



REDROW HOMES LIMITED

BURBAGE FILEDS FARM

BURBAGE

LE10 2HS

FLOOD RISK ASSESSMENT

AUGUST 2024

FW2285_FRA_001 V10

REVISION HISTORY

Revision	Reason for Issue	Author	Checker	Approved	Date
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DRAFT	Second Draft Issue for Comment	JR	OP	JD	10.02.2023
V1	First Issue	JR	OP	JD	15.03.2023
V2	Appendix B has been updated	JR	JD	JD	04.05.2023
V3	Minor update to foul strategy following client instruction	JD	JR	JD	19.05.2023
V4	Appendices plans updated to suit current layout	JR	JD	JD	19.06.2023
V5	Appendices A, B, J & K have been updated to suit the updated development layout.	JR	EC	JD	15.11.2023
V6	NPPF (2021) has been revised. References to this document have been updated to "NPPF (2023)"	JR	JD	JD	21.12.2023
V7	Section 6.0 Foul Water Drainage Strategy has been updated to suit the revised proposals. Correspondence from STW has been added to Appendix F.	JR	JD	JD	04.03.2024
V8	Report has been updated to include private swales located adjacently to the shared driveways. SUDS Consideration Table, Section 5.6.3, Section 5.6.6, Section 5.7.3, Section 5.10.3, Section 5.12.1, Appendix J & L have all been updated to suit.	JR	JD	DM	10.04.2024
V9	Report has been updated to suit the latest development layout received from Redrow Homes on 12.07.2024. Sections that have been updated: Executive summary point 3, 4.1.1, 5.4.8, 6.1.2 & 6.1.3. Appendix B, F, J & K have also been updated.	JR	JD	JD	19.07.2024
V10	Report has been updated to suit comments from Lichfield's comments received 30.07.2024 Sections that have been updated: Executive summary point 8, 1.1.4, 7.2.1, 8.1.3, 8.1.4, 8.1.6 & 8.1.7.	JR	EC	JD	29.08.2024

EXECUTIVE SUMMARY

1. The site is at **NO** quantifiable risk of flooding from tidal events.
2. The property is identified within the Environment Agency Flood Risk mapping as being at very **low** risk of flooding from Rivers and Seas.
3. The majority of the site is identified by the Environment Agency as being at **very low** risk from overland flows with areas along the perimeter of the site to the north and east being at **medium** and **High** risk of flooding from surface water.
4. The site is considered to be at a **Low** quantifiable risk of flooding from groundwater sources.
5. The site is identified by the Environment Agency as being at **NO** quantifiable risk of flooding from manmade lakes within the topographical catchment of the site.
6. The site is at a negligible risk of flooding from the existing sewerage network in the vicinity of the site.
7. The site is at a negligible risk of flooding from its own private drainage connections, however this can be mitigated by regular maintenance to ensure the ongoing performance of the system.
8. We therefore conclude that the proposed residential development is above the modelled flood level of the local watercourses and sits within Flood Zone 1 as defined in the National Planning Policy Framework December 2023 Table 1.

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1.0 INTRODUCTION

- 1.1.1 Farrow Walsh Ltd. has been engaged by the applicant Redrow Homes Limited to produce a Flood Risk Assessment to accompany the planning application for a proposed residential industrial development to be situated at Burbage Field Farm, Hinckley.
- 1.1.2 The development proposals include the demolition of two existing residential properties located adjacent to Coventry Road and an existing farm with all the associated buildings and hardstand. A site location plan is included within Appendix A and the development proposals can be found within Appendix B.
- 1.1.3 This report considers the flood risk associated with a development proposal of this type and considers mitigation measures to ensure user safety.
- 1.1.4 The Flood Risk Assessment (FRA) report has been informed by the guidance contained within The National Planning Framework (December 2023, Department for Communities and Local Government) (NPPF).
- 1.1.5 Reference has been made to basic flood maps contained within the Environment Agency websites and the Environment Agency Standing Advice for Local Planning Authorities.
- 1.1.6 In consulting the Environment Agency website this report examines the following:
- Assessment of Flood risk and the likely sources of flooding
 - Managing Residual Flood Risk
 - Managing surface water
 - Remedial Measures
- 1.1.7 This FRA examines the flood implications of the proposed development based on the following objectives, set out within the NPPF.
- Appraising risk
 - Managing risk
 - Reducing risk
 - A partnership approach

1.1.8 This report has been prepared using the following policy and guidance documentation:

- National Planning Policy Guidance (NPPG)
- Ciria C753 – The SUDs Manual
- Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (EA - February 2016)
- Strategic Flood Risk Assessment (JBA – 2019-2020)
- Non-Statutory Technical Standards 2015
- Written Ministerial Statement regarding Sustainable Drainage (HCWS161) 2014
- The Water Framework Directive (2000)
- Building Regulations Part H 2015

1.1.9 In consulting with key stakeholders and policies this report aims to assess the risk of flooding both to the site and the impact of any development on the downstream network.

1.1.10 The flood management strategy, including consideration of safe access and egress from the site and flood resilience measures, is based on relevant British Standards (BS8533), the standing advice provided by the Environment Agency and on best engineering judgement. The approach for the FRA is based on the requirements of the Environment Agency and Hinckley and Bosworth Council.

1.1.11 Any comments and opinions expressed in this report, including any conclusions are based on the information available to Farrow Walsh Ltd. at the time of writing. The conclusions therefore could differ if the information is found to be inaccurate, incomplete or misleading. Farrow Walsh Ltd. accepts no liability should this be proven to be the case, or, if additional information is made available with respect to this site.

2.0 SITE DETAILS

2.1 SITE LOCATION

- 2.1.1 The proposed development site is located towards the southern area of Burbage.
- 2.1.2 The site location is bounded by the M69 motorway to the south. The western and eastern boundaries are formed of existing properties, green fields, existing Bullfurlong Lane and Workhouse Lane. The northern boundary is bounded by Coventry Road.
- 2.1.3 A site location plan can be found within Appendix A.

2.2 SITE DESCRIPTION

- 2.2.1 The application site is irregular in shape in orientation north to south and covers a total area of 264,996m² or 26.5 hectares.
- 2.2.2 For the purpose of this report the site is classified as greenfield land, having 2 existing properties to the frontage and existing hardstand and buildings associated with the existing farm.
- 2.2.3 The site has existing access points already in place along Bullfurlong Lane and Workhouse Lane.

2.3 TOPOGRAPHY

- 2.3.1 The ground levels on the site are recorded to OS datum as between 126.91 to 103.83mAOD and the site generally slopes in a south-east direction towards the existing ditch.
- 2.3.2 A copy of the topographical survey can be located within Appendix C.

