Hayfield

Berrow Green, Martley

Flood Risk Assessment and Drainage Strategy

BGM-LE-GEN-XX-RP-CE-FRA01-P1-Flood Risk Assessment

October 2023

linkeng.co.uk

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LE23827 – Berrow Green, Martley

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APPENDICES

1 INTRODUCTION

1.1 Background

1.1.1 Link was commissioned by Hayfield to prepare a Flood Risk Assessment and associated Drainage Strategy in respect to a proposed development at Berrow Green, Martley. As required by Worcestershire County Council and Malvern Hills District Council and South Worcestershire Development Plan, this report has been prepared to provide Flood Risk, Sustainable Drainage Strategy and Water Management Plan in support of an outline planning application.

1.1.2 The proposed scheme shall comprise 54 proposed residential dwellings. The proposed site plan is included within Appendix A.

1.2 Site Location

1.2.1 The site is located south of Martley off B4197 Road and is bounded by agricultural fields to the south and west, existing residential properties to the southeast, and allotments north of the site. As stated above, a Site Location Plan is included in Appendix A.

1.2.2 The nearest Post Code is WR6 6PQ.

1.3 Topography

1.3.1 A detailed topographical survey of the site has been completed by healer surveys in September 2023.

1.3.2 The existing site level range has been found to be approximately 74.300mAOD in the southwest corner and 67.300mAOD in the northeast corner, with the general fall of the site from the west and southwest corner to the east and northeast corner. The topographical survey has been included within this report in Appendix B.

1.3.3 The main features within the site are a run of allotments situated along the northern boundary of the site. There are also electrical pylons running through the site, from southwest corner to the northeast corner.

1.4 Former Land Uses

1.4.1 Historical free to view mapping (https://maps.nls.uk/geo) has been reviewed as part of this flood risk assessment, which indicates the former use of the site has only been for agriculture.

1.5 Ground conditions

1.5.1 At the time of this report being written, no ground investigation has been carried out, therefore online information has been used to get a better understanding of the ground conditions.

1.5.2 A review of the British Geological Survey's geological mapping has been undertaken to determine the likely ground conditions on the site. Geological maps on the British Geological Survey online tools identifies the Helsby Sandstone Formation – Sandstone that completely covers the site as the bedrock geology.

1.5.3 Furthermore, a publicly available borehole in the proximity of the site (approximately 250m east of the site) has been reviewed, which suggest the proposed development is mainly to be constructed on Marl and Red Marl Sandstone and water was first struck at 20ft (6m) below the surface.

1.6 Watercourses

1.6.1 The River Teme is the nearest main river, approximately 800m to the west of the site, shown in Figure 1 below.

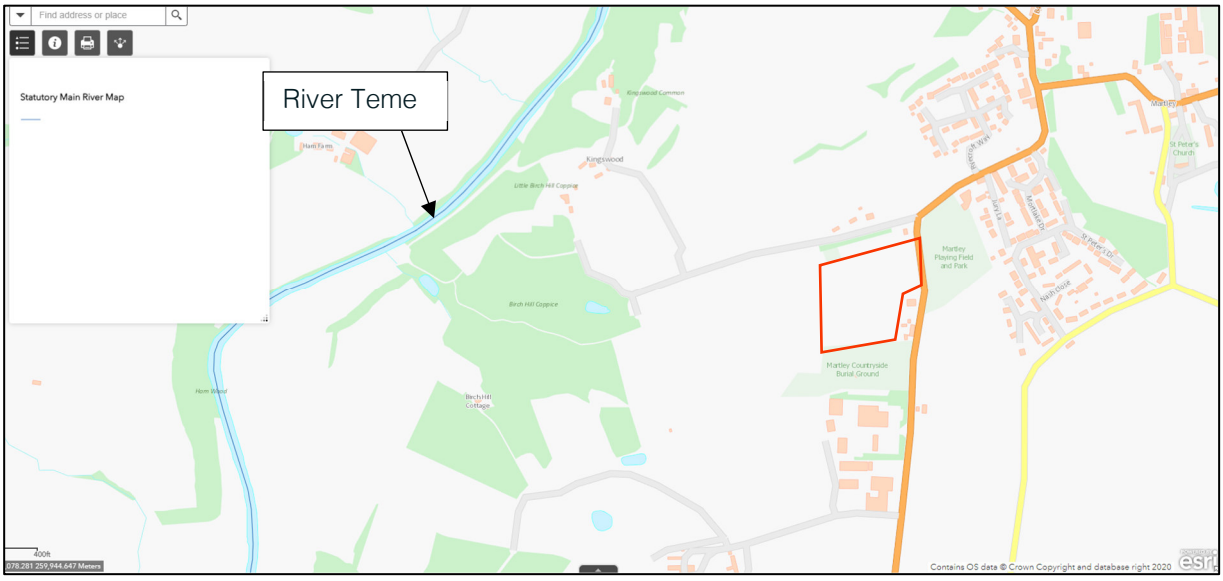

Figure 1: Main rivers map from EA (Site boundary shown in Red)

1.6.2 No other major water features have been identified within the proximity of the site, apart from a small ditch running parallel along the B4197 on the eastern boundary of the site which can be discharged into.

1.6.3 A 2D analysis of a 50mm storm on the existing surface was completed in InfoDrainage using the 'Deluge' function and included in Figure 2 below. As can be seen from the figure, the majority of the surface water runoff drains towards the existing highway and drainage ditch along the eastern boundary of the site.

