



Flood Risk Assessment and Drainage Strategy Report
Phase 2 Barton Road, Barlestone
MyPad

QUALITY MANAGEMENT

Job No.	EE100030		
Project	Phase 2 Barton Road, Barlestone		
Location	Phase 2 Barton Road, Barlestone		
Title	Flood Risk Assessment and Drainage Strategy Report		
Document Ref	FRA / DS	Issue/Status	Planning
Date	2 nd July 2026		
Prepared by	Steven Griffiths	Signature (for file)	
Checked by	Steven Griffiths	Signature (for file)	
Authorised by	Steven Griffiths	Signature (for file)	

REVISION SCHEDULE

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY REPORT

PHASE 2 BARTON ROAD, BARLESTONE

Rev	Date	Details	Prepared By	Approved By
A	31.03.2026	First Issue	S. Griffiths	S. Griffiths
B	14.04.2026	Report revised in line with Client comments	S. Griffiths	S. Griffiths
C	12.05.2026	Report revised in line with Client comments	S. Griffiths	S. Griffiths
D	02.07.2026	Report revised in line with LLFA comments	S. Griffiths	S. Griffiths

CONTRACT

The report describes work commissioned by MyPad as outlined within fee proposal dated 17th February 2026.

PURPOSE

This document has been prepared as a Flood Risk Assessment and Drainage Strategy Report for MyPad. Elston Engineering Ltd accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

Elston Engineering Ltd has no liability regarding the use of this report except to MyPad.

TABLE OF CONTENTS

1. Executive Summary	1
2. Introduction.....	2
2.1 Scope of Assessment.....	2
2.2 Study Objectives and Methodology.....	2
3. Development Site and Location	3
3.1 Existing Site.....	3
3.2 Topography	4
3.3 Geology and Groundwater	4
3.4 Hydraulic Features	5
3.5 Current Site Drainage.....	6
4. Development Proposals	8
5. Policy and Guidance	9
5.1 Flood and Water Management Act, 2010	9
5.2 National Flood Risk Standing Advice for Local Planning Authorities	10
5.3 The Sequential Test and Exception Test	10
5.4 The SuDS Manual (C753) 2015.....	11
6. Climate Change.....	12
7. Site Specific Flood Risk.....	13
7.1 Fluvial Flooding	13
7.2 Pluvial (Surface Water) Flooding.....	14
7.3 Tidal Flooding	15
7.4 Flooding from Artificial Sources.....	15
7.5 Groundwater Flooding	16
7.6 Flooding from Drainage Infrastructure	16
8. Sequential Test.....	17
9. Exception Test.....	18
10. Surface Water Management	19
10.1 Requirements and Regulations	19

10.2 Surface Water Drainage Design Parameters and Criteria	19
10.3 Surface Water Drainage Strategy	20
10.4 Drainage Discharge and Outfalls	21
10.5 Use of SuDS	21
10.6 Storage	27
10.7 Ownership and Maintenance	27
11. Foul Water Drainage Proposal	28
11.1 Requirements and Regulations	28
11.2 Foul Water Drainage Strategy	28
11.3 Operations and Maintenance	29
12. Conclusions	30
12.1 Flood Risk	30
12.2 Drainage Summary - Surface Water	30
12.3 Drainage Summary - Foul Water	31

APPENDIX

Appendix A	Drawing E279-00-11 – Phase 2 Drainage Plan
Appendix B	Phase 2 Ground Investigation report by Erda Associates Ltd
Appendix C	Soakaway Testing report by Erda Associates Ltd.
Appendix D	BWB Consulting Drainage Strategy Report
Appendix E	Drawing E279-70-01 – Section 104 Plan
Appendix F	Surface Water Drainage Calculations
Appendix G	SuDS Feature Maintenance Schedules

1. EXECUTIVE SUMMARY

Site Name	Phase 2 Barton Road, Barlestone
Location	Phase 2 Barton Road, Barlestone
Client	MyPad
Grid Reference	441954,305684
Area (ha)	1.752 ha
Current Land Use	Undeveloped agricultural land
Environment Agency Flood Zone	Flood Zone
NPPF Development Classification	More Vulnerable
History of Flooding	No incidents of flooding
Flood Defences	N/A
Summary of Risks	The site is not at risk from any sources of flooding.
Runoff Rate (l/s)	Max rate of <u>3.0 l/s</u> for 1 in 100 year + 40% CC

2. INTRODUCTION

2.1 SCOPE OF ASSESSMENT

Elston Engineering Ltd have been commissioned by MyPad to prepare a Flood Risk Assessment Report to support the Planning application for the works and change of use of Phase 2 Barton Road, Barlestone.

2.2 STUDY OBJECTIVES AND METHODOLOGY

The Report is a holistic risk-based approach to consider flood risk from all possible sources, so to satisfy the requirements of the National Flood Risk Standing Advice for Local Planning Authorities. The objectives of this report are as follows:

- Determine likely sources of flooding,
- Assess the proposals in the context of the National Planning Policy Guidance,
- Propose an appropriate drainage strategy, and
- Determine appropriate mitigation and/or protection measures.

The methodology followed in the preparation of this report include the following:

- An investigation of the flood risk within and external to the Site,
- Consideration of the pre-development and post-development surface water runoff and identification of a means of storm water disposal, and
- Consideration of storm events up to and including the 1 in 100-year return period storm event, plus Climate Change, and calculations of the required volume of onsite storage, where this is applicable.

The report deals with environmental issues that are associated with flooding, other impacts on the environment are not considered. Existing sources of flood risk have been formally assessed, this includes both ground water and urban drainage systems.

3. DEVELOPMENT SITE AND LOCATION

3.1 EXISTING SITE

The site is located off Barton Road, Barlestone and is centred about Ordnance Survey Grid Reference 441954, 305684. The site is the second phase of a residential development accessed off Barton Road which received planning approval in January 2021 under planning reference number 21/00096/OUT. The site is roughly rectangular in shape with a site area of approximately 1.754 ha. The site will be accessed off the highway's infrastructure constructed as part of the Phase 1 development. Figure 1, below, shows the site location and boundary.

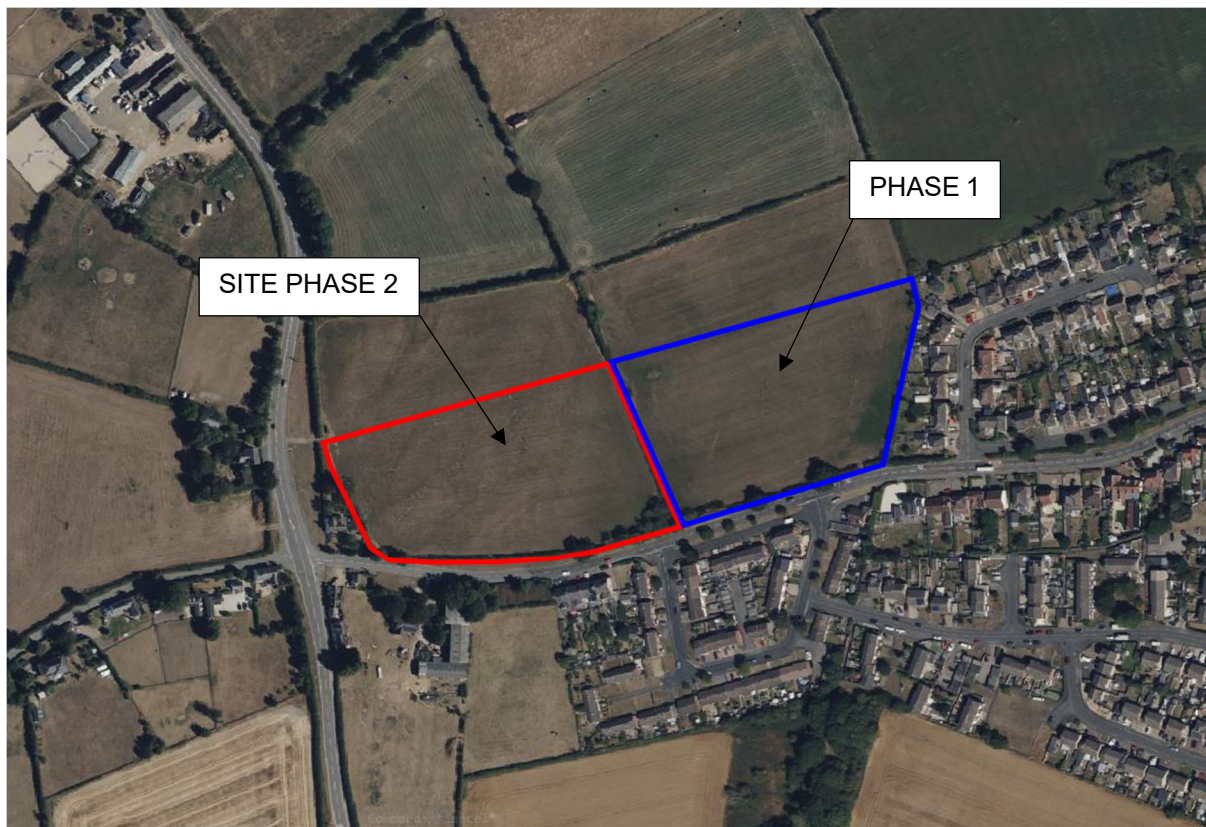


Figure 1 – Site Location Plan

The site was previous arable land but is currently being used for storage of materials during the construction of the Phase 1 development. The Northern boundary is undefined with further agricultural land to the North. The Western boundary is defined by a hedge line over which Hinckley Road (A447) is located. The Southern boundary is defined by a hedge line over which Barton Road is located. The Eastern boundary is undefined to the Phase 1 development site.

3.2 TOPOGRAPHY

Levels on site fall from North-West to South-East with levels on site ranging from 130.320m (AOD) and 127.060m (AOD).

Existing site levels are shown on drawing E279-00-11 – Phase 2 Drainage Plan which can be found in Appendix A.

3.3 GEOLOGY AND GROUNDWATER

A Phase 2 ground investigation report was undertaken by Erda Associates Ltd in July 2023 for the Phase 1 and 2 site. The report confirms the following ground conditions on site.

Topsoil / Made Ground

Topsoil was encountered in the majority of locations across the site and generally comprised dark brown slightly gravelly clayey sand. The topsoil was generally recorded to extend to depths of between 0.20m to 0.30mbgl.

Made ground was encountered in TP08 and WS04 which were situated in the area of the historic pond in the central northern part of the site. The made ground was generally noted to comprise reworked topsoil and natural deposits and extended to depths of between 1.30 and 1.70mbgl.

Superficial Strata

Superficial strata were encountered directly beneath the topsoil and made ground in all exploratory holes. The superficial strata were noted to be variable in nature but generally comprised interbedded loose to dense slightly clayey sandy gravel/gravelly sand and soft to stiff slightly gravelly sandy clay.

It was noted that the cohesive deposits generally improved in consistency and thickness to the west of the site.

A soft grey organic silt was noted immediately beneath the made ground in TP08 to a depth of 2.80mbgl. These deposits are considered to be related to the former pond.

The base of the superficial deposits was not encountered in any of the exploratory holes.

Groundwater

Groundwater was generally noted to be present in conjunction with granular deposits during the investigation works. The groundwater was noted to rise in excavations and boreholes that were left open which may be indicative that the groundwater is confined by shallower cohesive deposits.

Subsequent groundwater monitoring has recorded groundwater consistently at depths of between 0.60m to 1.80m. This is considered to be reflective of the underlying groundwater regime.

Soakaways

Indicative soakaway testing within the cohesive deposits has confirmed that these are generally impermeable and unsuitable for soakaways. In addition, granular horizons were generally noted to be saturated and also unsuitable for soakaways.

Furthermore, subsequent groundwater monitoring has shown that this is present at depths of between 0.60m and 1.80mbgl (generally at a depth of 1.00mbgl). Again, the presence of shallow groundwater makes soakaway drainage unviable and alternative drainage strategies should be sought.

A copy of the Phase 2 ground investigation report by Erda Associates Ltd can be found in Appendix B.

In addition to the Phase 2 ground investigation further on-site infiltration testing was undertaken to confirm whether soakaways could be utilised within the development. Erda Associates Ltd undertook infiltration testing in April 2025. 4 trial holes were dug on site however due to the ground conditions only one test was completed within 1425 minutes (23.7 hours) and as such the requirements of BRE365 were not met.

Given the findings from the ground investigation and additional soakaway testing infiltration drainage techniques are not consideration suitable as the primary method of surface water disposal for the development.

A copy of the soakaway testing report by Erda Associates Ltd can be found in Appendix C.

3.4 HYDRAULIC FEATURES

The nearest major watercourse to the site is the River Sense which is located approximately 5.5km West of the site. The River Erewash flows in a Northernly direction ultimately discharging to the Ashby de la Zouch Canal in Shackerstone.

There are a number of minor watercourses in close proximity to the site. The nearest watercourse is an unnamed open watercourse approximately 0.70km North of the site. The watercourse flows in a Western direction ultimately discharging to the Ashby de la Zouch Canal in Shackerstone.

3.5 CURRENT SITE DRAINAGE

Severn Trent Water are responsible for adopted drainage assets in Barlestone. There are no adopted assets within the site.

The Phase 1 and 2 sites were considered as part of the drainage strategy report prepared by BWB Consulting to support planning application reference number 21/00096/OUT which received planning approval in January 2021. The report states the following with regards to surface water runoff rates.

- 3.11 *Leicestershire County Council guidance states that runoff from the site to be discharged at rates and volumes no greater than the event specific greenfield values.*
- 3.12 *To comply with LLFA guidance, it is proposed to restrict the discharge rate from the total development area 1.97ha, to the receiving watercourse/sewer at the equivalent greenfield QBAR rate up to the 1 in 100-year plus climate change event of 8.7l/s.*
- 3.13 *The site is split into Western and Eastern drainage catchments. The Western Catchment has a developable area of 0.6ha and the Eastern Catchment a developable area of 1.37ha, taken from the current proposed masterplan.*
- 3.14 *Discharge rates are apportioned in consideration of meeting a minimum restricted rate of 3l/s to avoid risk of pipe blockage whilst restricting over the total catchment area to the equivalent calculated greenfield rate. Therefore, the smaller Eastern catchment, in line with the following principles, has been restricted to a minimum rate of 3l/s.*
- 3.15 *The Western catchment, in accordance with local guidance, is therefore restricted to 5.7l/s to meet the total greenfield rate site wide. This is summarised within **Table 3.1**. Micro Drainage Calculations/outputs are included for reference as **Appendix 3**.*
- 3.16 *The total restriction rate from the site is shown to meet the requirements of Severn Trent Water, **Appendix 4**, with surface water flows to their assets not permitted to exceed a rate of 5 l/s/ha.*

Table 3.1: Proposed Runoff Rates – Per Catchment

Catchment	Proposed Discharge Rate (l/s)
Western Catchment	3.0
Eastern Catchment	5.7
Total Proposed Runoff	8.7

Whilst the site plan / number of units resulting in an increase in impermeable area the development will maintain the discharge rates agreed within the approved document as part of the planning application reference number 21/00096/OUT.

As part of the Phase 1 site works new foul and surface water drainage network were constructed within the proposed onsite highway. Both the foul and surface water drainage systems were put forward for adoption under a Section 104 agreement. The systems would outfall to separate Severn Trent Water foul and surface water networks in Barton Road.

Foul water effluent from the Phase 1 and 2 sites would discharges to the Severn Trent Water sewer at an unrestricted rate.

The Phase 1 foul and surface water drainage systems were put forward for Section 104 adoption with Icosa Water.

A copy of the drainage strategy report prepared by BWB and approved as part of the Phase 1 planning application can be found in Appendix D.

A copy of the Phase 1 Section 104 drainage plan, drawing E279-70-01, can be found in Appendix E.

4. DEVELOPMENT PROPOSALS

The proposed development is the second phase of the Barton Road site. The development proposal comprises 28 residential properties with a mixture of 2 and 3 beds which will be accessed off the estate roads constructed as part of the phase 1 site.

As part of the works a new road shall be constructed connecting on the phase 1 road. The new roads will be put forward for adoption under a Section 38 agreement with the local highway's authority.

5. POLICY AND GUIDANCE

The following planning policies and guidance are relevant to the Proposed Development with regards to flood risk and surface water management.

5.1 FLOOD AND WATER MANAGEMENT ACT, 2010

In combination with the Flood Risk Regulations 2009, (which enact the EU Floods Directive in England and Wales) the Act places significantly greater responsibility on Local Authorities to manage and lead on local flooding issues. The Act and the Regulations together raise the requirements and targets Local Authorities need to meet, including:

- To play an active role in leading Flood Risk Management in the local area.
- The development of the Surface Water Management Plans (SWMPs).
- To implement the requirements of Flood and Water Management legislation.
- The preparation of preliminary Flood Risk Assessments (FRAs) and Flood Risk Management Plans (FRMPs).
- The development and implementation of drainage and flooding management strategies; and
- The responsibility for first approval, then subsequent adoption, management and maintenance of Sustainable Urban Drainage Systems (SuDS).

The Flood and Water Management Act also clarifies three key areas that influence development:

1. Sustainable Drainage (SuDS) - the Act makes provision for a national standard to be prepared on SuDS, and that developers will be required to obtain local authority approval for SuDS in accordance with the standards, likely with conditions. Supporting this, the Act requires local authorities to adopt and maintain SuDS, removing any ongoing responsibility for developers to maintain SuDS if they are designed and constructed robustly.
2. Flood Risk Management Structures - the Act enables the EA and local authorities to designate structures such as flood defences or embankments owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent.
3. Permitted flooding of Third-Party Land - The EA and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage or people's enjoyment of the environment or of cultural heritage.

5.2 NATIONAL FLOOD RISK STANDING ADVICE FOR LOCAL PLANNING AUTHORITIES

The National Flood Risk Standing Advice for Local Planning Authorities guidance advises how to take account of and address the risks associated with flooding and coastal change in the planning process.

The guidance applies a risk based, sequential approach to the proposed development site to avoid, where practicable, flood risk to people and property. As well as to manage any residual flood risk, and to consider the impact of Climate Change, by:

- The application of the Sequential Test.
- Applying the Exception Test, if required.
- Prevent development on land that is required for current and future flood management.
- Use the opportunity from new development to reduce the source and impact of flooding; and
- To seek opportunities to relocate development, including housing to more sustainable locations, should Climate Change increase flood risk to a current development and render it unsustainable in the long term.

5.3 THE SEQUENTIAL TEST AND EXCEPTION TEST

The purpose of the Sequential Test is to steer new development towards areas with the lowest probability of flooding (Flood Zone 1). Where there are no reasonably available sites within Flood Zone 1, local planning authorities in their decision making should consider the flood risk vulnerability of land uses and consider all reasonably available sites in Flood Zone 2 (areas with a medium probability of flooding), and only applying the Exception Test as required. Only when there are no reasonably available sites in either Flood Zone 1 or 2, should sites in Flood Zone 3 (areas with a high probability of flooding) be considered. With full reference made to the land use flood risk vulnerability and applying the Exception Test when necessary.

For the Exception Test to be passed:

- the development must demonstrate that it will provide wider sustainability benefits to the community that outweigh flood risk, and that is informed by a comprehensive Strategic Flood Risk Assessment, where one has been prepared; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its entire lifetime, that the vulnerability of its users is considered, that it will not increase flood risk elsewhere and it will aim to reduce the overall flood risk.

5.4 THE SUDS MANUAL (C753) 2015

The SuDS Manual provides best practice guidance on the planning, design, construction, operation, and maintenance of Sustainable Drainage Systems (SuDS) to facilitate their effective implementation within the planning process.

.

The SuDS Manual has been referred to in the decision-making process of which SuDS features will be suitable for the site. Section details the methodology used, the SuDS features that have been selected, and the reasoning for the selection.

6. CLIMATE CHANGE

Climate Change should be considered as part of the formal flood risk assessment process. The Department for Environment Food & Rural Affairs Climate Change Allowance online mapping confirms the percentage allowance based on catchment. A link to the Department for Environment Food & Rural Affairs Climate Change Allowance online mapping can be found below.

<https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall?mgmtcatid=3052>

The development falls within the Tame Anker and Mease Management Catchment and as such the climate change allowance as outlined in Table 1 and Table 2 below.

Table 1 - 3.3% Annual Exceedance Rainfall Event

	Central Allowance	Upper End Allowance
2050s	20%	35%
2070s	25%	35%

Table 2 - 1% Annual Exceedance Rainfall Event

	Central Allowance	Upper End Allowance
2050s	20%	40%
2070s	25%	40%

7. SITE SPECIFIC FLOOD RISK

7.1 FLUVIAL FLOODING

The Environment Agency Risk of Flooding from Rivers or the Sea mapping has been reviewed to give guidance for the fluvial and tidal risk to the site.

Figure 2, below, shows the current Risk of Flooding from Rivers or the Sea map for the site.



Figure 2 - Environment Agency Risk of Flooding from Rivers and Sea mapping for the site.

The Environment Agency flood mapping shows the site is not in an area affected by fluvial flooding.

The Environment Agency flood mapping classifies the site as being location in Flood Zone 1 and is considered to be at Low Risk of Flooding. Flood Zone 1 is defined as land that has a “Low Probability” of flooding.

Table 3 - Flood Zone Classifications.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map - all land outside Zones 2 and 3).
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1000 annual probability of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map).
Zone 3b The Functional Floodplain	This zone comprises land where water must flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional flood plain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map).

In addition to the flood mapping a copy of the Environment Agency Flood Map for Planning report was obtained for the site which confirmed the site is located in Flood Zone 1.

The site has been put forward a residential development and it is anticipated there will be between 90 and 100 units. Using Table 2: Flood Risk Vulnerability Classification of the National Planning Guidance, the development is classed as being 'More Vulnerable'.

More Vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non-residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

7.2 PLUVIAL (SURFACE WATER) FLOODING

Pluvial, or surface water, flooding occurs when natural and manmade systems have insufficient capacity to cope with high volumes of rainfall. Pluvial flooding can occur in urban areas during extreme, high

intensity, short duration summer rainfall events, which overwhelm the surface water drainage network. Or in rural areas following a medium intensity, long duration events, where the ground conditions are saturated and there is no additional storage capacity within the underlying soils. The flood water is then conveyed via overland flow routes that are in turn dictated by the local topography.

The Environment Agency Risk of Flooding from Surface Water mapping has been reviewed which shows some flooding from Pluvial Sources as shown in Figure 3, below.



Figure 3 - Environment Agency Flood Mapping - Flood Risk from Surface Flooding – Low Risk

The flood mapping shows a small amount of pluvial flooding in the South East corner of the site. Reviewing the existing ground levels this is in the lowest part of the site away from the proposed residential properties.

The development is therefore not considered to be at risk of flooding from Pluvial sources.

7.3 TIDAL FLOODING

The site is remote from the sea and watercourse close to the site are not subject to tidal influence, as such the development is not considered to be at risk of Tidal Flooding.

7.4 FLOODING FROM ARTIFICIAL SOURCES

Flooding from artificial sources refers to all flooding generated by manmade sources. This includes reservoirs, canals, artificial lakes and from mining abstraction. Reservoir flooding is extremely unlikely to happen, and there are no recorded fatalities from a breach of a reservoir retaining dam in the UK since the 1920s. The Reservoir Act 1975, mandates that the Environment Agency is responsible for all

reservoirs in England to be regularly inspected, and that essential maintenance works are carried out as and when required.

The Environment Agency Risk mapping has been reviewed which shows the site not at risk of flooding from Artificial Sources

7.5 GROUNDWATER FLOODING

Groundwater flooding occurs when water rises from an underlying aquifer or from water rising from abnormal springs. This usually occurs following long periods of sustained heavy rainfall, and the areas that are most susceptible are those that are low lying, and where there is a high-water table. Groundwater flooding is also known to occur in areas underlain by major aquifers, although increasingly it is associated with more localised floodplain sand and gravels.

Given the underlying geology encountered during the Phase 2 ground investigation undertaken by Erda Associates Ltd the site is not considered to be at risk of flooding from groundwater.

7.6 FLOODING FROM DRAINAGE INFRASTRUCTURE

Flooding can also arise from the drainage network when it is either overwhelmed from high rainwater volume following an intense storm event, or when there is a blockage within the network. Blockages in the drainage system can lead to localised flooding where this occurs.

Severn Trent Water are responsible for adopted drainage assets in Barlestone. There are no adopted assets within the site.

No flooding incidents have been reported which are due to adopted drainage assets and as such the development is not considered to be at risk of flooding from drainage infrastructure.

8. SEQUENTIAL TEST

As stated in Section **Error! Reference source not found.**, the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. All sources of flooding have been reviewed which have confirmed the site is located in Flood Zone 1.

The Sequential Test has been applied to the development site in accordance with the National Planning Policy Guidance. In accordance with the National Planning Policy Guidance the proposed development is considered suitable.

9. EXCEPTION TEST

The Exception Test is not required, in accordance with Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility' of the National Planning Policy Guidance. Table 4 below, shows the Flood Risk Vulnerability Classification from the NPPF.

Table 4 – NPPF - Flood Risk Vulnerability and Flood Zone 'Compatibility'.

Flood Zone	Flood Zone Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception test required	✓	✓	✓
Zone 3a †	Exception test required †	✗	Exception test required	✓	✓
Zone 3b	Exception test required *	✗	✗	✗	✓

Key:

✓ Development is appropriate.

✗ Development should not be permitted.

10. SURFACE WATER MANAGEMENT

10.1 REQUIREMENTS AND REGULATIONS

The means of draining surface water generated by a site are required to mirror the behaviour of the existing site run-off, so far as is practicable, to offset the off-site flood risk that might otherwise be created, or to bypass it entirely.

The following documents have been referred to as part of the development of the drainage strategy for the development to ensure current standards and industry best practice are adhered to:

- National Standards for Sustainable Drainage Systems.
- Code for Adoption, 2020.

In accordance with National Standards for Sustainable Drainage Systems, surface water runoff generated by a site should look to discharge to one of the following listed in order of priority:

- Priority 1: Collected for non-potable use
- Priority 2: Infiltrated to ground
- Priority 3: Discharged to an above ground surface water body
- Priority 4: Discharged to a surface water sewer, or another piped surface water drainage system
- Priority 5: Discharged to a combined sewer

10.2 SURFACE WATER DRAINAGE DESIGN PARAMETERS AND CRITERIA

When assessing the development the following surface water modelling parameters shall be used:

- **Rainfall Data:** FEH
- **Global Time of Entry:** 5 minutes
- **Volumetric Run-off Coefficient:** 0.75 (Summer), 0.84 (Winter)

Drainage modelling shall be checked against the following storm return periods and durations to ensure there is adequate attenuation capacity within the system and attenuation features:

- 1 in 2-year storm – 15 mins to 1440 mins storm duration
- 1 in 30-year storm – 15 mins to 1440 mins storm duration
- 1 in 300 + 35% climate change year storm – 15 mins to 1440 mins storm duration
- 1 in 100 + 40% climate change year storm – 15 mins to 1440 mins storm duration

10.3 SURFACE WATER DRAINAGE STRATEGY

In accordance with the surface water hierarchy outlined National Standards for Sustainable Drainage Systems. Priority 1 is to collect surface water runoff for non-potable use. To achieve this water butts are to be utilised within the development however these will only be used for external irrigation purposes and only account for a small amount of surface water runoff reduction from the development. Non-potable use cannot be considered as the primary method of surface water disposal.

Priority 2 is to discharge to a soakaway and / or infiltration drainage system. Infiltration testing undertaken by Erda Associates Ltd in April 2025 confirmed ground conditions on site were not suitable to support soakaways as the primary method of surface water disposal for the development with testing not meeting the requirements of BRE365, as such infiltration drainage techniques have been discounted as the primary solution for the disposal of surface water runoff. Permeable paving is however to be used on all plot driveways allowing runoff to discharge to the ground. The large surface area and the ability to deepen the voided sub-base to provide additional storage for the lower infiltration rate has meant that permeable drives are to be used to discharge a proportion of the surface water runoff from the site.

Priority 3 is to discharge to an above ground surface water body. There are a number of minor watercourses in close proximity to the site. The nearest watercourse is an unnamed open watercourse approximately 0.70km North of the site. To discharge to the watercourse, it would be necessary to cross third party land which MyPad do not have rights to cross, as such a discharge to an above ground surface water body has been discounted as a potential solution for the disposal of surface water runoff

Priority 4 is to discharge to a surface water sewer. As part of the Phase 1 development allowance was made for surface water runoff from the Phase 2 site to discharge to the new surface water drainage system which ultimately discharges to the Severn Trent Water surface water sewer in Burton Road.

As part of the Phase 2 development a new gravity surface water drainage system shall be constructed on site which will accept surface water runoff from the residential properties, adopted highway and private impermeable surfaced areas.

Surface water runoff from the Phase 2 site will discharge to the Phase 1 surface water drainage system at a restricted rate. Surface water discharge rates shall be discussed further in Section 10.4.

Individual SuDS features for the site have been reviewed based on the site characteristics, such as the underlying soil type and geology. As well as the design considerations from the development that may limit the feasibility of certain SuDS features from being implemented. Details of the specific SuDS features selected for the site can be found in Section 10.5.

Attenuation shall be provided to attenuate surface water flooding from storms, up to and including 1 in 100 years plus 40% Climate Change with a 1440-minute duration in accordance with Section 6 of this report. Onsite attenuation requirements shall be discussed further in Section 10.6.

Proposed Phase 2 Section 104 drainage layout plan, drawing E279-00-11 – Phase 2 Drainage Plan can be found in Appendix A.

10.4 DRAINAGE DISCHARGE AND OUTFALLS

The Phase 1 and 2 sites were considered as part of the drainage strategy report prepared by BWB Consulting to support planning application reference number 21/00096/OUT which received planning approval in January 2021.

Within the report it was confirmed that the total site (Phases 1 and 2) would discharge at a peak rate of **8.7 l/s** (Qbar) for all storm events up to and including 1 in 100 year + climate change. The report also stated that the Phase 1 site would discharge at a rate of **5.7 l/s** until Phase 2 was brought forward for development at which point the rate would be increased to the **8.7 l/s** via the installation of replacement flow control device. The discharge from the Phase 2 site into the Phase 1 system is to be restricted to a maximum discharge rate of up to **3.0 l/s**.

As part of the Phase 1 site works new foul and surface water drainage networks were constructed within the proposed onsite highway. Both the foul and surface water drainage systems were put forward for adoption under a Section 104 agreement. The systems would outfall to separate Severn Trent Water foul and surface water networks in Barton Road.

10.5 USE OF SUDS

To ensure the quality of runoff leaving the site is treated to a suitable level, SuDS features have been assessed for their suitability within the proposed development. In accordance with CIRIA Report C753 - The SuDS Manual 2015 features have been considered and their suitability evaluated in relation to the development.

Table 5, below, details all the SuDS features that have been considered for this site and providing supporting evidence to why each SuDS features type have or have not been deemed suitable.

Table 5 - SuDS Selector Table

SuDS Selector Table		
Feature	Suitable Y / N	Evidence
Rainwater Harvesting	Y	Rainwater harvesting in the form of water butts could be used to store surface water runoff for reuse or external irrigation purposes.
Green Roofs	N	Green roofs are ideally suited to flat roofs, pitched roofs have been proposed within the development and as such are not considered to be suitable within the development.
Infiltration Systems	N	Due to the ground conditions infiltration systems are not considered suitable.
Proprietary Treatment Systems	Y	Trapped gullies are to be provided within the adopted highway to assist with the removal of sediment.
Filter Strips	N	Due to the ground conditions filter strips are not considered suitable.
Filter Drains	N	Due to the ground conditions filter strips are not considered suitable.
Swales	N	Due to the limited space on site swales are not considered to be suitable within the development.
Bioretention Systems	N	Bioretention features have been discounted in favour of a wetland feature due to the available space.
Trees / vegetation	Y	New planting will be incorporated into the development which will assist with the disposal of surface water runoff.
Pervious Pavements	Y	Permeable paving is to be used to all plot parking discharging surface water runoff to the ground.
Attenuation Storage Tanks	N	A attenuation storage tank could be used but has been discounted in favour of a wetland feature due to pollution mitigation reasons.
Detention Basins	N	A detention basin could be used but has been discounted in favour of a wetland feature due to pollution mitigation reasons.
Ponds and Wetlands	Y	A wetland feature is to be used to provide surface water attenuation and treatment prior to discharge. The feature will have a permanently wet base

		approximately 300mm deep, attenuation storage will be provided above this.
--	--	--

To ensure the SuDS features provide the appropriate level of treatment the proposed features have been assessed against Table 26.2 and 26.3 of CIRIA C753 The SuDS Manual. A copy of Table 26.2 can be found below showing the different pollution hazard levels for different types of land use.

Table 6 - Table 26.2 Pollution Hazard Indices for Different Land Use Classifications from CIRIA C753
The SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roads (typically commercial / industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements / day.	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways.	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.	High	0.8	0.8	0.9

A copy of Table 26.3 showing the SuDS mitigation indices highlighting the level of mitigation each feature offers can be found below.

