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NPPF: Flood Risk Assessment & Outline Drainage Strategy

Land West of Tattenhall Road, Tattenhall

Gladman Developments Ltd

SHF.1132.307.HY.R.001.A

'Experience and expertise working in union'

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Executive Summary

This report presents a Flood Risk Assessment in accordance with the National Planning Policy Framework and National Planning Practice Guidance: Flood Risk and Coastal Change ID: 7 guidance[1], for a proposed residential development located on land west of Tattenhall Road, Tattenhall, Chester, CH3 9QY.

The report assesses the flood risk and how this could be managed to allow the Site to be developed in support of the outline planning application. The FRA also includes an assessment of the surface water and foul drainage requirements.

A summary of the baseline Site condition is included below:

- The 6.32-hectare (ha) Site is comprised of an agricultural (grassed) land, underlain by clayey soils and sandstone bedrock with moderate infiltration potential.
- The Site slopes generally south towards the bounding watercourse, Keys Brook, which conveys flows west along the southern boundary of the Site.

The risk of flooding is assessed as follows:

- The risk of fluvial flooding is assessed as negligible for most of the Site, and as low to high associated with Keys Brook in the southern extent.
- The risk of groundwater flooding is assessed as negligible for most of the Site, and as moderate in areas of the southern extent.
- The risk of surface water flooding is assessed as negligible for most of the Site, and as low associated ponding in the northern, western and southern extents.
- Flood risk from all other sources is assessed as negligible.

Flood risk from identified sources can be reduced to a negligible or low and acceptable level through the following approach:



Subject to the proposed avoidance measures, the Sequential Test is not required:

- Sequentially develop the Site, limiting the built development outside the mapped extent of the JFLOW fluvial flooding with a +300mm offset as a conservative approach (as per Drawing 0008).
- Set the surface water outfall from the proposed development at an appropriate height, above the bed level of the receiving watercourse
- Set building floor levels +150mm above external levels.
- No below surface habitable buildings (i.e. basements).
- Lined attenuation to prevent groundwater ingress.

Further to the above, the FRA has recommended further measures in line with statutory requirements / following best practice. The FRA has explored control, mitigate and management measures. A summary is included in the table below.

The proposed residential use is classified as ‘more vulnerable’. More vulnerable uses are considered acceptable in terms of flood risk in Flood Zone 1 and 2 (low and moderate risk),

[1] https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities

however parts of the Site are in Flood Zone 3a (high risk) and there is also a risk of flooding from other sources. Subject to the implementation of the above avoidance measures, the Sequential Test would be passed, and the Exception Test would not be required.

Source of Flooding	Risk of Flooding	Risk Without Measures	Recommended Measures	Risk to Development with Measures
Fluvial - Keys Brook	Negligible for most of the Site, Low to High associated with Keys Brook in the southern extent.	Negligible to High	Avoid and Control	Negligible
Tidal - Non identified	Negligible	Negligible	N/A	Negligible
Groundwater - Principal Aquifer (bedrock); Secondary (Undifferentiated) and Secondary A Aquifers (Superficial Designation)	Negligible for most of the Site; Moderate in areas of the southern extent.	Negligible to Moderate	Avoid	Negligible
Surface Water - Poor permeability and Site topography	Negligible for most of the Site; Low associated with the ponding in the north-eastern, western and southern extents.	Negligible to Low	Avoid and Control	Negligible
Sewers and Mains - None identified	Negligible	Negligible	N/A	Negligible
Infrastructure Failure - None identified	Negligible	Negligible	N/A	Negligible

- The FRA has considered the potential impact of the development on surface water runoff rates, given the increase in impermeable areas post-development. These rates have been calculated, and it has been demonstrated that surface water can be managed, such that flood risk to and from the Site following development will not increase. This will be achieved through restricted discharge rates (i.e. calculated greenfield [QBAR]) and appropriately sized detention basin, with an outfall to the bounding watercourse, Keys Brook.
- It is proposed that foul flows will discharge to the Ø160mm public foul sewer (currently subject to S104 agreement) via a pumping station and rising foul main.

The FRA demonstrates the proposed development would be operated with minimal risk from flooding and would not increase flood risk elsewhere. The development should therefore not be precluded on the grounds of flood risk, as well as surface water and foul drainage.

1.0 Introduction

1.1 Background

1.1.1 Enzygo Ltd was commissioned by Gladman Developments Ltd to carry out a site-specific Flood Risk Assessment (FRA), including an outline surface water and foul drainage strategy, in support of an outline application for a proposed residential development. The Site is located on land west of Tattenhall Road, Tattenhall, Chester, CH3 9QY (the 'Site').

1.1.2 The proposal is for the erection of up to 110 residential dwellings (including affordable housing), introduction of structural planting and landscaping, public open space, sustainable urban drainage system and associated works (all matters reserved except for access on the 6.32-hectare (ha) Site.

1.1.3 A site-specific FRA assesses the current and future flood risk to and from a development site. It demonstrates how flood risk will be managed now and over the development's lifetime, taking climate change, drainage, and the vulnerability of its intended users into account.

1.1.4 The objectives of a site-specific FRA are to:

- Assess whether a proposed development is likely to be affected by current or future flooding from a range of sources.
- Assess whether the development will increase flood risk elsewhere.
- Decide on measures to deal with these effects and risks and assess their appropriateness.
- Provide enough evidence for the local planning authority to apply (if necessary) the Sequential Test.
- Decide whether the development will be safe and will pass the Exception Test if applicable.

1.1.5 In England, planning applications for development need an FRA[2] for most developments including:

- In Flood Zones 2 and 3 including minor development and change of use.
- Sites of 1ha or larger in Flood Zone 1.
- Sites of less than 1ha in Flood Zone 1, including change of use to a more vulnerable class (for example from commercial to residential), and where they could be affected by sources of flooding other than rivers and the sea.
- Land in Flood Zone 1 in a Critical Drainage Area (CDA) as notified by the Environment Agency (EA).
- Land in Flood Zone 1 identified in a Strategic Flood Risk Assessment (SFRA) as being at increased flood risk in future.

1.1.6 An FRA is required for this development, as initial screening using EA online indicative flood mapping shows that the Site is partially located in Flood Zone 3a (high risk); is more than 1ha; and is at risk of groundwater and surface water flooding.

[2] Department for Environment, Food & Rural Affairs and Environment Agency (published March 2014 and update August 2024). Flood Risk Assessments if You're Applying for Planning Permission [https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications].

1.1.7 The purpose of this FRA is to assess the risk of flooding to the proposed development and where possible recommend measures to demonstrate that future users of the development would remain safe throughout its lifetime, that the development would not increase flood risk on Site and elsewhere and, where practicable, would reduce flood risk overall.

1.2 Scope

1.2.1 Government policy on development and flood risk is set out in the National Planning Policy Framework (NPPF) [3] and is supported by National Planning Practice Guidance: Flood Risk and Coastal Change [NPPG ID7] [4].

1.2.2 NPPF paragraphs 161-186 set out the need for an appropriate assessment of flood risk at all levels of the planning process and require the application of a sequential risk-based approach to assess the suitability of land for development in flood risk areas[5].

1.2.3 The FRA should also make allowances for climate change[6] to minimise vulnerability and provide resilience to flooding and coastal change in the future. The allowances are predictions of anticipated change in:

- Peak river flow by river basin district.
- Peak rainfall intensity.
- Sea level rise.
- Offshore wind speed and extreme wave height.

1.2.4 The allowances are based on climate change projections and different scenarios of carbon dioxide emissions to the atmosphere. There are different allowances for different periods of time over the next century.

1.2.5 Site-specific FRAs are categorised according to level[7]. Simple Level 1 Screening studies give a general indication of the potential flood risk to a site and identify whether more detailed Level 2 assessment is required or not. A Level 2 assessment is a qualitative appraisal to develop understanding of flood risk to a site and the effects of the site on flooding elsewhere including recommended measures (see Section 5 - Avoid, Control, Mitigate, Manage). Level 3 assessments are more detailed quantitative studies, for example modelling to establish flood levels at a site in the absence of EA or other data or providing detailed outline drainage designs.

1.2.6 This report is a Level 2 qualitative FRA, which includes a Level 3 assessment of the surface water and foul drainage requirements for the proposed development.

1.3 Aims

1.3.1 This FRA aims to provide enough flood risk information to satisfy the requirements of the NPPF, PPG ID7 and regional/local government plans and policies. It describes the potential for

[3] Ministry of Housing, Communities & Local Government (published March 2012 and updated February 2025). National Planning Policy Framework [https://www.gov.uk/government/publications/national-planning-policy-framework--2].
[4] Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (published March 2014 and updated August 2022). Planning Practice Guidance ID7-020-20220825; Flood Risk & Coastal Change [https://www.gov.uk/guidance/flood-risk-and-coastal-change].
[5] https://www.gov.uk/guidance/national-planning-policy-framework/14-meeting-the-challenge-of-climate-change-flooding-and-coastal-change#footnote59
[6] Environment Agency (published February 2016 and updated May 2022). Flood Risk Assessments: Climate Change Allowances [https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances].
[7] CIRIA (October 2004) CIRIA C624 - Part C, Chapter 6, Section 6.1 to 6.3.

the Site to be impacted by flooding, the impacts of the proposed development on flooding elsewhere near the Site, and the recommended measures that could be incorporated into the development to manage the identified risks.

1.4 Planning Context

National Policy

1.4.1 The FRA was prepared in accordance with the NPPF and NPPG ID7.

Regional/Local Policy

1.4.2 The FRA considers the following policies within the Cheshire West and Chester Council Local Plan (2015 to 2030) Part One (2015)[8] and Part Two (2019)[9]:

- Policy ENV1: Flood Risk and Water Management.
- Policy DM40: Development and Flood Risk.
- Policy DM41: Sustainable Drainage Systems (SuDS).
- Policy DM43: Water Quality, Supply and Treatment.

Strategic Flood Risk Assessment (SFRA)

1.4.3 The FRA has reviewed the guidance within the Cheshire West and Chester Council Strategic Flood Risk Assessment and associated mapping:

- Level 1 SFRA: Cheshire West and Chester Level 1 Strategic Flood Risk Assessment (2016)[10].
- A Level 2 SFRA has not yet been produced for this area.

1.4.4 Below is a summary of our review which justifies the requirement of site-specific assessment of all sources of flooding as part of this FRA (refer to Section 4):

- The SFRA is a Level 1 Screening study. Two of the aims of the SFRA (Section 1.2) are '*To provide a reference document to which all parties involved in development planning and flood risk can reliably turn to for initial advice and guidance*' and *'To develop a report that forms the basis of an informed development management process that also provides guidance on the potential risk of flooding associated with future planning applications and the basis for site-specific Flood Risk Assessments (FRAs) where necessary*'.
- The mapping of key flooding sources (fluvial/tidal, groundwater, surface water) is based on the following data sources, with caveats on limitations detailed below:
  - Fluvial/Tidal - Flood Map for Planning (Rivers and Sea)[11]

[8] https://consult.cheshirewestandchester.gov.uk/kse/event/24907
[9] https://consult.cheshirewestandchester.gov.uk/kse/event/34617
[10] https://www.cheshirewestandchester.gov.uk/documents/parking-roads-and-travel/highways/flood-risk-assessment-final-report.pdf
[11] https://www.data.gov.uk/dataset/bed63fc1-dd26-4685-b143-2941088923b3/flood-map-for-planning-rivers-and-sea-flood-zone-3
https://www.data.gov.uk/dataset/cf494c44-05cd-4060-a029-35937970c9c6/flood-map-for-planning-rivers-and-sea-flood-zone-2

The Environment Agency's Flood Map for Planning is the main dataset used by planners for predicting the location and extent of fluvial and tidal flooding. This is supported by the CFMPs and a number of detailed hydraulic river modelling reports which provide further detail on flooding mechanisms.

The Flood Map for Planning provides flood extents for the 1 in 100-year fluvial (Flood Zone 3), 1 in 200-year tidal (also Flood Zone 3) and the 1 in 1000-year fluvial and tidal flood events (Flood Zone 2). Flood zones were originally prepared by the Environment Agency using a methodology based on the national digital terrain model (NextMap), derived river flows from the Flood Estimation Handbook (FEH) and two-dimensional flood routing. Since their initial release, the Environment Agency has regularly updated their flood zones with detailed hydraulic model outputs as part of their flood risk mapping programme.

The EA Flood Map for Planning is precautionary in that it does not take account of flood defences (which can be breached, overtopped or may not be in existence for the lifetime of the development) and, therefore, represents a worst-case scenario of flooding. The flood zones do not consider sources of flooding other than fluvial and tidal, and do not take account of climate change. For this SFRA, Flood Zone 3 is referred to as Flood Zone 3a. Areas of functional floodplain are referred to as Flood Zone 3b (see Section 5.2.3).

The Environment Agency also provides a 'Risk of Flooding from Rivers and the Sea Map'. This map shows the Environment Agency's assessment of the likelihood of flooding from rivers and the sea, at any location, and is based on the presence and effect of all flood defences, predicted flood levels and ground levels. This dataset is further discussed in Section 5.2.5.

This SFRA uses the Environment Agency's Flood Map for Planning version issued in May 2015 to assess fluvial and tidal risk to potential development sites, as per the NPPF and the accompanying Flood Risk and Coastal Change Planning Practice Guidance. See Section 6.5.1 for this assessment.

- Groundwater - BGS Groundwater Flooding[12]

  The Environment Agency's national dataset, Areas Susceptible to Groundwater Flooding (AStGWF), provides the main dataset used to assess the future risk of groundwater flooding. The AStGWF map uses four susceptibility categories to show the proportion of each 1 km grid square where geological and hydrogeological conditions show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. The AStGWF is shown on the SFRA Maps.

- Surface Water - Risk of Flooding from Surface Water Extent[13]

  The updated Flood Map for Surface Water (uFMfSW) is the third-generation national surface water flood map, produced by The Environment Agency, aimed at helping to identify areas where localised, flash flooding can cause problems even if the Main Rivers are not overflowing. The uFMfSW, used in this SFRA to assess risk from surface water, has proved extremely useful in supplementing the EA Flood Map for Planning by identifying areas in Flood Zone 1, which may have critical drainage problems.

  As part of the PFRA, CWaC considered locally agreed surface water information that best represents local conditions to be the Areas Susceptible to Surface Water Flooding map produced by the Environment Agency. This was the first of three generations of surface water maps produced by the EA. CWaC should now consider the third generation updated Flood Map for Surface Water as their locally agreed surface water flood information.

[12] https://www.bgs.ac.uk/datasets/groundwater-flooding/

[13] https://www.data.gov.uk/dataset/95ea1c96-f3dd-4f92-b41f-ef21603a2802/risk-of-flooding-from-surface-water-extent-3-3-percent-annual-chance

The Environment Agency updated the second generation FMfSW in 2013 to produce a third-generation national surface water flood map, the updated Flood Map for Surface Water (uFMfSW). The uFMfSW is much more refined than the second-generation map in that:

- *More detailed hydrological modelling has been carried out using several design rainfall events rather than one for the second generation,*
- *A higher resolution Digital Terrain Model (DTM) has been used - 2 m, compared to 5 m for the second generation,*
- *Manual edits of DTM to improve flow routes at over 91,000 locations compared to 40,000 for the second generation,*
- *DTM edited to better represent road network as a possible flow pathway, this was not done for the second generation,*
- *Manning's n roughness (used to represent the resistance of a surface to flood flows in channels and floodplains) values varied using MasterMap Topography layer compared to blanket values for urban and rural land use applied in the second generation surface water flood map.*

The National Modelling and Mapping Method Statement, May 2013 details the methodology applied. The uFMfSW is displayed on the SFRA Maps.

1.4.5 In summary, the SFRA uses macro-scale data, which is broad-brush indicator of potential flood risk sources. It identifies the Flood Risk Management Hierarchy, whereby a site-specific FRA is undertaken to understand the micro-scale data for a review of more detailed / refined data sources (see Section 2.1-2.2 and Section 4).

Guidance Documents / Best Practice

1.4.6 This FRA also considers the following flood risk and drainage guidance documents:

- Dee River Basin District Flood Risk Management Plan (English Catchments) 2021 to 2027 (2022)[14].
- SuDS Guidance - Volume 1: Cheshire West and Chester Borough Council Design and Technical Guide (2020)[15].
- SuDS Guidance - Council Specific Information - Volume 2: Cheshire West and Chester Borough Council Design and Technical Guide (2020)[16].
- Cheshire West and Chester SuDS Submission Application and Approval Checklist[17].
- Cheshire West and Chester Local Flood Risk Management Strategy (2016)[18].
- Cheshire West and Chester Preliminary Flood Risk Assessment (2011)[19].

[14] https://assets.publishing.service.gov.uk/media/6374f4c0d3bf7f720e73515e/Dee-FRMP-2021-2027.pdf
[15] https://www.cheshirewestandchester.gov.uk/asset-library/planning-policy/surface-water-management-and-sustainable-drainage/suds-volume-1-design-and-technical-guidance.pdf
[16] https://www.cheshirewestandchester.gov.uk/asset-library/planning-policy/surface-water-management-and-sustainable-drainage/suds-volume-2-council-specific-guidance.pdf
[17] https://www.cheshirewestandchester.gov.uk/asset-library/planning-policy/surface-water-management-and-sustainable-drainage/suds-volume-1-appendix-a-submission-application-and-approval-checklist.xlsx
[18] https://www.cheshirewestandchester.gov.uk/documents/parking-roads-and-travel/highways/local-flood-risk-management-strategy.pdf
[19] https://consult.cheshirewestandchester.gov.uk/file/4411609/

1.5 Report Structure

1.5.1 This report is structured as follows:

- Section 2 identifies the sources of information that were consulted.
- Section 3 describes the existing Site.
- Section 4 outlines the baseline flood risk from all sources.
- Section 5 details the recommended measures against identified flood risk sources.
- Section 6 assesses the surface water drainage requirements of the proposed development.
- Section 7 assesses the foul drainage requirements of the proposed development.
- Section 8 presents a summary and conclusions.

2.0 Sources of Information

2.1 Sources of Information

2.1.1 The following information was consulted:

- Ordnance Survey mapping (Drawings 0001 and 0002).
- Detailed topographic survey (Appendix 1).
- EA online mapping (Flood Map for Planning[20], Long Term Flood Risk Assessment for Locations in England[21], Catchment Data Explorer[22] and Main River Map[23]).
- EA Reduction in Risk of Flooding from Rivers and Sea online mapping[24].
- Online mapping for Climate Change Allowances for Peak River Flow and Peak Rainfall in England online mapping[25].
- National Soils Resources Institute (NSRI): Soilscapes online mapping[26].
- British Geological Survey [BGS] Geology Viewer online mapping[27].
- British Geological Survey [BGS] Borehole Records online mapping[28].
- Landmark's Promap: Flood Data package (see Drawings).
- Geosmart 1 in 100-year groundwater flood risk map (see Drawings).
- DEFRA's Magic Map for identifying Designated Sites[29].
- River Levels UK for identifying Flood Alert and Flood Warning areas[30].

2.2 Consultation and Discussion with Regulators

2.2.1 Consultation and discussions were undertaken with the relevant water regulators.

Environment Agency

2.2.2 The Environment Agency (EA) is a statutory consultee on flood risk and planning and is directly responsible for the prevention, mitigation, and remediation of flood damage for main rivers and coastal areas; and it has a strategic overview for all forms of flooding.

2.2.3 EA Standing Advice[31] and the NPPF/PPG ID: 7 was consulted and reviewed.

2.2.4 Correspondence with the EA is included in Appendix 2.

[20] https://flood-map-for-planning.service.gov.uk/
[21] https://flood-warning-information.service.gov.uk/long-term-flood-risk/
[22] http://environment.data.gov.uk/catchment-planning/
[23] https://environment.maps.arcgis.com/apps/webappviewer/index.html?id=17cd53dfc524433980cc333726a56386
[24] ArcGIS - My Map
[25] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[26] https://www.landis.org.uk/soilscapes/
[27] https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/
[28] https://www.bgs.ac.uk/information-hub/borehole-records/
[29] https://magic.defra.gov.uk/magicmap.aspx
[30] https://riverlevels.uk/flood-map#.XclKwPn7RPZ
[31] Environment Agency and Department for Environment, Food & Rural Affairs (published April 2012 and updated August 2024). Preparing a Flood Risk Assessment: Standing Advice [https://www.gov.uk/guidance/flood-risk-assessment-standing-advice].

Lead Local Flood Authority

2.2.5 Cheshire West and Chester as the Lead Local Flood Authority (LLFA) is responsible for local flood risk management in their area and for maintaining a register of flood risk assets. They also have lead responsibility for managing the risk of flooding from surface water, groundwater, and ordinary watercourses.

2.2.6 Correspondence with the LLFA is included in Appendix 3.

Water Utility

2.2.7 Drainage and sewerage services in the UK are provided by a number of water and sewerage companies. Dwr Cymru (Welsh Water) are responsible for sewerage within the area of the Site.

2.2.8 All sewerage undertakers maintain the 'DG5 register' of properties and external areas (such as gardens, highways, open spaces) which have suffered flooding from public foul/combined sewers. It does not include flooding caused by blockages.

2.2.9 Dwr Cymru asset plans and pre-development enquiry response is included in Appendix 4.

2.2.10 United Utilities are responsible for clean water supply within the area of the Site. United Utilities asset plans are included in Appendix 5.

2.3 Site Walkover

2.3.1 Enzygo staff carried out a walkover of the Site during November 2024. Observations made were used to inform the Site description.

3.0 Site Location and Description

3.1 Location

3.1.1 The Site is located on land west of Tattenhall Road, Tattenhall, Chester, CH3 9QY.

3.1.2 The Site is centred on National Grid Reference (NGR) 348888, 359316.

3.1.3 The 6.32ha Site location is shown in Drawing 0001 and in more detail in Drawing 0002.

3.2 Land Use

3.2.1 The land use is comprised of a single parcel of agricultural (grassed) land (Figures 3.1 and 3.2).

3.2.2 The Site is bounded by a private road to the north, with agricultural land beyond; Tattenhall Road to the east, with agricultural land and a residential dwelling beyond; Keys Brook and the village of Tattenhall to the south; and agricultural land to the west.

3.2.3 Vehicle access is currently from Tattenhall Road to the east of the Site via gated access.

Figure 3.1: Aerial Image of the Site



Image © 2025 Digital Globe.

Figure 3.2: Images of the Site



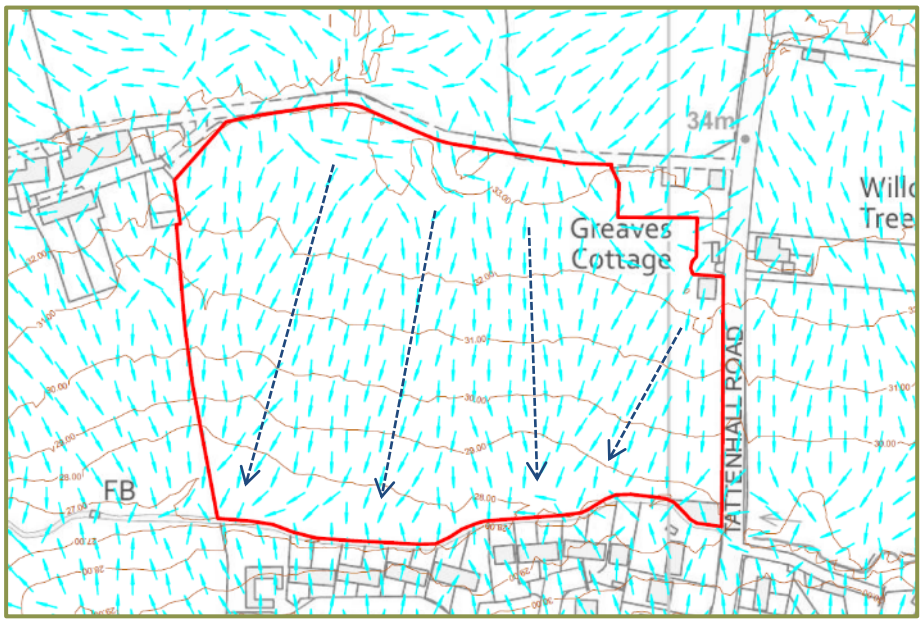
Left: *View looking south-east across the Site.* ***Right:*** *View looking south-west across the Site.*

3.3 Topographic Information

3.3.1 A detailed topographic survey was carried out during October 2024 and a copy is included in Appendix 1. A summary of the Site topography is included in Figure 3.3 and described below.