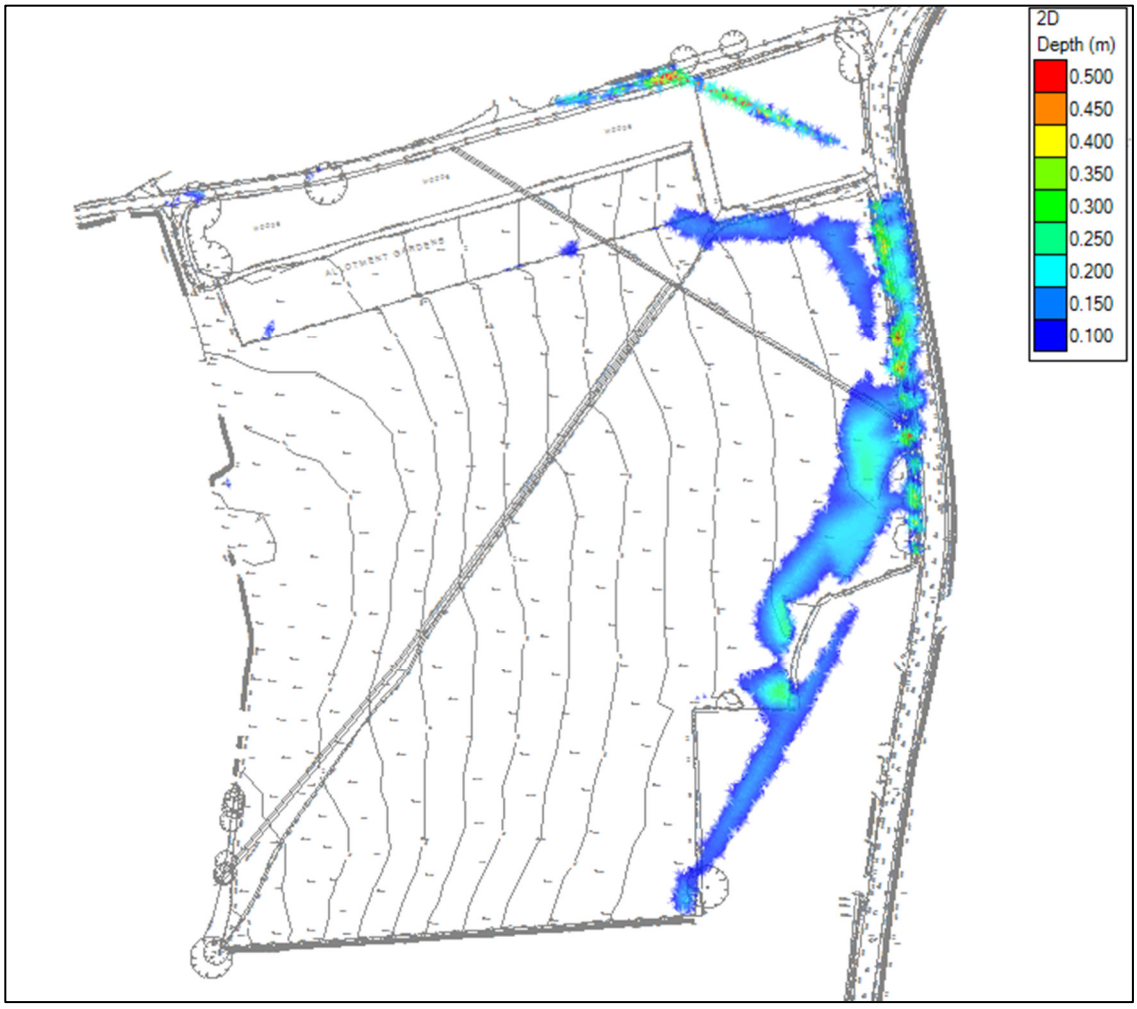

Figure 2: InfoDrainage 'Deluge' analysis of existing levels

1.7 Drainage

1.7.1 As the site is currently greenfield, no drains are located on site. A sewer record for the area provided by Severn Trent Water is included in **Appendix C.**

1.7.2 Based on the topography of the ground, the site naturally drains to the east, towards the existing drainage ditch along the B4197. This is confirmed and presented in Figure 2 above.

1.8 Flood Zones and Vulnerability Classification

1.8.1 The formal flood zone mapping approved by the government and prepared for use in the planning process, identifies areas potentially at risk of flooding from fluvial or tidal sources without taking into account the presence of flood defences or structures such as culverts or minor watercourses. An extract from the mapping is included in Figure 3 below; the red line denotes the site boundary.