Table 7 - Table 26.3 Indicative SuDS Mitigation Indices for Discharges to Surface Water

	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

In accordance with CIRIA C753 The SuDS Manual the different types of land use within a development should be totalled to give an overall Total Pollution Hazard level. The Total Pollution Hazard level should be lower than the total SuDS Mitigation features

Table 8, below demonstrates that the use of a wetland feature within the development will provide a suitable level of mitigation against the pollution hazard risk to the site.

Table 8 - Total SuDS Mitigation Index $\geq$ Pollution Hazard Index

Land Use	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements / day.	0.5	0.4	0.4
Total	0.7	0.6	0.45
Wetland	0.8	0.8	0.8
Mitigation Requirement Met?	Yes	Yes	Yes

10.6 STORAGE

Surface water attenuation shall be provided for surface water runoff from the adopted highway and the residential property roofs for all storm events up to and including 1 in 100 year + 40% Climate Change for a 10080-minute (7 days) duration. Attenuation storage shall be provided within the piped drainage network, and a wetland feature near to the outfall where levels are lowest on site.

Surface water drainage calculations have been undertaken to confirm the required pipe and wetland feature size to attenuate the flows from the Phase 2 development.

A copy of the surface water drainage calculations can be found in Appendix F.

10.7 OWNERSHIP AND MAINTENANCE

The new piped surface water drainage system shall be put forward for adoption by Icosa Water under a Section 104 agreement and will be designed to Code for Adoption standards.

The wetland feature will remain private and will be managed under a long-term management plan.

The private surface water drainage system around the residential properties to the adopted system shall be the responsibility of the individual property owners to maintain.

Future maintenance schedules for elements of the drainage system can be found in Appendix G.

11. FOUL WATER DRAINAGE PROPOSAL

11.1 REQUIREMENTS AND REGULATIONS

The following documents have been referred to as part of the development of the drainage strategy for the development to ensure current standards and industry best practices are adhered to:

- Buildings Regulations Part H - Drainage and Waste Disposal
- Code for Adoption, 2020.

In accordance with Building Regulations Part H - Drainage and Waste Disposal, foul effluent generated by a site should look to discharge to one of the following listed in order of priority:

- An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
- A private sewer communicating with a public sewer; or where that is not reasonably practicable,
- Either a septic tank which has an appropriate form of secondary treatment or another wastewater treatment system; or where it is not reasonably practicable,
- A cesspool.

11.2 FOUL WATER DRAINAGE STRATEGY

Severn Trent Water are responsible for adopted drainage assets in Barlestone. As part of the Phase 1 site works new foul and surface water drainage networks were constructed within the proposed onsite highway. Both the foul and surface water drainage systems were put forward for adoption by Severn Trent Water under a Section 104 agreement. The systems outfall to separate foul and surface water networks in Barton Road.

Foul water effluent from the Phase 1 foul water drainage system discharges to the Severn Trent Water sewer at an unrestricted rate.

Foul effluent from the Phase 2 development is proposed to discharge to the Phase 1 foul water system ultimately discharging to the existing Severn Trent Water foul water sewer in Barton Road.

A new foul water drainage system shall be constructed on site which will convey foul effluent from the residential properties and connect onto the Phase 1 system. A private foul water drainage system will be constructed to convey foul water effluent from the residential properties to the adopted drainage system.

The new Phase 2 foul water drainage system is proposed to discharge at an unrestricted rate into the Phase 1 foul water drainage system.

Proposed Phase 2 Section 104 drainage layout plan, drawing E279-00-11 – Phase 2 Drainage Plan can be found in Appendix A.

11.3 OPERATIONS AND MAINTENANCE

The Phase 2 foul water drainage system shall be put forward for adoption by Severn Water under a Section 104 agreement and will be designed to the Code for Adoption standards.

All private drainage on site will be the responsibility of the individual property owners to maintain.

12. CONCLUSIONS

12.1 FLOOD RISK

Based on the work carried out in the preparation of this report the following conclusions are made:

- The site is not at risk of flooding from any sources.
- The site is located in Flood Zone 1 – ‘Low Probability’.
- The development is classified as being ‘More Vulnerable’.
- The development satisfies the requirements of the Sequential Test and as such is deemed appropriate.
- The Exception Test is not required as the site is deemed appropriate.

12.2 DRAINAGE SUMMARY - SURFACE WATER

The disposal of surface water runoff generated by the proposed development has been assessed in accordance with the surface water hierarchy outlined National Standards for Sustainable Drainage Systems.

Surface water runoff from the Phase 2 development shall discharge to the Phase 1 surface water drainage system.

As part of the Phase 2 development a new gravity surface water drainage system shall be constructed on site which will accept surface water runoff from the residential properties, adopted highway and private impermeable surfaced areas.

Surface water runoff from the Phase 2 site into the Phase 1 system is to be restricted to a maximum discharge rate of up to **3.0l/s** for all storm events up to and including 1 in 100 year + 40% Climate Change for a 10080-minute (7 days) duration.

As outlined in the BWB Consulting drainage strategy report supporting planning application reference number 21/00096/OUT which received planning approval in January 2021, the surface water discharge from the Phase 1 site will be increased from **5.7l/s** to **8.7l/s** via a new flow control device for storms, up to and including 1 in 100 years plus 40% Climate Change with the implementation of the Phase 2 development.

The new piped surface water drainage system shall be put forward for adoption by Icosa Water under a Section 104 agreement and will be designed to Code for Adoption standards.

The wetland feature will remain private and will be managed under a long-term management plan.

The private surface water drainage system around the residential properties to the adopted system shall be the responsibility of the individual property owners to maintain.

12.3 DRAINAGE SUMMARY - FOUL WATER

The disposal of foul water effluent generated from the proposed development has been assessed in accordance with the guidance outlined by the Building Regulations Part H - Drainage and Waste Disposal.

Foul effluent from the Phase 2 development is proposed to discharge to the Phase 1 foul water system ultimately discharging to the existing Severn Trent Water foul water sewer in Barton Road.

A new foul water drainage system shall be constructed on site which will convey foul effluent from the residential properties and connect onto the Phase 1 system. A private foul water drainage system will be constructed to convey foul water effluent from the residential properties to the adopted drainage system.

The new Phase 2 foul water drainage system is proposed to discharge at an unrestricted rate into the Phase 1 foul water drainage system.

The Phase 2 foul water drainage system shall be put forward for adoption by Icosa Water under a Section 104 agreement and will be designed to the Code for Adoption standards.

All private drainage on site will be the responsibility of the individual property owners to maintain.

APPENDIX

APPENDIX A



ENGINEERING GA: General Notes.

1. Do not scale this drawing. If in doubt, ask.
2. This drawing is to be read in conjunction with all other relevant Engineers, Architects and specialist design drawings and details.
3. All dimensions are in metres unless noted otherwise. All levels are in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the Engineer immediately.
5. All drainage works shall be carried out in accordance with the Sewerage Sector Guidance Design and Construction Document Version 2.0.
6. Prior to commencement of any drainage works, the contractor shall check the invert level of the existing sewers. If there are any discrepancies with the invert levels shown the Engineer shall be contacted immediately.
7. It is the responsibility of the Contractor to locate any service apparatus in the vicinity of the works prior to the commencement of any intrusive works.
8. It is the responsibility of the Contractor to execute the works at all times in strict accordance with the requirements of the health and safety at work act 1974, and the C.D.M. regulations 2015. The Contractor will be deemed to have allowed for full compliance, including full liaison with the principal designer/principal contractor, within the rates.
9. The Contractor is responsible for ensuring that all works are to the satisfaction of the Engineer, and shall be deemed to have included within his rates for any necessary testing.
10. The Contractor will be responsible for providing all necessary de-watering and trench support to execute the works in a satisfactory manner, and shall be deemed to have allowed for the same within his rates.
11. All buried concrete products and mortar shall be made using sulphate resisting cement.
12. All materials for use in the contract must be BS kitemarked. All lifting eyes in P.C.C. products shall be pointed smooth after fixing. STW requires that precast concrete rings must not be cut on site.
13. Pipes shall be laid with soffits level unless stated otherwise.
14. STW requires that at all pipe crossings, a plastic membrane to be used for protection to eliminate any chances of cross contamination.
15. Precast concrete rings shall not be cut.
16. Temporary screen/grills to be provided in storm and foul manholes in order to prevent any construction debris/rubble from entering the receiving watercourse or public foul sewer system during the construction works.
17. Any existing trees or proposed tree planting within 12m of a public sewer shall accord with the requirements of the Sewer Sector Guidance Design and Construction Version 2, Cl'S B5.1.10-11.
18. All highway works shall be carried out in accordance with the relevant Highway Design Guide and technically approved drawings.
19. The Contractor shall check all tie-ins for line and level with existing before commencing any works. The Engineer shall be notified immediately in writing, should any errors be found.
20. All tactile paving tile arrangements shall be laid with the modules in line with the crossing and must be agreed with the highway authority prior to laying. New service boxes should be located away from pedestrian dropped crossing points to avoid the need for cutting tactile paving slabs.

REV	DESCRIPTION	DATE	INITIAL



T 01164 829032
E contact@ridnic.co.uk W www.ridnic.co.uk
A 4 Pear Tree Business Park, Desford Lane, Ratby, LE6 0PG
Company registration number: 10827228



PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT AT
**BARTON ROAD,
BARLESTONE**

TITLE
**PHASE 2
DRAINAGE PLAN**

DRAWN JG	DATE 02-05-2025	PURPOSE OF ISSUE ☒ PRELIMINARY ☐ APPROVAL ☐ CONSTRUCTION
SCALE 1/500	SIZE A1	REV. -
DWG NO. E279-00-11		



APPENDIX B



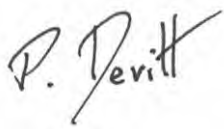
LAND AT BARTON ROAD, BARLESTONE

PHASE II GEO-ENVIRONMENTAL ASSESSMENT
FOR
MYPAD 2020 LIMITED

Project Ref:
EAL.288.22

Date:
July 2023

Prepared for:
MyPad 2020 Limited
The Quadrant
Nuart Road
Beeston
Nottingham
NG9 2NH

Prepared and Authorised by:		Phil Devitt BSc MSc MRICS <i>Director</i>
Date:	July 2023	
Version:	1.0	

Executive Summary

This presents the salient points of the report and should not be referred to in isolation. The conclusions and recommendations presented below are considered reasonable based on the findings of the site investigation. However, these cannot be guaranteed to gain regulatory approval and therefore copies of this report should be sent to the appropriate Regulatory Authorities and / or other organisations (as appropriate) by the Client for their comments and approval prior to undertaking any irrecoverable works associated with the subject site.

SUMMARY TABLE: PHASE II GEO-ENVIRONMENTAL ASSESSMENT	
SITE:	Land at Barton Road, Barlestone
CLIENT:	MyPad 2020 Limited
DATE:	July 2023
REFERENCE	EAL.288.22
DEVELOPMENT PROPOSAL:	Eighty-four residential dwellings with associated driveway access, private gardens and public open space.
HUMAN HEALTH:	No significant contamination identified.
CONTROLLED WATERS:	No significant contamination identified.
GAS RISK:	Preliminary assessment has identified that the site is within a Characteristic Situation 2 (CS2) setting. CS2 ground gas protection measures are required for all plots. However, this initial assessment will be confirmed following completion of the full monitoring programme.
RADON GAS:	Radon protection measures are not required.
NOTES	Soakaway drainage is not considered to be suitable for the site.
FOUNDATIONS:	Piled/vibro stone column foundations should be budgeted for across the site at this stage.
FLOOR SLAB:	A suspended floor slab is recommended.
CONCRETE:	DS-1, AC-2z recommended.

The executive summary given above is an overview of the key findings and conclusions of the report. There may be other information contained in the body of the report which puts into context the findings of the executive summary. No reliance should be placed on the executive summary until the whole report has been read in full.

CONTENTS

1.0	INTRODUCTION	3
2.0	BRIEF SUMMARY OF PREVIOUS PHASE I REPORT	5
3.0	PHASE II GROUND INVESTIGATION	7
4.0	GROUND CONDITIONS	8
5.0	GEOTECHNICAL TESTING	9
6.0	CONTAMINATION ASSESSMENT	11
7.0	PHASE II CONCEPTUAL SITE MODEL	13
8.0	RISK MANAGEMENT & REMEDIATION	15
9.0	RECOMMENDATIONS	16
10.0	CONCLUSIONS	16

APPENDICES

Appendix A
Appendix B
Appendix C
Appendix D
Appendix E

Figures
Exploratory Hole Logs
Laboratory Analysis Results
Tier 1 Generic Assessment Criteria
Foundation Zoning Plan

1.0 INTRODUCTION

1.1 PREAMBLE

Erda Associates Ltd. (Erda) has been appointed by MyPad 2020 Limited (hereafter referred to as the client) to undertake a Phase II Site Appraisal to provide a pre-development contamination and geotechnical assessment of the site known as *Land at Barton Road, Barlestone*. Site location and boundary plans are included in **Appendix A**.

The works reported within this document comprise the review of an existing desktop study and the undertaking of an intrusive ground investigation along with geotechnical testing and chemical analysis.

This document is intended to provide information that will assist decision making by identifying and recommending solutions to ground engineering and contamination issues.

The client intends to develop the site with eighty-four residential dwellings with associated driveways, private gardens and public open space. A proposed site development plan is included in **Appendix A**, for reference.

1.2 PROJECT BRIEF

The brief for the Phase II Geo-Environmental Assessment incorporates:

- A review of an existing Phase I Site Appraisal (Desk Study) for the subject site undertaken by GRM Development Solutions Limited

- Provide a strategy for, and to implement, a Phase II Environmental and Geotechnical Assessment.

- To determine any ground related geotechnical and contamination hazards that may affect the proposed development.

- Development of the Phase II Conceptual Model.

- To provide advice on further works required for the reduction of risks to the development and procedures likely to satisfy regulators.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they may have specific requirements that will need to be discussed and addressed at a later date.

1.3 DATA REFERENCES

- GRM Development Solutions Limited, Phase I Site Appraisal (Desk Study) Barton Road, Barlestone, dated September 2019, (reference P9075).

- British Geological Survey Online Geological Mapping.

- BSI (2020), BS 5930:2015+A1 2020 Code of practice for ground investigations.

- CIRIA (2007), C665 Assessing Risks Posed by Hazardous Ground Gases to Buildings.

- PHE-BGS (2011), Joint Indicative Atlas of Radon in Great Britain.

- EA (2020), LCRM: How to assess and manage the risks from land contamination.

1.4 LIMITATIONS

This report has been produced in accordance with industry best practice at the time of writing.

In the production of this report, Erda Associates Ltd., have relied upon information provided by third parties. Erda Associates Ltd cannot accept responsibility for the reliability and authenticity of this information. Erda Associates Ltd. will not be responsible for any opinions which it has expressed, or conclusions which it has drawn, in reliance upon information which is subsequently proven to be inaccurate.

All statements and opinions provided in this report have been reported in good faith and are based on the information gained during, and restrictions imposed by, site investigation techniques used at the time. Erda Associates Ltd cannot be held responsible for conditions not revealed by the investigation.

This report has been prepared for the sole use of the client and shall not be relied upon or transferred to third parties without the express written consent of Erda Associates Ltd. Unauthorised third parties rely upon the information contained within this report at their own risk.

1.5 PROPOSED DEVELOPMENT

The client intends to develop the site with eighty-four residential dwellings with associated driveways, private gardens and public open space. A proposed site development plan is included in **Appendix A**, for reference.

2.0 BRIEF SUMMARY OF PREVIOUS PHASE I REPORT

The following outlines a brief summary of previous GRM Development Solutions report that was written in relation to the site. A copy of the previous report is not included herein. However, it is recommended that the aforementioned report should be read in full.

2.1 SITE HISTORY AND SETTING

The sites previous use is recorded to be agricultural fields dating back to at least 1885. A moderate sized pond situated in the central, northern part of the site is no longer recorded from 1980 and was, presumably, infilled. The potentially infilled pond has been identified as a potential source of contamination and ground gas.

The surrounding land use has predominantly comprised agricultural fields. Barlestone village, situated to the east, has progressively expanded until it was situated adjacent the eastern and southern boundary of the site. No significant potentially contaminative land uses in the immediate surrounding area have been identified.

2.2 ANTICIPATED GEOLOGY

Made ground is not recorded to be present on site.

Superficial glaciofluvial deposits are recorded beneath the western portion of the site and generally comprise sand and gravel. The Oadby member is recorded to underlie the eastern part of the site and generally comprises gravelly clay.

A solid geology of the Gunthorpe Member comprising mudstone is recorded to underlie the superficial deposits.

No faults are recorded within 500m of the site.

2.3 HYDROGEOLOGY

The superficial glaciofluvial deposits are classified as a Secondary A Aquifer. The superficial Oadby Member is classified as a Secondary (Undifferentiated) Aquifer.

The solid geology (Gunthorpe Member) is classified as a Secondary B Aquifer.

There are no recorded groundwater abstraction licenses within 500m of the site. The site is not located within a Groundwater Source Protection Zone.

2.4 HYDROLOGY

Two small ponds were recorded to be present on site. However, these were not considered to be significant receptors due to their size and isolated nature.

A ditch is recorded along the eastern boundary and this was identified as a potential receptor.

2.5 RADON GAS ASSESSMENT

The site is not recorded to be within a radon affected area. Therefore, radon protection measures will not be required for new properties.

2.6 MINING

No significant risk of potential coal mining legacy or non-coal extraction has been identified for the site.

2.7 CONCEPTUAL SITE MODEL

Based on the above, the following conceptual site model was produced for the subject site;

Figure 2.7: Previous GRM Phase I Conceptual Site Model

info@grm-uk.com www.grm-uk.com



3 PHASE I CONCEPTUAL SITE MODEL

HUMAN HEALTH			
Source	Pathway	Receptor	Level of Risk
Localised made ground / in-fill material associated with pond in the north.	Indoor and outdoor inhalation of soil dust, the ingestion of, and dermal contact with, contaminated soil and soil dust, ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables.	End users.	Low.
Pesticides associated with current and historic agricultural land use.		Construction and Maintenance Workers.	
Localised made ground / in-fill material associated with pond in the north.	Inhalation of ground gas.	End users.	Very Low.
Limited made ground.	Water pipes.	End users.	Very low.

CONTROLLED WATERS			
Localised made ground / in-fill material associated with pond in the north.	Leaching of contaminants and vertical migration to the groundwater.	Secondary A Aquifer.	Very Low.
Pesticides associated with current and historic agricultural land use.	Leaching of contaminants and lateral migration to surface waters.	Ditch along the eastern boundary.	

3.0 PHASE II GROUND INVESTIGATION

3.1 FIELDWORK

The Phase II intrusive investigation was undertaken on the 29th and 30th June 2023 under the supervision of a suitably qualified engineer and in general accordance with the Code of Practice for Site Investigations BSI (2020), BS 5930:2015+A1 2020.

The Phase II investigation works incorporated the following:

- The advancing of seven window sample boreholes to a maximum depth of 5.00mbgl.

- The excavating of eleven trial pits to a maximum depth of 3.30mbgl.

- The collection of three shallow hand dug samples.

- The analysis of fourteen soil samples for a standard testing suite and selected site specific determinands.

- The analysis of five soil samples for geotechnical design criteria - Plasticity Index (PI).

- The installation and subsequent monitoring of five ground gas and groundwater monitoring wells.

- Indicative soakaway testing.

An exploratory hole plan along with all exploratory hole records are included in **Appendix B**.

3.2 RATIONALE

The Phase II investigation has been designed to facilitate an assessment of the general ground conditions across the site, including contaminant sources, pathways and receptors. The investigation has also been designed in consideration of the current site layout and access restrictions, the development proposal and health and safety issues.

3.3 LABORATORY ANALYSIS & TESTING

Selected soil samples were analysed at specialist environmental and geotechnical laboratories as detailed in the following sections.

3.3.1 Chemical Analysis

A total of seven samples of topsoil, two samples of made ground and five samples of natural strata were sent for analysis at a UKAS/MCERTS accredited laboratory. The samples were screened for heavy metals, PAHs, asbestos, herbicides/pesticides, water-soluble sulphate and pH. The soil analysis results are contained within **Appendix C**.

3.3.2 Geotechnical Testing

Five samples of the natural strata were sent to a UKAS accredited laboratory and subjected to Plasticity Index (PI) testing. The geotechnical test results are contained in **Appendix C**.

3.3.3 Gas Monitoring and Sampling

Ground gas monitoring has been undertaken at the site to assess the potential risk of ground gas. A total of six monitoring visits were scheduled. At this stage the monitoring programme is ongoing and only three visits have been completed.

4.0 GROUND CONDITIONS

The intrusive investigation has generally revealed that the site is underlain by topsoil over superficial Glaciofluvial and Oadby Member deposits. Localised made ground was encountered in the vicinity of the historic pond in the central northern area of the site. The site-specific observations are detailed in the following sections.

4.1 TOPSOIL/MADE GROUND

Topsoil was encountered in the majority of locations across the site and generally comprised dark brown slightly gravelly clayey sand. The topsoil was generally recorded to extend to depths of between 0.20m to 0.30mbgl.

Made ground was encountered in TP08 and WS04 which were situated in the area of the historic pond in the central northern part of the site. The made ground was generally noted to comprise reworked topsoil and natural deposits and extended to depths of between 1.30 and 1.70mbgl.

4.2 SUPERFICIAL STRATA

Superficial strata were encountered directly beneath the topsoil and made ground in all exploratory holes. The superficial strata were noted to be variable in nature but generally comprised interbedded loose to dense slightly clayey sandy gravel/gravelly sand and soft to stiff slightly gravelly sandy clay.

It was noted that the cohesive deposits generally improved in consistency and thickness to the west of the site.

A soft grey organic silt was noted immediately beneath the made ground in TP08 to a depth of 2.80mbgl. These deposits are considered to be related to the former pond.

The base of the superficial deposits was not encountered in any of the exploratory holes.

4.3 FIELD OBSERVATIONS

With the exception of the localised made ground in the area of the central northern pond, there were no further pertinent observations recorded.

4.4 GROUNDWATER

Groundwater was generally noted to be present in conjunction with granular deposits during the investigation works. The groundwater was noted to rise in excavations and boreholes that were left open which may be indicative that the groundwater is confined by shallower cohesive deposits.

Subsequent groundwater monitoring has recorded groundwater consistently at depths of between 0.60m to 1.80m. This is considered to be reflective of the underlying groundwater regime.

4.5 SOAKAWAYS

Indicative soakaway testing within the cohesive deposits has confirmed that these are generally impermeable and unsuitable for soakaways. In addition, granular horizons were generally noted to be saturated and also unsuitable for soakaways.

Furthermore, subsequent groundwater monitoring has shown that this is present at depths of between 0.60m and 1.80mbgl (generally at a depth of 1.00mbgl). Again, the presence of shallow groundwater makes soakaway drainage unviable and alternative drainage strategies should be sought.

5.0 GEOTECHNICAL TESTING

The geotechnical assessment considers the development proposal for eighty-four residential dwellings with associated driveways, private gardens and public open space.

5.1 GEOTECHNICAL TESTING

5.1.1 Laboratory Testing

The results contained in **Appendix C** illustrate PI values of between 15% and 26% indicating that the shallow natural cohesive deposits should be classified as medium plasticity as a maximum classification to be used across the site. Moisture contents of between 12% and 18%, have also been recorded in the natural cohesive strata.

Plasticity index testing of one selected sample of the granular soils has confirmed that these are non-plastic.

Water Soluble Sulphate and pH analysis revealed results of 4.4-347mg/ISO₄ and 6.2-7.7, respectively.

5.1.2 In-situ Testing

In-situ standard penetration testing (SPT) the natural soils was undertaken during the ground investigation works. Results of the testing are included on the exploratory hole logs in **Appendix B**. In summary, SPT N Values within the superficial deposits ranged from 0 to 52 indicating a variable consistency. Hand shear vane was also undertaken within the cohesive deposits during the trial pit investigation. In summary values ranged between 30kPa to 130kPa again indicating a variable consistency.

5.2 FOUNDATION DESIGN

Due to the variability between granular and cohesive deposits and poor composition of the granular deposits in conjunction with groundwater, traditional foundations are considered to be potentially unsuitable. At this stage it is recommended that piled foundations/vibro stone columns are budgeted for across the entire site. A piling/vibro specialist will need to be approached to provide pile/stone column dimensions and safe pile/vibro capacities. Consideration should be given to nearby structure when selecting foundation type. Consideration should also be given to the effects of shrink/heave within cohesive deposits on pile/vibro foundations.

It is noted that the cohesive soils generally increased with thickness to the western portion of the site. There may be a sufficient thickness of clay above the deeper granular deposits in the western area to utilise traditional foundations. However, this assessment would need to be confirmed with your appointed structural engineer. It is likely that plot specific investigation will be required to assist with foundation design/confirm the cohesive soils are sufficient. Where foundations require deepening due to tree influence (in accordance with NHBC Chapter 4.2 Building Near Trees) in the western field, it is likely that a piled or vibro foundation will be required. Piled/vibro foundations will also be required in the area of the former pond in the central northern area of the site.

A foundation zoning plan illustrating the above is included in **Appendix E**, for reference.

5.3 FLOOR SLABS

A suspended floor slab design is recommended.

5.4 EXCAVATION & GROUNDWATER CONDITIONS

Excavation of the materials encountered during the ground investigation should be easily achieved using conventional hydraulic excavation techniques.

From the ground investigation undertaken, it is likely that excavations will be generally stable in the short term. However, made ground is liable to collapse without warning.

Simple dewatering e.g. sump pumping may be required for excavations in excess of 1.00mbgl. Care should be taken to ensure that dewatering does not lead to settlement of soils below existing structures or services on or off-site.

5.5 BURIED CONCRETE

Based on the recorded water-soluble sulphate concentrations and pH values it is considered appropriate to adopt a Basic Design Sulphate Class of DS-1, together with an Aggressive Chemical Environment Concrete (ACEC) of AC-2z.

6.0 CONTAMINATION ASSESSMENT

The guidance detailed in section 1.3 has been followed to ensure that the risk posed to identified receptors, as detailed in the conceptual site model, is reported according to accepted compliance criteria.

Tier 1 Assessment Criteria for human health with regard to contamination within soils have been produced with reference to values published in LQM/CIEH S4UL and DEFRA's C4SLs. The Tier 1 Assessment Criteria are contained in **Appendix D**. The laboratory analysis results were assessed against the assessment criteria for a residential with produce end use. A SOM of 2.5% has been adopted for the PAH analysis.

6.1 HUMAN HEALTH

An assessment of the analysis results for metals and inorganics contained in **Appendix C**, revealed that the majority of samples do not exceed the respective GAC for residential end use with produce. This includes samples of the made ground retrieved from the former pond in the central northern area of the site.

Therefore, remediation to protect future end users of the site is not considered to be required.

6.1.1 Hydrocarbon Contamination

No visual or olfactory evidence of TPH contamination was identified in any of the exploratory holes. Therefore, the risk of this contamination is considered to be very low and no further assessment or remediation will be required.

6.1.2 Asbestos

Selected shallow samples were screened for asbestos as a precautionary measure. In summary asbestos was not detected in any of the samples and the risk is considered to be very low. Therefore, no further assessment or remediation is considered to be required.

6.1.4 Pesticides/Herbicides

Selected shallow samples were screened for pesticides/herbicides as a precautionary measure. In summary no significantly elevated concentrations were detected in any of the samples and the risk is considered to be very low. Therefore, no further assessment or remediation is considered to be required.

6.1.5 Ground Gas

To date a total of three ground gas monitoring visits have been undertaken to date and a further three visits are scheduled. The monitoring has been undertaken between the dates of the 15th December 2022 and 4th January 2023. A summary of the results is presented below.

Table 6.1.5 Ground Gas summary

Sample Location	Peak Methane (%v/v)	Peak Carbon Dioxide (%v/v)	Peak Flow Rate (l/hr)	GSV (l/hr)
WS1	0.0	0.9	0.1	0.0009
WS3	0.0	4.7	0.1	0.0047
WS4	0.0	2.3	0.1	0.0023
WS6	0.0	5.0	1.5	0.0750
WS7	0.0	7.0	0.1	0.0070

Concentrations of carbon dioxide and methane have been compared to the criteria outlined in CIRIA C665 where the gas screening value (GSV) (litres of gas per hour) is calculated.

Due to the elevated concentrations of carbon dioxide in WS6 and WS7, the site is preliminary assessed as being within a and structures will therefore require gas protection measures.

A CS2 classification requires the use of either;

A reinforced cast in situ suspended floor slab with minimal penetrations.
Carbon dioxide, methane and Radon resistant membrane
Laps and joints bonded as per manufacturers details.
All services entries sealed

Or if Precast beam and block is to be used;

A passive sub floor dispersal layer conforming to at least good performance .
This should be in the form of either: a clear void, polystyrene void former blanket,
geocomposite void former blanket or no-fines gravel layer.
Gas membrane as above.

The above assessment is preliminary and will be confirmed in a separate addendum letter once the full monitoring programme is complete.

6.2 CONTROLLED WATERS

Groundwater was typically encountered in conjunction with granular deposits during the ground investigation works. Subsequent groundwater monitoring has recorded groundwater to be situated at depths of between 0.60m and 1.80mbgl. This is considered to be representative of the underlying groundwater table which is confined by the overlying cohesive deposits.

In addition a drainage ditch was identified to be present along the eastern boundary of the site and is considered to be a potential receptor.

However, no significant contamination has been identified across the site. Therefore, the risk to controlled waters is considered to be very low and no further assessment or remediation is considered to be required.

7.0 PHASE II CONCEPTUAL SITE MODEL

7.1 SOURCE-PATHWAY-RECEPTOR

The conceptual model for the site considers the development proposal for eighty-four residential dwellings with associated driveways, private gardens and public open space along with the information gathered during the Phase I and II assessments.

Based on our contamination assessment and analysis contained in Section 7.0, no significant contamination has been identified on the site and no further remediation or assessment is considered to be required to protect future end users.

Initial ground gas monitoring has tentatively identified the site as being Characteristic Situation 2 for which gas protection measures will be required. However, this will require confirmation in a separate addendum letter once the full monitoring programme is complete.

For the controlled waters environment, the primary receptors are the Secondary A Aquifer and drainage ditch along the eastern boundary. However, no significant contamination has been identified across the site. Therefore, the risk to controlled waters is assessed as being very low and no further remediation or assessment will be required.

The development of the conceptual model is illustrated in Figure 7.1.

Figure 7.1: Phase II Conceptual Site Model

HUMAN HEALTH			
Source	Pathway	Receptor	Level of Risk/Recommended Action
No significant contamination identified.	Indoor and outdoor inhalation of soil dust, the ingestion of, and dermal contact with, contaminated soil and soil dust, ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables.	End users.	No significant risk identified -no further remediation or assessment required.
		Construction workers.	
Elevated carbon dioxide.	Inhalation of ground gas.	End users.	Characteristic Situation 2 ground gas protection measures are required for all plots.
		Construction workers.	No significant risk identified no further remediation or assessment required.
No significant contamination identified.	Water pipes.	End users.	Standard water pipes should be suitable.
CONTROLLED WATERS			
No significant contamination identified.	Leaching of contaminants and vertical migration to the groundwater.	Secondary A Aquifer.	No significant risk identified -no further remediation or assessment required.
	Leaching of contaminants and lateral migration to surface waters.	Drainage ditch along eastern boundary.	No significant risk identified -no further remediation or assessment required.

8.0 RISK MANAGEMENT & REMEDIATION

Previous sections have quantified the risk posed to identified receptors, which in some instances, require remediation to protect or reduce levels of risk. The following section details measures and recommendations for dealing with risks associated with soil, groundwater and ground gas contamination in respect to the development proposal for a eighty-four residential dwellings with associated private garden, driveways and public open space.

8.1 REMEDIATION TO PROTECT END USERS

The site has been indicatively classified as being within a Characteristic Situation 2 setting for which ground gas protection measures will be required. Please note that this preliminary assessment is based on initial data and will be confirmed in a separate addendum letter once the full monitoring programme is complete.

8.2 REMEDIATION TO PROTECT CONTROLLED WATERS

No significant risk has been identified to controlled waters and no further remediation is required.

8.3 REMEDIATION TO PROTECT CONSTRUCTION WORKERS

Significant risk to construction workers is not anticipated. However, basic PPE for all workers (overalls, gloves and dust masks if required) and wash facilities/personal hygiene should be provided as a precautionary measure.

8.4 WASTE MANAGEMENT

A waste classification has not been undertaken as part of this assessment.

However, based on the initial chemical data, it is considered that the shallow soils may be classified as non-hazardous if off-site disposal is required. A full waste classification should be undertaken in accordance to the Environment Agency's WM3 and advice sought from the proposed waste receiver.

9.0 RECOMMENDATIONS

Recommendations for further assessment of the site include:

Vibro/piled foundations are recommended for the site. Further assessment in the western portion of the site may allow a traditional foundation to be adopted.

CS2 ground gas protection is anticipated to be required for the site. However, please note that the monitoring programme is ongoing and this assessment will be confirmed in a separate addendum letter.