3.3.2 The Site falls to the south from 33.08 metres Above Ordnance Datum (m AOD) along the northern boundary to 26.89m AOD in the south-western corner. This fall of 6.19m over 235m gives a gradient of 1:38 across the Site.

Figure 3.3: Summary of Site Topography

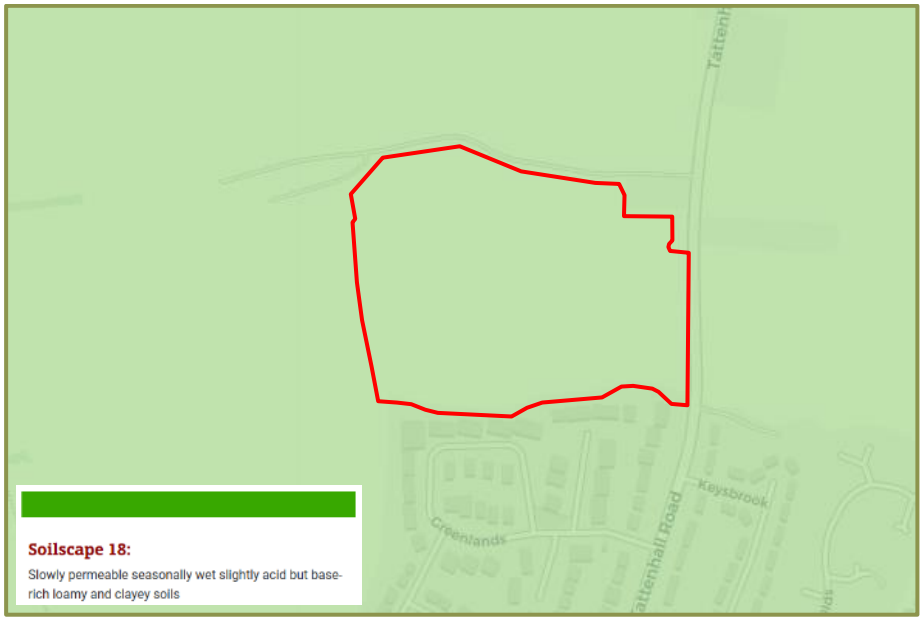


3.4 Soils and Geology

Soils Mapping

3.4.1 The online NSRI Soilscapes mapping (Figure 3.4) shows the Site is underlain by slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey soils. The soils mapping is indicative and there may be localised variation.

Figure 3.4: Soils Mapping



Soils Data © Cranfield University (NSRI) and for the Controller of HMSO [2025].

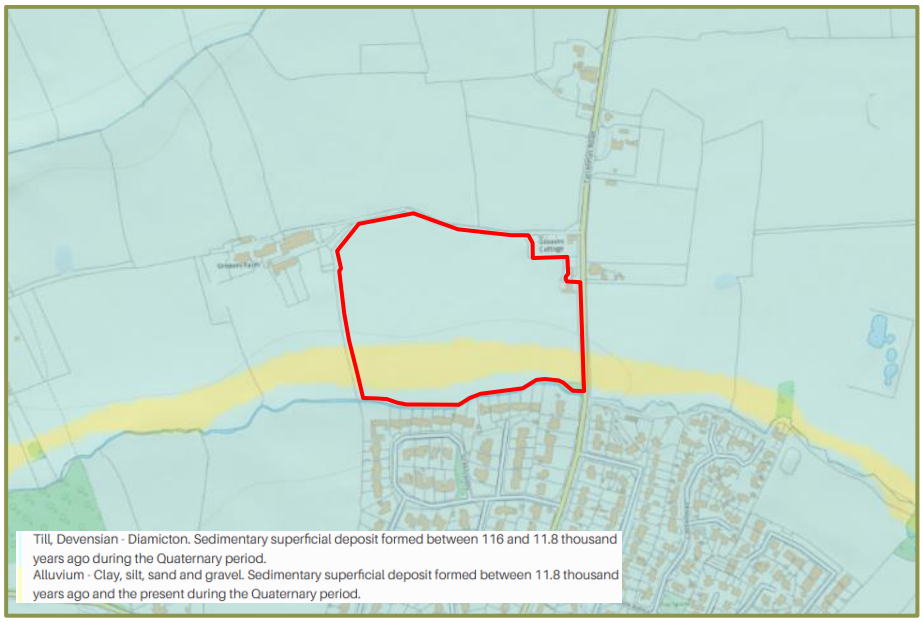
Geology Mapping

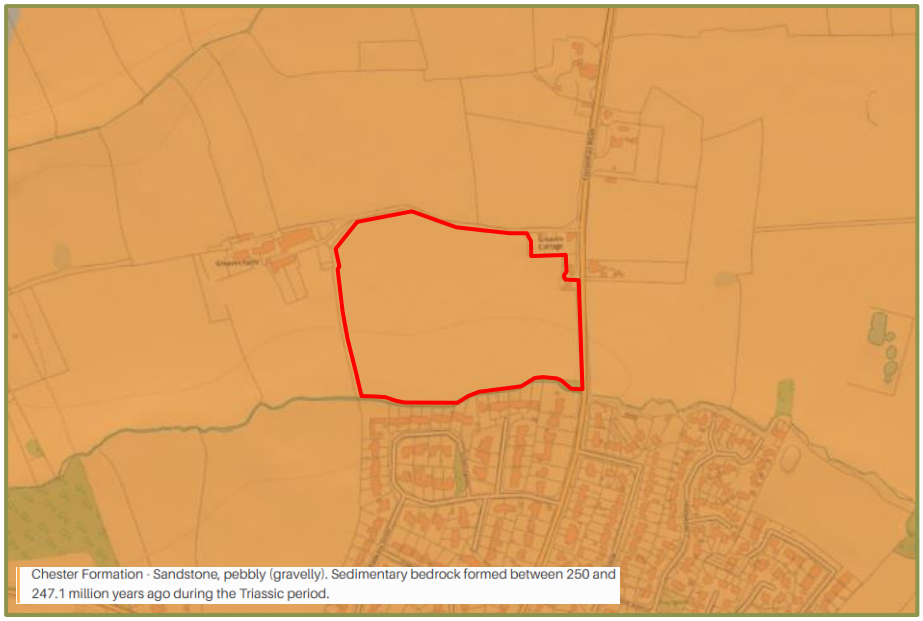
3.4.2 The online BGS Geology Viewer (Figure 3.5) shows the Site is largely underlain by Till, Devensian - Diamicton (superficial deposits) whilst a band of Alluvium - Clay, silt, and gravel is present beneath an area of the southern extent of the Site, likely associated with Keys Brook.

3.4.3 The bedrock beneath the Site is Chester Formation - Sandstone, pebbly (gravelly).

3.4.4 The geology mapping is indicative and there may be localised variation.

Figure 3.5: Geology Mapping





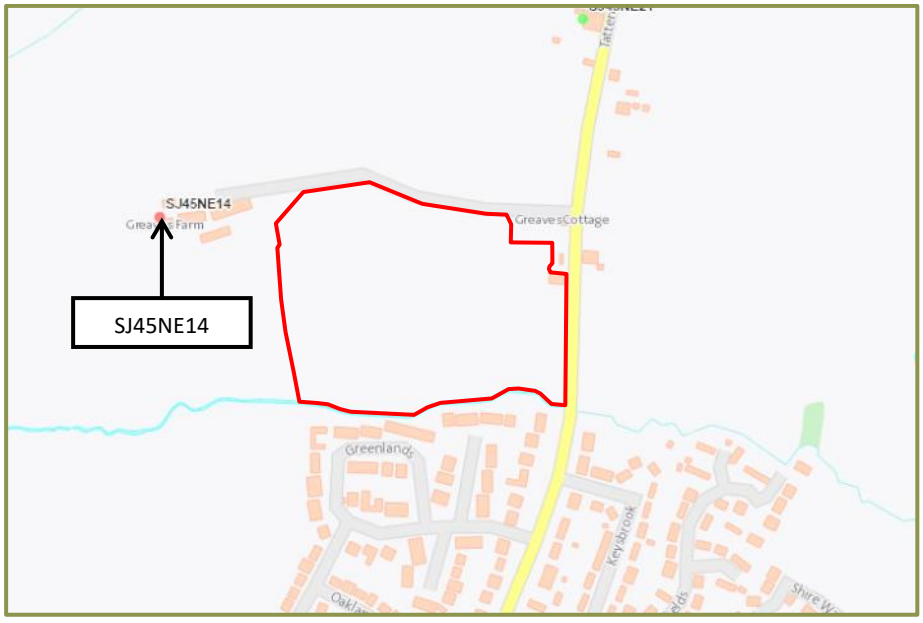
Top: *Superficial deposits.* ***Bottom:*** *Bedrock geology. Contains British Geological Survey materials © NERC [2025].*

BGS Borehole Records

3.4.5 The BGS Borehole Records online mapping (Figure 3.6) shows there are no borehole records located within the Site boundary, however, there is a borehole (SJ45NE14) located approximately 110m to the west of the Site located within the same mapped geology as the Site.

3.4.6 The borehole records (Appendix 6) confirm the geology as depicted by the Geology of Britain mapping (Table 3.1).

Figure 3.6: Borehole Mapping



Contains British Geological Survey materials © NERC [2025].

Table 3.1: BGS Borehole Data

Reference	Summary of Strata	Depth (m bgl)	Groundwater Depth (m bgl)
SJ45NE14	0.00 - 18.29m = Clay 18.29 - 27.13m = Clay and marl, soft patches 27.13 - 35.05m = Sandstone 35.05 - 38.40m = Rock	38.40	N/A

Contains British Geological Survey materials © NERC [2025].

3.5 Hydrogeology

Infiltration Potential

3.5.1 The SuDS Infiltration Potential Mapping (Drawing 0005) shows the Site is in the mapped extent indicative of moderate potential, associated with the underlying bedrock geology.

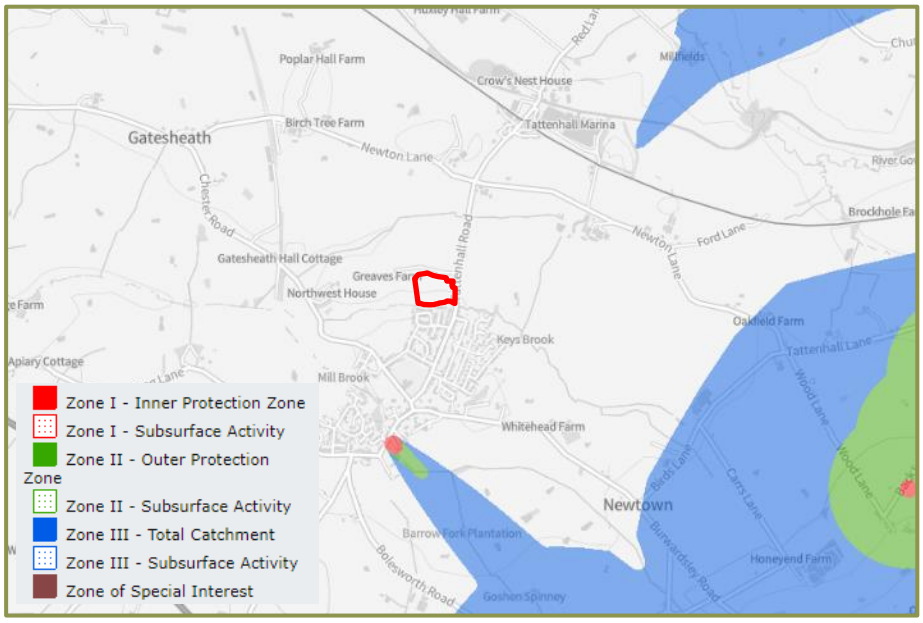
3.5.2 The loamy and clayey soils and clayey superficial deposits are indicative of mixed infiltration potential, whilst the sandstone bedrock is indicative of moderate to good infiltration potential, subject to the depth of the weathered layer and presence of shallow groundwater.

3.5.3 Groundwater ingress was encountered in the nearby borehole, with the resting water level recorded as 6.10mbgl (Below Ground Level).

Defra Magic Map

3.5.4 The online Defra Magic Map mapping (Figure 3.7) shows the Site is not located in a groundwater Source Protection Zone (SPZ).

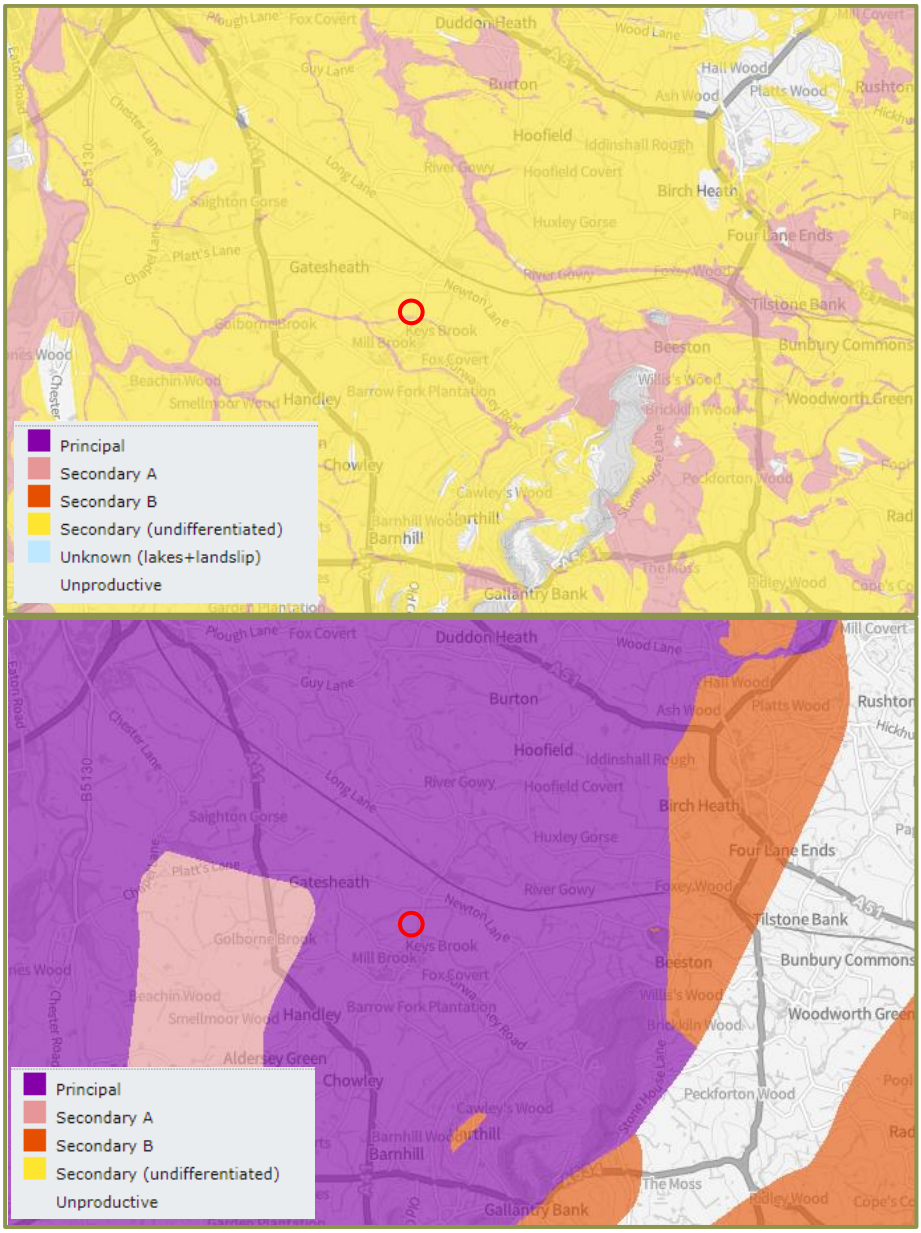
Figure 3.7: Source Protection Zone Map



From Magic Map. Contains Environment Agency information © Environment Agency and database right [2025].

3.5.5 The Site is located above a Secondary (Undifferentiated) Aquifer, whilst a band in the southern extent of the Site located above a Secondary A Aquifer (Superficial Deposits). The Site is additionally located above a Principal Aquifer (Bedrock Designation).

Figure 3.8: Aquifer Designation Map



***Top:** Aquifer Designation (superficial deposits). **Bottom:** Aquifer Designation (bedrock). From Magic Map. Contains Environment Agency information © Environment Agency and database right [2025].*

3.5.6 Indirect inputs of clean surface water to groundwater are permissible, for example where the base of the soakaway is above the water table and there is an unsaturated zone in the aquifer unit.

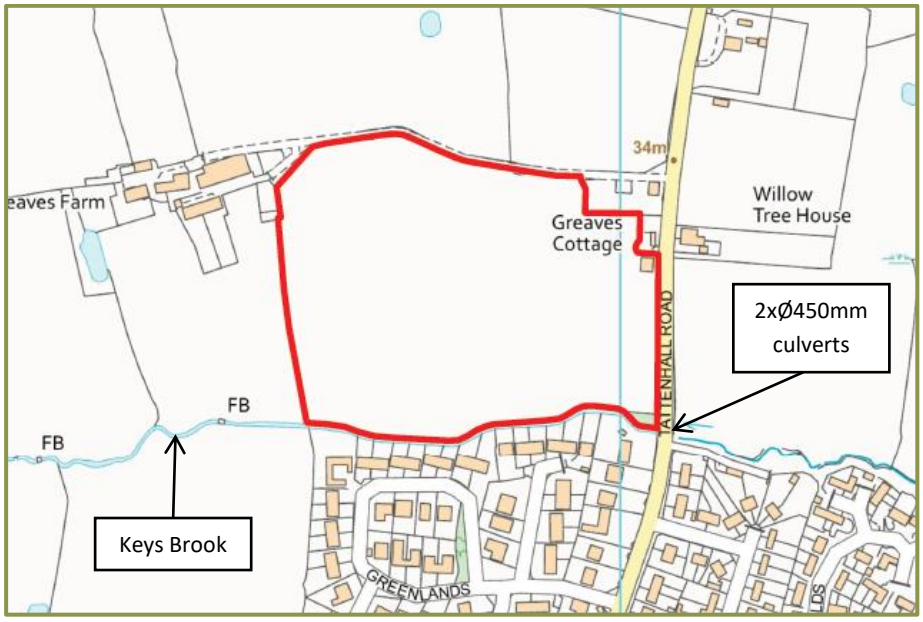
3.5.7 The Site is located within a Nitrate Vulnerable Zone (NVZ).

3.6 Catchment Hydrology

OS Mapping and Site Walkover Observations

3.6.1 OS mapping (Figure 3.9) shows Keys Brook conveying flows west along the southern boundary of the Site.

Figure 3.9: Map of Watercourses



Keys Brook

3.6.2 The Site walkover observed Keys Brook conveying flows west along the southern boundary of the Site (Figure 3.10).

3.6.3 The channel was observed to be free flowing and clear of blockages, with some overgrown vegetation and debris present. The channel along this reach of Keys Brook varied in size with the bed width measuring between approximately 1.00m and 2.00m, depths between approximately 0.50m and 1.50m, and between 1:2 and 1:4 side slopes.

3.6.4 The channel passes through a culvert beneath Tattenhall Road immediately east of the Site, entering via twin Ø450mm pipes on the eastern side and emerging as a twin box culvert, forming a single channel on the western Side, in the south-eastern corner of the Site. The channel then continues as an open channel adjacent to the southern boundary of the Site (Figure 3.10), conveying flows east towards the River Dee, of which Keys Brook is a tributary.

Figure 3.10: Keys Brook



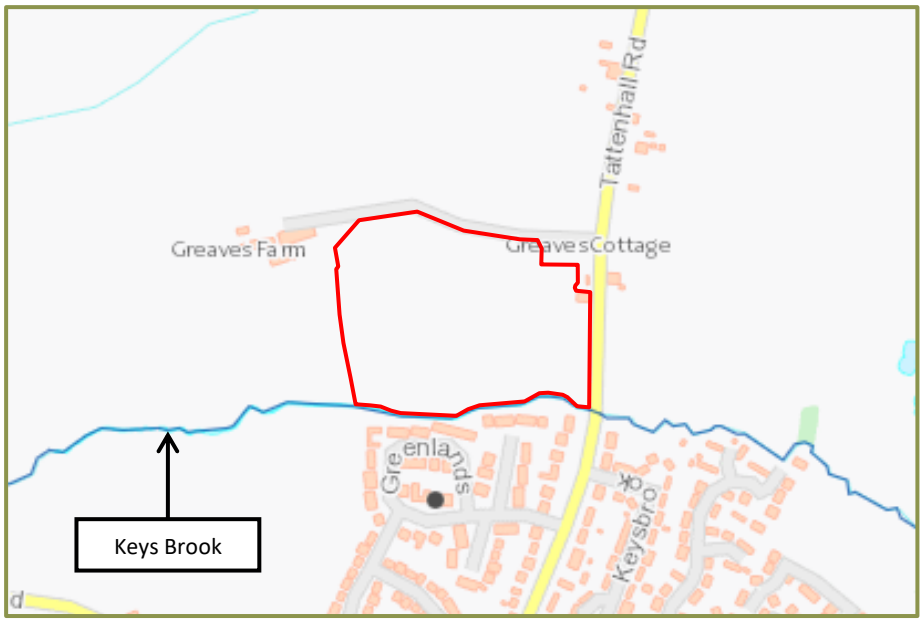
Left: *Views upstream of Keys Brook along the southern boundary of the Site.* ***Right:*** *View downstream.*

Main River Map

3.6.5 The EA online main river map (Figure 3.11) identifies Keys Brook as a 'main river', which is a watercourse where flood risk work is carried out by the Environment Agency.

3.6.6 No 'ordinary watercourses' were identified within the vicinity of the Site, these are watercourses where flood risk work is carried out by the local drainage authority/riparian landowner.