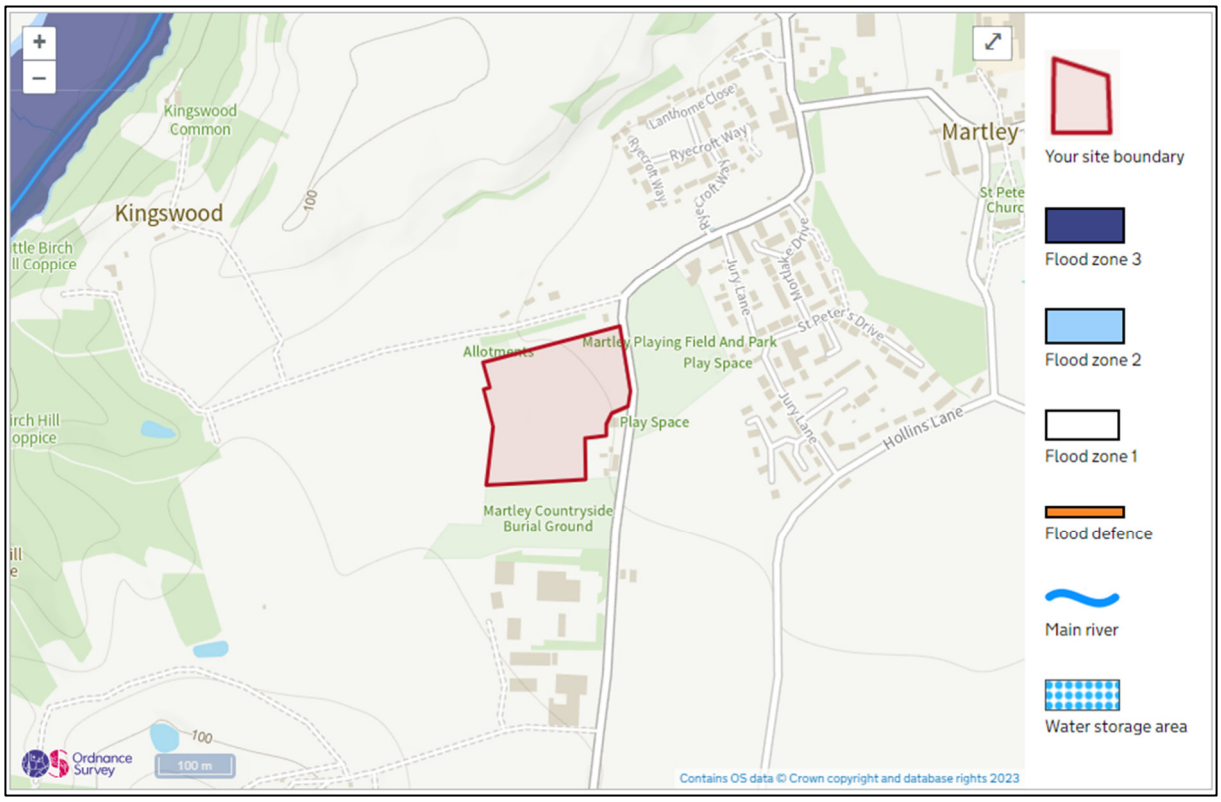

Figure 3: Flooding from Rivers and Watercourses

1.8.2 The formal flood zone mapping shows the site to be located within Flood Zone 1. Table 1 indicates what uses of land are appropriate for each flood zone, as set out within Table 3 – Flood risk vulnerability and flood zone 'compatibility' in the NPPF. The proposed use would be defined as 'More Vulnerable' so hence the proposed use is deemed acceptable.

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test	✓	✓	✓
Zone 3a	Exception Test	✗	Exception Test	✓	✓
Zone 3b	Exception Test	✗	✗	✗	✓

Table 1 - Flood risk vulnerability and flood zone 'compatibility'

1.9 National Planning Flood Risk Policies Relevant to this Development

1.9.1 The National Planning Policy Framework (NPPF) last revised by the Department of Communities and Local Government (DCLG) on 5th September 2023, took immediate effect on that date. The document Technical Guidance on the National Policy Framework (TGNPPF) also published by the Department of Communities

and Local Government, has now been withdrawn and superseded by the Planning Practice Guidance (PPG), published on 6 March 2014.

1.9.2 The requirement for conducting an FRA as part of a planning application is set out in Footnote 55 on page 48 of the NPPF, which states:

"A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."

1.9.3 Essential content of a site-specific FRA is explained in the NPPG, paragraph 30-32 as follows:

"A site-specific flood risk assessment is carried out by (or on behalf of) a developer to assess the flood risk to and from a development site. Where necessary, the assessment should accompany a planning application submitted to the local planning authority. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users (see Table 2 – Flood Risk Vulnerability).

"The objectives of a site-specific flood risk assessment are to establish:

- *whether a proposed development is likely to be affected by current or future flooding from any source;*
- *whether it will increase flood risk elsewhere;*
- *whether the measures proposed to deal with these effects and risks are appropriate;*
- *The evidence for the local planning authority to apply (if necessary) the Sequential Test, and;*
- *Whether the development will be safe and pass the Exception Test, if applicable."*

1.9.4 For certain types of flood sensitive development, NPPF describes how the Local Planning Authority (LPA) should check that the site proposed has the lowest frequency of flooding of those available for the development. This check is called the "Sequential Test." All development that is identified in the LPA's Local Development Framework Development Plan (LDFDP) has been Sequentially Tested using the LPA's Strategic Flood Risk Assessment (SFRA). When a test is required, and the development is not identified in the Development Plan, NPPF advises that the site-specific FRA includes the Test. NPPF also requires that the FRA includes an "Exception Test" for flood sensitive development proposed in areas with high frequency of flooding. The reason is to demonstrate that flood risk will be safely managed for the lifetime of the development.

1.9.5 According to the latest relevant Planning Practice Guidance, updated in October 2019, present day rainfall rates should be increased by 20% for design and by 40% to investigate the potential impact on flood risk of the current central expectation of climate change occurring in the anticipated 50-year lifetime of the development.

1.9.6 "Non-Statutory Technical Standards for Sustainable Drainage Systems" published by Department for Environment, Food and Rural Affairs in March 2015 sets out Government expectations for surface water

drainage systems serving major developments to restrict discharges to green field rates. The standards do not address the quality of surface water discharges and state circumstances when the discharge rate can be higher than green field, up to the existing flow in the case of redevelopment of brown field sites.

