Diamond Wood & Shaw Limited

Flood Risk Assessment

Leicester Road
Barwell
LE9 8BN

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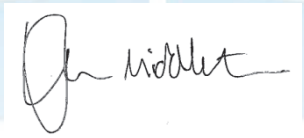
Flood Risk Assessment

Client:	**DT developments**
Contractor:	**TBD**
Planning:	**Hayward Architects** **19 Station Road,** **Hinckley,** **Leicestershire** **LE10 1AW**
Project:	**Development of residential scheme at Leicester Road, Barwell**
Project No:	**24-21177**
Date:	**Rev P1: Jan 2025** **Rev P2: Feb 2025** **Rev P3: July 2025**
Engineer:	**Leigh Middleton**



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Contents

1.0 Background

1.1 Diamond Wood & Shaw Limited are structural and civil consulting engineers who have been appointed to complete a Flood Risk Assessment for the proposed development at the site off Leicester Road, Barwell. Easting and northing for the approximate centre of the site are 445381mE 296978mN.

This Flood Risk Assessment has been prepared by a drainage engineer with ICE Graduate membership and over ten years experience in drainage design. The Assessment is compliant with the requirements set out in the NPPF (December 2024) and has been produced on behalf of Hayward Architects with respect to the above site.

2.0 Existing Site

2.1 The site is situated in the town of Barwell, Leicestershire. It is to the east edge of Barwell however Barwell and Earl Shilton are connected, and Earl Shilton is immediately east of the site. The site is bounded by residential area to the north and east, green fields to the south and west.

2.2 The site is irregular in shape and the planning boundary is approximately 12,400m^2.

2.3 The current site is largely undeveloped and greenfield, there is an existing dwelling of standard construction. There are a number of timber construction large sheds. There is associated asphalt areas and hardstanding with these dwellings. There is a public right of way along the southern boundary.

2.4 Two site topographical surveys have been completed, once combined. The onsite levels range from approximately 127.4m to 114.50m, the upper value is only found in the entrance to plots 1-3 from Shilton Road, the lower value is found in the southwest corner of the site. The site generally falls from the higher value to the lower value from north to south, there are sections that are steeper for example the southwest corner.

2.5 At the time of writing this report a full ground investigation has not been completed. Using the British Geological Survey's (BGS) Geology Map of Britain we can determine that the bedrock is likely to be Branscombe Mudstone Formation.

BGS describes Gunthrope Formation as:

"Mudstone, red-brown, with subordinate dolomitic siltstone and fine-grained sandstone, greenish grey, common gypsum veins and nodules."

The Mapping shows the superficial deposits to be 3 different soils: Oadby member (Blue), Wigston member (Pink) and Bosworth Clay Member (yellow).

BGS describes the three deposits are, respectively as:

"Diamicton, grey, weathering brown, characterised by Cretaceous and Jurassic rock fragments; subordinate lenses of sand and gravel, clay and silt. Clay, brown to grey, and silty clay, with chalk and flint fragments"

"Sand and gravel"

"Clay"

DEFRA's magic map shows that the bedrock is a secondary B aquifer, and the superficial deposits are secondary A or Secondary (undifferentiated). The magic map also indicates that the site is in an area with high or medium-high groundwater vulnerability.

Please see appendix C and D for extracts of the BGS mapping and DEFRA magic map respectively.

3.0 Flood Risk

3.1 The Government, within the NPPF, has determined that developments in the national planning context should seek:

"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere."

This is then achieved by using sequential risk-based approach to the location of the development that takes into account climate change to avoid flood risk to people and property. This is done by applying the sequential test, the aim of the sequential test is to...

"...steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding."

There are times where development cannot be directed to areas of lower flood risk. In these cases, the exception test will have applied which is based on the vulnerability classification of the development. There are two aspects of the exception test, and both must be passed for the development to pass the exception test. The NPPF advises that:

"For the exception test to be passed it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and
b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall."

3.2 A Flood Risk Assessment (FRA) is only required when a site falls into one of three situations, they are:

1) The site is in flood zone 1 and is over 1ha.
2) The site is in flood zone 2.
3) The site is in flood zone 3.

3.3 To assess the flood risk for a site you must first identify the flood risk zone classification. The classes are:

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 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 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
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
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. Land where water flows or is stored in times of flood.

The zone can be identified by many different sources, most commonly using the EA's Flood Map For Planning or the local SFRA. The flood zones are determined using modelling of the local areas topographical, flood risk and other features to determine impact of a series of flooding events, which then is translated into one of the above zones.

3.4 All developments will fall into one of five vulnerability classification. An assessment of the development needs to be made and a classification identified for the site. The classifications are:

Essential infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines.

Highly vulnerable

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

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.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.

- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

3.5 Once the flood zone and vulnerability has been determined a check on the sites flood risk compatibility will need to be made. This assessment is made by using a table located with the NPPG. The table is:

Flood Zone	**Vulnerability 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	×	×	×	✓

✓ development permitted × development not permitted.