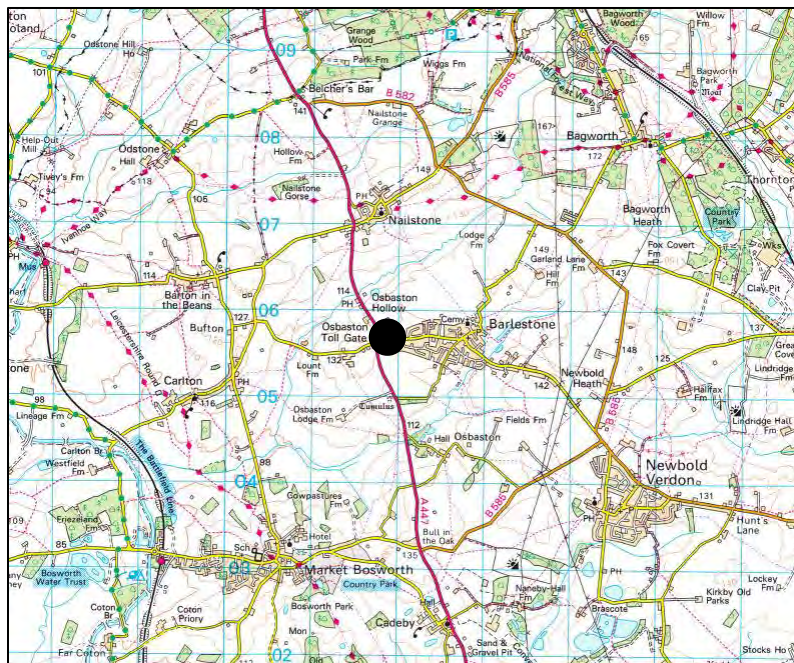
Should any signs of contamination be evident during redevelopment of the site, a qualified environmental specialist should be consulted to assess the risk posed to end users and the environment.

10.0 CONCLUSIONS

The Phase II ground investigation has illustrated that the proposed development of the site with eighty-four residential dwellings with associated private gardens, driveways and public open space does not pose a significant risk, providing that the above recommendations are followed.

Appendix A





KEY:

● Approximate Site Location

Approximate Postcode: CV13 0HL

DO NOT SCALE



TITLE:

Site Location Plan

PROJECT:

Barton Road, Barlestone

PROJECT No:

EAL.288.22

DATE:

07/2023

SCALE:

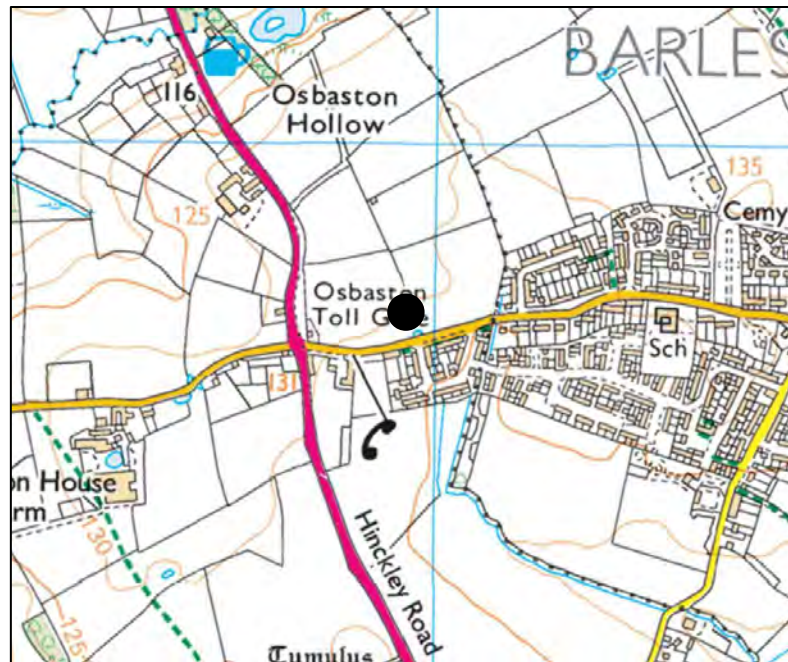
NTS

DRAWN:

PD

DWG No:

Figure 1





KEY:



Site Boundary



DO NOT SCALE



TITLE:

Site Layout

PROJECT:

Barton Road, Barlestone

PROJECT No:

EAL.288.22

DATE:

07/2023

SCALE :

NTS

DRAWN :

PD

DWG No:

Figure 2



KEY:

DO NOT SCALE



TITLE:

Development Proposal

PROJECT:

Barton Road, Barlestone

PROJECT No:

EAL.288.22

DATE:

07/2023

SCALE :

NTS

DRAWN :

PD

DWG No:

Figure 3

Appendix B





KEY:



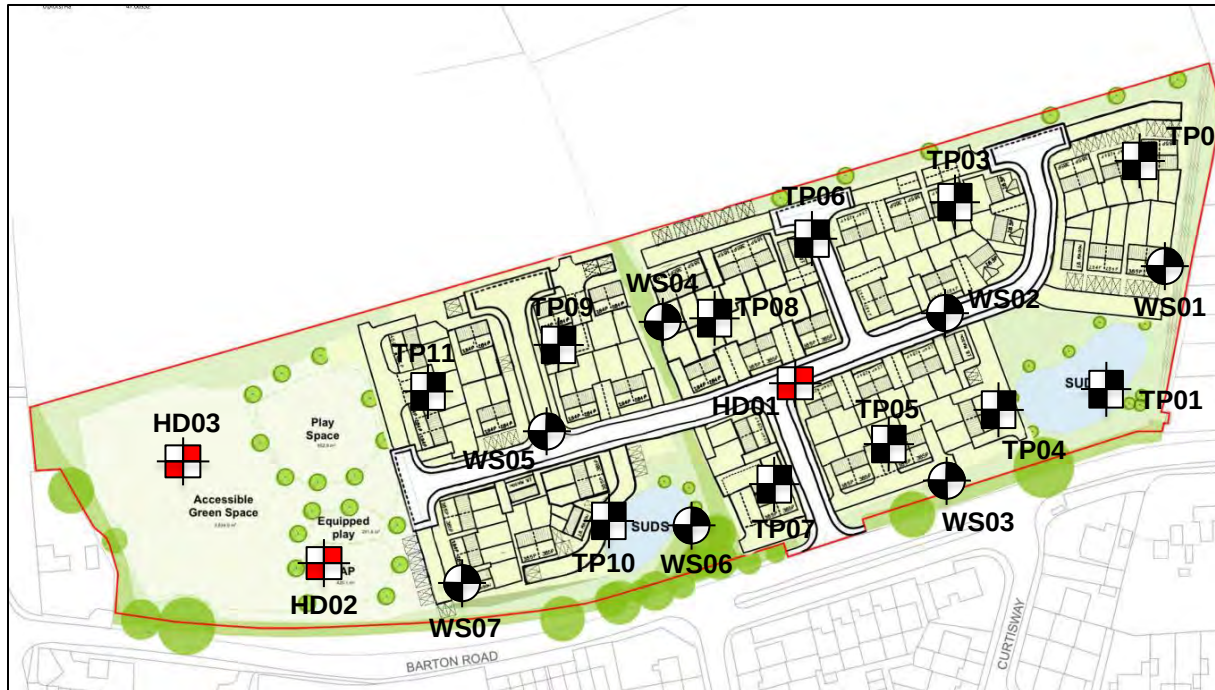
Shallow Hand Dug Sample



Trial Pit



WS Borehole



DO NOT SCALE



TITLE:

Exploratory Hole Location Plan

PROJECT:

Barton Road, Barlestone

PROJECT No:

EAL.288.22

DATE:

07/2023

SCALE:

NTS

DRAWN:

PD

DWG No:

Figure 4



Web: www.erda-ltd.co.uk
Email: p.devitt@erda-ltd.co.uk
Mob: 07531 051197

CLIENT

MYPAD 2020 LTD

SITE LOCATION

LAND AT BARTON ROAD, BARLESTONE

Date: 29th June 2023

Plant: JCB 3CX

BOREHOLE NO.

TP01

Sheet No. 1 of 1

Job No.

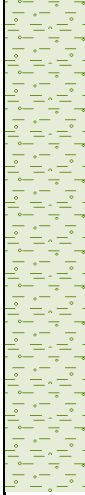
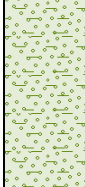
EAL.288.22

Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS		SPT Results						N Value	Installation	Test Sample Details
				Depth	No Type	Seating	Test Drive							
							15mm	15mm	15mm	15mm	15mm			
TOPSOIL: Dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies.	0.10 0.20 0.30		0.30 (0.30)	0.10	1	ES								
Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.40 0.50 0.60 0.70 0.80		0.80 (0.50)	0.40	2	ES								
Loose reddish brown slightly clayey sandy GRAVEL. Gravel is fine to coarse, fine to coarse mixed lithologies and flint. ...Trial pit collapsing from 2.00mbgl ...groundwater encountered at 2.90mbgl.	0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00		3.00 (2.20)	1.00	1	D								
Trial pit terminated at 3.00mbgl.	3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00			2.90										Groundwater

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks: 1. Groundwater encountered at 2.90mbgl. 2. Trial pit collapsing from 2.00mbgl									Logged By:	Checked By:	Date	Scale
									DW	DW	23.07.2023	NTS

 Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 29th June 2023			BOREHOLE NO. TP02							
CLIENT MYPAD 2020 LTD			Plant: JCB 3CX			Sheet No. 1 of 1							
SITE LOCATION LAND AT BARTON ROAD, BARLESTONE						Job No. EAL.288.22							
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS		SPT Results						Installation	Test Sample Details
				Depth	No	Type	Seating	Test Drive					
TOPSOIL: Dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies.	0.10 0.20 0.30		0.30 (0.30)	0.20	I	ES							30/40/40kPa
Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.40 0.50 0.60 0.70		0.70 (0.40)										
Firm reddish brown grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse, rounded to subrounded mixed lithologies with flint.	0.80 0.90 1.00		1.00 (0.30)										
Soft to firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40		2.40 (1.40)	1.20 1.30	I	D							
Loose reddish brown slightly clayey sandy GRAVEL. Gravel is fine to coarse, fine to coarse mixed lithologies and flint. ...Groundwater encountered at 2.70mbgl.	2.50 2.60 2.70 2.80 2.90 3.00		3.00 (0.60)	2.70									Groundwater
Trial pit terminated at 3.00mbgl.	3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00												

Casing record			Chiselling records								
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
Remarks: 1. Groundwater encountered at 2.70mbgl 2. Trial pit remained stable throughout excavation								Logged By:	Checked By:	Date	Scale
								DW	DW	23.07.2023	NTS

 Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 29th June 2023			BOREHOLE NO. TP03								
CLIENT MYPAD 2020 LTD			Plant: JCB 3CX			Sheet No. 1 of 1								
SITE LOCATION LAND AT BARTON ROAD, BARLESTONE						Job No. EAL.288.22								
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS		SPT Results						Installation	Test Sample Details	
				Depth	No	Type	Sealing	Test Drive						N Value
TOPSOIL: Dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies.	0.10 0.20 0.30		0.30 (0.30)	0.50	I	ES								70/75/100kPa
Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.40 0.50		0.50 (0.20)											
Firm to stiff reddish brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30		2.30 (1.80)	0.90 1.10	I 	D 								Groundwater
Loose reddish brown slightly clayey sandy GRAVEL. Gravel is fine to coarse, fine to coarse mixed lithologies and flint. ...groundwater encountered at 2.40mbgl	2.40 2.50 2.60 2.70 2.80 2.90 3.00		3.00 (0.60)	2.40										
Trial pit terminated at 3.00mbgl.	3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00													

Casing record			Chiselling records								
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
Remarks: 1. Groundwater encountered at 2.40mbgl. 2. Trial pit remained stable throughout excavation							Logged By:	Checked By:	Date	Scale	
							DW	DW	23.07.2023	NTS	



Web: www.erda-ltd.co.uk
Email: p.devitt@erda-ltd.co.uk
Mob: 07531 051197

CLIENT

MYPAD 2020 LTD

SITE LOCATION

LAND AT BARTON ROAD, BARLESTONE

Date: 29th June 2023

Plant: JCB 3CX

BOREHOLE NO.

TP05

Sheet No. 1 of 1

Job No.

EAL.288.22

Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS		SPT Results						Test Sample Details
				Depth	No Type	Seating	Test Drive				N Value	
TOPSOIL: Dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies.	0.10 0.20 0.30		0.30 (0.30)									
Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.40 0.50		0.50 (0.20)	0.50	I	ES						
Firm reddish brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint. ... becoming stiff frm 1.20mbgl.	0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00 3.10 3.20 3.30		3.00 (2.80)	1.00 1.20	I	D						90/90/110kPa
Trial pit terminated at 3.30mbgl.	3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00											

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks: 1. Groundwater not encountered 2. Trial pit remained stable throughout excavation									Logged By:	Checked By:	Date	Scale
									DW	DW	23.07.2023	NTS

 Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 29th June 2023			BOREHOLE NO. TP06								
CLIENT MYPAD 2020 LTD			Plant: JCB 3CX			Sheet No. 1 of 1								
SITE LOCATION LAND AT BARTON ROAD, BARLESTONE						Job No. EAL.288.22								
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS		SPT Results						Installation	Test Sample Details	
				Depth	No	Type	Seating	Test Drive						
TOPSOIL: Dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies.	0.10 0.20 0.30		0.30 (0.30)	0.20	I	ES							130/130/130kPa	
Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.40 0.50		0.50 (0.20)											
Firm reddish brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint. ... becoming stiff from 1.20mbgl.	0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50		2.50 (2.00)	1.10 1.20	I	D								
Loose light brown slightly clayey sandy GRAVEL. Gravel is fine to coarse, fine to coarse mixed lithologies and flint. ...groundwater at 2.80mbgl	2.60 2.70 2.80 2.90 3.00		3.00 (0.50)	2.80										
Trial pit terminated at 3.00mbgl.	3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00													
														Groundwater

Casing record			Chiselling records								
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
Remarks: 1. Groundwater encountered at 2.80mbgl 2.Trial pit collapsing from 2.80mbgl								Logged By:	Checked By:	Date	Scale
								DW	DW	23.07.2023	NTS

 Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 29th June 2023		BOREHOLE NO. TP07								
CLIENT MYPAD 2020 LTD			Plant: JCB 3CX		Sheet No. 1 of 1								
SITE LOCATION LAND AT BARTON ROAD, BARLESTONE					Job No. EAL.288.22								
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS		SPT Results						Test Sample Details	
				Depth	No Type	Seating	Test Drive						N Value
TOPSOIL: Dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies.	0.10 0.20 0.30		0.30 (0.30)										
Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.40 0.50 0.60 0.70		0.70 (0.40)	0.40	I	ES							
Stiff reddish brown mottled grey sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint and rare cobbles of slate and sandstone	0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50		2.50 (1.70)	1.00									
				1.50	I	D							
Loose reddish brown slightly clayey sandy GRAVEL. Gravel is fine to coarse, fine to coarse mixed lithologies and flint.	2.60 2.70		2.70 (0.20)										
Firm reddish brown mottled grey sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint	2.80 2.90 3.00		3.00 (0.30)										
Trial pit terminated at 3.00mbgl.	3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00												

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks: 1. Groundwater not encountered 2. Trial pit remained stable throughout excavation									Logged By:	Checked By:	Date	Scale
									DW	DW	23.07.2023	NTS

 Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197				Date: 29th June 2023		BOREHOLE NO. TP08								
CLIENT MYPAD 2020 LTD				Plant: JCB 3CX		Sheet No. 1 of 1								
SITE LOCATION LAND AT BARTON ROAD, BARLESTONE						Job No. EAL.288.22								
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results						Test Sample Details	
				Depth	No	Type	Seating	Test Drive						N Value
							Thm	Thm	Thm	Thm	Thm	Thm		
MADE GROUND comprising dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies. Reworked tospoil.	0.10 0.20 0.30		0.30 (0.30)	0.10	1	ES							Groundwater	
MADE GROUND comprising loose reddish brown slightly clayey sandy GRAVEL. Gravel is fine to coarse, fine to coarse mixed lithologies and flint. Reworked natural. ...groundwater encountered at 1.30mbgl	0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30		1.30 (1.00)											
Soft greyish blue slightly sandy clayey SILT. Common decomposing organic matter.	1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80		2.80 (1.40)	1.30 1.40	2	ES								
Firm dark brown slightly sandy very gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	2.90 3.00		3.00 (0.20)											
Trial pit terminated at 3.00mbgl.	3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00													

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks: 1. Groundwater encountered at 1.30mbgl 2. Trial pit remained stable throughout excavation 3. Trench extended approximately 10m, the lateral edge of Silt not encountered. Visual depression may be indicative of former ponds size, approximately 15m x 15m									Logged By:	Checked By:	Date	Scale
									DW	DW	23.07.2023	NTS



Web: www.erda-ltd.co.uk
Email: p.devitt@erda-ltd.co.uk
Mob: 07531 051197

CLIENT

MYPAD 2020 LTD

SITE LOCATION

LAND AT BARTON ROAD, BARLESTONE

Date: 29th June 2023

Plant: JCB 3CX

BOREHOLE NO.

TP09

Sheet No. 1 of 1

Job No.

EAL.288.22

Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS		SPT Results						Test Sample Details
				Depth	No Type	Seating	Test Drive					
TOPSOIL: Dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies.	0.10 0.20 0.30		0.30 (0.30)	1.00								65/65/90kPa
Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.40		0.40 (0.10)									
Firm reddish brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20		1.20 (0.80)									
Loose reddish brown slightly clayey gravelly SAND. Gravel is fine to coarse, fine to coarse mixed lithologies and flint.	1.30 1.40		1.40 (0.20)									
Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint. ...frequent cobbles at 2.00mbgl	1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00		3.00 (1.50)									
Trial pit terminated at 3.00mbgl.	3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00											

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks: 1. Groundwater not encountered 2. Trial pit remained stable throughout excavation									Logged By:	Checked By:	Date	Scale
									DW	DW	23.07.2023	NTS

 Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 29th June 2023		BOREHOLE NO. TP10								
CLIENT MYPAD 2020 LTD			Plant: JCB 3CX		Sheet No. 1 of 1								
SITE LOCATION LAND AT BARTON ROAD, BARLESTONE					Job No. EAL.288.22								
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS		SPT Results						Test Sample Details	
				Depth	No Type	Seating	Test Drive						N Value
TOPSOIL: Dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies.	0.10 0.20		0.20 (0.20)	0.80									
Firm dark brown very sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40		1.40 (1.20)										
Firm dark brown slightly sandy very gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50		2.50 (1.10)										
Trial pit terminated at 2.50mbgl.	2.60 2.70 2.80 2.90 3.00 3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00												

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks: 1. Groundwater not encountered 2. Trial pit remained stable throughout excavation									Logged By:	Checked By:	Date	Scale
									DW	DW	23.07.2023	NTS

 CLIENT MYPAD 2020 LTD			Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 29th June 2023			BOREHOLE NO. TP I I									
SITE LOCATION LAND AT BARTON ROAD, BARLESTONE						Plant: JCB 3CX			Sheet No. 1 of 1 Job No. EAL.288.22									
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results						Installation	Test Sample Details				
				Depth	No	Type	Seating	Test Drive				N Value						
TOPSOIL: Dark brown slightly clayey slightly gravelly sand. Gravel is fine to coarse, rounded to subrounded mixed lithologies.	0.10 0.20 0.30		0.30 (0.30)	0.10	I	ES								79/90/85kPa				
Firm dark brown very sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	0.40 0.50		0.50 (0.20)															
Firm reddish brown very sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint. ... becoming stiff from 1.0mbgl.	0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60		1.60 (1.10)	0.80 1.00	I	D												
Loose reddish brown slightly clayey gravelly SAND. Gravel is fine to coarse, fine to coarse mixed lithologies and flint.	1.70 1.80		1.80 (0.20)															
Firm reddish brown very sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded mixed lithologies with flint.	1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00		3.00 (1.10)	2.50														
Trial pit terminated at 3.00mbgl.	3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00																	

 Web: www.erdaltd.co.uk Email: p.devitt@erdaltd.co.uk Mob: 07531 051197			Date: 30th June 2023 Ground Level: Orientation: Coordinates: Plant: Window Sample Rig Dimensions:		BOREHOLE NO. WS01 Sheet No. 1 of 1 Job No. EAL.288.22										
CLIENT MYPAD 2020 LTD SITE LOCATION LAND AT BARTON ROAD, BARLESTONE															
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results						Test Sample Details		
				Depth	No	Type	Sealing	Test Drive						N Value	
TOPSOIL: dark brown slightly gravelly clayey sand. Gravel is fine to coarse rounded to sub-angular quartzite and sandstone.	0.10 0.20 0.30		0.30 (0.30)	0.20	1	ES									
Soft orange mottled yellow slightly gravelly very sandy CLAY. Gravel is fine to coarse rounded quartzite. ... no recovery from 1.00 to 1.50mbgl.	0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50		1.50 (1.20)	0.80	2	D									
Medium dense orange mottled yellow slightly clayey slightly gravelly SAND. Gravel is fine to coarse rounded quartzite. ... groundwater encountered at 2.00mbgl.	1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00 3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00		5.00 (3.50)	2.00	3	D	0	0	3	3	4	4	14		
							3	4	3	3	3	3	12		
							4	4	4	4	5	5	18		
... becoming loose from 5.00mbgl. Borehole terminated at 5.00mbgl.															

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks:									Logged By:	Checked By:	Date	Scale
1. Gas/groundwater monitoring standpipe installed to 3.00m (GL to 1.00m plain/bentonite, 1.00m to 3.00m slotted/gravel).									PD	PD	01.07.23	NTS
2. Groundwater encountered at 2.00mbgl.												
3. Borehole collapsing below 3.00mbgl.												

 Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 30th June 2023 Ground Level: Orientation: Coordinates: Plant: Window Sample Rig Dimensions:		BOREHOLE NO. WS02 Sheet No. 1 of 1 Job No. EAL.288.22										
CLIENT MYPAD 2020 LTD			SITE LOCATION LAND AT BARTON ROAD, BARLESTONE												
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results						Test Sample Details		
				Depth	No	Type	Sealing	Test Drive				N Value		Insulation	
TOPSOIL: dark brown slightly gravelly clayey sand. Gravel is fine to coarse rounded to sub-angular quartzite and sandstone.	0.10 0.20 0.30		0.30 (0.30)	0.10	1	ES									
Soft dark reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse rounded to sub-angular quartzite and sandstone.	0.40		2.50 (2.20)	0.60	2	D									
	0.50														
	0.60														
	0.70														
	0.80														
	0.90														
	1.00														
	1.10														
	1.20														
	1.30														
	1.40														
	1.50														
	1.60														
	1.70														
	1.80														
1.90															
2.00															
2.10															
2.20															
2.30															
2.40															
2.50															
... groundwater encountered at 2.50mbgl.															
Dense reddish brown mottled orange clayey gravelly SAND. Gravel is fine to coarse rounded to angular quartzite and siltstone.	2.60 2.70 2.80 2.90 3.00 3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00		4.00 (1.50)												
Borehole terminated at 4.00mbgl.	4.10														
	4.20														
	4.30														
	4.40														
	4.50														
	4.60														
	4.70														
	4.80														
	4.90														
	5.00														

Casing record			Chiselling records								
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks
Remarks: 1. Borehole reinstated with arisings upon completion. 2. Groundwater encountered at 2.50mbgl. 3. Borehole remained stable.							Logged By:	Checked By:	Date	Scale	
							PD	PD	01.07.23	NTS	

			Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 30th June 2023 Ground Level: Orientation: Coordinates: Plant: Window Sample Rig Dimensions:			BOREHOLE NO. WS04 Sheet No. 1 of 1 Job No. EAL.288.22						
CLIENT MYPAD 2020 LTD						SITE LOCATION LAND AT BARTON ROAD, BARLESTONE									
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results						Test Sample Details		
				Depth	No	Type	Sealing	Test Drive						N Value	
MADE GROUND comprising dark brown slightly gravelly clayey sand. Gravel is fine to coarse rounded to sub-angular quartzite and sandstone. Rare brick fragments. (Reworked topsoil).	0.10 0.20 0.30 0.40	[Green cross-hatch pattern]	0.40 (0.40)	0.30	1	ES									
Soft yellowish brown slightly sandy gravelly CLAY. Gravel is fine to coarse rounded to sub-angular quartzite. Possible MADE GROUND?	0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70		1.70 (1.30)	1.30	2	D									
Stiff dark reddish brown mottled dark grey slightly gravelly CLAY. Gravel is fine to coarse rounded to angular quartzite, chalk, and mudstone.	1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00		3.00 (1.30)	1.80	3	D									
Borehole terminated at 3.00mbgl.	3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00 4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00														

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks:									Logged By:	Checked By:	Date	Scale
1. Gas/groundwater monitoring standpipe installed to 3.00m (GL to 1.00m plain/bentonite, 1.00m to 3.00m slotted/gravel).									PD	PD	01.07.23	NTS
2. No groundwater encountered.												
3. Borehole remained stable.												

			Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 30th June 2023 Ground Level: Orientation: Coordinates: Plant: Window Sample Rig Dimensions:			BOREHOLE NO. WS05 Sheet No. 1 of 1 Job No. EAL.288.22					
CLIENT MYPAD 2020 LTD			SITE LOCATION LAND AT BARTON ROAD, BARLESTONE											
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results						Test Sample Details	
				Depth	No	Type	Sealing	Test Drive						N Value
TOPSOIL: dark brown slightly gravelly clayey sand. Gravel is fine to coarse rounded to sub-angular quartzite and sandstone.	0.10 0.20		0.20 (0.20)	0.10	1	ES								
Firm light orange mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse quartzite.	0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00		1.00 (0.80)											
Firm dark reddish brown mottled dark grey slightly gravelly CLAY. Gravel is fine to coarse rounded to angular quartzite, chalk, and mudstone. Occasional sand lenses.	1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00 3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00		4.00 (3.00)	1.20	2	D								
No recovery from 4.00m to 5.00mbgl. Very soft and rods sank under own weight.	4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00													

Borehole terminated at 5.00mbgl.

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks: 1. Gas/groundwater monitoring standpipe installed to 3.00m (GL to 1.00m plain/bentonite, 1.00m to 3.00m slotted/gravel). 2. Groundwater encountered at 2.00mbgl. 3. Borehole collapsing below 3.00mbgl.									Logged By:	Checked By:	Date	Scale
									PD	PD	01.07.23	NTS

 Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197				Date: 30th June 2023 Ground Level: Orientation: Coordinates: Plant: Window Sample Rig Dimensions:										BOREHOLE NO. WS06	
CLIENT MYPAD 2020 LTD														Sheet No. 1 of 1	
SITE LOCATION LAND AT BARTON ROAD, BARLESTONE														Job No. EAL.288.22	
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results						Test Sample Details		
				Depth	No	Type	Sealing	Test Drive						N Value	
TOPSOIL: dark brown slightly gravelly clayey sand. Gravel is fine to coarse rounded to sub-angular quartzite and sandstone.	0.10 0.20 0.30		0.30 (0.30)	0.20	1	ES									
Firm light orange mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse quartzite.	0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20		1.20 (0.90)	0.60	2	D									
Medium dense reddish brown SAND.	1.30 1.40		1.40 (0.20)												
Stiff dark reddish brown mottled dark grey slightly gravelly CLAY. Gravel is fine to coarse rounded to angular quartzite, chalk, and mudstone.	1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00 3.10 3.20 3.30 3.40 3.50 3.60 3.70 3.80 3.90 4.00		4.00 (2.60)	1.60	3	D									
Borehole terminated at 4.00mbgl.	4.10 4.20 4.30 4.40 4.50 4.60 4.70 4.80 4.90 5.00														

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks: 1. Gas/groundwater monitoring standpipe installed to 4.00m (GL to 1.00m plain/bentonite, 1.00m to 4.00m slotted/gravel). 2. Groundwater encountered at 2.00mbgl. 3. Borehole collapsing below 3.00mbgl.									Logged By:	Checked By:	Date	Scale
									PD	PD	01.07.23	NTS

			Web: www.erda-ltd.co.uk Email: p.devitt@erda-ltd.co.uk Mob: 07531 051197			Date: 30th June 2023 Ground Level: Orientation: Coordinates: Plant: Window Sample Rig Dimensions:										BOREHOLE NO. WS07	
CLIENT MYPAD 2020 LTD			Sheet No. 1 of 1														
SITE LOCATION LAND AT BARTON ROAD, BARLESTONE			Job No. EAL.288.22														
Description of Strata	Reduced level (m)	Legend	Depth (Thickness) m	SAMPLES/TESTS			SPT Results						N Value	Insulation	Test Sample Details		
				Depth	No	Type	Sealing	Test Drive									
TOPSOIL: dark brown slightly gravelly clayey sand. Gravel is fine to coarse rounded to sub-angular quartzite and sandstone.	0.10		0.20 (0.20)	0.10	1	ES											
Firm light orange mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse quartzite.	0.20																
	0.30																
	0.40																
	0.50																
	0.60																
	0.70																
... becoming reddish brown from 0.80mbgl.	0.80																
	0.90			0.90	2	D											
	1.00								2	2	2	2	2	2	8		
	1.10																
	1.20																
	1.30																
	1.40																
	1.50																
	1.60																
	1.70																
	1.80																
	1.90																
	2.00								2	2	2	2	3	3	10		
	2.10																
	2.20																
	2.30																
	2.40			2.40	3	D											
	2.50																
	2.60		5.00 (4.80)														
	2.70																
	2.80																
	2.90																
... becoming stiff from 3.00mbgl.	3.00								5	4	5	6	6	6	23		
	3.10																
	3.20																
	3.30																
	3.40																
	3.50																
	3.60																
	3.70																
	3.80																
	3.90																
	4.00								4	5	6	10	7	10	33		
	4.10																
	4.20																
	4.30																
	4.40																
	4.50																
	4.60																
	4.70																
	4.80																
	4.90																
	5.00								5	7	7	7	7	7	28		

Borehole terminated at 5.00mbgl.

Casing record			Chiselling records									
Date	Diameter (mm)	Depth (m)	Time	From (m)	To (m)	Date	Water strike	Water level (after 20mins)	Flow	Standing level	Remarks	
Remarks:									Logged By:	Checked By:	Date	Scale
1. Gas/groundwater monitoring standpipe installed to 5.00m (GL to 1.00m plain/bentonite, 1.00m to 5.00m slotted/gravel).									PD	PD	01.07.23	NTS
2. No groundwater encountered.												
3. Borehole remained stable.												

Appendix C



**Philip Devitt**

Erda Associates Ltd
102 Scalpcliffe Road
BURTON-ON-TRENT
DE15 9AB

e: p.devitt@erda-ltd.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 23-42792

Project / Site name:	Barton Road, Barlestone	Samples received on:	03/07/2023
Your job number:	EAL 288 22	Samples instructed on/ Analysis started on:	03/07/2023
Your order number:	EAL 288 22	Analysis completed by:	10/07/2023
Report Issue Number:	1	Report issued on:	10/07/2023
Samples Analysed:	5 soil samples		

Signed:

Elżbieta Suchy
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 23-42792
Project / Site name: Barton Road, Barlestone
Your Order No: EAL 288 22

Lab Sample Number				2734769	2734770	2734771	2734772	2734773
Sample Reference				WS01	WS02	WS04	WS05	HD03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.10	0.30	0.10	0.10
Date Sampled				30/06/2023	30/06/2023	30/06/2023	30/06/2023	30/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	13	9	9.4	8.7	9.8
Total mass of sample received	kg	0.001	NONE	0.9	0.8	0.9	0.9	0.9

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	KSZ	N/A	KSZ	N/A	KSZ

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.1	6.4	7.3	6.2	6.6
Total Cyanide	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Total Sulphate as SO4	mg/kg	50	MCERTS	620	580	580	430	330
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	12	13	9.1	17	12
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0061	0.0063	0.0045	0.0085	0.0058
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	6.1	6.3	4.5	8.5	5.8
Organic Matter (automated)	%	0.1	MCERTS	4.3	5.4	3.5	3.9	4.8

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
----------------------------	-------	---	--------	---	-------	---	-------	---

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.15	0.12	0.13	0.19	0.16
Fluorene	mg/kg	0.05	MCERTS	0.23	0.1	0.12	0.17	0.14
Phenanthrene	mg/kg	0.05	MCERTS	0.33	0.15	0.19	0.29	0.26
Anthracene	mg/kg	0.05	MCERTS	0.06	< 0.05	< 0.05	< 0.05	0.06
Fluoranthene	mg/kg	0.05	MCERTS	0.09	0.08	0.08	0.14	0.48
Pyrene	mg/kg	0.05	MCERTS	0.08	0.06	0.07	0.13	0.54
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.06	< 0.05	< 0.05	0.06	0.2
Chrysene	mg/kg	0.05	MCERTS	0.05	< 0.05	< 0.05	< 0.05	0.2
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.06	0.07	0.06	0.24
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	0.06
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.06	0.18
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.08
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.12

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	1.05	< 0.80	< 0.80	1.1	2.72
-----------------------------	-------	-----	-----------	------	--------	--------	-----	------

Analytical Report Number: 23-42792
Project / Site name: Barton Road, Barlestone
Your Order No: EAL 288 22

Lab Sample Number				2734769	2734770	2734771	2734772	2734773
Sample Reference				WS01	WS02	WS04	WS05	HD03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.10	0.30	0.10	0.10
Date Sampled				30/06/2023	30/06/2023	30/06/2023	30/06/2023	30/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	10	7.6	9.5	7.4	10
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5	0.3	0.4	0.3	0.4
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24	17	20	15	15
Copper (aqua regia extractable)	mg/kg	1	MCERTS	20	17	22	18	21
Lead (aqua regia extractable)	mg/kg	1	MCERTS	53	35	41	31	40
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16	12	16	9.9	11
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	38	27	31	23	23
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	84	68	77	63	81

Pesticide and Herbicide Screen

GCMS Pesticide Screen		N/A	NONE	None Detected	-	-	-	None Detected
-----------------------	--	-----	------	---------------	---	---	---	---------------

Acid Herbicides

2,3,6-TBA	µg/kg	50	NONE	-	-	< 50	-	-
2,4,5-T	µg/kg	10	NONE	-	-	< 10	-	-
2,4,5-TP (Fenoprop)	µg/kg	10	NONE	-	-	< 10	-	-
2,4-D	µg/kg	10	NONE	-	-	< 10	-	-
2,4-DB	µg/kg	10	NONE	-	-	< 10	-	-
4-CPA	µg/kg	20	NONE	-	-	< 20	-	-
Bromacil	µg/kg	10	NONE	-	-	< 10	-	-
Bromoxynil	µg/kg	10	NONE	-	-	< 10	-	-
Clopyralid	µg/kg	100	NONE	-	-	< 100	-	-
Dicamba	µg/kg	20	NONE	-	-	< 20	-	-
Diclofop	µg/kg	10	NONE	-	-	< 10	-	-
Dichlorprop	µg/kg	10	NONE	-	-	< 10	-	-
Dinoseb	µg/kg	10	NONE	-	-	< 10	-	-
Flamprop	µg/kg	50	NONE	-	-	< 50	-	-
Flamprop-Isopropyl	µg/kg	10	NONE	-	-	< 10	-	-
Ioxynil	µg/kg	10	NONE	-	-	< 10	-	-
MCPA	µg/kg	10	NONE	-	-	< 10	-	-
MCPB	µg/kg	20	NONE	-	-	< 20	-	-
MCPP (Mecoprop)	µg/kg	10	NONE	-	-	< 10	-	-
Picloram	µg/kg	50	NONE	-	-	< 50	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



Analytical Report Number : 23-42792
Project / Site name: Barton Road, Barlestone

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2734769	WS01	None Supplied	0.2	Brown loam and clay with gravel and vegetation.
2734770	WS02	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
2734771	WS04	None Supplied	0.3	Brown loam and clay with gravel and vegetation.
2734772	WS05	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
2734773	HD03	None Supplied	0.1	Brown loam and clay with gravel and vegetation.

