Wain Estates (Land) Limited

Wilderness Park, Land North of Wilderness Lane, Great Barr

Flood Risk Assessment and Drainage Strategy

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PJA
Park Point
17 High Street
Longbridge
B31 2UQ
UK
pja.co.uk

Version Control and Approval

Version	Date	Main Contributor	Checked by	Approved by
A	31 August 2023	Michael Turner	Phoebe Ryding	Alison Caldwell
B	01 September 2023	Charlotte Turner	Phoebe Ryding	Phoebe Ryding
C	05 October 2023	Amy Bennett	Andrea Nelmes	Andrea Nelmes
D	25 October 2023	Andrea Nelmes	Phoebe Ryding	Andrea Nelmes
E	30 October 2023	Phoebe Ryding	Alison Caldwell	Alison Caldwell

Purpose

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The conclusions and recommendations contained herein are limited by the availability of background information and the planned use for the Site.

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CDM

The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force in April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance Wain Estates (Land) Limited, is made aware of their duties under the CDM Regulations.

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Appendices

1 Executive Summary

1.1.1 PJA has been commissioned by Wain Estates (Land) Limited to prepare a Flood Risk Assessment (FRA) and Drainage Strategy to support an outline planning application for a new residential-led development of up to 150 new dwellings, a countryside park and associated works at Wilderness Park, Land north of Wilderness Lane, Great Barr, Birmingham.

Table 1-1: Executive Summary Table

Overview	
Site Location	Land north of Wilderness Lane, Great Barr, Birmingham
Development Proposal	Outline planning application (with the exception of access) for the development of up to 150 new dwellings, a countryside park and associated works.
Environment Agency Flood Zone(s)	Flood Zone 1
Vulnerability Classifications(s)	More Vulnerable
Fluvial Flood Risk	Low
Tidal Flood Risk	N/A
Surface Water Flood Risk	Low
Groundwater Flood Risk	Low
Sewer Flood Risk	Low
Artificial Flood Risk	Low
Ground Conditions	Varying underlying conditions of Sandstone and Mudstone bedrock. Given the outline nature of this planning application, a conservative assumption has been made that infiltration is not viable.
Surface Water Drainage	Surface water will be sustainably managed on-site. Swales will convey flows through the Site before being attenuated in basins and discharging to the network of on-site ditches at the existing QBar runoff rate.
Foul Water Drainage	Foul water will be pumped and lifted to the southern extents of the site where all flows will then drain by gravity to a public foul water sewer located to the south of the proposed development, in Wilderness Lane.

2 Introduction

2.1 Terms of Reference

2.1.1 PJA has been commissioned by Wain Estates (Land) Limited to prepare a Flood Risk Assessment (FRA) and Drainage Strategy for a proposed residential development at *Wilderness Park, Birmingham* (herein referred to as 'the Site').

2.2 Scope of works

Flood Risk Assessment (FRA)

2.2.1 This FRA provides information on the nature of identified potential flood risk at the Site and follows government guidance with regard to development and flood risk largely in line with the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG).

Drainage Strategy

2.2.2 The surface water drainage strategy aims to sustainably manage surface water from the Site and has been developed generally in accordance with current sustainable development best practices and the specific requirements of Sandwell Metropolitan Borough Council (MBC) as the Lead Local Flood Authority (LLFA).

2.2.3 A high-level foul water drainage strategy has also been produced for the Site in consultation with Severn Trent Water Ltd (STWL) and aims to address the requirements of STWL as the Statutory Undertaker.

2.3 Information Sources

2.3.1 This report comprises a review of readily available public information and other relevant information obtained from the following sources:

- Environment Agency (EA);
- British Geological Survey (BGS);
- Cranfield Soil and Agrifood Institute Soilscapes;
- DEFRA Magic Mapping;
- HR Wallingford;
- Severn Trent Water Limited (STWL); and
- Sandwell MBC as LLFA.

3 Site Description

3.1.1 The Site, which is the focus of this FRA, is greenfield in nature (undeveloped) and is currently low-grade agricultural land, with private access only. The Site is approximately 27ha in size and is bound to the east by Peak House Road and existing residential development. To the north-east the Site is bound by Birmingham Road, and to the north-west by Aston University Sports Centre. The south-west and south of the Site are bound by the Q3 Academy and the south-east is bound by existing residential development.

3.1.2 The Site's Ordnance Survey (OS) co-ordinates are 403865, 295483.

3.1.3 A Site Location Plan is available in Figure 3-1 and a Summary of the Site is available in Table 3-1.

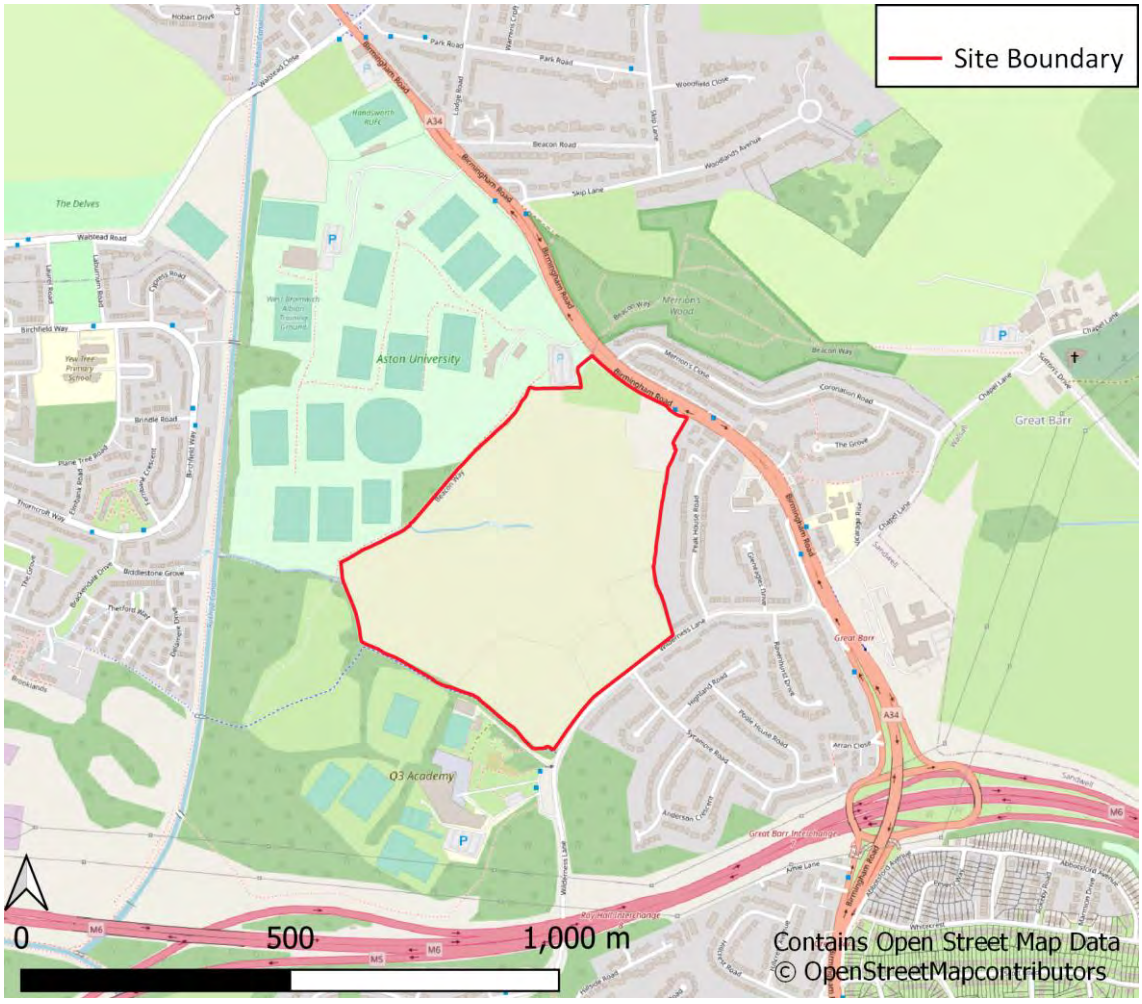


Figure 3-1: Site Location Plan

Table 3-1: Summary of Site

Site Address	Wilderness Park, Land north of Wilderness Lane, Great Barr, Birmingham, B43 7SB
Existing Land use	Low-grade agricultural land, with private access only
Proposed Development Type	Residential led (More Vulnerable)
Site Area	27ha
OS Co-ordinates	403865, 295483
County	West Midlands
Local Planning Authority	Sandwell Metropolitan Borough Council
Lead Local Flood Authority	Sandwell Metropolitan Borough Council
Local Water Authority	Severn Trent Water Ltd (Sewerage Undertaker)

3.2 Site Topography

3.2.1 From a review of the existing detailed Site topographic survey (undertaken by JLP Surveying in July 2023), the Site generally slopes from east to west. The highest elevation within the Site is approximately 160mAOD and is situated to the north-east corner of the Site. The lowest elevation within the Site is approximately 129 mAOD and is situated to the south-west corner of the Site.

3.2.2 The Site topographic survey is available within Appendix A.

3.2.3 A representation of the Site topography is illustrated within Figure 3-2, utilising the publicly available 1m DTM LiDAR data.

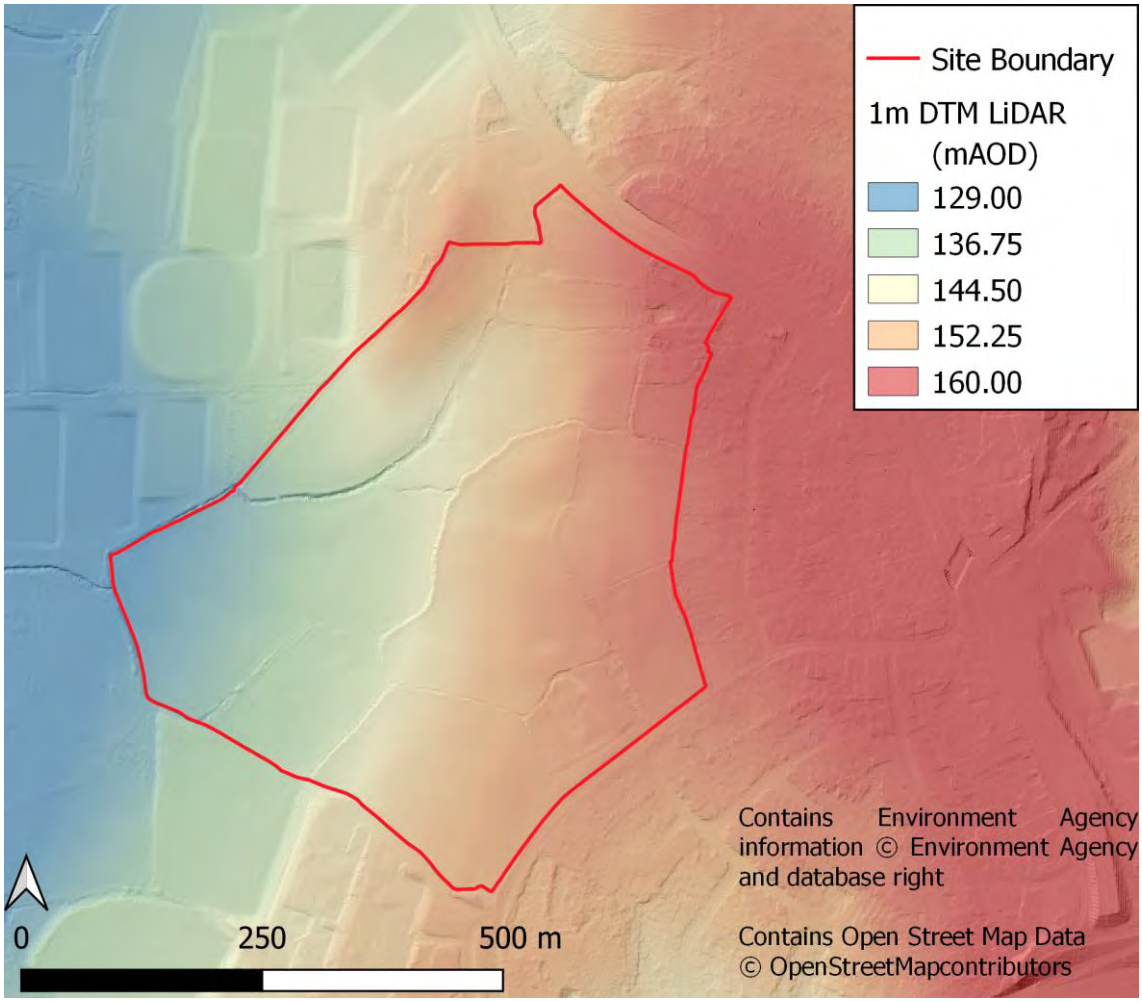


Figure 3-2: LiDAR 1m DTM.