1.10 Local Policy Guidance

1.10.1 The South Worcestershire Development Plan, adopted in February 2016, outlines the requirements and considerations developers should follow as part of their proposals. As part of this report, the adopted policies have been reviewed, and the proposal has been developed to comply with their requirements. The relevant planning policies within the district plan, they are outlined below.

1.10.2 SWDP 28: Management of Flood Risk

"A. In order to minimise the impacts of and from all forms of flood risk the following is required:

i. Other than sites allocated in this Plan all development proposals must clearly demonstrate that the Sequential Test, as set out in the latest version of the Strategic Flood Risk Assessment (SFRA), has been applied.

ii. If the Sequential Test has been satisfied, development proposals, other than those allocated in this Plan, must also satisfy the Exception Test in all applicable situations as set out in the latest version of the SFRA.

iii. Site specific Flood Risk Assessments (FRAs), informed by the latest version of the SFRA, where: The development proposal is over 1ha in size. The development proposal includes land in Flood Zones 2 and 3 (as defined by the latest Environment Agency mapping). The development proposal (includes Flood Zone 1) affects land where evidence, in particular the SFRA, indicates there are records of historic flooding or other sources of flooding, e.g. due to critical drainage problems, including from ordinary watercourses and / or a need for more detailed analysis.

B. All development proposals must adhere to the advice(63) in the latest version of the SFRA and will:

i. Provide level for level, volume for volume, floodplain compensation where necessary.

ii. Ensure no increase in flood risk or harm to third parties.

iii. Explore opportunities to reduce flood risk overall, including contributions where appropriate.

iv. Ensure development is safe from flooding for its lifetime.

v. Ensure development is appropriately flood resistant and resilient.

vi. Take into account all forms of flooding.

vii. Include appropriate allowances for climate change.

viii. Ensure safe access and exits are available for residential development in accordance with DEFRA guidance (table 13.1 from FD2320 – Danger to People for Combinations of

Depth and Velocity – see below). Access to "safe refuges" or "dry islands" are unlikely to be considered safe as this will further burden the Emergency Service in times of flood.

ix. *Provide an assessment of residual risk.*

x. *Provide satisfactory Evacuation Management Plans, where necessary, including consultation with the Emergency Services and Emergency Planners.*

xi. *Ensure development layouts are informed by drainage strategies incorporating sustainable drainage systems (SuDS), as set out in SWDP 29."*

1.10.3 SWDP 29: Sustainable Drainage Systems

"*A. To minimise flood risk, improve water quality and groundwater recharge and enhance biodiversity and amenity interest, all development proposals (as appropriate to their nature and scale) will be required to:*

i. *Demonstrate through a Water Management Statement that site drainage and runoff will be managed in a sustainable and co-ordinated way that mimics the natural drainage network.*

ii. *Manage surface water through Sustainable Drainage Systems (SuDS). SuDS schemes must protect water quality and, wherever practicable, reduce the risk of diffuse pollution by means of treating at source and following the management train approach.*

iii. *Secure the long-term maintenance of SuDS schemes.*

iv. *As a minimum, demonstrate that for a Greenfield site, the post-development surface water run-off rate will not increase. Proposals on brownfield land must show a 20% reduction in surface water run-off rates compared with the pre-development situation. A greater reduction in surface water run-off rates may be sought in areas identified, e.g. in a Worcestershire Surface Water Management Plan as having surface water flooding problems. In all cases, development proposals must not increase surface water flood risk beyond the site.*

v. *Prior to the submission of a planning application, consult with Severn Trent Water to ensure appropriate water infrastructure is secured (surface water sewer capacity).*

vi. *Avoid culverting of any watercourses and secure adequate maintenance access. Open up any culverted watercourses unless this will clearly compromise public safety.*

vii. *Demonstrate that the submitted landscaping scheme will preserve and wherever possible improve the ecological status of on-site watercourses and water bodies, including integration into the wider blue and green infrastructure.*

viii. *Demonstrate compliance with the Water Framework Directive, exploring opportunities to help meet its targets.*

B. Lack of space, prohibitive costs, inadequate infiltration and land contamination will not be accepted as reasons for not including SuDS. Given the wide range of SuDS techniques (see Table 9 below) available, there is a sustainable drainage solution to suit all sites."

2 FLOOD RISK

2.1 Flood Risk from Rivers and Watercourses

2.1.1 The site is shown on the available flood maps, see Figure 3 above, to be at a low risk of flooding from rivers and watercourses as it is in Flood Zone 1. Therefore, the site is not considered to be at risk of flooding from rivers and watercourses.

2.2 Flooding from the Sea

2.2.1 The site is situated approximately 72km from the sea and is approximately 67m above sea level. Therefore, it is considered that the risk of flooding from the sea is negligible and is not discussed further within this report.

2.3 Flooding from Surface Water

2.3.1 The EA website contains mapping of areas believed to be vulnerable to surface water flooding. An extract from the flood map is given in Figure 4. This shows that the majority of the site is at no risk from surface water flooding apart from a small area on the eastern boundary being shown to have a low flood risk. This is believed to be due to the topography of the ground in combination with the absence of drainage infrastructure.