Figure 3.11: Main River Map

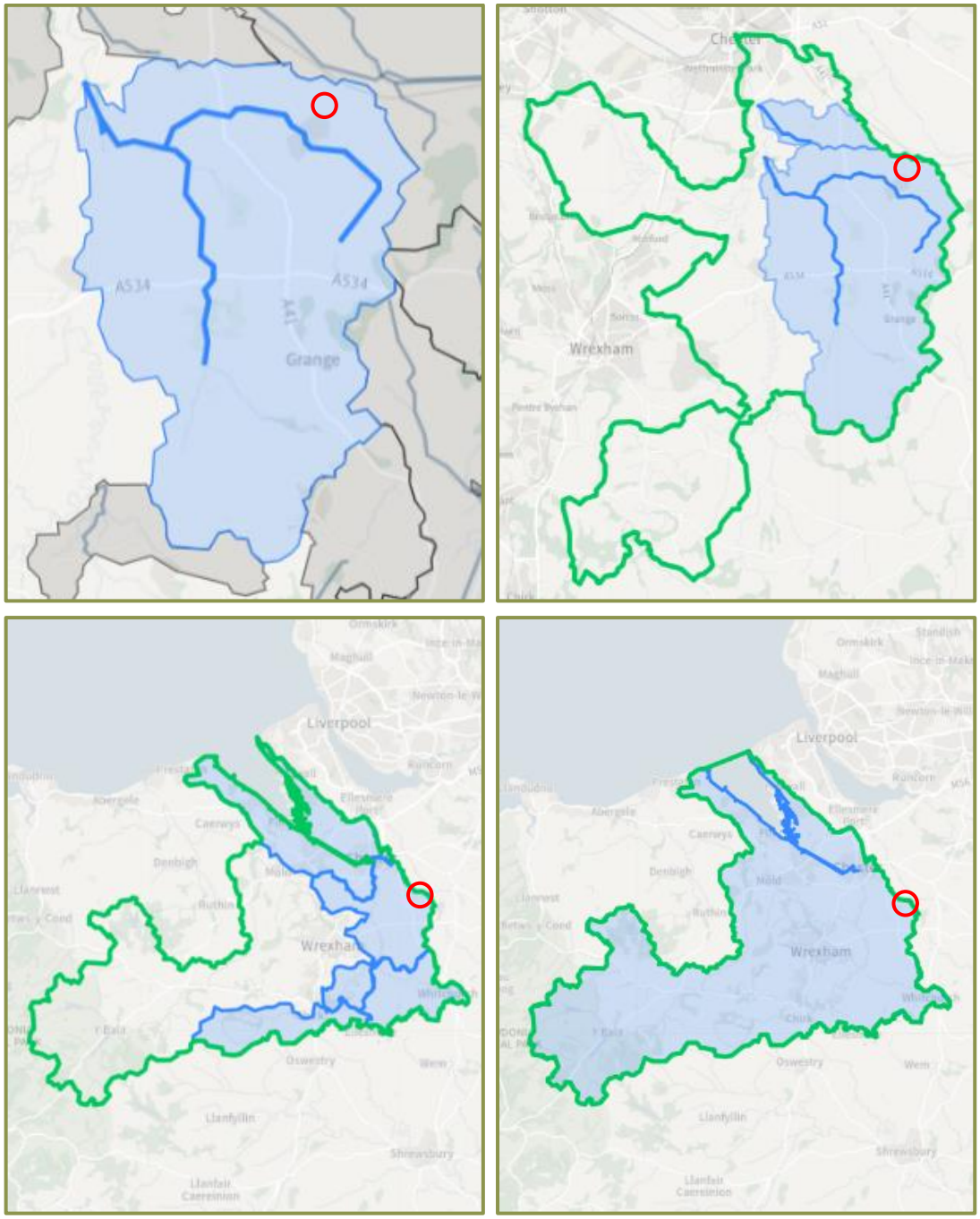


Contains Environment Agency information © Environment Agency and database right [2025].

Environment Agency Catchment Data Explorer Mapping

3.6.7 The Site resides within the Aldford Brook Water Body Catchment (Figure 3.12), which is in the Dee Lower Chester Weir to Ceiriog Operational Catchment, Dee Management Catchment, and Dee River Basin District.

Figure 3.12: Catchment Data Explorer



Top Left: *Aldford Brook Water Body Catchment.* ***Top Right:*** *Dee Lower Chester Weir to Ceiriog Operational Catchment.* ***Bottom Left:*** *Dee Management Catchment.* ***Bottom Right:*** *Dee River Basin District. Contains Environment Agency information © Environment Agency and database right [2025].*

3.7 Sewerage Assets

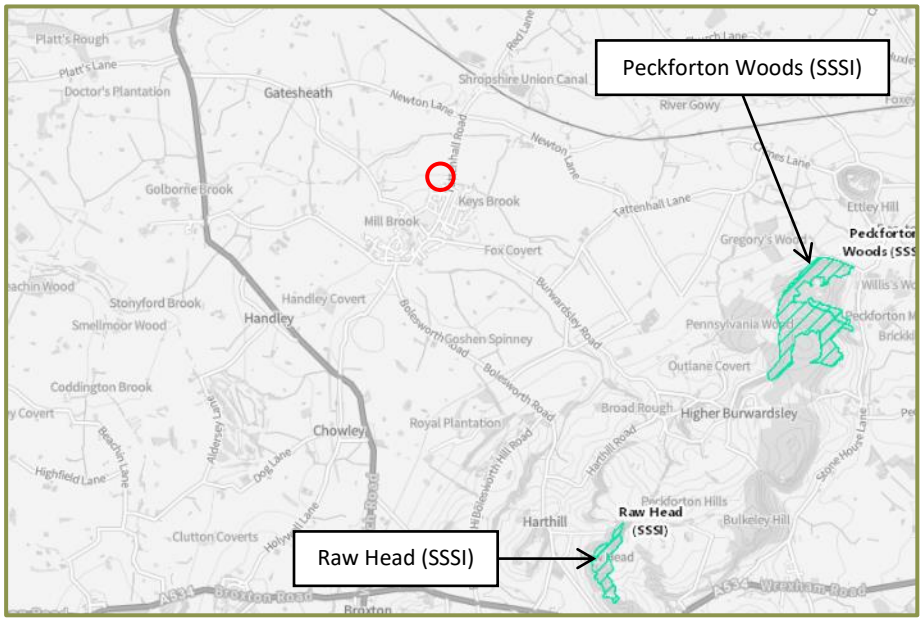
3.7.1 Dwr Cymru asset plans (Appendix 4) show there is a Ø160mm pumped foul sewer (subject to S104 agreement) orientated north/south beneath Tattenhall Road to the east of the Site. There is also a Ø225mm public combined sewer, orientated east to west, within the housing development to the south of the Site. The surface water sewer network which serves the residential development to the south of the Site outfalls into Keys Brook.

3.7.2 United Utilities asset plans (Appendix 5) show there is a Ø125mm water distribution main orientated north to south beneath Tattenhall Road, located approximately 2m to the east of the Site.

3.8 Designated Sites

3.8.1 The online Defra Magic Map mapping (Figure 3.13) shows the nearest designated site is Peckforton Woods, a Site of Special Scientific Interest [SSSI], located approximately 4km to the south-east of the Site. Raw Head SSSI is located approximately 4.5km to the south of the Site. These designated sites are not considered hydrologically connected to the Site from a flood risk or drainage perspective.

Figure 3.13: Designated Sites



From Magic Map. Contains Environment Agency information © Environment Agency and database right [2025].

4.0 Assessment of Flood Risk Sources

4.1 Potential Sources of Flooding

4.1.1 A summary of the potential sources of flooding and source is summarised in Table 4.1. Each source of flooding and level of risk is then assessed in further detail below.

Table 4.1: Potential Risk Posed by Flooding Sources

Flooding Source	Potential Flood Risk at Application Site (Yes/No)	Potential Source	Data Sources
Fluvial	Yes	Keys Brook	EA consultation response (Appendix 2) and EA Flood Zone mapping (Drawing 0003).
Tidal	No	None identified	EA consultation response (Appendix 2) and EA Flood Zone mapping (Drawing 0003).
Groundwater	Yes	Principal Aquifer (bedrock); Secondary (Undifferentiated) and Secondary A Aquifers (Superficial Designation)	Geosmart Groundwater (Drawing 0004), BGS Borehole Records (Appendix 6)
Surface Water	Yes	Poor permeability and Site topography	EA Complex Surface Water Flood Mapping (Drawings 0006.1 to 0006.4) and EA online mapping: Long Term Flood Risk Assessment for Locations in England.
Sewers and Mains	No	None identified	Dwr Cymru (Appendix 4) and United Utilities (Appendix 5) asset plans, and topographic survey (Appendix 1).
Infrastructure Failure	No	None identified	OS mapping (Drawings 0001 to 0002) and EA online mapping: Long Term Flood Risk Assessment for Locations in England.

4.2 Fluvial Flooding

EA Flood Zone Mapping

4.2.1 The EA Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, since these can be breached, overtopped and may not be in existence for the lifetime of a development.

4.2.2 The EA Flood Zone mapping (Drawing 0003) shows most of the Site is in Flood Zone 1, which is land outside the 1 in 1000-year (<0.1% Annual Exceedance Probability [AEP]) extent of fluvial (river) flooding, at 'low' risk. However, an area in the southern extent of the Site, adjacent to Keys Brook, is located within Flood Zone 2 and 3. This is land between the 1 in 100-year (1% AEP) and 1 in 1000-year (0.1% AEP) probability of fluvial flooding, at 'medium' risk (Flood Zone 2); and land within the 1 in 100-year (<1% AEP) risk of fluvial flooding, at 'high' risk (Flood Zone 3), respectively.

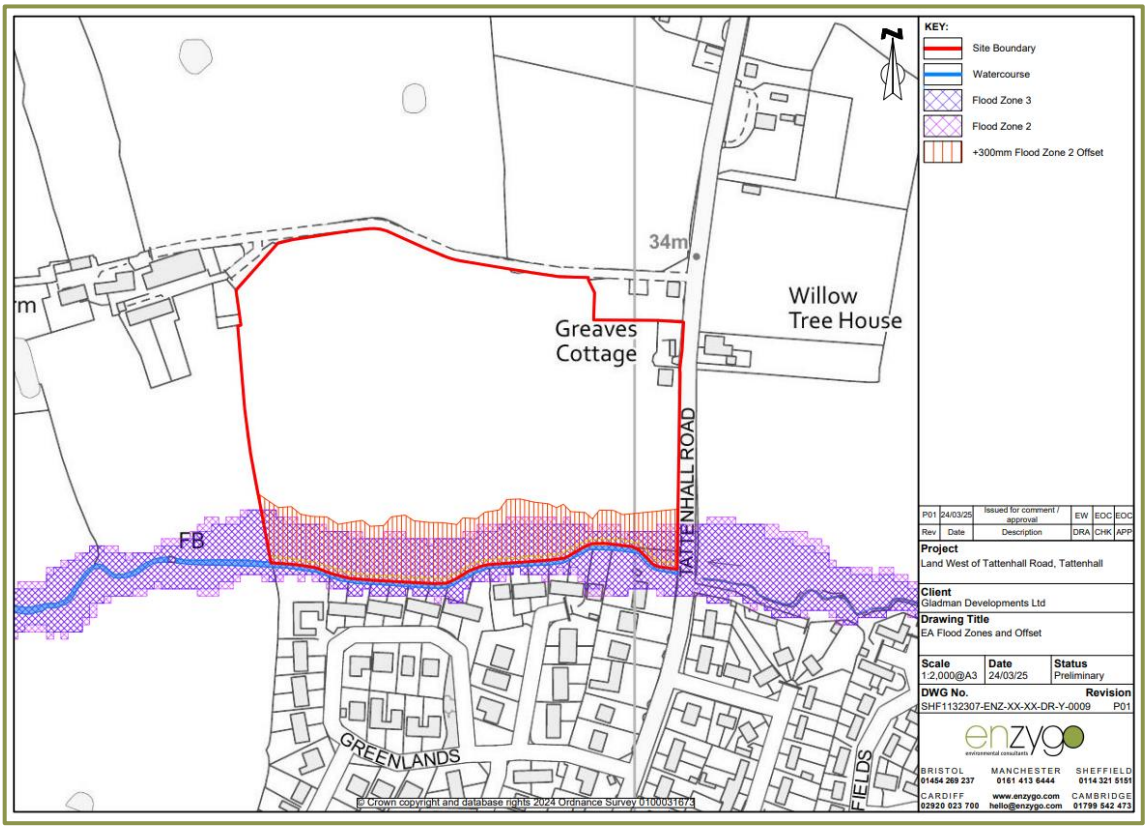
4.2.3 The EA Flood map for planning does not differentiate between flood Zone 3a (<100-year) and flood zone 3b (<30-year). SFRA mapping shows the area associated with Flood Zone 3 to be Flood Zone 3a however the mapping was produced when the Flood Zone 3b was associated with the 20-year return period not 30-year.

Modelled Flood Levels

4.2.4 The EA correspondence stated there was currently no detailed modelling data for the Site. The modelling provided was JFLOW modelling which is broadscale national generalised modelling.

4.2.5 In lieu of modelling data, a conservative approach has been taken forward where the developable footprint is set +300mm above the extent of Flood Zone 2 (Figure 4.1).

Figure 4.1: Flood Zone 2 and +300mm Offset



SFRA Mapping

4.2.6 The SFRA mapping confirms that most of the Site is in Flood Zone 1, and the area in the southern extent of the Site is in Flood Zone 2 and 3a. It also confirms that Keys Brook is a main river.

Flood History

4.2.7 Correspondence with the EA did not report any flooding incidents within the Site boundary or immediate vicinity (Appendix 2).

4.2.8 Correspondence with the LLFA (Appendix 3) did not report any records of historical fluvial flooding incidents within the Site boundary or immediate vicinity. However, they commented that Tattenhall had "*experienced flooding within the vicinity of Keys Brook and in other areas*

from Mill Brook during Storm Babet and Storm Christoph". The dates of these two storms were 19-21 January 2021 and 18-21 October 2023 respectively.

Flood Defences

4.2.9 The EA Reduction in Risk of Flooding from Rivers and Sea online mapping shows the Site does benefit from flood defences, consisting of 'Engineered High Ground' along the right-hand bank of Keys Brook, considered effective up to the 1 in 5-year flooding event. However, this defence is not included in the flood map and correspondence. The EA (Appendix 2) did not comment on any flood defences within the vicinity of the Site.

Flood Warning Service

4.2.10 The River Levels UK website (Figure 4.2) shows the south extent of the Site is in an area which receives flood warnings for 'River Dee catchment in England from Whitchurch to Chester'.

Figure 4.2: Flood Warning Areas



River Levels UK [2025].

Flood Risk Summary

4.2.11 The risk of fluvial flooding is assessed as negligible for most of the Site, and as low to high associated with Keys Brook in the southern extent.

4.2.12 Measures required for fluvial flooding are discussed in Section 5.

4.3 Tidal Flooding

EA Flood Zone Mapping

4.3.1 OS mapping (Drawings 0001 to 0002) shows the Site is not located close to tidally affected flooding sources.

Flood Risk Summary

4.3.2 The risk of tidal flooding is assessed as negligible.

4.4 Groundwater Flooding

Introduction

4.4.1 Groundwater flooding occurs when subsurface water emerges either at surface or in made ground or in subsurface structures such as basements and services ducts. It occurs as diffuse seepage, emergence from new point source springs or an increase in flow from existing springs. It results from aquifer recharge from infiltrating rainfall, from sinking streams entering aquifers from adjacent non-aquifers, or from high river levels or tides driving water through near surface deposits. It tends to occur with a delay following rainfall and can last for several weeks or months. Groundwater flooding or shallow water tables also prevent or reduce infiltration and so can worsen surface water flooding.

Flood History

4.4.2 Consultation with the LLFA reported no historical groundwater flooding incidents within the Site boundary or immediate vicinity.

Geosmart Groundwater Flood Risk Map

4.4.3 The Geosmart 1 in 100-year groundwater flood risk map (Drawing 0004) shows most of the Site is at negligible risk of groundwater flooding and falls within Risk Class 4, however, a band in the southern extent of the Site is at 'moderate' risk and falls within Risk Class 2 (Table 4.2).

4.4.4 This risk of groundwater flooding is likely to be associated with the presence of Alluvium - Clay, silt, and gravel superficial deposits within this area of the Site.

4.4.5 Mapped classes combine understanding of likelihood, model and data uncertainty, and possible severity. Likelihood is ranked according to whether we expect groundwater flooding at a site due to extreme elevated groundwater levels with an annual probability of occurrence greater than 1%, considering model and data uncertainty. Severity relates to expectations of the amount of property damage or other harm that groundwater flooding at that location might cause (Table 4.2).

Table 4.2: Groundwater Flood Risk Classification

Risk Class	Probability of Groundwater Flooding	Effect
4: Negligible	Annual probability less than 1%.	Negligible unless unusually sensitive use.
3: Low	Annual probability greater than 1%.	Remote possibility of damage to property or harm to sensitive receptors Flooding likely to be limited to seepages and waterlogged ground, damage to basements and subsurface infrastructure, and should pose no significant risk to life. Surface water flooding may be worsened.
2: Moderate	Annual probability greater than 1%.	Significant possibility of damage to property or harm to other sensitive receptors at or near this location. flooding is likely to be in the form of shallow pools or streams. Surface water flooding and failure of drainage systems may be worsened when groundwater levels are high.
1: High	Annual probability greater than 1%.	Groundwater flooding will occur which could lead to damage to property or harm to other sensitive receptors at or near this location. Flooding may result in damage to property, road, or rail closures and, in exceptional cases, may pose a risk to life. Surface water flooding and failure of drainage systems may be worsened when groundwater levels are high.

Borehole Records and Soakaway Testing Results

4.4.1 BGS online borehole records reported groundwater ingress in a nearby borehole with a resting water level of 6.10m bgl. Groundwater beneath the Site is likely to be in hydrological continuity with the flood levels of Keys Brook and given the proximity of the Site to the watercourse, fluvial flooding is deemed to be the dominant source of flooding in this area.

Flood Risk Summary

4.4.2 The risk of groundwater flooding is assessed as negligible for most of the Site and as moderate in areas of the southern extent.

4.4.3 Measures required for groundwater flooding are discussed in Section 5.

4.5 Surface Water Flooding

Introduction

4.5.1 Surface water flooding occurs following rainfall on ground where infiltration rates are less than the rainfall precipitation rate. This can occur when either:

- Soils or ground materials are naturally of low permeability or have been compacted (infiltration excess runoff).

- Soils or ground materials are saturated from previous rainfall either directly or from upslope (saturation excess runoff and return flow) or from high groundwater levels.

Flood History

4.5.2 Consultation with the LLFA (Appendix 3) reported no historical surface water flooding incidents within the Site boundary or immediate vicinity.

EA Long Term Flood Risk Mapping

4.5.3 In January 2025, the EA released an update to their online Long Term Flood Risk mapping, including that of surface water. The new mapping still presents the likelihood of flood extents as 'Low', 'Medium' and 'High' risk as well as now providing the likelihood of estimated flood depths (up to 0.20, 0.30, 0.60 and 0.90m) as 'Very low', 'Low', 'Medium', and 'High' risk.

4.5.4 Additionally, the new mapping includes the same risk classes for extent and depth with a pre-applied 'Central Allowance' climate change uplift. This is based on the latest UK Climate Projections (UKCP18) from the Met Office, using the Representative Concentration Pathway (RCP) 8.5 to derive the new near-term '2040 to 2060' epoch. The mapping also now utilises a 2m grid as an improvement to the spatial resolution of the data.

4.5.5 At the time of writing, whilst the extent and depth datasets are available, the updates have not been released for the velocity or hazard datasets.

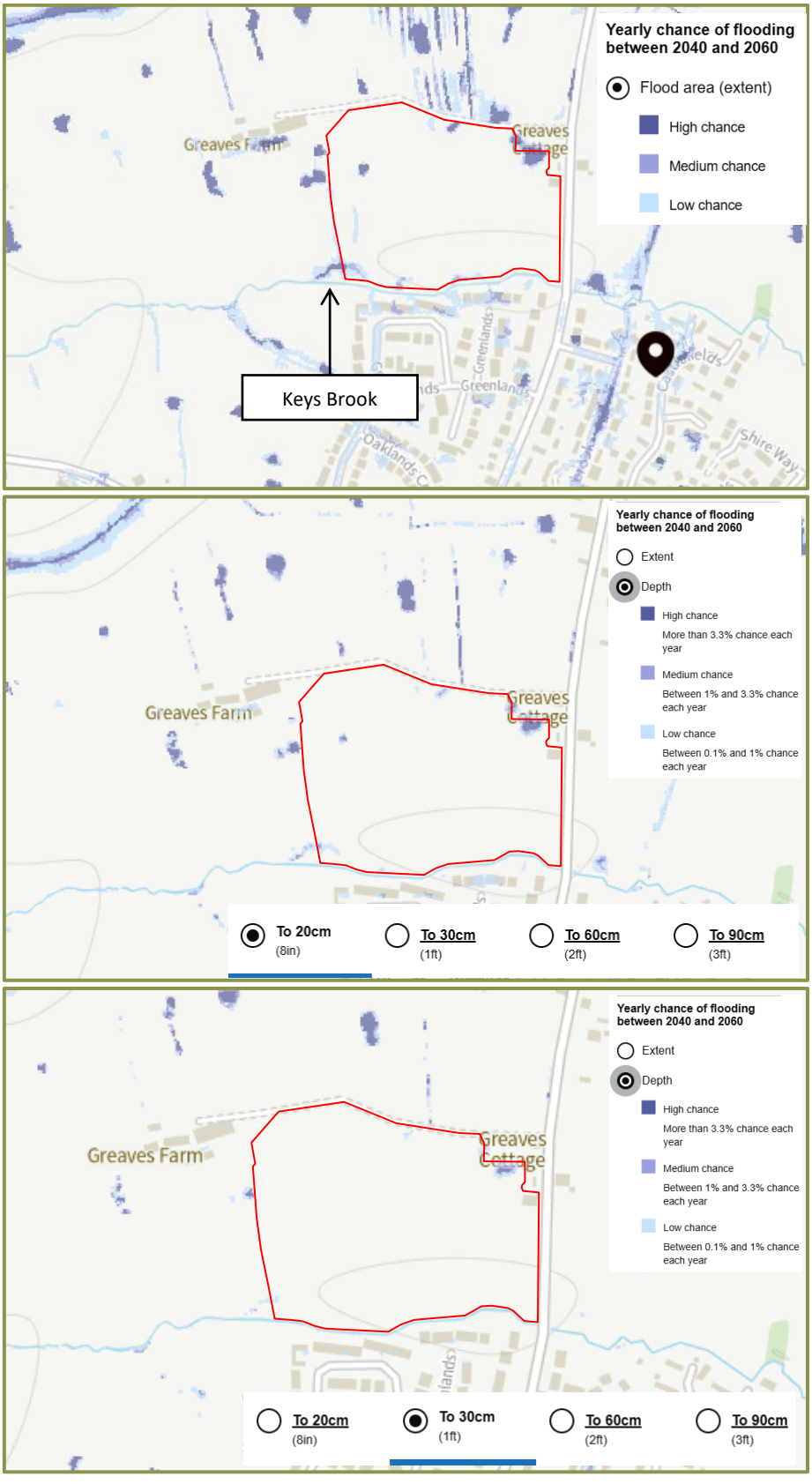
4.5.6 The EA Long Term Flood Risk Mapping (Figure 4.3), considering the 2040 to 2060 epoch as a worst-case scenario, shows most of the Site is located outside the mapped extent of surface water flooding. There are, however, areas of ponding within the Site, including adjacent to Keys Brook in the southern extent as well as several isolated areas of ponding in the western and northern extents of the Site.

4.5.7 The flood extents for these areas of ponding are at 'Low' (0.1% to 1% AEP) to 'High' (>30.3% AEP) chance of flooding between 2040 and 2060; whilst the depths and their respective chance are detailed below:

- Up to 20cm: 'Very Low' up to 'High' in the north-eastern corner; up to 'Medium' along the southern boundary; and up to 'High' along the western boundary.
- Up to 30cm: 'Very Low' up to 'High' in the north-eastern corner; up to 'Low' along the southern boundary; and up to 'Medium' along the western boundary.
- Up to 60cm: 'Very Low' chance for all areas of ponding.
- Up to 90cm: 'Very Low' chance for all areas of ponding.

