March 2014, updated August 2022.
- 7 Environment Agency Flood Risk Standing Advice.
- 8 Environment Agency 'Flood Risk Assessments – Climate Change Allowances' - February 2016., updated May 2022.
- 9 The SuDS Manual – CIRIA C753.
- 10 Interim Code of Practice for Sustainable Drainage Systems – National SuDS Working Group, July 2004.
- 11 Cranfield University Soilscales Map - <http://www.landis.org.uk/soilscales/>.
- 12 British Geological Survey – Geology of Britain viewer, <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.
- 13 FEH WebService – Centre for Ecology and Hydrology, <https://fehweb.ceh.ac.uk/GB/map>.
- 14 Design and analysis of urban storm drainage. The Wallingford Procedure Vol.1.
- 15 Institute of Hydrology Report No. 124 – Flood Estimation for small catchments.
- 16 Sustainable Drainage Systems – Non-statutory technical standards for sustainable drainage systems – March 2015.
- 17 Water Industry Act 1991.
- 18 Flood and Water Management Act 2010.

APPENDIX D



CLIENT INFORMATION

Topographical Survey

code	1:9000A1	Date	28.07.2021
exam	AB	Checked	AW
level/datum	GNSS	Grid orientation	GNSS
job number	4471	Retain	0
ranking no.	0001	Sheet	2 of 2