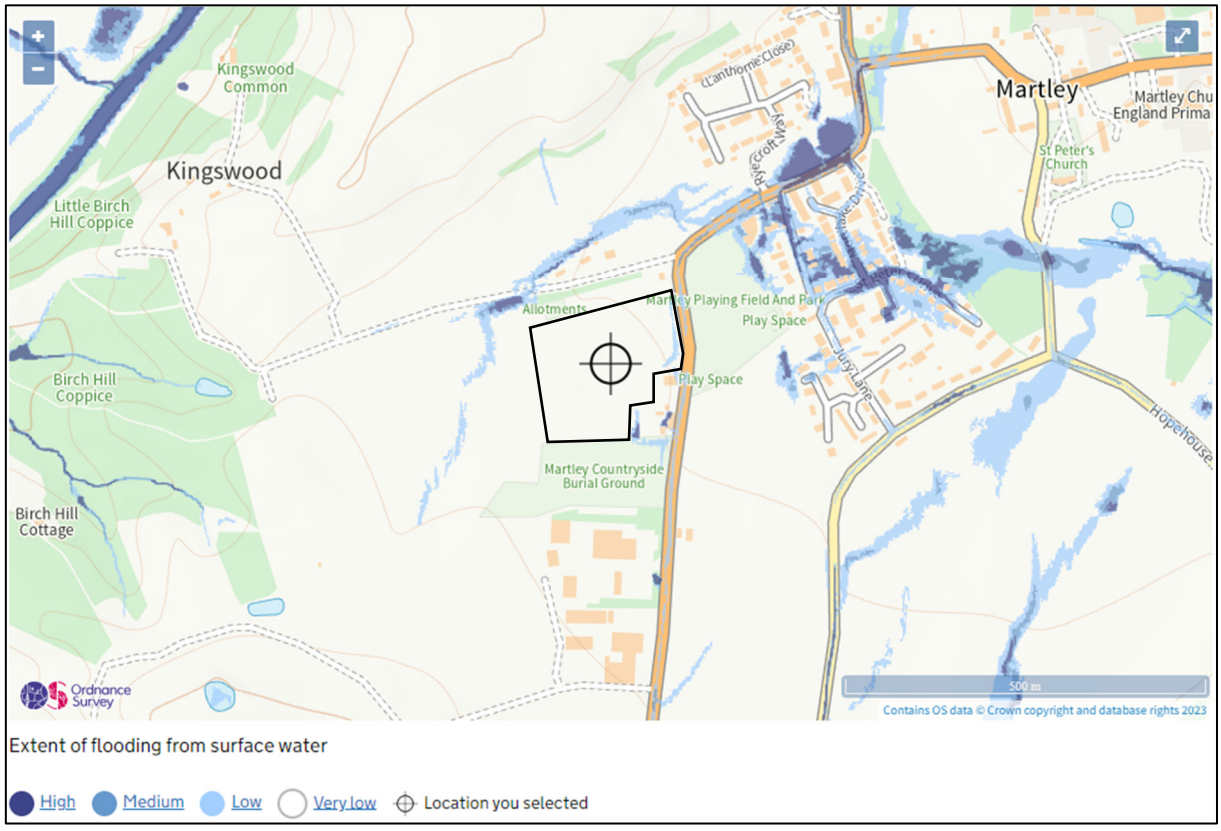

Figure 4: Flooding from Surface Water

2.4 Flooding from Groundwater

2.4.1 The South Worcestershire Development Plan Strategic Flood Risk Assessment states that *"the majority of South Worcestershire is within the <25% susceptibility classification, therefore is at a lower risk of*

groundwater flooding." However, it also then states that areas *"along the…River Teme fall within the higher susceptibility classifications and are therefore at a higher risk of groundwater flooding."*

2.4.2 As mentioned in Section 1.5 Ground Conditions above, a borehole within the proximity of the site shows water to be first struck at approximately 6m below the surface. Furthermore, the is situated between 30m and 40m above the River Teme to the west of the site. This indicates that there is not likely to be a high risk of flooding due to groundwater.

2.4.3 Therefore, it can be concluded that the proposed development is at low risk from flooding by groundwater.

2.5 Flooding from Sewers

2.5.1 Flooding can occur from other sources such as blocked drains and sewers. A pre-development enquiry to Severn Trent Water was carried out and they stated that there are no existing public sewers within the site boundary. Furthermore, it is expected that sewers in the area are periodically maintained by Severn Trent Water. Therefore, the proposed development is at low risk from flooding by blocked drains and sewers.

2.6 Flooding from Reservoirs, Canals, and Other Artificial Sources

2.6.1 The reservoir flood map shown in Figure 5 shows the extent of flooding should a canal, reservoir, or other artificial source breach upstream of the development. This shows that the site would not be at risk of flooding from this source and as such this source of flooding is not considered a risk.