Analytical Report Number : 23-42792
Project / Site name: Barton Road, Barlestone

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Acid Herbicides by LC-MS	Detemination of Acid Herbicides by LC MS	In-house method	L057B-PL	W	NONE
GC Pesticide Screen (TIC)	Analysis of unknown pesticides by GCMS	GC Pesticide Screen (TIC)	L064B	D	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS



Analytical Report Number : 23-42792
Project / Site name: Barton Road, Barlestone

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

**Philip Devitt**

Erda Associates Ltd
102 Scalpcliffe Road
BURTON-ON-TRENT
DE15 9AB

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

e: p.devitt@erda-ltd.co.uk

Analytical Report Number : 23-43065

Project / Site name:	Barton Road, Barlestone	Samples received on:	04/07/2023
Your job number:	EAL.288.22	Samples instructed on/ Analysis started on:	04/07/2023
Your order number:	EAL.288.22	Analysis completed by:	12/07/2023
Report Issue Number:	1	Report issued on:	12/07/2023
Samples Analysed:	5 soil samples		

Signed:

Elżbieta Suchy
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 23-43065
Project / Site name: Barton Road, Barlestone
Your Order No: EAL.288.22

Lab Sample Number				2736539	2736540	2736541	2736542	2736543
Sample Reference				TP1	TP3	TP4	TP8	TP11
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.50	0.10	1.40	0.10
Date Sampled				29/07/2023	29/07/2023	29/07/2023	29/07/2023	29/07/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		
Stone Content				%	0.1	NONE	< 0.1	< 0.1
Moisture Content				%	0.01	NONE	18	12
Total mass of sample received				kg	0.001	NONE	0.4	0.4

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	ASE	ASE	ASE	ASE	ASE

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.7	7.1	7.2	6.4	7.2
Total Sulphate as SO ₄	mg/kg	50	MCERTS	720	650	340	1300	370
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	32	12	8.8	690	14
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.016	0.0058	0.0044	0.35	0.0068
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	16.2	5.8	4.4	347	6.8
Organic Matter (automated)	%	0.1	MCERTS	3.9	3.5	4.3	9.1	2.7

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.07	< 0.05	0.06	< 0.05	0.15
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.19	0.08	0.13	< 0.05	0.3
Pyrene	mg/kg	0.05	MCERTS	0.17	0.08	0.11	< 0.05	0.27
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.08	< 0.05	< 0.05	< 0.05	0.15
Chrysene	mg/kg	0.05	MCERTS	0.08	< 0.05	0.08	< 0.05	0.14
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.13	< 0.05	0.06	< 0.05	0.19
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	0.1
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.09	< 0.05	0.06	< 0.05	0.16
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.07	< 0.05	< 0.05	< 0.05	0.11
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.07	< 0.05	< 0.05	< 0.05	0.12

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	0.95	< 0.80	< 0.80	< 0.80	1.69
-----------------------------	-------	-----	-----------	------	--------	--------	--------	------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.7	6.9	6.8	8.5	6.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	< 0.2	0.3	< 0.2	0.3
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	16	15	21	11
Copper (aqua regia extractable)	mg/kg	1	MCERTS	22	19	19	22	16
Lead (aqua regia extractable)	mg/kg	1	MCERTS	42	32	33	19	26
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	13	11	11	17	8.3
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	29	25	24	32	18
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	71	61	60	52	56

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



Analytical Report Number : 23-43065

Project / Site name: Barton Road, Barlestone

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2736539	TP1	None Supplied	0.1	Brown sand with gravel and vegetation.
2736540	TP3	None Supplied	0.5	Brown sand with gravel and vegetation.
2736541	TP4	None Supplied	0.1	Brown sand with gravel and vegetation.
2736542	TP8	None Supplied	1.4	Brown clay and sand with gravel.
2736543	TP11	None Supplied	0.1	Brown sand with gravel and vegetation.

Analytical Report Number : 23-43065

Project / Site name: Barton Road, Barlestone

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.



TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Erda Associates Ltd
Client Address: 102 Scalpcliffe Road, BURTON-ON-TRENT,
DE15 9AB

Contact: Philip Devitt
Site Address: Barton Road, Barlestone

Client Reference: EAL.288.22
Job Number: 23-42732-1
Date Sampled: 30/06/2023
Date Received: 03/07/2023
Date Tested: 12/07/2023
Sampled By: Client- PD

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

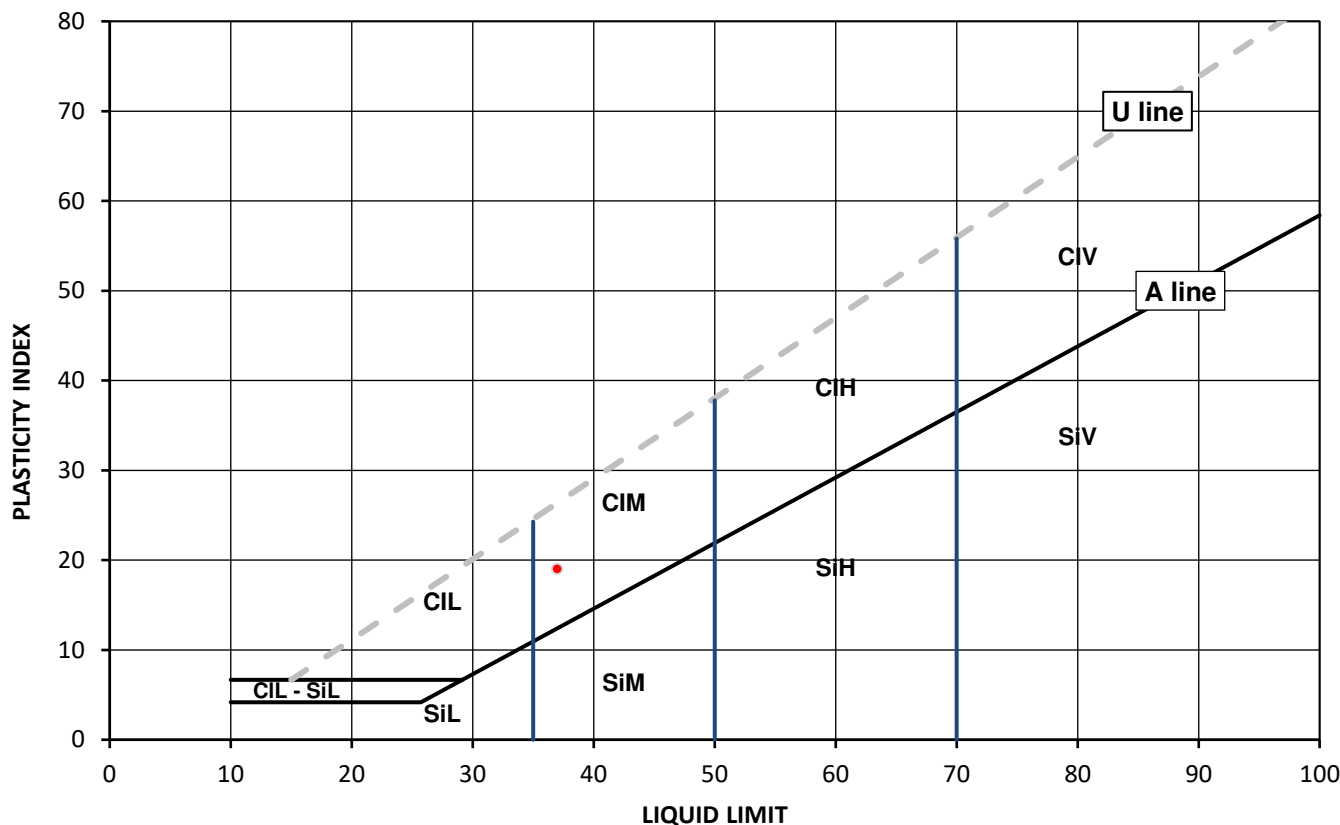
Test Results:

Laboratory Reference: 2734546
Hole No.: WS02
Sample Reference: Not Given
Sample Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 1.40
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation:

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
18	37	18	19	82



Plasticity		Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
L	Low	50 to 70
M	Medium	exceeding 70
H	High	append to classification for organic material (eg CIHO)
V	Very high	
O	Organic	

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.



TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Erda Associates Ltd
Client Address: 102 Scalpcliffe Road, BURTON-ON-TRENT,
DE15 9AB

Contact: Philip Devitt
Site Address: Barton Road, Barlestone

Client Reference: EAL.288.22
Job Number: 23-42732-1
Date Sampled: 30/06/2023
Date Received: 03/07/2023
Date Tested: 12/07/2023
Sampled By: Client- PD

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

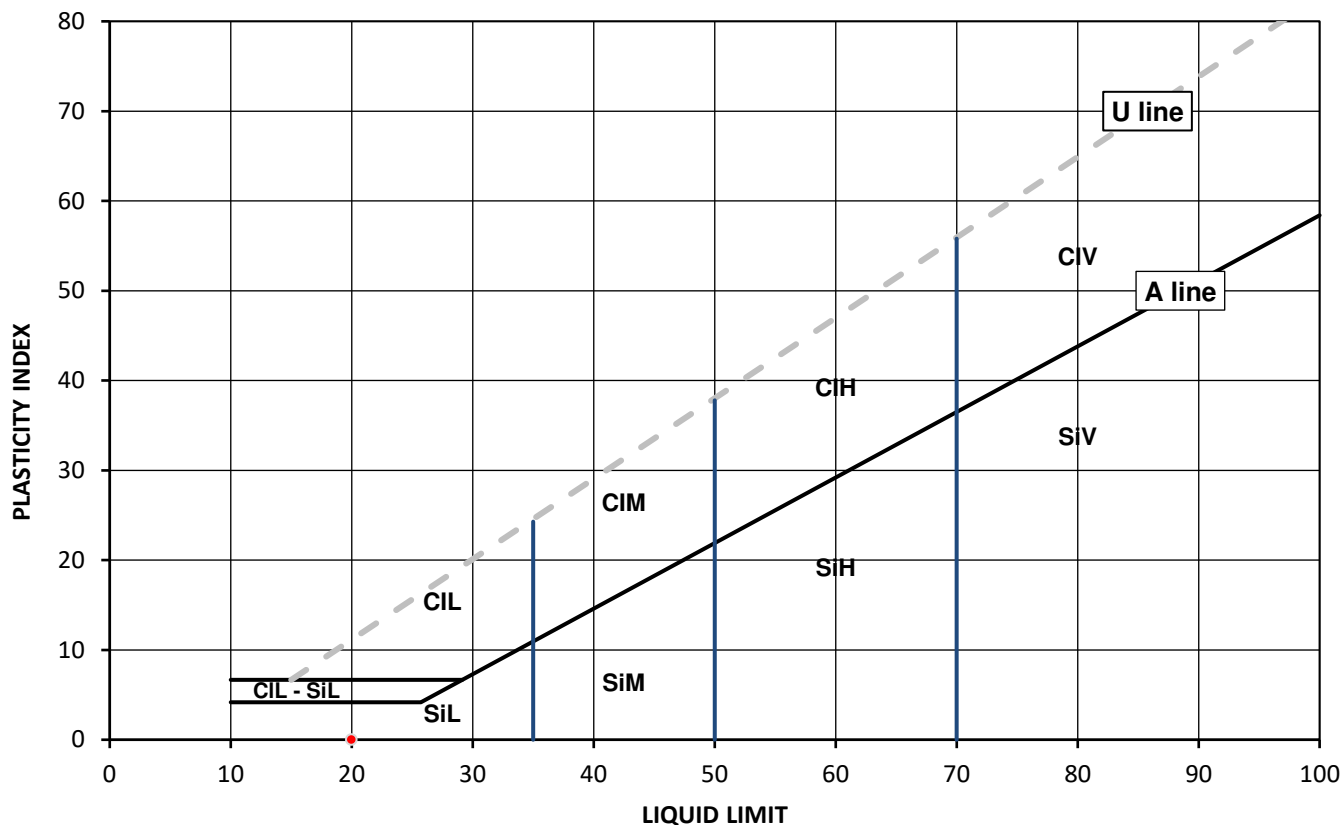
Test Results:

Laboratory Reference: 2734547
Hole No.: WS03
Sample Reference: Not Given
Sample Description: Brown slightly gravelly SAND

Depth Top [m]: 2.30
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation:

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
18	20	NP	NP	99



		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks: NP - non plastic

Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.



TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Erda Associates Ltd
Client Address: 102 Scalpcliffe Road, BURTON-ON-TRENT,
DE15 9AB

Contact: Philip Devitt
Site Address: Barton Road, Barlestone

Client Reference: EAL.288.22
Job Number: 23-42732-1
Date Sampled: 30/06/2023
Date Received: 03/07/2023
Date Tested: 12/07/2023
Sampled By: Client- PD

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

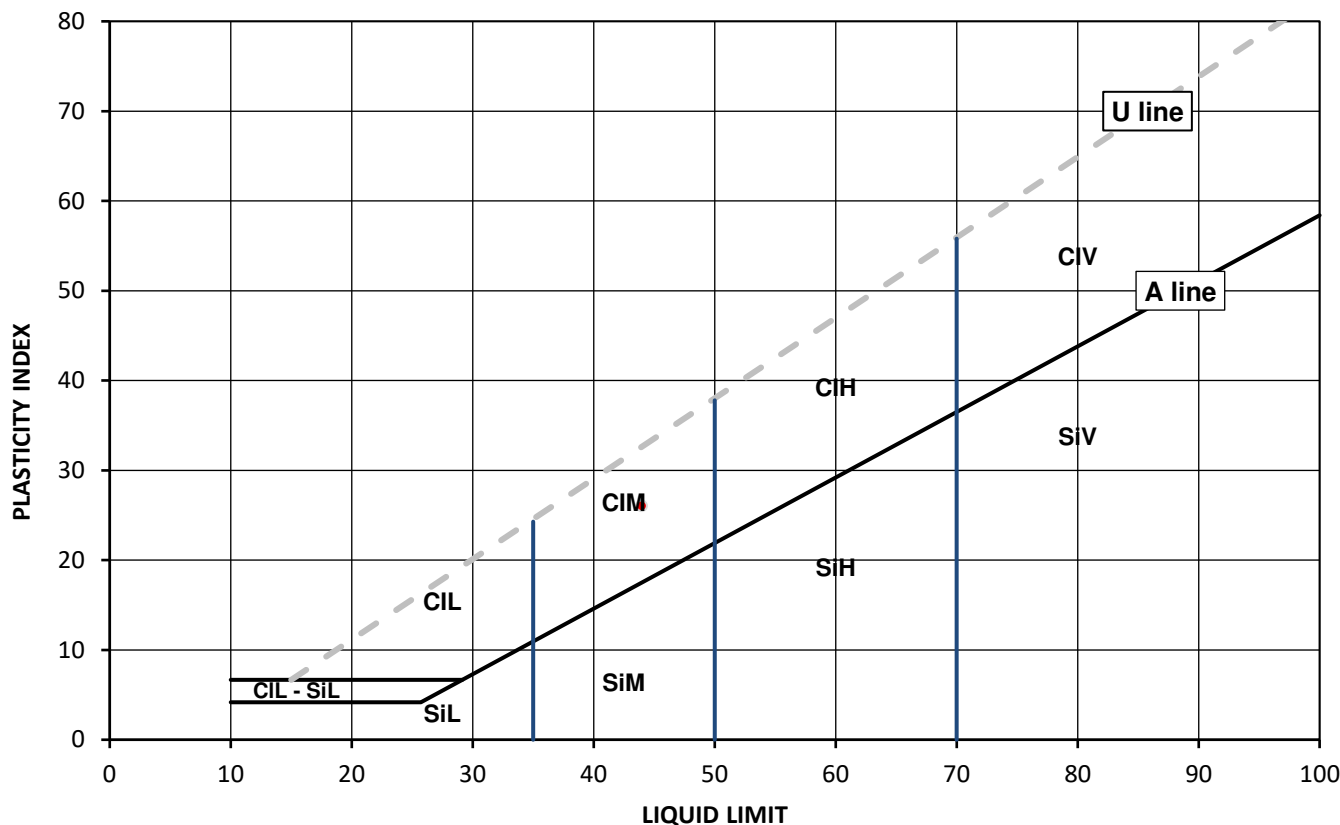
Test Results:

Laboratory Reference: 2734548
Hole No.: WS05
Sample Reference: Not Given
Sample Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 1.20
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation:

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
15	44	18	26	99



		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.



SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Erda Associates Ltd
Client Address: 102 Scalpcliffe Road, BURTON-ON-TRENT, DE15 9AB
Contact: Philip Devitt
Site Address: Barton Road, Barlestone

Water Content by BS 1377-2:1990: Clause 3.2
Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5

Client Reference: EAL.288.22
Job Number: 23-42732-1
Date Sampled: 30/06/2023
Date Received: 03/07/2023
Date Tested: 12/07/2023
Sampled By: Client- PD

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Water Content BS 1377-2 [W] %	Water Content BS EN ISO 17892-1 [W] %	Atterberg				Density			Total Porosity# %		
		Reference	Depth Top	Depth Base	Type					% Passing 425um	WL	Wp	Ip	bulk	dry	PD			
			m	m															
2734546	WS02	Not Given	1.40	Not Given	D	Brown slightly gravelly sandy CLAY	Atterberg 1 Point	18		82	37	18	19						
2734547	WS03	Not Given	2.30	Not Given	D	Brown slightly gravelly SAND	Atterberg 1 Point	18		99	20	NP	NP						
2734548	WS05	Not Given	1.20	Not Given	D	Brown slightly gravelly sandy CLAY	Atterberg 1 Point	15		99	44	18	26						

Note: # Non accredited; NP - Non plastic

Comments:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd



SUMMARY REPORT

DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS 1377-2: 1990: Clause 3.2

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Erda Associates Ltd

Client Address: 102 Scalpcliffe Road, BURTON-ON-TRENT,
DE15 9AB

Contact: Philip Devitt

Site Address: Barton Road, Barlestone

Client Reference: EAL.288.22

Job Number: 23-42732-1

Date Sampled: 30/06/2023

Date Received: 03/07/2023

Date Tested: 12/07/2023

Sampled By: Client- PD

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2734546	WS02	Not Given	1.40	Not Given	D	Brown slightly gravelly sandy CLAY		18	Sample was quartered, oven dried at 107.9 °C			
2734547	WS03	Not Given	2.30	Not Given	D	Brown slightly gravelly SAND		18	Sample was quartered, oven dried at 107.9 °C			
2734548	WS05	Not Given	1.20	Not Given	D	Brown slightly gravelly sandy CLAY		15	Sample was quartered, oven dried at 107.9 °C			

Comments:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Erda Associates Ltd
Client Address: 102 Scalpcliffe Road, BURTON-ON-TRENT,
DE15 9AB

Contact: Philip Devitt
Site Address: Barton Road, Barlestone

Client Reference: EAL 288 22
Job Number: 23-42847-1
Date Sampled: 29/07/2023
Date Received: 04/07/2023
Date Tested: 12/07/2023
Sampled By: i2 - DW

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

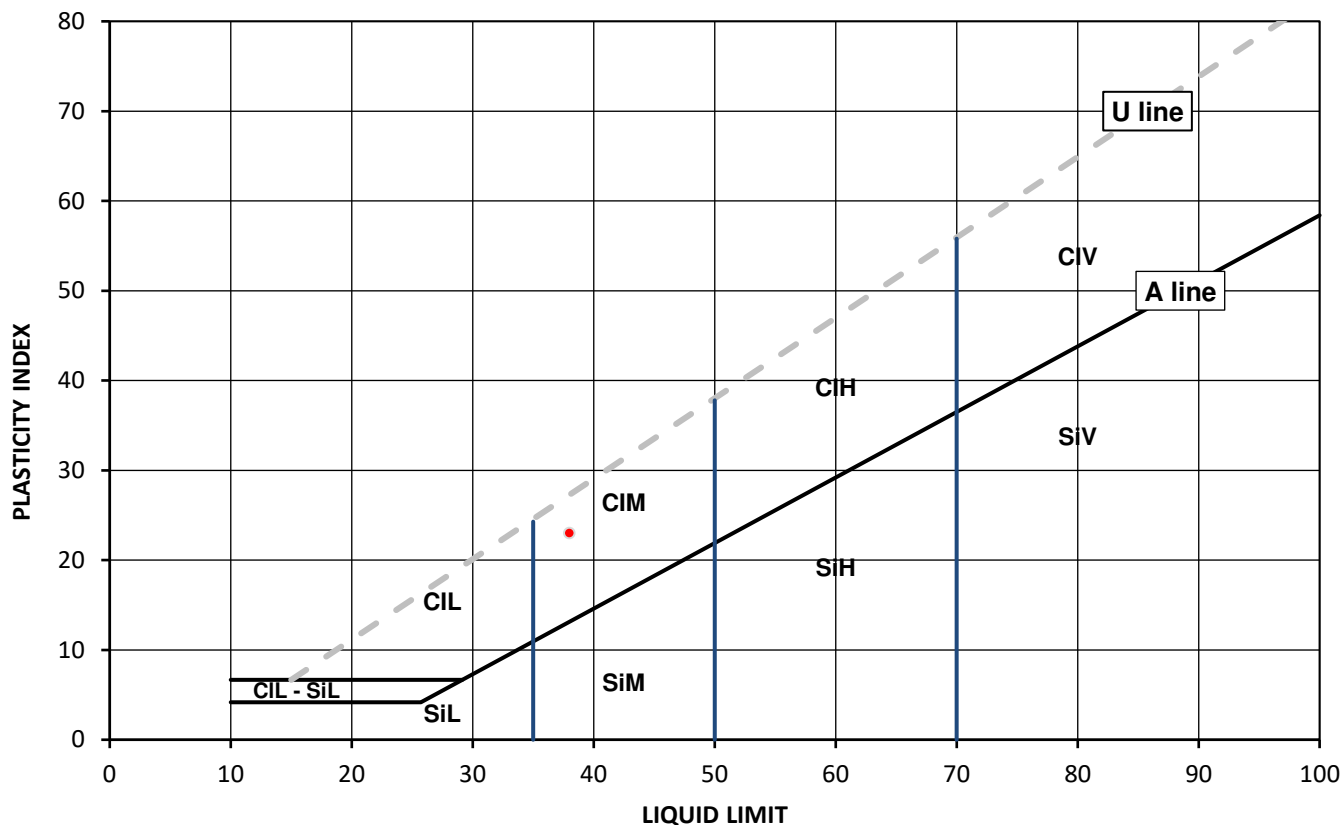
Test Results:

Laboratory Reference: 2735137
Hole No.: TP3
Sample Reference: Not Given
Sample Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 0.90
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation:

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
12	38	15	23	99



		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.



TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Erda Associates Ltd
Client Address: 102 Scalpcliffe Road, BURTON-ON-TRENT,
DE15 9AB

Contact: Philip Devitt
Site Address: Barton Road, Barlestone

Client Reference: EAL 288 22
Job Number: 23-42847-1
Date Sampled: 29/07/2023
Date Received: 04/07/2023
Date Tested: 12/07/2023
Sampled By: i2 - DW

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

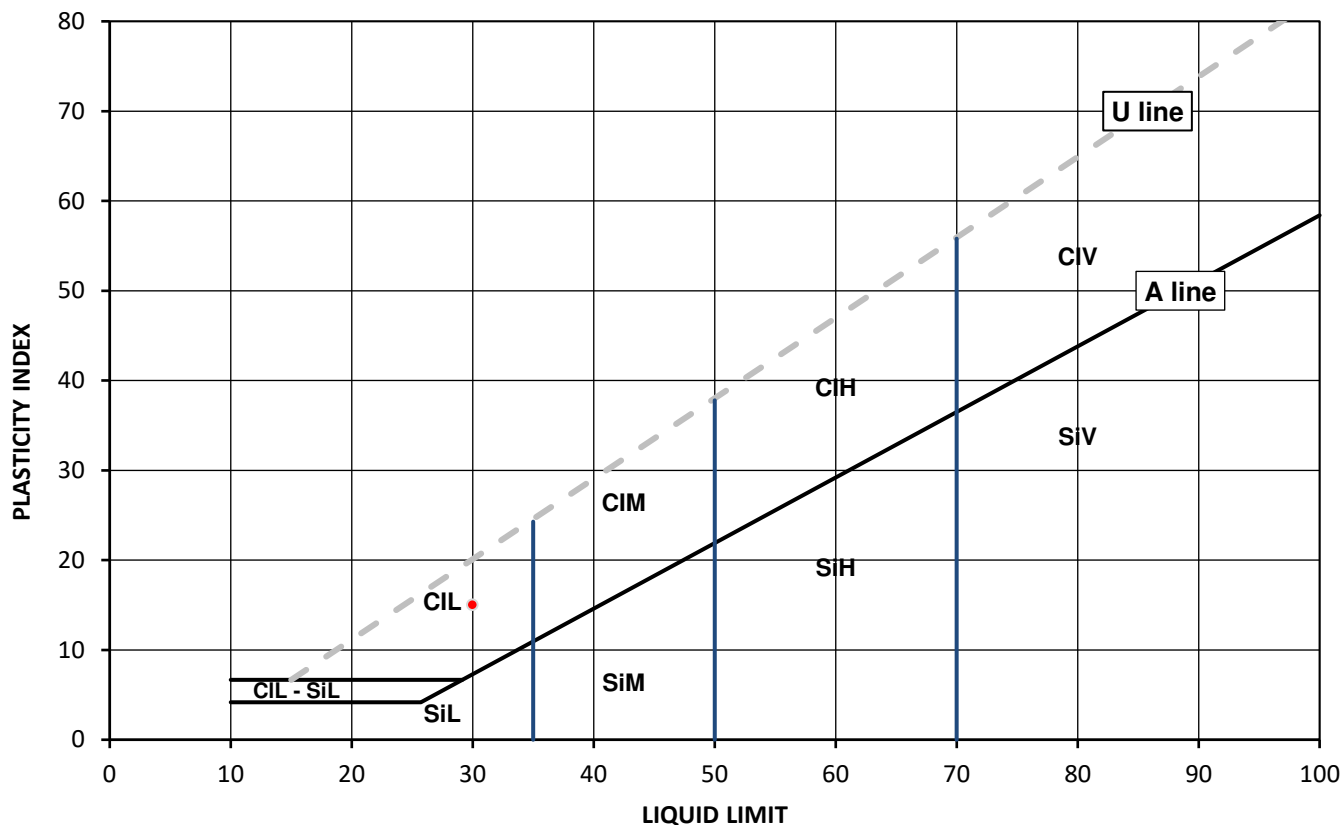
Test Results:

Laboratory Reference: 2735138
Hole No.: TP3
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 0.80
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation:

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
18	30	15	15	99



		Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.





SUMMARY REPORT

DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS 1377-2: 1990: Clause 3.2

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Erda Associates Ltd

Client Address: 102 Scalpcliffe Road, BURTON-ON-TRENT,
DE15 9AB

Contact: Philip Devitt

Site Address: Barton Road, Barlestone

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: EAL 288 22

Job Number: 23-42847-1

Date Sampled: 29/07/2023

Date Received: 04/07/2023

Date Tested: 12/07/2023

Sampled By: i2 - DW

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2735137	TP3	Not Given	0.90	Not Given	D	Brown slightly gravelly sandy CLAY		12	Sample was quartered, oven dried at 107.9 °C			
2735138	TP3	Not Given	0.80	Not Given	D	Brown slightly gravelly very sandy CLAY		18	Sample was quartered, oven dried at 107.9 °C			

Comments:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed:

Katarzyna Koziel

Katarzyna Koziel
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Appendix D



Tier 1 Assessment Criteria

	Residential With Produce (mg/kg) -			
Determinand	1% SOM			Source
Arsenic	37.00			LQM S4UL
Boron	290.00			LQM S4UL
Cadmium	22.00			C4SL
Chromium III	910.00			LQM S4UL
Chromium VI	6.00			LQM S4UL
Lead	200.00			C4SL
Mercury, elemental	1.20			LQM S4UL
Mercury, inorganic	40.00			LQM S4UL
Mercury, methyl	11.00			LQM S4UL
Selenium	250.00			LQM S4UL
Nickel	180.00			LQM S4UL
Copper	2400.00			LQM S4UL
Vanadium	410.00			LQM S4UL
Zinc	3700.00			LQM S4UL
Total Cyanide	34.00			In House*
Polycyclic Aromatic Hydrocarbons				
	SOM 1%	SOM 2.5%	SOM 6%	
Benzo(a)pyrene	2.20	2.70	3.00	LQM S4UL
Dibenz(ah)anthracene	0.24	0.28	0.30	LQM S4UL
Acenaphthene	210.00	510.00	1100.00	LQM S4UL
Acenaphthylene	170.00	420.00	920.00	LQM S4UL
Anthracene	2400.00	5400.00	11000.00	LQM S4UL
Benzo(a)anthracene	7.20	11.00	13.00	LQM S4UL
Benzo(b)fluoranthene	2.60	3.30	3.70	LQM S4UL
Benzo(ghi)perylene	320.00	340.00	350.00	LQM S4UL
Benzo(k)fluoranthene	77.00	93.00	100.00	LQM S4UL
Chrysene	15.00	22.00	27.00	LQM S4UL
Fluoranthene	280.00	560.00	890.00	LQM S4UL
Fluorene	170.00	400.00	860.00	LQM S4UL
Indeno(123cd)pyrene	27.00	36.00	41.00	LQM S4UL
Phenanthrene	95.00	220.00	440.00	LQM S4UL
Pyrene	620.00	1200.00	2000.00	LQM S4UL
Naphthalene	2.30	5.60	13.00	LQM S4UL

Note:

All figures are copyright Land Quality Management Limited, reproduced with permission; Publication Number S4UL3852. All rights reserved.

