FLOOD RISK ASSESSMENT & SURFACE WATER DRAINAGE STRATEGY

Toton West

Land at Stapleford Lane, Toton, Nottingham, NG9 7JA

On behalf of Bloor Homes East Midlands

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Document Management

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List of abbreviations

AEP	Annual Exceedance Probability
BBC	Broxtowe Borough Council
BGS	British Geological Survey
CFMP	Catchment Flood Management Plans
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FSR	Flood Studies Report
Ha	Hectare
IDB	Internal Drainage Board
LiDAR	Light Detecting And Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NCC	Nottinghamshire County Council
NGR	National Grid Reference
NPPF	National Planning Policy Framework (December 2023)
NPPFTG	National Planning Policy Framework Technical Guidance
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
STW	Severn Trent Water
SuDS	Sustainable Drainage Systems

1. Introduction

Background

1.1. Pegasus Group has been appointed by Bloor Homes East Midlands to undertake a Flood Risk Assessment (FRA) and prepare a Surface and Foul Water drainage strategy for proposed development of agricultural greenfield into a residential housing scheme with associated works.

1.2. The site currently comprises open agricultural land. The total site area is 18.88ha, of which 7.42Ha is proposed to be comprised of impervious surfaces. Under proposals, the site would deliver up to 420 new dwellings with associated infrastructure.

1.3. The site is located at NGR SK 49217 35555. A site location plan can be found in Section 2, Figure 2.1.

1.4. This assessment considers the risk of flooding from all sources, including tidal, fluvial, surface water, historic, groundwater, sewer and artificial sources.

Table 1.1 – Key Stakeholders

Stakeholder	Discipline
Client	Bloor Homes East Midlands
Planning Consultant	Pegasus Group
Architect	Pegasus Group
Hydrology, Flood Risk and Drainage	Pegasus Group
Topographical Survey	Tag Surveys
Water Company	Severn Trent Water
Highways Authority	Nottinghamshire County Council
Local Lead Flood Authority	Nottinghamshire County Council
Environmental Agency	Environmental Authority

National and Local Policies

1.5. Both the National Planning Policy Framework (NPPF) and the Lead Local Flood Authority – Nottinghamshire County Council (LLFA - NCC) state that a site-specific Flood Risk Assessment will be required for proposals:

- In flood zones 2 or 3 including minor development and change of use
- In flood zone 1 where:
    - Site is more than 1 hectare (Ha)
    - Land 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.
    - Land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

1.6. The site is approximately 18.88Ha in area and is located west of the B6003 (Toton Lane), with the entirety of the site located within flood zone 1.

1.7. As of April 2015, the legislation for dealing with FRAs changed, with additional emphasis placed on the use of Sustainable Drainage Systems (SuDS) within drainage schemes for new developments. This is supported by the Broxtowe Borough Council Emerging Local Plan core policies relating to:

i. Policy 1 - Climate Change

1.8. Policy 1 states that "*Development will be supported that adopts the precautionary principle, that avoids areas of current and future flood risk, which, individually or cumulatively does not increase the risk of flooding elsewhere and, where possible, reduces flood risk…*

…All new development should incorporate measures to reduce surface water runoff whilst managing surface water drainage in a sustainable manner, and Sustainable Drainage Systems should be incorporated into all new development unless it can be demonstrated that such measures are not viable or technically feasible."

1.9. In February 2016, the Environment Agency (EA) introduced new guidance relating to the climate change allowances that must be considered within an FRA. Since 2016, the allowances for sea level rise, peak river flow and peak rainfall have each been updated. These changes along with allowances for urban creep have been assessed in the following sections. Furthermore, in January 2025, the EA updated their fluvial and pluvial flood maps.

1.10. Given the above, any new planning application that requires an FRA will also require a surface water drainage strategy to be submitted. The drainage strategy must demonstrate the use of SuDS within the design and should be in line with the requirements as set out within the National Planning Policy Framework Technical Guidance (NPPFTG). The drainage strategy must also account for climate change over the lifetime of the development, in accordance with the climate change allowances published by the EA.

1.11. In addition to the requirements from the NPPF and EA, as discussed above, this assessment has also reviewed the information, and requirements included in the Broxtowe Borough Council Level 1 Strategic Flood Risk Assessment (2016).

1.12. The purpose of this document is to provide an FRA and Drainage Strategy for the proposed redevelopment to support a planning application. The Drainage Strategy sets out how post-development surface and wastewater would be sustainably managed to mitigate potential flood risk and protect groundwater.

1.13. Preparation of this FRA has been informed by a review of information held by the Environment Agency, Severn Trent Water and the Nottinghamshire County Council in their capacity as LLFA. These studies have identified technical and environmental constraints which have been considered and which have informed the development of the drainage strategy set out in the following sections.

2. Existing Site & Hydrology

Site Location & Existing Conditions

2.1. The site is currently greenfield agricultural land, located to the west of the B6003 south of Bardills Roundabout, approximately 4.5km to the west of the centre of Nottingham, approximate NGR SK 49217 35555.

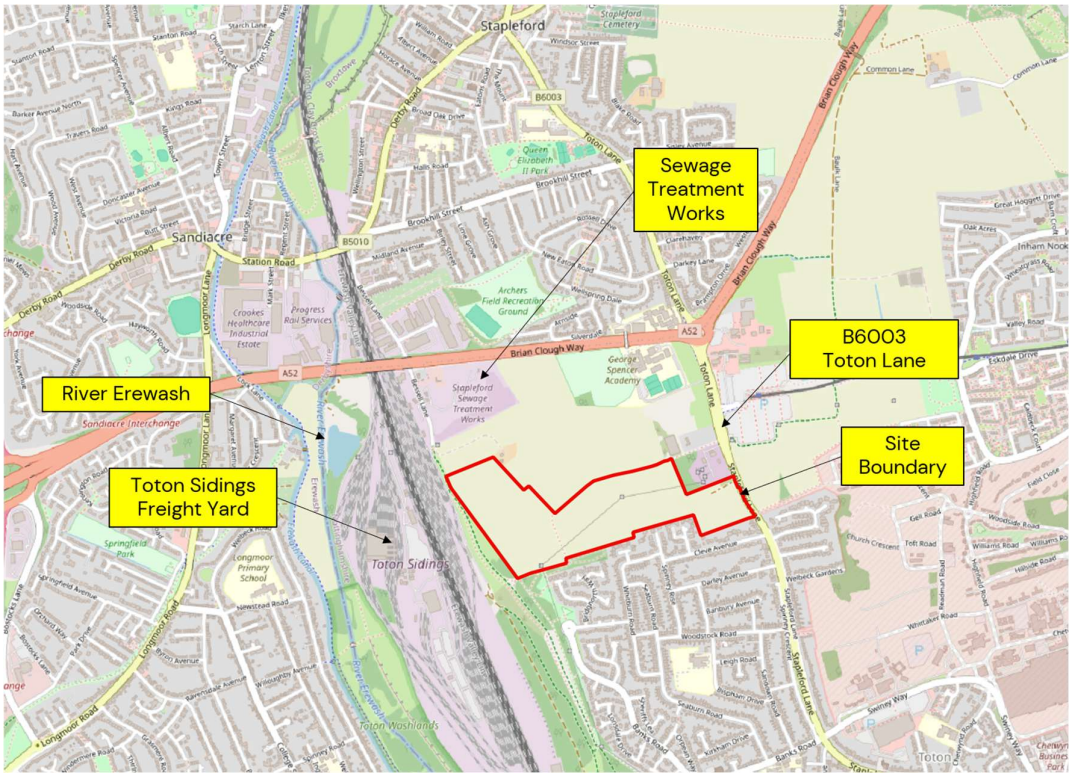
2.2. The site is bounded by greenfield to the north, residential development to the south, the B6003 to the east and Toton freight yard to west.