4.5.8 Mapping is included in Figures 4.3 below. Depths for 60cm and 90cm scenario are not included as there was no inundation on the Site.

Figure 4.3: EA Long Term Flood Risk Mapping



Contains EA information © EA and database right [2025].

4.5.9 The updated Long Term Flood Risk Mapping no longer shows a flow pathway along the reach of Keys Brook, indicative of fluvial flooding, when compared to the older EA Complex Surface Water Mapping (see below).

EA Complex Surface Water Flood Mapping

4.5.10 The EA Complex Surface Water Flood Mapping (Drawings 0006.1 to 0006.4) shows most of the Site is located outside the mapped extent of surface water flooding. There is, however, a flow pathway located in the southern extent associated with Keys Brook, and three isolated areas of ponding in the northern extent of the Site.

4.5.11 For the area of ponding in the north-eastern corner of the Site, the velocity is up to 0.25m/s, with the flood hazard being 'low' (0.50 - 0.75) to 'moderate' (0.75 - 1.25). For the two remaining areas of ponding in the northern extent, the velocity is up to 0.25m/s, with the flood hazard being 'low' (0.50 - 0.75) to 'moderate' (0.75 - 1.25).

4.5.12 The flood outlines of the flow pathway, in the southern extent of the Site, are associated with the 1 in 30-year, 100-year and 1000-year events. Flood depths are up to 0.60m during the extreme 1 in 1000-year event, with velocity being up to 2.00m/s, and flood hazard being 'low' (0.50 - 0.75) to 'significant' (1.25 - 2.00). This flow pathway is considered indicative of fluvial flooding from Keys Brook, which will be the dominant source of flooding for this Site.

Flood Risk Summary

4.5.13 The risk of surface water flooding is assessed as negligible for most of the Site, and as low to associated with ponding in the northern, western, and southern extents.

4.5.14 Measures required for surface water flooding are discussed in Section 5.

4.6 Sewer Flooding

Introduction

4.6.1 Sewer flooding occurs when urban drainage networks become overwhelmed after heavy or prolonged rainfall due to restrictions or blockage in the sewer network or if the volume of water draining into the system exceeds the sewer design capacity.

4.6.2 New adoptable sewers are built to have a minimum design standard up to and including the 1 in 30-year rainfall event. Older sewers were not designed to any standard. Modern sewer systems will only surcharge during rainstorm events with a return period greater than 1 in 30-years (e.g. 1 in 100-years).

Asset Plans

3.8.2 Dwr Cymru (Appendix 4) and United Utilities (Appendix 5) asset plans show there are a no assets located within the Site boundary. There are, however, several private and public assets in the vicinity of the Site, including a private foul sewer and water main beneath Tattenhall Road to the east of the Site and a combined gravity sewer beneath housing located to the south of the Site.

3.8.3 Any surcharging of the sewer networks or burst of the water main would result in shallow flows (<150mm) that would shed overland, following the localised topography (Drawing 0007). For the private foul sewer and water main, flows would be south, following Tattenhall Road towards Keys Brook; whilst the combined gravity sewer to the South of the Site would

shed flows north, also towards Keys Brook. Neither of these scenarios would result in flows within the Site boundary.

Flood Risk Summary

4.6.3 The risk of flooding from sewers is assessed as negligible.

4.7 Flooding from Infrastructure Failure

Reservoir Failure

4.7.1 The EA online flood mapping shows the Site is outside the extent of flooding sourced from reservoirs.

Flood Risk Summary

4.7.2 The risk of flooding from reservoir failure is assessed as negligible.

5.0 Planning and Flood Risk

5.1 Introduction

5.1.1 The main steps to be followed in addressing flood risk are set out below:



5.2 Assess

5.2.1 As per Paragraph: 003 Reference ID: 7-003-20220825 (Revision date: 25/08/2022) of NPPG ID7, we have prepared a site-specific FRA to assess flood risk from all sources to the Development. A summary is included below:

- The risk of fluvial flooding is assessed as negligible for most of the Site, and as low to high associated with Keys Brook in the southern extent.
- The risk of groundwater flooding is assessed as negligible for most of the Site, and as moderate in areas of the southern extent.
- The risk of surface water flooding is assessed as negligible for most of the Site, and as low associated with ponding in the northern, western, and southern extents.
- Flood risk from all other sources is assessed as negligible.

5.3 Decision Making Process

5.3.1 As per Paragraph: 004 Reference ID: 7-004-20220825 (Revision date: 25/08/2022) of NPPG ID7, where an assessment shows that flood risk is a consideration for a plan or development proposal, the process is set out below:

Avoid

5.3.2 The approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This means avoiding, so far as possible, development in current and future medium and high flood risk areas considering all sources of flooding including areas at risk of surface water flooding.

5.3.3 As per the National flood risk standing advice for local planning authorities (‘*When development is exempt from the sequential test’*)[32],

“A development is exempt from the sequential test if it is a:

- *Householder development like residential extensions, conservatories or loft conversions*
- *Small non-domestic extensions with a footprint of less than 250 square metres*
- *Change of use (except changes of use to a caravan, camping or chalet site, or to a mobile home or park home site)*

A development is also exempt from the sequential test if it is a development on a site allocated in the development plan through the sequential test and:

[32] https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities#:~:text=A%20development%20is%20exempt%20from,extensions%2C%20conservatories%20or%20loft%20conversions

- *The proposal is consistent with site's allocated use*
- *There have been no significant changes to the known level of flood risk to the site, now or in the future, which would have affected the outcome of the test*

You may not need a sequential test if development can be laid out so that only elements such as public open space, biodiversity and amenity areas are located in areas at risk of any source of current or future flooding."

5.3.4 Subject to the below avoidance measures, the Sequential Test is not required:

- Sequentially develop the Site, limiting the built development outside the mapped extent of the JFLOW fluvial flooding with a +300mm offset as a conservative approach (as per Drawing 0008).
- Set the surface water outfall from the proposed development at an appropriate height, above the bed level of the receiving watercourse
- Set building floor levels +150mm above external levels.
- No below surface habitable buildings (i.e. basements).
- Lined attenuation to prevent groundwater ingress.

5.3.5 Further to the above, the following measures are recommended in line with statutory requirements / following best practice:

- Provide an 8m easement free from development along the side of the bounding watercourse, Keys Brook. This easement would provide access for inspection and maintenance purposes, including vehicle access.

Control

5.3.6 We recommend the following control measures to manage the risk of flooding to and from the development:

- Adoption of a surface water management strategy (see Section 6).
- Undertake maintenance activities to keep Keys Brook clear from debris and overgrown vegetation to maintain the conveyance of the channels.
- Fit the outfall with backflow prevention and provide a high-level overflow.

Mitigate

5.3.7 Based on the above avoidance measures, no mitigation measures are proposed.

5.4 Summary

5.4.1 Table 5.1 summarises the risk of flooding, both without and with recommended measures.

Table 5.1: Risk of Flooding and Recommended Measures

Source of Flooding	Risk of Flooding	Risk Without Measures	Recommended Measures	Risk to Development with Measures
Fluvial - Keys Brook	Negligible for most of the Site; Low to High associated with Keys Brook in the southern extent.	Negligible to High	Avoid and Control	Negligible
Tidal - Non identified	Negligible	Negligible	N/A	Negligible
Groundwater - Principal Aquifer (bedrock); Secondary (Undifferentiated) and Secondary A Aquifers (Superficial Designation)	Negligible for most of the Site; Moderate in areas of the southern extent.	Negligible to Moderate	Avoid	Negligible
Surface Water - Poor permeability and Site topography	Negligible for most of the Site; Low associated with ponding in the northern, western and southern extents.	Negligible to Low	Avoid and Control	Negligible
Sewers and Mains - Non identified	Negligible	Negligible	N/A	Negligible
Infrastructure Failure - Non identified	Negligible	Negligible	N/A	Negligible

Key: *Green - Negligible, Yellow - Low, Orange - Medium and Red - High; based on risk with without/with recommended measures from each flooding source.*

5.5 Flood Guidance and Sequential Test

5.5.1 The proposal is for a residential development. The PPG ID: 7 (not included in this report) classifies the proposed use as 'more vulnerable'.

5.5.2 The EA Flood Zones and acceptable development types are listed in Table 5.2. All development types, including more vulnerable uses, are acceptable in Flood Zone 1 and 2 (low to moderate risk); whilst 'more vulnerable' uses are subject to the exception test in Flood Zone 3a (high risk). Subject to the above measures, the Sequential Test would be passed, and the Exception Test would not be required as indicated in Table 5.3.

Table 5.2: EA Flood Zones and Appropriate Land Use

Flood Zone	Probability	Explanation	Appropriate Land use
Zone 1	Low	Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).	All development types generally acceptable.
Zone 2	Medium	Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% 0.1%) in any year.	Most development type are generally acceptable.
Zone 3a	High	A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.	Some development types not acceptable.
Zone 3b	'Functional Floodplain'	Land where water must flow or be stored in times of flood. SFRAs should identify this zone (land which would flood with an annual probability of 1 in 30 (3.33%) or greater in any year or is designed to flood in an extreme (0.1% flood, or at another probability to be agreed between the LPA and the EA, including water conveyance routes).	Some development types not acceptable.

Note: *The Flood Zones are the current best information on the extent of the extreme flood from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. The identified risk of fluvial flooding is highlighted green.*

Table 5.3: Vulnerability and Flood Zone 'Compatibility' as Identified in Table 2 of PPG ID: 7

Flood Risk Vulnerability classification (see Table 1 of PPG ID: 7)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	Yes	Yes	Yes	Yes	Yes
Zone 2	Yes	Yes	Exception test required	Yes	Yes
Zone 3a	Exception test required	Yes	No	Exception test required	Yes
Zone 3b 'Functional Floodplain'	Exception test required	Yes	No	No	No

Key: *Yes: Development is appropriate, No: Development should not be permitted. The identified risk of fluvial flooding is highlighted green.*

6.0 Surface Water Drainage

6.1 Introduction

6.1.1 Consideration of flood issues is not confined to the floodplain. This is recognised in the NPPF and associated guidance where all proposed development of 1ha or more in Flood Zone 1 and so outside the floodplain nevertheless requires an FRA. The alteration of natural surface water flow patterns through development can lead to problems elsewhere in a catchment, particularly flooding downstream, and the replacement of permeable vegetated areas by low-permeability roofs, roads and other paved surfaces will increase the speed, volume, and peak flow of surface water runoff. So, the NPPF and associated guidance require an FRA for all proposed development of 1ha or more outside the floodplain in Flood Zone 1.

6.1.2 A surface water management strategy for the development is proposed to manage and reduce the flood risk posed by surface water runoff from the Site. The developer will be required to ensure that any scheme for surface water management should build in enough capacity for the entire Site.

6.1.3 The surface water drainage arrangements for any development Site should be such that the volume and peak flow rates of surface water leaving a developed Site are no greater than the rates prior to the proposed development unless specific off-Site arrangements are made and result in the same net effect.

6.1.4 An assessment of the surface water runoff rates was undertaken to determine the surface water options and attenuation requirements for the Site.

6.2 Existing Drainage System

6.2.1 The land use is comprised of a single parcel of agricultural (grassed) land.

6.2.2 The Site is underlain by mixed permeability (loamy and clayey) soils and superficial deposits, underlain by sandstone bedrock. Drainage is predominantly via overland flow, following the topography of the Site south towards Keys Brook, with a small amount of infiltration to bedrock and throughflow to watercourse.

6.3 Developable and Impermeable Areas

6.3.1 An allowance of 55% impermeable area (inclusive of 10% for urban creep) was applied to the 3.11ha developable area. The existing and proposed impermeable areas are summarised in Table 6.1.

6.3.2 The proposed development will increase the impermeable surfaces and so increase the amount of runoff.

Table 6.1: Impermeable Area

Area	Existing Buildings and Hardstanding	Proposed Buildings and Hardstanding	Difference
Area (ha)	0	1.71	+1.71
Percentage of Total Site Area (%)	0	27.1	27.1

6.4 Greenfield Runoff Rates

6.4.1 An assessment of greenfield runoff rates was undertaken to determine the attenuation requirements for the proposed development.

6.4.2 The runoff rates were calculated using the HRWallingford UKSuDS online tool, with FEH method inputs (descriptors obtained from the FEH webservice[33]). This is a recommended methodology for Sites up to 50ha in area and the approach is in line with the current 'industry best practice' guidelines as outlined in the Interim Code of Practice for SuDS[34], and EA Report SC030219 - Rainfall runoff management for developments.

6.4.3 The following parameters were used in the runoff calculations:

- Developable Area: 3.11ha
- Average Annual Rainfall (SAAR): 699mm/year
- Region No.: 9
- BFIHOST19: 0.361

6.4.4 BFIHOST was updated to BFIHOST19 (November 2019) since a number of issues were identified with BFIHOST, which including a tendency to underestimate BFI in clay-dominated catchments.

6.4.5 BFIHOST19 is the baseflow index developed using the Hydrology of Soil Types (HOST) classification and is the baseflow proportion of the flow on average. It is estimated based on the daily mean flow data. Baseflow comprises water entering the watercourse through shallow subsurface flow and groundwater flow (mechanisms other than direct surface runoff); hence permeable soils and geology tend to yield a higher baseflow.

6.4.6 The Soilscapes online soils map viewer and Geology of Britain online map viewer identified the following:

- Soils: Slowly permeable, naturally wet, loamy and clayey.
- Superficial Deposits: Mostly Diamicton with a band of Alluvium (Clay, sand, silt, gravel).
- Bedrock: Sandstone, pebbly.

6.4.7 BFIHOST19 value assigned by the FEH webservice is considered to replicate on-site conditions.

6.4.8 Table 6.2 shows the calculated greenfield runoff rates. Runoff calculations are included in Appendix 7.

[33] Centre for Ecology and Hydrology, Flood Estimation Handbook Web Service [https://fehweb.ceh.ac.uk/].
[34] Office of the Deputy Prime Minister, National SuDS Working Group (July 2004) Interim Code of Practice for Sustainable Drainage Systems [https://www.susdrain.org/files/resources/other-guidance/nswg_icop_for_suds_0704.pdf].

Table 6.2: Greenfield Runoff Rates

Annual Probability (Return Period, Years)	Greenfield Runoff (l/s)
QBAR	14.1
100% (1)	12.5
3.33% (30)	25.3
1% (100)	31.0
1% Plus Climate Change	45.0

Note: 45% climate change added. The 1 in 1-year, 30-year and 100-year annual probability events are of importance to the Water Companies and the EA when looking at sewage discharge and flood risk.

6.5 Surface Water Management Strategy

Hierarchy of Discharge

6.5.1 In accordance with requirement H3 of the Building Regulations 2010[35] rainwater runoff must discharge to one of the following, listed in order of priority:

1. ***An adequate soakaway or some other adequate infiltration system:*** The use of infiltration-based SuDS is not feasible due to largely low infiltration potential into the superficial deposits. Where infiltration may be feasible into the superficial deposits (i.e. alluvium) there is likely to be a degree of high groundwater which is hydraulically connected to Keys Brook.
2. ***A watercourse:*** There is a main river, Keys Brook, conveying flows west along the southern boundary of the Site.
3. ***A sewer:*** There are no public surface water sewers located within the immediate vicinity of the Site.

6.5.2 The potential route to discharge surface water from the proposed development will be by outfall to the bounding watercourse, Keys Brook.

6.6 Sustainable Drainage Options (SuDS)

Choice of SuDS Options

6.6.1 Sustainable water management measures should be used to control the surface water runoff from the proposed development Site, thereby managing the flood risk to the Site and surrounding areas from surface water runoff. These measures will also improve the quality of water discharged from the Site.

6.6.2 Current guidance promotes sustainable water management using SuDS. Options applicable to this Site are identified in Table 6.3.

[35] Office of the Deputy Prime Minister, The Building Regulations 2010, amended 2021 [https://www.gov.uk/government/publications/drainage-and-waste-disposal-approved-document-h]

Table 6.3: SuDS Options

Green roofs	Infiltration basins
Water butts	Detention basins
Permeable paving	Oversized pipes
Rainwater harvesting	Brown roofs
Filter strips	Swales
Wetland Areas	Cellular Storage

Note: *SuDS appropriate to the development are highlighted green.*

6.6.3 A hierarchy of SuDS techniques is identified[36]:

1. **Prevention** - the use of good Site design and housekeeping measures on individual Sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
2. **Source Control** - control of runoff at or very near its source (such as the use of rainwater harvesting).
3. **Site Control** - management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole Site).
4. **Regional Control** - management of runoff from several Sites, typically in a detention pond or wetland.

6.6.4 Using SuDS as opposed to conventional drainage systems provides several benefits by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream.
- Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed Sites.
- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources.
- Reducing potable water demand through rainwater harvesting.
- Improving amenity through the provision of public open spaces and wildlife habitat.
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

SuDS Maintenance

6.6.5 A detention basin will form the main attenuation feature within the development Site.

6.6.6 Maintenance of the SuDS features would be in line with the SuDS Manual (CIRIA C753, 2015), as detailed in Figure 6.1. It is standard for SuDS features within a new development to be maintained by a private maintenance company unless the council adopt it. If the maintenance company goes into administration, the Site will be contracted to a new maintenance company. Residents will pay a surcharge to the maintenance company and a number of them would be

[36] CIRIA (2004) Report C609, Sustainable Drainage Systems - Hydraulic, Structural and Water Quality advice.

appointed to its board. This will ensure maintenance throughout the lifetime of the development.

6.6.7 Details of other SuDS features, and maintenance would be considered further at detailed design when a detailed layout has been produced. The level of detailed provided within this FRA should be sufficient at outline stage to demonstrate that SuDS would be deliverable.

Figure 6.1: Detention Basin Operation and Maintenance Requirements (Table 22.1 of the SuDS Manual)

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

Drainage Design Summary

6.6.8 Surface water runoff would be directed to the drainage system through drainage gullies located around the perimeter of the buildings and through contouring of the hardstanding areas.

6.6.9 Landscaped areas should be incorporated into the layout where possible, and the associated gardens of each unit will allow a proportion of the rainfall to infiltrate into the soil substrate.

6.6.10 Surface water will be directed to an onsite detention basin, positioned to achieve a gravity fed connection to the bounding watercourse, Keys Brook.

6.6.11 An outline surface water drainage layout is in ENZ-XX-XX-DR-D-0001-P02.

Attenuation Requirements

6.6.12 Attenuation storage is required to reduce the post-application surface water runoff from the Site to calculated greenfield runoff rates, up to and including the 1 in 100-year (+45%CC) rainfall event, assuming no infiltration losses.

6.6.13 The following input parameters were assumed in the calculations:

- Impermeable Area: 2.86ha (38.5%);
- Cv (proportion of rainfall forming surface water runoff): 100% summer, 100% winter;
- Infiltration losses: 0m/hour;
- With outfall: at QBAR (14.2l.s) (Table 6.2).

6.6.14 The attenuation volume for the 1 in 100-year event (plus climate change) is 1363m^3.

6.6.15 Attenuation calculations are included in Appendix 7. The calculated runoff rates and attenuation volumes will be reviewed at detailed design stage.

6.7 Exceedance Routes

6.7.1 The detention basin will be designed with a capacity up to a 1 in 100-year (plus 45% climate change) event, with a +300mm freeboard allowance, based on the calculated greenfield runoff (QBAR) restricted discharge rate. This provides a betterment (reduction) in runoff when compared to existing undeveloped conditions, where runoff is uncontrolled across all return periods.

6.7.2 A storm event in excess of this design standard would be extreme and would cause the detention basin to overtop (with no sudden deluge) and would then shed overland following the topography (south) towards Keys Brook, as per existing conditions (Drawing 0007).

6.7.3 Finished floor levels of new dwellings will be set above external levels, which will manage the residual risk of overtopping.

6.8 SuDS Proforma

6.8.1 A copy of the Cheshire West and Chester Council SuDS Proforma is included in Appendix 8.

7.0 Foul Drainage Strategy

7.1 Proposed Strategy

7.1.1 It is proposed that foul flow is discharged to the Ø160mm foul sewer beneath Tattenhall Road. It is noted that the sewer is currently under a S104 agreement. The topography of the Site would allow for a largely gravity fed connection however some minor areas of the Site would require a pumping station and rising foul main.

7.1.2 An outline foul drainage layout is in Drawing ENZ-XX-XX-DR-D-0002-P01.

7.1.3 In accordance with the Design and Construction Guidance[37] document, peak foul water discharge from a residential development is 4,000 litres per property per day. Using this method, peak foul flows are estimated to be 5.1l/s from the 110-unit residential development. The calculated foul flow rate will be reviewed at detailed design stage.

7.1.4 All foul sewerage should be designed in accordance with Building Regulations Part H38. In areas where sewers are to be adopted by Welsh Water, sewerage should be designed in accordance with Design and Construction Guidance document and supplemented with additional standards provided by Welsh Water. An application to enter into a Section 104 agreement for sewer adoption must be made in writing to Welsh Water prior to any works commencing on Site. A connection point should be agreed with Welsh Water.

[37] Water UK (published October 2019 and update May 2021). Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code") [SSG-App-C-Des-Con-Guide.pdf (water.org.uk)]

[38] HM Government (published 2002 and updated October 2015) The Buildings Regulations 2010 - Drainage and Waste Disposal: Part H [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/442889/BR_PDF_AD_H_2015.pdf].

8.0 Summary and Conclusions

8.1 Introduction

8.1.1 A site-specific Flood Risk Assessment (FRA) has been undertaken for a proposed residential development, located on a 6.32ha Site on land west of Tattenhall Road, Tattenhall, Chester, CH3 9QY

8.2 Flood Risk

8.2.1 The risk of flooding is assessed as follows:

- The risk of fluvial flooding is assessed as negligible for most of the Site, and as low to high associated with Keys Brook in the southern extent.
- The risk of groundwater flooding is assessed as negligible for most of the Site, and as moderate in areas of the southern extent.
- The risk of surface water flooding is assessed as negligible for most of the Site, and as low associated with ponding in the northern, western and southern extents.
- Flood risk from all other sources is assessed as negligible.

8.3 Measures

8.3.1 Flood risk from identified sources can be reduced to a negligible or low and acceptable level through the following approach:



8.3.2 Subject to the proposed avoidance measures, the Sequential Test is not required:

- Sequentially develop the Site, limiting the built development outside the mapped extent of the JFLOW fluvial flooding with a +300mm offset as a conservative approach (as per Drawing 0008).
- Set the surface water outfall from the proposed development at an appropriate height, above the bed level of the receiving watercourse
- Set building floor levels +150mm above external levels.
- No below surface habitable buildings (i.e. basements).
- Lined attenuation to prevent groundwater ingress.

8.3.3 Further to the above, the FRA has recommended further measures in line with statutory requirements / following best practice. The FRA has explored control, mitigate and management measures.

8.4 Flood Guidance

8.4.1 The proposed residential use is classified as more vulnerable. More vulnerable uses are considered acceptable in terms of flood risk in Flood Zone 1 and 2 (low and moderate risk), however parts of the Site are in Flood Zone 3a (high risk) and there is also a risk of flooding

from other sources. Subject to the implementation of the above avoidance measures, the Sequential Test would be passed, and the Exception Test would not be required.

8.5 Site Drainage

Surface Water

8.5.1 The proposed development will increase the area of impermeable surfaces and therefore increase the amount of runoff without appropriate management.