3.3 Ground Conditions

BGS Mapping

3.3.1 From a review of the publicly available BGS Geology of Britain viewer[1], the Site is identified to be underlain by four differing types of bedrock. The north-west of the Site is underlain by Rubery Sandstone Member - Sandstone, the west by Coalbrookdale Formation – Mudstone. The east of the Site is underlain by Enville Member – Sandstone with subordinate conglomerate of Siltstone and Mudstone with bands of Enville Member – Sandstone running north to south.

3.3.2 An extract of the BGS Bedrock Geology Map which illustrates these characteristics is available in Figure 3-3 .

[1]British Geological Survey. Geology of Britain Viewer.
https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html

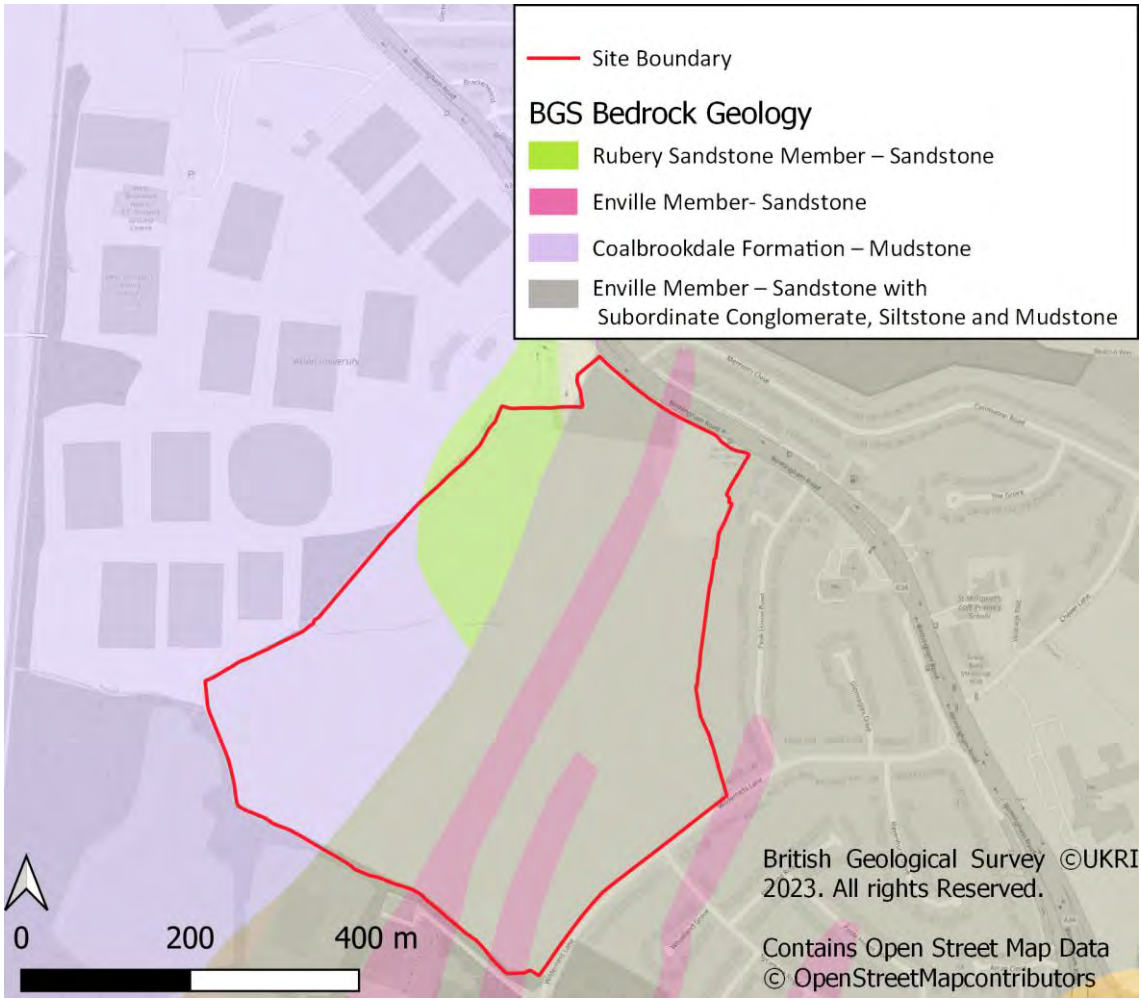


Figure 3-3: BGS Bedrock Geology Extract

3.3.3 From a review of the publicly available BGS Geology of Britain viewer, the Site is not overlain by any superficial deposits.

Cranfield Soilscape Viewer

3.3.4 The Cranfield University Soilscape viewer[2] describes the soils as "*Slowly permeable seasonally wet acid loamy and clayey soils*" for the west of the Site and *"Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils*" in the east of the Site.

[2]Cranfield Soil and Agrifood Institute. Soilscape Viewer. http://www.landis.org.uk/soilscapes/

Hydrogeology

3.3.5 From a review of the publicly available DEFRA Magic Mapping[3], Aquifer Designation Map (Bedrock) identifies the Site is underlain by both Secondary A (associated with the Enville Member Sandstone with Subordinate, Conglomerate, Siltstone and Mudstone Bedrock) and Secondary B Aquifers (associated with the Coalbrookdale Formation Mudstone Bedrock). Secondary A aquifers comprise permeable layers that can support local water supplies whilst Secondary B aquifers mainly comprise lower permeability layers that may store and yield limited amounts of groundwater through fissures and openings or eroded layers.

3.3.6 The Site is not underlain by any Groundwater Source Protection Zones.

3.3.7 Initial geological conditions suggest that surface water drainage via infiltration will generally be variable across the Site but may be feasible where the Site is underlaid by the Rubery Sandstone Member to the north of the Site. It is recommended that infiltration testing to BRE Digest 365 Soakaway Design Guidance is undertaken to confirm this prior to the next stage of design. Given the outline nature of this planning application, a conservative assumption has been made that infiltration is not viable.

3.4 Existing Drainage Assets

3.4.1 The Site is currently greenfield and from a review of the STWL sewer asset mapping, included in Appendix C, there are no sewers identified serving or located within the Site. A 225mm diameter combined sewer is identified in Birmingham Road, north of the Site, and a 225mm diameter foul sewer in Wilderness Lane southeast of the Site. The existing residential development adjacent to the Site is served by a separate public network.

3.4.2 An extract of the STWL sewer asset mapping is shown in Figure 3-4 .

[3] DEFRA Magic Map https://magic.defra.gov.uk/MagicMap.aspx

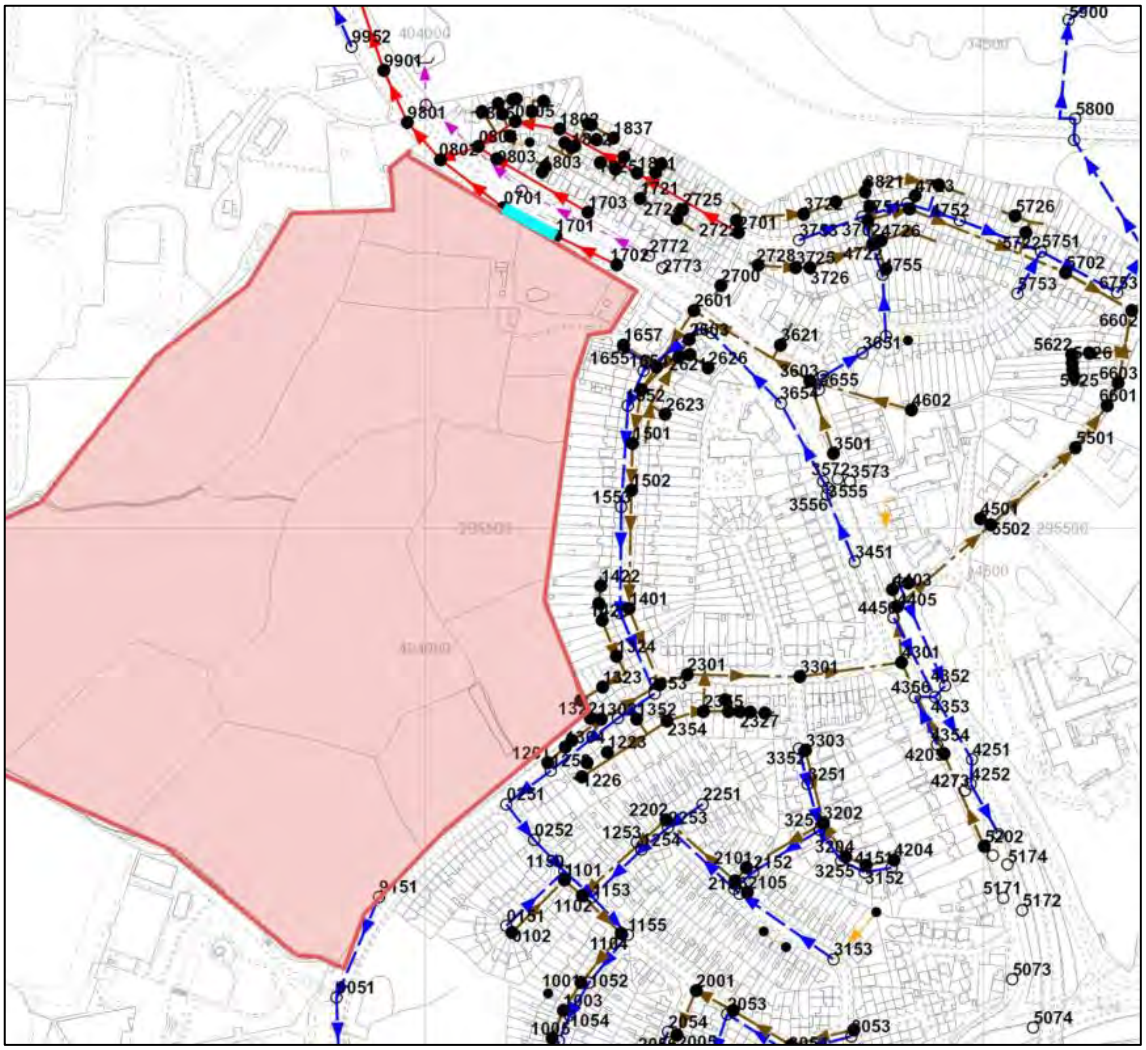


Figure 3-4: STWL Sewer Asset Mapping Extract

3.4.3 Natural surface water runoff within the Site currently drains via a network of small ditches (classified as ordinary watercourses) which generally flow west towards an area of woodland and Rushall Canal located south-west of the Site. According to aerial mapping, the watercourse leaving the Site becomes culverted under Rushall Canal and remerges south of the existing residential properties fronting Delamere Drive. Two existing ponds have been identified to be present to the north east and south east corners of the Site via OS background mapping. This is shown in Figure 3-5 .