2.4 HYDROLOGICAL CONTEXT

- 2.4.1 An existing unnamed watercourse is running through the site and crosses M69 motorway and discharges into Soar Brook. Several sections of the watercourse are culverted. Please refer to Appendix K.
- 2.4.2 Soar Brook is a tributary of the River Soar and is located 776m south of the development site.
- 2.4.3 The site lies within the operation catchment of the Soar River operational catchment and the overall catchment of the Humber Basin District.
- 2.4.4 The site lies within upper reaches of the overall Soar operational catchment area.

2.5 GEOLOGICAL CONTEXT

2.5.1 The British Geological Society (BGS) online mapping indicates that the site geology comprises of:

- Dunsmore Gravel – Sand and gravel. Sedimentary superficial deposit
- Wolston Sand and Gravel – sand and gravel
- Oadby Member – Diamicton Alluvium – Clay, silt, and gravel

2.5.2 The bedrock is identified by the British Geological Society as Mercia Mudstone Group – Mudstone.

2.5.3 A Phase 1 ground investigation has been undertaken by the client, with an extract included within Appendix D.

2.6 GROUNDWATER VULNERABILITY

2.6.1 The bedrock stratum below the site is classified by the Environment Agency as a Secondary B Aquifer

2.6.2 In terms of vulnerability, the ground is classified as Medium Vulnerability, as can be seen in the Ground Investigation in Appendix D.

2.6.3 The site does not lie within a Source Protection Zone.

2.7 EXISTING DRAINAGE

2.7.1 Severn Trent are responsible for maintaining the public sewers within the area of Burbage and the sewer records have been obtained and can be found within Appendix F.

2.7.2 The sewer records confirm existing 355mm combined rising main crossing the development.

2.7.3 An existing Ø225mm foul sewer is located within Westminster Drive and Robinson Way which is discharging into the combined Ø450mm sewer. The combined Ø450mm sewer is crossing then private land and discharges downstream beneath De Havilland Way.

2.7.4 In the developer enquiry response received from STW states that the existing Ø450mm combined sewer doesn't have enough capacity to accommodate the additional foul flows from the new development.

2.7.5 An offline water storage tank has been installed to limit the existing network surcharge and flooding occurrence.

2.7.6 There are existing surface water sewers with a diameter between 225 – 450mm located within Coventry Road, Bull furlong Lane and Robinson Way. Ultimately these are discharging into the unnamed watercourse which crosses the development.

2.7.7 An existing spring has been located outside of the site boundary which ultimately discharges into the existing unnamed watercourse which crosses the development.

2.7.8 An existing 225Ø pipe is crossing the site on the eastern boundary. The pipe is serving the adjacent constructed development and discharges into the existing unnamed watercourse.

2.7.9 An existing unnamed watercourse is crossing the site from northwest to south east, which ultimately is crossing M69 motorway.

2.7.10 In several locations the existing ditch is culverted. Some of the existing culverts are damaged and will require to be replaced, subject to LLFA's comments and OWC technical applications.

2.7.11 Within Appendix L, more information can be found regarding existing ditch, including photos and hydraulic model results.

2.7.12 The existing topographical survey identifies manholes and below ground drainage within the site.

2.7.13 The topographical and drainage surveys can be found contained within Appendix C.

2.8 ARTIFICIAL WATER BODIES

2.8.1 There is an unnamed pond 30 metres to the east of the site. It is assumed that Workhouse Lane is has been constructed recently as part of an adjacent development.

2.8.2 Another 2 unnamed ponds are located 550m and 847m to the southeast of the new development which are assumed to serve the Amazon and DPD industrial parks.

2.8.3 Two more unnamed ponds are located adjacent to the north eastern boundary, in line with the existing watercourse.

2.8.4 Lakeside fishery is located 500m to the southwest of the development.

3.0 ASSESSMENT OF FLOOD RISK

3.1 FLUVIAL

3.1.1 The site lies in the Humber Basin Catchment and Soar Brook is classified as a main river and falls under the administrative jurisdiction of the Environment Agency.

3.1.2 The Environment Agency have derived flood maps of England from which it is possible to initially identify whether a site is located within an area that is at risk of fluvial flooding. The maps, which are available on the Environment Agency's website, categorise land as being within Flood Zone 1, Flood Zone 2 or Flood Zone 3, with Flood Zone 1 being all land falling outside of the flood plain and Flood Zones 2 and 3 being all land within the floodplain. Flood Zone 3 is split into two further categories, namely Flood Zone 3a and Flood Zone 3b with Flood Zone 3b considered to be the functional floodplain.

3.1.3 The definitions of the Flood Zones extracted from the National Planning Policy Framework (NPPF) are described below:

- Flood Zone 1 – low probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%).
- Flood Zone 2 – medium probability. This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (15 – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.
- Flood Zone 3a – high probability. This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- Flood Zone 3b – the functional floodplain. This zone comprises land where water has to flow or be stored in times of flood. Typically, land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood.

3.1.4 The extent of flooding on main rivers is indicated on the Environment Agency web site and an extract from the indicative flood maps can be seen in Figure 1. The areas of dark blue identify flooding probability of 1 percent (1 in 100 year) and the light blue areas are areas of extreme flood between the 1 percent and 0.1 percent (1 in 1000 year) probability.