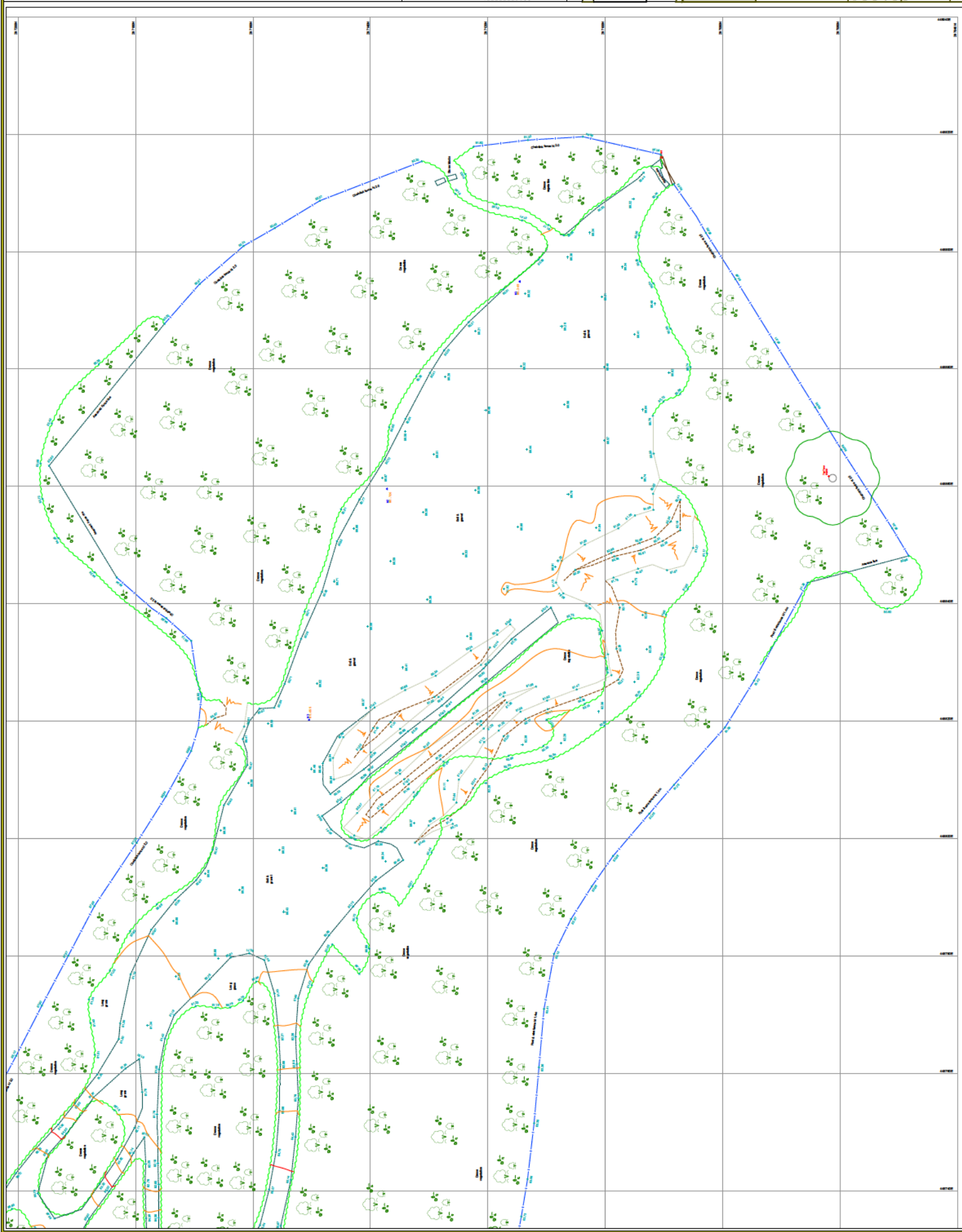


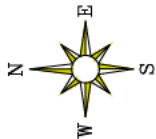






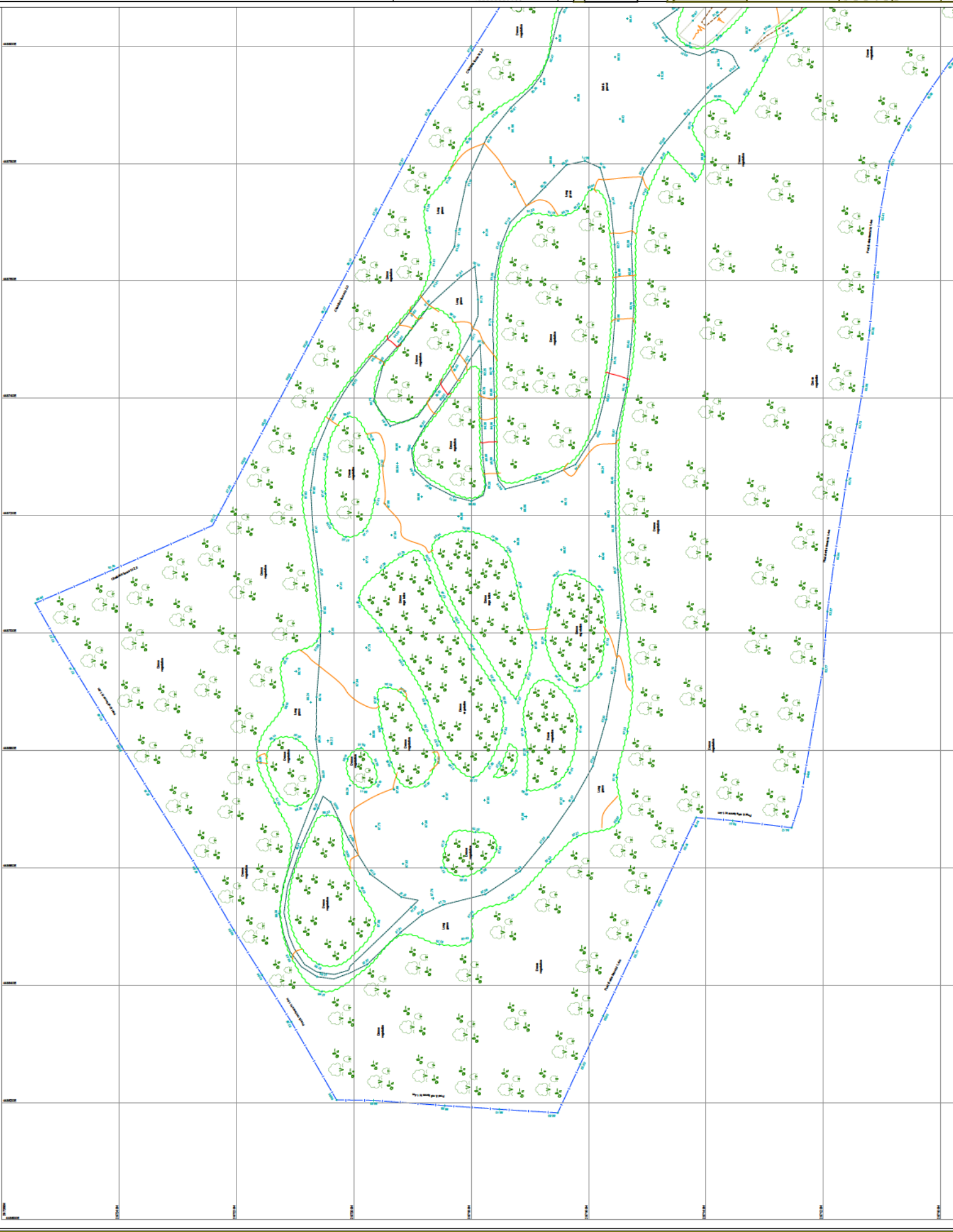




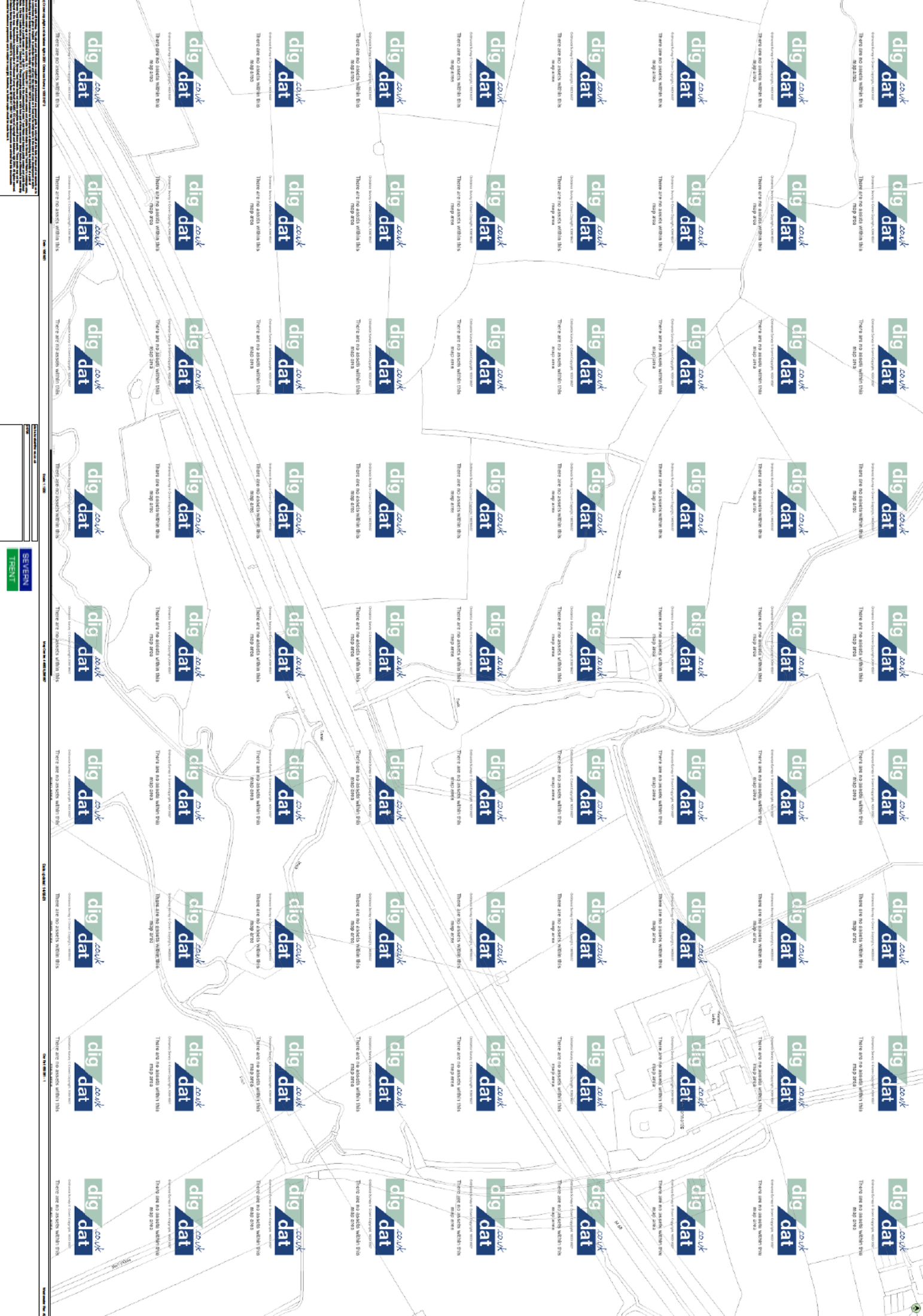


Key		Legend	
Blue line	Proposed	Blue line	Proposed
Red line	Existing	Red line	Existing
Green line	Boundary	Green line	Boundary
Black line	Other	Black line	Other
Blue dot	Spot height	Blue dot	Spot height
Red dot	Spot height	Red dot	Spot height
Green dot	Spot height	Green dot	Spot height
Black dot	Spot height	Black dot	Spot height
Blue square	Spot height	Blue square	Spot height
Red square	Spot height	Red square	Spot height
Green square	Spot height	Green square	Spot height
Black square	Spot height	Black square	Spot height
Blue circle	Spot height	Blue circle	Spot height
Red circle	Spot height	Red circle	Spot height
Green circle	Spot height	Green circle	Spot height
Black circle	Spot height	Black circle	Spot height