Using the table, the suitability of the location of the development can be made, this coupled with the application of a climate change percentage will determine whether the development will pass the sequential test.

3.6 As our environment that we live in changes due to our presence, it is likely that the peak river flow and/or rainfall will also increase as a result. To account for this, a percentage factor needs to be added to our assessments and design calculations.

For larger developments and rural areas, consideration of the increase in peak river flow is required. The increase applied is dependent on the particular river basin within which the site is located. Climate change will also have an effect on rainfall by increasing the peak intensity of the rainfall or river flow. Details of the river basins and the climate change percentage to be applied can be found within the Government guidance. There are three levels of increase that can be applied which are determined using the sites flood zone and vulnerably classification. These levels are known as central, higher central and upper end allowances, these are specifically referred to by the peak river flow numbers. The percentage level is applied in line with the following table:

Flood Zone	**Vulnerability classification**				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water-compatible
Zone 2	Upper end	Higher central and upper end	Higher central and upper end	Central and higher central	Central
Zone 3a	Upper end	×	Higher central and upper end	Central and higher central	Central
Zone 3b	Upper end	×	×	×	Central

× Development not permitted.

Consideration to sites just outside of flood zone 2 and 3a also may need to be made, as the increase in flood risk due to climate change, changes in level, etc. may put them in a higher zone in the future.

Usually, the EA will hold modelled data for flood levels, along with expected flood levels associated with breaches of any flood defences or banks that the EA maintain; this comes in the form of modelled flood maps.

Any development which is to be located within a flood plain may also need to provide storage compensation for the potential loss. This is important as the loss of flood plain storage could result in the development site becoming flooded or may displace flood volumes to another area and increase their risk. The use of upper end, higher central or central values for this calculation will depend on the sensitivity of the floodplain to small changes in volume and the vulnerability classification of the development.

In this case, the site falls into the Soar Management Catchment, for which the predicted increase in flows are as follows:

Soar management Catchment Peak River Flow Allowances	**Total potential change anticipated for the '2020s' (2015 to 2039)**	**Total potential change anticipated for the '2050s' (2040 to 2069)**	**Total potential change anticipated for the '2080s' (2070 to 2115)**
Upper	28%	35%	60%
Higher	18%	21%	37%
Central	14%	16%	28%

However, the guidance states that for small (less than 5km²) and urbanised sites, peak rainfall allowances should be used for climate change increases instead. For the peak rainfall only upper and central are used. These are as follows:

Soar management Catchment Peak Rainfall Allowances	**Total potential change for 3.3% AEP anticipated for the '2050s' (up to 2060)**	**Total potential change for 3.3% AEP anticipated for the '2070s' (2061 to 2125)**	**Total potential change for 1% AEP anticipated for the '2050s' (up to 2060)**	**Total potential change for 1% AEP anticipated for the '2070s' (2061 to 2125)**
Upper	35%	35%	40%	40%
Central	20%	25%	20%	25%

For the smaller catchments, developments with a lifetime beyond 2100 should use the upper figures ones between 2061 and 2100 should use the central allowance for the 2070s epoch and for any development up to 2060 use the central allowance for the 2050s epoch. These

are based on the expected lifetime and not the design life, the guidance states that residential developments are to have a minimum lifetime of 100 years.

These figures are utilised within the proposed drainage design to ensure that any development within a flood risk area proposed does not cause any run-off from the development for the required realization of the risk, and the design life of the development dictates which percentage figure should be applied. Where there is any on site flooding indicated within the flood mapping provided, adjustments to the finished floor levels should be made to ensure people and properties are protected.

4.0 Flood Risk For The Proposed Development Site

4.1 The proposed redevelopment of the site is for residential development and associated works. The planning boundary is approximately 1.24ha.

4.2 Using the EA's Flood Map for Planning, the site is classified to be in Flood Zone 1 for flooding from rivers and seas. This means that there is a low probability of flooding from rivers and seas.

The NPPF identifies that sites will need an FRA due to the site being over 1 ha.

Please see appendix B for Flood mapping for planning. Surface Water Flood risk can be seen in appendix E.

4.3 Using the vulnerability classifications in the NPPG a development of residential dwellings will be classified as 'more vulnerable'.

4.4 Applying the sequential test using the suitability table, i.e., the development is in flood zone 1 for rivers and seas and is 'more vulnerable'. The table indicates that this type of development is suitable for this site from the rivers and seas flood risk point of view

Therefore, the building passes the sequential test.

4.5 The exception test does not need to be applied for this site.

4.6 Review of sources of flooding

Flood Source	Presence	Risk	Description
Fluvial	None	N/A	The nearest main watercourse which is 2.29 miles to the west of the site. This watercourse does not affect our development. There is however unnamed local watercourse that is closer to the development, the closest is 550m to the east of the site, this also does not affect the site.