* Values calculated using CLEA v1.071

Tier 1 Assessment Criteria

Determinand	Residential With Produce			Source
	1% SOM	2.5% SOM	6% SOM	
Benzene	0.087	0.17	0.37	LQM S4UL
Ethylbenzene	47.00	110.00	260.00	LQM S4UL
Phenol	280.00	550.00	1100.00	LQM S4UL
Toulene	130.00	290.00	660.00	LQM S4UL
Xylene, o-	60.00	140.00	330.00	LQM S4UL
Xylene, m-	59.00	140.00	320.00	LQM S4UL
Xylene, p-	56.00	130.00	310.00	LQM S4UL
Aliphatic C5-C6	42	78	160	LQM S4UL
Aliphatic C6-C8	100	230	530	LQM S4UL
Aliphatic C8-C10	27	65	150	LQM S4UL
Aliphatic C10-C12	130 (48) ^{vap}	330 (118) ^{vap}	760 (283) ^{vap}	LQM S4UL
Aliphatic C12-C16	1100 (24) ^{sol}	2400 (59) ^{sol}	4300 (142) ^{sol}	LQM S4UL
Aliphatic C16-C35	65000 (8.48) ^{sol}	92000 (21) ^{sol}	110000	LQM S4UL
Aliphatic C35-C44	65000 (8.48) ^{sol}	92000 (21) ^{sol}	110000	LQM S4UL
Aromatic C5-C7	70	140	300	LQM S4UL
Aromatic C7-C8	130	290	660	LQM S4UL
Aromatic C8-C10	34	83	190	LQM S4UL
Aromatic C10-C12	74	180	380	LQM S4UL
Aromatic C12-C16	140	330	660	LQM S4UL
Aromatic C16-C21	260	540	930	LQM S4UL
Aromatic C21-C35	1100	1500	1700	LQM S4UL
Aromatic C35-C44	1100	1500	1700	LQM S4UL
Combined Aliphatic and Aromatic C44-C70	1600	1800	1900	LQM S4UL

Note:

All figures are copyright Land Quality Management Limited, reproduced with permission; Publication Number S4UL3852. All rights reserved.

^{vap} - S4UL presented exceed the vapour saturation limit, which is presented in brackets.

^{sol} - S4UL presented exceeds the solubility saturation limit, which is presented in brackets.

Appendix E





KEY:



Area requiring piled/vibro foundations



Area where traditional foundations may be suitable subject to structural engineer assessment.

Any foundations that require deepening (due to tree influence or in the area of the former pond) should be piled or vibro.

Consideration should be given to presence of loose granular deposits at depth and plot specific investigation may be required.

DO NOT SCALE



TITLE:

Foundation Zoning Plan

PROJECT:

Barton Road, Barlestone

PROJECT No:

EAL.288.22

DATE:

07/2023

SCALE:

NTS

DRAWN:

PD

DWG No:

Figure 5

APPENDIX C

Mr Tom Botterill
MyPad 2020 Ltd
The Quadrant
Nuart Road
Beeston
Nottingham
NG9 2NH

Dear Tom,

Re: Barton Road, Barlestone Infiltration Testing to Assist with Soakaway Design

Background

Erda Associates Ltd. were requested by MyPad 2020 Ltd. (hereafter referred to as the client) to undertake infiltration testing to assist with the design of a proposed permeable driveway for a proposed residential development at the site known as **Barton Road, Barlestone**. The site currently comprises an agricultural field. Site location and boundary plans are included in **Appendix A**.

A previous round of soakaway testing was undertaken at the subject site in October 2024. The results of the testing showed variable infiltration rates. As such a further round of testing was requested.

Site Works

A second round of infiltration testing was undertaken in the shallow soils between 20th and 21st March 2025.

Four soakaway test pits (SA01-04) were excavated in areas specified by the client for potential future soakaway drainage. An exploratory hole location plan is enclosed in **Appendix A**. The excavations were limited to a maximum depth of 0.50m as specified by the client.

Ground Conditions

The investigation has identified that the site is underlain by topsoil, over yellow sandy gravelly clay. The topsoil was generally recorded to extend to depths of between 0.30m and 0.40mbgl. The topsoil was immediately underlain by the clay. The base of the clay was not encountered in any of the exploratory holes.

Groundwater was not encountered in any of the trial pits.

Soakaway Testing

Soakaway drainage was noted to be relatively slow. It was not possible to complete full test runs in any of the soakaway positions over the twenty four hour monitoring period.

Infiltration was too slow to calculate an infiltration rate for positions SA01 SA03. It was possible to complete one test run in SA04 and calculate an infiltration rate of **$1.51 \times 10^{-6} \text{m/s}$** . Full soakaway calculations are included in **Appendix B**.

Based on the two rounds of soakaway testing and variable results, it is considered that soakaway infiltration will not be suitable for the site due to the limited successful infiltration. It is noted that the

majority of test positions attempted have failed. Therefore, it is recommended that alternative drainage strategies are sought for the site.

We trust the above is sufficient for your requirements. However, should you have any queries, or require any further information, please do not hesitate to contact us.

Yours Sincerely

A handwritten signature in black ink that reads 'P. Devitt'.

Phil Devitt, BSc MSc MRICS
Director

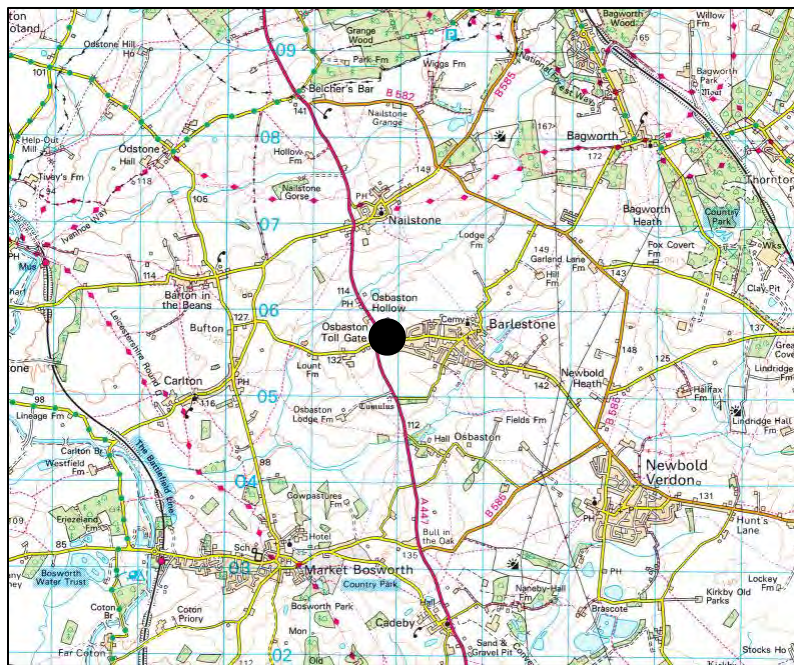
Encl.

Appendix A – Site Plans

Appendix B – Soakaway Results

Appendix A





KEY:

● Approximate Site Location

DO NOT SCALE



TITLE:

Site Location Plan

PROJECT:

Barton Road, Barlestone

PROJECT No:

EAL.288.22

DATE:

04/2025

SCALE:

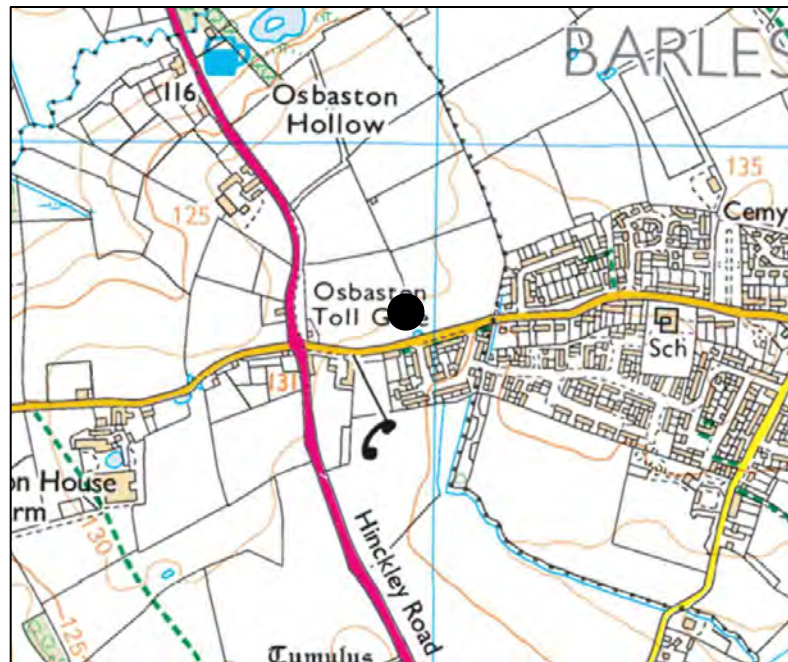
NTS

DRAWN:

PD

DWG No:

Figure 1





KEY:



Site Boundary



DO NOT SCALE



TITLE:

Site Layout

PROJECT:

Barton Road, Barlestone

PROJECT No:

EAL.288.22

DATE:

04/2025

SCALE :

NTS

DRAWN :

PD

DWG No:

Figure 2



KEY:



DO NOT SCALE



TITLE:

Development Proposal

PROJECT:

Barton Road, Barlestone

PROJECT No:

EAL.288.22

DATE:

04/2025

SCALE:

NTS

DRAWN:

PD

DWG No:

Figure 3

KEY:



Approximate Shallow Soakaway
Test Pit Location



DO NOT SCALE



TITLE:

Exploratory Hole Location Plan

PROJECT:

Barton Road, Barlestone

PROJECT No:

EAL.288.22

DATE:

04/2025

SCALE :

NTS

DRAWN :

PD

DWG No:

Figure 5

Appendix B



Page 1 of 1

Soil Profile:

Depth (m)		Description
From:	To:	
0.00	0.20	Topsoil.
0.20	0.50	Yellow sandy gravelly clay.

Not to scale

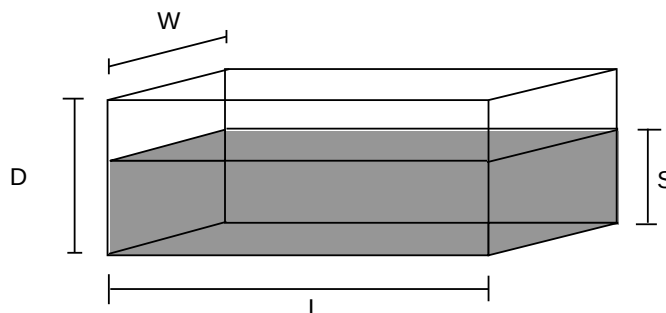
All dimensions in metres.

D = Depth of test pit =

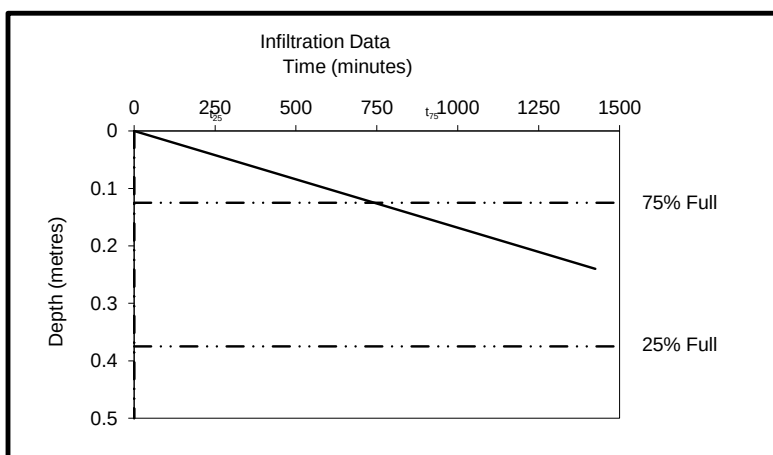
W = Width of test pit =

L = Length of test pit =

S= Storage depth (of water) =



Test Date: 20.03.2025

[illegible]

Notes:

Water did not sufficiently dissipate during test period.

Test and analysis carried out in general accordance with BRE Digest 365 : 2007

Job No.: EAL.288.22
Site: Barton Road, Barlestone
Client: MyPad 2020 Ltd.



INSITU SOAKAWAY TEST RESULTS

Page 1 of 1

Trial pit No.: SA02

Soil Profile:

Depth (m)		Description
From:	To:	
0.00	0.30	Topsoil.
0.30	0.50	Yellow sandy gravelly clay.

Sketch plan of test zone

Not to scale

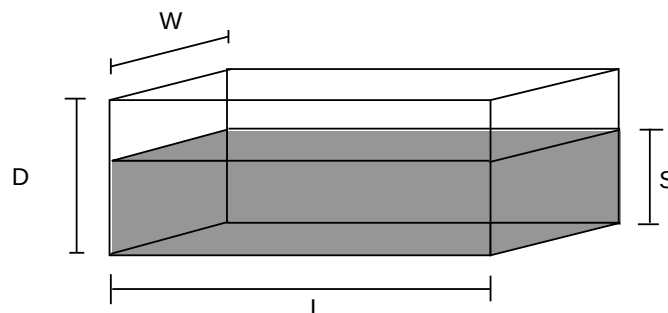
All dimensions in metres.

D = Depth of test pit =

W = Width of test pit =

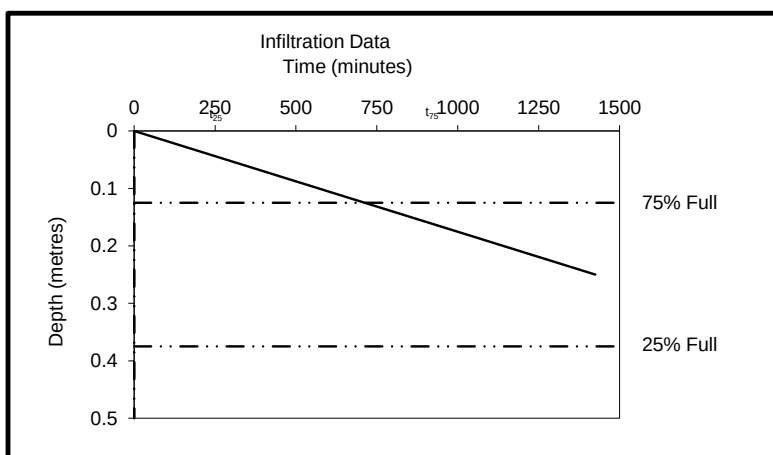
L = Length of test pit =

S = Storage depth (of water) =



Soakaway Test Run 1

Test Date: 20.03.2025



Time (minutes)	Depth (m)
0	0.00
1425	0.25

Notes:

Water did not sufficiently dissipate during test period.

Test and analysis carried out in general accordance with BRE Digest 365 : 2007

Job No.: EAL.288.22
Site: Barton Road, Barlestone
Client: MyPad 2020 Ltd.



Page 1 of 1

Soil Profile:

Depth (m)		Description
From:	To:	
0.00	0.20	Topsoil.
0.20	0.50	Yellow sandy gravelly clay.

Not to scale

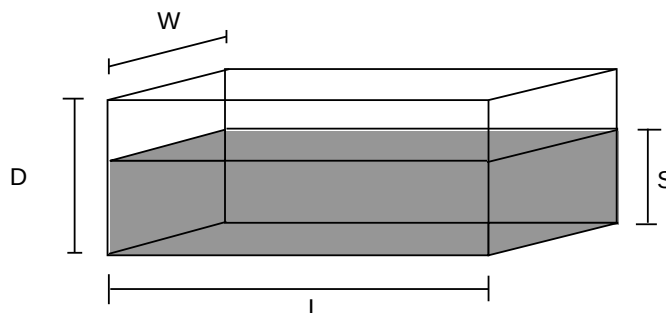
All dimensions in metres.

D = Depth of test pit =

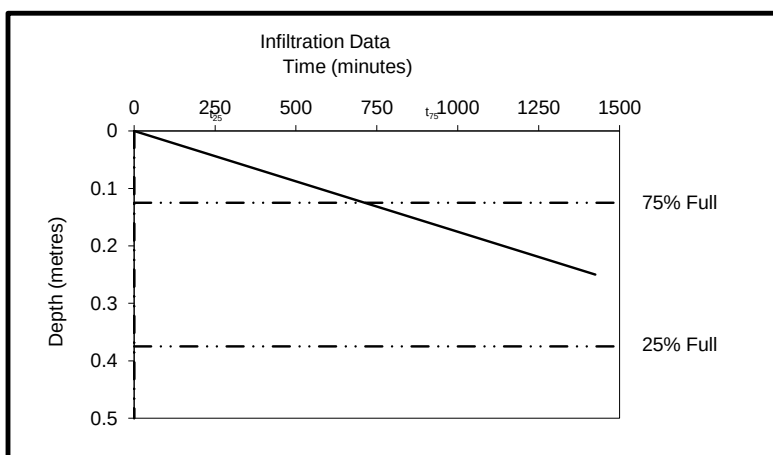
W = Width of test pit =

L = Length of test pit =

S= Storage depth (of water) =



Test Date: 20.03.2025

[illegible]

Notes:

Water did not sufficiently dissipate during test period.

Test and analysis carried out in general accordance with BRE Digest 365 : 2007

Job No.: EAL.288.22
Site: Barton Road, Barlestone
Client: MyPad 2020 Ltd.



Page 1 of 1

Soil Profile:

Depth (m)	Description
From:	To:
0.00	0.30 Topsoil.
0.30	0.50 Yellow mottled red sandy gravelly clay.

Not to scale

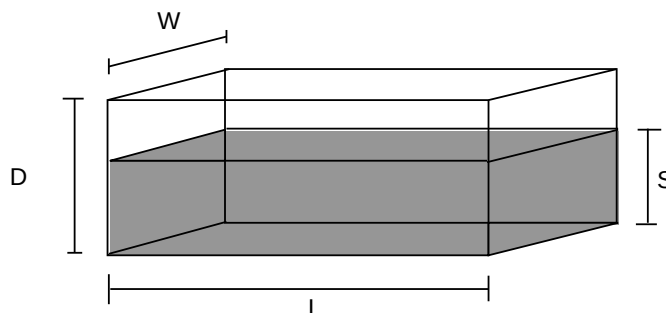
All dimensions in metres.

D = Depth of test pit =

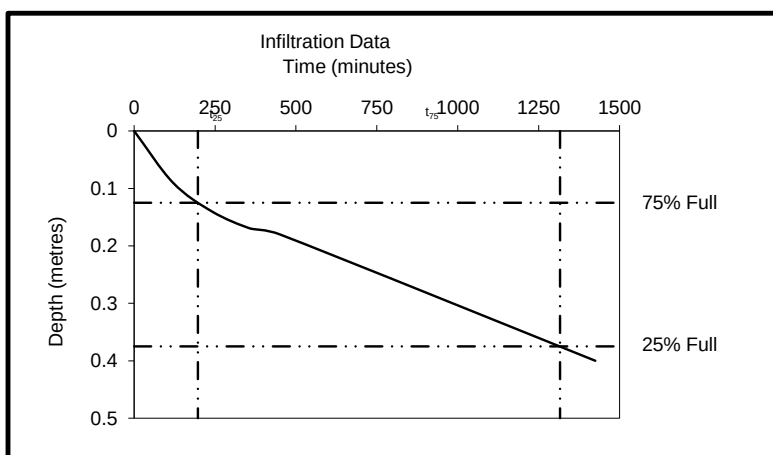
W = Width of test pit =

L = Length of test pit =

S= Storage depth (of water) =



Test Date: 06.04.2025

[illegible]

Notes:

Therefore:

S= 0.50 m $a_{p50}= 1.18 \text{ m}^2$ $V_{p75-25}= 0.12 \text{ m}^3$

From the above graph,

$t_{p25} = 197$ (min) $t_{p75} = 1316$ (min)

$$\frac{\text{Sublimation Rate} \times V_{p75-25} \times N}{a_{p50} \times t_{p75-25}} = 1.51E-06 \quad \tau_{run1} = \frac{1.51 \times 10^{-6}}{1} \text{ m/s}$$

$$\text{or} = 5.45E-03 \quad \text{or} = 5.45 \times 10^{-3} \text{ m/hr}$$

Test and analysis carried out in general accordance with BRE Digest 365 : 2007

Job No.: EAL.288.22

Site: Barton Road, Barlestone

Client: MyPad 2020 Ltd.



APPENDIX D



BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

ENVIRONMENT

Leicestershire County Council
Barton Road
Barlestone
Sustainable Drainage Statement

ENVIRONMENT

Leicestershire County Council Barton Road Barlestone Sustainable Drainage Statement

Birmingham
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB
T: 0121 233 3322

Cambridge
14-16 High Street, Histon, Cambridge
CB24 9JD
T: 01223 235 173

Leeds
Whitehall Waterfront, 2 Riverside Way, Leeds
LS1 4EH
T: 0113 233 8000

London
11 Borough High Street
London, SE1 9SE
T: 0207 407 3879

Manchester
4th Floor Carvers Warehouse, 77 Dale Street
Manchester, M1 2HG
T: 0161 233 4260

Market Harborough
12a Woodcock House, Compass Point Market Harborough, Leicestershire, LE16 9HW
T: 01858 455020

Nottingham
Waterfront House, Station Street, Nottingham NG2 3DQ
T: 0115 924 1100

December 2020

DOCUMENT ISSUE RECORD

Document Number:	BRB-BWB-ZZ-XX-RP-CD-0001_SDS
BWB Reference:	NTW-2800_SDS

Revision	Date of Issue	Status	Author:	Checked:	Approved:
P01	28/10/19	S0	Josephine Green BA(Hons)/BEng(Hons) EngTech MICE	Rob Ward BEng (Hons)	Keith Alger BSc(Hons), MSc
P02	16/12/2020	S2	Keith Alger BSc(Hons), MSc	Rachel Meredith BSc (Hons) MCIWEM	Keith Alger BSc(Hons), MSc

Notice

All comments and proposals contained in this report, including any conclusions, are based on information available to BWB Consulting during investigations. The conclusions drawn by BWB Consulting could therefore differ if the information is found to be inaccurate or misleading. BWB Consulting accepts no liability should this be the case, nor if additional information exists or becomes available with respect to this scheme.

Except as otherwise requested by the client, BWB Consulting is not obliged to and disclaims any obligation to update the report for events taking place after: -

- (i) The date on which this assessment was undertaken, and
- (ii) The date on which the final report is delivered

BWB Consulting makes no representation whatsoever concerning the legal significance of its findings or the legal matters referred to in the following report.

All Environment Agency mapping data used under special license. Data is current as of December 2020 and is subject to change.

The information presented, and conclusions drawn, are based on statistical data and are for guidance purposes only. The study provides no guarantee against flooding of the study site or elsewhere, nor of the absolute accuracy of water levels, flow rates and associated probabilities.

This document has been prepared for the sole use of the Client in accordance with the terms of the appointment under which it was produced. BWB Consulting Limited accepts no responsibility for any use of or reliance on the contents of this document by any third party. No part of this document shall be copied or reproduced in any form without the prior written permission of BWB

CONTENTS

1.	INTRODUCTION.....	1
	Sustainable Drainage Guidance.....	3
2.	EXISTING CONDITIONS.....	4
	Existing Runoff Rates.....	4
	Existing Runoff Volume	5
3.	SURFACE WATER DRAINAGE STRATEGY	6
	Drainage Hierarchy	6
	Peak Flow Control.....	7
	Attenuated Storage	8
	Runoff Volume Control	9
	Long Term Storage	9
	Sustainable Drainage Systems	10
	Residual Risk and Designing for Exceedance	10
4.	FOUL WATER DRAINAGE.....	11
5.	MAINTENANCE	12
6.	SUMMARY	13

FIGURES

Figure 1.1: Site Location

Figure 3.1: Drainage Catchments

TABLES

Table 1.1: Site Details

Table 2.1: Existing Greenfield Runoff Rates from the Site

Table 3.1: Proposed Runoff Rates - Per Catchment

Table 3.2: Outline Attenuated Storage Requirements

Table 3.3: Runoff Volume Comparison

Table 6.1: Sustainable Drainage Statement Summary

APPENDICES

- APPENDIX 1: Outline Proposals
- APPENDIX 2: Topographical Survey
- APPENDIX 3: Existing Runoff Rates & Volumes
- APPENDIX 4: Severn Trent Water Asset Mapping
- APPENDIX 5: Micro Drainage Storage Calculations
- APPENDIX 6: Outline Surface Water Drainage Strategy

1. INTRODUCTION

- 1.1 A Sustainable Drainage Statement (SDS) sets out the principles of drainage design for a development and summarises the reasoning behind the chosen design. This includes consideration of national and local guidance, justification of specific flow rates, volumes of attenuated storage, as well as the appropriate level of treatment to be provided to surface water runoff.
- 1.2 This SDS has been produced by BWB Consulting on behalf of Leicestershire County Council in respect of a site located at Barton Road, Barlestone, Leicestershire. The site is included within the Hinckley and Bosworth Borough Council Level 2 Strategic Flood Risk Assessment (SFRA)¹ and is defined as *Land at Barton Road, Barlestone (AS455)*, it is considered to be at low risk of flooding from fluvial and pluvial sources and was not subject to any further detailed assessment.
- 1.3 It is proposed that the site is developed to accommodate approximately 55 residential dwellings, with an area set aside for Local Equipped Area for Play (LEAP). The sites vehicular access is towards the southeast of the proposed development onto Barton Road. Proposals are shown within Appendix 1.
- 1.4 A Flood Risk Assessment has been developed for the site (reference [BRB-BWB-ZZ-XX-RP-YE-0001_FRA] and this SDS accompanies this overarching document.
- 1.5 This SDS is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.
- 1.6 The location of the site is illustrated within Figure 1.1, with contextual information provided within Table 1.1.

¹ Level 2 Strategic Flood Risk Assessment (Hinckley and Bosworth Borough Council, May 2020)

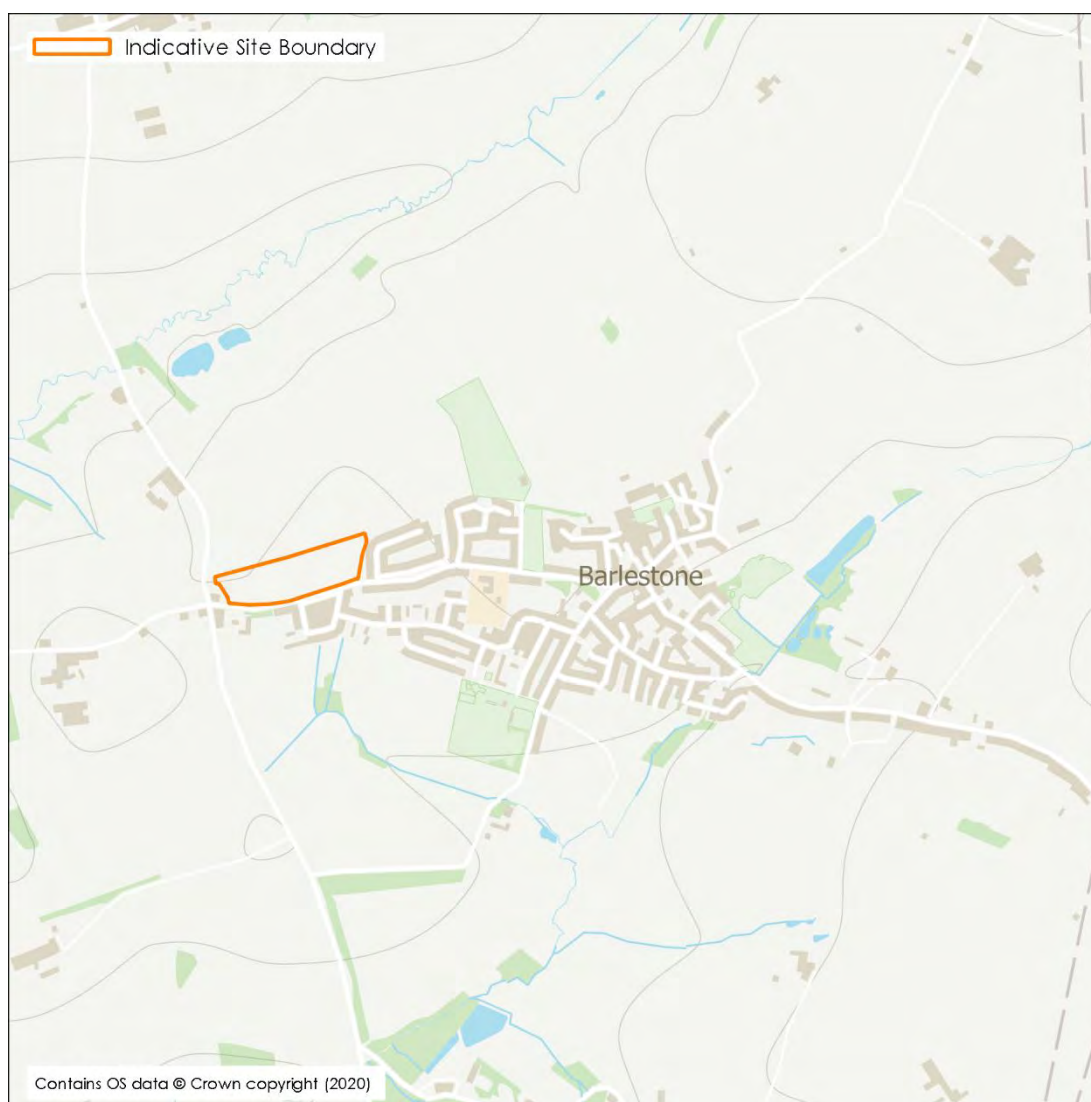


Figure 1.1: Site Location

Table 1.1: Site Details

Site Name	Land off Barton Road
Location	Barlestone, Leicestershire
NGR (approx.)	SK419057
Application Site Area (ha)	3.25ha (Approximately)
Development Area (ha)	1.97ha (Approximately)
Development Type	Residential
Lead Local Flood Authority	Leicestershire County Council
Local Planning Authority	Hinckley and Bosworth Borough Council
Environment Agency Area	East Midlands
Sewerage Undertaker	Severn Trent Water

Sustainable Drainage Guidance

- 1.7 Sustainable Drainage Systems (SuDS) aim to reduce the impact of development by replicating the natural runoff regime in a sustainable, cost effective manner, whilst protecting water quality and reducing pollution. SuDS should be used to provide an appropriate treatment train (determined by the perceived hazard level of the runoff source) and designed with water quality, quantity, amenity and biodiversity in mind to ensure a sustainable development is achieved.
- 1.8 In their role as LLFA, Leicestershire County Council have published online SuDS guidance for new developments which includes a Statutory Consultation Checklist and Interim LLFA Guidance Note². Within the local guidance it is outlined that new developments should;
- i. Aim to discharge surface water runoff as high up the hierarchy of drainage as reasonably practicable;
 - ii. Seek to mimic the greenfield runoff rate as closely as possible;
 - iii. Consider SuDS alongside the development of the masterplan;
 - iv. Provide attenuation up to the 1 in 100-year return period plus an allowance for climate change;
- 1.9 Leicestershire County Council requires a range of SuDS to be considered on all sites and implemented where appropriate with attenuation features sized to manage the 1 in 100 (plus climate change) event. The factor of climate change uplift should be appropriate to the lifetime of the proposed development and in line with Environment Agency guidance. Furthermore, discharge from sites should be limited to the greenfield rate for equivalent events.
- 1.10 In consideration of Environment Agency local and wider guidance, a 40% allowance for climate change has been allowed within the sizing of storage based on the classification use and estimated lifetime of the development.
- 1.11 Leicestershire County Council state that where applicable, the impact of 'urban creep' should be included within the attenuation volume calculations. Unless it can be demonstrated otherwise, a 10% increase in the impermeable area should be included within the storage calculations. Urban creep guidance is also contained within Section 24.7 of CIRIA C753 'The SuDS Manual'³.

Local guidance has been considered in conjunction with the Non-statutory Technical Standards for Sustainable Drainage Systems⁴ and The SuDS Manual as part of the following document.

² Interim LLFA Guidance Note: Planning and Development in Leicestershire, Leicestershire County Council (2018)

³ The SuDS Manual, CIRIA (2007)

⁴ Non-Statutory Technical Standards for Sustainable Drainage Systems, DEFRA (2015)

2. EXISTING CONDITIONS

- 2.1 The site is located to the west of the village of Barlestone, Leicestershire. The site is surrounded by greenfield land to the north, existing residential development to the east, Barton Road to the south and the A447 to the west. The existing site is agricultural and entirely greenfield in nature and is considered to be entirely permeable.
- 2.2 The existing drainage regime of the site is considered to be to the existing minor watercourses (drainage ditches). The site is split into an Eastern and Western drainage Catchment. A topographical survey included for reference as Appendix 2, indicates that there is a fall across the Western Catchment from 130.27m AOD in the northwest to 127.23m AOD in the southeast towards a central ditch identified along the middle field boundary and across the Eastern Catchment from 128.22m AOD in the northwest to 125.21m AOD in the southeast towards a ditch along the eastern site boundary.
- 2.3 It must be noted that the easternmost ditch although it has been identified within the available background mapping is not fully indicated on the topographical survey, with only the most northerly extent having been surveyed due to dense vegetation in certain areas. Therefore, for the purposes of this report an approximate route has been assumed, with vegetation clearance in the southern portion of the site required, in order to full expose the full alignment of the ditch as it passes through the site.
- 2.4 An existing pond was also identified in the southeast of the western field close to this ditch depression.
- 2.5 British Geology Survey (BGS) records show the site is underlain by Gunthorpe Member – Mudstone. The Environment Agency classifies this bedrock type as a Secondary B Aquifer suggesting low permeability. BGS mapping indicates that the western portion of the site is expected to be underlain by Glaciofluvial deposits, Mid Pleistocene - Sand and Gravel superficial deposits. The eastern portion of the site is expected to be underlain by Oadby Member – Diamicton superficial deposits.
- 2.6 The BGS online borehole log records include a record approximately 200m east of the site, located to the north of the existing residential development on Little Mill Close. The record confirms the presence of sandstone, siltstone and mudstone in vicinity of the site and did not appear to refer to groundwater strike or emergence.