8.5.2 Surface water runoff from the Site will be restricted to greenfield rate (QBAR), which offers a betterment to existing conditions with uncontrolled runoff across all return periods.

8.5.3 Surface water runoff from the proposed development would be attenuated on-site up to and including the 1 in 100-year event, plus 45% climate change.

8.5.4 A SuDS drainage scheme is proposed to manage excess runoff from the development, comprising a detention basin designed to maintain runoff at pre-development rates, with an outfall to the bounding watercourse, Keys Brook.

Foul Water

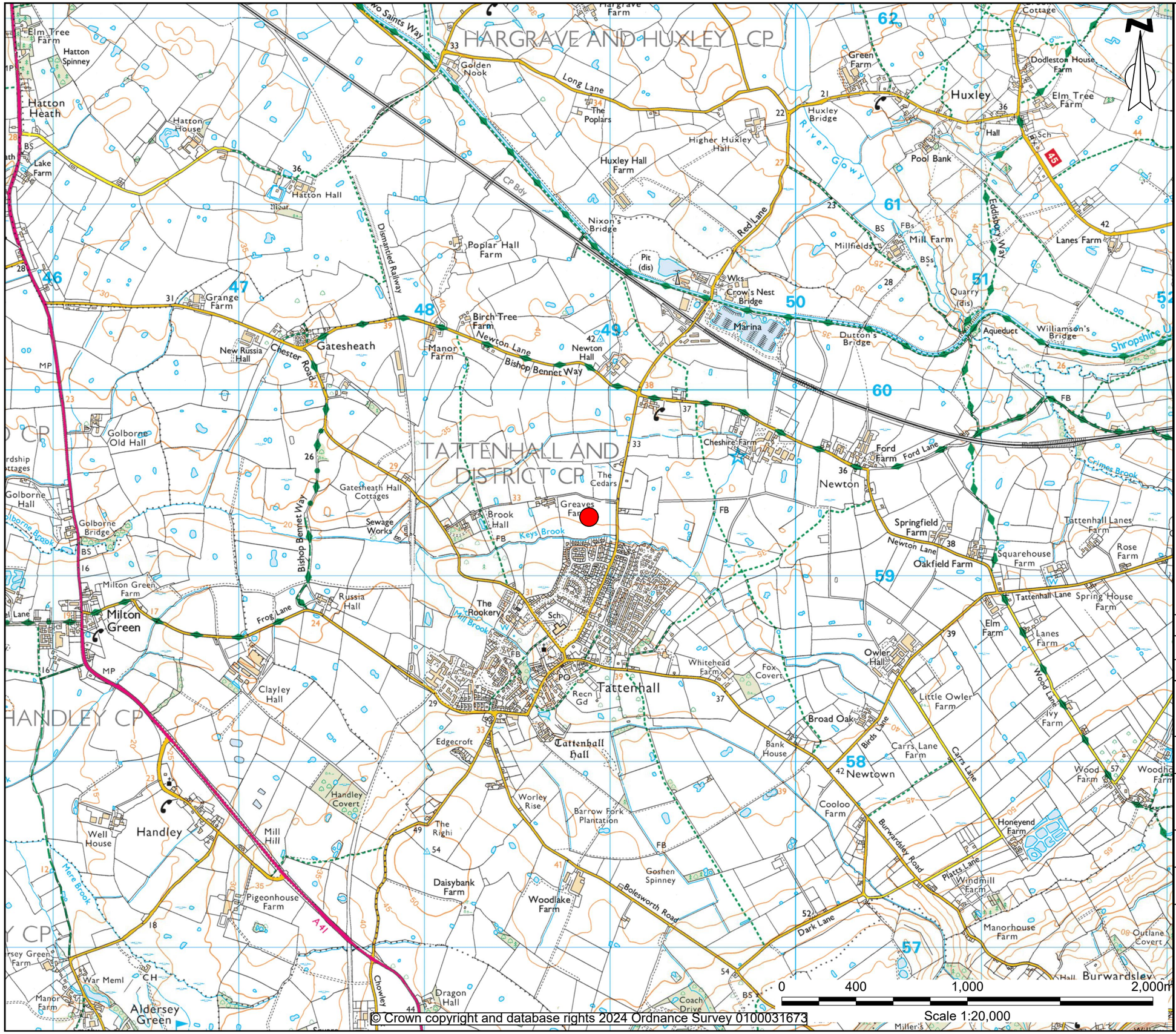
8.5.5 It is proposed that foul flows will discharge to the foul sewer (which is subject to S104 agreement) in Tattenhall Road, via a pumping station and rising foul main.

8.6 Conclusion

8.6.1 This FRA demonstrates the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of national policy and guidance.

8.6.2 The development should therefore not be precluded on the grounds of flood risk, as well as surface water and foul drainage.

DRAWINGS



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KEY:

Site Location

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
Land West of Tattenhall Road, Tattenhall

Client
Gladman Developments Ltd

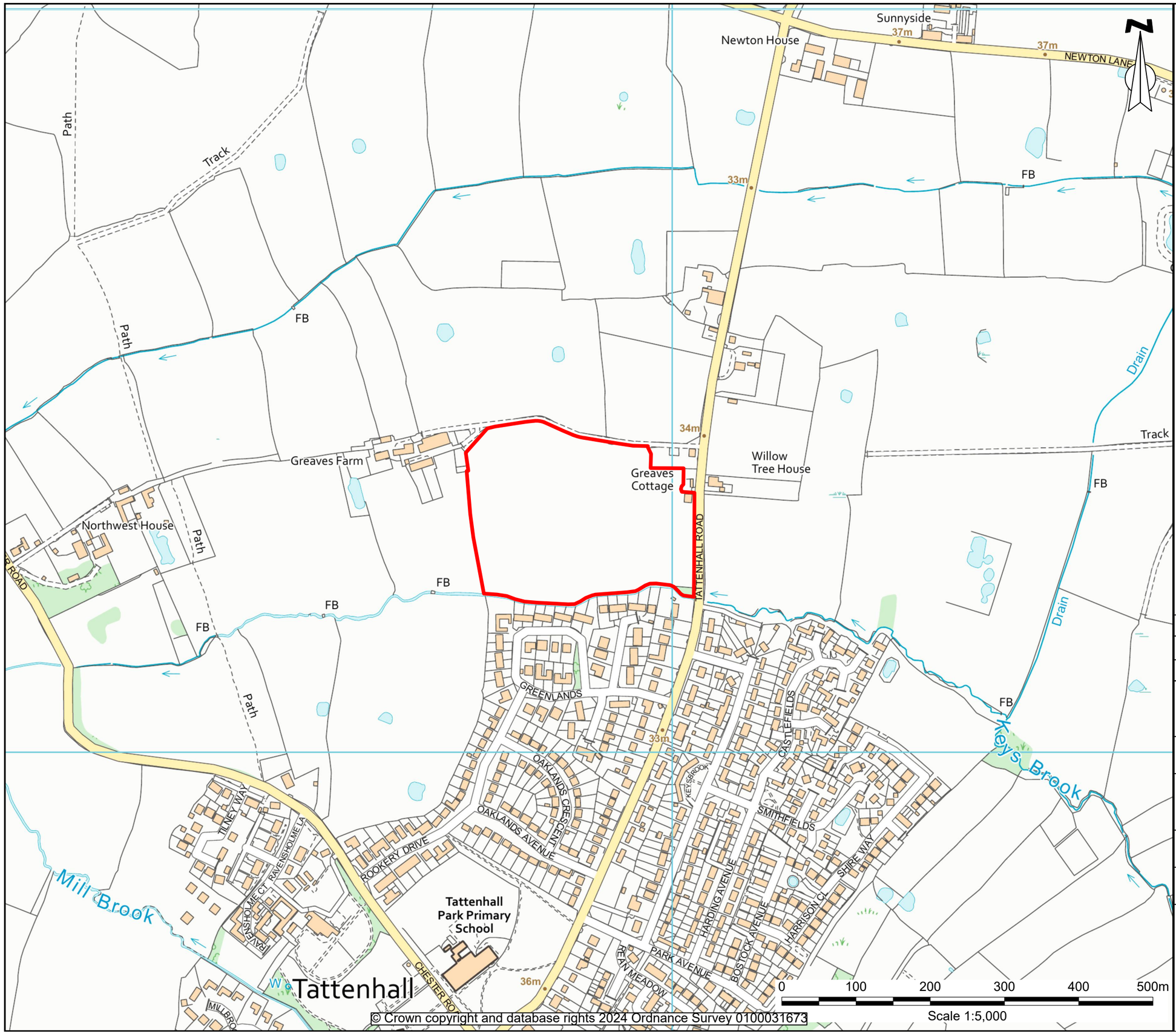
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Site Location Plan

Scale	Date	Status
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DWG No. SHF1132307-ENZ-XX-XX-DR-Y-0001 **Revision** P01

Bristol 01454 269 237
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KEY:

- Site Boundary
- Surface Water Features

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
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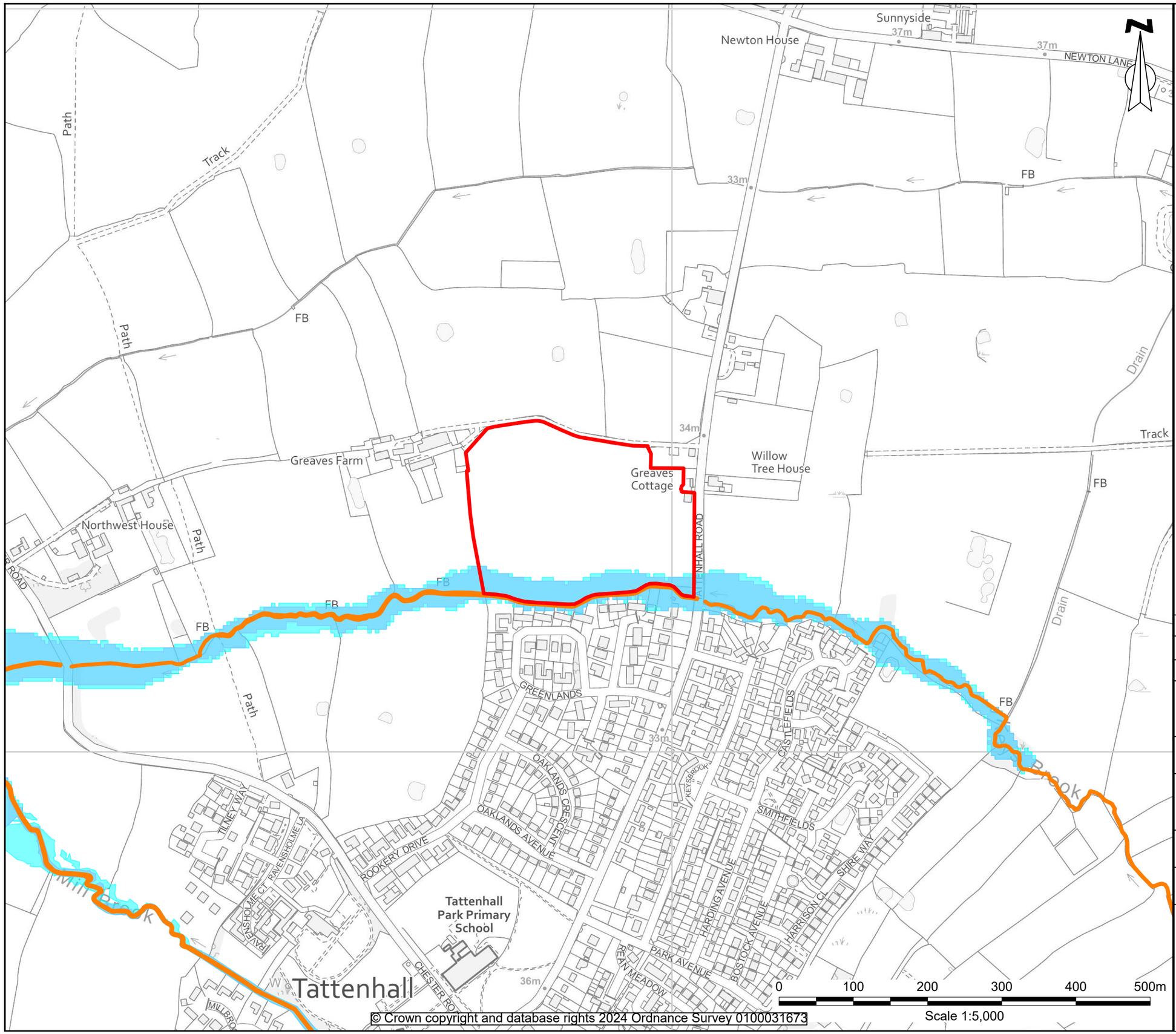
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Drawing Title
Surface Water Features

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KEY:

- Site Boundary
- Flood Zone 3
- Flood Zone 2
- Flood Zone 1
- Flood Defences

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
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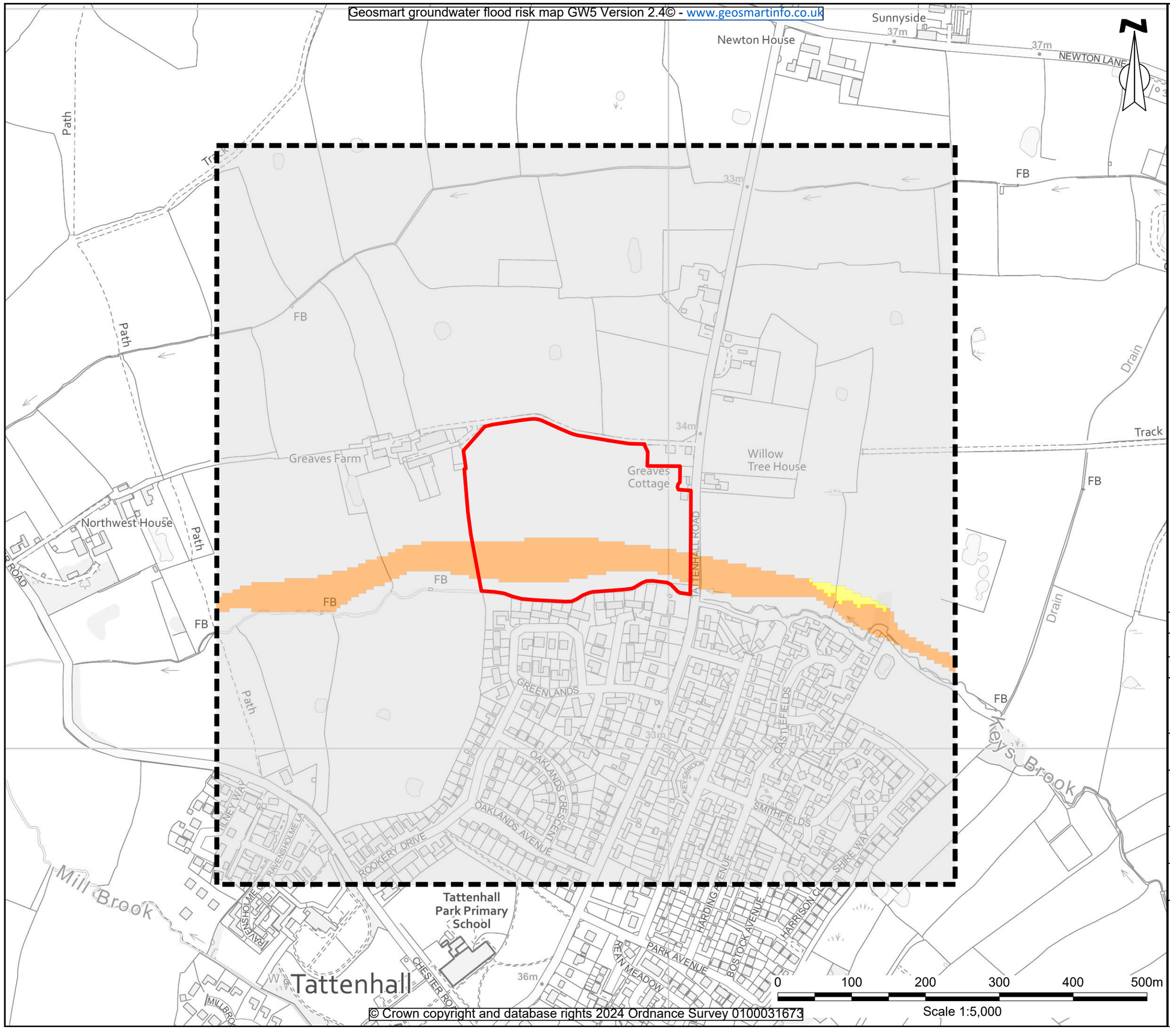
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Geosmart groundwater flood risk map GW5 Version 2.4© - www.geosmartinfo.co.uk



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KEY:

- Site Boundary
- Class 1 - High Risk
- Class 2 - Moderate Risk
- Class 3 - Low Risk
- Class 4 - Negligible Risk
- Search Extent

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
Land West of Tattenhall Road, Tattenhall

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Drawing Title
Groundwater Flood Risk

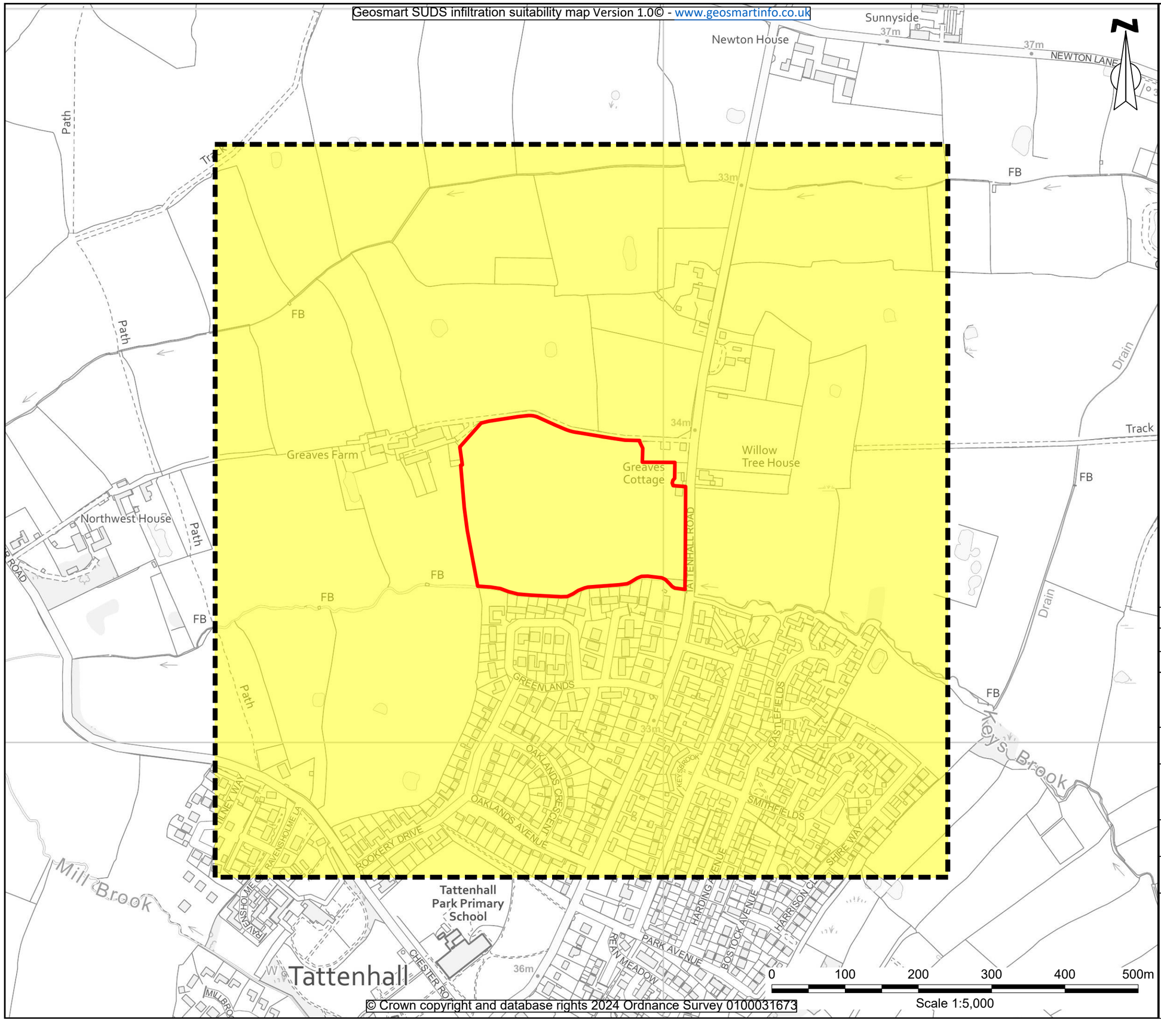
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Geosmart SUDS infiltration suitability map Version 1.0© - www.geosmartinfo.co.uk



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KEY:

- Site Boundary
- High Potential
- Moderate Potential
- Low Potential
- Search Extent

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
Land West of Tattenhall Road, Tattenhall

Client
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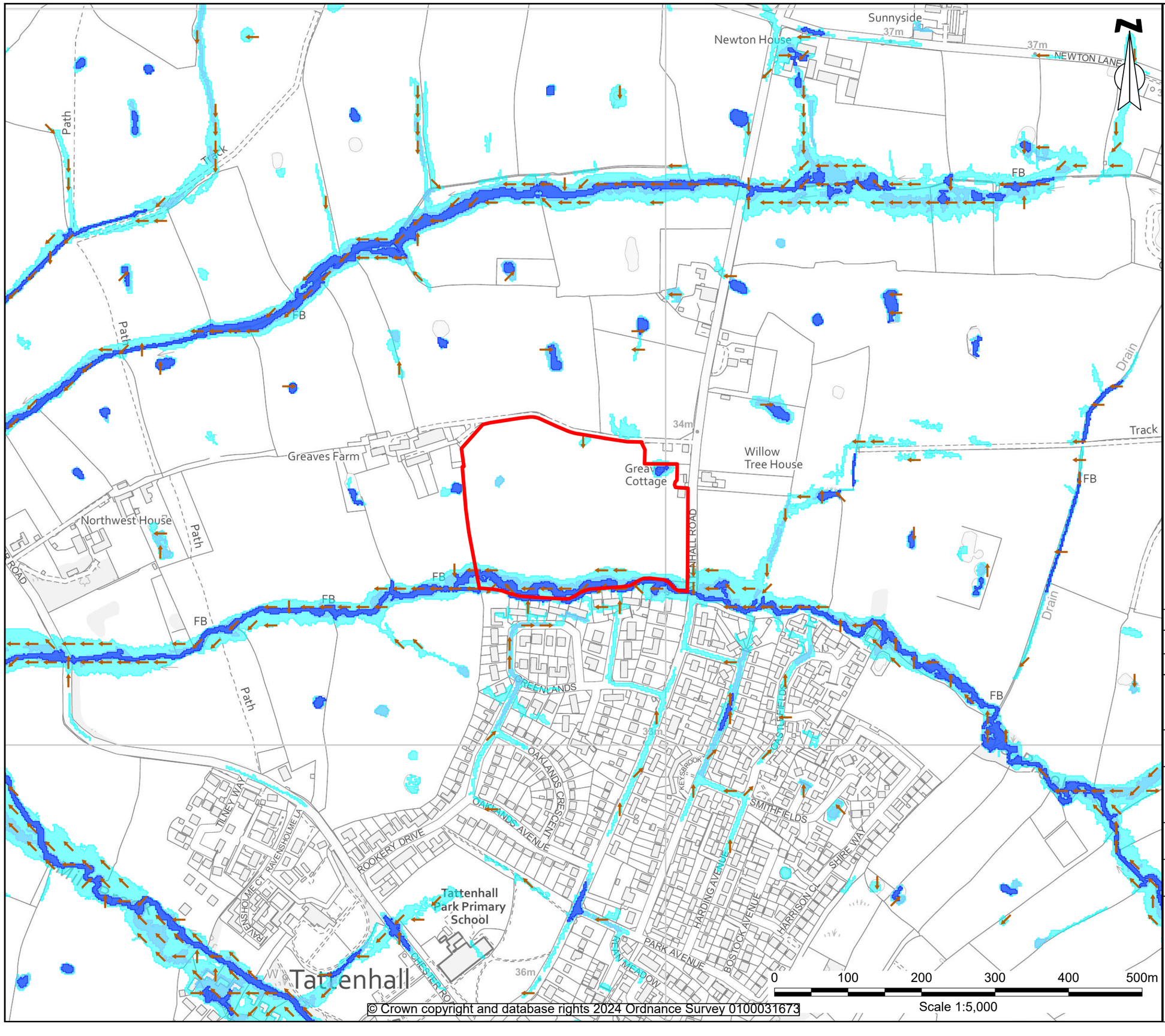
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SuDS Infiltration Potential