PROJECT		CLIENT	
Land off The Yarnolds		ATE	
Earl Shilton			
LE9 7TR			
TITLE		Topographical Survey	
Scale		Date	
1:25000		28.07.2011	
Drawn		By	
AD		AD	
Level datum		Sea level datum	
OSMS		OSMS	
Job number		4471	
Drawing no.		001	
Sheet		2 of 2	



APPENDIX E



SAVERN
TRENT

SAVERN
TRENT

SAVERN
TRENT

SAVERN
TRENT

SAVERN
TRENT

APPENDIX F

Project No	26726-01-CALC-01
Sheet	1 of 10
Engineer	Z. Jordan
Date	June 2023
Revision	B

DESIGN CALCULATIONS FRONT SHEET

SCHEME	Barrow Hill Quarry, Mill Lane, Earl Shilton
CLIENT	AT Contracting and Plant Hire Ltd
ASPECTS OF SCHEME TO BE DESIGNED	1. Surface water attenuation design and simulation results for the 1%AEP40CC event for the development site.
CODES OF PRACTICE, DESIGN SPECIFICATIONS & BRITISH STANDARDS	1. Design and analysis of urban storm drainage. Wallingford Procedure Vol. 1. 2. Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems – 2015 3. The SuDS Manual – CIRIA C753.
NOTES	Existing runoff conditions have been calculated using the IH124 method within UK SuDS to calculate the Greenfield Discharge rate for the developable site area of 2.03ha, the QBAR Greenfield rate has been calculated at 8.6l/s. Calculations for the Attenuation Basins were carried out using the Source Control system within the MicroDrainage computer program. Attenuation Basin 1 will discharge into Attenuation Basin 2 at a controlled rate of 3l/s before discharging into the existing ditch network to the south of the site at 8.6l/s. This has been analysed using the Cascade feature on MicroDrainage.

INDEX

Pages	Calculations	Checked by	Date
2	Greenfield QBAR calculations.	RC	08.06.2023
3 – 6	Attenuation Basin 1 design and surface water simulation results for the 1%AEP40CC event including cascade summary.	RC	08.06.2023
7-10	Attenuation Basin 2 design and surface water simulation results for the 1%AEP40CC event including cascade summary.	RC	08.06.2023

Calculated by:	Ryan Chafer
Site name:	Barrow Hill Quarry
Site location:	Earl Shilton

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:	52.56955° N
Longitude:	1.28042° W
Reference:	15925717
Date:	Jun 07 2023 13:38

Runoff estimation approach

IH124

Site characteristics	
Total site area (ha):	2.03

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):	624	624
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

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):	8.57	8.57
1 in 1 year (l/s):	7.11	7.11
1 in 30 years (l/s):	17.13	17.13
1 in 100 year (l/s):	22.02	22.02
1 in 200 years (l/s):	26.05	26.05

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.

M-EC		Page 3
The Old Chapel Station Road, Hugglescote Leicestershire LE67 2GB	Barrow Hill Quarry, Mill Lane, Earl Shilton Attenuation Basin 1	
Date 08/06/2023 09:53 File cascade.CASX	Designed by ZJ Checked by RC	
XP Solutions	Source Control 2020.1.3	

Cascade Summary of Results for attenuation basin 1 REV B 100yr.SRCX

Upstream Structures **Outflow To** **Overflow To**
 (None) attenuation basin 2 REV B 100yr.SRCX (None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	85.853	0.453	3.0	136.7	O K
30 min Summer	85.965	0.565	3.0	178.9	O K
60 min Summer	86.069	0.669	3.0	220.8	O K
120 min Summer	86.172	0.772	3.0	265.9	O K
180 min Summer	86.229	0.829	3.0	291.7	O K
240 min Summer	86.262	0.862	3.0	307.6	O K
360 min Summer	86.294	0.894	3.0	322.8	O K
480 min Summer	86.300	0.900	3.0	326.0	O K
600 min Summer	86.294	0.894	3.0	323.0	O K
720 min Summer	86.281	0.881	3.0	316.4	O K
960 min Summer	86.242	0.842	3.0	298.1	O K
1440 min Summer	86.174	0.774	3.0	266.4	O K
2160 min Summer	86.097	0.697	3.0	232.8	O K
2880 min Summer	86.033	0.633	3.0	206.1	O K
4320 min Summer	85.911	0.511	3.0	158.1	O K
5760 min Summer	85.810	0.410	3.0	121.7	O K
7200 min Summer	85.733	0.333	3.0	95.5	O K
8640 min Summer	85.671	0.271	3.0	75.7	O K
10080 min Summer	85.623	0.223	3.0	61.0	O K
15 min Winter	85.899	0.499	3.0	153.6	O K
30 min Winter	86.022	0.622	3.0	201.3	O K
60 min Winter	86.134	0.734	3.0	248.8	O K
120 min Winter	86.247	0.847	3.0	300.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	136.640	0.0	140.5	24
30 min Summer	89.880	0.0	184.9	38
60 min Summer	56.280	0.0	231.3	68
120 min Summer	34.790	0.0	286.3	128
180 min Summer	26.088	0.0	322.2	186
240 min Summer	21.140	0.0	348.1	246
360 min Summer	15.517	0.0	383.2	364
480 min Summer	12.334	0.0	406.2	484
600 min Summer	10.266	0.0	422.6	602
720 min Summer	8.808	0.0	435.2	722
960 min Summer	6.878	0.0	452.8	898
1440 min Summer	4.818	0.0	457.0	1122
2160 min Summer	3.370	0.0	499.2	1512
2880 min Summer	2.625	0.0	518.9	1932
4320 min Summer	1.870	0.0	554.1	2688
5760 min Summer	1.487	0.0	588.0	3456
7200 min Summer	1.261	0.0	622.7	4176
8640 min Summer	1.111	0.0	658.7	4848
10080 min Summer	1.006	0.0	695.6	5552
15 min Winter	136.640	0.0	157.4	23
30 min Winter	89.880	0.0	207.1	38
60 min Winter	56.280	0.0	259.5	68
120 min Winter	34.790	0.0	320.6	126