Existing Runoff Rates

- 2.7 The site is wholly greenfield in nature. Taking this into account an assessment of the equivalent greenfield surface water runoff rates from the proposed development area of 1.97ha has been undertaken and this is summarised within Table 2.1. Calculations are included for reference as Appendix 3.
- 2.8 The runoff rates have been estimated using the IH124 method, with appropriate prorated adjustments for a site of less than 50ha, as recommended in Interim Code of

Practice for Sustainable Drainage⁵. This was undertaken within Micro Drainage, which makes the necessary adjustments for small sites automatically.

Table 2.1: Existing Greenfield Runoff Rates from the Site

Return Period (Yrs.)	Runoff Rate (l/s)
1	7.2
Mean Annual Flow Rate (QBAR)	8.7
30	17.0
100	22.2

Existing Runoff Volume

- 2.9 An assessment of the existing surface water runoff rates from the proposed for development has been made for a 1 in 100-year, 6 hour storm.
- 2.10 As the existing site is permeable, the runoff volume has been calculated using the Source Control module within Micro Drainage to be 514.33m³, results are included within Appendix 3.

⁵ The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

3. SURFACE WATER DRAINAGE STRATEGY

- 3.1 Development proposals are to involve the construction of approximately 55 residential dwellings and an area of open space. The site vehicular access lies towards the southeast of the proposed development onto Barton Road.
- 3.2 Based upon the proposed developable area of 1.97ha, the total impermeable area has been measured to be approximately to be 1.41ha, with an additional 10% allowance for urban creep in accordance with local guidance.

Drainage Hierarchy

- 3.3 The Planning Policy Guidance⁶ and the SuDS Manual identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:
- v. into the ground (infiltration);
 - vi. to a surface water body;
 - vii. to a surface water sewer, highway drain, or another drainage system;
 - viii. to a surface water/combined sewer.
- 3.4 The aim of this approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible. In line with the drainage hierarchy primarily infiltration into the ground should be considered.
- 3.5 The local SFRA and BGS records indicate that the site is in an area of low permeability with a high groundwater table, therefore it is expected that infiltration will not be viable. However, it is recommended in accordance with current guidance that infiltration testing be conducted to confirm this.
- 3.6 The site is identified to comprise two catchments, therefore it is proposed that each catchment is served by its own attenuation with outfall.
- 3.7 Both Western and Eastern catchments are proposed to outfall to the sewer, in the case of the Eastern catchment there is the potential to outfall into an existing ditch which is assumed to connect into a 600mm surface water sewer, on the northern side of Barton Road. Further details on the invert level of the ditch are required to confirm this approach. At this time it is assumed that the eastern parcel to connect into manhole 1704, with the western parcel connecting into manhole 0608.

⁶ Planning Practice Guidance. <http://planningguidance.planningportal.gov.uk/>.

- 3.8 Following a site visit the minor ditch feature shown on the topographical survey was identified to be generally shallow with no continuation of the ditch beneath Barton Road to the south. It is therefore proposed to connect the Western catchment into surface water sewer within Barton Road at Manhole 0606.
- 3.9 Severn Trent Water sewer records are included for reference as Appendix 4.
- 3.10 Runoff from each parcel is to be restricted at a suitable rate, in accordance with local guidance. Connection to the sewer should be made through a S106 (Water Industry Act 1991) application in consultation with Severn Trent Water.

Peak Flow Control

- 3.11 Leicestershire County Council guidance states that runoff from the site to be discharged at rates and volumes no greater than the event specific greenfield values.
- 3.12 To comply with LLFA guidance, it is proposed to restrict the discharge rate from the total development area 1.97ha, to the receiving watercourse/sewer at the equivalent greenfield QBAR rate up to the 1 in 100-year plus climate change event of 8.7l/s.
- 3.13 The site is split into Western and Eastern drainage catchments. The Western Catchment has a developable area of 0.6ha and the Eastern Catchment a developable area of 1.37ha, taken from the current proposed masterplan.
- 3.14 Discharge rates are apportioned in consideration of meeting a minimum restricted rate of 3l/s to avoid risk of pipe blockage whilst restricting over the total catchment area to the equivalent calculated greenfield rate. Therefore, the smaller Eastern catchment, in line with the following principles, has been restricted to a minimum rate of 3l/s.
- 3.15 The Western catchment, in accordance with local guidance, is therefore restricted to 5.7l/s to meet the total greenfield rate site wide. This is summarised within Table 3.1. Micro Drainage Calculations/outputs are included for reference as Appendix 3.
- 3.16 The total restriction rate from the site is shown to meet the requirements of Severn Trent Water, Appendix 4, with surface water flows to their assets not permitted to exceed a rate of 5 l/s/ha.

Table 3.1: Proposed Runoff Rates - Per Catchment

Catchment	Proposed Discharge Rate (l/s)
Western Catchment	3.0
Eastern Catchment	5.7
Total Proposed Runoff	8.7

Figure 3.1: Drainage Catchments

- 3.17 In restricting to greenfield rates this approach satisfies LLFA guidance in terms of the proposed runoff rate and is compliant with the necessary runoff volume control criteria.

Attenuated Storage

- 3.18 As the development proposals require a restricted runoff rate, it will be necessary to provide attenuated storage to balance the excess volume in a safe manner within the site.
- 3.19 Enough storage for events up to the 1 in 100-year storm with a 40% allowance for climate change should be provided in line with national guidance in consideration of the end use classification and the longevity of the development.
- 3.20 After considering the site constraints and development aspirations it is suggested that the necessary surface water storage volume is found within detention basins located at the lowest elevations of the site within each drainage catchment between the proposed development parcel and the outfall location.
- 3.21 For the purpose of this outline assessment, it has been assumed that the basin will accommodate all of the necessary storage, but it may be possible to redistribute a portion of the storage within other drainage components during the detailed design of the development (e.g.: in the pipe network, swales, filter drains, etc).
- 3.22 A simulation has been run using Micro Drainage 'Source Control' to identify the necessary storage provision. Using a restriction of 3l/s for the Western Catchment and applying a 10% allowance to the proposed impermeable area ($0.39\text{ha} \times 10\% = 0.43\text{ha}$) and a restriction of 5.7l/s for the Eastern Catchment and applying a 10% allowance to the proposed impermeable area ($0.89\text{ha} \times 10\% = 0.98\text{ha}$), the volume of attenuated storage required for the development has been calculated for storm events up to the 100 year + 40% storm. The results are summarised in Table 3.2. Micro Drainage outputs are shown within Appendix 5.

Table 3.2: Outline Attenuated Storage Requirements

Drainage Catchment	Rainfall Method	Critical Storm	Maximum Volume (m ³)
Western	FSR	480 min Winter	280
	FEH	600 min Winter	295
Eastern	FSR	600 min Winter	670
	FEH	720 min Winter	720

- 3.23 At this outline design stage it is expected that a minimum of 1,015m³ of attenuated storage will be provided to cater for the maximum anticipated runoff volume for all storm durations up to the 1 in 100-year return period storm, including a 40% climate change allowance and a 10% future urban creep allowance.
- 3.24 A freeboard allowance of 300mm has also been afforded within the calculated storage in line with LLFA guidance.

- 3.25 It is envisaged that the final required attenuated storage volume will be determined during the detailed design stage, once the development layout and drainage areas are fixed.

Runoff Volume Control

- 3.26 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6⁷ states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6 hour rainfall event should not exceed the runoff volume prior to development or redevelopment. Additionally, if practicable on previously developed sites, the runoff volume should not exceed the equivalent greenfield runoff volume.
- 3.27 Where it is not reasonably practicable to constrain the volume of runoff from a development at or below the existing volume, then the runoff must be discharged in a manner that does not adversely affect flood risk, i.e.:
- ix. The additional runoff volume resulting from the development (the 'long term storage volume') should be discharged separately from the site at a rate of 2l/s/ha or less. Or,
 - x. All the runoff volume from the development should be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Or,
 - xi. All the runoff volume from the development should be discharged at a rate of 2l/s/ha or less.
- 3.28 An estimate of the post-development runoff volume from the 1 in 100-year 6 hour storm can be derived from the Micro Drainage calculations. The existing and post-development runoff volumes are compared within Table 3.3.

Table 3.3: Runoff Volume Comparison

Existing Volume (m ³)	Proposed Volume (m ³)	Difference (m ³)
514.33	699.00	+184.67

- 3.29 The 1 in 100-year 6 hour storm runoff volume from the site has been shown to increase as a result of the proposed development. However, as the runoff volume from the development will be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions, the volume control criteria will be met.

Long Term Storage

- 3.30 It is proposed to discharge the runoff from the development at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Therefore, provision for long term storage is not required.

⁷ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

Sustainable Drainage Systems

- 3.31 Leicestershire County Council encourages developments which accord with the principles of sustainability in design, including appropriate measures to minimise the impact of surface water drainage.
- 3.32 The proposed strategy incorporates two pipe networks running from the northwest to the southeast of the site within both drainage catchments primarily passing through silt trap prior to outfall to the detention basins to the southeast prior to outfall to the nearby watercourse. Surface water flows are restricted to the total equivalent greenfield rate (QBAR) of 8.7l/s.
- 3.33 The recommended SuDS features to be considered within the proposals could include:
- Detention Basin
 - Permeable paving (recommended to be used within driveways and external areas where practicable)
 - Silt traps
 - Swales
- 3.34 An indicative surface water layout for the development is shown on BWB drawing reference: BRB-BWB-ZZ-XX-DR-C-0001. This is included for reference as Appendix 6.

Residual Risk and Designing for Exceedance

- 3.35 It is recommended that the final layout uses the proposed road infrastructure to provide drainage exceedance (overland flood flow) routes through the development and towards the detention basin and surrounding landscaping for events in excess of the capacity of the drainage system.
- 3.36 In the unlikely event that the capacity of the attenuated storage is exceeded, exceedance flows would be directed onto Barton Road. These would be directed south and east, being intercepted by the local highway drainage.
- 3.37 If such a flooding event occurs, then exceedance flows contributed by the development would be minor in context of the catchment, and not considered to materially increase flood risk elsewhere.
- 3.38 Furthermore, given that the capacity of the basin affords storage up to the 1 in 100yr plus 40% climate change design event with an additional 300mm freeboard allowance plus 10% allowance on impermeable areas for urban creep, any exceedance event is considered to be far beyond the design parameters, and with a low probability of occurrence.
- 3.39 In addition to the volume of storage provided within the detention basin, there will also be capacity within upstream pipes, manholes and recommended SuDS which has not been accounted for at this stage and a further level of redundancy to the network will therefore be provided.

4. FOUL WATER DRAINAGE

- 4.1 In developing the site, it is recommended to provide a foul drainage network which will be offered for adoption and connect into the existing Severn Trent Water maintained network.
- 4.2 A Developer Services Enquiry submitted to Severn Trent Water, included for reference as Appendix 4, indicates that Severn Trent Water have calculated a foul discharge rate for the development to be approximately 1l/s. Correspondence identifies that a foul connection for this can be accommodated to the 225mm combined sewer south of the site within Barton Road. A recommended connection point is manhole 0606.
- 4.3 Connection is to be sought through S106 agreement in consultation with Severn Trent Water.

5. MAINTENANCE

- 5.1 Unless adopted, it is likely that a management company would adopt any proposed SuDS features, and maintenance of these, including vegetation maintenance, trash screen clearing and regular outfall inspections.
- 5.2 Requirements for ongoing maintenance of the drainage network should form part of the Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.
- 5.3 It is envisaged that the Operation and Maintenance manual will be developed at the detailed design stage, but some examples are included below.
- i. All drainage features should be located in open areas which are readily accessible.
 - ii. Gullies should be inspected and de-silted at least once a year, where necessary.
 - iii. Pipes, manholes and silt traps should be inspected and de-silted at least once a year, where necessary.
 - iv. If permeable paving is incorporated within the layout, it should be swept a minimum of every 6 months to maintain flow capacity of the joints between blocks.
 - v. The surface water attenuation areas will be predominantly dry and the base should be seeded with a wildflower grass seed mix that can tolerate wet ground conditions.
 - vi. Regular inspections of the attenuation basin should be undertaken to remove litter/debris, invasive/colonising vegetation and silt build up as necessary. Inlet and outlet structures to be regularly inspected, with remedial work as required to maintain water flows and prevent silt/vegetation build up.
 - vii. Vegetation/grass with the attenuation basin should be maintained appropriately to allow establishment and promote habitat formation, without impeding the operation of the inlet and outlet structure.
 - viii. Hydro-brakes should be inspected every 6 months, litter/debris and silt build up should be removed as necessary.

6. SUMMARY

- 6.1 This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.
- 6.2 This SDS is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

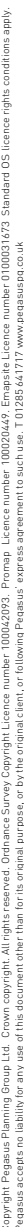
Table 6.1: Sustainable Drainage Statement Summary

		Existing Site	Proposed Development
Site Area (Ha)		3.25	
Impermeable Area (Ha)		-	1.41
Outfall Location		Watercourse	Watercourse/Sewer
Peak Runoff Rate (l/s)	QBAR	8.7	8.7
	1 in 30-Year	17.0	
	1 in 100-Year	22.2	
	1 in 100-Year + CC	-	
Infiltration Rate		N/A	N/A
Runoff Volume (100yr RP 6 hour Storm)		514.33m ³	699.00m ³
Volume Control		-	N/A
Proposed Storage Volume		-	1,015m ³
Interception Volume		-	IMP Area (m ²) x 0.005 (m) = 70.5m ³
Flow Control Type		-	Vortex
SuDS Features		-	Attenuation Basin (Recommended SuDS: Permeable Block Paving Swales Filter Drains)
Maintenance Responsibility		-	Management Company

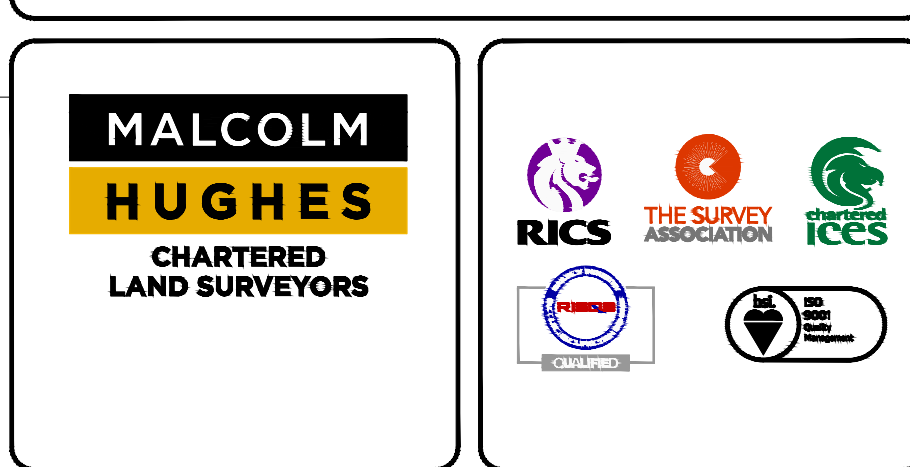
- 6.3 It is envisaged that the final drainage strategy will be determined during the detailed design stage, as the development layout is finalised.

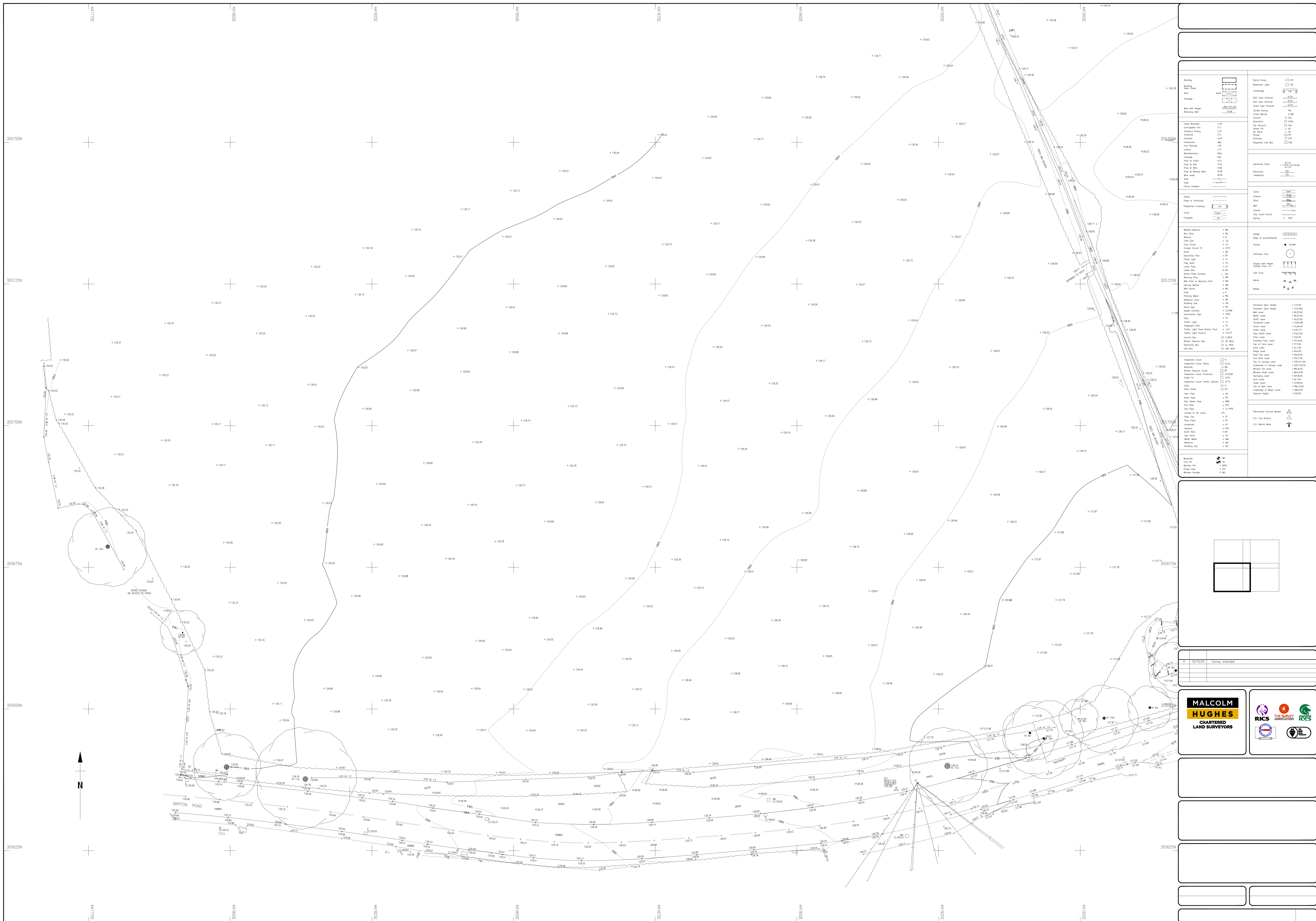
APPENDICES

APPENDIX 1: Outline Proposals



APPENDIX 2: Topographical Survey

[illegible][illegible]



APPENDIX 3: Existing Runoff Rates & Volumes

BWB Partnership		Page 1																								
Friars Studio 3 Friar Gate Derby DE1 1BU																										
Date 23/10/2019 16:54 File	Designed by josephine.green Checked by																									
Micro Drainage		Source Control 2018.1.1																								
<u>ICP SUDS Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.450</td> </tr> <tr> <td>Area (ha)</td> <td>1.970</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>700</td> <td>Region Number</td> <td>Region 4</td> </tr> </table> Results 1/s <table> <tr> <td>QBAR Rural</td> <td>8.7</td> </tr> <tr> <td>QBAR Urban</td> <td>8.7</td> </tr> <tr> <td>Q100 years</td> <td>22.2</td> </tr> <tr> <td>Q1 year</td> <td>7.2</td> </tr> <tr> <td>Q30 years</td> <td>17.0</td> </tr> <tr> <td>Q100 years</td> <td>22.2</td> </tr> </table>			Return Period (years)	100	Soil	0.450	Area (ha)	1.970	Urban	0.000	SAAR (mm)	700	Region Number	Region 4	QBAR Rural	8.7	QBAR Urban	8.7	Q100 years	22.2	Q1 year	7.2	Q30 years	17.0	Q100 years	22.2
Return Period (years)	100	Soil	0.450																							
Area (ha)	1.970	Urban	0.000																							
SAAR (mm)	700	Region Number	Region 4																							
QBAR Rural	8.7																									
QBAR Urban	8.7																									
Q100 years	22.2																									
Q1 year	7.2																									
Q30 years	17.0																									
Q100 years	22.2																									
©1982-2018 Innovyze																										

BWB Partnership		Page 1																																				
Friars Studio 3 Friar Gate Derby DE1 1BU																																						
Date 23/10/2019 17:03 File	Designed by josephine.green Checked by																																					
Micro Drainage		Source Control 2018.1.1																																				
<u>Greenfield Runoff Volume</u> FEH Data <table> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>1999</td> </tr> <tr> <td>Site Location</td> <td>GB 442400 305200 SK 42400 05200</td> </tr> <tr> <td>C (1km)</td> <td>-0.029</td> </tr> <tr> <td>D1 (1km)</td> <td>0.362</td> </tr> <tr> <td>D2 (1km)</td> <td>0.326</td> </tr> <tr> <td>D3 (1km)</td> <td>0.287</td> </tr> <tr> <td>E (1km)</td> <td>0.309</td> </tr> <tr> <td>F (1km)</td> <td>2.376</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>1.970</td> </tr> <tr> <td>SAAR (mm)</td> <td>644</td> </tr> <tr> <td>CWI</td> <td>94.920</td> </tr> <tr> <td>SPR Host</td> <td>39.770</td> </tr> <tr> <td>URBEXT (1990)</td> <td>0.1022</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>38.88</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>514.329</td> </tr> </table>			Return Period (years)	100	Storm Duration (mins)	360	FEH Rainfall Version	1999	Site Location	GB 442400 305200 SK 42400 05200	C (1km)	-0.029	D1 (1km)	0.362	D2 (1km)	0.326	D3 (1km)	0.287	E (1km)	0.309	F (1km)	2.376	Areal Reduction Factor	1.00	Area (ha)	1.970	SAAR (mm)	644	CWI	94.920	SPR Host	39.770	URBEXT (1990)	0.1022	Percentage Runoff (%)	38.88	Greenfield Runoff Volume (m³)	514.329
Return Period (years)	100																																					
Storm Duration (mins)	360																																					
FEH Rainfall Version	1999																																					
Site Location	GB 442400 305200 SK 42400 05200																																					
C (1km)	-0.029																																					
D1 (1km)	0.362																																					
D2 (1km)	0.326																																					
D3 (1km)	0.287																																					
E (1km)	0.309																																					
F (1km)	2.376																																					
Areal Reduction Factor	1.00																																					
Area (ha)	1.970																																					
SAAR (mm)	644																																					
CWI	94.920																																					
SPR Host	39.770																																					
URBEXT (1990)	0.1022																																					
Percentage Runoff (%)	38.88																																					
Greenfield Runoff Volume (m³)	514.329																																					
©1982-2018 Innovyze																																						

APPENDIX 4: Severn Trent Water Asset Mapping

Sewer Node		Sewer Pipe Data								
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK41057501	130.08	128.56	nil	F	VC	C	225	nil	0.00	nil
SK41057601	130.70	nil	nil	C	nil	nil	nil	nil	0.00	nil
SK41057602	nil	nil	nil	C	nil	nil	nil	nil	0.00	nil
SK41058601	nil	nil	126.00	C	nil	nil	nil	nil	0.00	nil
SK41059501	125.00	124.06	nil	S	VC	C	150	nil	0.00	nil
SK41059502	125.40	124.25	124.11	S	VC	C	150	nil	47.93	nil
SK41059601	126.14	124.69	124.23	S	VC	C	150	nil	57.57	nil
SK41059602	128.32	125.98	125.30	C	VC	C	225	nil	146.50	nil
SK42050500	nil	122.68	122.60	F	VC	C	nil	nil	0.00	nil
SK42050501	124.16	122.98	122.78	F	VC	C	nil	nil	76.30	nil
SK42050502	124.15	122.77	122.68	F	VC	C	nil	nil	0.00	nil
SK42050503	124.28	123.14	123.06	S	VC	C	300	nil	135.25	nil
SK42050504	124.01	123.32	123.15	S	VC	C	300	nil	97.88	nil
SK42050505	124.22	122.91	122.74	S	CO	C	600	nil	67.06	nil
SK42050506	124.17	122.59	122.57	C	VC	C	nil	nil	412.50	nil
SK42050507	123.99	122.52	122.44	C	VC	C	225	nil	300.50	nil
SK42050509	124.33	122.74	122.70	S	CO	C	600	nil	125.00	nil
SK42050510	124.71	123.96	123.93	S	VC	C	150	nil	438.33	nil
SK42050511	124.43	123.91	nil	S	VC	C	150	nil	0.00	nil
SK42050512	123.77	122.05	121.66	C	VC	C	225	nil	159.41	nil
SK42050601	124.32	123.39	123.35	S	VC	C	225	nil	419.00	nil
SK42050602	125.30	123.81	123.41	S	VC	C	225	nil	129.15	nil
SK42050603	126.76	125.39	124.58	S	VC	C	150	nil	68.72	nil
SK42050604	125.88	124.52	123.81	S	VC	C	225	nil	26.46	nil
SK42050605	124.80	123.13	122.63	C	VC	C	nil	nil	126.12	nil
SK42050606	126.93	125.27	123.70	C	VC	C	nil	nil	61.68	nil
SK42050607	125.23	124.13	122.93	S	CO	C	600	nil	85.97	nil
SK42050608	126.95	125.92	124.65	S	CO	C	225	nil	69.99	nil
SK42051501	124.62	122.28	122.06	C	VC	C	225	nil	255.55	nil
SK42051502	124.52	122.86	122.79	S	CO	C	450	nil	457.43	nil
SK42051503	124.43	123.20	123.06	S	CO	C	450	nil	307.21	nil
SK42051504	125.03	123.37	123.26	S	CO	C	450	nil	518.27	nil
SK42051505	125.25	122.75	122.55	F	VC	C	225	nil	347.15	nil
SK42051601	124.49	122.50	122.37	F	VC	C	225	nil	355.15	nil
SK42051603	125.71	123.66	123.17	C	VC	C	225	nil	110.08	nil
SK42051604	125.72	124.28	124.13	S	CO	C	600	nil	65.67	nil
SK42051605	125.79	124.14	123.71	F	VC	C	225	nil	102.44	nil
SK42051606	125.72	124.79	124.53	S	VC	C	300	nil	204.42	nil
SK42051607	125.95	124.61	124.34	S	CO	C	225	nil	45.81	nil
SK42051608	126.63	125.04	124.17	F	VC	C	225	nil	36.85	nil
SK42051701	126.00	124.40	124.16	F	VC	C	225	nil	145.88	nil
SK42051702	126.39	125.30	124.84	S	VC	C	150	nil	143.50	nil
SK42051703	126.61	125.36	125.31	S	VC	C	150	nil	206.00	nil
SK42051704	124.64	124.63	124.59	S	VC	C	150	nil	176.75	nil

SEVERN

TRENT

WATER

SEWER RECORD DATA TABLE

O/S Map scale:

1:2500

This map is centred upon:

O / S Grid reference:

Date of issue:

18.09.19

x:

441963

2 of 2

y:

305712

Disclaimer Statement:

1. Do not scale off this Map.

1 October 2011

4

100018202

MATERIALS

SHAPE

PURPOSE

TABULAR KEY

A. Sewer pipe data refers to downstream sewer pipe.

B. Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.

C. Gradient is stated a 1 in...

On 1st October 2011 many private sewers were transferred into the ownership of Severn Trent Water as public sewers, where two or more properties in separate ownership are served by those sewers. Most of these former private sewers will not be shown on the public sewer records, therefore a full site survey should be carried out prior to any layout design or construction works to identify where these sewers may be and to avoid later delays and possible added costs.

WONDERFUL ON TAP



WONDERFUL ON TAP



MISCINCOME.NC@SEVERNTRENT.CO.UK

A handwritten signature in black ink, appearing to be "M. Smith".