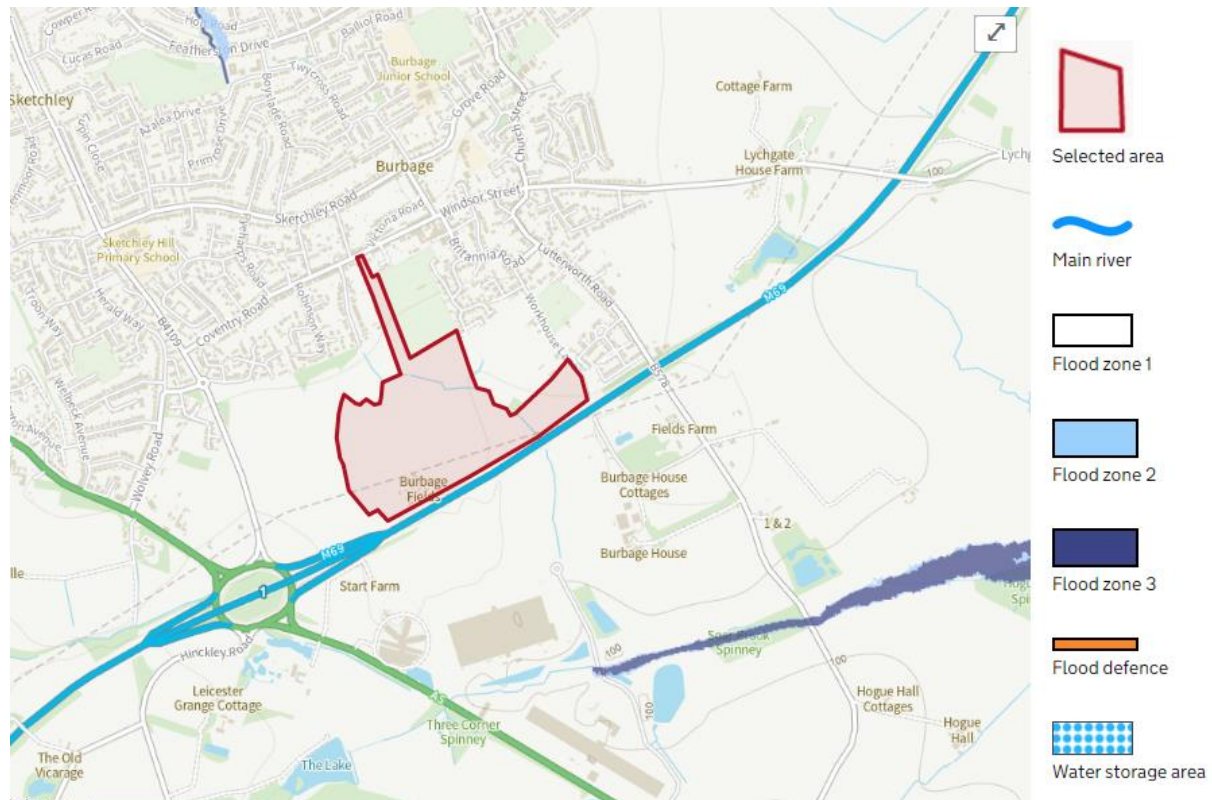


Figure 1 – Extract from EA Flood Map for Planning (January 2023)

3.1.5 It is identified on the EA indicative planning flood mapping the site lies within Flood Zone 1.

3.1.6 Based on Table 1 of the NPPF the site has a low probability of flooding due to main rivers within the extents outlined within Figure 1.

3.1.7 The SFRA indicates that no historic fluvial flood events have been recorded within the vicinity of the site.

3.2 TIDAL OR COASTAL

3.2.1 The ground levels on the site are recorded to OS datum as between 126.91 to 103.83mAOD and the site generally slopes in a south-east direction towards the existing ditch. Topographical survey can be found within Appendix C.

3.2.2 The site lies in the Humber Basin Catchment and Soar Brook is classified as a main river and falls under the administrative jurisdiction of the Environment Agency.

3.2.3 The site is indicated by mapping as being remote from the areas at risk of tidal flooding with the existing coastal defences intact or removed.

3.2.4 The site is therefore considered comprehensively free from risk from tidal or coastal flooding effects, being horizontally and vertically remote from such influences at present, and after consideration of climate change effects.

3.3 GROUNDWATER FLOODING

3.3.1 Groundwater flooding occurs as a result of rising water from underlying aquifers or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at a shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although it is increasingly being associated with localised floodplain sand and gravels.

3.3.2 SFRA states that in general, the majority of Hinckley and Bosworth borough is within the <25% susceptible classification, therefore it is at lower risk of groundwater flooding.

3.3.3 LLFA advised previously that high levels of groundwater were encountered on an adjacent site during construction.

3.3.4 As part of the Phase 2 Ground Investigation, groundwater monitoring should be undertaken.

3.4 ARTIFICIAL WATER BODIES FLOODING

3.4.1 All the artificial water bodies within in in the vicinity of the site are described in the paragraph 2.8.

3.4.2 The EA online mapping indicates that there are no areas within the vicinity of the site at risk of flooding from reservoirs.

3.4.3 We conclude that the risk of failure of the water main is remote. It must however be noted that for a failure adjacent to the site the nature of the escape and probable pressurized column of water could itself cause some local flood damage, but this is beyond practical mitigation.

3.4.4 The SFRA indicates there have been no recorded historic incidents of flooding due to artificial sources.

3.5 SURFACE WATER FLOODING

- 3.5.1 Surface water flooding occurs when natural and engineered systems drainage network capacity is exceeded and thus cannot accommodate the volume of rainfall / runoff. Surface water flooding occurs often in urban areas during extreme, high intensity, low duration rainfall events which overwhelm the local surface water drainage systems. In rural areas this type of flooding can occur during medium intensity, long duration events where saturated ground conditions prevent natural infiltration into the subsoils below the surface. Flood water arising from such events is then conveyed above ground following the topography of the surrounding land.
- 3.5.2 The site is located within the upper reaches of the overall catchment as on the Environment Agency catchment website. The local catchment tends east to south towards to Soar Brook from source to Soar Water Body.
- 3.5.3 The Environment Agency have modelled locations along critical flow paths and area situated in topographic depressions, which could flood following an extreme rainfall event when drainage capacity has been exceeded. Figure 3 indicates the predicted surface water flood risk map taken from the Environment Agency's website.
- 3.5.4 The EA mapping indicates that the existing unnamed watercourse that crosses the development is flooding, with the southern section being at high risk.
- 3.5.5 The EA Mapping indicates the following risk depth of flooding:
- Low risk depth: between 300 – 900mm
 - Medium risk: between 300 and 900mm and higher than 900mm at the outfall point from the development where the ditch is culverted beneath M69 motorway
 - High risk: between 300 and 900mm and higher than 900mm at the outfall point from the development where the ditch is culverted beneath M69 motorway.
- 3.5.6 No flooding information has been found related to this site in the SFRA.
- 3.5.7 Based on the above, the developer instructed JBA Consulting to undertake a hydraulic modelling study of an unnamed watercourse, which can be found within Appendix K.
- 3.5.8 The study revealed that the existing culvert located to the south of the boundary, culvert which crosses M69 motorway and location where the major flooding occurs, has enough capacity to accommodate the existing flows.

3.5.9 The majority of the site is considered to be at very low risk from surface water flows by the EA with areas at the perimeter of the site to the north and east are noted to be low or medium risk.