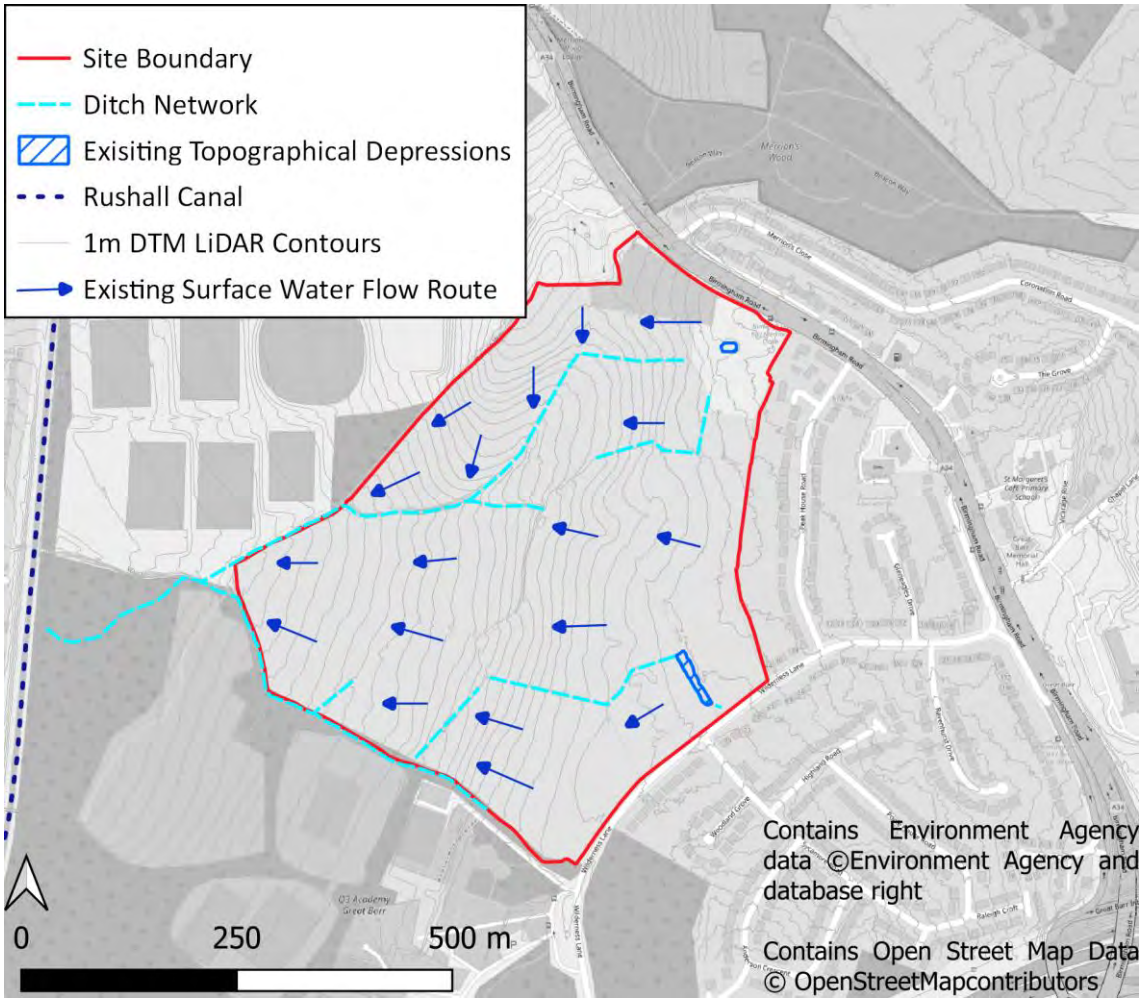


Figure 3-5: Hydrological Regime.

3.4.4 LiDAR data also shows there to be a topographical depressions to be present within these areas. However the pond within the north east corner of the Site has been observed to be dry (as part of a site visit conducted on the 24th October, refer to Figure 3-6) following a period of heavy rainfall and extreme weather conditions across the Midlands region following the impacts of Storm Babet. As such this feature is considered to simply a topographical depression which has the potential to hold water in an extreme weather event.

Figure 3-6: Northeastern 'Topographical Depression' (taken during site visit conducted on 24th October 2023)

3.5 Site Proposals

3.5.1 These proposals comprise an outline planning application (with the exception of access) for the development of up to 150 new dwellings, a countryside park and associated works.

3.5.2 The Illustrative Masterplan (Document Reference - 09364-FPRC-XX-ZZ-DR-L-0012-P07-Illustrative Masterplan) produced by FPCR in October 2023, is available in Appendix B, and an extract is shown in Figure 3-7

Figure 3-7: Illustrative Masterplan produced by FPCR (09364-FPRC-XX-ZZ-DR-L-0012-P07).

4 Planning Context

4.1 National Planning Policy Framework

4.1.1 The National Planning Policy Framework (NPPF) was published by the Ministry of Housing, Communities and Local Government and most recently updated in 2023. The NPPF's Planning Practice Guidance (PPG) supports the Framework and is an online resource that is frequently updated.

4.1.2 Paragraph 167 of the NPPF identifies that Local Planning Authorities should ensure that flood risk is not increased elsewhere by development and where appropriate, applications should be supported by a Site-specific Flood Risk Assessment. Development should only be allowed where it can be demonstrated that:

a within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

c it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d any residual risk can be safely managed; and

e safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

4.1.3 Further to this, paragraph 169 of the NPPF sets out that major development should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

f take account of advice from the lead local flood authority;

g have appropriate proposed minimum operational standards;

h have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

i where possible, provide multifunctional benefits.

4.2 Local Policy & Guidance

Black Country Core Strategy 2011-2026

4.2.1 The Black County Core Strategy was adopted in February 2011.

4.2.2 Policy Env 5 relates to Flood Risk and Sustainable Drainage Systems.

This identifies *"that to assist in both reducing the extent and impact of flooding and also reducing potential urban heat island effects, all developments should:*

- *Incorporate Sustainable Drainage Systems (SUDs), unless it would be impractical to do so, in order to significantly reduce surface water run-off and improve water quality. The type of SUDs used will be dependent on ground conditions;*
- *Open up culverted watercourses where feasible and ensure development does not occur over existing culverts where there are deliverable strategies in place to implement this;*
- *Take every opportunity, where appropriate development lies adjacent to the river corridors, or their tributaries or the functional floodplain, to benefit the river by reinstating a natural, sinuous river channel and restoring the functional floodplain within the valley where it has been lost previously;*
- *On sites requiring a Flood Risk Assessment, reduce surface water flows back to equivalent greenfield rates;*
- *Create new green space, increase tree cover and/or provide green roofs".*

4.2.3 Given the above policy, the existing ditch network within the Site is to be retained, with appropriate easements to enable access for future maintenance. A surface water drainage strategy is proposed to sustainably manage surface water, through the use of Sustainable Drainage Systems (SuDS), and enhance biodiversity, provide amenity value and improve water quality. Surface Water Drainage proposals are detailed further in Section 6 of this Report.

The Black Country Authorities Level 1 Strategic Flood Risk Assessment (SFRA) (2020)

4.2.4 The Level 1 SFRA was published on the 25th June 2020 and provides an understanding of the risk from all types of flooding across The Black Country.

4.2.5 From a review of the Historic Flooding map, contained in Figure 5-1 of the Report, there have been reported incidents of flooding within Great Barr however, none are located within the Site boundary.

4.2.6 Table 5-4 of the Level 1 SFRA identifies that there have been no records of the Rushall Canal, which is located to the west of the Site, as breaching or overtopping into the Site.

4.2.7 Whilst the likelihood of groundwater flooding in the Black Country is relatively low, there are records of flooding in parts of northeast and southeast Wolverhampton since groundwater abstraction for industry has stopped and levels have since rebounded. The site lies outside these areas.

4.2.8 Flood risk from all likely sources is reviewed within Section 5, which takes into account the data within the SFRA.

The Black Country Local Strategy for Flood Risk Management Strategy (October 2015)

4.2.9 This document looks at key sustainability issues across the Black County and key opportunities for how they can be managed. The promotion of the use of SuDS in new developments is a key opportunity outlined in the document.

4.2.10 Given this, the proposed development has provided a SuDS strategy which complies with national and local policy, as detailed in Section 6.

4.3 Consultation

4.3.1 Pre-application consultation has been undertaken with key stakeholders in relation to flood risk and drainage. A summary of their responses has been provided below and full responses included within Appendix I.

Sandwell Metropolitan Borough Council LLFA

4.3.2 Sandwell MBC LLFA were contacted on 17th August 2023 regarding historic flood records and local policy however, no response in relation to historic flood records has been received.

4.3.3 As part of their pre-application service, Sandwell MBC LLFA provided advice in relation to surface water drainage and a checklist of information required to support an outline planning application. This response has been provided in Appendix I.

Environment Agency

4.3.4 The EA confirmed on the 11th August 2023 that they hold no detailed modelling for the Site and have no historic records of flooding in this area.

Severn Trent Water

4.3.5 STWL were consulted on the 9th August 2023 regarding historic sewer flooding. A response was received on 15th August which stated that there have been reports of flood incidents within the proximity of the Site since 1996 however, the exact locations of these could not be disclosed. Given

there are no STWL sewers within the Site boundary, it is assumed that these incidents were not within the Site. STWL's response is contained in Appendix I.

4.3.6 A Pre-Development Enquiry was submitted to STWL on 9th December 2022 regarding foul water drainage proposals for the Site. A response was received on 16th December 2022 in which STWL provided asset mapping and advice on the proposed foul water drainage connection points, which are summarised in Section 6 and 7.

5 Assessment of Flood Risk

5.1.1 The flood risk to and from the Site has been assessed based on a review of publicly available information. A summary of the flood risk at the Site is provided in Table 5-1 and discussed in more detail in the chapter below.

Table 5-1: Potential Sources of Flood Risk

Source of Flooding	On Site Presence
Fluvial	×
Surface Water	✓ *(section 5.4)*
Tidal	×
Groundwater	×
Sewers	×
Reservoirs	×
Canal	×

5.2 Historic Flooding

5.2.1 The EA's historic flood outline mapping shows that the Site is located outside the extents of any historic flood event.

Table 5-2: Summary of Consultation

Source of Flooding	Date Response Received	Comments
Environment Agency	11th August 2023	No detailed hydraulic modelling is held for the Site and no records of flooding for this area are held.
Sandwell MBC LLFA	N/A	No response received at the time of writing
Severn Trent Water	15th August 2023	There have been reports of flood incidents within the proximity of the Site since 1996 however, the exact locations of these could not be disclosed. Given there are no public sewers present within the Site boundary, it is reasoned that these incidents did not occur within the Site.

5.2.2 All statutory consultee responses are available within Appendix I.

5.3 Fluvial Sources

5.3.1 The EA, through the publicly available Flood Map for Planning service, categorises potential fluvial flood risk into Flood Zones, assuming no flood defences.

5.3.2 Figure 5-1 is an extract of the publicly available Flood Map for Planning and identifies that the Site lies wholly within Flood Zone 1, suggesting that its risk of flooding from fluvial and tidal sources is low. Areas located within Flood Zone 1 are considered to have less than a 0.1% chance of flooding in any given year (0.1% Annual Exceedance Probability (AEP) event).