Scale	Date	Status
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DWG No. SHF1132307-ENZ-XX-XX-DR-Y-0005 **Revision** P01

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KEY:

- Site Boundary
- 30 Year Extent
- 100 Year Extent
- 1000 Year Extent
- Flow Direction

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
Land West of Tattenhall Road, Tattenhall

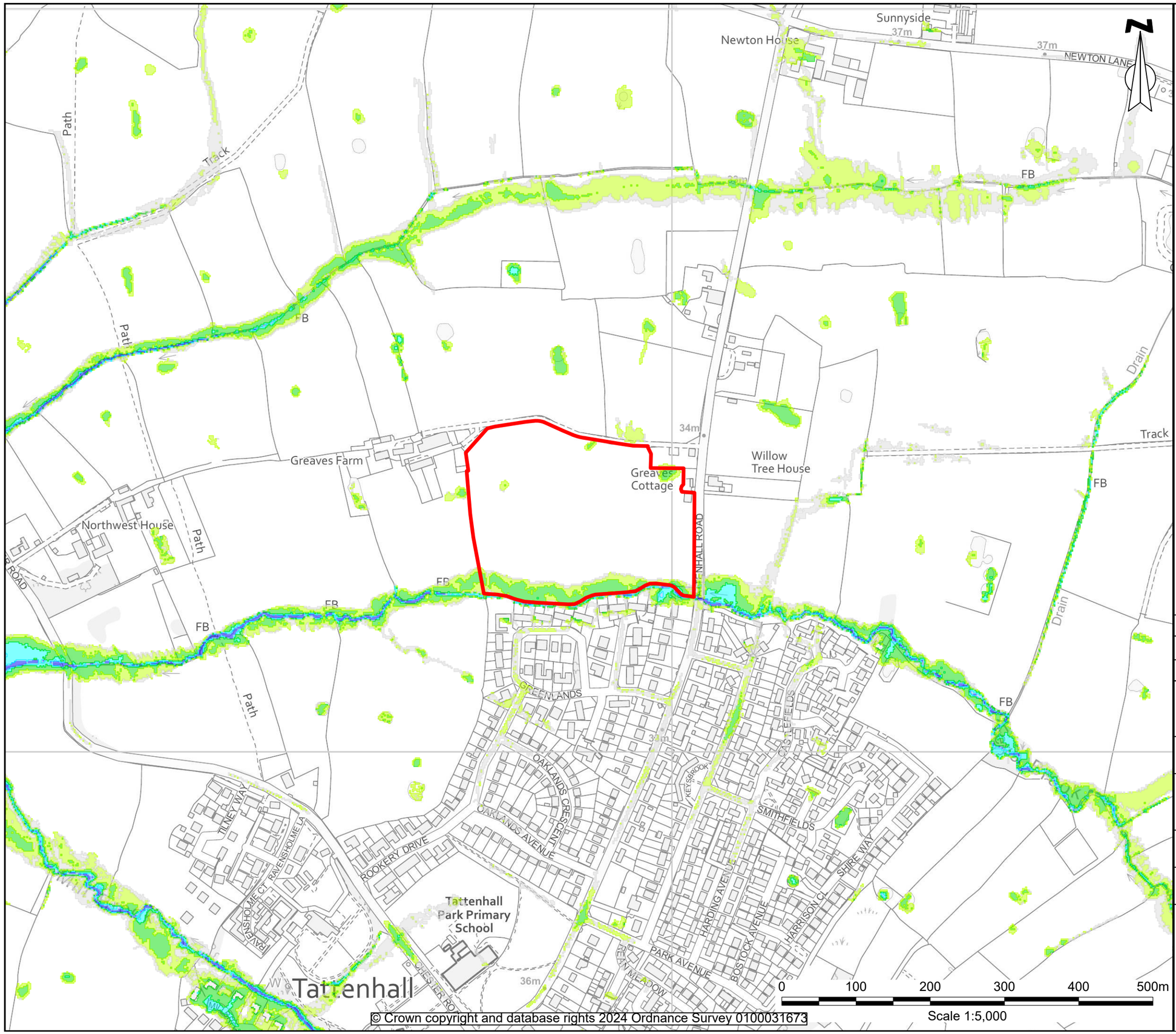
Client
Gladman Developments Ltd

Drawing Title
EA Surface Water Flow Paths

Scale	Date	Status
1:5000@A3	01/11/24	Preliminary

DWG No. SHF1132307-ENZ-XX-XX-DR-Y-0006.1 **Revision** P01

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enzygo.com
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KEY:

- Site Boundary
- Depth greater than 1.20 (m)
- Depth 0.90 - 1.20 (m)
- Depth 0.60 - 0.90 (m)
- Depth 0.30 - 0.60 (m)
- Depth 0.15 - 0.30 (m)
- Depth 0.0 - 0.15 (m)

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
Land West of Tattenhall Road, Tattenhall

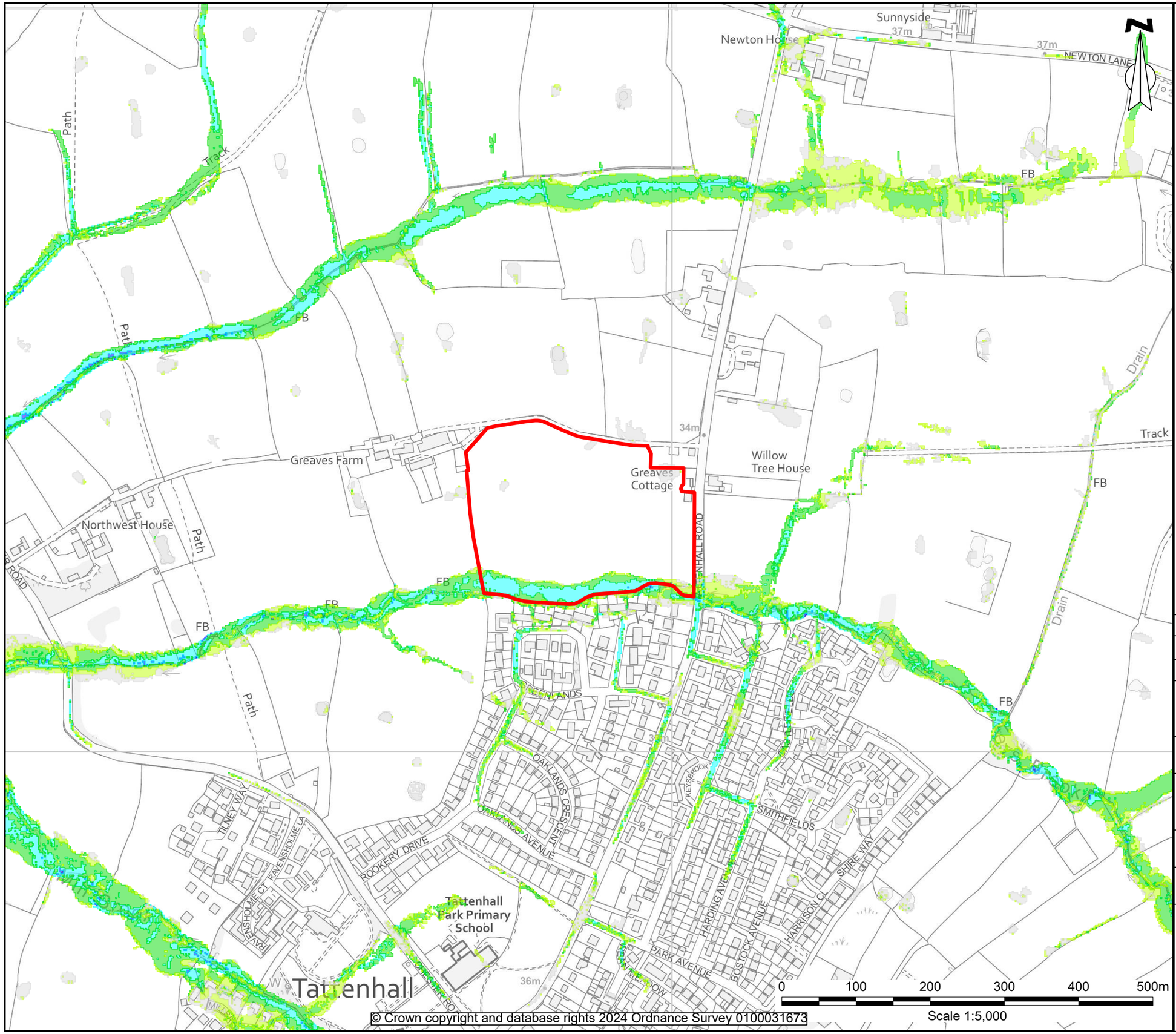
Client
Gladman Developments Ltd

Drawing Title
EA 1 in 1000 Year Surface Water Depth

Scale	Date	Status
1:5000@A3	01/11/24	Preliminary

DWG No. SHF1132307-ENZ-XX-XX-DR-Y-0006.2 **Revision** P01

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KEY:

- Site Boundary
- Velocity 2.00 or greater (m/s)
- Velocity 1.00 - 2.00 (m/s)
- Velocity 0.50 - 1.00 (m/s)
- Velocity 0.25 - 0.50 (m/s)
- Velocity 0.00 - 0.25 (m/s)

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
Land West of Tattenhall Road, Tattenhall

Client
Gladman Developments Ltd

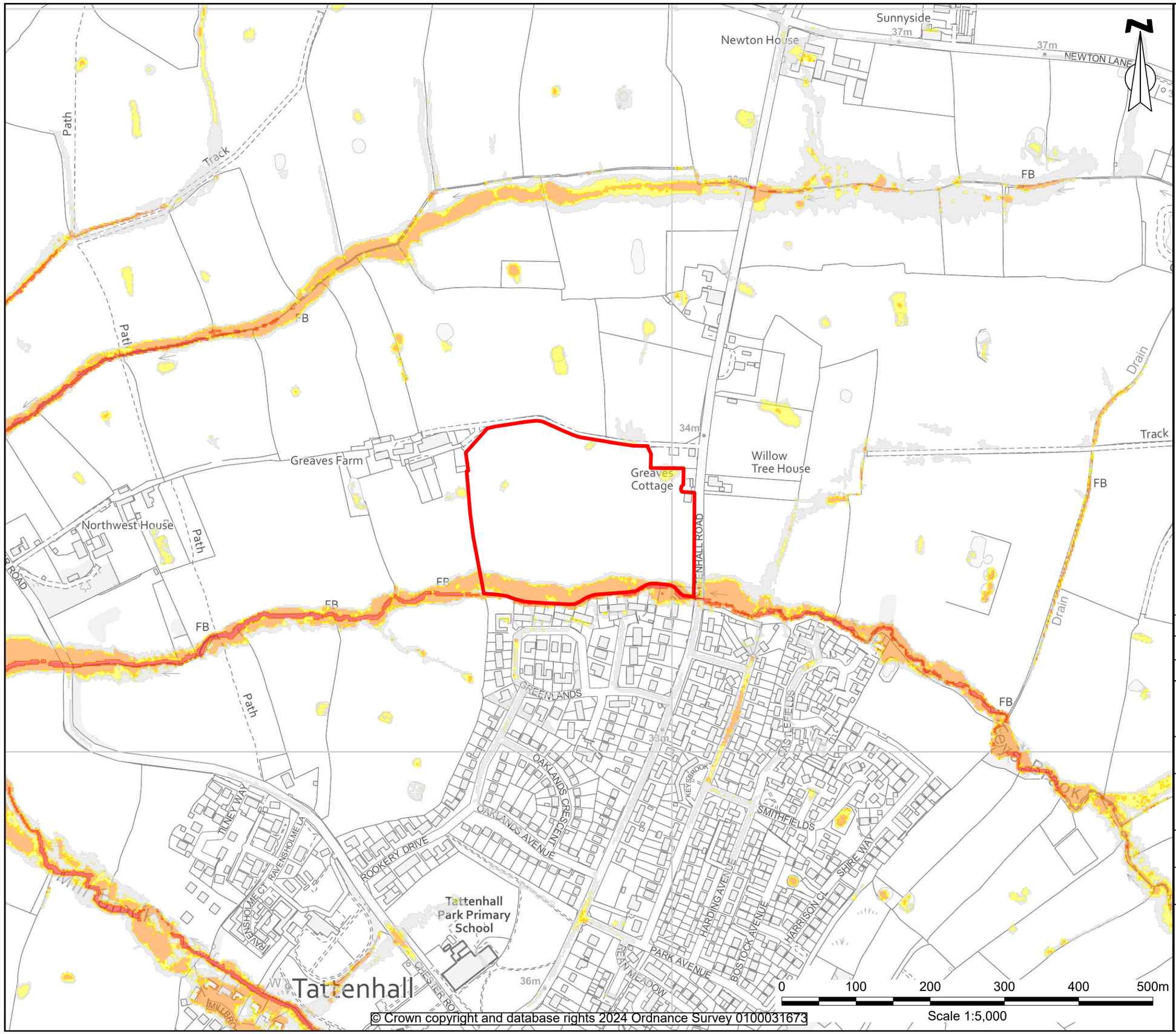
Drawing Title
EA 1 in 1000 Year Surface Water Velocity

Scale	Date	Status
1:5000@A3	01/11/24	Preliminary

DWG No. SHF1132307-ENZ-XX-XX-DR-Y-0006.3 **Revision** P01

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KEY:

- Site Boundary
- Extreme Hazard (> 2.0)
- Significant Hazard (1.25 - 2.00)
- Moderate Hazard (0.75 - 1.25)
- Low Hazard (0.50 - 0.75)

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
Land West of Tattenhall Road, Tattenhall

Client
Gladman Developments Ltd

Drawing Title
EA 1 in 1000 Year Surface Water Hazard

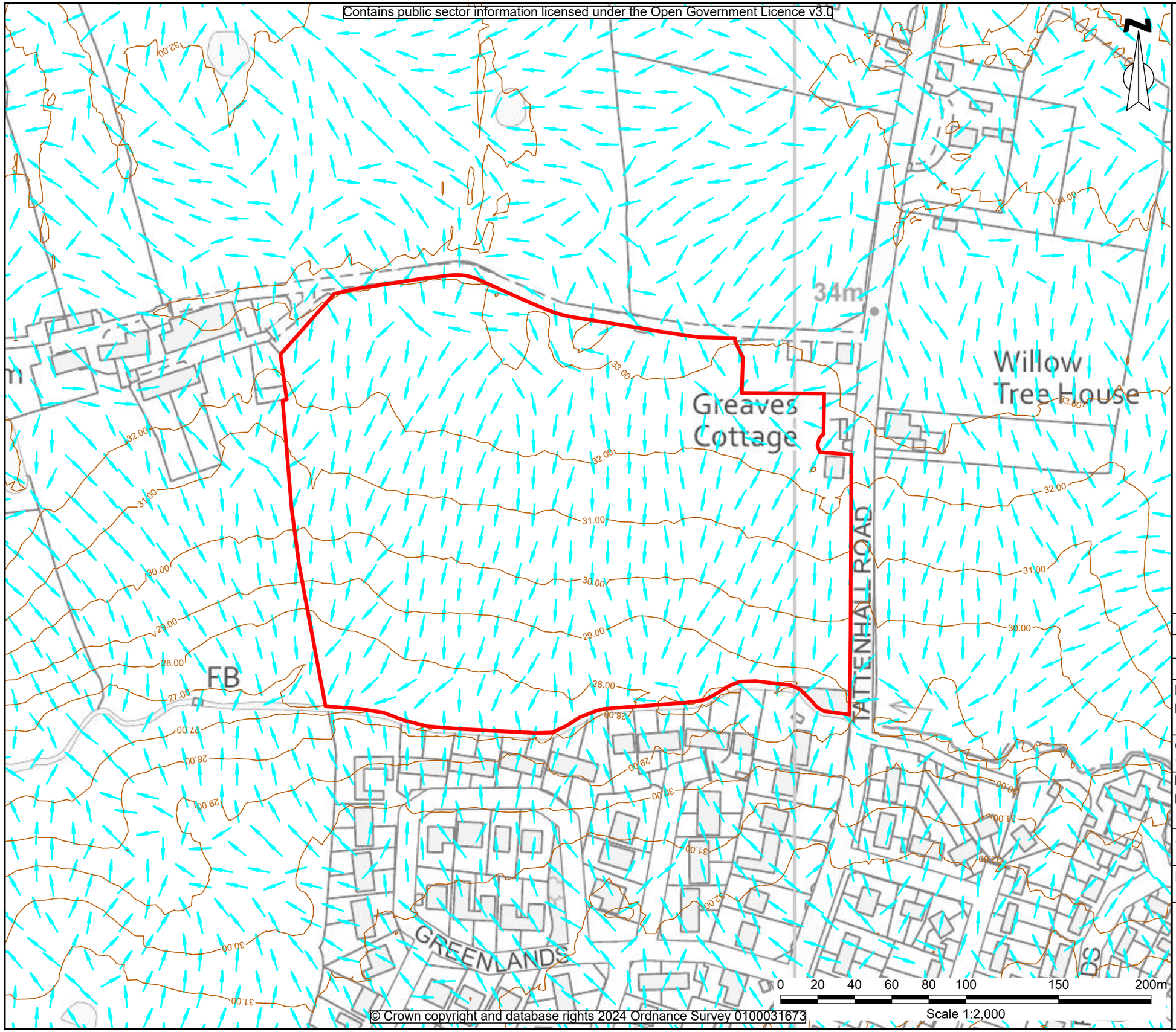
Scale	Date	Status
1:5000@A3	01/11/24	Preliminary

DWG No. SHF1132307-ENZ-XX-XX-DR-Y-0006.4 **Revision** P01

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KEY:

- Site Boundary
- Contours
- Surface Water Flow Path

Rev	Date	Description	DRA	CHK	APP
P01	01/11/24	Issued for comment / approval	LW	DA	DA

Project
Land West of Tattenhall Road, Tattenhall

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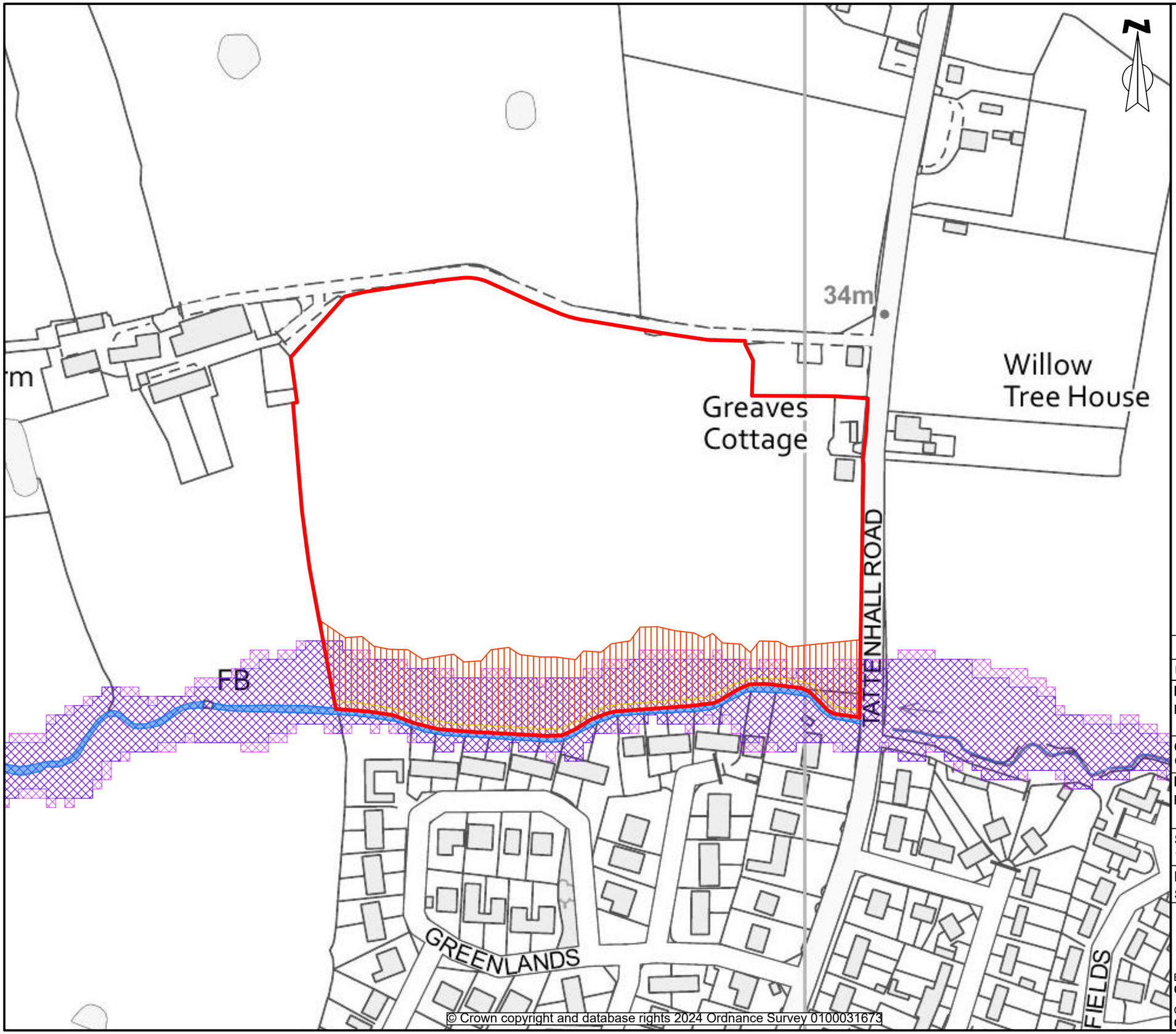
Drawing Title
Flow Pathway Analysis

Scale	Date	Status
1:2000@A3	01/11/24	Preliminary

DWG No. SHF1132307-ENZ-XX-XX-DR-Y-0007 **Revision** P01

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KEY:

- Site Boundary
- Watercourse
- Flood Zone 3
- Flood Zone 2
- +300mm Flood Zone 2 Offset

Rev	Date	Description	DRA	CHK	APP
P01	24/03/25	Issued for comment / approval	EW	EOC	EOC

Project
Land West of Tattenhall Road, Tattenhall

Client
Gladman Developments Ltd

Drawing Title
EA Flood Zones and Offset

Scale	Date	Status
1:2,000@A3	24/03/25	Preliminary

DWG No. SHF1132307-ENZ-XX-XX-DR-Y-0009 **Revision** P01

enzygo environmental consultants

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CAMBRIDGE 01799 542 473

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KEY:

- Site Boundary
- Indicative Attenuation Basin
- Flood Zone 3
- Flood Zone 2
- Flood Zone 1
- Watercourses
- Watercourse Easement (8m)
- Proposed Surface Water Pipe
- Proposed Surface Water Manhole
- Proposed Headwalls
- +300mm Flood Zone 2 Offset

Rev	Date	Description	DRA	CHK	APP
P02	10/04/25	Basin updated to suit latest framework. Network drainage added	TB	EO	EO
P01	17/03/25	Issued for comment / approval	TB	EO	EO

Project
Tattenhall Road, Tattenhall

Client
Gladman Developments Ltd

Drawing Title
Preliminary Surface Water Drainage Strategy

Scale	Date	Status
1:500 @ A1	17/03/25	Preliminary

DWG No. SHF1132307-ENZ-XX-XX-DR-D-0001 **Revision** P02

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N

KEY:

- Site Boundary
- Indicative Attenuation Basin
- Flood Zone 3
- Flood Zone 2
- Flood Zone 1
- Watercourses
- Watercourse Easement (8m)
- Proposed Foul Water Pipe
- Proposed Foul Water Manhole
- Proposed Foul Water Rising Main
- +300mm Flood Zone 2 Offset

Greaves Cottage

TATTENHALL ROAD

F18 CL:32.313 IL:30.284
1.000 1:80 D150
F17 CL:32.535 IL:30.657
1.001 1:50 D150
F19 CL:31.920 IL:29.934
F11 CL:32.641 IL:30.570
D150 1:80 2.000
F12 CL:32.673 IL:29.898
F1 CL:32.315 IL:30.162
D150 1:80 1.000
D150 1:135 2.001
F13 CL:32.493 IL:29.614
F2 CL:31.864 IL:29.912
D150 1:135 1.001
2.002 1:98 D150
D150 1:36 1.002
F15 CL:32.338 IL:30.501
F4 CL:31.260 IL:29.484
D150 1:135 1.003
1.002 1:135 D150
F3 CL:31.080 IL:29.695
F5 CL:31.149 IL:28.956
2.003 1:26 D150
F14 CL:31.230 IL:29.162
D150 1:11 3.000
F7 CL:30.992 IL:28.591
1.006 1:135 D150
F8 CL:31.631 IL:28.224
D150 1:135 1.004
F6 CL:30.938 IL:28.737
D150 1:135 1.005
F26 CL:30.396 IL:28.400
F20 CL:29.558 IL:27.660
F21 CL:29.547 IL:27.549
D150 1:135 1.003
D150 1:135 1.004
F22 CL:29.726 IL:27.222
2.000 1:18 D150
F23 CL:29.742 IL:27.113
D150 1:135 1.005
F27 CL:30.034 IL:27.919
F35 CL:29.878 IL:28.031
D150 1:135 1.007
Foul Water Outfall:
Approx IL: 27.675
Invert level estimated, confirmation required prior to detailed design
Approx plots to drain via gravity: 59
Sewer position taken from Welsh Water asset plans. Pipe to be confirmed if private or adopted. Pipe may need increasing to accomodate increased flows
5.000 1:30 D150
3.000 1:30 D150
D150 1:96 1.006
F24 CL:28.922 IL:26.187
F36 CL:29.374 IL:27.538
D150 1:16 5.001
3.002 1:135 D150
F29 CL:28.896 IL:26.677
F28 CL:28.909 IL:26.906
F34 CL:29.160 IL:27.119
F16 Brake Chamber CL:29.728 IL:27.842
F9 CL:29.676 IL:27.759
1.007 1:135 D150
D150 1:135 3.006
D150 1:135 3.005
F31 CL:28.759 IL:26.467
D150 1:135 3.001
D150 1:80 4.000
D150 1:135 4.000
D150 1:134 1.008
F33 CL:28.727 IL:26.244
F32 CL:28.711 IL:26.370
3.004 1:135 D150
3.003 1:135 D150
F30 CL:28.822 IL:26.504

Adoptable Foul Water Pump Station:
To be designed by pump station manufacturer
approximate number of dwellings to be pumped: 51 Plots

0 0.1 0.2 0.3 0.4 0.5m
Scale 1:5

Rev	Date	Description	DRA	CHK	APP
P01	10/04/25	Issued for comment / approval	TB	EO	EO

Project
Tattenhall Road, Tattenhall

Client
Gladman Developments Ltd

Drawing Title
Preliminary Foul Water Drainage Strategy

Scale	Date	Status
1:500 @ A1	10/04/25	Preliminary

DWG No. SHF1132307-ENZ-XX-XX-DR-D-0002 **Revision** P01

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APPENDICES

Appendix 1 - Topographic Survey



N

NOTES

THIS SURVEY IS ORIENTATED TO ORDNANCE SURVEY GRID NORTH. THE SURVEY IS TO A PLANE GRID. HORIZONTAL MEASUREMENTS TAKEN FROM THIS SURVEY WILL BE GROUND DISTANCES.

SITE CENTRE: E 348879, N 359320

LOCAL SCALE FACTOR: 0.9996334

ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM GENERATED BY ACTIVE GPS NETWORK.

DRAINAGE:-

NO ALLOWANCE HAS BEEN MADE FOR SUB SURFACE ACCESS TO MANHOLES OR INSPECTION BOX TYPE BELOW GROUND DIRECTLY FROM THE SURFACE OR FROM THE SURFACE AND TRUS WILL ONLY BE APPROXIMATE. ANY FLOW TYPES (FOUL WATER, SURFACE WATER OR COMBINED) ARE ASSUMED AND THEREFORE REQUIRE VERIFICATION.

ROAD MARKINGS:-

ROAD MARKINGS DISPLAYED ARE SYMBOLIC. LENGTH, SPACING AND THICKNESS ETC ARE INDICATIVE ONLY.

LEGEND

- 362.9 SPOT LEVEL
- SURVEY STATION
- SAPLING
- BUSHES/SHRUB
- TREE (INDICATIVE ONLY)
- HEDGE/AREA OF UNDERGROWTH
- 99.00 CONTOUR
- GATE
- OVERHEAD CABLE
- FENCE
- 1 PHOTOGRAPH LOCATION AND NUMBER

ABBREVIATIONS

AA	ARCH LEVEL	LB	LETTER BOX
AV	AIR VALVE	LP	LAMPOST
BB	BUS BOX	MH	MANHOLE
BC	BOLLARD BEACON	MK	MARKER
BH	BOREHOLE	OHC	OVERHEAD CABLE
BL	BICI LEVEL	OL	OPENING LEVEL
BS	BUS STOP	OSBM	OS BENCHMARK
CB	CATCH PIT	P	POST
CB	CLOSED BOARD FENCE	PR	POST AND RAIL FENCE
CA	CHAIN LINK FENCE	PW	POST AND WIRE FENCE
CaTV	CABLE TELEVISION COVER	PEC	PEDESTRIAN CROSSING
CC	CONTROL CABIN	PM	PARKING METER
CL	CROWN LEVEL	PL	PARKING LEVEL
Conc/p	CONCRETE PANEL FENCE	RWL	RETAINING WALL
CPY	CANOPY	SAP	SAPLING
CL	CROWN LEVEL	SEC	SECURITY CAMERA
Cstv	CABLE STAY	SGY	STRIP GULLY
CTP	CABLE TV DIVISION POINT	SL	SPRINGING LEVEL
CYK	CYCLE RACK	SP	SIGNPOST
DK	DROPPED KERB	Spl.	SPRINGING LEVEL
DP	DOWNPIPE	SV	STOP VALVE
EP	ELECTRIC INLET POINT	Tac	TACTILE PAVING
EP	ELECTRICITY DISTRIBUTION COVER	TBS	TRAFFIC BOLLARD
EP	ELECTRICITY SUPPLY POLE	TE/7	TREE = NUMBER
ER	EARTH ROD	THL	THRESHOLD LEVEL
FH	FIRE HYDRANT	TL	TOP OF LEDGE
FL	FIELD LEVEL	ToF	TOP OF FENCE
G/DP	GULLY AND DOWNPIPE	ToW	TOP OF WALL
GP	GATE POST	TP	TELEPHONE POLE
GP	GAS PIPE	WM	WIRE MESH FENCE
GV	GAS VALVE	WF	WOODEN RAIL FENCE
IC	INSPECTION CHAMBER	WLV	WATER LEVEL
IL	INVERT LEVEL	WM	WATER METER
IR	IRON RAILING FENCE	WO	WASH OUT
KO	KERB OUTLET		

STATION CO-ORDINATES

STATION	EASTING	NORTHING	LEVEL	DESCRIPTION
STN1	349040.68	359204.48	29.29	Survey Nail
STN2	349041.62	359293.30	29.48	Survey Nail
STN3	349040.47	359351.87	32.57	Survey Nail
STN4	349029.43	359126.18	31.97	Survey Nail

TREE SCHEDULE

No.	DIAM.	SPREAD Ø	HEIGHT
TE/1	1.20	24	20
TE/2	0.50	10	10
TE/3	1.30	19	16
TE/4	0.90	18	16
TE/5	0.90	18	16
TE/6	1.10	20	16
TE/7	1.10	22	16
TE/8	1.00	18	16
TE/9	0.90	16	16
TE/10	0.80	16	16
TE/11	1.00	16	18
TE/12	1.10	16	14
TE/13	0.95	20	18
TE/14	0.90	20	20
TE/15	0.75	20	20
TE/16	0.65	18	20
TE/17	0.80	18	18
TE/18	1.00	20	18
TE/19	0.50	10	8
TE/20	0.80	16	14
TE/21	0.80	12	14
TE/22	0.30	12	12

TREE DIAMETER MEASURED APPROXIMATELY 1.5M ABOVE GROUND LEVEL. TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE GENERALISED CANOPY SIZE. TREE BOLE MAY NOT SIT CENTRALLY TO THE CANOPY. TREE HEIGHT ESTIMATED FROM GROUND LEVEL.

Rev	Date	Revision notes	By
*	*	*	*

DO NOT SCALE FROM THIS DRAWING

Status: **INFORMATION**

THE SURVEY ASSOCIATION AFFILIATE MEMBER

Project: **Tattenhall Road, Tattenhall.**

Title: **TOPOGRAPHICAL SURVEY AS OF 27.08.24 SHEET 1 OF 1**

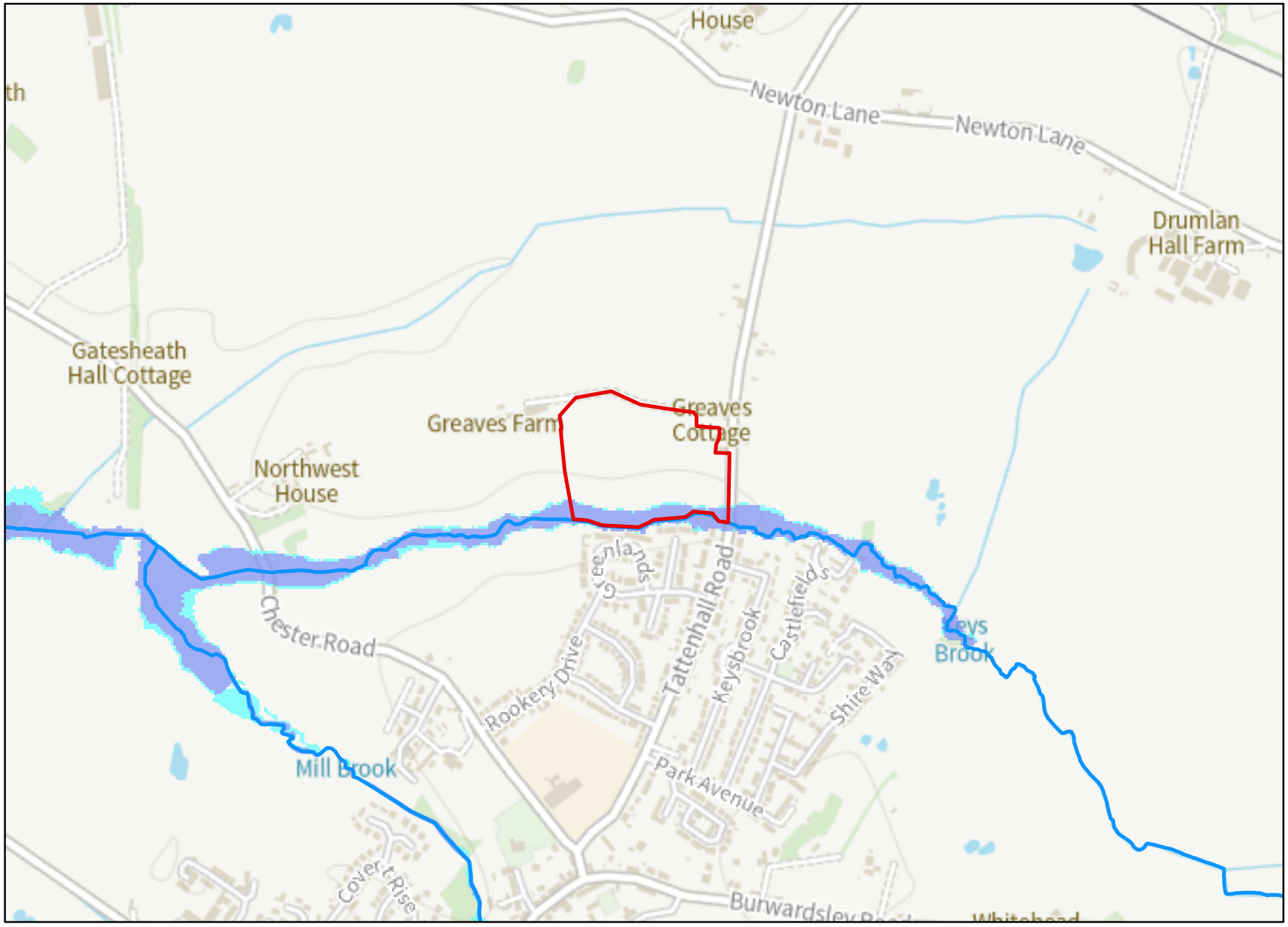
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Gladman House, Alexandria Way
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CW12 1LB
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Drawn By	Publish Date	Scale(s)	Sheet Size
JH	24.10.24	1:500	A0

Project no.	Drawing no.	Revision
2023-030	Topo_01_2D	0

Appendix 2 - EA Correspondence

Detailed Flood Map Centred on Tattenhall Road, Tattenhall, Chester, CH3 9QY.
Created 23/10/2024 [GMMC381302SW]



Environment Agency

1:10,001

N

Legend

- Site Location
- Main River
- Flood Zone 3
- Flood Zone 2

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Outlook

GMMC381302SW Response attached from the Environment Agency

From GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Date Mon 28/10/2024 13:57
To Daniel Alstead <daniel.alstead@enzygo.com>

1 attachments (2 MB)
GMMC381302SW DFM.pdf;

Dear Daniel,

Thank you for your enquiry which was received on 18/10/24.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

There are currently no detailed modelling data for your site.
Please see attached for a Detailed Flood Map which displays your site in relation to the Flood Zones in that area.

Please note: J-Flow is broadscale National Generalised Modelling and as such is not sufficiently accurate for use in Flood Risk Assessments.

We have no records of flooding affecting the site.

However, this does not mean flooding has not occurred in the past or that it will not flood in future.

We recommend that you also contact United Utilities and Lead Local Flood Authority Cheshire West and Chester,
who may hold additional information (the former especially in relation to sewer flooding).

There are no flood defences in the vicinity of the site.

There are no 2D levels available for this site.

Lead Local Flood Authority Cheshire West and Chester is responsible for issues relating to surface water and hold information on surface water flooding.

For surface information please use the link:
https://check-long-term-flood-risk.service.gov.uk/map?easting=362125.07&northing=388310.97&map=SurfaceWater

Please be aware you can check your risk of flooding on our external website
https://flood-warning-information.service.gov.uk/long-term-flood-risk/

Here are some useful links below:
https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Please refer to the Open Government Licence which explains the permitted use of this information.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Sarah Walters

Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire
Email: Inforequests.gmmc@environment-agency.gov.uk
Office address: Richard Fairclough House, Knutsford Road, Latchford, Warrington, WA14 4UW

From: Daniel Alstead <daniel.alstead@enzygo.com>
Sent: 18 October 2024 11:34
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>; LLFA@cheshirewestandchester.gov.uk
Cc: Edward Willis <Edward.willis@enzygo.com>; Helena Du-Roe (Guest) <helena.du-roe@enzygo.com>; Ben Davies <Ben.Davies@enzygo.com>; Rory Brown <Rory.Brown@enzygo.com>
Subject: REF:241021/CS06 Flood Risk and Drainage Enquiry - Land West of Tattenhall Road, Tattenhall

Our Reference: SHF.1132.307 - Land West of Tattenhall Road, Tattenhall

Location: Land West of Tattenhall Road, Tattenhall, Chester, CH3 9QY [NGR: 348888, 359316]

To whom it may concern,

Introduction

Enzygo have been commissioned to prepare a Flood Risk Assessment [FRA], inclusive of an outline drainage strategy [surface water and foul] for a proposed outline planning application for a residential development, located on the above 'Site'. A location plan is included in Figures 1 and 2.

Ordnance Survey [OS] mapping shows Keys Brook [a 'main river'] conveys flows west along the southern boundary of the Site.

Environment Agency online Flood Map for Planning [Figure 1] shows most of the Site is in Flood Zone 1, at 'low' risk of fluvial [river] flooding. There is an area in the southernmost extent, adjacent to Keys Brook, which is in Flood Zone 2 and 3, at 'medium' to 'high risk'. The online flood mapping does not differentiate between Flood Zone 3a and 3b [functional flood zone] and does not necessarily allow for latest climate change allowances.

Environment Agency online surface water mapping [Figure 2] shows most the Site is located outside the mapped extent of surface water flooding. The flow pathway along the reach of Keys Brook is indicative of fluvial flooding. There are small areas of surface water ponding ['low' to 'high' risk, which is likely to be generated by low permeable [Clayey] soils and topographic low spots.

Figure 1: Flood Map for Planning

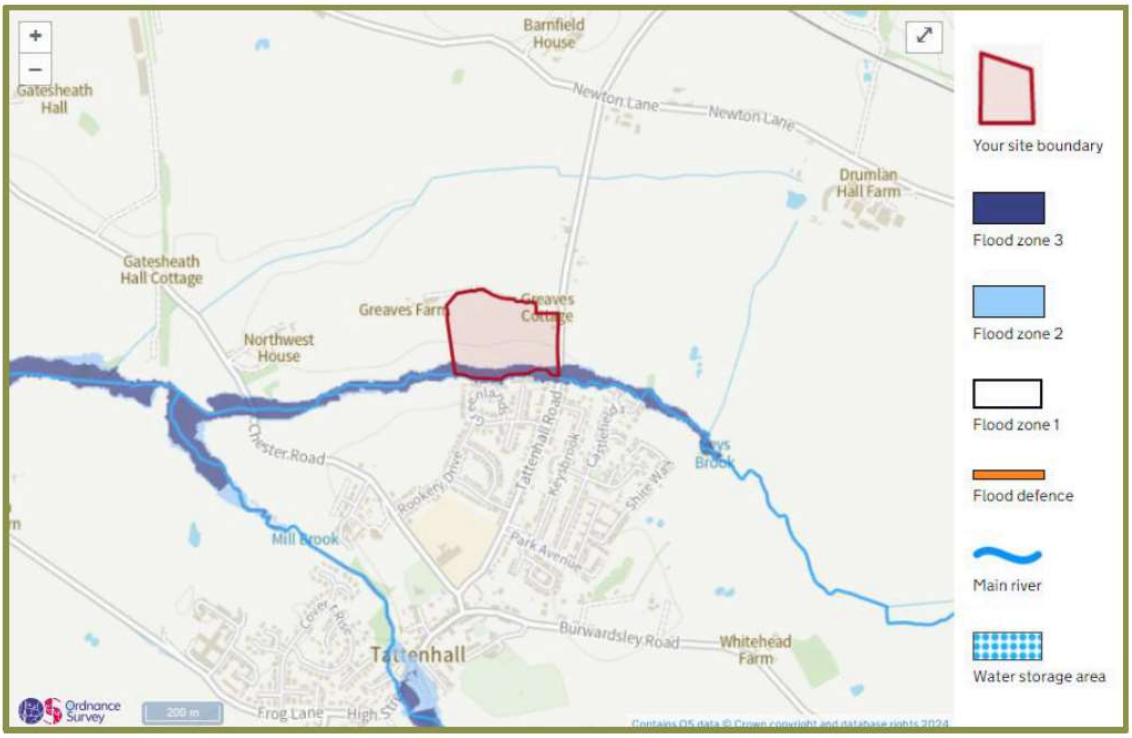
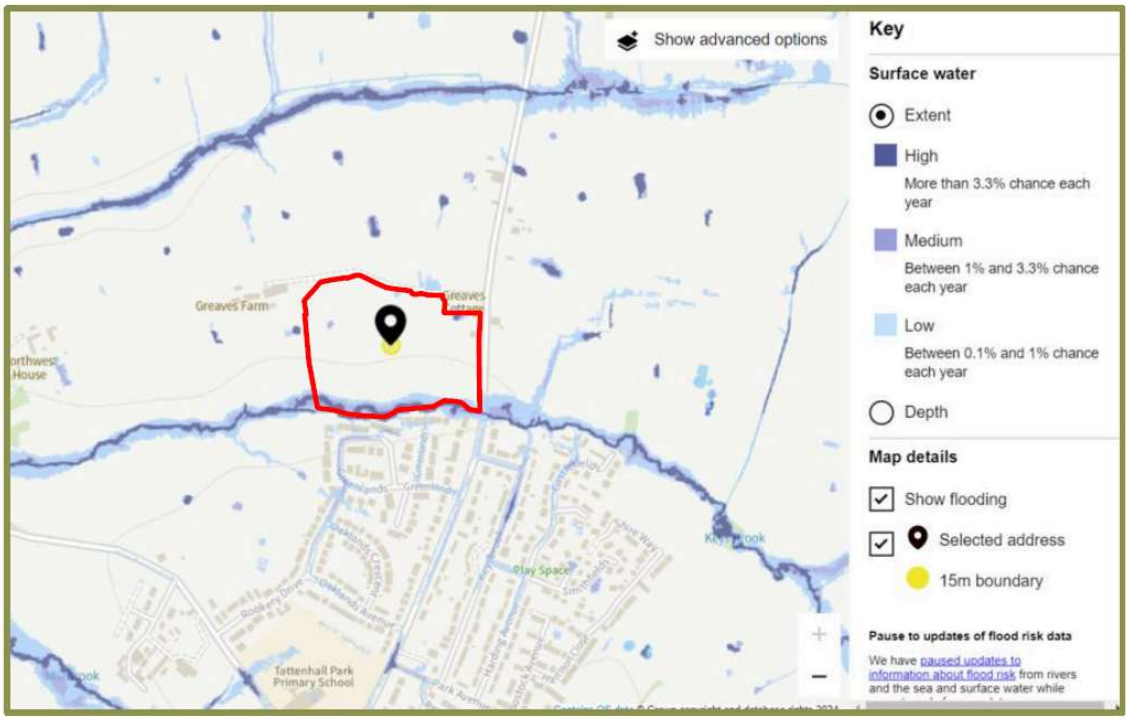


Figure 2: Surface Water Mapping



Data Request

Could you provide us with flooding data? In relation to the Site, we would require clarification on the following points. Please note we are consulting with both the Environment Agency and Lead Local Flood Authority [LLFA].