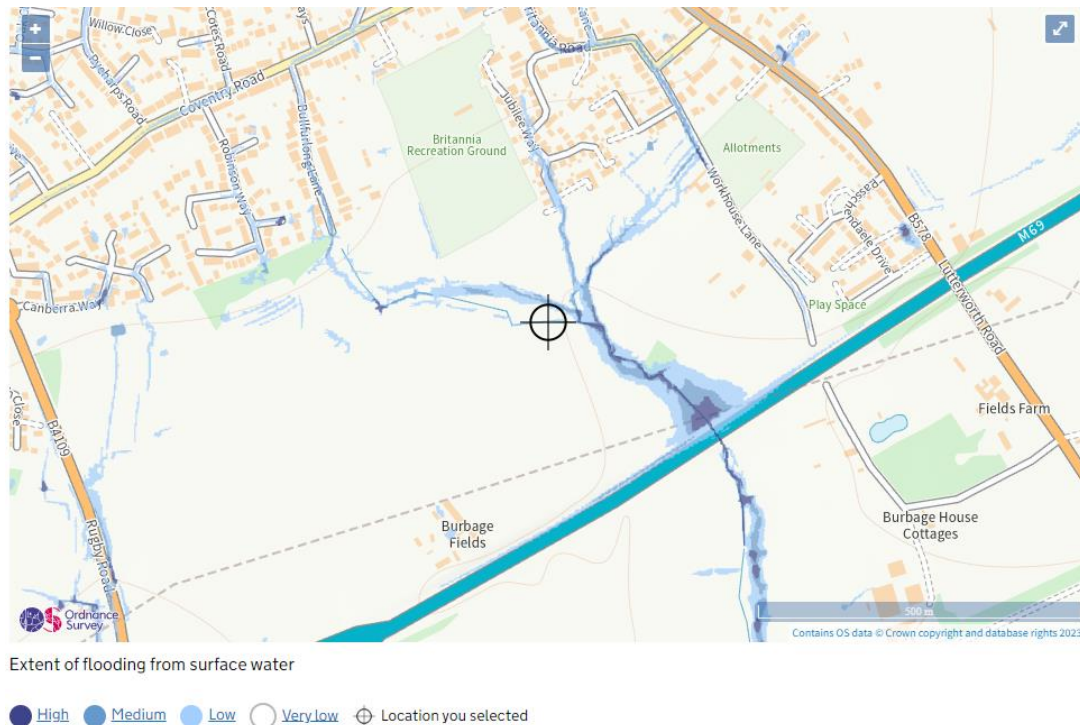


Figure 2 – Extract from the EA Mapping Risk of Surface Water Flooding (January 2023)

3.6 EXISTING SEWER FLOODING

- 3.6.1 The sewer network surrounding the development is owned and maintained by Severn Trent Water. A copy of the sewer records for the area can be found within Appendix F.
- 3.6.2 The sewer records confirm existing 355mm combined rising main crossing the development.
- 3.6.3 An existing Ø225mm foul sewer is located within Westminster Drive and Robinson Way which is discharging into the combined Ø450mm sewer. The combined Ø450mm sewer is crossing then private land and discharges downstream beneath De Havilland Way.
- 3.6.4 In the developer enquiry response received from STW states that the existing Ø450mm combined sewer doesn't have enough capacity to accommodate the additional foul flows from the new development.
- 3.6.5 There are existing surface water sewers with a diameter between 225 – 450mm located within Coventry Road, Bull Furlong Lane and Robinson Way. Ultimately these are discharging into the unnamed watercourse which crosses the development.

- 3.6.6 Generally, due to the site levels and those of the surrounding areas it is considered that any breach of the sewers would follow the natural topography of the land and drain south into the existing unnamed watercourse.
- 3.6.7 The site is also not recorded as a critical drainage area by the SFRA.
- 3.6.8 At the time of SFRA study no information was received from STW regarding existing sewer flooding.
- 3.6.9 The developer enquiry response received from STW states that the existing foul network is surcharged and in order to limit the existing sewer surcharge and flooding an offline tank has been installed. Please refer to Appendix F for the STW correspondence and records.
- 3.6.10 It should be noted that the sewerage systems are designed to accommodate the 1 in 30-year storm events and thus for storm events above this probability flooding from sewers will occur.

4.0 PROPOSED DEVELOPMENT

4.1 DEVELOPMENT PROPOSALS

- 4.1.1 The development proposal includes the demolition of the 2 residential properties and farm and the construction of a new residential development containing 442 plots & 2 areas for self-build dwellings. A site location plan is included within Appendix A and the development proposals can be found within Appendix B.
- 4.1.2 The buildings shall be a minimum 150mm above the final ground levels to ensure that the overland flows do not enter the properties, with the exception of the level thresholds which must be provided with threshold drains to prevent flows entering the properties.
- 4.1.3 For the purpose of this report the site is classified as greenfield land, having 2 existing properties to the frontage and existing hardstand and buildings associated with the existing farm.
- 4.1.4 The current use of the application site is classed as greenfield use, with a hardstand area of 6,572m² (2.5%) which currently drains into the existing watercourse.
- 4.1.5 In accordance with Table 2 of NPPG (2019), a residential land use has a flood vulnerability classification of 'more vulnerable'.
- 4.1.6 In accordance with Table 3 of NPPG (2019), the more vulnerable development within Flood Zone 1 is appropriate.

5.0 SURFACE WATER MANAGEMENT

5.1 FLOOD RISK FROM THE DEVELOPMENT

- 5.1.1 In accordance with NPPG site specific flood risk assessments should consider and assess how runoff from the development will be managed and whether it will increase flood risk elsewhere.
- 5.1.2 The primary flood risk generated by the new development is likely to be the risk posed by overland surface water flooding due to exceedance of the existing drainage network.

5.2 EXISTING SURFACE WATER DISCHARGE

- 5.2.1 The existing 2 residential properties drainage network it is assumed to be drain into the existing STW located within Coventry Road.
- 5.2.2 Topographical survey shows existing inspection chamber and tanks which served the Burbage Filed Farm. The outfall of the existing sewers is to be confirmed.
- 5.2.3 All existing Severn Trent Water sewers can be seen in Appendix F.
- 5.2.4 For the purpose of this report the site is classified as greenfield, due to the size of the existing hardstand.

5.3 CLIMATE CHANGE

- 5.3.1 National Planning Policy Guidance requires that climate change be incorporated within the surface water drainage design in accordance with The Environment Agency's 'Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities' February 2016 when assessing flood risk for a development.
- 5.3.2 The design life of the development is beyond 2070, therefore in accordance with the Environment Agency guidance the development should make allowances for an increase in extreme rainfall intensity of an additional 40% when compared to the 1961-1990 baseline.