M-EC		Page 4
The Old Chapel Station Road, Hugglescote Leicestershire LE67 2GB	Barrow Hill Quarry, Mill Lane, Earl Shilton Attenuation Basin 1	
Date 08/06/2023 09:53 File cascade.CASX	Designed by ZJ Checked by RC	
XP Solutions	Source Control 2020.1.3	

Cascade Summary of Results for attenuation basin 1 REV B 100yr.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	86.310	0.910	3.0	330.7	O K
240 min Winter	86.348	0.948	3.0	349.9	O K
360 min Winter	86.387	0.987	3.0	369.4	O K
480 min Winter	86.398	0.998	3.0	375.5	O K
600 min Winter	86.397	0.997	3.0	374.6	O K
720 min Winter	86.387	0.987	3.0	369.8	O K
960 min Winter	86.355	0.955	3.0	353.4	O K
1440 min Winter	86.275	0.875	3.0	313.9	O K
2160 min Winter	86.182	0.782	3.0	270.1	O K
2880 min Winter	86.099	0.699	3.0	233.5	O K
4320 min Winter	85.924	0.524	3.0	162.9	O K
5760 min Winter	85.767	0.367	3.0	106.9	O K
7200 min Winter	85.651	0.251	3.0	69.4	O K
8640 min Winter	85.566	0.166	3.0	44.5	O K
10080 min Winter	85.509	0.109	2.9	28.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	26.088	0.0	360.7	184
240 min Winter	21.140	0.0	389.7	242
360 min Winter	15.517	0.0	429.1	358
480 min Winter	12.334	0.0	454.8	474
600 min Winter	10.266	0.0	473.2	588
720 min Winter	8.808	0.0	477.9	700
960 min Winter	6.878	0.0	474.5	918
1440 min Winter	4.818	0.0	461.3	1178
2160 min Winter	3.370	0.0	559.3	1624
2880 min Winter	2.625	0.0	581.1	2080
4320 min Winter	1.870	0.0	620.6	2936
5760 min Winter	1.488	0.0	658.5	3632
7200 min Winter	1.261	0.0	697.8	4320
8640 min Winter	1.111	0.0	737.9	4936
10080 min Winter	1.006	0.0	779.3	5640

M-EC		Page 5
The Old Chapel Station Road, Hugglescote Leicestershire LE67 2GB	Barrow Hill Quarry, Mill Lane, Earl Shilton Attenuation Basin 1	
Date 08/06/2023 09:53	Designed by ZJ	
File cascade.CASX	Checked by RC	
XP Solutions		Source Control 2020.1.3

Cascade Rainfall Details for attenuation basin 1 REV B 100yr.SRCX

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448750 296950 SP 48750 96950	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.549

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	3	0.183	3	6	0.183

M-EC		Page 6
The Old Chapel Station Road, Hugglescote Leicestershire LE67 2GB	Barrow Hill Quarry, Mill Lane, Earl Shilton Attenuation Basin 1	
Date 08/06/2023 09:53 File cascade.CASX	Designed by ZJ Checked by RC	
XP Solutions	Source Control 2020.1.3	