APPENDIX 5: Micro Drainage Storage Calculations

BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 24/10/2019 08:47		Designed by josephine.green				
File Eastern Catchment (FEH)...		Checked by				
Micro Drainage			Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event			Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³) Status
15 min Summer			125.233	0.393	5.7	328.2 O K
30 min Summer			125.293	0.453	5.7	382.5 O K
60 min Summer			125.358	0.518	5.7	443.1 O K
120 min Summer			125.427	0.587	5.7	508.4 O K
180 min Summer			125.466	0.626	5.7	546.0 O K
240 min Summer			125.492	0.652	5.7	571.2 O K
360 min Summer			125.523	0.683	5.7	601.8 O K
480 min Summer			125.539	0.699	5.7	617.9 O K
600 min Summer			125.547	0.707	5.7	625.6 O K
720 min Summer			125.549	0.709	5.7	627.9 O K
960 min Summer			125.536	0.696	5.7	615.3 O K
1440 min Summer			125.510	0.670	5.7	589.2 O K
2160 min Summer			125.470	0.630	5.7	550.0 O K
2880 min Summer			125.430	0.590	5.7	511.3 O K
4320 min Summer			125.330	0.490	5.7	417.0 O K
5760 min Summer			125.244	0.404	5.7	338.0 O K
7200 min Summer			125.171	0.331	5.7	273.1 O K
8640 min Summer			125.110	0.270	5.7	220.9 O K
10080 min Summer			125.063	0.223	5.7	180.5 O K
15 min Winter			125.277	0.437	5.7	368.3 O K
30 min Winter			125.344	0.504	5.7	429.5 O K
Storm Event			Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer			181.874	0.0	312.9	26
30 min Summer			106.550	0.0	364.3	41
60 min Summer			62.422	0.0	449.6	70
120 min Summer			36.570	0.0	526.6	130
180 min Summer			26.748	0.0	577.3	188
240 min Summer			21.424	0.0	616.0	248
360 min Summer			15.670	0.0	674.1	366
480 min Summer			12.551	0.0	717.7	484
600 min Summer			10.567	0.0	752.3	602
720 min Summer			9.180	0.0	780.3	722
960 min Summer			7.277	0.0	813.3	892
1440 min Summer			5.246	0.0	817.6	1122
2160 min Summer			3.781	0.0	993.7	1516
2880 min Summer			2.997	0.0	1049.4	1936
4320 min Summer			2.127	0.0	1114.1	2724
5760 min Summer			1.667	0.0	1173.6	3464
7200 min Summer			1.380	0.0	1213.9	4184
8640 min Summer			1.183	0.0	1247.0	4848
10080 min Summer			1.038	0.0	1273.6	5544
15 min Winter			181.874	0.0	349.3	26
30 min Winter			106.550	0.0	403.5	41
©1982-2018 Innovyze						

BWB Partnership				Page 2	
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 24/10/2019 08:47 File Eastern Catchment (FEH)...		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	125.416	0.576	5.7	498.2	O K
120 min Winter	125.493	0.653	5.7	572.0	O K
180 min Winter	125.536	0.696	5.7	615.4	O K
240 min Winter	125.566	0.726	5.7	644.8	O K
360 min Winter	125.602	0.762	5.7	681.9	O K
480 min Winter	125.623	0.783	5.7	702.7	O K
600 min Winter	125.634	0.794	5.7	714.2	O K
720 min Winter	125.639	0.799	5.7	719.7	O K
960 min Winter	125.630	0.790	5.7	710.3	O K
1440 min Winter	125.596	0.756	5.7	675.2	O K
2160 min Winter	125.546	0.706	5.7	625.1	O K
2880 min Winter	125.492	0.652	5.7	571.1	O K
4320 min Winter	125.352	0.512	5.7	437.8	O K
5760 min Winter	125.220	0.380	5.7	316.8	O K
7200 min Winter	125.115	0.275	5.7	224.9	O K
8640 min Winter	125.039	0.199	5.7	160.6	O K
10080 min Winter	124.991	0.151	5.5	120.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	62.422	0.0	503.6	70	
120 min Winter	36.570	0.0	589.4	128	
180 min Winter	26.748	0.0	645.7	186	
240 min Winter	21.424	0.0	688.4	244	
360 min Winter	15.670	0.0	751.9	360	
480 min Winter	12.551	0.0	798.1	474	
600 min Winter	10.567	0.0	832.7	588	
720 min Winter	9.180	0.0	857.2	700	
960 min Winter	7.277	0.0	870.0	918	
1440 min Winter	5.246	0.0	835.1	1176	
2160 min Winter	3.781	0.0	1112.9	1628	
2880 min Winter	2.997	0.0	1175.0	2088	
4320 min Winter	2.127	0.0	1246.6	2948	
5760 min Winter	1.667	0.0	1314.8	3688	
7200 min Winter	1.380	0.0	1360.0	4328	
8640 min Winter	1.183	0.0	1397.4	4936	
10080 min Winter	1.038	0.0	1427.9	5544	
©1982-2018 Innovyze					

BWB Partnership		Page 3
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 24/10/2019 08:47 File Eastern Catchment (FEH)...		
Designed by josephine.green Checked by		
Micro Drainage		Source Control 2018.1.1

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 442400 305200 SK 42400 05200
C (1km)	-0.029
D1 (1km)	0.362
D2 (1km)	0.326
D3 (1km)	0.287
E (1km)	0.309
F (1km)	2.376
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.980

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4	4	8	8	12
	0.326		0.327		0.327

©1982-2018 Innovyze

BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 24/10/2019 08:47 File Eastern Catchment (FEH)...		
Designed by josephine.green Checked by		
Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 125.940

Tank or Pond Structure

Invert Level (m) 124.840

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	775.9	1.000	1100.4	1.100	1136.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0115-5700-0800-5700
Design Head (m)	0.800
Design Flow (l/s)	5.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	115
Invert Level (m)	124.840
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	5.7
Flush-Flo™	0.244	5.7
Kick-Flo®	0.543	4.8
Mean Flow over Head Range	-	4.9

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)
0.100	4.0	1.200	6.9	3.000	10.6	7.000	15.9
0.200	5.7	1.400	7.4	3.500	11.4	7.500	16.4
0.300	5.7	1.600	7.9	4.000	12.2	8.000	16.9
0.400	5.5	1.800	8.3	4.500	12.9	8.500	17.4
0.500	5.1	2.000	8.8	5.000	13.5	9.000	17.9
0.600	5.0	2.200	9.2	5.500	14.1	9.500	18.4
0.800	5.7	2.400	9.5	6.000	14.8		
1.000	6.3	2.600	9.9	6.500	15.3		

©1982-2018 Innovyze

BWB Partnership					Page 1	
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 24/10/2019 08:51 File Eastern Catchment (FSR)...		Designed by josephine.green Checked by				
Micro Drainage			Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		125.173	0.333	5.7	257.8	O K
30 min Summer		125.267	0.427	5.7	336.8	O K
60 min Summer		125.358	0.518	5.7	416.1	O K
120 min Summer		125.441	0.601	5.7	490.6	O K
180 min Summer		125.481	0.641	5.7	527.3	O K
240 min Summer		125.503	0.663	5.7	547.8	O K
360 min Summer		125.530	0.690	5.7	572.7	O K
480 min Summer		125.541	0.701	5.7	583.2	O K
600 min Summer		125.544	0.704	5.7	585.8	O K
720 min Summer		125.541	0.701	5.7	583.4	O K
960 min Summer		125.529	0.689	5.7	571.8	O K
1440 min Summer		125.502	0.662	5.7	546.9	O K
2160 min Summer		125.460	0.620	5.7	508.0	O K
2880 min Summer		125.417	0.577	5.7	468.6	O K
4320 min Summer		125.322	0.482	5.7	384.8	O K
5760 min Summer		125.239	0.399	5.7	313.3	O K
7200 min Summer		125.167	0.327	5.7	253.5	O K
8640 min Summer		125.108	0.268	5.7	205.3	O K
10080 min Summer		125.061	0.221	5.7	167.7	O K
15 min Winter		125.211	0.371	5.7	289.4	O K
30 min Winter		125.315	0.475	5.7	378.3	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		143.457	0.0	248.4	26	
30 min Summer		94.113	0.0	325.5	41	
60 min Summer		58.745	0.0	424.0	70	
120 min Summer		35.372	0.0	510.6	130	
180 min Summer		25.914	0.0	560.8	188	
240 min Summer		20.646	0.0	595.3	248	
360 min Summer		15.021	0.0	648.5	366	
480 min Summer		11.967	0.0	687.4	484	
600 min Summer		10.024	0.0	718.0	602	
720 min Summer		8.670	0.0	743.0	720	
960 min Summer		6.890	0.0	780.5	856	
1440 min Summer		4.976	0.0	810.2	1102	
2160 min Summer		3.587	0.0	943.6	1500	
2880 min Summer		2.841	0.0	995.8	1912	
4320 min Summer		2.043	0.0	1071.7	2688	
5760 min Summer		1.615	0.0	1137.1	3456	
7200 min Summer		1.345	0.0	1183.1	4176	
8640 min Summer		1.158	0.0	1221.1	4840	
10080 min Summer		1.020	0.0	1251.8	5544	
15 min Winter		143.457	0.0	278.5	26	
30 min Winter		94.113	0.0	362.9	41	
©1982-2018 Innovyze						

BWB Partnership				Page 2		
Friars Studio 3 Friar Gate Derby DE1 1BU						
Date 24/10/2019 08:51 File Eastern Catchment (FSR)...		Designed by josephine.green Checked by				
Micro Drainage		Source Control 2018.1.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter		125.416	0.576	5.7	468.0	O K
120 min Winter		125.508	0.668	5.7	552.0	O K
180 min Winter		125.553	0.713	5.7	594.4	O K
240 min Winter		125.579	0.739	5.7	618.7	O K
360 min Winter		125.611	0.771	5.7	649.4	O K
480 min Winter		125.626	0.786	5.7	663.9	O K
600 min Winter		125.632	0.792	5.7	669.6	O K
720 min Winter		125.632	0.792	5.7	669.8	O K
960 min Winter		125.622	0.782	5.7	660.2	O K
1440 min Winter		125.587	0.747	5.7	626.6	O K
2160 min Winter		125.533	0.693	5.7	575.7	O K
2880 min Winter		125.474	0.634	5.7	520.7	O K
4320 min Winter		125.337	0.497	5.7	397.7	O K
5760 min Winter		125.209	0.369	5.7	287.9	O K
7200 min Winter		125.106	0.266	5.7	203.7	O K
8640 min Winter		125.033	0.193	5.6	145.4	O K
10080 min Winter		124.986	0.146	5.5	109.5	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter		58.745	0.0	474.9	70	
120 min Winter		35.372	0.0	571.6	128	
180 min Winter		25.914	0.0	627.4	186	
240 min Winter		20.646	0.0	665.7	242	
360 min Winter		15.021	0.0	724.3	358	
480 min Winter		11.967	0.0	766.4	474	
600 min Winter		10.024	0.0	798.6	588	
720 min Winter		8.670	0.0	823.5	698	
960 min Winter		6.890	0.0	853.8	914	
1440 min Winter		4.976	0.0	836.1	1154	
2160 min Winter		3.587	0.0	1056.9	1612	
2880 min Winter		2.841	0.0	1115.2	2080	
4320 min Winter		2.043	0.0	1199.8	2940	
5760 min Winter		1.615	0.0	1273.8	3640	
7200 min Winter		1.345	0.0	1325.5	4320	
8640 min Winter		1.158	0.0	1368.2	4928	
10080 min Winter		1.020	0.0	1403.4	5456	
©1982-2018 Innovyze						

BWB Partnership		Page 3																																										
Friars Studio 3 Friar Gate Derby DE1 1BU																																												
Date 24/10/2019 08:51 File Eastern Catchment (FSR)...	Designed by josephine.green Checked by																																											
Micro Drainage		Source Control 2018.1.1																																										
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.700</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.400</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.980 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.326</td> <td>4 8</td> <td>0.327</td> <td>8 12</td> <td>0.327</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.700	Shortest Storm (mins)	15	Ratio R	0.400	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	0 4	0.326	4 8	0.327	8 12	0.327
Rainfall Model	FSR	Winter Storms	Yes																																									
Return Period (years)	100	Cv (Summer)	0.750																																									
Region	England and Wales	Cv (Winter)	0.840																																									
M5-60 (mm)	20.700	Shortest Storm (mins)	15																																									
Ratio R	0.400	Longest Storm (mins)	10080																																									
Summer Storms	Yes	Climate Change %	+40																																									
Time (mins)	Area	Time (mins)	Area	Time (mins)	Area																																							
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)																																							
0 4	0.326	4 8	0.327	8 12	0.327																																							
©1982-2018 Innovyze																																												

BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 24/10/2019 08:51 File Eastern Catchment (FSR)...	Designed by josephine.green Checked by	
Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 125.940

Tank or Pond Structure

Invert Level (m) 124.840

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	726.6	1.000	1041.5	1.100	1076.1

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0115-5700-0800-5700
Design Head (m)	0.800
Design Flow (l/s)	5.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	115
Invert Level (m)	124.840
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	5.7
Flush-Flo™	0.244	5.7
Kick-Flo®	0.543	4.8
Mean Flow over Head Range	-	4.9

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)
0.100	4.0	1.200	6.9	3.000	10.6	7.000	15.9
0.200	5.7	1.400	7.4	3.500	11.4	7.500	16.4
0.300	5.7	1.600	7.9	4.000	12.2	8.000	16.9
0.400	5.5	1.800	8.3	4.500	12.9	8.500	17.4
0.500	5.1	2.000	8.8	5.000	13.5	9.000	17.9
0.600	5.0	2.200	9.2	5.500	14.1	9.500	18.4
0.800	5.7	2.400	9.5	6.000	14.8		
1.000	6.3	2.600	9.9	6.500	15.3		

©1982-2018 Innovyze

BWB Partnership					Page 1																																																																																																																																					
Friars Studio 3 Friar Gate Derby DE1 1BU																																																																																																																																										
Date 23/10/2019 17:21 File Western Catchment.srcx		Designed by josephine.green Checked by																																																																																																																																								
Micro Drainage			Source Control 2018.1.1																																																																																																																																							
<u>Summary of Results for 100 year Return Period (+40%)</u>																																																																																																																																										
<table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>126.958</td><td>0.558</td><td>3.0</td><td>143.3</td><td>O K</td></tr><tr><td>30 min Summer</td><td>127.034</td><td>0.634</td><td>3.0</td><td>166.9</td><td>O K</td></tr><tr><td>60 min Summer</td><td>127.112</td><td>0.712</td><td>3.0</td><td>192.5</td><td>O K</td></tr><tr><td>120 min Summer</td><td>127.188</td><td>0.788</td><td>3.0</td><td>218.7</td><td>O K</td></tr><tr><td>180 min Summer</td><td>127.229</td><td>0.829</td><td>3.0</td><td>233.1</td><td>O K</td></tr><tr><td>240 min Summer</td><td>127.254</td><td>0.854</td><td>3.0</td><td>242.0</td><td>O K</td></tr><tr><td>360 min Summer</td><td>127.279</td><td>0.879</td><td>3.0</td><td>251.4</td><td>O K</td></tr><tr><td>480 min Summer</td><td>127.288</td><td>0.888</td><td>3.0</td><td>254.6</td><td>O K</td></tr><tr><td>600 min Summer</td><td>127.287</td><td>0.887</td><td>3.0</td><td>254.4</td><td>O K</td></tr><tr><td>720 min Summer</td><td>127.281</td><td>0.881</td><td>3.0</td><td>252.1</td><td>O K</td></tr><tr><td>960 min Summer</td><td>127.258</td><td>0.858</td><td>3.0</td><td>243.6</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>127.215</td><td>0.815</td><td>3.0</td><td>228.0</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>127.155</td><td>0.755</td><td>3.0</td><td>207.3</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>127.098</td><td>0.698</td><td>3.0</td><td>187.8</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>126.951</td><td>0.551</td><td>3.0</td><td>141.2</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>126.824</td><td>0.424</td><td>3.0</td><td>104.0</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>126.723</td><td>0.323</td><td>3.0</td><td>76.6</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>126.648</td><td>0.248</td><td>3.0</td><td>57.1</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>126.594</td><td>0.194</td><td>2.9</td><td>43.7</td><td>O K</td></tr><tr><td>15 min Winter</td><td>127.015</td><td>0.615</td><td>3.0</td><td>161.0</td><td>O K</td></tr><tr><td>30 min Winter</td><td>127.097</td><td>0.697</td><td>3.0</td><td>187.5</td><td>O K</td></tr></tbody></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	126.958	0.558	3.0	143.3	O K	30 min Summer	127.034	0.634	3.0	166.9	O K	60 min Summer	127.112	0.712	3.0	192.5	O K	120 min Summer	127.188	0.788	3.0	218.7	O K	180 min Summer	127.229	0.829	3.0	233.1	O K	240 min Summer	127.254	0.854	3.0	242.0	O K	360 min Summer	127.279	0.879	3.0	251.4	O K	480 min Summer	127.288	0.888	3.0	254.6	O K	600 min Summer	127.287	0.887	3.0	254.4	O K	720 min Summer	127.281	0.881	3.0	252.1	O K	960 min Summer	127.258	0.858	3.0	243.6	O K	1440 min Summer	127.215	0.815	3.0	228.0	O K	2160 min Summer	127.155	0.755	3.0	207.3	O K	2880 min Summer	127.098	0.698	3.0	187.8	O K	4320 min Summer	126.951	0.551	3.0	141.2	O K	5760 min Summer	126.824	0.424	3.0	104.0	O K	7200 min Summer	126.723	0.323	3.0	76.6	O K	8640 min Summer	126.648	0.248	3.0	57.1	O K	10080 min Summer	126.594	0.194	2.9	43.7	O K	15 min Winter	127.015	0.615	3.0	161.0	O K	30 min Winter	127.097	0.697	3.0	187.5	O K
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status																																																																																																																																					
15 min Summer	126.958	0.558	3.0	143.3	O K																																																																																																																																					
30 min Summer	127.034	0.634	3.0	166.9	O K																																																																																																																																					
60 min Summer	127.112	0.712	3.0	192.5	O K																																																																																																																																					
120 min Summer	127.188	0.788	3.0	218.7	O K																																																																																																																																					
180 min Summer	127.229	0.829	3.0	233.1	O K																																																																																																																																					
240 min Summer	127.254	0.854	3.0	242.0	O K																																																																																																																																					
360 min Summer	127.279	0.879	3.0	251.4	O K																																																																																																																																					
480 min Summer	127.288	0.888	3.0	254.6	O K																																																																																																																																					
600 min Summer	127.287	0.887	3.0	254.4	O K																																																																																																																																					
720 min Summer	127.281	0.881	3.0	252.1	O K																																																																																																																																					
960 min Summer	127.258	0.858	3.0	243.6	O K																																																																																																																																					
1440 min Summer	127.215	0.815	3.0	228.0	O K																																																																																																																																					
2160 min Summer	127.155	0.755	3.0	207.3	O K																																																																																																																																					
2880 min Summer	127.098	0.698	3.0	187.8	O K																																																																																																																																					
4320 min Summer	126.951	0.551	3.0	141.2	O K																																																																																																																																					
5760 min Summer	126.824	0.424	3.0	104.0	O K																																																																																																																																					
7200 min Summer	126.723	0.323	3.0	76.6	O K																																																																																																																																					
8640 min Summer	126.648	0.248	3.0	57.1	O K																																																																																																																																					
10080 min Summer	126.594	0.194	2.9	43.7	O K																																																																																																																																					
15 min Winter	127.015	0.615	3.0	161.0	O K																																																																																																																																					
30 min Winter	127.097	0.697	3.0	187.5	O K																																																																																																																																					
<table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>181.874</td><td>0.0</td><td>144.6</td><td>26</td></tr><tr><td>30 min Summer</td><td>106.550</td><td>0.0</td><td>169.1</td><td>41</td></tr><tr><td>60 min Summer</td><td>62.422</td><td>0.0</td><td>200.5</td><td>70</td></tr><tr><td>120 min Summer</td><td>36.570</td><td>0.0</td><td>234.9</td><td>128</td></tr><tr><td>180 min Summer</td><td>26.748</td><td>0.0</td><td>257.7</td><td>188</td></tr><tr><td>240 min Summer</td><td>21.424</td><td>0.0</td><td>275.2</td><td>246</td></tr><tr><td>360 min Summer</td><td>15.670</td><td>0.0</td><td>301.9</td><td>364</td></tr><tr><td>480 min Summer</td><td>12.551</td><td>0.0</td><td>322.3</td><td>482</td></tr><tr><td>600 min Summer</td><td>10.567</td><td>0.0</td><td>339.1</td><td>600</td></tr><tr><td>720 min Summer</td><td>9.180</td><td>0.0</td><td>353.3</td><td>690</td></tr><tr><td>960 min Summer</td><td>7.277</td><td>0.0</td><td>373.0</td><td>798</td></tr><tr><td>1440 min Summer</td><td>5.246</td><td>0.0</td><td>401.1</td><td>1048</td></tr><tr><td>2160 min Summer</td><td>3.781</td><td>0.0</td><td>438.5</td><td>1468</td></tr><tr><td>2880 min Summer</td><td>2.997</td><td>0.0</td><td>463.4</td><td>1880</td></tr><tr><td>4320 min Summer</td><td>2.127</td><td>0.0</td><td>492.9</td><td>2644</td></tr><tr><td>5760 min Summer</td><td>1.667</td><td>0.0</td><td>515.9</td><td>3352</td></tr><tr><td>7200 min Summer</td><td>1.380</td><td>0.0</td><td>533.8</td><td>4040</td></tr><tr><td>8640 min Summer</td><td>1.183</td><td>0.0</td><td>548.8</td><td>4672</td></tr><tr><td>10080 min Summer</td><td>1.038</td><td>0.0</td><td>561.6</td><td>5352</td></tr><tr><td>15 min Winter</td><td>181.874</td><td>0.0</td><td>161.8</td><td>26</td></tr><tr><td>30 min Winter</td><td>106.550</td><td>0.0</td><td>188.8</td><td>41</td></tr></tbody></table>							Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	181.874	0.0	144.6	26	30 min Summer	106.550	0.0	169.1	41	60 min Summer	62.422	0.0	200.5	70	120 min Summer	36.570	0.0	234.9	128	180 min Summer	26.748	0.0	257.7	188	240 min Summer	21.424	0.0	275.2	246	360 min Summer	15.670	0.0	301.9	364	480 min Summer	12.551	0.0	322.3	482	600 min Summer	10.567	0.0	339.1	600	720 min Summer	9.180	0.0	353.3	690	960 min Summer	7.277	0.0	373.0	798	1440 min Summer	5.246	0.0	401.1	1048	2160 min Summer	3.781	0.0	438.5	1468	2880 min Summer	2.997	0.0	463.4	1880	4320 min Summer	2.127	0.0	492.9	2644	5760 min Summer	1.667	0.0	515.9	3352	7200 min Summer	1.380	0.0	533.8	4040	8640 min Summer	1.183	0.0	548.8	4672	10080 min Summer	1.038	0.0	561.6	5352	15 min Winter	181.874	0.0	161.8	26	30 min Winter	106.550	0.0	188.8	41																						
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)																																																																																																																																						
15 min Summer	181.874	0.0	144.6	26																																																																																																																																						
30 min Summer	106.550	0.0	169.1	41																																																																																																																																						
60 min Summer	62.422	0.0	200.5	70																																																																																																																																						
120 min Summer	36.570	0.0	234.9	128																																																																																																																																						
180 min Summer	26.748	0.0	257.7	188																																																																																																																																						
240 min Summer	21.424	0.0	275.2	246																																																																																																																																						
360 min Summer	15.670	0.0	301.9	364																																																																																																																																						
480 min Summer	12.551	0.0	322.3	482																																																																																																																																						
600 min Summer	10.567	0.0	339.1	600																																																																																																																																						
720 min Summer	9.180	0.0	353.3	690																																																																																																																																						
960 min Summer	7.277	0.0	373.0	798																																																																																																																																						
1440 min Summer	5.246	0.0	401.1	1048																																																																																																																																						
2160 min Summer	3.781	0.0	438.5	1468																																																																																																																																						
2880 min Summer	2.997	0.0	463.4	1880																																																																																																																																						
4320 min Summer	2.127	0.0	492.9	2644																																																																																																																																						
5760 min Summer	1.667	0.0	515.9	3352																																																																																																																																						
7200 min Summer	1.380	0.0	533.8	4040																																																																																																																																						
8640 min Summer	1.183	0.0	548.8	4672																																																																																																																																						
10080 min Summer	1.038	0.0	561.6	5352																																																																																																																																						
15 min Winter	181.874	0.0	161.8	26																																																																																																																																						
30 min Winter	106.550	0.0	188.8	41																																																																																																																																						
©1982-2018 Innovyze																																																																																																																																										

BWB Partnership				Page 2	
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/10/2019 17:21 File Western Catchment.srcx		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	127.182	0.782	3.0	216.5	O K
120 min Winter	127.267	0.867	3.0	246.8	O K
180 min Winter	127.313	0.913	3.0	263.8	O K
240 min Winter	127.342	0.942	3.0	274.8	O K
360 min Winter	127.374	0.974	3.0	287.2	O K
480 min Winter	127.388	0.988	3.0	292.6	O K
600 min Winter	127.392	0.992	3.0	294.2	O K
720 min Winter	127.390	0.990	3.0	293.3	O K
960 min Winter	127.364	0.964	3.0	283.4	O K
1440 min Winter	127.312	0.912	3.0	263.4	O K
2160 min Winter	127.233	0.833	3.0	234.6	O K
2880 min Winter	127.152	0.752	3.0	206.1	O K
4320 min Winter	126.936	0.536	3.0	136.6	O K
5760 min Winter	126.750	0.350	3.0	83.7	O K
7200 min Winter	126.624	0.224	3.0	51.2	O K
8640 min Winter	126.550	0.150	2.8	33.5	O K
10080 min Winter	126.510	0.110	2.6	24.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	62.422	0.0	224.6	70	
120 min Winter	36.570	0.0	263.1	126	
180 min Winter	26.748	0.0	288.6	184	
240 min Winter	21.424	0.0	308.2	242	
360 min Winter	15.670	0.0	338.0	358	
480 min Winter	12.551	0.0	360.8	472	
600 min Winter	10.567	0.0	379.4	584	
720 min Winter	9.180	0.0	395.2	694	
960 min Winter	7.277	0.0	416.6	898	
1440 min Winter	5.246	0.0	440.6	1116	
2160 min Winter	3.781	0.0	491.1	1584	
2880 min Winter	2.997	0.0	519.0	2044	
4320 min Winter	2.127	0.0	552.2	2848	
5760 min Winter	1.667	0.0	577.8	3472	
7200 min Winter	1.380	0.0	597.9	4104	
8640 min Winter	1.183	0.0	614.8	4680	
10080 min Winter	1.038	0.0	629.2	5248	
©1982-2018 Innovyze					

BWB Partnership		Page 3
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/10/2019 17:21 File Western Catchment.srcx		
Designed by josephine.green		
Checked by		
Micro Drainage		Source Control 2018.1.1

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 442400 305200 SK 42400 05200
C (1km)	-0.029
D1 (1km)	0.362
D2 (1km)	0.326
D3 (1km)	0.287
E (1km)	0.309
F (1km)	2.376
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.430

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4 0.143	4	8 0.143	8	12 0.144

©1982-2018 Innovyze

BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/10/2019 17:21 File Western Catchment.srcx		
Designed by josephine.green Checked by		
Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 127.700

Tank or Pond Structure

Invert Level (m) 126.400

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	210.7	1.000	393.4	1.300	459.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0082-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	126.400
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.0
Flush-Flo™	0.297	3.0
Kick-Flo®	0.623	2.4
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)
0.100	2.4	1.200	3.3	3.000	5.0	7.000	7.4
0.200	2.9	1.400	3.5	3.500	5.4	7.500	7.7
0.300	3.0	1.600	3.7	4.000	5.7	8.000	7.9
0.400	2.9	1.800	3.9	4.500	6.0	8.500	8.2
0.500	2.8	2.000	4.1	5.000	6.3	9.000	8.4
0.600	2.5	2.200	4.3	5.500	6.6	9.500	8.6
0.800	2.7	2.400	4.5	6.000	6.9		
1.000	3.0	2.600	4.7	6.500	7.2		

©1982-2018 Innovyze

BWB Partnership					Page 1																																																																																																																																					
Friars Studio 3 Friar Gate Derby DE1 1BU																																																																																																																																										
Date 23/10/2019 17:33 File Western Catchment (FSR)...		Designed by josephine.green Checked by																																																																																																																																								
Micro Drainage			Source Control 2018.1.1																																																																																																																																							
<u>Summary of Results for 100 year Return Period (+40%)</u>																																																																																																																																										
<table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>126.852</td><td>0.452</td><td>3.0</td><td>111.8</td><td>O K</td></tr><tr><td>30 min Summer</td><td>126.967</td><td>0.567</td><td>3.0</td><td>146.0</td><td>O K</td></tr><tr><td>60 min Summer</td><td>127.074</td><td>0.674</td><td>3.0</td><td>179.9</td><td>O K</td></tr><tr><td>120 min Summer</td><td>127.164</td><td>0.764</td><td>3.0</td><td>210.2</td><td>O K</td></tr><tr><td>180 min Summer</td><td>127.204</td><td>0.804</td><td>3.0</td><td>224.3</td><td>O K</td></tr><tr><td>240 min Summer</td><td>127.224</td><td>0.824</td><td>3.0</td><td>231.4</td><td>O K</td></tr><tr><td>360 min Summer</td><td>127.244</td><td>0.844</td><td>3.0</td><td>238.5</td><td>O K</td></tr><tr><td>480 min Summer</td><td>127.247</td><td>0.847</td><td>3.0</td><td>239.6</td><td>O K</td></tr><tr><td>600 min Summer</td><td>127.241</td><td>0.841</td><td>3.0</td><td>237.4</td><td>O K</td></tr><tr><td>720 min Summer</td><td>127.231</td><td>0.831</td><td>3.0</td><td>233.7</td><td>O K</td></tr><tr><td>960 min Summer</td><td>127.209</td><td>0.809</td><td>3.0</td><td>226.1</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>127.167</td><td>0.767</td><td>3.0</td><td>211.4</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>127.107</td><td>0.707</td><td>3.0</td><td>190.8</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>127.045</td><td>0.645</td><td>3.0</td><td>170.5</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>126.907</td><td>0.507</td><td>3.0</td><td>128.0</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>126.793</td><td>0.393</td><td>3.0</td><td>95.3</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>126.701</td><td>0.301</td><td>3.0</td><td>70.8</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>126.633</td><td>0.233</td><td>3.0</td><td>53.5</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>126.584</td><td>0.184</td><td>2.9</td><td>41.4</td><td>O K</td></tr><tr><td>15 min Winter</td><td>126.899</td><td>0.499</td><td>3.0</td><td>125.6</td><td>O K</td></tr><tr><td>30 min Winter</td><td>127.025</td><td>0.625</td><td>3.0</td><td>164.2</td><td>O K</td></tr></tbody></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	126.852	0.452	3.0	111.8	O K	30 min Summer	126.967	0.567	3.0	146.0	O K	60 min Summer	127.074	0.674	3.0	179.9	O K	120 min Summer	127.164	0.764	3.0	210.2	O K	180 min Summer	127.204	0.804	3.0	224.3	O K	240 min Summer	127.224	0.824	3.0	231.4	O K	360 min Summer	127.244	0.844	3.0	238.5	O K	480 min Summer	127.247	0.847	3.0	239.6	O K	600 min Summer	127.241	0.841	3.0	237.4	O K	720 min Summer	127.231	0.831	3.0	233.7	O K	960 min Summer	127.209	0.809	3.0	226.1	O K	1440 min Summer	127.167	0.767	3.0	211.4	O K	2160 min Summer	127.107	0.707	3.0	190.8	O K	2880 min Summer	127.045	0.645	3.0	170.5	O K	4320 min Summer	126.907	0.507	3.0	128.0	O K	5760 min Summer	126.793	0.393	3.0	95.3	O K	7200 min Summer	126.701	0.301	3.0	70.8	O K	8640 min Summer	126.633	0.233	3.0	53.5	O K	10080 min Summer	126.584	0.184	2.9	41.4	O K	15 min Winter	126.899	0.499	3.0	125.6	O K	30 min Winter	127.025	0.625	3.0	164.2	O K
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status																																																																																																																																					
15 min Summer	126.852	0.452	3.0	111.8	O K																																																																																																																																					
30 min Summer	126.967	0.567	3.0	146.0	O K																																																																																																																																					
60 min Summer	127.074	0.674	3.0	179.9	O K																																																																																																																																					
120 min Summer	127.164	0.764	3.0	210.2	O K																																																																																																																																					
180 min Summer	127.204	0.804	3.0	224.3	O K																																																																																																																																					
240 min Summer	127.224	0.824	3.0	231.4	O K																																																																																																																																					
360 min Summer	127.244	0.844	3.0	238.5	O K																																																																																																																																					
480 min Summer	127.247	0.847	3.0	239.6	O K																																																																																																																																					
600 min Summer	127.241	0.841	3.0	237.4	O K																																																																																																																																					
720 min Summer	127.231	0.831	3.0	233.7	O K																																																																																																																																					
960 min Summer	127.209	0.809	3.0	226.1	O K																																																																																																																																					
1440 min Summer	127.167	0.767	3.0	211.4	O K																																																																																																																																					
2160 min Summer	127.107	0.707	3.0	190.8	O K																																																																																																																																					
2880 min Summer	127.045	0.645	3.0	170.5	O K																																																																																																																																					
4320 min Summer	126.907	0.507	3.0	128.0	O K																																																																																																																																					
5760 min Summer	126.793	0.393	3.0	95.3	O K																																																																																																																																					
7200 min Summer	126.701	0.301	3.0	70.8	O K																																																																																																																																					
8640 min Summer	126.633	0.233	3.0	53.5	O K																																																																																																																																					
10080 min Summer	126.584	0.184	2.9	41.4	O K																																																																																																																																					
15 min Winter	126.899	0.499	3.0	125.6	O K																																																																																																																																					
30 min Winter	127.025	0.625	3.0	164.2	O K																																																																																																																																					
<table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>142.699</td><td>0.0</td><td>113.4</td><td>26</td></tr><tr><td>30 min Summer</td><td>93.626</td><td>0.0</td><td>148.8</td><td>41</td></tr><tr><td>60 min Summer</td><td>58.456</td><td>0.0</td><td>187.7</td><td>70</td></tr><tr><td>120 min Summer</td><td>35.213</td><td>0.0</td><td>226.2</td><td>128</td></tr><tr><td>180 min Summer</td><td>25.807</td><td>0.0</td><td>248.7</td><td>188</td></tr><tr><td>240 min Summer</td><td>20.567</td><td>0.0</td><td>264.2</td><td>246</td></tr><tr><td>360 min Summer</td><td>14.959</td><td>0.0</td><td>288.2</td><td>364</td></tr><tr><td>480 min Summer</td><td>11.918</td><td>0.0</td><td>306.1</td><td>482</td></tr><tr><td>600 min Summer</td><td>9.984</td><td>0.0</td><td>320.5</td><td>600</td></tr><tr><td>720 min Summer</td><td>8.635</td><td>0.0</td><td>332.5</td><td>674</td></tr><tr><td>960 min Summer</td><td>6.862</td><td>0.0</td><td>352.0</td><td>786</td></tr><tr><td>1440 min Summer</td><td>4.956</td><td>0.0</td><td>380.0</td><td>1042</td></tr><tr><td>2160 min Summer</td><td>3.574</td><td>0.0</td><td>414.4</td><td>1456</td></tr><tr><td>2880 min Summer</td><td>2.831</td><td>0.0</td><td>437.6</td><td>1876</td></tr><tr><td>4320 min Summer</td><td>2.035</td><td>0.0</td><td>471.7</td><td>2604</td></tr><tr><td>5760 min Summer</td><td>1.609</td><td>0.0</td><td>497.9</td><td>3344</td></tr><tr><td>7200 min Summer</td><td>1.340</td><td>0.0</td><td>518.3</td><td>4032</td></tr><tr><td>8640 min Summer</td><td>1.154</td><td>0.0</td><td>535.3</td><td>4672</td></tr><tr><td>10080 min Summer</td><td>1.016</td><td>0.0</td><td>549.7</td><td>5344</td></tr><tr><td>15 min Winter</td><td>142.699</td><td>0.0</td><td>127.1</td><td>26</td></tr><tr><td>30 min Winter</td><td>93.626</td><td>0.0</td><td>166.5</td><td>40</td></tr></tbody></table>							Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	142.699	0.0	113.4	26	30 min Summer	93.626	0.0	148.8	41	60 min Summer	58.456	0.0	187.7	70	120 min Summer	35.213	0.0	226.2	128	180 min Summer	25.807	0.0	248.7	188	240 min Summer	20.567	0.0	264.2	246	360 min Summer	14.959	0.0	288.2	364	480 min Summer	11.918	0.0	306.1	482	600 min Summer	9.984	0.0	320.5	600	720 min Summer	8.635	0.0	332.5	674	960 min Summer	6.862	0.0	352.0	786	1440 min Summer	4.956	0.0	380.0	1042	2160 min Summer	3.574	0.0	414.4	1456	2880 min Summer	2.831	0.0	437.6	1876	4320 min Summer	2.035	0.0	471.7	2604	5760 min Summer	1.609	0.0	497.9	3344	7200 min Summer	1.340	0.0	518.3	4032	8640 min Summer	1.154	0.0	535.3	4672	10080 min Summer	1.016	0.0	549.7	5344	15 min Winter	142.699	0.0	127.1	26	30 min Winter	93.626	0.0	166.5	40																						
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)																																																																																																																																						
15 min Summer	142.699	0.0	113.4	26																																																																																																																																						
30 min Summer	93.626	0.0	148.8	41																																																																																																																																						
60 min Summer	58.456	0.0	187.7	70																																																																																																																																						
120 min Summer	35.213	0.0	226.2	128																																																																																																																																						
180 min Summer	25.807	0.0	248.7	188																																																																																																																																						
240 min Summer	20.567	0.0	264.2	246																																																																																																																																						
360 min Summer	14.959	0.0	288.2	364																																																																																																																																						
480 min Summer	11.918	0.0	306.1	482																																																																																																																																						
600 min Summer	9.984	0.0	320.5	600																																																																																																																																						
720 min Summer	8.635	0.0	332.5	674																																																																																																																																						
960 min Summer	6.862	0.0	352.0	786																																																																																																																																						
1440 min Summer	4.956	0.0	380.0	1042																																																																																																																																						
2160 min Summer	3.574	0.0	414.4	1456																																																																																																																																						
2880 min Summer	2.831	0.0	437.6	1876																																																																																																																																						
4320 min Summer	2.035	0.0	471.7	2604																																																																																																																																						
5760 min Summer	1.609	0.0	497.9	3344																																																																																																																																						
7200 min Summer	1.340	0.0	518.3	4032																																																																																																																																						
8640 min Summer	1.154	0.0	535.3	4672																																																																																																																																						
10080 min Summer	1.016	0.0	549.7	5344																																																																																																																																						
15 min Winter	142.699	0.0	127.1	26																																																																																																																																						
30 min Winter	93.626	0.0	166.5	40																																																																																																																																						
©1982-2018 Innovyze																																																																																																																																										