2.3. There is a single field ditch located within the site boundary, which outfalls to a culverted watercourse.

2.4. The Environment Agency flood map shows the entirety of the site to be within Flood Zone 1 (less than a 1 in 1000-year probability of flooding).

2.5. A copy of the EA flood map can be found in Section 4 of this report.

Figure 2.1 – Site Location



2.6. A topographical survey of the site was conducted by Tag Surveys in June 2023, a pdf of which is included in Appendix A. The topography falls in a westerly direction from 63m AOD to 37m AOD adjacent to Toton Sidings freight yard.

Existing Drainage and Hydrology

2.7. The residential area to the south of the site and the B6003 to the east contains Severn Trent water public combined and foul sewers.

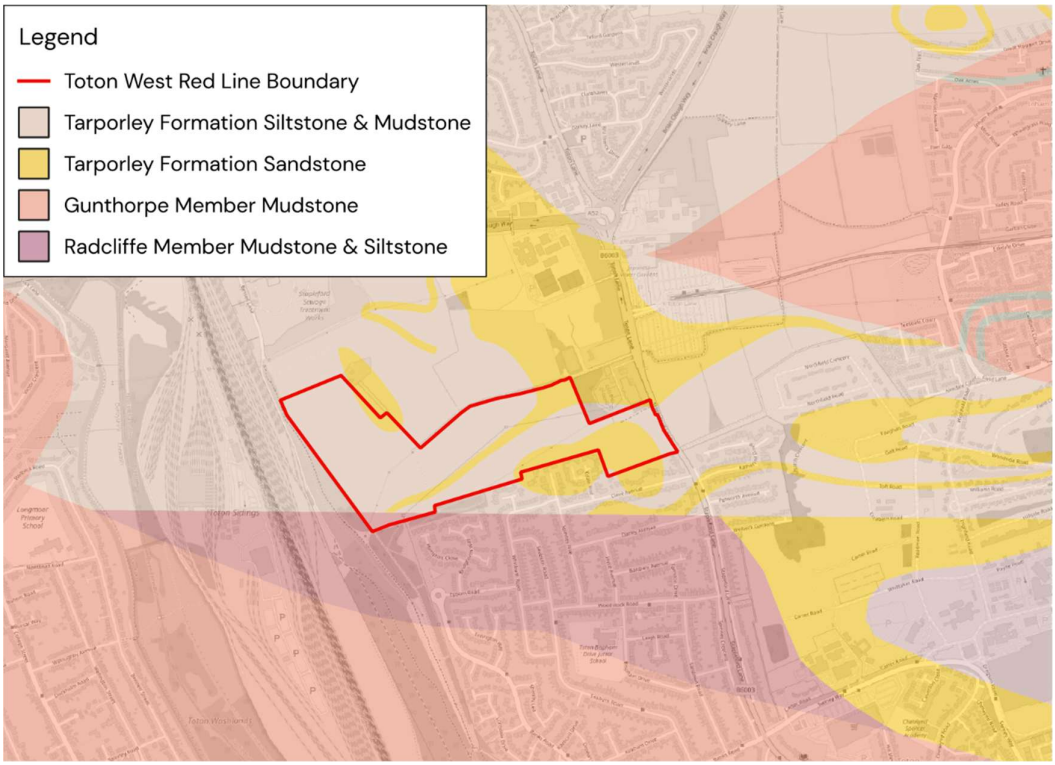
2.8. There are no Main Rivers located on Site. The River Erewash (Main River) flows approximately 600m west of the Site located to the west of Toton sidings, at a slightly lower elevation, circa 36m AOD. The Erewash canal is located west of the main river.

2.9. To assist with land drainage, a field ditch has been dug across the site, which gravitates westwards and outfalls to a culverted water course which continues west beneath the freight yard (Appendix D3).

2.10. Soilscapes data shows "Slightly acid loamy and clayey soils with impeded drainage" present across the site, indicating the ground is not suitable for infiltration.

2.11. Data from the British Geological Survey (BGS) mapping defines the bedrock across the site consists of Tarporley Formation Siltstone and Mudstone (Figure 2.3). There are no superficial deposits present on site.

Figure 2.2 - Bedrock



2.12. A review of the Groundwater Vulnerability Mapping indicates that the bedrock forms a Secondary B aquifer. A secondary B aquifer is defined by the EA as "permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks".

2.13. The superficial deposits do not form a productive aquifer. The site is not in a Drinking Water Safeguard Zone in relation to groundwater nor is it located in a Source Protection Zone.

3. Development Vulnerability & Flood Zone Classification

Statutory Requirements

3.1. Local Planning Authorities, (LPA) have a statutory obligation to consult the Environment Agency (EA) on all applications in the flood zones. The EA will consider the effects of flood risk in accordance with the NPPF.

3.2. The NPPF requires the following as part of the planning process:

- A 'site specific' Flood Risk Assessment will be undertaken for any site that has a flood risk potential.
- Flood risk potential is minimised by applying a 'sequential approach' to locating 'vulnerable' land uses.
- Sustainable drainage systems are used for surface water management where practical.
- Flood risk is managed using flood resilient and resistant techniques.
- Residual risk is identified and safely managed.