Cascade Model Details for attenuation basin 1 REV B 100yr.SRCX

Storage is Online Cover Level (m) 86.700

Tank or Pond Structure

Invert Level (m) 85.400

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	248.0	1.000	521.6	1.300	623.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0081-3000-1100-3000
Design Head (m)	1.100
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	81
Invert Level (m)	85.300
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	3.0	Kick-Flo®	0.682	2.4
Flush-Flo™	0.333	3.0	Mean Flow over Head Range	-	2.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	0.800	2.6	2.000	4.0	4.000	5.5	7.000	7.1
0.200	2.9	1.000	2.9	2.200	4.1	4.500	5.8	7.500	7.3
0.300	3.0	1.200	3.1	2.400	4.3	5.000	6.1	8.000	7.6
0.400	3.0	1.400	3.4	2.600	4.5	5.500	6.3	8.500	7.8
0.500	2.9	1.600	3.6	3.000	4.8	6.000	6.6	9.000	8.0
0.600	2.7	1.800	3.8	3.500	5.1	6.500	6.9	9.500	8.2

M-EC		Page 7
The Old Chapel Station Road, Hugglescote Leicestershire LE67 2GB	Barrow Hill Quarry, Mill Lane, Earl Shilton Attenuation Basin 2	
Date 08/06/2023 09:54 File cascade.CASX	Designed by ZJ Checked by RC	
XP Solutions	Source Control 2020.1.3	

Cascade Summary of Results for attenuation basin 2 REV B 100yr.SRCX

Upstream Structures	Outflow To	Overflow To
attenuation basin 1 REV B 100yr.SRCX	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	79.638	0.478	8.6	173.2	O K
30 min Summer	79.756	0.596	8.6	225.8	O K
60 min Summer	79.862	0.702	8.6	276.8	O K
120 min Summer	79.963	0.803	8.6	329.0	O K
180 min Summer	80.014	0.854	8.6	356.4	O K
240 min Summer	80.042	0.882	8.6	371.4	O K
360 min Summer	80.058	0.898	8.6	380.5	O K
480 min Summer	80.049	0.889	8.6	375.3	O K
600 min Summer	80.028	0.868	8.6	363.7	O K
720 min Summer	80.005	0.845	8.6	351.4	O K
960 min Summer	79.961	0.801	8.6	327.5	O K
1440 min Summer	79.881	0.721	8.6	286.4	O K
2160 min Summer	79.768	0.608	8.6	231.5	O K
2880 min Summer	79.657	0.497	8.6	181.3	O K
4320 min Summer	79.501	0.341	8.6	117.2	O K
5760 min Summer	79.390	0.230	8.6	75.7	O K
7200 min Summer	79.317	0.157	8.5	50.4	O K
8640 min Summer	79.271	0.111	8.3	34.9	O K
10080 min Summer	79.242	0.082	8.1	25.3	O K
15 min Winter	79.687	0.527	8.6	194.7	O K
30 min Winter	79.816	0.656	8.6	254.5	O K
60 min Winter	79.932	0.772	8.6	312.6	O K
120 min Winter	80.045	0.885	8.6	373.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	136.640	0.0	320.2	23
30 min Summer	89.880	0.0	421.3	38
60 min Summer	56.280	0.0	527.4	68
120 min Summer	34.790	0.0	652.4	126
180 min Summer	26.088	0.0	734.0	186
240 min Summer	21.140	0.0	793.1	244
360 min Summer	15.517	0.0	873.2	362
480 min Summer	12.334	0.0	925.6	480
600 min Summer	10.266	0.0	962.8	572
720 min Summer	8.808	0.0	991.7	620
960 min Summer	6.878	0.0	1032.0	742
1440 min Summer	4.818	0.0	1065.7	1002
2160 min Summer	3.370	0.0	1138.0	1412
2880 min Summer	2.625	0.0	1182.2	1760
4320 min Summer	1.870	0.0	1262.8	2476
5760 min Summer	1.487	0.0	1339.7	3176
7200 min Summer	1.261	0.0	1419.2	3888
8640 min Summer	1.111	0.0	1501.1	4576
10080 min Summer	1.006	0.0	1585.1	5240
15 min Winter	136.640	0.0	358.6	23
30 min Winter	89.880	0.0	472.0	38
60 min Winter	56.280	0.0	591.1	66
120 min Winter	34.790	0.0	730.7	124

M-EC		Page 8
The Old Chapel Station Road, Hugglescote Leicestershire LE67 2GB	Barrow Hill Quarry, Mill Lane, Earl Shilton Attenuation Basin 2	
Date 08/06/2023 09:54 File cascade.CASX	Designed by ZJ Checked by RC	
XP Solutions	Source Control 2020.1.3	