Pluvial	Adjacent roads	Very Low	The northern and eastern boundary of the site is bounded by Shilton Road and Leicester, respectively. Both these roads are at low risk of surface water flooding. This flood risk should not affect the users of the development. Overall, Pluvial risk is considered to be Very low for the development.
Tidal	None	N/A	There is no coastline or tidal watercourses within the vicinity of the development site.
Canals	None	N/A	There is no canal within the vicinity of the development site.
Groundwater	On site	Very Low	Hinckley and Bosworth's Level 1 SFRA indicates that the site is in the less that 25% category. There is no "no risk" category.
Sewer	Site adjacent	Very Low	There is a foul water sewer to the north of the site in Shilton Road, the Level 1 SFRA does not indicate that there is any Historical flooding in the area.
Reservoirs	None	N/A	There is no reservoir flooding within the vicinity of the development site.
Development	On site	Very Low	The site's drainage will be developed to meet all appropriate standards and to store the 1 in 100 year event (1% AEP) plus 40% climate change, as a result of this it is considered to be a very low risk.

Overall, the site is at very low risk. mitigation measures will be required to manage and lower the risk to acceptable levels.

4.7 DEFRA's magic map also highlights that the groundwater in the area has a high/high-meduim vulnerability classification. This means that consideration to the use of infiltration techniques (if viable and used) will need to be assessed to ensure that the groundwater does not become contaminated.

Please see appendix D for the DEFRA magic map extracts.

4.8 The site is located in the town of Earl Shilton which is an urbanised area. The design life of the development will fall into the '2070s' category and as it is a residential development it will have an expected lifetime of 100 years so the upper allowance of the 2070s epoch should be applied. It is therefore appropriate to apply 40% climate change to the design which is in line with NPPG and the gov.uk guidance.

4.9 The site is at very low risk from the sources of flooding that can affect the site when mitigation measures are not included in the assessment. These sources are pluvial, groundwater, sewer and the development itself. With careful management of the development and mitigation measures to guide the development to reduce the risk to the end users, together with reducing the discharge rate to an appropriate rate, the risks can be managed.

5.0 Drainage Strategy

5.1 As discussed previously, the development is a residential development.

Regarding drainage there are two elements that need to be considered, they are the surface water from the parking & roof areas and the foul water from the properties.

5.2 Hierarchy

When designing a surface water drainage system for any site there is hierarchy of discharge methods that must be assessed to find the best possible option for the site. The hierarchy is as follows:

1. Discharge to the ground using SuDS/infiltration features.
2. Discharge to a watercourse.
3. Discharge to a sewer, this level can be further split down to discharge to a surface water sewer and discharge to a combined/foul water sewer, the former being on top.

When designing a drainage system all the parts of the hierarchy must be assessed in order, discounting options that are not viable for the site until the best possible option is selected for the development scheme.

Applying the hierarchy to this site:

1. A formal ground investigation for the site has not been completed however the BGS mapping shows that the ground is unsuitable for infiltration techniques, testing should be carried out during a formal Ground Investigation. This does not preclude the use of SuDS features earlier in the management train, just not as the final point of discharge.
2. There are no watercourses. The nearest watercourse is unnamed and 500m away through a housing development so this is not accessible. The surface water sewer likely discharges to this watercourse.
3. There is a head of the system surface water sewer in the adjacent housing estate. As this is the highest option on the hierarchy it will be taken forward.

5.3 Proposed Discharge Rate

This site is considered a greenfield. The highest option on the hierarchy is to use the surface water sewer, to which the site should be discharged at greenfield run-off rate. As a summary of part of appendix I:

Site area is 1.24ha:
Using UKSuDS tool for greenfield estimation

Event	Rate
Qbar	5.33 l/s
1 in 1 year	4.43 l/
1 in 30 year	10.66 l/s
1 in 100 year	13.7 l/s
1 in 200 year	16.21 l/s

We propose that the development should be attenuated to the Qbar value all events up to the 1 in 100 year event + 40% climate change.

5.4 Surface Water Strategy

When rain falls on the natural environment it will, for the most part, soak into the ground with part being evaporated or taken up by plants. Most water ends up in a watercourse either by surface runoff or by flows within the ground. Developing a site removes the planting and natural ground by increasing the impermeable area, therefore managing the water as part of the drainage scheme in order to slow the discharge and clean flows is required to allow development to continue.

The SuDS manual states that *"Sustainable drainage systems (SuDS) are designed to maximise the opportunities and benefits we can secure from surface water management".* There are four main aspects of SuDS design; they are: water quantity, water quality, amenity and biodiversity. The main goal of a SuDS system is to control the runoff from any development with an aim to managing the flood risk not only to the development but to the wider environment as well. This needs to be done in such a way that the use of the water is maximised within the development, to prevent pollution entering the water cycle, improve the environment for nature and to ultimately, create better places for people to live in.