3.3. Table 1 of the NPPF defines each flood zone based on the probability of river and sea flooding in that area, as summarised below:

- Zone 1 : Low probability (< 1 in 1000 years)
- Zone 2 : Medium probability (1 in 1000 - 1 in 100 years for fluvial events and 1 in 1000 – 1 in 200 years for tidal events)
- Zone 3a : High probability (> 1 in 100 years for fluvial events and > 1 in 200 years for tidal events)
- Zone 3b : The functional floodplain (>1 in 30 years)

3.4. The NPPF sets out a matrix which indicates the types of development that are acceptable in different Flood Zones (see Table 3.1). The proposal is for residential development, which is classed as a More Vulnerable development. The site is located in Flood Zone 1. All types of development are appropriate in Flood Zone 1.

Table 3.1 – NPPF Guidance

Flood Zones	Flood Risk 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	✗	✗	✗	✓

Sequential Test

3.5. The Sequential Test is required for all developments proposed in Flood Zone 2 or 3 unless the proposals are for minor development or change of use.

3.6. The site is entirely located within flood zone 1 and the site is allocated, so the Sequential Test is not needed.

Exception Test

3.7. The Exception Test is not required for More Vulnerable Development in Flood Zone 1 (see table 3.1)

4. Site Specific Flooding Issues and Existing Flood Records

National Planning Policy Framework (NPPF)

4.1. In accordance with the National Planning Policy Framework, this Flood Risk Assessment considers all sources of flooding including:

a) Tidal Flooding – from the sea;

b) Fluvial Flooding – from rivers and streams;

c) Surface Water Flooding – from overland surface water flow and exceedance;

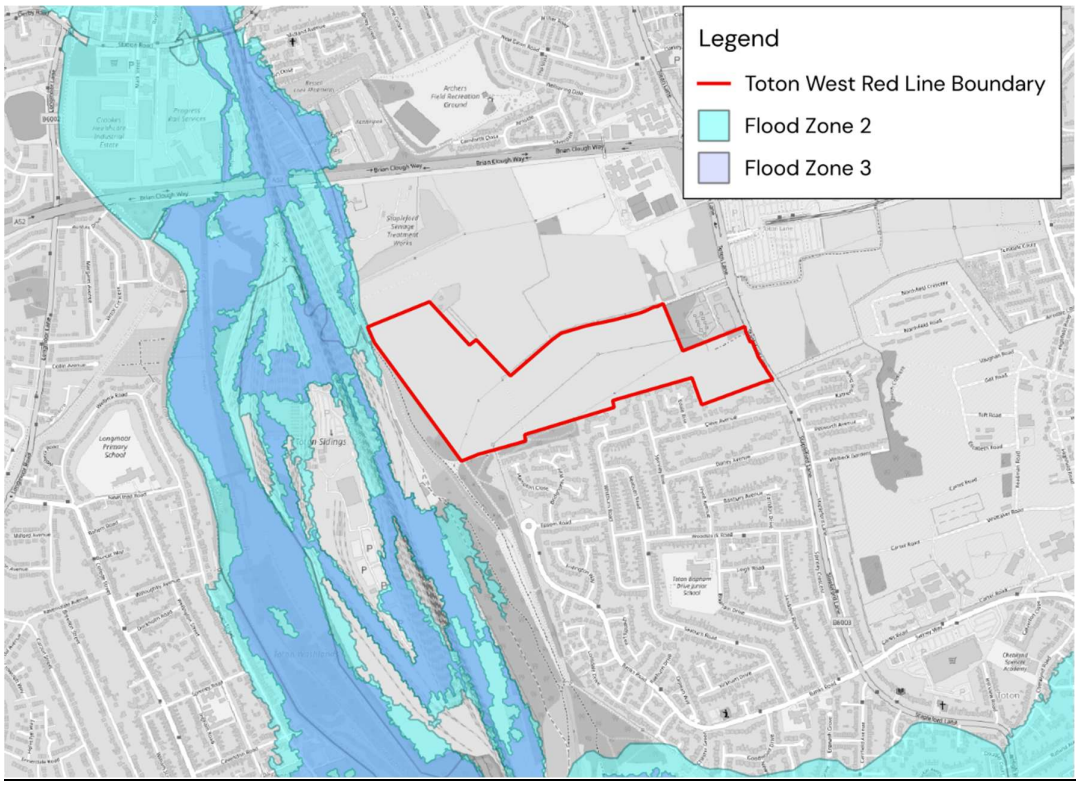
d) Historic Flooding – known historic flooding issues;

e) Groundwater Flooding – from elevated groundwater levels or springs;

f) Flooding from Sewers – exceedance flows from existing sewer systems; and

g) Artificial Sources – reservoirs, canals etc.

Figure 4.1 – Flood Map for Planning



Tidal Flooding

4.2. The Flood Map for Planning (see Figure 4.1) defines the whole site to be within Flood Zone 1. This represents a low risk of flooding occurring (less than a 1 in 1000-year probability).

4.3. The site is located inland, approximately 87km west of the nearest coastline and therefore is not considered to be at risk of tidal flooding.

4.4. The NCC SFRA does not assess the impact of tidal flooding around Nottinghamshire.

4.5. Overall, the tidal flood risk to the site is considered **Very Low**.

Fluvial Flooding

4.6. The site is in Flood Zone 1.

4.7. The closest "Main River" as identified by the EA to the site is the River Erewash, located 600m to the west of the site.

4.8. The site is higher in elevation at its lowest point compared to the River Erewash, so it is unlikely to be affected by overland flow from flooding of these watercourses.

4.9. Overall, the fluvial flood risk to the site is considered **Low** and the proposed residential development is appropriate.