5.4 PROPOSED SURFACE WATER DRAINAGE STRATEGY

- 5.4.1 Surface Water runoff from the proposed development should mimic, as far as possible, the surface flows from an undeveloped greenfield site.
- 5.4.2 Building Regulations 2010 Part H guidance for disposal of surface water is as follows:
- A soakaway or infiltration system, or where not reasonably practical;
 - A surface water ditch or watercourse, or where not reasonably practical;
 - A below ground sewer

- 5.4.3 The ground investigation undertaken on the site has advised that use of soakaways for surface water drainage may be locally feasible where sand and gravel deposits lie (northern extents), however impermeable cohesive soils are anticipated which is likely to make soakaway drainage ineffective and unfeasible.
- 5.4.4 LLFA advised that a high level of groundwater was encountered on an adjacent site during construction and de-watering works were required to be undertaken.
- 5.4.5 Based on the above, discharge of surface water using infiltration techniques is not a feasible solution.
- 5.4.6 Therefore, surface water disposal by the means of treatment and detention prior to controlled release into the existing unnamed watercourse which crosses the site is deemed the most appropriate solution.
- 5.4.7 Existing greenfield runoff rates have been calculated for the development area and can be found within Appendix I and are also shown below.

Greenfield Runoff Rates	
Storm Event	Site 26.5ha (l/s)
$Q_{BAR,GR}$	115.62
$Q_{1,GR}$	95.97
$Q_{30,GR}$	231.25
$Q_{100,GR}$	297.16

Table 1 – Greenfield Runoff Rates

- 5.4.8 The development area of the site is 26.5 hectares, and it is proposed that 37.55% (9.952ha) of the development will be impermeable and require collecting and attenuating prior to discharge. The above areas are based on the current site layout available contained within Appendix B.
- 5.4.9 It is currently proposed that the drains within the proposed access road will be offered for adoption to STW and the plot drainage will remain under private ownership.
- 5.4.10 It is proposed that the surface water from the development will be controlled using flow controls prior to discharge into the existing unnamed watercourse at the southern boundary, upstream of the existing culvert crossing M69 motorway.
- 5.4.11 A copy of the Drainage Strategy can be found within Appendix J.

5.5 PROPOSED SURFACE WATER DISCHARGE

5.5.1 Surface water drainage will be provided in new below ground gravity drains constructed around the properties, and in the shared driveways mirroring the existing runoff arrangement with surplus flows being attenuated using attenuation basins. The proposed surface water runoff rates for each parcel will match the existing greenfield runoff rates and are shown below.

Storm Event	(l/s/ha)
Q _{1,PR}	4.30
Q _{30,PR}	4.30
Q _{100+40%cc,PR}	4.30

Table 2 – Proposed Discharge Rates

5.5.2 This rate is subject to approval from the LLFA.

5.5.3 By controlling the discharge rate from the site for a 1in100 year + 40% storm event the site is offering a betterment to the downstream network by utilising on site flood storage at an earlier stage in the overall river catchment potentially reducing flooding downstream.

5.5.4 All sewers and drainage are to be constructed in accordance with all relevant industry standards, including but not limited to:

- Building Regulations Approved Document Part H 2010
- Sewer Sector Design Guidance

5.5.5 The drawings & schedules of the as-built site drainage system are to be made available to the building occupier to enable drainage maintenance and future works to be undertaken.

5.6 CONSIDERATION OF SUDS

5.6.1 With reference to CIRIA 753 and the surface water treatment process, the provision of filter drains, rain gardens and attenuation basins will aid in the removal of sediment, hydrocarbons and heavy metals.

5.6.2 Rain gardens are small depressions that can act as infiltration points for clean water. These are attractive features, easy to retrofit, maintain which can reduce rate of run and some volume reduction. The rain gardens will be provided with a perforated pipe connected to the drainage system.

5.6.3 Filter drains & private swales will be located adjacent to the shared private drives (where possible). Filter drain stone will collect particulates which helps to prevent pollutants from entering groundwater.

5.6.4 The Environment Agency and Leicestershire County Council require Sustainable Drainage (SuDS) techniques to be incorporated within new developments where possible.

5.6.5 Consideration should therefore be given to the use of the Sustainable Urban Drainage Systems. Table 3 below gives commentary in relation to the suitability of SuDS techniques for the proposed development.

SUDS Technique	Commentary	Suitability
Green Roof	Due to the large roof size and pitched nature of roof within the development, the option of incorporating a green roof into the development is not suitable for this site.	No
Rain Gardens	Limited, to be used to collect roof clean water and discharged into the drainage network. Final locations subject to detailed drainage design	Potential
Infiltration by Soakaway	LLFA advised previously that high levels of groundwater were encountered on the adjacent site during construction.	No
Water Butt	Storage of roof runoff via the use of water butts has the potential to be utilised.	Potential
Filter Drain	Filter strips to be located where possible adjacent private shared drives	Yes
Infiltration Trench	There is no suitable area within the site for infiltration trenches/filter trenches	No
Swale	Based on the presence of the existing watercourse, topography and proposed site layout, there is no suitable position for adoptable swales. Private swales are to be utilised adjacent to the shared drives where feasible.	Yes
Bio-retention	There are limited areas for this to be sited, and concerns over maintenance by the private dwelling owners.	No
Permeable Paving	Permeable paving has potential to be used.	Potential
Infiltration Basin	LLFA advised previously that high levels of groundwater were encountered on the adjacent site during construction.	No
Detention Basin	Detention basins to be located to the south eastern boundary.	Yes

Table 3 – SuDS Consideration Table

5.6.6 The table above identifies that due to site constraints, the most feasible method for providing SuDS is to utilise a detention basin, rainwater gardens, private swales and filter drains.

5.7 ATTENUATION PROPOSALS

5.7.1 In accordance with current design guidelines the attenuation volume for a site should be calculated based on a 1 in 100 year + climate change allowance.

5.7.2 It is proposed that some roof areas are to be collected and drained through rain gardens and connected into the drainage system.

5.7.3 Filter drains & private swales are to be located adjacent with the shared driveways, where possible and connected into the drainage system.

5.7.4 Hydraulic modelling of the drainage network to be undertaken using industry recognised software to confirm the drainage design suitability and calculations to be provided to LLFA.

5.8 MAINTENANCE

5.8.1 At this stage it has been assumed that the dwelling owners will maintain the drainage elements as outlined within this report. Future maintenance schedules for the SuDS features have been provided within Appendix L.

5.8.2 The drawings and schedules of the as built drainage are to be made available to the building owner to enable drainage maintenance and future works to be undertaken.

5.8.3 At this stage, the maintenance company has not yet been appointed and as such the applicant will be responsible until such time as they are appointed. Once appointed the contact details will be provided to the LLFA for records.

5.9 EXCEEDANCE FLOWS

5.9.1 Exceedance flows are to be contained within the site and directed away from buildings towards the areas of driveway and landscaping. The intention is to direct flows away from the building with the FFL being a minimum of 150mm above the external surrounding levels, with the exception of level threshold entrances.