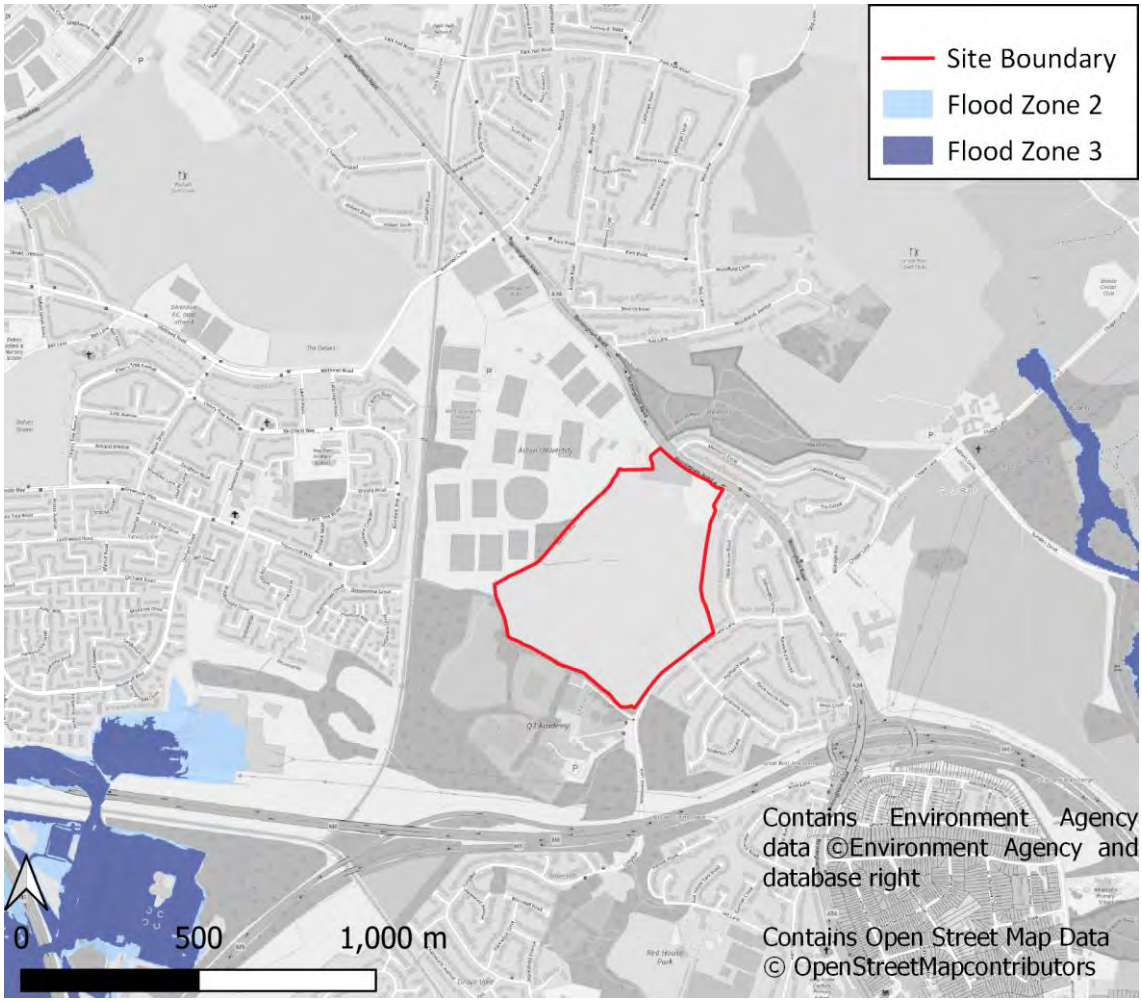


Figure 5-1: Publicly Available Flood Map for Planning Extract

5.4 Surface Water Sources

5.4.1 The Long-Term Flood Risk Information, Flood Risk from Surface Water Map identifies the Site to be generally at 'very low risk' from surface water flooding.

5.4.2 A central surface water flow route of predominantly low risk runs through the from the centre toward the western boundary. From a review of the site-specific topographic survey, these corridors of surface water flood risk are associated with the existing ditch network within the Site, which will be retained.

5.4.3 The area of high-risk surface water flooding in the northeast corner of the Site is consistent with the location of the topographical depression, which will also be retained, demonstrating that there is potential for surface water to collect at this point during a storm event.

5.4.4 An extract of this mapping is provided in Figure 5-2.

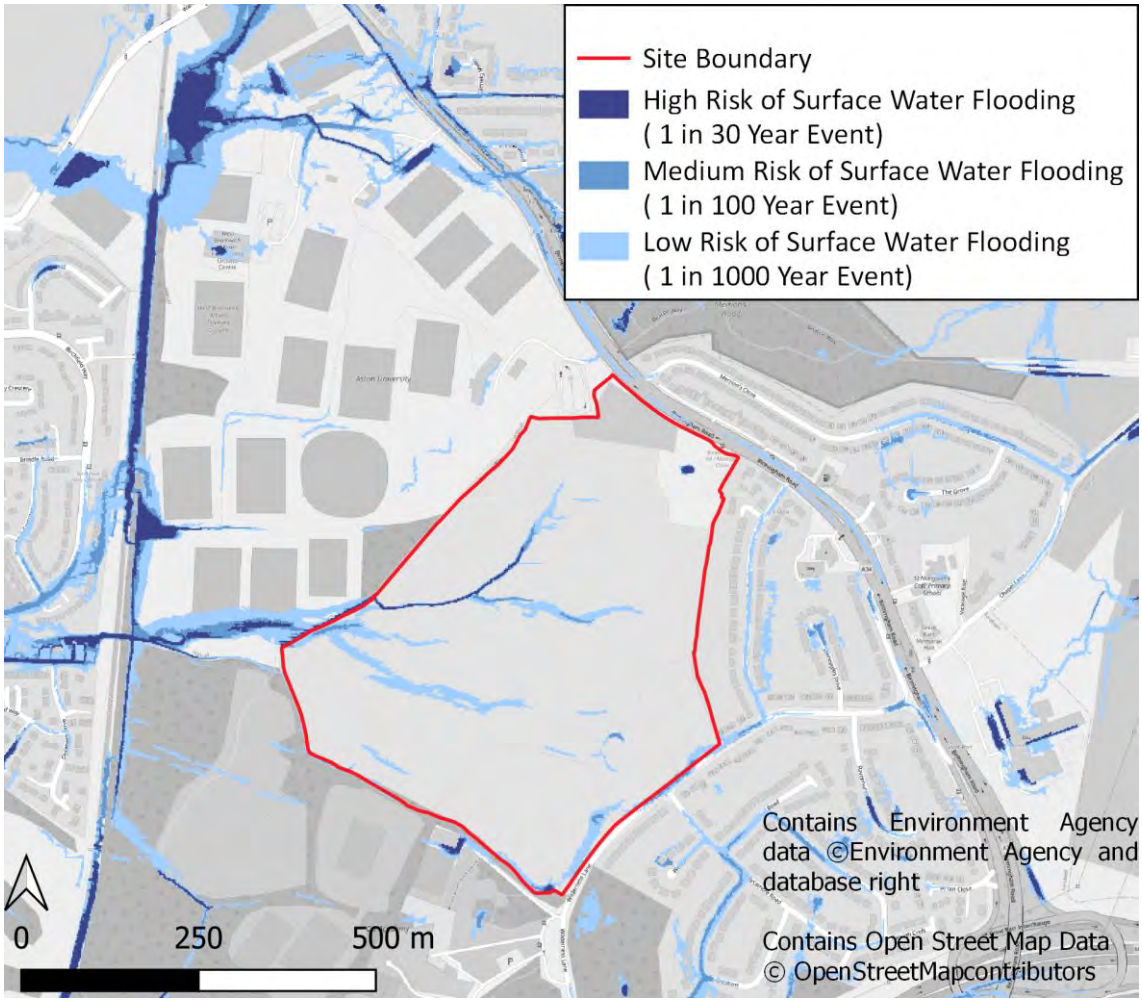


Figure 5-2: Long-Term Flood Risk Information, Flood Risk from Surface Water Map Extract

5.4.5 The production of this mapping has been undertaken at a national scale to provide the first publicly available generation of surface water flood risk mapping. The two previous generations were primarily developed for regulator use as the approach and risk was refined. For example, the first did not include any allowance for losses through drainage via sewers, whilst the second incorporated a national loss coefficient.

5.4.6 Although this current generation of mapping incorporates local estimates of sewer and infiltration loss, generally at an LLFA level, along with various other refinements in runoff estimation, it does not allow for local improvements to the underlying Digital Terrain Model (DTM). This means that local features, such as the adjoining highways, are represented using from LiDAR data without any consideration of surface water drainage features such as culverts or small watercourses which typically provide associated surface water drainage.

5.4.7 As part of the final Site design, measures will be implemented to ensure there is negligible increase in surface water flood risk on- and off-site and ensure that exceedance flows will be directed away from proposed and existing property.

5.4.8 All built development is proposed to be located to the east of the Site, outside of the identified existing surface water flow routes. Given this, flood risk from surface water sources is considered to be low.

5.5 Tidal Sources

5.5.1 Given the in-land location of the Site, flood risk from this source is considered not to be relevant.

5.6 Groundwater Sources

5.6.1 Groundwater flooding is typically caused by high groundwater levels. It occurs where excess water emerges at the ground surface via springs or within manmade structures such as basements. The risk of groundwater flooding depends on the nature of the geological strata underlying the Site, as well as on the local topography.

5.6.2 According to the Level 1 SFRA, groundwater flooding in the Black Country is relatively low with records in Wolverhampton and the border between Dudley and Sandwell, where high water tables have been recorded. The areas mentioned above are approximately 9km west of the Site.

5.6.3 Sandwell MBC have been contacted to provide Appendix A of the Level 1 SFRA as this has not been published online and contains the Areas Susceptible to Groundwater Flood Risk dataset however, at the time of writing, this has not been provided.

5.6.4 From a review of the BGS Borehole Records[4], publicly available borehole records are located 500m east and 270m west. Whilst the boreholes to the east of the Site did not strike groundwater, three boreholes which are located approximately 270m to the west of the Site struck groundwater at 1.10mbgl and 1.30mbgl. The underlying geology of all the boreholes 270m west of the Site comprise Coalbrookdale Formation – Mudstone, which is the same geology as the bedrock to the west of the Site. No built development has been proposed in this area of the Site, with all built development proposed at a topographically higher location, which is underlaid by bedrock of the Enville Member – Sandstone with subordinate conglomerate of Siltstone and Mudstone.

5.6.5 Given this, flood risk from groundwater may be considered to vary depending on the underlying bedrock geology, where the Coalbrookdale Formation – Mudstone geology may support a higher groundwater table as recorded by local borehole information. However, this characteristic is not

[4] British Geological Survey Borehole Records: https://mapapps2.bgs.ac.uk/geoindex/home.html

typical of this type of bedrock which is designated as a Secondary B aquifer and as such is relatively low yielding in terms of groundwater due to decreased transmissivity.

5.6.6 The eastern extents of the Site are underlaid by a different bedrock typology, which is designated as a Secondary A aquifer. This area of the site is topographically higher and there have been no reports of groundwater flooding. The presence of surface water sewers and ditches also indicate that soil conditions present limited opportunity for infiltration. On this basis it reasoned that the risk of ground water flooding at the Site is considered to be low. It is recommended that ground investigation works are carried out at the detail design stage to determine whether groundwater is present or not.

5.7 Sewer Sources

5.7.1 As set out in Section 3.4, there are no public surface water sewers which have been identified as serving the Site.

5.7.2 STWL were consulted on the 9th August 2023 regarding historic sewer flooding. A response was received on 15th August 2023 which stated that there have been reports of flood incidents within the proximity of the Site since 1996 however, the exact locations of these could not be disclosed.

5.7.3 Given there are no public sewers within the Site boundary, it is reasoned that these incidents did not occur within the Site.

5.7.4 Furthermore, Figure 5-8 of the Level 1 SFRA identifies that there have been fewer than 10 incidents of sewer flooding reported within the vicinity of the Site.

5.7.5 Given this, the Site may is considered to be at low risk of sewer flooding.

5.8 Sources of Reservoir Failure

5.8.1 All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the EA ensure that reservoirs are inspected regularly, and essential safety work is carried out.

5.8.2 The publicly available Long-Term Flood Risk, Information, Flood Risk from Reservoirs Mapping identifies that the Site lies outside the maximum extent of flooding from reservoirs.

5.8.3 Given this, flood risk from reservoirs is considered to be very low.

5.9 Canal Sources

5.9.1 The Rushall Canal is located approximately 230 metres west of the Site. From a review of the Level 1 SFRA, there have been no records of the Rushall Canal breaching or overtopping.

5.9.2 The location of Rushall Canal is shown in Figure 3-5. The Site is generally set at a higher elevation than the Canal, where the Canal has been surveyed at an elevation of 118mAOD adjacent to the Site and levels in the Site range from 129mAOD to 160mAOD. The Site is set approximately 2m as a minimum above the canal and as such any breach along the Canal is unlikely to impact the Site. Furthermore, the proposed development will be set at a minimum level of approximately 150mAOD to the east of the Site, a 32m difference to the level of the Canal, which will ensure the proposed development remains safe if the Canal was ever to fail and flood.

5.9.3 Given this, flood risk from canals is considered to be low.

5.10 Climate Change

5.10.1 In accordance with the NPPF and supporting PPG, an FRA should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account. Climate change will affect peak river flows and, consequently, the extent of fluvial flooding is likely to increase in the future.