Surface Water Flooding

Figure 4.2 – RoFSW Extents

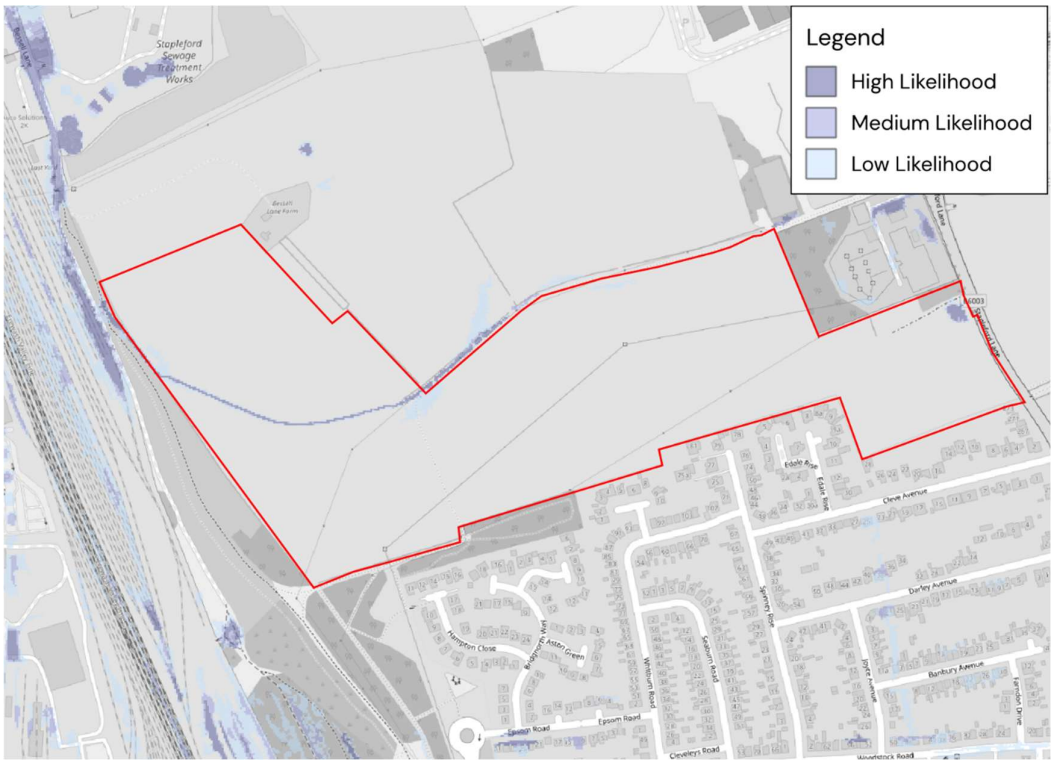


Figure 4.3 – RoFSW 0.2m Depths

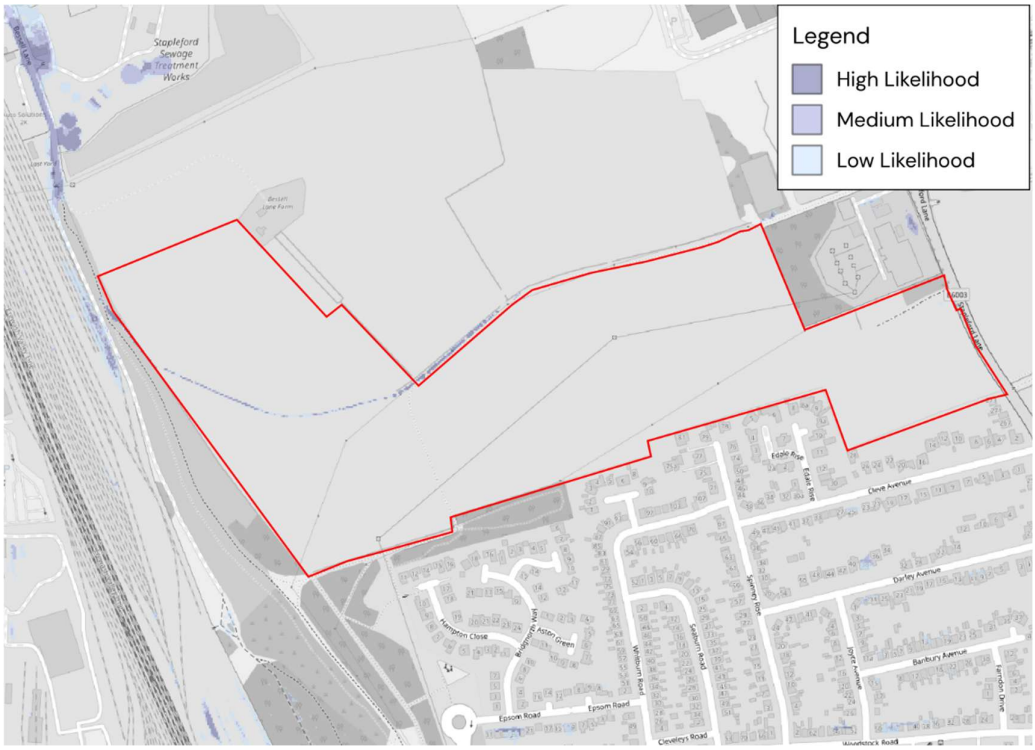
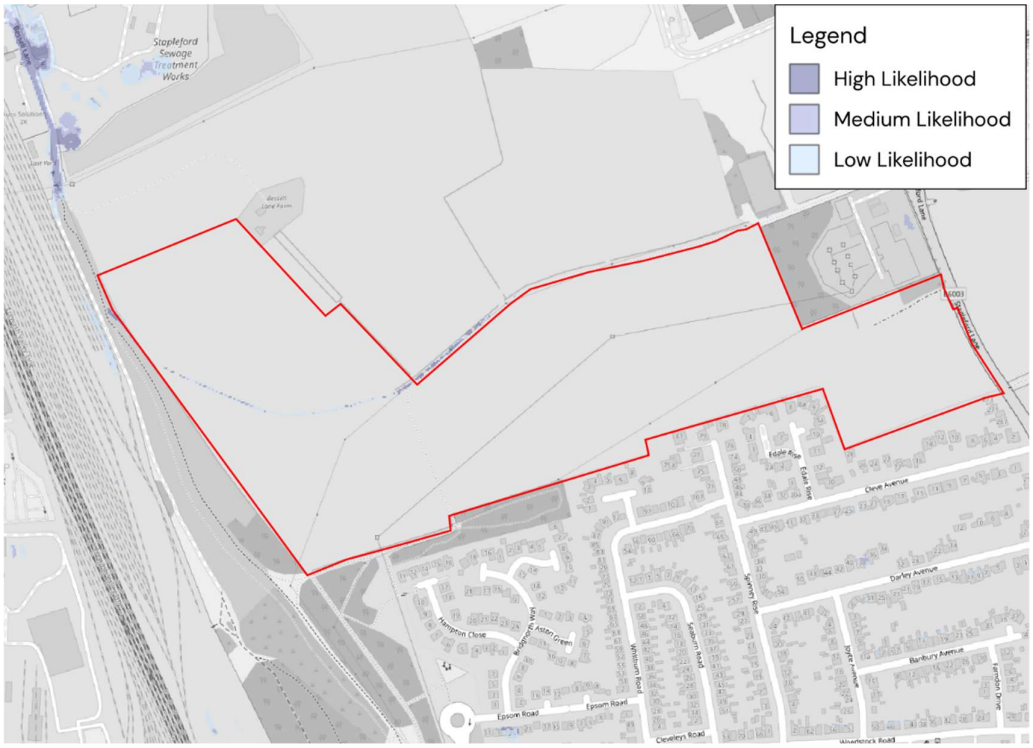