5.9.2 Exceedance flow routes can be seen on the drainage strategy drawing within Appendix J.

5.10 WATER QUALITY

5.10.1 With reference to CIRIA 753 and the surface water treatment process, the provision of filter drains, rain gardens and attenuation basins will aid in the removal of sediment, hydrocarbons and heavy metals.

5.10.2 Rain gardens are small depressions that can act as infiltration points for clean water. These are attractive features, easy to retrofit, maintain which can reduce rate of run and some volume reduction. The rain gardens will be provided with a perforated pipe connected to the drainage system.

5.10.3 Filter drains & private swales will be located adjacent to the shared private drives (where possible). Filter drain stone will collect particulates which helps to prevent pollutants from entering groundwater.

5.11 CONSTRUCTION SEQUENCING

5.11.1 The main drainage runs and attenuation tanks are to be constructed at the start of the programme to ensure that runoff is controlled from the site throughout the duration of the construction works. This will minimise the impact of the developed at the start of the project potentially lessening the effects of flooding downstream.

5.11.2 Protection is to be provided to the sewer through the lifetime of the works and the drainage outfalls are to have mesh grillage installed during the construction phase to prevent the entry of construction debris entering the sewer network.

5.12 DRAINAGE SUMMARY

5.12.1 The proposed surface water drainage system can be summarised as follows:

- Surface water runoff from the site will be conveyed by pipes, private swales, rain gardens and filter drains attenuated within detention basins, then discharged into the existing unnamed watercourse at a controlled rate.
- Use of rain gardens, swales and filter drains in suitable locations.
- Detention ponds to be sized, to store runoff volumes in extreme storm events up to the 1 in 100 year +40% climate change storm event. The 10% urban creep should be considered.
- Use of Flow control to control discharge rate into the existing watercourse.
- The existing watercourse is culverted in several locations. We would recommend replacing the damaged culverts, where required.

6.0 FOUL WATER DRAINAGE STRATEGY

6.1 FOUL WATER DRAINAGE DESIGN

- 6.1.1 In the developer enquiry response received from STW dated December 2022 it states that the existing Ø450mm combined sewer doesn't have sufficient capacity to accommodate the additional foul flows from the new development. However, upon further review and discussions with STW they have confirmed an alternative discharge arrangement would be acceptable.
- 6.1.2 Due to the existing topography and existing STW sewerage, the foul of up to 11 self-build & 422 dwellings will be pumped via an adoptable pumping station into the combined sewer located within Coventry Road.
- 6.1.3 11 self-build & 422 dwellings will be pumped at controlled rate of 6.5l/s discharging into a new manhole located between manholes 8101 & 7002. This pumping station and sewers will be offered for adoption under a S104 agreement.

7.0 FLOOD MITIGATION STRATEGY

7.1 PRINCIPLES FOR MITIGATION STRATEGY

7.1.1 In accordance with Table 3 of NPPG (2019), a building used for general industry has a flood vulnerability classification of 'more vulnerable'.

Flood Risk Vulnerability Classification					
Flood Zones	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	✗	✗	✗	✓

Table 4 – Extract from NPPG2019 (Table 3)

- ✓ Denotes Development is appropriate
- ✗ Development should not be permitted

7.1.2 The findings of the FRA indicate that the site is located within FZ1 and thus deemed appropriate for development in accordance with NPPG.

7.1.3 The findings of the FRA indicate that the site may be susceptible to surface water flooding when considering the impacts of climate change. As such the plots have been located outside of the extents of the existing unnamed watercourse and flooding areas.

7.1.4 All the FFL's to be 150mm above the surrounding levels.

7.1.5 The drainage to be designed to accommodate a surcharged outfall such that in extreme storm events the drainage system can accommodate the runoff.

7.1.6 Flood plain compensation area to be designed, not less than the existing one.

7.1.7 The drainage design should account for any residual risk of flooding from surface water as a result of exceedance events.

7.2 SEQUENTIAL APPROACH

- 7.2.1 The site is located within Flood Zone 1, however surface water flooding is observed to the existing unnamed watercourse which runs through the site. While all properties and the attenuation basins have been positioned outside of the existing surface water flood extents, Lichfield's are currently assessing the site to ensure a sequential approach is undertaken.

7.3 FINISHED FLOOR LEVELS

- 7.3.1 Floor levels should be set such that they are a minimum of 150mm above the final surrounding ground levels.

7.4 SAFE ACCESS

- 7.4.1 In accordance with current guidance and DEFRA FD2320 safe access is to be provided for users in the event of flooding. Where safe access cannot be provided measures are to be implemented to ensure the users' safety until the emergency services have been able to reach them.
- 7.4.2 The EA online mapping indicates that the site access lies within FZ1 have therefore has a low probability of flooding. The access points lie outside the mapped extents of flooding caused by rivers and seas.
- 7.4.3 The mapping indicates that the main site access will encounter a flood depth between 300 and 900mm with flows over than 0.25m/s. It should be noted that the proposed access road will be designed higher than the existing levels to accommodate for the existing watercourse to be culverted and as such the risk of main road flooding is minimal.
- 7.4.4 The south eastern parcel of the development access is through Flanders Close. The mapping indicates the flood depths are between 300 – 900mm with flows less than 0.2m/s.
- 7.4.5 While the emergency vehicles will have access to the residents in extreme events, an alternative route will be available to be used, the 3.0m wide track connecting this parcel with the rest of the development will grant safe egress should extreme events occur.
- 7.4.6 In accordance with DEFRA FD2320 Table 13.1 shown in Figure 3 a flood depth between 300 and 900mm and a velocity over 0.25m/s would represent a danger to most, meaning the majority of users would be required to maintain a stay put approach.

Table 13.1 Danger to people for different combinations of depth and velocity

Velocity (m/s)	Depth of flooding (m)											
	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.00												
0.10												
0.25												
0.50												
1.00												
1.50												
2.00												
2.50												
3.00												
3.50												
4.00												
4.50												
5.00												

Key:
 Danger for some
 Danger for most
 Danger for all

Figure 3 – Extract from DEFRA FD2320 showing Table 13.1

7.4.7 In extreme flood events above the 1 in 1000-year (0.1%) storm event the development would operate a 'stay put' approach in extreme flooding events for residents. They would be advised to stay within the development and await assistance from emergency services.

7.5 FLOOD WARNING & EVACUATION

7.5.1 Whilst the site is considered to have a low probability of flooding from all sources, and a stay put approach can be adopted, access and egress from the site in storm events above the 1 in 100 year probability will impact on the ability of some users to be able to access / egress the site. Therefore, it is important that all users of the development are made aware of the flood warning procedures

7.5.2 By utilising the flood warning systems available it is anticipated that the residents will be able to egress from the site in a safe manner in advance of an extreme (1.0 – 0.1 percent probability) storm event occurring.