This is done by managing run-off in as similar a way to the natural process as possible. This includes managing water as close to the source as possible. As the water travels through the various parts of the drainage system on site, SuDS are used to slow the flow to allow natural processes such as cleaning of the water to take place. Slowing the flow limits the impacts water can have on assets beyond the boundary of the site.

Consideration to all types of features is required to fully assess the most suitable system to be implemented. SuDS principles should be the primary focus of the consideration but also their planning context, maintenance issues and other factors have to be considered as they have a material effect on the design of not only the drainage for the development but the development itself. Using the primary SuDS manual component types the following is suitable:

Component Type	Description	Site Context	Suitable On This Development (Yes/No)
Rainwater Harvesting Systems	Rainwater is collected from the roof of a building or from other paved surfaces in an over-ground or underground tank for use on site.	Rainwater harvesting connected to the RWPs of the building could be implemented. The water stored used to water plants and to clean cars, for example. We would recommend a smart waterbutt system is implemented if this option is taken forward.	Yes
Green Roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation. Blue roofs store water at roof level, without the use of vegetation.	The use of green roofs needs to be in keeping with the surrounding developments and green/blue roof in this instance are not. They are also not suitable for roof of this type.	No
Infiltration Systems	Systems that collect and store runoff allowing it to infiltrate into the ground.	The onsite infiltration testing has not been completed but the BGS Mapping show that these types of systems are not	No

		suitable for this development.	
Proprietary Treatment Systems	These subsurface and surface structures are designed to provide treatment of water through the removal of contaminants.	A system like this is not required for this development.	No
Filter Strips	Runoff from an impermeable area is allowed to flow across grassed or otherwise densely planted areas to promote sedimentation and filtration.	The only areas that would benefit from a filter strip would be the areas where long linear areas can shed sheet flow to open space. There are no areas that could have this type of system implemented.	No
Filter Drains	Runoff is temporarily stored below the surface in a shallow trench filled with stone/gravel, providing attenuation, conveyance, and treatment.	There is limited scope for these features to be implemented, however between the set of car parking bays, Hydroplanters could be installed that would be able to accept exceedance flows from the car parking areas.	Yes, but limited
Swales	A vegetated channel used to convey and treat runoff. These can be wet or dry and can be lined or unlined.	To have meaningful open features there needs to be as significant amount of open space to be implemented, which this development does not have.	No
Bioretention Systems	A shallow landscaped depression allows runoff to pond temporarily on the surface, before filtering through vegetation and underlying soils prior to connection or infiltration.	The current layout allows for open features, but may not have the infiltration to allow this feature to operate effectively.	No

Trees	Trees can be planted within a range of infiltration SuDS components to improve their performance, before filtering through vegetation and underlying soils prior to connection or infiltration. These can also be a standalone element.	Open features with space for trees to be planted in are possible and should be considered. These will add to the SuDS benefits and also to add increased biodiversity.	Yes
Pervious Pavements	Runoff is allowed to soak through structural paving. The sub-base can be used for attenuation of water on site and can be either full infiltration (Type A), partial infiltration (Type B) or fully lined (Type C).	This feature can be implemented on the development. The car parking areas can be pervious system that could be used as sub-surface storage as well. As these areas will be used for car parking, any water allowed to filtrate will undergo a cleaning process too.	Yes
Attenuation Tanks	Large, below-ground voided spaces can be used to temporarily store runoff be infiltration, controlled release or use. These are often made of geocelluar crates.	To have a system that attenuates flows, attenuation of some description is needed, attenuation tanks are an alternative to large open features such as detention basins and ponds. This feature can be combined with other features to have multi-functional spaces.	Yes
Detention Basins	A landscaped depression with an outlet that restricts flows, so that the basin fills and provides attenuation. When not in use they are generally dry and may have	The current layout allows for open features.	Yes

	planted borders of improved biodiversity.		
Ponds and Wetlands	A permanent pool of water can be used to provide both attenuation and treatment of runoff, where outflows are controlled, and water levels are allowed to increase following rainfall. These can also be planted for improved biodiversity.	The current layout allows for open features.	No

The highest viable option on the hierarchy is discharge to the surface water sewer. The favoured option is discharge to the sewer in adjacent housing estate because the existing topography and proposed outline levels have a general fall from the top of the site to the bottom and a gravity connection can be made to this sewer. See appendix F for the sewer records.

Like most developments, there is limited space on site, therefore scope for open attenuation features such as ponds is limited by the available open space. The available space is further limited by the fact that the site is sloped significantly. This means we will need to use an efficient design to maximise the use of space, while providing the amount of storage needed to attenuate to the required rate. The most efficient use of space is to combine elements of the design to have multifunctional areas, in this case we propose to combine permeable paving area (source control and storage) by using the area underneath the private car park to have storage, this creates an efficient use of space on site.