Figure 4.4 – RoFSW 0.3m Depths

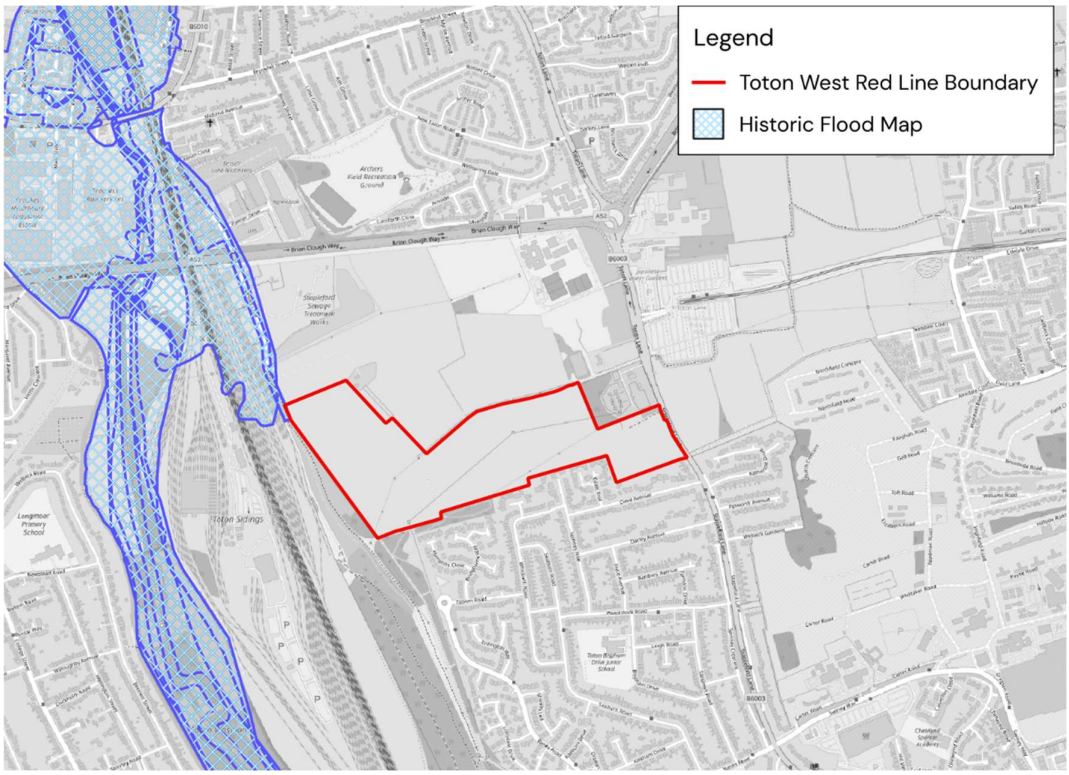


4.10. The updated (2025) EA surface water flood map, (Fig. 4.2) indicated some localised areas along the field ditch to be at risk of pluvial flooding in the 3.33% and 1% AEP storm, with flood depths ranging from 0.1m – 0.3m. These areas are relatively small (Figures 4.3 and 4.4), and are based on existing site levels. These areas will be subject to earthworks, to create the development parcels roads, storage basin and public open space. Under proposals, the surface water would be collected via a positive drainage system and conveyed via a piped network to the basin located within the public open space to the northwest, which will mitigate the pluvial flood risk.

4.11. Overall, the site is considered to be at **Low** risk of flooding from surface water.

Historic Flooding

Figure 4.6 – Historical Flooding (NCC – 2018)

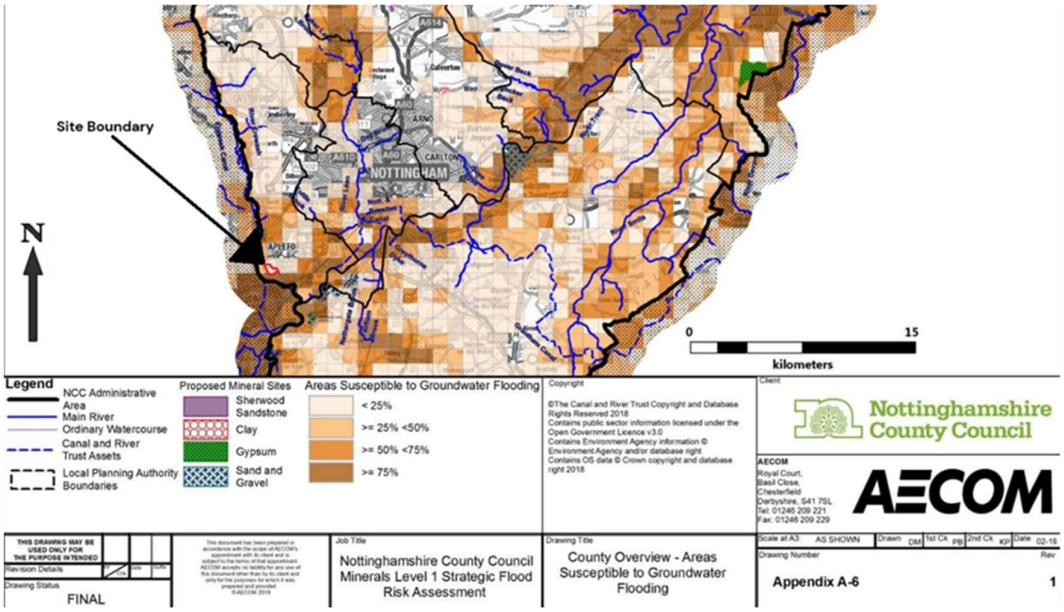


4.12. The EA Historical Flood map (Figure 4.6) shows historical flooding to have occurred along much of the River Erewash. This watercourse is 0.4km from the site and at a lower elevation, such that flooding would not impact the site.

4.13. Overall, the site is considered to be at **Low** risk of flooding from overland flows.

Groundwater Flooding

Figure 4.7 – Areas Susceptible to Groundwater Flooding *(NCC SFRA, 2018)*



4.14. The hydrogeology aquifer classification defines the site's bedrock to comprise of the "Tarporley Siltstone Formation" with "high productivity aquifers" present.