5.10.2 On 19th February 2016, the EA released updated guidance on climate change allowances[5] to support the NPPF, which was later revised for peak river flows in 2021 and for peak rainfall intensity in 2022.

5.10.3 Further to this, when undertaking a surface water drainage design, an allowance for climate change should also be applied to peak rainfall intensities in accordance with the EA guidance (2070s epoch from 2061 to 2125) Further information on the surface water drainage design and how climate change allowances have been applied is included in Section 6.5.

5.10.4 The Site and associated surface water drainage strategy has been designed to sustainably manage the run-off from the critical 1 in 100-year storm event with a 40% allowance for climate change.

5.10.5 The potential impacts of climate change have been considered as part of the surface water drainage design and the layout of the proposed development of this Site, where built development has been specifically located outside of the identified surface water flood routes thereby applying the principles of the Sequential Approach.

5.11 Sequential and Exception Test Requirements

National Policy and Guidance

5.11.1 Paragraph 162 of the NPPF states *"The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas*

[5] Flood risk assessments: climate change allowances. Environment Agency 2016. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

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".

5.11.1 The PPG sets out the principles of the Sequential and Exception Tests and what is required to pass them when proposing new development in an area at risk of flooding. The Sequential Test aims to promote development in areas of low flood risk. The Exception Test is applied where development cannot be located within an area of suitably low flood risk.

5.11.2 The Exception Test requires a demonstration that flood risk to people and property can be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable Sites at lower risk of flooding are not available. Essentially, the Exception Test requires the proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will remain safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

Local Policy and Guidance

5.11.3 Paragraph 166 of the NPPF States "Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan making stage, or if more recent information about existing or potential flood risk should be taken into account".

5.11.4 The Site has not been reviewed as part of a Sequential Test as part the Local Plan Evidence Base and as such, the below provides evidence that a sequential approach has been taken to the development Site itself.

Flood Risk Vulnerability & Flood Zone Incompatibility

5.11.5 Annex 3 of the NPPF, reprinted in Table 5-3, summaries the flood risk vulnerability classification for different types of development, whereby it is identified that the proposed residential development at the Site is classified as More Vulnerable development.

Table 5-3: Vulnerability Classification

Class	Description
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.
Source: NPPF Annex 3: Flood Risk Vulnerability Classification	

5.11.6 An extract of PPG Table 2 is provided in Table 5-4, which identifies that more vulnerable development is appropriate within Flood Zone 1.

Table 5-4: Flood Risk Vulnerability and Flood Zone 'Incompatibility' (Flood Risk & Coastal Change PPG Table 2)

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b	Exception Test required*	X	X	X	✓*

Key

✓ Exception Test is not required

X Development should not permitted

"†" In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

"" In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:*

- *remain operational and safe for users in times of flood;*
- *result in no net loss of floodplain storage;*
- *not impede water flows and not increase flood risk elsewhere.*

5.12 Site Specific Sequential Assessment of Flood Risk

5.12.1 Table 5-5 provides the percentage coverage of each flood risk type that the overall Site area is identified to be at risk from.

Table 5-5 – Sequential Approach Risk Rating

Flood Risk	% Site at Risk	% Proposed Development Area at Risk	Site Specific Assessment
Fluvial	0%	0%	The Site lies wholly within Flood Zone 1.
Tidal	0%	0%	Inland Site location.
Surface Water	6.64%	1.2%	Proportionally, the proposed development parcels are at very low risk of surface water flooding where only 1.2 % of the development is at risk of existing low surface water flood risk, which is predominantly associated with the existing topographical depression within the northeast corner of the Site. This feature will be retained as part of the proposed development. However a significant offset between this feature and any dwellings will be maintained. The percentage of surface water flood risk within the Site represents the areas at low risk, being the most extensive out of the three.
Groundwater	n/a	n/a	Flood risk from groundwater has been assessed to be potentially varied across the Site due to the variable geology underlying the Site. It is recommended that a Ground Investigation is undertaken to inform the detailed design of the proposed development.
Sewer	n/a	n/a	No public sewers are present within the Site boundary
Reservoir	0%	0%	The site lies outside the maximum extent of flooding from reservoirs.
Canal	0%	0%	Rushall Canal is located 230m west of the Site. However, the Site is 32m higher topography than the canal. Therefore, a breach event is unlikely to impact the Site.

5.13 Site-Specific Measures

5.13.1 Whilst areas of the Site may be considered to be at Surface Water flood risk, these will be mitigated through:

- Steering all proposed development to be located outside corridors and areas shown to be affected by surface water flood flooding i.e., toward the eastern extents of the Site which is set at a higher elevation;
- Raising finished floor levels by a minimum of 150mm above surrounding ground levels and avoiding positioning dwellings in natural depressions;

- Implementation of a surface water drainage strategy which positively and sustainably manages surface water runoff from the Proposed Development to greenfield conditions up to and including the 1 in 100 year +40% climate change event;
- Managing existing surface water flow routes through green-blue corridors; these will be essentially provided within the undeveloped areas of the Site.

5.13.2 Exceedance events (storm events that are of a greater magnitude than the drainage system is designed to accommodate) will be managed, as far as practicable, by ensuring the layout of the development conveys exceedance flows away from buildings and toward areas of open space, surrounding areas of green and blue infrastructure. This will be achieved through careful consideration of the levels of the Site and strategically placed kerbing to direct exceedance flows toward the highway network in addition to green landscaped corridors as a means of conveyance toward SuDS features and receiving watercourses. Refer to Appendix E for an exceedance flood routing plan of the Site.

5.14 Conclusion

5.14.1 Based on publicly available data the Site has been found to generally be at a low risk of flooding from all sources. Approximately 6.64% of the entire Site is at risk of surface water flooding, which is predominantly classified as low risk. The Sequential Approach has been applied to the setting and layout of the proposed development, steering the development away from any areas of surface water flood risk. Subsequently only 1.2% of the proposed developable area has been evaluated to be affected by surface water flood risk which is primarily associated with the topographical depression located within the north east corner of the Site.

6 Surface Water Drainage Strategy

6.1.1 A Surface Water Drainage Strategy outlining the means of surface water management and disposal from the Site has been produced largely in line with the latest guidance as follows:

- CIRIA C753 "The SuDS Manual", (CIRIA, December 2015);
- CIRIA document C522 Sustainable Drainage Systems – design manual for England and Wales;
- CIRIA document C635 Designing for exceedance in urban drainage;
- Rainfall Runoff Management for Developments – SC030219 (Environment Agency, 2013);
- Severn Trent Water guidance notes relating to disposals of surface water; either by infiltration or if infiltration is not viable to the nearest watercourse or land drainage channel. For foul water a connection into Birmingham Road combined system or foul water sewer in Wilderness Lane.
- Environment Agency's pollution prevention guidelines (PPGs); and
- Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

6.1.2 The proposed Surface Water Drainage Strategy aims to sustainably manage surface water runoff without increasing flood risk to on- or off-Site, nor adversely impacting on water quality through the use of SuDS.

6.1.3 SuDS aim to mimic the natural processes of surface water drainage by allowing water to flow along natural flow routes ensuring that runoff rates and volumes during storm events are not increased above the Greenfield values. SuDS also aim to provide water treatment, biodiversity, and amenity benefits within blue and green corridors.

6.1.4 There are typically three design storm events which should be considered when designing the SuDS system and managing flows and volumes:

- 1 in 1 year storm event, on sloping Sites without basements, where surcharging above soffits of any surface water drainage pipework is not permitted.
- 1 in 30-year storm event, where surface water flooding of the site does not occur at this frequency.
- 1 in 100-year storm event with allowances for future climate change, where runoff from the site should be controlled to the greenfield rate using SuDS attenuation features to manage flows and volumes within the extents of the development Site.

6.1.5 Further to this, dedicated overland flow routes should be identified through the development to convey any exceedance flows in events greater than the 1 in 100-year plus climate change event or in the event of system failure.

6.2 Existing Surface Water Drainage Features

6.2.1 The Site is currently undeveloped and is shown to drain through a series of ditches which convey surface water runoff throughout the Site.

6.2.2 The existing surface water drainage features are shown in Figure 6-1.

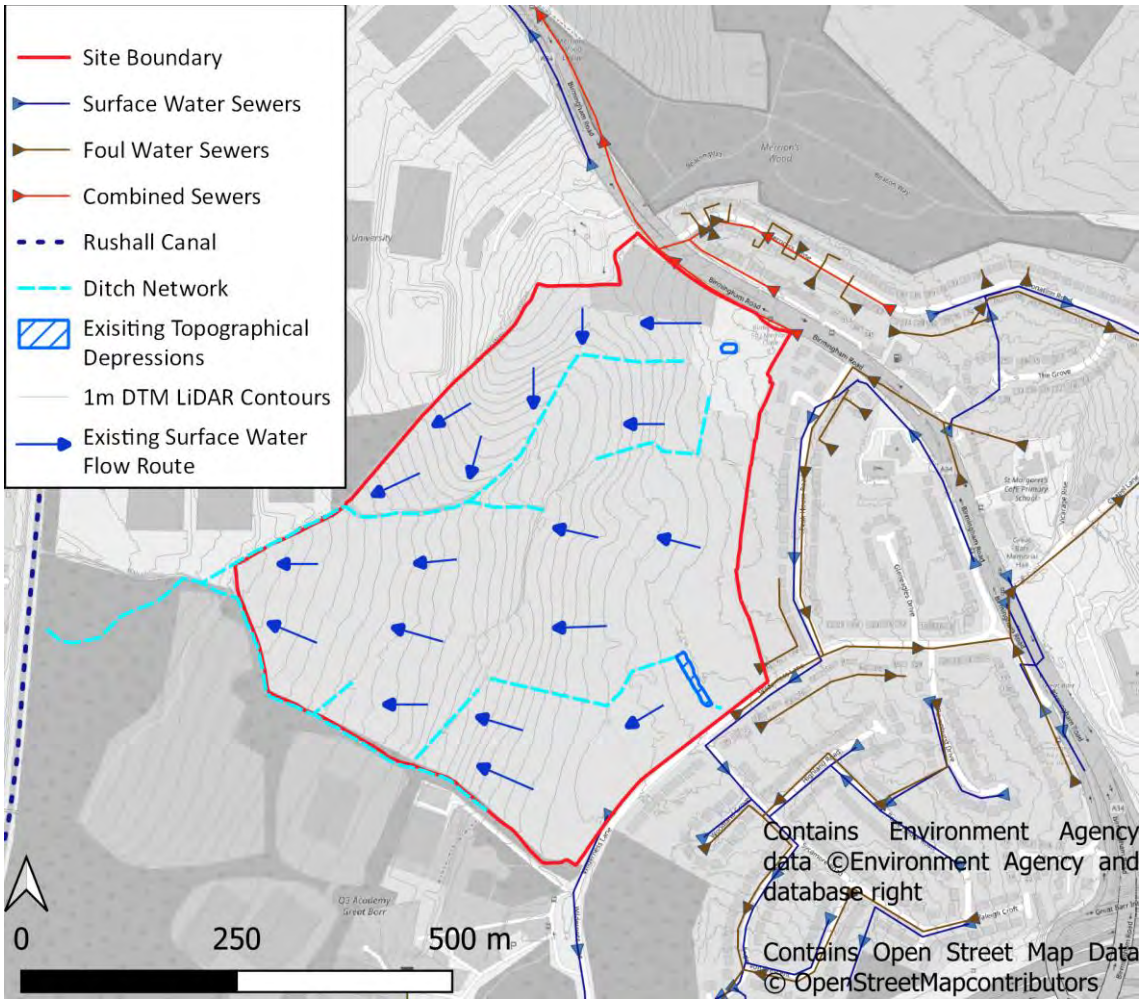


Figure 6-1: Existing Surface Water Features

6.3 Discharge Hierarchy

6.3.1 In accordance with SuDS guidance, surface water should be sustainably managed and designed in accordance with the discharge hierarchy; collect for re-use; infiltrate to ground; discharge to watercourse; discharge to surface water sewer, highway drain or another drainage system; and lastly discharge to a combined sewer.