BWB Partnership				Page 2	
Friars Studio 3 Friar Gate Derby DE1 1BU					
Date 23/10/2019 17:33 File Western Catchment (FSR)...		Designed by josephine.green Checked by			
Micro Drainage		Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	127.141	0.741	3.0	202.3	O K
120 min Winter	127.240	0.840	3.0	237.2	O K
180 min Winter	127.286	0.886	3.0	253.9	O K
240 min Winter	127.310	0.910	3.0	262.8	O K
360 min Winter	127.336	0.936	3.0	272.5	O K
480 min Winter	127.344	0.944	3.0	275.5	O K
600 min Winter	127.342	0.942	3.0	274.8	O K
720 min Winter	127.334	0.934	3.0	271.9	O K
960 min Winter	127.309	0.909	3.0	262.5	O K
1440 min Winter	127.258	0.858	3.0	243.6	O K
2160 min Winter	127.177	0.777	3.0	214.8	O K
2880 min Winter	127.091	0.691	3.0	185.5	O K
4320 min Winter	126.882	0.482	3.0	120.6	O K
5760 min Winter	126.716	0.316	3.0	74.7	O K
7200 min Winter	126.605	0.205	2.9	46.6	O K
8640 min Winter	126.540	0.140	2.7	31.1	O K
10080 min Winter	126.506	0.106	2.5	23.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	58.456	0.0	210.3	70	
120 min Winter	35.213	0.0	253.4	126	
180 min Winter	25.807	0.0	278.5	184	
240 min Winter	20.567	0.0	295.9	242	
360 min Winter	14.959	0.0	322.7	358	
480 min Winter	11.918	0.0	342.7	472	
600 min Winter	9.984	0.0	358.7	582	
720 min Winter	8.635	0.0	372.0	692	
960 min Winter	6.862	0.0	393.6	892	
1440 min Winter	4.956	0.0	422.4	1110	
2160 min Winter	3.574	0.0	464.2	1580	
2880 min Winter	2.831	0.0	490.1	2028	
4320 min Winter	2.035	0.0	528.4	2776	
5760 min Winter	1.609	0.0	557.6	3456	
7200 min Winter	1.340	0.0	580.5	4040	
8640 min Winter	1.154	0.0	599.6	4672	
10080 min Winter	1.016	0.0	615.8	5240	
©1982-2018 Innovyze					

BWB Partnership		Page 3																																																
Friars Studio 3 Friar Gate Derby DE1 1BU																																																		
Date 23/10/2019 17:33 File Western Catchment (FSR)...	Designed by josephine.green Checked by																																																	
Micro Drainage		Source Control 2018.1.1																																																
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.600</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.400</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.430 <table> <thead> <tr> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>From:</th> <th>To:</th> <th>From:</th> <th>To:</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>4</td> <td>8</td> <td>8</td> <td>12</td> </tr> <tr> <td></td> <td>0.143</td> <td></td> <td>0.143</td> <td></td> <td>0.144</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.600	Shortest Storm (mins)	15	Ratio R	0.400	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	From:	To:	From:	To:	From:	To:	0	4	4	8	8	12		0.143		0.143		0.144
Rainfall Model	FSR	Winter Storms	Yes																																															
Return Period (years)	100	Cv (Summer)	0.750																																															
Region	England and Wales	Cv (Winter)	0.840																																															
M5-60 (mm)	20.600	Shortest Storm (mins)	15																																															
Ratio R	0.400	Longest Storm (mins)	10080																																															
Summer Storms	Yes	Climate Change %	+40																																															
Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)																																													
From:	To:	From:	To:	From:	To:																																													
0	4	4	8	8	12																																													
	0.143		0.143		0.144																																													
©1982-2018 Innovyze																																																		

BWB Partnership		Page 4
Friars Studio 3 Friar Gate Derby DE1 1BU		
Date 23/10/2019 17:33 File Western Catchment (FSR)...		
Designed by josephine.green Checked by		
Micro Drainage		Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 127.700

Tank or Pond Structure

Invert Level (m) 126.400

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	210.7	1.000	393.4	1.300	459.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0082-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	126.400
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

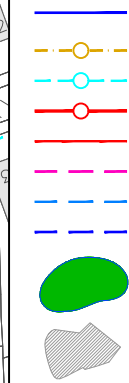
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.0
Flush-Flo™	0.297	3.0
Kick-Flo®	0.623	2.4
Mean Flow over Head Range	-	2.6

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)
0.100	2.4	1.200	3.3	3.000	5.0	7.000	7.4
0.200	2.9	1.400	3.5	3.500	5.4	7.500	7.7
0.300	3.0	1.600	3.7	4.000	5.7	8.000	7.9
0.400	2.9	1.800	3.9	4.500	6.0	8.500	8.2
0.500	2.8	2.000	4.1	5.000	6.3	9.000	8.4
0.600	2.5	2.200	4.3	5.500	6.6	9.500	8.6
0.800	2.7	2.400	4.5	6.000	6.9		
1.000	3.0	2.600	4.7	6.500	7.2		

©1982-2018 Innovyze

APPENDIX 6: Outline Surface Water Drainage Strategy



BWB
CONSULTANCY | ENVIRONMENT
INFRASTRUCTURE | BUILDINGS



BETTER SOLUTIONS, INTELLIGENTLY ENGINEERED

APPENDIX E

ICOSA:
General Notes.

1. No backdrops to be used, steeper gradients are preferred to the use of backdrops.
2. For Type C manholes the opening cover and frame should be located centrally over the pipe – refer to the Sewer Sector Guidance Design and Construction Document Version 2.0 Figures B14.
3. The outside of the sewer should be in vehicle carriageway (not footpath) and be at least 1m from the kerb line. The outside manholes should be at least 0.5m from kerb line.
4. The materials to be used should be suitable for the ground conditions.
5. In situations where traffic loading is anticipated to be heavier than would occur on a typical residential estate distributor road (i.e. braking or turning near a junction) a higher specification cover (E600) should be used. This should comprise either a Class E600 cover or a D400 of a type that has been assessed and approved by the sewerage company as having sufficient additional ruggedness to ensure durability.
6. It is not permitted for services to be laid above adoptable sewers where the sewers and services are parallel. The lateral separation should be at least 1m.

ICOSA:
Plastic Pipe Standards.

1. Solid wall PVC-U to BS EN 1401.
2. Spiral wound welded HDPE to EN 13476 Parts 1&2.
3. Structural-wall thermoplastics to EN 13476 Parts 1&3.
4. Polypropylene to BS EN 1852.



ENGINEERING KEY:

MANHOLE REFERENCE
COVER LEVEL
INVERT LEVEL
PIPE DIAMETER
PIPE GRADE
PIPE LENGTH

SECTION 104 STORM SEWER

MANHOLE REFERENCE
COVER LEVEL
INVERT LEVEL
PIPE DIAMETER
PIPE GRADE
PIPE LENGTH

SECTION 104 FOUL SEWER

SEWER/DRAINAGE EASEMENT DIMENSIONED

PRIVATE STORM SEWER

HIGHWAY GULLY

PRIVATE FOUL LATERAL

PRIVATE STORM LATERAL

CARRIAGEWAY LOW/HIGH POINT

EXISTING STORM WATER SEWER

EXISTING FOUL WATER SEWER

G	EVAPOTRANSPIRATION FEATURE ADDED TO BASIN.	23.10.25	JG
F	BEND WIDENING FRONTING PLOT 25 INTRODUCED.	27.05.25	JG
E	RAMP MOVED ADJACENT TO PLOT 26.	26.03.24	JG
D	ADDITIONAL IMP. AREA ADDED, STORM SEWER UPSIZED TO SUIT, FOUL SEWER LOWERED TO SUIT.	28.02.25	JG
C	S107 MOVED TO ACCOMMODATE 1800mm DIAMETER FOR CATCHPIT.	17.12.24	JG
B	RD2 REDUCED TO 4.8m WIDTH.	25.11.24	JG
A	UPDATED TO CLIENT COMMENTS.	17.10.24	JG
REV	DESCRIPTION	DATE	INITIAL

ridehalgh nicholls
consulting engineers

T 01164 829032
E contact@ridnic.co.uk W www.ridnic.co.uk
A 4 Pear Tree Business Park, Desford Lane, Ratby, LE6 0PG
Company registration number: 10827228

CLIENT

mypad
From hand to living

PROJECT

**PROPOSED RESIDENTIAL DEVELOPMENT AT
BARTON ROAD,
BARLESTONE**

TITLE

SECTION 104 PLAN

DRAWN	JG	DATE	07-10-2024	PURPOSE OF ISSUE	☐ PRELIMINARY ☒ APPROVAL ☐ CONSTRUCTION
SCALE	1/500	SIZE	A1		
DWG NO.	E279-70-01			REV.	G

APPENDIX F

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	100.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	9.000
Ratio-R	0.400	Preferred Cover Depth (m)	1.500
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S101	0.080	5.00	127.418	1500	442001.416	305682.959	1.800
S102	0.197	5.00	128.137	1500	441993.979	305709.277	2.755
S103	0.165	5.00	127.192	1500	442082.026	305789.572	1.725
S104	0.011	5.00	127.322	1500	442086.707	305774.997	2.021
S105	0.022	5.00	126.957	1500	442080.734	305741.376	1.932
S106	0.133	5.00	126.895	1500	442076.873	305736.863	1.895
S107	0.114	5.00	126.892	1800	442071.464	305734.382	1.992
S107A	0.000		127.015	1200	442073.077	305729.370	2.132
S108	0.000		126.600		442075.189	305722.805	1.897
S109	0.206	5.00	126.600		442093.437	305704.240	1.900
S110	0.000		126.850	3000	442095.547	305699.583	2.175
S1604	0.000		125.724	1500	442106.529	305693.851	1.104
S201	0.061	5.00	130.047	1200	441863.991	305719.094	1.725
S202	0.040	5.00	129.739	1200	441872.863	305681.144	1.725
S203	0.083	5.00	129.664	1200	441874.229	305675.302	1.725
S204	0.199	5.00	128.703	1200	441945.054	305691.860	1.725
S205	0.000		127.800		441949.688	305680.442	1.850
S206	0.162	5.00	127.800		441959.418	305683.868	1.850
S207	0.000	5.00	128.481	1800	441962.208	305698.453	2.681

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.000	S101	S102	27.349	0.600	125.618	125.457	0.161	169.9	300	5.38	53.0
1.002	S102	S107	81.451	0.600	125.382	124.975	0.407	200.1	375	6.57	48.2
3.000	S103	S104	15.308	0.600	125.467	125.376	0.091	168.2	225	5.25	53.5
3.001	S104	S105	34.147	0.600	125.301	125.100	0.201	169.9	300	5.73	51.5
3.002	S105	S106	5.939	0.600	125.025	125.000	0.025	237.6	375	5.81	51.1
3.003	S106	S107	5.951	0.600	125.000	124.975	0.025	238.0	375	5.90	50.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	1.203	85.0	11.5	1.500	2.380	0.080	0.0	74	0.847
1.002	1.277	141.0	57.4	2.380	1.542	0.439	0.0	167	1.214
3.000	1.005	40.0	23.9	1.500	1.721	0.165	0.0	125	1.048
3.001	1.203	85.0	24.6	1.721	1.557	0.176	0.0	110	1.044
3.002	1.171	129.3	27.4	1.557	1.520	0.198	0.0	117	0.936
3.003	1.170	129.2	45.6	1.520	1.542	0.331	0.0	153	1.071

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.003	S107	S107A	5.265	0.600	124.900	124.883	0.017	309.7	450	6.65	47.9
1.004	S107A	S108	6.896	0.600	124.883	124.855	0.028	246.3	375	6.75	47.6
5.000	S109	S110	5.113	0.600	124.700	124.675	0.025	204.5	375	5.07	54.4
5.001	S110	S1604	12.388	0.600	124.675	124.620	0.055	225.2	300	5.27	53.5
4.000	S201	S202	38.973	0.600	128.322	128.014	0.308	126.5	225	5.56	52.2
4.001	S202	S203	6.000	0.600	128.014	127.939	0.075	80.0	225	5.63	51.9
4.002	S203	S204	72.735	0.600	127.939	126.978	0.961	75.7	225	6.43	48.7
4.003	S204	S205	12.323	0.600	126.978	126.375	0.603	20.4	225	6.50	48.5
1.000	S206	S207	14.849	0.600	125.950	125.800	0.150	99.0	300	5.16	54.0
1.001	S207	S102	33.564	0.600	125.800	125.457	0.343	97.9	300	5.51	52.4

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.003	1.150	182.8	114.9	1.542	1.682	0.884	0.0	259	1.211
1.004	1.150	127.0	114.0	1.757	1.370	0.884	0.0	279	1.294
5.000	1.263	139.5	30.4	1.525	1.800	0.206	0.0	118	1.017
5.001	1.043	73.7	29.9	1.875	0.804	0.206	0.0	133	0.990
4.000	1.161	46.1	8.6	1.500	1.500	0.061	0.0	65	0.892
4.001	1.463	58.2	14.2	1.500	1.500	0.101	0.0	75	1.210
4.002	1.504	59.8	24.3	1.500	1.500	0.184	0.0	100	1.428
4.003	2.907	115.6	50.3	1.500	1.200	0.383	0.0	104	2.814
1.000	1.580	111.7	23.7	1.550	2.381	0.162	0.0	93	1.263
1.001	1.589	112.3	23.0	2.381	2.380	0.162	0.0	92	1.257

Simulation Settings

Rainfall Methodology	FEH-99	E (1km)	0.309	Drain Down Time (mins)	1440
Rainfall Events	Singular	F (1km)	2.376	Additional Storage (m³/ha)	20.0
C (1km)	-0.029	Summer CV	0.750	Starting Level (m)	
D1 (1km)	0.362	Winter CV	0.840	Check Discharge Rate(s)	x
D2 (1km)	0.326	Analysis Speed	Detailed	Check Discharge Volume	x
D3 (1km)	0.287	Skip Steady State	x		

Storm Durations

60	120	180	240	360	480	600	720	960	1440
----	-----	-----	-----	-----	-----	-----	-----	-----	------

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
30	35	0	0
100	40	0	0

Node S110 Online Head/Flow Control

Flap Valve	x	Invert Level (m)	124.675	Design Flow (l/s)	8.7
Replaces Downstream Link	✓	Design Depth (m)	1.325		

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.001	0.000	0.400	8.520	0.800	7.110	1.200	8.280	1.600	9.560	2.000	10.690
0.100	3.780	0.500	8.040	0.900	7.170	1.300	8.620	1.700	9.850	2.100	10.950
0.200	7.060	0.600	7.560	1.000	7.560	1.400	8.940	1.800	10.140	2.200	11.210
0.300	8.450	0.700	7.270	1.100	7.930	1.500	9.260	1.900	10.420		

Node S207 Online Head/Flow Control

Flap Valve	x	Invert Level (m)	125.800	Design Flow (l/s)	2.6
Replaces Downstream Link	✓	Design Depth (m)	1.400		

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.001	0.000	0.200	2.200	0.400	2.200	0.600	1.900	1.000	2.200	1.400	2.600
0.100	1.800	0.300	2.200	0.500	2.100	0.800	2.000	1.200	2.400	1.600	2.800

Node S109 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	26.032
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	124.700	Main Channel Slope (1:X)	10000.0
Safety Factor	2.0	Time to half empty (mins)	270	Main Channel n	0.030

Inlets S108

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	317.5	0.0	0.500	426.7	0.0	1.000	550.5	0.0	1.500	688.3	0.0
0.100	337.8	0.0	0.600	450.3	0.0	1.100	576.9	0.0	1.600	717.6	0.0
0.200	359.2	0.0	0.700	474.5	0.0	1.200	603.9	0.0	1.700	747.4	0.0
0.300	381.1	0.0	0.800	499.3	0.0	1.300	631.5	0.0	1.800	777.8	0.0
0.400	403.6	0.0	0.900	524.6	0.0	1.400	659.6	0.0	1.900	808.8	0.0

Node S206 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	10.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	125.950	Main Channel Slope (1:X)	100000.0
Safety Factor	2.0	Time to half empty (mins)	285	Main Channel n	0.030

Inlets S205

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	195.3	0.0	0.450	282.3	0.0	1.050	416.1	0.0
0.050	204.4	0.0	0.650	324.6	0.0	1.250	465.2	0.0
0.250	242.2	0.0	0.850	369.2	0.0	1.850	626.2	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m ³)	
Full Bore Velocity	✓		

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	S101	33	125.676	0.058	6.8	0.1541	0.0000	OK
60 minute summer	S102	33	125.489	0.106	25.8	0.3404	0.0000	OK
60 minute summer	S103	33	125.564	0.097	14.1	0.3563	0.0000	OK
60 minute summer	S104	33	125.388	0.086	15.0	0.1622	0.0000	OK
60 minute summer	S105	34	125.147	0.122	16.7	0.2428	0.0000	OK
60 minute summer	S106	34	125.139	0.139	27.8	0.4414	0.0000	OK
60 minute summer	S107	34	125.112	0.212	62.7	0.7805	0.0000	OK
60 minute summer	S107A	34	125.076	0.193	62.1	0.2187	0.0000	OK
360 minute winter	S108	264	125.000	0.298	18.2	0.0000	0.0000	OK
360 minute winter	S109	264	125.001	0.301	15.3	0.6515	0.0000	OK
360 minute winter	S110	264	125.000	0.325	8.6	2.3003	0.0000	SURCHARGED
60 minute summer	S1604	1	124.620	0.000	7.5	0.0000	0.0000	OK
60 minute summer	S201	33	128.373	0.051	5.2	0.0930	0.0000	OK
60 minute summer	S202	33	128.078	0.064	8.6	0.1028	0.0000	OK
60 minute summer	S203	33	128.017	0.078	15.6	0.1623	0.0000	OK
60 minute summer	S204	33	127.062	0.084	32.5	0.2896	0.0000	OK
480 minute winter	S205	376	126.236	0.286	10.9	0.0000	0.0000	OK
480 minute winter	S206	376	126.236	0.286	10.7	0.5005	0.0000	OK
480 minute winter	S207	376	126.236	0.436	10.9	1.1089	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	S101	2.000	S102	6.8	0.721	0.080	0.2565	
60 minute summer	S102	1.002	S107	25.5	0.871	0.181	2.5137	
60 minute summer	S103	3.000	S104	14.1	0.896	0.352	0.2407	
60 minute summer	S104	3.001	S105	14.8	0.904	0.174	0.5610	
60 minute summer	S105	3.002	S106	16.7	0.491	0.129	0.2024	
60 minute summer	S106	3.003	S107	27.6	0.808	0.213	0.2185	
60 minute summer	S107	1.003	S107A	62.1	0.898	0.340	0.3641	
60 minute summer	S107A	1.004	S108	62.1	1.128	0.489	0.3794	
60 minute summer	S108	Flow through pond	S109	28.5	0.023	0.003	70.1534	
240 minute winter	S109	5.000	S110	8.6	0.415	0.062	0.4901	
360 minute winter	S110	Head/Flow	S1604	8.5				278.1
60 minute summer	S201	4.000	S202	5.2	0.649	0.112	0.3124	
60 minute summer	S202	4.001	S203	8.5	0.795	0.147	0.0644	
60 minute summer	S203	4.002	S204	15.5	1.206	0.258	0.9334	
60 minute summer	S204	4.003	S205	32.3	2.446	0.279	0.1626	
60 minute summer	S205	Flow through pond	S206	16.3	0.010	0.003	40.8423	
120 minute summer	S206	1.000	S207	15.0	0.374	0.135	0.9360	
60 minute summer	S207	Head/Flow	S102	2.2				

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	S101	33	125.712	0.094	17.3	0.2502	0.0000	OK
60 minute summer	S102	33	125.553	0.171	62.2	0.5458	0.0000	OK
60 minute summer	S103	33	125.647	0.180	35.7	0.6639	0.0000	OK
60 minute summer	S104	32	125.441	0.140	38.0	0.2635	0.0000	OK
480 minute winter	S105	456	125.399	0.373	7.7	0.7450	0.0000	OK
480 minute winter	S106	456	125.398	0.398	12.7	1.2635	0.0000	SURCHARGED
480 minute winter	S107	456	125.398	0.498	29.6	1.8387	0.0000	SURCHARGED
480 minute winter	S107A	456	125.398	0.515	28.4	0.5829	0.0000	SURCHARGED
480 minute winter	S108	456	125.398	0.695	28.1	0.0000	0.0000	OK
480 minute winter	S109	456	125.398	0.698	22.4	1.5138	0.0000	SURCHARGED
480 minute winter	S110	456	125.398	0.723	9.0	5.1118	0.0000	SURCHARGED
60 minute summer	S1604	1	124.620	0.000	8.5	0.0000	0.0000	OK
60 minute summer	S201	33	128.404	0.082	13.2	0.1501	0.0000	OK
60 minute summer	S202	33	128.130	0.116	21.9	0.1857	0.0000	OK
60 minute summer	S203	33	128.072	0.133	39.8	0.2789	0.0000	OK
60 minute summer	S204	33	127.129	0.151	82.7	0.5177	0.0000	OK
600 minute winter	S205	585	126.651	0.701	12.5	0.0000	0.0000	OK
600 minute winter	S206	585	126.651	0.701	11.2	1.2273	0.0000	SURCHARGED
600 minute winter	S207	585	126.651	0.851	9.0	2.1654	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	S101	2.000	S102	17.3	0.915	0.204	0.5230	
60 minute summer	S102	1.002	S107	61.8	0.882	0.438	5.8240	
60 minute summer	S103	3.000	S104	35.7	1.112	0.892	0.4898	
60 minute summer	S104	3.001	S105	38.4	1.019	0.451	1.4061	
60 minute summer	S105	3.002	S106	42.2	0.484	0.327	0.5385	
60 minute summer	S106	3.003	S107	69.8	0.803	0.540	0.5607	
60 minute summer	S107	1.003	S107A	154.6	1.147	0.845	0.7079	
60 minute summer	S107A	1.004	S108	154.7	1.572	1.218	0.7072	
60 minute summer	S108	Flow through pond	S109	61.1	0.034	0.006	184.6223	
60 minute summer	S109	5.000	S110	12.4	0.591	0.089	0.5639	
120 minute summer	S110	Head/Flow	S1604	8.5				402.7
60 minute summer	S201	4.000	S202	13.2	0.786	0.286	0.6570	
60 minute summer	S202	4.001	S203	21.8	0.965	0.375	0.1356	
60 minute summer	S203	4.002	S204	39.6	1.506	0.663	1.9173	
60 minute summer	S204	4.003	S205	82.4	3.047	0.713	0.3332	
60 minute summer	S205	Flow through pond	S206	31.4	0.012	0.006	114.3802	
60 minute summer	S206	1.000	S207	17.4	0.498	0.155	1.0457	
60 minute summer	S207	Head/Flow	S102	2.2				

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	S101	33	125.729	0.111	23.4	0.2947	0.0000	OK
600 minute winter	S102	585	125.654	0.272	14.2	0.8710	0.0000	OK
60 minute summer	S103	33	125.731	0.264	48.3	0.9710	0.0000	SURCHARGED
600 minute winter	S104	585	125.654	0.353	7.8	0.6627	0.0000	SURCHARGED
600 minute winter	S105	585	125.654	0.629	8.8	1.2553	0.0000	SURCHARGED
600 minute winter	S106	585	125.654	0.654	14.1	2.0746	0.0000	SURCHARGED
600 minute winter	S107	585	125.654	0.754	32.9	2.7823	0.0000	SURCHARGED
600 minute winter	S107A	585	125.654	0.771	31.7	0.8722	0.0000	SURCHARGED
600 minute winter	S108	585	125.654	0.951	31.5	0.0000	0.0000	OK
600 minute winter	S109	585	125.654	0.954	24.4	2.0684	0.0000	SURCHARGED
600 minute winter	S110	585	125.654	0.979	8.9	6.9202	0.0000	SURCHARGED
60 minute summer	S1604	1	124.620	0.000	8.5	0.0000	0.0000	OK
60 minute summer	S201	33	128.418	0.096	17.8	0.1767	0.0000	OK
60 minute summer	S202	33	128.158	0.144	29.5	0.2296	0.0000	OK
60 minute summer	S203	33	128.104	0.165	53.7	0.3461	0.0000	OK
60 minute summer	S204	33	127.176	0.198	111.7	0.6819	0.0000	OK
720 minute winter	S205	705	126.891	0.940	14.9	0.0000	0.0000	OK
720 minute winter	S206	705	126.890	0.940	11.6	1.6466	0.0000	SURCHARGED
720 minute winter	S207	705	126.890	1.090	11.7	2.7748	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	S101	2.000	S102	23.4	0.919	0.276	0.7137	
60 minute summer	S102	1.002	S107	82.7	0.899	0.586	6.9637	
60 minute summer	S103	3.000	S104	48.1	1.228	1.203	0.5688	
60 minute summer	S104	3.001	S105	50.4	1.021	0.593	1.9885	
60 minute summer	S105	3.002	S106	57.2	0.518	0.442	0.6551	
60 minute summer	S106	3.003	S107	94.0	0.852	0.727	0.6564	
60 minute summer	S107	1.003	S107A	207.5	1.310	1.135	0.8340	
60 minute summer	S107A	1.004	S108	207.6	1.886	1.635	0.7606	
60 minute summer	S108	Flow through pond	S109	82.9	0.038	0.008	252.3069	
60 minute summer	S109	5.000	S110	13.4	0.625	0.096	0.5639	
60 minute summer	S110	Head/Flow	S1604	8.5				450.7
60 minute summer	S201	4.000	S202	17.8	0.830	0.385	0.8376	
60 minute summer	S202	4.001	S203	29.4	1.010	0.505	0.1743	
60 minute summer	S203	4.002	S204	53.5	1.560	0.894	2.4859	
60 minute summer	S204	4.003	S205	110.8	3.156	0.959	0.4324	
60 minute summer	S205	Flow through pond	S206	35.6	0.014	0.007	156.8715	
60 minute summer	S206	1.000	S207	16.8	0.533	0.150	1.0457	
720 minute winter	S207	Head/Flow	S102	2.3				

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	S101	690	125.994	0.376	4.3	0.9985	0.0000	SURCHARGED
720 minute winter	S102	690	125.994	0.612	17.0	1.9564	0.0000	SURCHARGED
60 minute summer	S103	34	126.244	0.777	72.9	2.8588	0.0000	SURCHARGED
720 minute winter	S104	690	125.994	0.693	9.5	1.2993	0.0000	SURCHARGED
720 minute winter	S105	690	125.994	0.969	10.1	1.9322	0.0000	SURCHARGED
720 minute winter	S106	690	125.994	0.994	17.0	3.1505	0.0000	SURCHARGED
720 minute winter	S107	690	125.994	1.094	39.5	4.0339	0.0000	SURCHARGED
720 minute winter	S107A	690	125.993	1.110	38.6	1.2559	0.0000	SURCHARGED
720 minute winter	S108	690	125.993	1.290	38.5	0.0000	0.0000	OK
720 minute winter	S109	690	125.993	1.293	28.7	2.8038	0.0000	SURCHARGED
720 minute winter	S110	690	125.993	1.318	8.9	9.3174	0.0000	SURCHARGED
60 minute summer	S1604	1	124.620	0.000	8.5	0.0000	0.0000	OK
60 minute summer	S201	35	129.160	0.838	26.9	1.5407	0.0000	SURCHARGED
60 minute summer	S202	35	129.079	1.065	41.7	1.6990	0.0000	SURCHARGED
60 minute summer	S203	35	129.028	1.089	68.4	2.2786	0.0000	SURCHARGED
60 minute summer	S204	34	127.739	0.761	147.3	2.6168	0.0000	SURCHARGED
720 minute winter	S205	705	127.197	1.247	20.6	0.0000	0.0000	OK
720 minute winter	S206	705	127.197	1.247	15.8	2.1831	0.0000	SURCHARGED
720 minute winter	S207	705	127.197	1.397	10.2	3.5546	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	S101	2.000	S102	34.8	0.920	0.409	1.9259	
60 minute summer	S102	1.002	S107	116.9	1.060	0.829	8.9838	
60 minute summer	S103	3.000	S104	68.4	1.719	1.711	0.6088	
60 minute summer	S104	3.001	S105	72.0	1.028	0.847	2.4046	
60 minute summer	S105	3.002	S106	80.6	0.730	0.623	0.6551	
60 minute summer	S106	3.003	S107	137.8	1.249	1.066	0.6564	
60 minute summer	S107	1.003	S107A	295.0	1.862	1.613	0.8342	
60 minute summer	S107A	1.004	S108	294.0	2.666	2.315	0.7606	
60 minute summer	S108	Flow through pond	S109	111.4	0.045	0.011	385.3303	
60 minute summer	S109	5.000	S110	14.2	0.695	0.102	0.5639	
720 minute winter	S110	Head/Flow	S1604	8.7				962.5
60 minute summer	S201	4.000	S202	24.9	0.865	0.539	1.5500	
60 minute summer	S202	4.001	S203	38.3	1.010	0.659	0.2386	
60 minute summer	S203	4.002	S204	67.7	1.703	1.132	2.8927	
60 minute summer	S204	4.003	S205	145.6	3.662	1.260	0.4901	
60 minute summer	S205	Flow through pond	S206	50.4	0.015	0.009	240.7303	
60 minute summer	S206	1.000	S207	17.3	0.587	0.155	1.0457	
1440 minute winter	S207	Head/Flow	S102	2.5				

APPENDIX G

Operation and Maintenance Requirements for Piped Drainage Network		
Maintenance Schedule	Required Action	Typical Frequency
Regular	Inspection of manholes for debris and sediment build-up	Annually (and following poor performance)
	Cleaning of manhole chambers and removing any debris and sediment build-up.	Annually (and following poor performance)
Occasional Maintenance	Jetting of pipes between manholes to flush any debris and sediment build-up down the pipes. Debris and sediment build-up to be collected at the downstream manhole and removed from the piped network.	Three monthly (or as required)
Monitoring	Survey pipes for any signs of root ingress, cracking or collapse and undertake remedial work to replace pipe runs as necessary.	Every 5 years or as required following poor performance.

Operation and Maintenance Requirements for Pervious Pavements		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations- pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment.
	Occasional Maintenance	Stabilise and mow contributing and adjacent areas
	Removal of weeds or management using glyphosphate applied directly into the weeds by an applicator rather than spraying	As required- once a year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	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	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial Inspection	Monthly for three months after installation

	Inspect for evidence of poor operation and/or weed growth- if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Operation and Maintenance Requirements for Trees		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets and outlets	Quarterly
Occasional Maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
	Water	As required (in periods of drought)
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

Operation and Maintenance Requirements for Ponds and Wetlands		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris.	Monthly (or as required)
	Cut the grass - public areas.	Monthly (during growing season)
	Cut the meadow grass.	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years).	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework, etc for evidence of blockage and /or physical damage.	Monthly
	Inspect water body for signs of poor water quality.	Monthly (May - October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options.	Half yearly
	Check any mechanical devices, eg penstocks.	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface).	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level.	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Annually
Occasional Maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%.	With effective pre-treatment, this will only be required rarely, e.g. every 20-50 years.
Remedial Actions	Repair erosion or other damage.	As required.
	Replant, where necessary.	As required.
	Aerate pond when signs of eutrophication are detected.	As required.

	Realign rip-rap or repair other damage.	As required.
	Repair / rehabilitate inlets, outlets and overflows.	As required.

Operation and Maintenance Requirements for Proprietary Treatment System (Gullies)		
Maintenance Schedule	Required Action	Typical Frequency
Routine Maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation.	Six monthly
	Remove sediment, oil, grease and floatables.	As necessary - indicated by system inspections or immediately following significant spill.
Remedial Actions	Replace malfunctioning parts or structures.	As required.
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies.	Monthly during first half of operation, then six months.