4.15. Since the soils have potentially a low permeability, the risk of groundwater flooding at the site is considered low. In Figure 4.7, the NCC SFRA shows the area of the site to have less than 25% susceptibility from groundwater flooding.

4.16. The site is sloped with little to no localised depressions, which is not conducive to groundwater flooding

4.17. Overall, the site is considered to be at **Very Low** risk of groundwater flooding.

Flooding from Sewers

4.18. An asset plan provided by Severn Trent Water shows there are no foul sewers located within the site boundary. A sewage treatment works is located 100m to the north of the site from the northeastern corner.

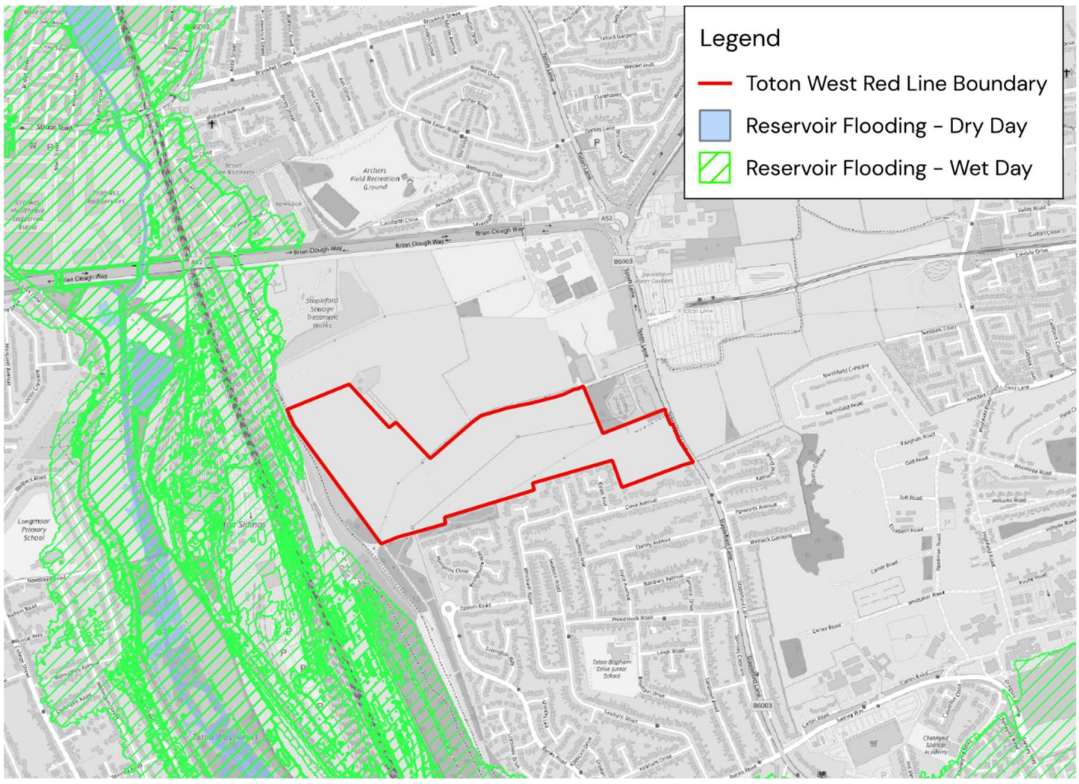
4.19. The asset plan also shows that the residential properties to the south of the site are serviced by a public foul water sewer.

4.20. The NCC Historical Flood Map has identified one sewer flooding instance at the treatment works located northwest of the site. The areas of the site closest to the sewage treatment works are at a higher elevation, and as such the site is unlikely to receive overland flows should flooding occur at this location.

4.21. The site is therefore considered to be at **Very Low** risk of flooding from sewers.

Flooding from Artificial Sources

Figure 4.9 – Flooding from Artificial Sources



4.22. The Reservoirs Act 1975 requires that all reservoirs are inspected regularly by competent persons to assess the likelihood of failure, the likelihood of reservoir failure is therefore considered minimal.

4.23. The EA's Reservoir Flood Extents data shows that the site is not predicted to be at risk should a catastrophic breach occur during a dry day or a wet day. The flood risk extents loosely follow the path of the River Erewash.

4.24. The site is located at a higher elevation to the River Erewash, so it is unlikely that the site will be affected by a reservoir breach. Toton Sidings are situated between the site and the river.

4.25. The site is therefore considered to be at **Very Low** risk of flooding from artificial sources.

Post Development Flood Risk Summary

4.26. The risk of flooding to the site from all sources has been assessed above, with the conclusions summarised in Table 4.1:

Table 4.1 – Flood Risk Summary

Flood Source	Flood Risk	Mitigation/Comments
Tidal	Very Low	The site's inland location ensures that it is well beyond the extent of any tidal influences.
Fluvial	Low	• The entirety of the site is located within flood zone 1 • The closest watercourse is located over 600m away from the site
Surface Water	Low	• The site contains several surface water ditches and drains • Any surface water arising within the site boundary will be managed by the proposed surface water drainage strategy.
Historic	Low	• There are no instances of historical flooding on site, however flooding extents from the river Erewash have been identified to extend up to the site boundary.
Groundwater	Very Low	• The GI indicates the site to be underlain by permeable chalk, and the hydrogeology aquifer classification defines the bedrock on site as "high productivity aquifer". • The Nottingham County Council SFRA identifies the site as having less than a 25% chance of groundwater flooding • The site topography is not conducive of groundwater flooding
Sewers	Very Low	• The site is greenfield with no foul sewers located within the site boundary • The residential land to the south of the site contains Severn Trent water public foul sewers

		• Severn Trent water and the NCC have determined that sewer flooding events have occurred at the foul treatment station located to the north of the site
Artificial	Very Low	• The likelihood of reservoir failure is considered minimal, and the site is predicted to not be at risk from a catastrophic reservoir breach. • The site is not considered to be at risk of reservoir flooding.

Access & Egress

4.27. Site access is planned to be from Toton Lane to the east. The access is located entirely within flood zone 1.

4.28. The site generally slopes in a north westerly direction towards the culverted watercourse. In an extreme rainfall event beyond that which the on-site drainage infrastructure is designed for, rainfall would be diverted along the road corridors to areas of public open space where the basin is proposed. There will be some regrading of levels to provide development platforms, but it is envisaged that footpath access/egress can be safely maintained.