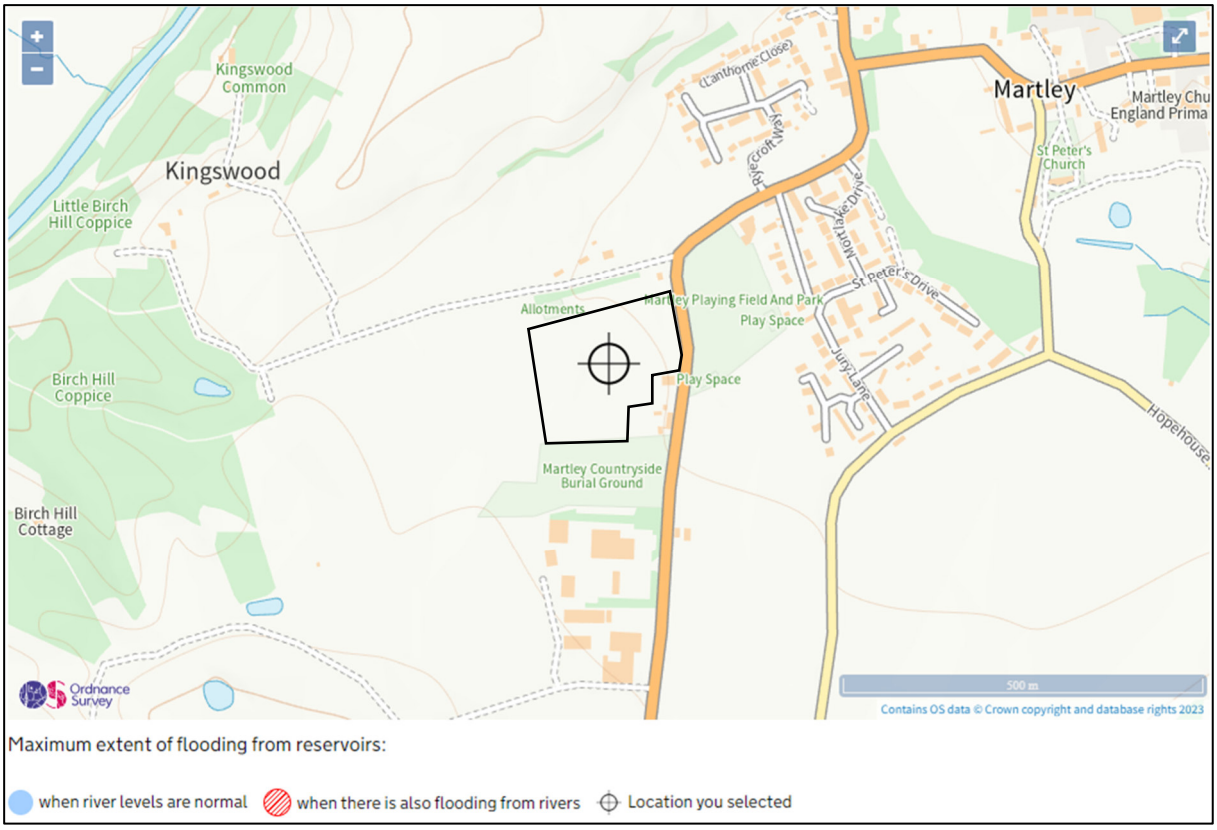

Figure 5: Flooding from Reservoirs

3 MITIGATION

3.1 Flood Risk Management

3.1.1 As per the site masterplan included in **Appendix A**, it is anticipated that a significant portion of the site will be impermeable hardstanding surfacing in comparison to the existing site, which will lead to an increase in overland flows in the event of flooding. It is anticipated that the levels design of the site will follow the general profile of the existing topography (as shown in **Appendix B**) and therefore any potential overland flows will be directed in a north/north easterly direction towards the highway. As a result, the residential dwellings and additional structures in the proposed development will not be impacted in the event of flooding.

3.1.2 It is suggested that the following flood risk management measures are considered to mitigate the risks identified above:

- *It is recommended that where possible development finished floor levels are set above the existing levels and at least 150mm above the proposed surrounding external levels.*
- *The proposed development will incorporate a positive surface water drainage system, described further in Section 4, which will intercept runoff from roofs and paved areas into ponds before discharging flows offsite at a rate no higher than the predevelopment runoff rates (greenfield Qbar).*

3.2 Residual Risks

3.2.1 Residual risks are the risks that remain once the flood risk management measures described above have been implemented. These are typically associated with extreme events that overwhelm drainage systems exceeding the flood levels used to design any mitigation measures. The primary residual risks that will affect this development are:

- *An extreme rainfall event which exceeds the capacity of the proposed surface water drainage system to both intercept and convey the flows. During such an event, water that is unable to enter the formal drainage system will flow over the ground through the development. The risk can be reduced by designing site levels to direct any runoff away from the proposed buildings and towards the highway, proposed ponds, existing ditches, or other corridors running through the site.*

4 PROPOSED DRAINAGE STRATEGY

4.1 Outfall Assessment

4.1.1 As required by Part H of the Building Regulations and the paragraph 7-080 in Planning Policy Guidance of the NPPF, the required Drainage Hierarchy has been considered in the development of this strategy as summarised below.

Outfall Option	Available Option	Comment
Infiltration Drainage	×	The use of infiltration has been ruled out at this stage due to lack of information for the site.
Watercourse	✓	It is proposed that the existing drainage ditch to the east of the site is utilised as a suitable storm drainage outfall. This drainage ditch is the nearest watercourse to the site. As discussed in the above sections, the site currently naturally drains towards the existing ditch, therefore, it is proposed that the drainage strategy will follow the same principle and discharge into the existing ditch at predevelopment runoff rates (Greenfield Qbar).
Surface Water Sewer	n/a	Not considered as there are no existing sewers on the site.
Combined Sewer	n/a	Not considered as there are no existing sewers on the site.

Table 2 – Outfall Assessment

4.1.2 Note that a suitable discharge consent will need to be agreed with the approving body by the contractor prior to completing the connection to the drainage ditch.

4.2 SuDS Assessment

4.2.1 As part of the surface water drainage strategy for the site a number of Sustainable Drainage Systems (SuDS) were considered. Table 3 below provides a list of the options considered and a justification for their inclusion or omission.