Table 6-1 – Drainage Hierarchy

Discharge Location	Suitability	Comments
Collect for Re-Use	✓	Water butts and rainwater harvesting systems can collect rainwater for non-potable uses e.g., within gardens and other non-potable uses. The potential to incorporate rainwater harvesting and re-use measures may be assessed and incorporated during the detailed design stage.
Infiltration	✓ / ×	From review of the BGS Mapping, the Site is underlain by a variety of geologies, and it has been assumed that an infiltration led drainage strategy may not be viable. This is further substantiated by the presence of a public surface water drainage system surrounding the Site and the ditch network within the Site. However, it is recommended that infiltration testing in accordance with BRE Digest 365 Soakaway Design Guidance is undertaken prior to the next design stage to confirm whether infiltration is viable in certain areas of the Site. Given the outline nature of this planning application, a conservative assumption has been made that infiltration is not viable.
Watercourse	✓	There is an existing ditch network (classified as ordinary watercourses) within the Site boundary. The surface water drainage strategy proposes to discharge into the existing ditches on Site.
Surface Water Sewer	✓ / ×	There are no public surface water sewers within the Site, but there is existing, STWL public surface water sewers serving existing residential development surrounding the Site, which could be utilised as a point of discharge, should the need arise.
Combined Sewer	×	No combined sewers within the Site, there is an existing combined sewer in the road however there is topographical constraints and more appropriate options available.

6.3.2 In accordance with the above search sequence, it is proposed to discharge surface water runoff to the existing ditches within the Site.

6.4 Pre-Development Surface Water Run-Off Rates

6.4.1 Greenfield run-off rates for the Site have been calculated utilising HR Wallingford FEH runoff calculator, the results which are contained in Appendix F and available in Table 6-2 .

Table 6-2: Greenfield Runoff Rates

Event	26.7 ha	1ha
1 in 1 Year	107.48	4.03
QBar	129.50	4.85
1 in 30 Year	258.99	9.70
1 in 100 Year	332.80	12.46

6.4.2 Based on Site topography, the Site has been split into four drainage catchments (A-D) according to the four proposed development parcels as shown in Appendix E. The greenfield runoff estimate from each catchment have been provided in Table 6-3. In accordance with Sandwell MBC local guidance, the Site should not increase flood risk elsewhere and as such, discharge has been limited to no greater than the existing QBar discharge rate.

Table 6-3 - Proposed Discharge Rates

Catchment	Proposed Developable Area [ha]	Proposed Discharge Rate (QBar) [l/s]
A	2.12	10.3
B	0.57	2.8
C	1.48	7.2
D	0.66	3.2
TOTAL	4.83	23.5

6.5 Climate Change Impact

6.5.1 In line with the climate change allowances recommended by the EA in their guidance, most recently updated in May 2022, the impact of climate change on the peak rainfall intensities in urban drainage designs should be assessed by Management Catchment and increased accordingly.

6.5.2 The peak rainfall intensity allowances for the Tame Anker and Mease Management Catchment has therefore been reviewed, as detailed for the 3.3% annual exceedance rainfall event in Table 6-4 and 1% event in Table 6-5.

Table 6-4 – 3.3% Peak Rainfall Allowances for the Tame Anker and Mease Management Catchment

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

Table 6-5 – 1% Peak Rainfall Allowances for the Tame Anker and Mease Management Catchment

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

6.5.3 The Site and associated surface water drainage strategy has been designed to sustainably manage the run-off from the critical 1 in 100-year storm event (1%AEP) with a 40% allowance for climate change.

6.5.4 Consideration of the potential impact of climate change has been given to the Site, particularly with regard to locating built development outside of the maximum identified surface water flood extents and the management of exceedance flow routing.

6.6 Proposed Surface Water Drainage Strategy

6.6.1 The proposed Surface Water Drainage Strategy is shown on the Indicative Drainage Strategy drawing (Ref. 06832-WR-A-0503), included in Appendix E.

6.6.2 Given the varied bedrock geology present on site, it is reasoned that the ability to infiltrate surface water runoff from the development will also be equally variable. The presence of surface water sewers and ditches within the local area and within the Site respectively, indicate that soil conditions signify limited opportunity for infiltration.

6.6.3 In accordance with the drainage hierarchy, as indicated previously, infiltration testing in accordance with BRE Digest 365 Soakaway Design Guidance is recommended to determine whether infiltration may be achievable within the sandstone bedrock geology underlying the eastern extents of the Site. . Until this has been undertaken, a positive discharge has been assumed and it is proposed that surface water runoff from the proposed development is limited to the QBar rate, thereby mimicking the existing greenfield drainage regime of the Site and aiming to ensure that there is negligible impact on downstream flood risk.

6.6.4 Surface water runoff from the proposed development parcels will be discharged via ditches to the south-west of the Site. Surface water runoff will be attenuated predominantly via basins, which will discharge to the receiving ditch network within the Site at a restricted QBar rate. These attenuation basins will offer water storage, water quality treatment, amenity and biodiversity value. Swales will be implemented to convey surface water through the Site.

6.6.5 There are a variety of other SuDS features that the development could consider in addition to the attenuation basins and swales already proposed, as the masterplan and detailed design is developed further. Table 6-6 provides a catalogue of these and their appropriate application to the Site and its use.

Table 6-6: Summary of SuDS Feature Selection

Feature	Description	Selection
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation.	× Due to the proposed residential nature of the development, green roofs have not been proposed.
Filter Strips	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	✓ / × Filter strips may be further assessed and implemented at a later stage of design.
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.	✓ / × Pervious surfaces may be further assessed and implemented at a later stage of design.
Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff, and can infiltrate the water into the ground (if ground conditions allow).	✓ Swales has been proposed to convey water through the development.
Infiltration Basins	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the ground. They may also be landscaped to provide aesthetic and amenity value.	✓ / × Infiltration basins have not been proposed at this stage, however, may be utilised following the outcome of infiltration testing to be undertaken in accordance BRE Digest 365 Soakaway Design Guidance.
Basins / Ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment whereas basins are usually dry for a larger period of time outside storm events. They provide temporary storage for storm runoff. These features may provide amenity and wildlife benefits.	✓ Attenuation basins have been proposed on the Site to attenuate and treat the surface water runoff from the development and will provide additional amenity and wildlife benefits.
Underground Attenuation	Underground attenuation structures are below-ground attenuation features. These are typically formed using crates which provide a high void space for attenuation and water quantity control.	× Underground attenuation has not been proposed for use on this Site.
Bioretention / raingardens	Bioretention systems or rain gardens are areas of vegetation into which rainwater and runoff can be directed. These are particularly affected at providing water quality improvements.	✓ / × Rain gardens may be further assessed and implemented at a later stage of design.
Filter Drains	Filter drains are gravel filled trenches that collect and move water. They also treat pollution. The trench is filled with free draining gravel and often has a perforated pipe in the bottom to collect the water	✓ / × Filter drains may be further assessed and implemented at a later stage of design.
Water Butts	Water butts are water tanks which are used to collect and store rainwater runoff, typically from roof tops via pipes. Overflows will still enter the site surface water drainage system.	✓ Water butts should be incorporated as part of rainwater harvesting and re-use measures. They may be further assessed and implemented at a later stage of design.

6.6.6 To ensure maximum peak discharge is maintained at QBar runoff rates, on-Site attenuation will be required. The required storage volume for the attenuation of the 1 in 100-year event plus 40% climate change event has been calculated for each drainage catchment/land parcel assuming a proportion of impermeable surfacing based on the illustrative masterplan and the restricted discharge rate. The proposed attenuation basins are shown together with their required capacity on the Indicative Drainage Strategy drawing in Appendix E.

6.6.7 A summary table for the proposed attenuation volume required for each drainage catchment is provided in Table 6-7 which also identifies the impermeable area applied to each drainage catchment (which assumes a 60% impermeability).

Table 6-7: SuDS Summary

Assumed Catchment	Proposed Discharge Rate (l/s)	Proposed Impermeable Area [ha]	Proposed Attenuation Volume Required [m^3]
A	10.30	1.27	920
B	2.80	0.34	245
C	7.20	0.89	640
D	3.20	0.40	300
TOTAL	**23.50**	**2.90**	**2105**

6.6.8 The proposed attenuation basins have been designed as dry features at this stage however, some may be designed to have a permanently wetted pool below the existing outlet level to the basin, full details of this will be available at the detailed design stage.

6.6.9 Water butts may be available for all households to provide an opportunity for water re-use. However, as the attenuation capacity for the water butts cannot be guaranteed during a rainfall event, these have not been accounted for within drainage strategy attenuation calculations.

6.6.10 Surface water run-off from roofs and hard surfaces across the development will drain to a new surface water drainage network incorporating SuDS components to control discharge to the receiving watercourses, in addition to providing attenuation storage on-Site and providing treatment to run-off. The surface water drainage system will be designed to convey the 1 in 30-year storm event without flooding.

- 1 in 100-year storm event with allowances for future climate change, where runoff from the site should be controlled to the greenfield rate using SuDS attenuation features to manage flows and volumes within the extents of the development Site.

6.6.11 In the event of the critical 1 in 100-year (+40% climate change allowance) storm event, surface water runoff will be managed within the Site by conveying flows away from vulnerable development and through the development via the highway and green/blue corridors. These flows will then be directed toward the proposed attenuation basins which are located at a lower

topographical level to the proposed developable area. and have been sized to provide the required attenuation and treatment.

6.6.12 Vortex flow controls, such as a Hydrobrakes, have been specified to restrict the surface water outfall to the greenfield QBar run-off rates to the ditches across the Site.

6.6.13 The proposed SuDS features have been sized in Causeway Flow. The design calculations confirm that the proposed surface water drainage system is capable of attenuating, and discharging in a controlled manner, the run-off from the design 1 in 100-year storm with a 40% allowance for climate change without flooding of the development. Refer to Appendix G for the model output.

6.6.14 The surface water drainage strategy is based upon the Site's masterplanning details at the time of production. Changes to the site development profile, impermeable areas across the site or other such aspects of the scheme will result in the need to revise the calculations.

6.7 Development Creep

6.7.1 Over the lifetime of a development, it is possible that the overall impermeable area within the Site could increase by as much as 10% through the house buyers undertaking activities such as property extensions and introducing paved gardens.

6.7.2 Table 6-8 identifies the potential increase in impermeable area as a result of urban creep over the lifetime of the development.

Table 6-8 - Development Creep Assessment

Catchment	Impermeable Area (ha)	10% Creep (ha)	Total Impermeable Area
A	1.27	0.12	1.39
B	0.34	0.04	0.38
C	0.89	0.09	0.98
D	0.4	0.04	0.44
TOTAL	2.89	0.29	3.18

6.8 Water Quality

Principles of Water Quality Assessment

6.8.1 The general principles are to mitigate against adverse impacts on water quality in the receiving water environment is described in the CIRIA C753 "The SuDS Manual" (2015). This document recommends the following steps to determine the required water quality management for discharges to surface waters and groundwaters based on the risk posed:

1 Interception: Prevent runoff and associated pollutants from the Site to receiving surface waters for the majority of small rainfall events (e.g., <5mm rainfall events);
2 Determine the pollution hazard level associated with the given type of development;
3 Select a risk assessment approach based on receiving water environment and the pollution hazard level; and
4 Undertake a detailed risk assessment for each outfall or discharge point taking into account the pollution hazard level, the status of the receiving water environment and effectiveness of the proposed SuDS techniques.

6.8.2 The extent of the treatment required will depend on the water quality status of receiving watercourses, land use, the level of pollution prevention in the catchment and for groundwater, the natural protection afforded by underlying soil layers. The pollution hazard level of the development type should be identified.

6.8.3 Residential roofs are noted as having 'very low' pollution hazard level and require removal of gross solids and sediments only. Residential car parks, access roads, driveways and non-residential car parking with infrequent change (e.g., schools) are shown to present 'low' pollution hazard level.

6.8.4 Low pollution hazard levels require application of a 'simple index approach' for water quality risk assessment for discharges to surface and ground waters.