As described previously, the site falls from the top of the site to the site entrance. The most efficient system for the network to convey water on site is to have the point of discharge be at the lowest point of the site and the system to flow towards this by gravity. By implementing a system like this it uses the natural topography of the ground and mimics the currently natural flow path for water through the site, which is the objective of SuDS. In this case, there are two possible discharge points, Shilton Road and Coronation Road. Shilton road is at the top of the site and is only a foul sewer, this means that a pumped arrangement will be needed to discharge to this sewer and it is the lowest of the hierarchy. The other in Coronation Road is in the neighbouring housing development but does have both a surface and foul water sewers (therefore being higher on the hierarchy). As this is the highest option on the hierarchy this should be taken forward, this also follows the SuDS principles as it allow the development to use the natural topography. As with any system, it is likely that a pipe network

will be needed to convey the water on site, especially when there is limited space for open features such as swales and watercourses.

The site is in flood zone 1 so no special consideration to setting FFLs, so they should be set 150mm above the proposed site levels to ensure water flows away from the building.

There are a number of smaller features that could be included in the design to further slow the flow through the site, such as trees in the small amount open space. You could also incorporate smart water butts to the scheme to allow a source of water residents to reduce the water burden each house places on infrastructure, the smart nature also means that they will space for first flows in rainfall events.

5.5 Foul Water Strategy

Once the scheme has been fully developed and the SVP 'pop up' locations are finalised, the foul water system can be completely designed. The system should receive the foul water from "pop up" locations connected to a main run, which should then be connected to the foul sewer in Coronation Street.

If the foul water system cuts through the any permeable paving it will need to be sealed to ensure water is contained in the sub-base of the paving areas.

Section 106 consent will be needed from Severn Trent.

5.6 For details of the surface water system please see appendix F, H, & I for the sewer records, complete drainage scheme and calculations.

5.7 In Summary, the surface water systems should be detailed designed to control to greenfield run-off rate and store the 1 in 100 year plus 40% climate change event (1% AEP), discharging to the surface and foul water sewer in Coronation Road.

6.0 Maintenance Plan

6.1 Responsibility of the maintenance will depend on whether the SuDS feature is to be adopted or is to remain in private ownership. There are a number of potential owners of the responsibility which can include land owners, water authorities, management companies, etc.

6.2 It is important to understand who is responsible for the maintenance of a system to ensure that important maintenance actions are not missed and ultimately, the system continues to operate and does not fail, leading to flood.

6.3 In this case, the system is in private ownership areas. Private systems including the permeable paving and any other element of the system will be the responsibility of residents which will have a management company set up to perform these, it is assumed that is paid for by the residents via a service charge.

6.4 The table below shows the parts of the system that are SuDS features, it then identifies the maintenance actions that need to occur.

Component of the system	**Regular Maintenance**	**Occasional Maintenance**	**Remedial Maintenance**
Permeable paving	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.
		Stabilise and mow contributing and adjacent areas.	As required.
	Occasional maintenance	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying.	As required – once per year on less frequently used pavements.

		Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.
	Remedial Actions	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, 48 h after large storms in first six months.
		Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
		Monitor inspection chambers.	Annually.
Ponds and Wetlands	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, 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, e.g. penstocks.	Half yearly.
		Hand cut submerged and emergent aquatic plants (at min. 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.	Annually.
		Remove sediment from any forebay.	Every 1-5 years, or as required.
		Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.	Every 5 years, or as required.
	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 rearely, eg every 25-30 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.

6.5 As can be seen in the table there are three primary types of maintenance, they are

1. Regular maintenance
2. Occasional maintenance
3. Remedial maintenance

6.6 Regular maintenance needs to be carried out monthly or after each rainfall event during the first year of use and then the maintenance regime can fall into a regular pattern, say every 3 months with greater emphasis in Autumn when leaf fall occurs. Occasional maintenance needs to occur with less frequency than the regular maintenance but still needs to follow a regime to ensure the feature operates as intended and with efficiency. Remedial maintenance is only required when needed, such as when damage has been caused to the drainage system

6.7 Further information on the types of maintenance and the maintenance actions themselves can be found it the CIRIA report C753 – The SuDS Manual in chapter 32 – Operation and maintenance which is freely available for download from www.ciria.org.

7.0 Conclusions

7.1 The site is located in flood zone 1, as identified by the EA using their 'Map for Planning'.

The site has passed the sequential test. This is due to the 'more vulnerable' classification for residential units. This is acceptable for rivers and seas flood risk point of view.

The site is partially at very low risk of surface water flooding.

The site, overall, is considered to be at very low risk of flooding from any sources.

7.2 The site should have 40% climate changed applied to it.

The site has should be limited to greenfield run-off rate.

The surface water drainage system should be designed to control and store up to the 1 in 100 year plus 40% climate change event (1% AEP).