SuDS System	Used	Justification
Rainwater Harvesting System	No	The use of rainwater harvesting is not considered economically viable on this site considering installation and operational costs.
Green Roofs	No	Green roofs have not been proposed for this site as there is insufficient access to roof areas for maintenance and as such the system could not be effectively maintained to ensure long term performance.
Infiltration Systems	No	Systems such as soakaways and other infiltration systems are not considered at this stage due to lack of information of the geology and groundwater levels. Further site investigation would be required to assess the suitability of infiltration systems.
Proprietary Treatment Systems	No	The use of proprietary treatment systems is not considered economically viable or required on this site considering installation and operational costs.
Filter Strips	No	Filter strips have not been considered the most effective proposal for this site due to the proposed site layout.
Filter Drains	No	Filter Drains have not been considered the most effective proposal for this site due to the proposed site layout.
Swales	No	Swales are not suitable for this scheme due to available space and proposed land use.
Bioretention Systems	No	Bioretention Systems have not been considered the most effective proposal for this site due to the lack of available landscape areas.
Porous Pavements	No	The use of porous paving is not considered economically viable on this site considering installation and operational costs.
Attenuation Storage Tanks (oversized pipes)	No	The attenuation tank will reduce the quantity of rainfall runoff reaching the watercourse. Cellular Attenuation Tank is provided in order to attenuate surface water due to the restricted discharge.
Detention Basins	Yes	There is sufficient space for a detention basin on this site.
Ponds and Wetlands	No	There is insufficient space for ponds and wetlands on this site.

Table 3 – SuDS Assessment

4.2.2 The outline proposals for the drainage system include private storm and foul pipes combined with ponds and flow control, before discharging into an existing ditch at a rate no more than greenfield runoff rates.

4.3 Proposed Surface Water Drainage Strategy

4.3.1 It is anticipated that a new drainage system will comprise gutters, down pipes, gullies, pipes, ponds, and flow controls, collecting runoff from roof areas, roads, shared drives and footways. The site will be split into two separate networks, each served by a different pond and discharge via a Vortex flow control unit into the existing drainage ditch running along the east boundary of the site.

4.3.2 In accordance with South Worcestershire Development Plan Policy 29: Sustainable Drainage Systems and the Strategic Flood Risk Assessment for the area, it is proposed that the maximum discharge rate up to a 100-year storm plus 40% allowance for climate change is restricted to predevelopment greenfield run off rates, which is calculated to be **4.3 l/s** for the site. A calculation, using 'Source Control' in MicroDrianage for the predevelopment greenfield runoff rates (Qbar), has been included in **Appendix D** (BGM-LE-GEN-XX-CAL-CE-002). In order to restrict the flow, it is proposed to use a flow control device at the each of the outfalls for the two ponds with the required attenuation storage.

4.3.3 To support this assessment a Drainage Strategy Drawing (No. BGM-LE-GEN-XX-DR-CE-001) has been prepared and a drainage network simulation analysis has been carried out demonstrating the system's performance.

4.3.4 The results (BGM-LE-GEN-XX-CAL-CE-001) and drainage strategy drawing (No. BGM-LE-GEN-XX-DR-CE-001) have been included in **Appendix D**.

4.3.5 The site has been assessed for a number of return periods and a series of rainfall events and the predevelopment discharge rates for the critical storms are provided in Table 4 below. The proposed discharge rates that the network will be limited to have also been included. The proposed discharge rates have been calculated based upon the Qbar greenfield runoff rates based on the catchment of impermeable areas (65%). This is due to the whole site not being drained into the proposed system.

Return Period	Greenfield Runoff Rates (l/s)	Proposed Discharge Rates (l/s)
Q_{bar}	7.0	4.75
$Q_{1\ in\ 1\ year}$	5.8	4.75
$Q_{1\ in\ 30\ year}$	13.8	4.75
$Q_{1\ in\ 100\ year\ +\ 40\%\ CC}$	18.1	4.75

Table 4 – Predevelopment surface water discharge rates

4.3.6 In addition to the surface water treatment provided by the SuDS features the following measures are to be included within the surface water drainage system to improve water quality prior to discharge offsite.

- *Trapped gullies;*
- *Sediment sump within flow control device.*

4.4 Attenuation storage

4.4.1 Within the proposed drainage strategy, detention basins have been included to attenuate flows before discharging into vortex flow control units. The site has been split into two separate networks, Network A and Network B, each with their own detention basin and flow control.

4.4.2 Each detention basin has been sized based upon the proposed discharge rates above, which have been pro-rata'ed to the catchment areas draining into each network. See Table 5 below.

4.4.3 The detention basins have a depth of 1.2m plus an allowance of 300mm freeboard has been added.

Network	Impermeable Area (ha)	Discharge rate (l/s)	Proposed Volume (Incl. freeboard) (m^3)
A	1.29	3.75	1,284
B	0.20	1.0	202
Total	1.49	4.75	1,486

Table 5 – Attenuation Calculations

4.4.4 In addition, to aid in minimising the area taken up by the detention basins, Network A has been designed with a series of oversized pipes (600mm diameter) to aid in the storage of attenuated volumes.

4.4.5 A Drainage Strategy Drawing (No. BGM-LE-GEN-XX-DR-CE-001) have been included in **Appendix D**.

4.5 Exceedance Flows

4.5.1 As demonstrated by the surface water drainage calculations, there is nominal flooding indicated for design storm events up to and including the 1 in 100-year event plus an allowance of 40% for climate change. As such the potential source of overland flooding on the site is failure of the surface water drainage system or a rainfall event in excess of the systems or surrounding areas design parameters.