Cascade Summary of Results for attenuation basin 2 REV B 100yr.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	80.103	0.943	8.6	406.3	O K
240 min Winter	80.136	0.976	8.6	425.3	O K
360 min Winter	80.160	1.000	8.6	439.8	O K
480 min Winter	80.157	0.997	8.6	437.8	O K
600 min Winter	80.140	0.980	8.6	427.9	O K
720 min Winter	80.117	0.957	8.6	414.0	O K
960 min Winter	80.063	0.903	8.6	383.3	O K
1440 min Winter	79.967	0.807	8.6	330.8	O K
2160 min Winter	79.824	0.664	8.6	258.2	O K
2880 min Winter	79.651	0.491	8.6	179.0	O K
4320 min Winter	79.423	0.263	8.6	87.9	O K
5760 min Winter	79.290	0.130	8.4	41.2	O K
7200 min Winter	79.226	0.066	8.0	20.3	O K
8640 min Winter	79.204	0.044	7.5	13.5	O K
10080 min Winter	79.194	0.034	6.9	10.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	26.088	0.0	822.0	182
240 min Winter	21.140	0.0	888.2	240
360 min Winter	15.517	0.0	977.9	354
480 min Winter	12.334	0.0	1036.5	468
600 min Winter	10.266	0.0	1078.5	576
720 min Winter	8.808	0.0	1101.0	682
960 min Winter	6.878	0.0	1123.4	778
1440 min Winter	4.818	0.0	1143.1	1082
2160 min Winter	3.370	0.0	1274.7	1544
2880 min Winter	2.625	0.0	1323.9	1900
4320 min Winter	1.870	0.0	1414.4	2560
5760 min Winter	1.488	0.0	1500.4	3224
7200 min Winter	1.261	0.0	1589.9	3824
8640 min Winter	1.111	0.0	1681.3	4488
10080 min Winter	1.006	0.0	1775.5	5152

M-EC		Page 9
The Old Chapel Station Road, Hugglescote Leicestershire LE67 2GB	Barrow Hill Quarry, Mill Lane, Earl Shilton Attenuation Basin 2	
Date 08/06/2023 09:54	Designed by ZJ	
File cascade.CASX	Checked by RC	
XP Solutions		Source Control 2020.1.3

Cascade Rainfall Details for attenuation basin 2 REV B 100yr.SRCX

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 448750 296950 SP 48750 96950	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.702

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	3	0.234	3	6	0.234
				6	9
					0.234

M-EC		Page 10
The Old Chapel Station Road, Hugglescote Leicestershire LE67 2GB	Barrow Hill Quarry, Mill Lane, Earl Shilton Attenuation Basin 2	
Date 08/06/2023 09:54 File cascade.CASX	Designed by ZJ Checked by RC	
XP Solutions	Source Control 2020.1.3	

Cascade Model Details for attenuation basin 2 REV B 100yr.SRCX

Storage is Online Cover Level (m) 80.460

Tank or Pond Structure

Invert Level (m) 79.160

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	300.0	1.000	595.9	1.300	704.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0134-8600-1100-8600
Design Head (m)	1.100
Design Flow (l/s)	8.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	134
Invert Level (m)	79.060
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	8.6	Kick-Flo®	0.716	7.0
Flush-Flo™	0.327	8.6	Mean Flow over Head Range	-	7.4