Appendices

- *A: Proposed Architectural Layout*
- *B: Flood Maps For Planning*
- *C: BGS Mapping Extracts*
- *D: DEFRA Magic Map Extracts*
- *E: Gov.uk Long Term Flood Risk Extracts*
- *F: Severn Trent Sewer Records*
- *G: Main Rivers Map Extracts*
- *H: Drainage Strategy Drawings – Main Site & Outfall*
- *I: Drainage Calculations*

Appendix A

Proposed Residential Develoment @ *Shilton Road Barwell*

Proposed Site Layout

Job No	23-115	PL03	Site	Shilton Road, Barwell	
Client	D&T Developers		Date	22.01.25	
Gross Area	1.3 ha				

Total Houses	28

Private Sale				Area		total	
Ref	No	Beds	Storeys	(m²)	(ft²)	(m²)	(ft²)
2 Bed	7	2	2	79	850	553	5,950
3 Bed	10	3	2	93	1,000	930	10,000
4 Bed	5	4	2	119	1,277	595	6,385
Total	22				Total	2,078	22,335

Affordable	[20%]			Area		total	
Ref	No	Beds	Storeys	(m²)	(ft²)	(m²)	(ft²)
Maisonette	2	1	1	50	538	100	1,076
2 Bed	2	2	2	79	850	158	1,700
3 Bed	2	3	2	93	1,000	186	2,000
Total	6				Total	444	4,776

- Planning Application Boundary
- Demolished Dwelling
- Existing Trees Retained
- Existing Trees Removed
- Illustrative Trees
- Existing PROW line
- Block Paving
- Affordable Dwelling

SHILTON ROAD

LEICESTER ROAD

LEAP 111m²

Balancing Pond Area (Indicative)

15.9m

north

0 5 10 20 30 40 50

Metres at scale 1:500

hayward ARCHITECTS LTD

19 Station Rd
Hinckley
Leicestershire
LE10 1AW

Tel: 01455 635665
Fax: 01455 618971

www.hayward-architects.co.uk

Drawing No: 23-115-PL03

Drawing Stage: Planning Application

Scale: 1:500@A2

Date: 22.01.25

Drawn By: JET

Rev	Date	By	Description

Appendix B

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**445378/297007**	**9 Oct 2024 15:57**

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

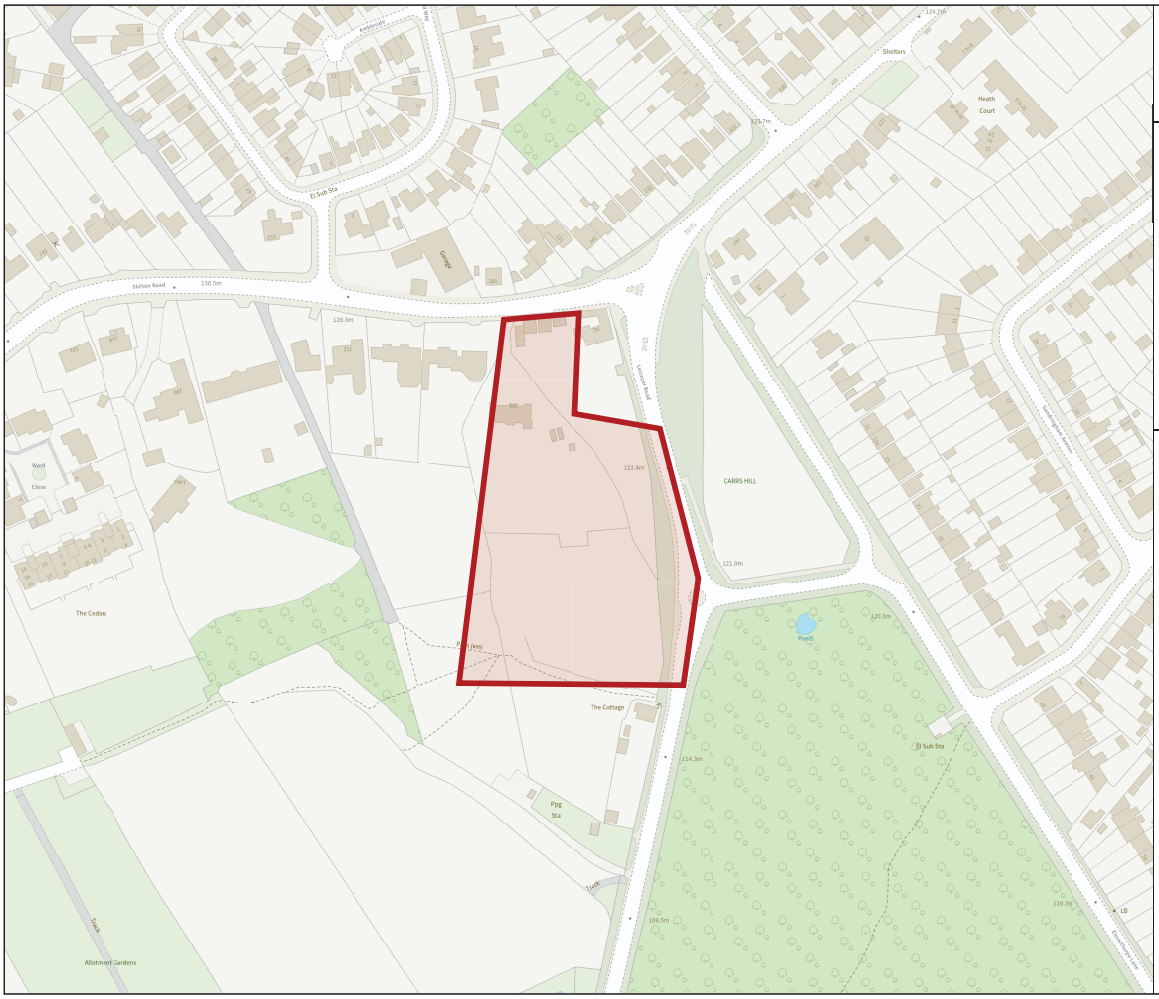
You will need to do a flood risk assessment if your site is **any of the following:**