4.5.2 As noted above the site falls from the southwest corner to the northeast and north so any overland flow shall be directed by the levels design towards the proposed ponds and the existing highway and drainage ditch. This route has been highlighted on the Drainage Strategy Drawing No. BGM-LE-GEN-XX-DR-CE-001.

4.6 Foul Water Drainage Strategy

4.6.1 As a greenfield site, there is currently no existing foul water sewer serving the site. The proposed development is change in land use and will require a proposed foul drainage network.

4.6.2 In order to establish a foul outfall, a developer enquiry was submitted to Severn Trent Water, the local water company.

4.6.3 The response to this developer enquiry application confirmed that the foul sewers in the vicinity of the site have sufficient capacity to accept the foul flows from the proposed development and Severn Trent Water

would be willing to accept a connection to their network at a preferred location subject to a formal S106 application being made ahead of connection. Severn Trent Water have suggested that existing MH SO75591502, situated in the highway to the southeast of the site, will be the most suitable connection point. This connection point can be achieved via a piped gravity system of 150mm diameter pipes. An easement will be required along the portion of pipework situated within the highway in order to connect into the existing network.

4.6.4 The proposed foul drainage strategy is to convey all foul flows from the development to the southeast corner of the site. As discussed above, Severn Trent Water agree with the principal of this connection subject to a formal S106 application.

4.6.5 The foul drainage strategy is shown on drawing BGM-LE-GEN-XX-DR-CE-001 included in **Appendix D**.

5 DRAINAGE MANAGEMENT PLAN

5.1 Responsibility

5.1.1 The occupier of the proposed development shall be responsible for the maintenance and operation of the drainage system, including any attenuation and flow control devices.

5.2 Maintenance of Pipe Networks

5.2.1 Maintenance and management of main storm sewers and chambers inclusive of pipework from paved areas and buildings (but excluding internal building drainage) should be visually inspected and jetted/cleaned as required. As a minimum, this should be carried out every 5 years. Methods of inspection to give indications of blockages etc. may include:

- *Pulling a mandrel through the pipe to identify physical faults (e.g., disjointed pipes).*
- *Flushing/jetting.*
- *CCTV.*
- *Measurement of water depths in pipe entries, catchpits or interceptors along a drain run may identify potentially blocked pipes.*

5.2.2 Gully gratings, manhole gratings and channel gratings shall be visually inspected at least once every year and replaced or re-set if damaged or dislodged. Gullies should be inspected at least once every year, ideally during springtime as the autumn and winter seasons produce the most detritus build up in the form of leaves, litter and silt. This material should be removed from the channels and disposed of at a licensed tip. This material should not be tipped in other areas of the development as it may pose a pollution threat to the surrounding drainage system.

5.2.3 Jetting should only be carried out after removal of the silt and debris, as jetting alone will simply wash the debris further downstream without removing the problem.

5.3 Maintenance of SuDS Features

5.3.1 The regular and correct maintenance of the SuDS features is essential to the continued performance. The SuDS Manual C753 provides advice on the management of the system. The recommended maintenance regimes for the ponds, as highlighted in Table 3, is given in Table 23.1 in the SuDS Manual C753 respectively, which will form the basis of the strategy for the provided development.

TABLE 23.1 Operation and maintenance requirements for ponds and wetlands

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

Table 5 – Table 23.1 of CIRIA 753

5.3.2 It should be noted that maintenance regimes detailed above are initial recommendations and the actual maintenance work undertaken should be adapted to suit the system performance by the maintenance provider.

6 CONCLUSION

6.1.1 This site-specific Flood Risk Assessment has been prepared in accordance with NPPF guidance, local policy on Flood Risk, and SuDS Guidance.

6.1.2 The government approved flood mapping shows the site to be located within Flood Zone 1 and with low flood risk from both fluvial and pluvial sources on the site. Furthermore, there is no risk of flooding from other sources, such as, surface water, groundwater, or sewers.

6.1.3 The proposed levels on the site shall be set such that in the unlikely event of these systems failing the development on the site will remain protected.

6.1.4 The surface water drainage strategy has been designed to attenuate flows from the impermeable areas of the site in two detention basins, each with a vortex flow control unit restricting the flows to predevelopment greenfield runoff rates (Qbar). Furthermore, oversized pipes have been included within the design to aid in the storage of attenuated volumes.

6.1.5 The drainage strategy demonstrated that an appropriate drainage system for both foul and surface water can be provided on the site which discharges to a suitable outfall. Subject to the mitigation measures proposed, the development may proceed without being subject to significant flood risk. Moreover, the development will not significantly increase flood risk to the wider catchment area.

APPENDICES

APPENDIX A – Proposed Site Plan

A1. BGM-LE-GEN-XX-DR-CE-000 – Proposed Site Plan

APPENDIX B – Topographical Survey

B1. N2045-R0-A0 – Topographical Survey

APPENDIX C – Severn Trent Water Correspondence and Sewer Records

C1. A1L_Sewer_Tabular Berrow Green Road

C2. Developer enquiry 1088363 Berrow Green Road

C3. Severn Trent Surface Water Guidance Note (August 2021)

APPENDIX D – Drainage Strategy Drawing No. BGM-LE-GEN-XX-DR-CE-001 & Supporting Calculations

D1. BGM-LE-GEN-XX-DR-CE-001-S5-A - Proposed Drainage Strategy

D2. BGM-LE-GEN-XX-CAL-CE-001 - Drainage Simulation Analysis Results

D3. BGM-LE-GEN-XX-CAL-CE-002 - Greenfield Runoff Rates Calculations

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