Existing Water Quality of the Proposed Receiving Watercourses

6.8.5 The Site falls within the Environment Agency's Humber River Basin which covers an area of 26,100km^2 and extends from the West Midlands in the south, northwards to North Yorkshire and from Staffordshire in the west to parts of Lincolnshire and the Humber Estuary in the East[6].

6.8.6 The Humber River Basin has been divided into 18 Management Catchments, of which the site falls into the Tame and Anker and Mease Management Catchment and within this, Tame Lower Rivers and Lakes Operational Catchment.

6.8.7 Within the Tame Lower Rivers and Lakes Operational Catchment, the Site falls into the catchment for the Tame - conf two arms to River Rea Water Body. This is identified as a heavily modified waterbody. The 2019 Cycle identifies it has a 'Moderate' ecological status and a 'Fail' chemical status.

6.8.8 Reasons for not achieving 'good' status include:

- Urbanisation – urban development
- Sewage discharge (continuous and intermittent), Pollution from wastewater;
- Physical modifications from urban and transport; and

6 Humber_RBD_Part_1_river_basin_management_plan.pdf (publishing.service.gov.uk)

- Pollution from towns, cities and transport.

6.8.9 As such the EA will be seeking improvements to the water quality of the local watercourse system to achieve a status of 'Good' by 2027.

6.8.10 The principles of the SuDS Management Train should be incorporated into the proposed surface water drainage schemes for new development, to reduce the risk of further pollutants entering watercourses via run-off from roofs and paved areas.

6.8.11 SuDS components can reduce pollution in run-off through filtering out pollutants or reducing flow rates to encourage deposition of any contaminants. Suitable components could include:

- permeable paving;
- swales;
- attenuation basins; and
- proprietary treatment systems.

6.8.12 Where possible, interception storage should be included as part of the treatment train to manage pollutants at source. Later stages of treatment in the train should incrementally reduce the level of pollution in run-off before discharge to the receiving water body.

6.9 Contamination and Water Quality

6.9.1 The Site will utilise SuDS Management Trains across each network to ensure treatment of run-off and removal of pollutants prior to discharge.

6.9.2 This is likely to include a mixture of components across the Site, specified according to the opportunities/constraints presented by:

- the likely pollution hazard of the run-off;
- the available surface space; and
- the proposed ground levels/falls across areas of hardstanding.

6.9.3 Treatment components within each SuDS Management Train may include:

- permeable pavement (for car parking areas);
- attenuation basins incorporating pre-treatment (such as a sediment forebay) and low flow channels;
- bioretention areas / rain gardens in greenspace around the Site;
- swales and linear wetlands; and
- filter drains bordering paved areas such as roads and yards.

6.9.4 The arrangement and composition of each management train will be confirmed at the detailed design stage.

6.9.5 The proposed uses at the Site will comprise residential roofs and individual driveways. Roofs are classified as a 'very low' pollution risk and individual driveways are classed as a 'low' pollution risk level in Table 26.2 of CIRIA C753 The SuDS Manual. 'Low' hazard pollution levels require application of a 'simple index approach' for water quality risk assessment for discharge to surface and groundwaters. The "pollution hazard indices" for a low pollution hazard Site are given in Table 6-9 below.

Table 6-9 - Pollution Hazard Indices for a Low Pollution Hazard Site

Total Suspended Solids (TSS)	Metals	Hydrocarbons
0.5	0.4	0.4

6.9.6 The surface water drainage system should provide a sufficient level of water quality treatment to prevent pollution of the receiving waterbodies.

6.9.7 Table 6-10 provides the indicative SuDS mitigation indices for the proposed SuDS features for the Site. It demonstrates that the mitigation index for the basins or ponds are greater than the "*pollution hazard index*" for each pollutant type. As such, the strategy is deemed to comply with the water quality requirements of the SuDS standards.

Table 6-10 - Indicative SuDS Mitigation Indices

SuDS component	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Detention basins	0.5	0.5	0.6
Swale	0.5	0.6	0.6

6.10 Designing for Exceedance

6.10.1 During a rainfall event with a return period well in excess of that for which the surface water drainage system was designed (in this case a 1 in 100 year plus 40% climate change allowance), or in the event of a blockage, the capacity of the surface water drainage system may be exceeded, resulting in localised flooding in the areas affected. This is considered to be a residual risk.

6.10.2 The layout and landscaping of the Site should be designed and developed to ensure that exceedance flood flow paths are routed away from development and toward landscaped areas, areas of open attenuation or surrounding green infrastructure.

6.10.3 In line with Building Regulations, the finished floor levels of the properties will be set at least 150mm above the surrounding ground levels to prevent surface water ingress through doorways. Location of buildings in ground depressions will be avoided to prevent water ponding around dwellings.

6.10.4 Minor modifications to topography, the profile of the access road, footpath or kerb and strategically placed green/blue infrastructure will be developed to ensure that exceedance flood flows are managed and there is little or no risk of property flooding or unacceptable ponding within the highway.

7 Foul Water Drainage Strategy

7.1.1 STWL are the statutory undertaker in the area; their sewer asset mapping identifies that there are no public sewers currently serving the Site. There are existing, public combined, surface and foul sewers surrounding the Site serving existing residential development.

7.1.2 STWL had been previously consulted to support an initial works in relation to the Site. The Pre-Development Enquiry provided comments on the development proposals and opportunities for foul water drainage. STWL's response is included in Appendix H.

7.1.3 Through the pre-development enquiry service, STWL advised that there are two potential points for foul connection:

1 into the highway on Birmingham Road to the existing 225mm combined sewer to the north of the Site,
2 or to the existing 225mm foul water sewer located in Wilderness Lane to the south.

7.1.4 Due to the topographical levels at the Site and points of connection to the public sewer system it is proposed that the majority of foul water from the proposed development is pumped via a new pumping station to the south of the Site, which will lift flows toward the southern area of the development (Parcel D). Foul flows will then drain by gravity toward the public foul sewer in Wilderness Lane (MH1304).

8 Adoption & Management

8.1 Surface Water Drainage System

8.1.1 Responsibility for the maintenance of the main surface water drainage networks and SuDS features may be offered to STWL for adoption under S104 of the Water Industry Act 1991. To meet the requirements for adoption, the proposed infrastructure must be designed and constructed according to Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

8.1.2 Alternatively, it is common for SuDS features to be operated and maintained by a third-party private maintenance company. Should this be necessary, a third-party management company would be established to maintain the features in perpetuity and an adoption agreement between the final Site developer and Maintenance Company would be largely based upon the CIRIA ICoP MA2 SuDS Maintenance Framework Agreement.

8.1.3 Drainage serving new roads to be offered for adoption by the Local Highway Authority will become highway drains, adopted as part of Section 38 agreements (Highways Act 1980).

8.1.4 In England it also appears increasingly likely that Schedule 3 of the Flood and Water Management Act will be enacted in England, with DEFRA currently recommending implementation of this in 2024. This legislation, when enacted, will require SuDS Approval Bodies (SABs) to be formed in England who will review the design of SuDS and will likely be responsible for the future operation and maintenance. As the layout of the development evolves it is recommended that the surface water drainage design seeks to comply with this legislation when it comes forward ensuring that the SuDS proposed are designed and built in accordance with the SAB's requirements and may be offered for adoption to the SAB if required.

8.1.5 Typical maintenance schedule of the attenuation basins, swales flow control devices and headwalls proposed on are shown in the tables below.

Table 8-1: Attenuation Basin Indicative Maintenance Table.

FRQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only) • Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)) (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015))
Annually	• Remove all dead growth prior to the start of growing season • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife • Remove sediment from inlets, outlets and forebay • Manage wetland plants, where required
As Required	• Prune and trim trees and remove cuttings • Remove sediment from forebay, when 50% full and from micropools if volume reduced by more than 25% • Repair erosion or other damage by re-turfing or reseeding • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

Table 8-2: Flow Control (e.g. Hydrobrake) Indicative Maintenance Schedule

FRQUENCY	ACTION
Monthly	• Inspect and identify any areas that are not operating correctly. If required, take remedial action (for three months following installation)
Six Monthly	• Inspect and identified ant area that are not operating correctly. If required, take remedial actions. • Remove sediment from any pre-treatment structures.
Annually	• N/A
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return the feature to full working order.

Table 8-3: Swale Indicative Maintenance Schedule

FRQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only) • Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)) (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015))
Annually	• Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where required • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife
As Required	• Repair erosion or other damage by re-turfing, reseeding or replacing filter materials. • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove and replace top 300 – 500mm of gravel, clean and replace where required (typically every 60-month period) • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

Table 8-4: Headwall Indicative Maintenance Schedule

FRQUENCY	ACTION
Monthly	• Inspect surface structures removing obstructions and silt as necessary • Check there is no physical damage • Trim vegetation 1m minimum. Surrounding structure and keep hard aprons free from silt and debris
As Required	• Check topsoil levels are 20mm above edges of baskets and chambers to avoid mower damage • Unpack stone in basket features and unblock or repair and repack stone as design detail as necessary • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

8.1.6 The proposed maintenance regimes for the devices should be largely in accordance with The SuDS Manual (CIRIA C753) and other best practice guidelines and in accordance with manufacturer's recommendations. This will ensure the design performance, structural integrity and where applicable- appearance of each feature is maintained throughout its lifetime.

8.1.7 Further details will be provided on the maintenance requirements of the proposed SuDS components across the development as the detailed design is developed. The details of the party responsible for maintenance of each feature should be confirmed prior to occupation of the Site.

8.2 Foul Water Drainage System

8.2.1 It is anticipated that the proposed foul sewer network may be offered to STWL for adoption under Section 104 of the Water Industry Act 1991. To meet the requirements for adoption, the proposed infrastructure must be designed and constructed according to Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

9 Conclusion & Recommendations

9.1 Conclusion

9.1.1 PJA has been commissioned by Wain Estates (Land) Limited to prepare a Flood Risk Assessment and Drainage Strategy for the proposed residential development at 'Wilderness Park'.

9.1.2 This Flood Risk Assessment (FRA) has been undertaken in accordance with current national and local flood risk policy requirements. This report assesses the existing and future potential flood risk at the Site, including an assessment of the potential effects of the Site on flood risk on- and off-Site.

9.1.3 The assessment concludes that the Site is considered to be at either a very low or low risk of flooding from the sources assessed (fluvial, tidal, reservoirs, canals, surface water, groundwater and sewers). There are confined areas and corridors of surface water flood risk, predominantly located to the western half of the Site, associated with the valley lines and ditch courses present within the Site. The FRA has determined that approximately 6.64% of the entire Site is affected by low surface water flood risk, being the most extensive.

9.1.4 The Sequential Approach has been applied to the setting and layout of the proposed development, steering the development away from any areas of surface water flood risk. Subsequently only 1.2% of the proposed developable area has been evaluated to be affected by surface water flood risk which is primarily associated with direct rainfall collecting within a topographical depression located within the north eastern corner of the Site. This feature was observed to be dry during a site visit conducted on the 23rd October 2023 following a significant storm event (Storm Babet) which caused significant flooding across the Midlands Region. This feature will be retained but free from any development as part of the proposed development.

9.1.5 A Surface Water Drainage Strategy has been prepared to demonstrate that a sustainable drainage solution can be provided for the Site. The Surface Water Drainage Strategy has been designed largely in accordance with the NPPF and current sustainable drainage best practice and meets the requirements of Sandwell MBC (as the LLFA).

9.1.6 The proposed surface water drainage strategy aims to mimic the hydrological regime of the existing Site by discharging run-off to the existing ditches present within the Site to the site-specific greenfield QBar rate. Attenuation storage will be provided in the form of open SuDS features such as attenuation basins and swales. Water butts may be used to store water for re-use within feasible locations, but these have not been included within attenuation calculations as the capacity availability cannot be guaranteed.

9.1.7 Safe access and egress will be available to and from the Site for events up to and including the 1 in 100 years plus climate change flood events.

9.1.8 SuDS Management Trains will provide suitable treatment of run-off by removing pollutants prior to discharge.

9.1.9 The responsibility for the operation and maintenance of each SuDS feature will be confirmed prior to the commencement of construction. The SuDS used on Site should be maintained in accordance with manufacturer's recommendations and current best practice and guidelines to ensure routine operation.