5. Proposed Surface Water Drainage Strategy

5.1. This drainage strategy has been developed with consideration to the BBC local plan polices set out in Section 1.8 and the requirements of the NPPF. It is intended that the sustainable drainage strategy proposed in the following sections, is robust replicates the predevelopment scenario, and takes account of the environmental and technical considerations discussed in the previous sections.

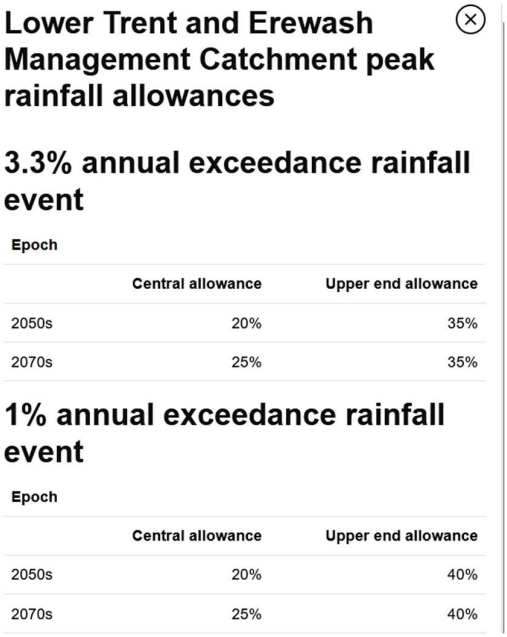
5.2. As set out in previous sections, there is a 0.4m DIA culvert located to the west which conveys flows from the field ditch on-site to a culverted watercourse, which continues across the railway. The culverted watercourse was provided by STW as a discharge location for attenuated surface water (appendix E1). The strategy set out proposes two objectives:

- To enable existing flow routes across the site to be maintained, without increasing flood risk.
- To mitigate the potential increase in flood risk; resulting from development by utilising a SuDs system that will attenuate post development run off by restricting the rate (and volume) of run off to greenfield rates agreed with the LLFA. The soil mapping for the area shows that the soils are not suitable for infiltration.

5.3. In respect of these objectives, an assessment has been made, to ensure that even when allowing for climate change allowance (+40%), and urban creep (+10%), the rate of runoff leaving the site, will not exceed the predevelopment scenario.

5.4. Additionally, the hydraulic design of the drainage system was modelled to accommodate the 1 in 30-year rainfall events with a climate change allowance of 35%, as recommended by the EA.

Figure 5.1 – Climate Change Allowances (EA)



Lower Trent and Erewash Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	25%	35%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	40%
2070s	25%	40%

5.5. It is acknowledged that the NCC guidance does not require climate change allowances to be added for hydraulic modelling of drainage systems, however in doing so we have demonstrated that the drainage design is sufficient to convey runoff. During the detailed design phase, storm water pipes may be downsized.

5.6. The existing development is greenfield, so as agreed with STW and the LLFA the discharge rates of the site need to be limited to Qbar, or the lowest reasonable minimum (appendix E2). The Qbar greenfield runoff rate for the total Site area of 18.88Ha is calculated to be 29.5l/s, or approximately 1.56 l/s/Ha. For the drainage strategy, an adjusted discharge rate of 2l/s/Ha has been used in line with Wallingford guidance. Greenfield runoff rates are shown in Appendix C2.

5.7. The provision of impervious surfaces such as roofs, roads, driveways, and hardstanding, will increase the rate and volume of runoff, unless mitigated. To achieve this; the development catchment will be provided with a detention basin, sized to accommodate the volume of water associated with the 1% AEP critical duration event, including a 40% allowance on rainfall intensities to cater for the predicated effects of climate change. In addition, the modelling has been subjected to a sensitivity analysis, by adding a 10% increase to contributing areas to allow for potential urban creep. Discharges from the detention basin will be restricted to 2.0 l/s/ha of developed area. The top area of the detention basin has also been included in the catchment analysis.

5.8. It is proposed that the drainage strategy for the Site provides attenuation using a suitably sized detention basin, serving the catchment area (see Appendix D2). The total volume of attenuation required for the 1 in 100-year event, plus an allowance of 40% climate change is 6208m^3. Calculations supporting these numbers can be found in Appendix C1. A freeboard of 300mm is also required when sizing the basin, and side slopes no steeper than 1 in 3 as per CIRIA SuDS manual guidance.

5.9. Under development proposals, the site would be redeveloped to provide residential housing with associated infrastructure, with impervious areas consisting of roofs, roads and hardstanding's. The Site consists of 13.23Ha of developed land – which has been assumed to consist of 55% impervious area, approximating to 7.55ha, (increasing to 8.31ha when urban creep is factored in).

Surface Water Management

5.10. The SuDS hierarchy demands that surface water run off should be disposed of as high up the following list as practically possible:

- Into the ground (infiltration) and re-use, or then;
- To a surface water body, or then;
- To a surface water sewer, highway drain or another drainage system, or then;
- To a combined sewer.

5.11. As detailed in section 4, the ground mapping from Soilscapes and BGS indicates that the site is underlain by poorly infiltrating soils. Boreholes within the proximity of the site show fine clayey sands and silts, which are indicative of poor infiltration potential. Alternative SuDS features have been considered in the following table.

Table 5.1 – Assessment of SuDS Suitability

SuDS Technique	Potentially suitable for this development	Justification
Rainwater Harvesting	Yes	Water butts could be used for each property; however, these are unlikely to have a large impact on reducing runoff and flood risk
Green Roofs	No	Not feasible for use with residential buildings as potential to increase foundation loads. Communal facilities may be able to incorporate green roofs.
Infiltration Systems (Soakaways, etc.)	No	Infiltration is not considered feasible as low impermeability soils likely exist beneath the site.
Filter Drains	No	Infiltration is not considered feasible as low impermeability soils exist beneath the site.
Swales	No	Site topography generally unsuitable for swales
Bioretention Systems	Yes	Bioretention systems could be used to provide attenuation, and treatment.
Underground storage	Yes	Could be considered for attenuation purposes, Underground storage would provide less biodiversity and water quality benefits compared to detention basins.
Detention basins & ponds	Yes	The site supports a large basin to assist in attenuation, water treatment and conveyance. The basin would form part of a landscaped open space and designed for ease of maintenance These would be multifunctional and could be used as an informal play space.
Wetlands	No	The SuDS Manual defines a wetland as "[a body] of water with larger proportions of the surface area covered by aquatic planting.