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

Notes

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

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



Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
445378/297007

Scale
1:2500

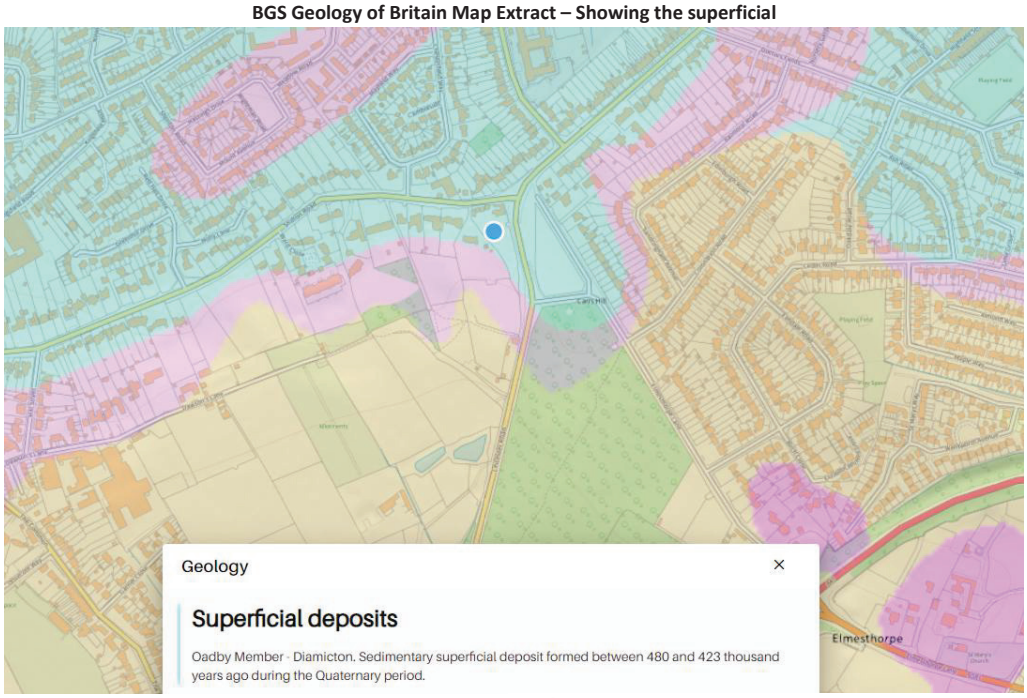
Created
9 Oct 2024 15:57

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

0 20 40 60m

Appendix C

BGS Geology of Britain Map Extract – Showing the superficial



Geology

Superficial deposits

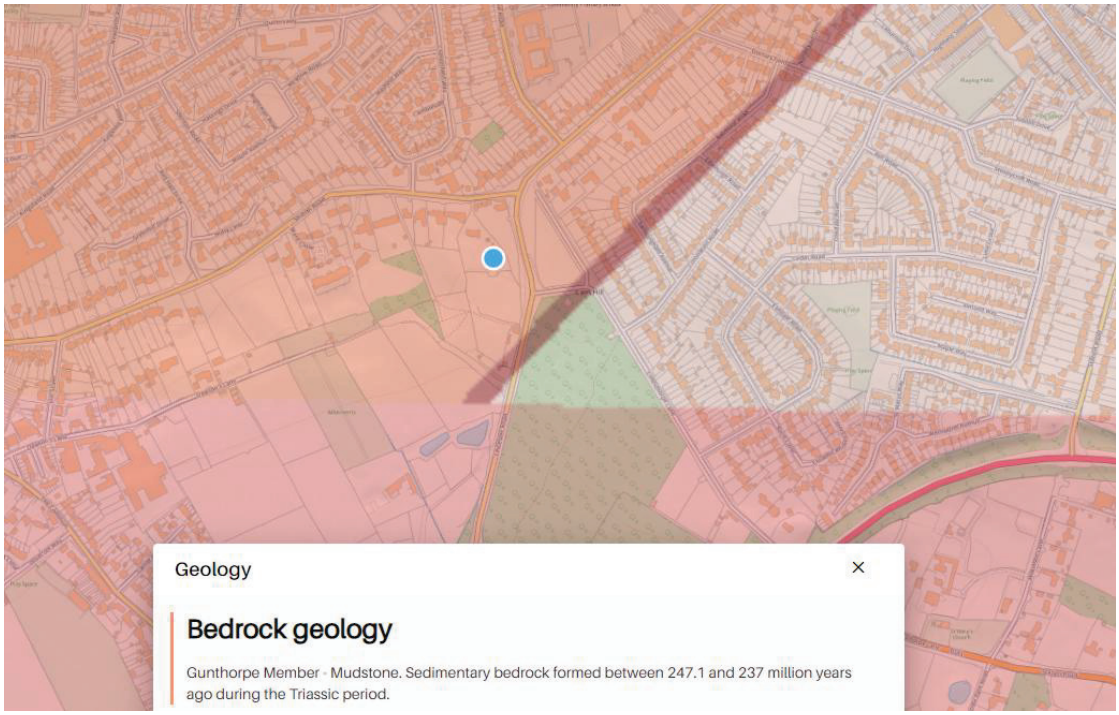