7.5.3 Flood warnings are published by the Met Office can be found here:

<https://flood-warning-information.service.gov.uk/warnings>

7.5.4 The Met Office Flood Forecasting Centre in conjunction with the Environment Agency publishes Flood Guidance Statements containing:

- General overview of the flood risk
- Assessment of the flood risk
- Weather warnings and flood warnings
- Specific area of concern map

7.5.5 The Met Office uses a Flood Risk Matrix (see Figure 4) to assess the likelihood against the potential impact and assigns a risk colour and level.

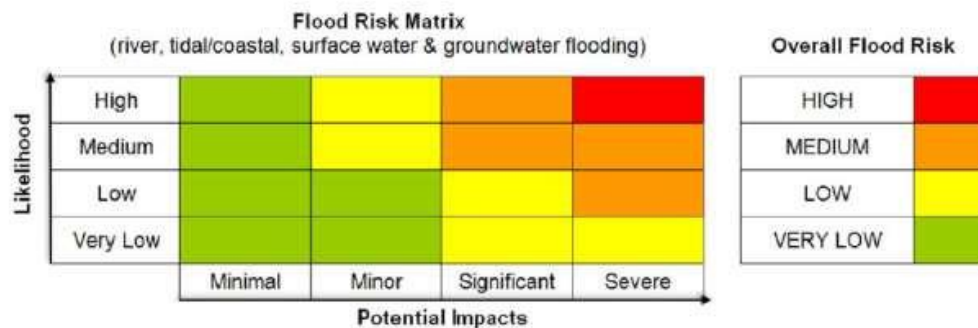


Figure 4 – Flood Risk Matrix

7.5.6 Typical examples of impacts from flooding aligned with the flood risk matrix are shown in Table 4.

Flood Impacts Table			
Minimal Impacts	Minor Impacts	Significant Impacts	Severe Impacts
Generally, no impact, however there may still be	Localised flooding of land and roads – risk of aquaplaning	Flooding affecting properties and parts of communities	Widespread flooding affecting significant numbers of properties and whole communities
Isolated and minor flooding of low-lying land and roads	Localised flooding could affect individual properties	Damage to buildings/structures is possible	Collapse of buildings/structures is possible
Isolated instances of spray/wave overtopping on coastal promenades	Individual properties in coastal location affected by spray and/or wave overtopping	Possible danger to life due to fast flowing/deep water/wave overtopping/wave inundation	Danger to life due to fast flowing/deep water/wave overtopping/wave inundation
Little or no disruption to travel although wet road surfaces could lead to difficult driving conditions	Localised disruption to key sites identified in flood plans (e.g. Railways, utilities)	Disruption to key sites identified in flood plains (e.g. railways, utilities, hospitals)	Widespread disruption or loss of infrastructure identified in flood plans (e.g. railways, utilities, hospitals)
	Local disruption to travel – longer journey times	Disruption to travel is expected. A number of roads are likely to be closed	Large scale evacuation of properties may be required
			Severe disruption to travel. Risk of motorists becoming stranded.

Table 5 – Flood Impact Table

7.5.7 The Environment Agency constantly monitors rainfall, river levels and sea conditions to forecast the possibility of flooding. If necessary, the Environment Agency can be contacted:

Incident hotline 0800 80 70 60 (24hrs)

Floodline 0345 988 1188

7.5.8 The Environment Agency Flood Warning Levels:

Warning type		Meaning	When it is used
	Flood Alert	Flooding is possible. Be prepared.	Two hours to two days in advance of flooding
	Flood Warning	Flooding is expected. Immediate action required	Half an hour to one day in advance of flooding
	Severe Flood Warning	Severe Flooding. Danger to life.	When flooding poses a significant threat to life.

Table 6 – Environment Agency Flood Warning Levels

8.0 SEQUENTIAL AND EXCEPTION TESTS

8.1 SEQUENTIAL TEST

- 8.1.1 For clarity the aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Furthermore, approval of the Sequential Test lies with the Local Planning Authority.
- 8.1.2 The NPPF indicates that for a less vulnerable land use within Flood Zone 1, development is appropriate. Environment Agency mapping and the SFRA both indicate that the entirety of the site lies within Flood Zone 1.
- 8.1.3 The majority of the site is considered to be at very low risk from overland flows by the EA with areas at the perimeter of the site to the north and east are noted to be medium or high risk.
- 8.1.4 Surface water flooding is observed to the existing unnamed watercourse which runs through the site. Properties and the attenuation basins have been positioned outside of the existing surface water flood extents to ensure a sequential approach is taken by trying to position buildings as far away from the source of flooding as practical.
- 8.1.5 The site is in an existing green land with 2 existing properties adjacent Coventry Road and an existing farm to the south western boundary.
- 8.1.6 The NPPF defines what type of development is appropriate in an individual location and seeks to guide development generally away from areas of flood risk. It nevertheless accepts implicitly that some development in areas of higher potential risk may be appropriate or indeed essential, and seeks to classify zones of risk, types of development and development suitability.
- 8.1.7 Whilst it is believed that the site will pass the sequential test. Lichfield's are currently undertaking the sequential test to confirm the site suitability.

8.2 EXCEPTION TEST

- 8.2.1 Table 3 within the NPPF indicates that the site is appropriate for use as a more vulnerable land use due to the site being within Flood Zone 1.
- 8.2.2 Wider sustainable benefits to the community include:
- Potential for reduced risk of flooding elsewhere by increasing flood storage volume within the site
 - Reduction in surface water runoff when compared to the existing situation delaying discharge into the watercourse and potentially providing a betterment downstream

8.2.3 The FRA demonstrates safety and flooding sustainability by:

- Maintaining floor level 150mm proud of surrounding ground level to reduce opportunity for surface water flows to run towards building.
- Controlling runoff on site to greenfield runoff rates to delay the discharge into the watercourse network.
- Safe and dry ingress and egress routes for pedestrians being available from the property to the surrounding highways.