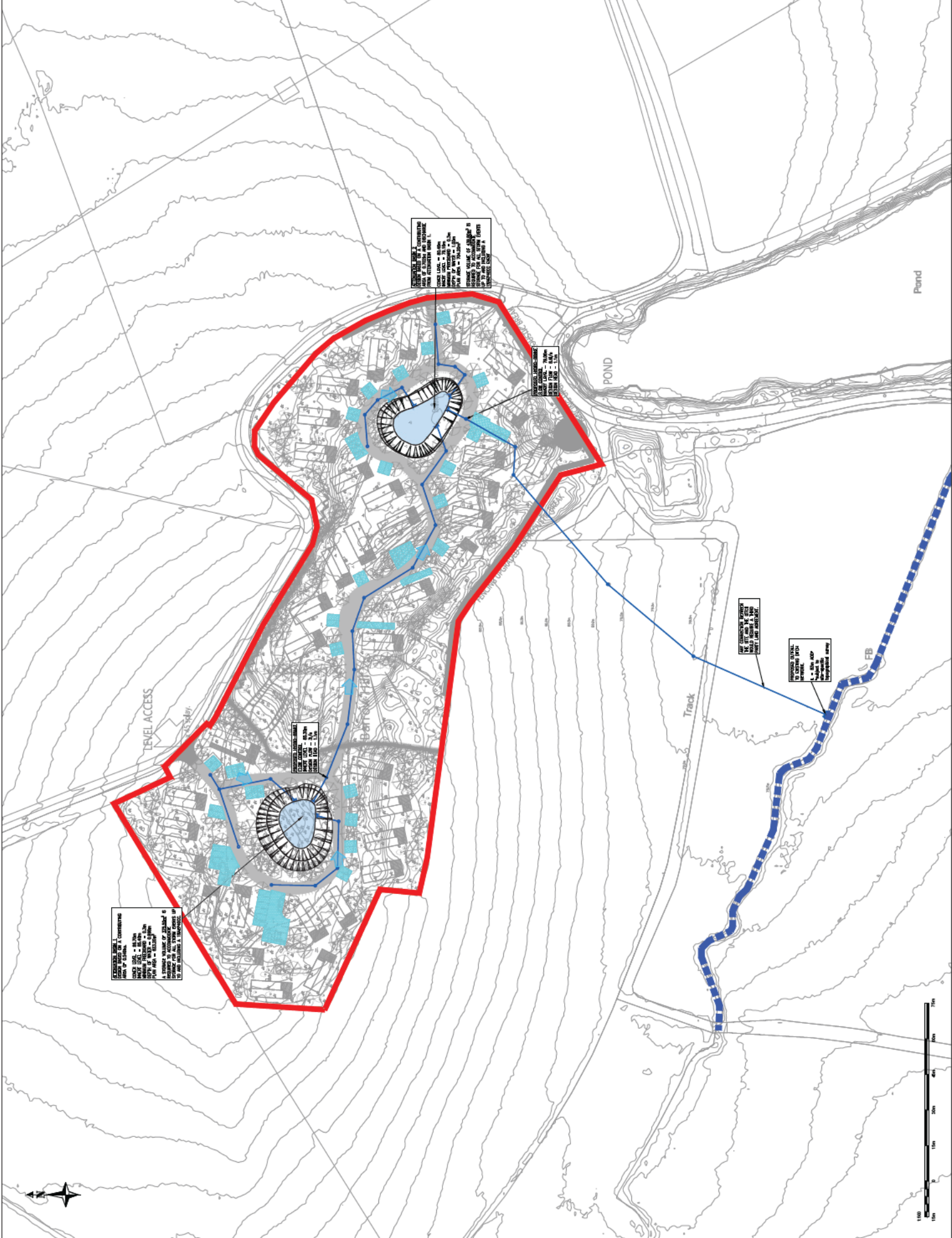
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8	0.800	7.4	2.000	11.4	4.000	15.8	7.000	20.7
0.200	8.2	1.000	8.2	2.200	11.9	4.500	16.8	7.500	21.4
0.300	8.6	1.200	9.0	2.400	12.4	5.000	17.6	8.000	22.1
0.400	8.5	1.400	9.6	2.600	12.9	5.500	18.4	8.500	22.7
0.500	8.3	1.600	10.3	3.000	13.8	6.000	19.2	9.000	23.4
0.600	8.0	1.800	10.8	3.500	14.9	6.500	20.0	9.500	24.0

APPENDIX G

- NOTES:
1. FOR THE SCALE THE DRAWING.
 2. THIS DRAWING IS TO BE USED IN CONJUNCTION WITH ALL OTHER DRAWINGS AND SPECIFICATIONS.
 3. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.
 4. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.
 5. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.
 6. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.
 7. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.
 8. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.
 9. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.
 10. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.
 11. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.
 12. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) STANDARDS.

- KEY:
- 1. SEE DRAWING
 - 2. PROPOSED SURFACE WATER DRAINAGE
 - 3. PROPOSED SURFACE WATER DRAINAGE
 - 4. PROPOSED SURFACE WATER DRAINAGE
 - 5. PROPOSED SURFACE WATER DRAINAGE
 - 6. PROPOSED SURFACE WATER DRAINAGE
 - 7. PROPOSED SURFACE WATER DRAINAGE
 - 8. PROPOSED SURFACE WATER DRAINAGE
 - 9. PROPOSED SURFACE WATER DRAINAGE
 - 10. PROPOSED SURFACE WATER DRAINAGE
 - 11. PROPOSED SURFACE WATER DRAINAGE
 - 12. PROPOSED SURFACE WATER DRAINAGE



PROJECT	BARROWHILL QUARRY, MILL LANE, EARL SHILTON
CLIENT	DRAINAGE STRATEGY
DATE	20/01/2020
SCALE	1:500
FOR INFORMATION / APPROVAL	
BY	
DATE	
FOR INFORMATION / APPROVAL	
BY	
DATE	

MEC CONTRACTING AND PLANT HIRE LTD

Civil Engineering

Transport

Road Safety

Flood Risk & Drainage

Structures

Geo-Environmental

M-EC Acoustic Air

Utilities

M-EC Geomatics

Street Lighting

Expert Witness



Brighton | Leicester

T: 01530 264 753
group@m-ec.co.uk
www.m-ec.co.uk