9.1.10 Through the pre-development enquiry service, STWL advised that there are two potential points for foul connection:

3 into the highway on Birmingham Road to the existing 225mm combined sewer to the north of the Site,

4 or to the existing 225mm foul water sewer located in Wilderness Lane to the south.

9.1.11 Due to the topographical levels at the Site and points of connection to the public sewer system it is proposed that the majority of foul water from the proposed development is pumped via a new pumping station to the south of the Site, which will lift flows toward the southern area of the development (Parcel D). Foul flows will then drain by gravity toward the public foul sewer in Wilderness Lane (MH1304).

9.1.12 This report demonstrates that the proposed development may be undertaken in a sustainable manner without increasing the flood risk either at the Site or to any third-party land in line with NPPF requirements.

Appendix A Topographic Survey

N

Topographical Survey Legend

Bin	Litter bin	TL	Tie line
BH	Bore Hole	TP	Telegraph pole
Bol	Bollard	TPS	Tactile paving slabs
BS	Bus stop	TS	Traffic signal light
BT	British telecom ic	TV	Television cover
CPS	Concrete paving slabs	VP	Vent pipe
DR	Drain	WM	Water meter
Elec	Electrical ic	WO	Wash Out
EP	Elec. pole	UTL	Unable to lift
ER	Earth rod	Fence annotation	
FH	Fire Hydrant	B/W	Barbed wire
FP	Flagpole	C/B	Closed boarded
FT	Floodlight	C/I	Corrugated iron
G	Gully	C/L	Chain link
GP	Gate post	C/P	Concrete panel
GV	Gas valve	H/R	Hand rail
IC	Inspection cover	I/R	Iron railings
JB	Junction box	O/B	Open boarded
KO	Kerb outlet	P/C	Post & chain
LB	Letter box	P/R	Post & rail
LP	Lamp post	P/W	Post & wire
Mkr	Utility marker	W/M	Wire mesh
MP	Mile post	Level prefix descriptions	
MW	Monitoring Well	AL	Arch level
NP	Name plate	BL	Bed level
P	Post	CL	Cover level
PM	Parking meter	EH	Eaves level
RE	Rodding eye	FL	Floor level
RS	Road sign	IL	Invert level
rwp	Rain water pipe	PL	Parapet level
SP	Sign post	RH	Roof/ridge level
ST	Stop tap	SL	Soffit level
SB	Service Box	Spr	Arch springing level
SV	Stop valve	Top	Top of pipe/culvert
TCB	Telephone call box	WH	Wall height
TH	Trial Hole	WL	Water level

BENCH MARK INFORMATION

All levels relate to O.S (Newlyn) Datum, Established using network RTK. Survey plotted on a plane local grid, orientated to National Grid.

NOTES

ONLY MANHOLES AND SERVICES VISIBLE AT TIME OF SURVEY SHOWN

DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED WITH LOCAL AUTHORITY RECORDS PRIOR TO WORK COMMENCING

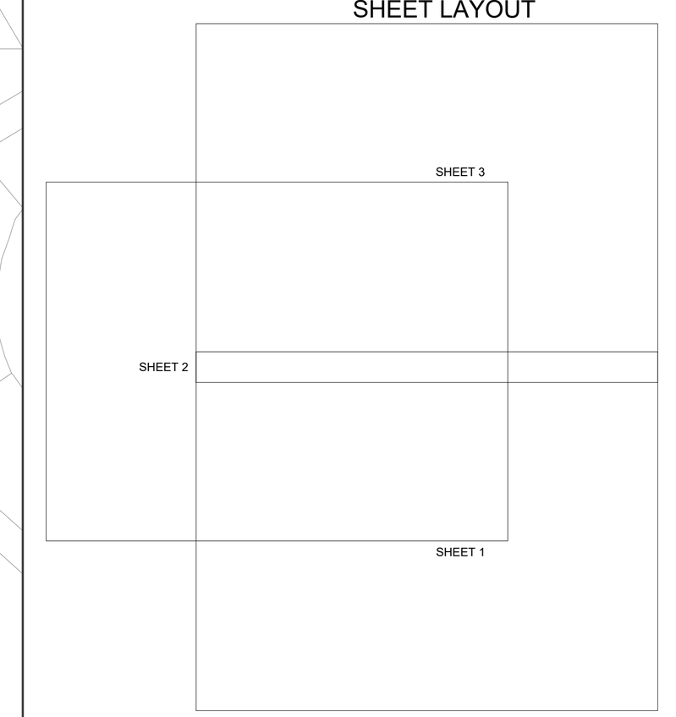
Levels defining edge of carriageway are observed at channel (bottom of kerb). Unless otherwise stated.

TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE THE AVERAGE SPREAD. THE DRIP LINE LAYER DENOTES THE TREES EXTREMITY

SURVEY STATIONS

stn1	404067.426	295250.274	155.037
stn1a	404115.785	295291.395	155.801
stn2	404016.980	295209.846	154.274
stn3	403990.421	295196.944	153.819
stn4	403928.890	295106.014	153.360
stn5	403908.498	295113.662	152.483
stn6	403881.092	295114.531	152.300

SHEET LAYOUT



REVISIONS

REV.	DESCRIPTION	SURVEYED	DRAWN	DATE

JLP Surveying

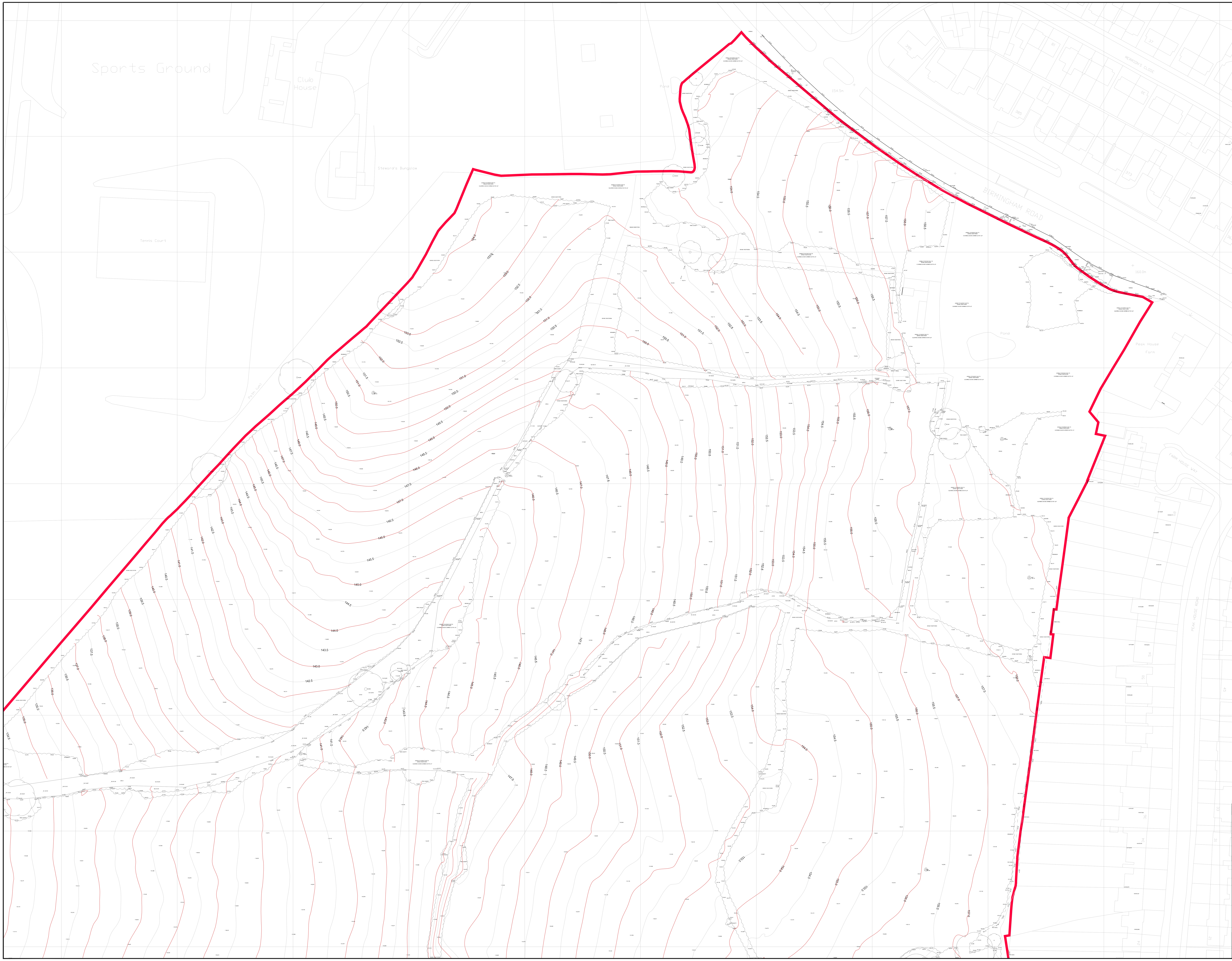
JLP Surveying Consultants Ltd,
Suite 45 Rodney House,
King Street,
Wigan
WN1 1BT
Tel - 01942 243313
Fax - 01942 492230
Mobile - 07710 428498
EMAIL:- peterhouston@jlpsurveys.com

PROJECT
Wilderness Lane
Great Barr
Birmingham

DRAWING TITLE
Topographical Land Survey

SCALE	SHEET SIZE	No. of SHEETS	DATE	REVISION
1 : 500	A0	3	22.07.23	

DRAWING NUMBER
S23-0690-1



Topographical Survey Legend

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KO	Kerb outlet	P/C	Post & chain
LB	Letter box	P/R	Post & rail
LP	Lamp post	P/W	Post & wire
Mkr	Utility marker	W/M	Wire mesh
MP	Mile post	Level prefix descriptions	
MW	Monitoring Well	AL	Arch level
NP	Name plate	BL	Bed level
P	Post	CL	Cover level
PM	Parking meter	EH	Eaves level
RE	Rodding eye	FL	Floor level
RS	Road sign	IL	Invert level
rwp	Rain water pipe	PL	Parapet level
SP	Sign post	RH	Roof/ridge level
ST	Stop tap	SL	Soffit level
SB	Service Box	Spr	Arch springing level
SV	Stop valve	Top	Top of pipe/culvert
TCB	Telephone call box	WH	Wall height
TH	Trial Hole	WL	Water level

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stn4	403928.890	295106.014	153.360
stn5	403908.498	295113.662	152.483
stn6	403881.092	295114.531	152.300

SHEET LAYOUT

REVISIONS

REV.	DESCRIPTION	SURVEYED	DRAWN	DATE

JLP Surveying

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Suite 45 Rodney House,
King Street,
Wigan
WN1 1BT
Tel - 01942 243313
Fax - 01942 492230
Mobile - 07710 428498
EMAIL:- peterhouston@jlpsurveys.com

PROJECT
Wilderness Lane
Great Barr
Birmingham

DRAWING TITLE
Topographical Land Survey

SCALE	SHEET SIZE	No. of SHEETS	DATE	REVISION
1 : 500	A0	3	22.07.23	

DRAWING NUMBER
S23-0690-3

Topographical Survey Legend

BN	Litter bin	TL	Tie line
BH	Bore hole	TP	Telegraph pole
BO	Bollard	TPS	Tactile paving slabs
BS	Bus stop	TS	Traffic signal light
BT	British telecom ic	TV	Television cover
CPS	Concrete paving slabs	VP	Vent pipe
DM	Dim	WM	Water marker
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FT	Floodlights	C/I	Corrugated iron
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RG	Road gully	P	Parapet level
RW	Rain water pipe	PL	Parapet level
SP	Sign post	RH	Roofridge level
ST	Stop tap	SL	Soffit level
SB	Service Box	Spr	Arch springing level
TC	Traffic cone	TK	Top of kerb/crown
TCB	Telephone call box	WH	Wall height
TH	Trial Hole	WL	Water level

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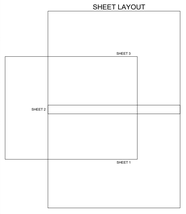

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DRAWING NUMBER
S23-0690-2

Appendix B Illustrative Masterplan