		They also tend to have greater depth variations and may include shallow islands". A SuDS feature of this definition would be unviable due to the topography.
Permeable Paving	No	Although a tanked system could be used in private areas, it is less sustainable compared to the proposed attenuation basins. The basins would form part of a landscaped open space and designed for ease of maintenance. These would be multifunctional and could be used as informal play spaces.

5.12. The drainage strategy drawing can be found in appendix D1, which details all features discussed above.

5.13. The existing overland flow routes shall be maintained to convey runoff from undeveloped areas to the field ditch, which bisects the site and flows west

5.14. Runoff from private driveways and adoptable highways across the site would be collected using a positive drainage system and conveyed to the attenuation basin located to the northwest of the site. Current surface water flooding risks would be mitigated using this methodology, as all development flows would be routed through the drainage system. Additionally, dwellings would be raised 150mm above finished ground level.

5.15. Main sewers would be offered for adoption to STW and have been designed to accommodate the critical 1 in 30-year event plus 35% climate change, without flooding. All private drainage will be designed in accordance with Part H of the Building Regulations. Calculations supporting this can be found in appendix C1.

5.16. As mentioned above, the Wallingford guidance suggests applying a minimum discharge rate of 2l/s/Ha for the total area of developed land (13.23Ha). Post-development discharge rates are discussed in Table 5.2.

Table 5.2 – Post-Development Discharge Rates (By catchment)

Catchment Name	Catchment Area (Ha)	55% Impervious Area (Ha) + Basin Area	Discharge (L/s)
1	13.23	7.55	26.46

5.17. Basins have been sized at 1.5m depth including a 300mm freeboard, and side slopes no steeper than 1 in 3.

5.18. The drainage strategy has been designed for 1_100 rainfall events, plus 40% climate change. The current 1 in 100-year greenfield runoff rate of 85.30l/s, is significantly higher than the post-development discharge rate, of 26.46l/s, and as such it is evident significant betterment is achieved.

5.19. As required by the SuDS Manual, post development runoff should be treated to minimise contaminants in the surface water discharged from the site. The treatment required depends on the proposed land use, according to the pollution hazard indices.

5.20. Table 5.3 shows the pollution indices for the proposed development.

Table 5.3 – Pollution Hazard Indices

Pollutant	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Residential Streets and driveways	Low	0.5	0.4	0.4
Total pollution hazard indices		**0.7**	**0.6**	**0.45**

5.21. Table 5.4 shows the pollution mitigation indices for the proposed detention basins. It is shown that each individual pollution mitigation indices equals or exceeds the proposed development pollution indices.

Table 5.4 – Indicative SuDS Mitigation Indices

Type of SuDS component	Total suspended solids (TSS)	Metals	Hydrocarbons
Detention Basin	0.5	0.5	0.6
Low flow channel	0.5	0.6	0.6
Total Mitigation Indices **(The mitigation indices are acceptable since they are equal or higher than the hazard indices)**	**1.0**	**1.1**	**1.2**

5.22. It is a requirement to consider exceedance routes for storms greater than the 1% annual exceedance probability. Based upon a review of the topographical survey, the site naturally gravitates and falls towards the field ditch which bisects the Site. It is therefore predicted that exceedance flows would follow the roads; and discharge naturally into the field ditch or be stored temporarily in adjacent public open space.

6. Foul Strategy

6.1. Severn Trent Water were consulted in the development of the foul water drainage strategy, and provided three potential points of connection – MH6502, located to the east of the site; and MH0201 and MH0101, both located to the south of the site. These drainage arrangements are shown in Appendix D3.

6.2. MH6502 is situated at a higher elevation than the rest of the site (CL: 63.49), however utilising a gravity-based drainage system to connect to MH0201 or MH0101 would require manholes over 6m deep, and as such a pumped solution is preferable.

6.3. The foul pumping station would be located towards the northwest of the site, and pump to MH6502 (see appendix D1).

6.4. Severn Trent Water have confirmed that a maximum pumped flow of 3.8l/s would be required to connect to MH6502. There is sufficient capacity in the existing foul sewer network to support the proposed development (appendix E1)

7. Maintenance Arrangements

7.1. It is proposed that the roads of the development would be offered for adoption, along with the foul and surface water sewers. Drainage up to the lateral connections would remain private (unadopted)

7.2. The basin, ditch and public open space would be managed and maintained by an external management company.

7.3. It is proposed that the following schedule of inspections and maintenance operations would be undertaken. The schedule is based on current best practice as set out in C753 The SuDS Manual and a detailed management plan will be developed as the design evolves.

TABLE 22.1 Operation and maintenance requirements for detention basins

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

8. Summary and Conclusion

8.1. Under proposals, the site would be redeveloped to provide up to 420 new dwellings with associated infrastructure. The increase in impervious surfaces would increase the rate and volume of run off post-development, which could increase flood risk to the site and downstream catchments, unless mitigated in a sustainable manner.

8.2. The geology of the site does not support infiltration-based SuDs techniques, so in following the drainage hierarchy, it is proposed that post development flows, will be attenuated using a detention basin, with discharge restricted to 2l/s/ha and controlled by a hydro brake discharging to field ditch which outfalls to the culverted watercourse.

8.3. The LLFA have confirmed that post development flows can be discharged to their network as long as the runoff rates do not exceed 2l/s/ha (appendix E2). The basin has been designed to accommodate the volume of water from the critical duration 1% AEP event; and include an allowance of 40% climate change, 10% urban creep allowance, and 150mm of freeboard. The results of the modelling, show there is sufficient capacity to accommodate the increased rate and volume of runoff resulting from development, without increasing flood risk to the development or downstream catchment.

8.4. As discussed above, by restricting the discharge rate for the development area to 2.0 l/s/ha, the total site discharge post development will be lower than the 1 in 100-year greenfield rate; and this will provide significant betterment to the downstream surface water drainage network, by reducing discharges, which will reduce potential flood risk.

8.5. The proposals will also optimise opportunities to promote and enhance biodiversity, with the basin and existing ditch integrating with the landscaping as a part of a holistic green infrastructure strategy. The detention basin will be designed to incorporate a low flow channel, which will provide effective water treatment enabling pollutants to be removed before discharge.

8.6. All other potential sources of flooding have been considered; and are assessed as being low or very low. Finished floor levels will be set at least 150mm above ground level, and development levels will be set to ensure exceedance flows are directed along road corridors, to areas of public open space and the existing field ditch.

8.7. In summary, a conservative approach has been adopted to the sustainable management of post development flood risk; and implementation of the measures set out in the drainage strategy will effectively mitigate flood risk for the site and provide betterment, while promoting biodiversity.