Wigston Member - Sand and gravel. Sedimentary superficial deposit formed between 2.588 million years ago and the present during the Quaternary period.

Geology

Superficial deposits

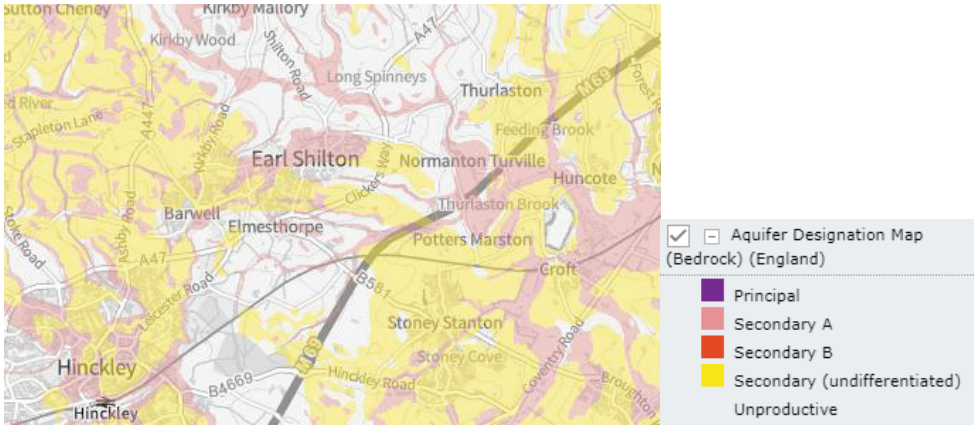
Bosworth Clay Member - Clay and silt. Sedimentary superficial deposit formed between 480 and 423 thousand years ago during the Quaternary period.

BGS Geology of Britain Map Extract – Showing the bedrock

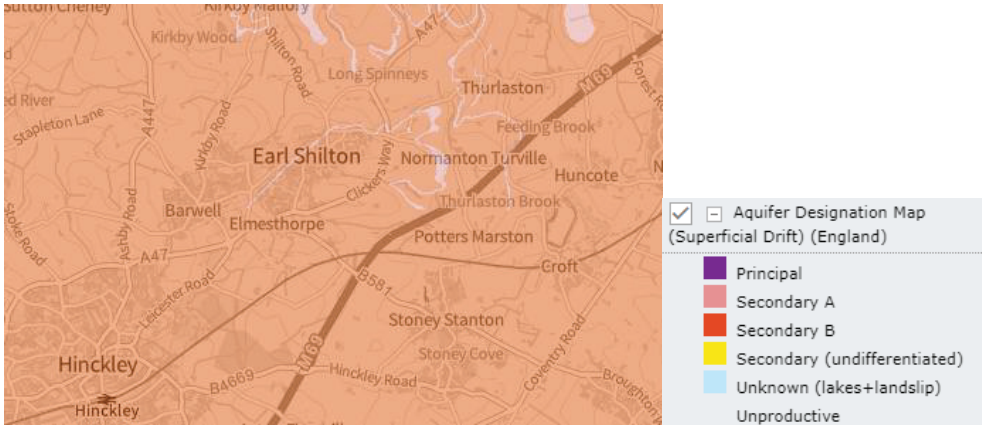


Appendix D

DEFRA Magic Map Extract – showing superficial deposits designations



DEFRA Magic Map Extract – showing bedrock designations



DEFRA Magic Map Extract – showing groundwater vulnerabilities