8.2.4 There will be a significant reduction in the level of surface water runoff rate over the current land use.

8.2.5 In view of the above the exception test is deemed to have passed.

9.0 MITIGATION

9.1 FLOOD PLAIN COMPENSATION

- 9.1.1 The existing unnamed watercourse is flooding during extreme flood events.
- 9.1.2 In order to protect the proposed housing against the risks of flooding in the future climate change scenarios, the plots and associated structures have been located outside of the flooding zones associated with the existing unnamed watercourse.
- 9.1.3 As a future mitigation solution, it is being proposed to increase the existing flood compensation area adjacent to the outfall (culvert running beneath M69), at the source of the flooding.
- 9.1.4 The Developer instructed JBA Consulting to undertake a hydraulic modelling study of an unnamed watercourse, which can be found within Appendix K.
- 9.1.5 The report states that the maximum flood depth outside of the river channel during the 100 year with 50% climate change event is approximately 0.1m.
- 9.1.6 It is considered that the construction of the new development, regular maintenance of the existing ditch, increased flood compensation area to the south and controlled discharge rate into the unnamed watercourse will reduce the flooding depths in the future.

10.0 CONCLUSIONS

10.1 CONCLUSIONS

- 10.1.1 The site proposed for development is free of potential risk of flooding from tidal events.
- 10.1.2 The site is outside the extents of the mapped flood plain of main river systems while being classified as a very low risk area.
- 10.1.3 The site is at medium and high risk of flooding from overland flow routing from surface water.
- 10.1.4 The site is at a low susceptibility of flooding from groundwater sources.
- 10.1.5 The site is at no risk of flooding from manmade lakes.
- 10.1.6 The escape flow route from the strategic water mains has also been considered. In the unlikely event of failure of the mains the flows would not reach the properties.
- 10.1.7 The site is at no risk of flooding from existing sewerage systems for the same reason as the water mains issue.
- 10.1.8 The proposed surface water discharge rate matches the undeveloped greenfield runoff rates for the 1in100 year + 40% climate change combined with the use of above ground SUDS will treat and delay runoff entering the watercourse network. The hydraulic models of the proposed drainage systems have been checked using a surcharged outfall to confirm the performance of the system for extreme events.
- 10.1.9 The site is at a negligible risk of flooding from its own private drainage systems; however, this can be mitigated against by regular maintenance in accordance with the maintenance strategy provided within this report and channelling of flows within the development away from the properties.
- 10.1.10 We therefore conclude the application site lies within Flood Zone 1 as defined in the NPPF Table 1 and since the exception test for this has been passed more vulnerable development uses should be permitted.

APPENDICES

APPENDIX A – SITE LOCATION PLAN



1. DO NOT SCALE.
2. This drawing is to be read in conjunction with all other relevant drawings and details.
3. Should there be any conflict between the details indicated on this drawing and those on other drawings the Engineer should be informed **PRIOR** to construction on site.
4. Until technical approval has been obtained from the relevant Authority, it should be understood that all drawings issued are **Preliminary** and **NOT** for construction. Should the Contractor commence site work prior to such approval being given it is entirely at their own risk.
5. Sketch proposals are for illustrative purposes only and as such are subject to detailed site investigation including ground conditions / contaminants, drainage, design and planning / density negotiations.
6. All dimensions are in millimetres unless otherwise stated.
7. The Farrow Walsh Designers Risk Assessments for this project must be reviewed **PRIOR** to the commencement of any works on site.

1. This drawing to be read in conjunction with all other relevant Engineers and Architect's details.
2. All work is to be carried out in accordance with the current British Standards, codes of practice and building regulations.
3. The design of any temporary works required shall be the responsibility of the Contractor.
4. Do not scale this drawing. All dimensions are in millimetres unless noted otherwise. Any discrepancies are to be recorded and reported to the Engineers immediately.
5. All work is to be to the satisfaction of the Engineer.
6. The Contractor is responsible for and must take all necessary precautions to ensure the stability of the works at all times during construction.
7. All workmanship and materials are to be to current British A15s.
8. All services are to be located and protected as necessary by the Contractor prior to the commencement of the works.
9. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the Contractor. Any variations are to be recorded and reported to the Engineer immediately.

 Development Area

A3	Plan has been updated to suit the latest development layout received from Redrow Homes 12.07.2024	JR	JD	JD	19.07.24
A2	Plan has been updated to suit the revised plans received from Redrow Homes on 08.11.2023	JR	EC	JD	15.11.23
A1	Issued for Approval	JR	OP	JD	15.03.23
Rev	Description of updates	own	revised		Date

Revision Schedule

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FOR APPROVAL

Client: **Redrow Homes Limited**

Project:
Burbage Field Farm,
Bullfurlong Lane, Hinckley

Title: **Site Location Plan**

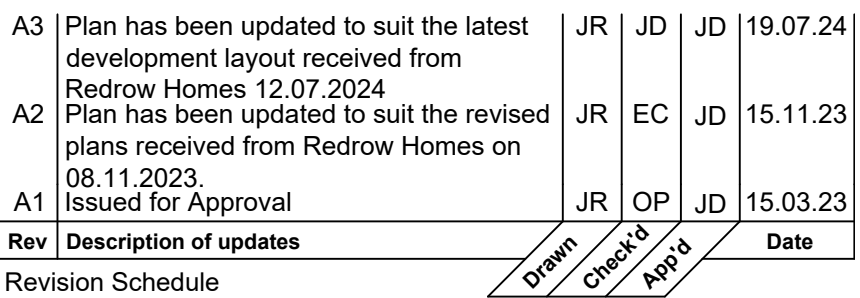
Drawn: JR	Checked: OP	Approved: JD	Date: March 2023	Scale: 1:5000 @ A1
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Drawing No.
FW2285-C-000

Revision

A3

1. This drawing to be read in conjunction with all other relevant Engineers and Architect's details.
2. All work is to be carried out in accordance with the current British Standards, codes of practice and building regulations.
3. The design of any temporary works required shall be the responsibility of the Contractor.
4. Do not scale this drawing. All dimensions are in millimetres unless noted otherwise. Any discrepancies are to be recorded and reported to the Engineers immediately.
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9. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the Contractor. Any variations are to be recorded and reported to the Engineer immediately.

 Development Area

Drawing No. FW2285-C-001	Revision: A3
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APPENDIX B – DEVELOPMENT PROPOSALS



#	16-07-24	Layout amended to suit highway constraints, wind setting system and tree line added	DL
#	03-07-24	Layout amended to suit P14Highways constraints, house types now amended	DL
Revision	Date	Amendment	Initials

Drawing Status	PRELIMINARY PLANNING CONSTRUCTION ☒
Development	LAND SOUTH OF BURBAGE
Location	BURBAGE
Marketing Name	
Drawing Title	SITE LAYOUT
Drawing Number	1693-08-02-100
Revision	B DL Scale 1:1000 OCT 23
Drawn By	Date
Checked By	Date



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Legal Disclaimer: TBC

*"This layout has been designed after due consideration of all
Content & Constraints Map"*

APPENDIX C – TOPOGRAPHICAL SURVEY