Flood Risk

- **Can you confirm the Flood Zone[s] within the Site boundary as described above?**
- **Please can you provide modelled flood levels, where available? Can you comment on the age of the model from which the levels have been extracted? Where the 1 in 100-year modelled flood levels do not current climate change allowances, would you allow an interpolated level, or would you require a model re-run?**

- **Do you agree with our above interpretation of surface water flooding? If so, would you accept the use of the surface water flood outline as a conservative representation of fluvial flooding along Keys Brook in lieu of a hydraulic modelling exercise? To provide a level of confidence, the developable area (including surface water attenuation) could be set topographically higher than the mapped outline (i.e. sequential development of the Site to the lowest risk area within the redline boundary, outside the mapped outline). Or would you require a site-specific hydraulic model?**
- **Do you have any records of historic flooding events on this Site, either from fluvial, surface water, groundwater, sewers or infrastructure failure sources? If you are aware of historical flooding at the Site, can you please provide us with details of these historical flood events where it is available, including flood levels, estimated return periods, photographs, and other such data as may be relevant to our study?**

Drainage

In accordance with requirement H3 of the Building Regulations 2000 rainwater runoff must discharge to one of the following, listed in order of priority:

I. *An adequate soakaway or some other adequate infiltration system:* Soils and geology mapping indicate that infiltration-based SuDS may not feasible due to low infiltration potential into the Clayey superficial deposits [Till, Devensian - Diamicton]. Perched (shallow) groundwater may be present in the Alluvium deposits [where present along Keys Brook. Infiltration into the underlying Sandstone would be subject to the depth of the weathered layer and presence of groundwater. **Would you accept a desktop study of soils/geology/available borehole records/infiltration potential mapping in lieu of soakaway testing?**

   Furthermore, the Site is located above a Principal Aquifer [bedrock designation]. **Would you require a Hydrogeological Risk Assessment to demonstrate that the development does not increase flood risk or impact on controlled waters quality [surface water and groundwater] for both the construction and operational phases.**

II. *A watercourse:* Keys Brook conveys flows west along the southern boundary of the Site. **Would you require a Water Framework Directive Assessment to establish an outfall to the bounding main river?**

III. *A sewer:* At this stage we do not hold sewer asset plans for the Site and immediate vicinity. We would need to obtain sewer asset plans and request a pre-development enquiry with United Utilities.

   The potential route to discharge surface water from the proposed development will be by outfall to the bounding watercourse. The potential route to discharge foul flows from the proposed development will be by connection to the nearby public sewer network. **Would you accept a surface water outfall to Keys Brook, discharging at the calculated QBAR rate?**

Further to the above, could you also comment on the below:

- **Do you have any information on drainage within the Site and in the local area, including any known drainage problems?**
- **What level of allowance for climate change would be required when considering surface water attenuation?**
- **Please can you also indicate to us whether you are aware of any relevant environmentally sensitive receptors [such as aquatic wildlife in receiving watercourses, etc.] in the area around the Site that we should be aware of when preparing the surface water drainage strategy?**

Closure

We trust that the details presented herein are self-explanatory and clear. If, for any reason you should have any queries or comments, please do not hesitate to contact me.

Best Regards

Daniel Alstead BSc (Hons), MSc, MCIWEM, C.WEM
Director of Hydrology

Phone: 0114 321 5151
Mobile: 07595 654 238
Email: daniel.alstead@enzygo.com
Web: enzygo.com

Air Quality | Landscape | Hydrology | Permitting | Ecology | Geo-environmental | Noise | Transport | Planning | Arboriculture

enzygo.com

**Enzygo Ltd, Enzygo GeoEnvironmental Ltd, Brown2Green Associates Ltd,
Offices in Bristol, Cardiff, Cambridge, Sheffield & Manchester**

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At Enzygo Ltd we merit any and all comments received from our clients, take pride in providing an excellent service and place value on our ability to correct error. Should you wish to comment on any aspect of the service that I personally, or Enzygo Ltd as a whole, have given you, please reply through my e-mail address above, or email hello@enzygo.com (in confidence - if appropriate).

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Appendix 3 - Cheshire West and Chester Council Correspondence

Eric O'Connor

From: Goodship, Esther <Esther.Goodship@atkinsrealis.com>
Sent: 30 October 2024 15:19
To: Daniel Alstead
Cc: LLFA; Edward Willis; Helena Du-Roe; Ben Davies; Rory Brown
Subject: RE: Flood Risk and Drainage Enquiry - Land West of Tattenhall Road, Tattenhall

Some people who received this message don't often get email from esther.goodship@atkinsrealis.com. Learn why this is important

Hi Daniel,

I provide support to the CWAC LLFA and provide responses to your queries in red below.

Kind regards

Esther Goodship BSc MRes CSci CEnv CWEM MCIWEM
Associate Director (Flood Risk Management)
AtkinsRéalis
Tel: 01925 238342
Chadwick House
Birchwood Science Park, Warrington, WA3 6AE

From: LLFA <LLFA@cheshirewestandchester.gov.uk>
Sent: 21 October 2024 13:59
To: Goodship, Esther <Esther.Goodship@atkinsrealis.com>
Subject: FW: Flood Risk and Drainage Enquiry - Land West of Tattenhall Road, Tattenhall

Hi Esther,

Another enquiry from Enzygo. Are you able to offer some advice please?

Thanks

From: Daniel Alstead <daniel.alstead@enzygo.com>
Sent: 18 October 2024 11:34
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>; LLFA <LLFA@cheshirewestandchester.gov.uk>
Cc: Edward Willis <Edward.willis@enzygo.com>; Helena Du-Roe <helena.du-roe@enzygo.com>; Ben Davies <Ben.Davies@enzygo.com>; Rory Brown <Rory.Brown@enzygo.com>
Subject: Flood Risk and Drainage Enquiry - Land West of Tattenhall Road, Tattenhall

You don't often get email from daniel.alstead@enzygo.com. Learn why this is important

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Our Reference: SHF.1132.307 - Land West of Tattenhall Road, Tattenhall

Location: Land West of Tattenhall Road, Tattenhall, Chester, CH3 9QY [NGR: 348888, 359316]

To whom it may concern,

Introduction

Enzygo have been commissioned to prepare a Flood Risk Assessment [FRA], inclusive of an outline drainage strategy [surface water and foul] for a proposed outline planning application for a residential development, located on the above 'Site'. A location plan is included in Figures 1 and 2.

Ordnance Survey [OS] mapping shows Keys Brook [a 'main river'] conveys flows west along the southern boundary of the Site.

Environment Agency online Flood Map for Planning [Figure 1] shows most of the Site is in Flood Zone 1, at 'low' risk of fluvial [river] flooding. There is an area in the southernmost extent, adjacent to Keys Brook, which is in Flood Zone 2 and 3, at 'medium' to 'high risk'. The online flood mapping does not differentiate between Flood Zone 3a and 3b [functional flood zone] and does not necessarily allow for latest climate change allowances.

Environment Agency online surface water mapping [Figure 2] shows most the Site is located outside the mapped extent of surface water flooding. The flow pathway along the reach of Keys Brook is indicative of fluvial flooding. There are small areas of surface water ponding ['low' to 'high' risk, which is likely to be generated by low permeable [Clayey] soils and topographic low spots.

Figure 1: Flood Map for Planning

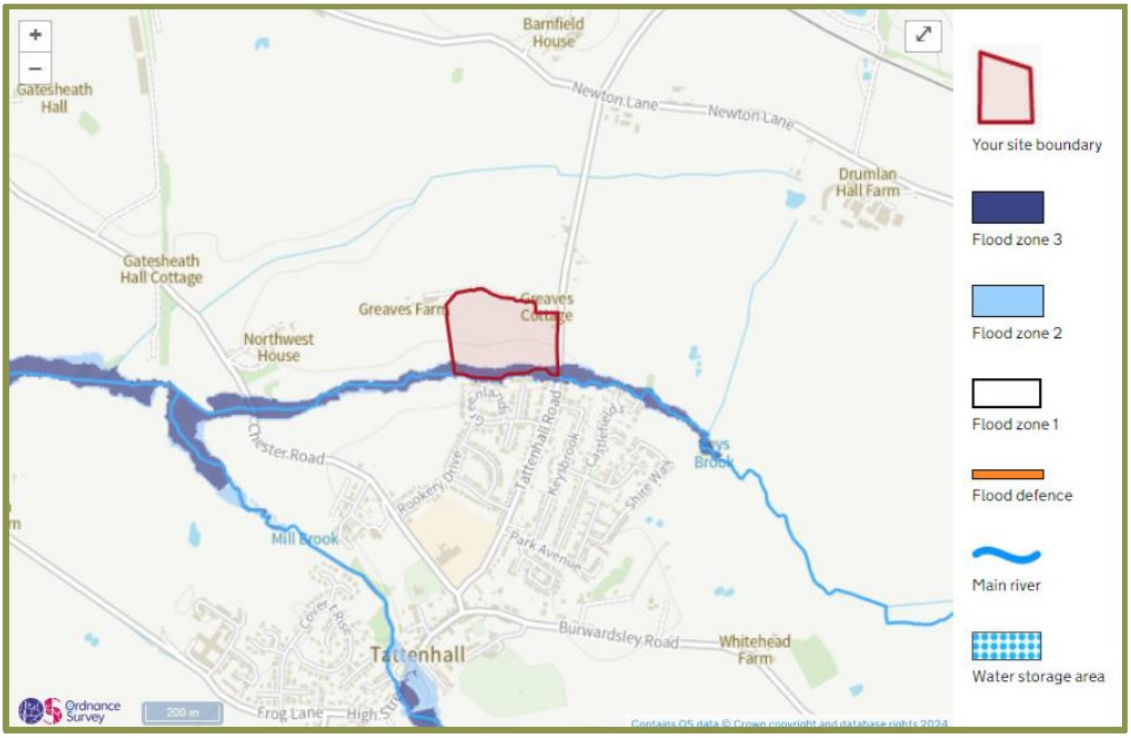
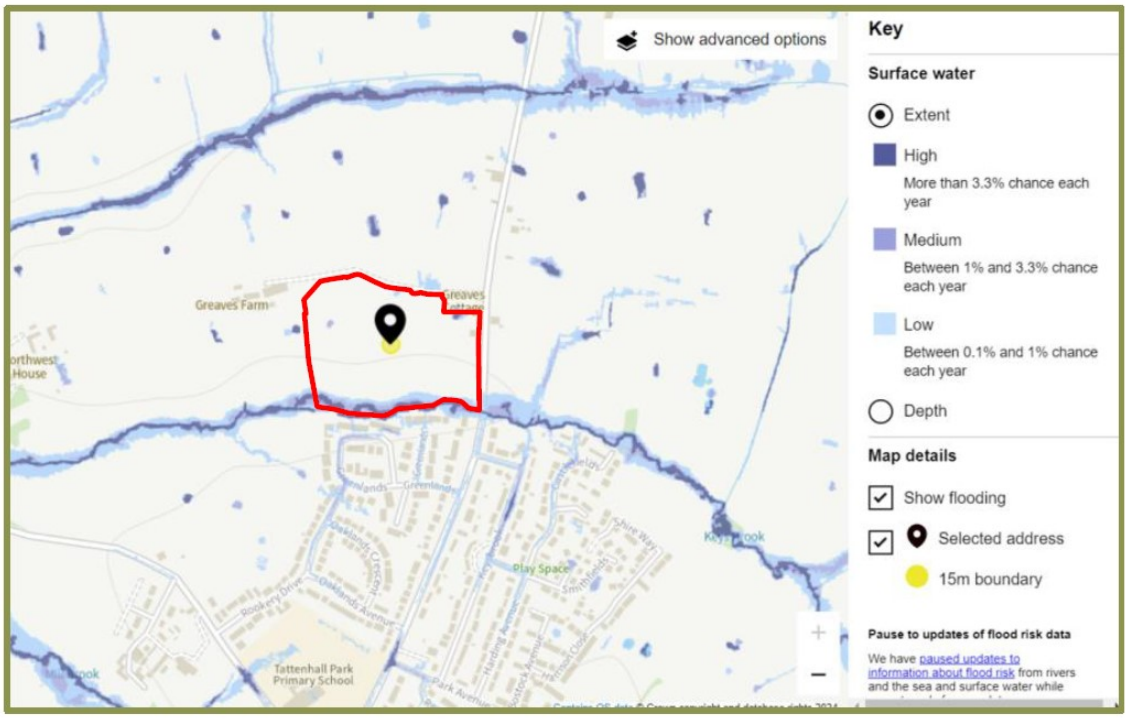


Figure 2: Surface Water Mapping



Data Request

Could you provide us with flooding data? In relation to the Site, we would require clarification on the following points. Please note we are consulting with both the Environment Agency and Lead Local Flood Authority [LLFA].

Flood Risk

- **Can you confirm the Flood Zone[s] within the Site boundary as described above? Environment Agency to confirm**
- **Please can you provide modelled flood levels, where available? Can you comment on the age of the model from which the levels have been extracted? Where the 1 in 100-year modelled flood levels do not current climate change allowances, would you allow an interpolated level, or would you require a model re-run? CWAC do not have any flood model outputs for Mill Brook or Keys Brook.**
- **Do you agree with our above interpretation of surface water flooding? If so, would you accept the use of the surface water flood outline as a conservative representation of fluvial flooding along Keys Brook in lieu of a hydraulic modelling exercise? To provide a level of confidence, the developable area (including surface water attenuation) could be set topographically higher than the mapped outline (i.e. sequential development of the Site to the lowest risk area within the redline boundary, outside the mapped outline). Or would you require a site-specific hydraulic model? As the brook is Man River, the flood outline should be based on the Environment Agency fluvial flood mapping rather than surface water**
- **Do you have any records of historic flooding events on this Site, either from fluvial, surface water, groundwater, sewers or infrastructure failure sources? If you are aware of historical flooding at the Site, can you please provide us with details of these historical flood events where it is available, including flood levels, estimated return periods, photographs, and other such data as may be relevant to our study? Tattenhall has experienced flooding within the vicinity from Keys Brook and in other areas from Mill Brook during Storm Christoph and Storm Babet.**

Drainage

In accordance with requirement H3 of the Building Regulations 2000 rainwater runoff must discharge to one of the following, listed in order of priority:

I. *An adequate soakaway or some other adequate infiltration system:* Soils and geology mapping indicate that infiltration-based SuDS may not feasible due to low infiltration potential into the Clayey superficial deposits [Till, Devensian - Diamicton]. Perched (shallow) groundwater may be present in the Alluvium deposits [where present along Keys Brook. Infiltration into the underlying Sandstone would be subject to the depth of the weathered layer and presence of groundwater. **Would you accept a desktop study of soils/geology/available borehole records/infiltration potential mapping in lieu of soakaway testing? Infiltration testing should be provided to confirm the drainage hierarchy**

   Furthermore, the Site is located above a Principal Aquifer [bedrock designation]. **Would you require a Hydrogeological Risk Assessment to demonstrate that the development does not increase flood risk or impact on controlled waters quality [surface water and groundwater] for both the construction and operational phases. Controlled waters is a matter for the Environment Agency**

II. *A watercourse:* Keys Brook conveys flows west along the southern boundary of the Site. **Would you require a Water Framework Directive Assessment to establish an outfall to the bounding main river? Environment Agency to confirm**

III. *A sewer:* At this stage we do not hold sewer asset plans for the Site and immediate vicinity. We would need to obtain sewer asset plans and request a pre-development enquiry with United Utilities.

   The potential route to discharge surface water from the proposed development will be by outfall to the bounding watercourse. The potential route to discharge foul flows from the proposed development will be by connection to the nearby public sewer network. **Would you accept a surface water outfall to Keys Brook, discharging at the calculated QBAR rate? Yes, any new outfall into a watercourse would require limiting to QBAR greenfield runoff rate and would be subject to Environmental Permit. The drainage design should consider a submerged outfall.**

Further to the above, could you also comment on the below:

- **Do you have any information on drainage within the Site and in the local area, including any known drainage problems? There are no known drainage issues within the area other than those hydraulically connected to flooding of watercourses.**
- **What level of allowance for climate change would be required when considering surface water attenuation? 45% climate change allowance on rainfall**
- **Please can you also indicate to us whether you are aware of any relevant environmentally sensitive receptors [such as aquatic wildlife in receiving watercourses, etc.] in the area around the Site that we should be aware of when preparing the surface water drainage strategy? Not known, a survey would have to be carried out by the applicant**

Closure

We trust that the details presented herein are self-explanatory and clear. If, for any reason you should have any queries or comments, please do not hesitate to contact me.

Best Regards

Daniel Alstead BSc (Hons), MSc, MCIWEM, C.WEM
Director of Hydrology

Phone: 0114 321 5151
Mobile: 07595 654 238
Email: daniel.alstead@enzygo.com
Web: enzygo.com

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Appendix 4 - Dwr Cymru Asset Plans and Correspondence

Dŵr Cymru
Welsh Water

Land west of Tattenhall Road Chester CH3 9QY

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the company's apparatus. The onus of locating apparatus before carrying out any excavations rests entirely on you. The information which is supplied by the Company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 which is based upon the best Information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain or disposal main and any associated apparatus laid before 1 September 1989, or, if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map Ref:	348876,359270
Map scale:	1:3500
Printed by:	Warren Rees
Printed on:	15 Nov 2024

Dŵr Cymru
Welsh Water

Developer Services
PO Box 3146
Cardiff
CF30 0EH

Tel: +44 (0)800 917 2652
Fax: +44 (0)2920 740472
E.mail: developer.services@dwrcymru.com

Gwasanaethau Datblygu
Blwch Post 3146
Caerdydd
CF30 0EH

Ffôn: +44 (0)800 917 2652
Ffacs: +44 (0)2920 740472
E.bost: developer.services@dwrcymru.com

Miss Dani Lister
Enzygo Ltd
Offices 3-4, Samuel House
Sheffield
South Yorkshire
S36 2AA

Date: 05/12/2024
Our Ref: PPA0009062

Dear Miss Lister,

Grid Ref: 348871 359317
Site Address: Land west of Tattenhall Road, Tattenhall
Development: Residential Development - 150 units

I refer to your pre-planning enquiry received relating to the above site, seeking our views on the capacity of our network of assets and infrastructure to accommodate your proposed development. Having reviewed the details submitted I can provide the following comments which should be taken into account within any future planning application for the development.

APPRAISAL

Firstly, we note that the proposal relates to a residential development for 150 no. units on land west of Tattenhall Road, Tattenhall, Cheshire and acknowledge that the site comprises of a potential windfall development with no allocated status in the Local Plan. Accordingly, whilst it does not appear an assessment has been previously undertaken of the public sewerage and watermains systems, we offer the following comments as part of our appraisal of this development.

PUBLIC SEWERAGE NETWORK

The proposed development site is located in the immediate vicinity of a mixed sewerage system comprising combined and foul, as well as surface water, public sewers which drain to Tattenhall Wastewater Treatment Works (WwTW).

You are also advised that some public sewers and lateral drains may not be recorded on our maps of public sewers because they were originally privately owned and were transferred into public ownership by nature of the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011. The presence of such assets may affect the proposal. In order to assist you may contact Dwr Cymru Welsh Water on 0800 085 3968 to establish the location and status of the apparatus in and around your site. Please be mindful that under the Water Industry Act 1991 Dwr Cymru Welsh Water has rights of access to its apparatus at all times.

glas
Glas Cymru Cyfyngedig

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We welcome correspondence in Welsh and English

Dŵr Cymru Cyf, a limited company registered in Wales no 2366777. Registered office: Pentwyn Road, Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu gohebiaeth yn y Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn Nelson, Treharris, Morgannwg Ganol CF46 6LY.

SURFACE WATER DRAINAGE

With respect to the disposal of surface water flows from the proposed development, the developer is required to explore and fully exhaust all surface water drainage options outlined under Sections 3.2 and 3.4 of Part H of the publication 'Building Regulations 2000. Disposal should be made through the hierarchical approach, preferring infiltration and, where infiltration is not possible, disposal to watercourses in liaison with the Land Drainage Authority, Natural England and/or the Environment Agency. Discharge of surface water to the public sewer is only to be made as a last resort. In addition, please note that no highway or land drainage run-off will be permitted to discharge directly or indirectly into the public sewerage system.

FOUL WATER DRAINAGE – SEWERAGE NETWORK

We have considered the impact of foul flows generated by the proposed development and concluded it is unlikely that sufficient capacity exists to accommodate your development within the immediate public sewerage system without causing detriment to the existing services we provide to our customers, or in regard to the protection of the environment. There are no planned reinforcement works within Dwr Cymru Welsh Water's Capital Investment Programme and therefore, at this stage, we are unable to provide you with a point of adequacy on the network.

In light of the above, our recommendation is that the developer undertakes a development enabling assessment analysis to identify a solution for mitigating the impact of the proposed development. This may include the removal of surface water flows from the immediate public sewerage system to offset the new foul flows from the development. Where this is not possible, the identification of an alternative reinforcement solution to the network via further hydraulic modelling analysis will be required to identify suitable off-site reinforcement works to the public sewerage system. Please note that we will seek to control the identification and delivery of a solution via appropriate planning conditions and therefore recommend that a development enabling assessment analysis is undertaken in advance of a planning application being submitted, in order to avoid any subsequent delays. Please contact us to discuss further on this matter.

You may need to apply to Dwr Cymru Welsh Water for any connection to the public sewer under Section 106 of the Water industry Act 1991. However, if the connection to the public sewer network is either via a lateral drain (i.e. a drain which extends beyond the connecting property boundary) or via a new sewer (i.e. serves more than one property), it is now a mandatory requirement to first enter into a Section 104 Adoption Agreement (Water Industry Act 1991). The design of the sewers and lateral drains must also conform to the Welsh Ministers Standards for Foul Sewers and Lateral Drains, and conform with the publication "Sewers for Adoption"- 7th Edition. Further information can be obtained via the Developer Services pages of www.dwrcymru.com.

FOUL WATER DRAINAGE – SEWAGE TREATMENT

No problems are envisaged with the Wastewater Treatment Works for the treatment of domestic discharges from this site.

POTABLE WATER SUPPLY

This development is not within DCWW potable water catchment.

I trust the above information is helpful and will assist you in forming water and drainage strategies that should accompany any future planning application. I also attach copies of our water and sewer extract plans for the area, and a copy of our Planning Guidance Note which provides further information on our approach to the planning process, making connections to our systems and ensuring any existing public assets or infrastructure located within new development sites are protected.

Please note that our response is based on the information provided in your enquiry and should the information change we reserve the right to make a new representation. Should you have any queries or wish to discuss any aspect of our response please do not hesitate to contact our dedicated team of planning officers, either on 0800 917 2652 or via email at **developer.services@dwrcymru.com**

Please quote our reference number in all communications and correspondence.

Yours faithfully,

Rhys Evans
Planning Liaison Manager
Developer Services

***Please Note** that demands upon the water and sewerage systems change continually; consequently, the information given above should be regarded as reliable for a maximum period of 12 months from the date of this letter.*

Appendix 5 - United Utilities Asset Plans

Water for the North West

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

Your Ref: 212011
Our Ref: UUPS-ORD-523337
Date: 09/10/2023

Atkins - Utility Solutions

The Hub
500 Park Avenue,, Aztec West, Almondsbury
Bristol,
BS32 4RZ

FAO:

Dear Sirs

Location: Site off Tattenhall Road Tattenhall Chester

I acknowledge with thanks your request dated 06/10/2023 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. http://www.unitedutilities.com/work-near-asset.aspx .

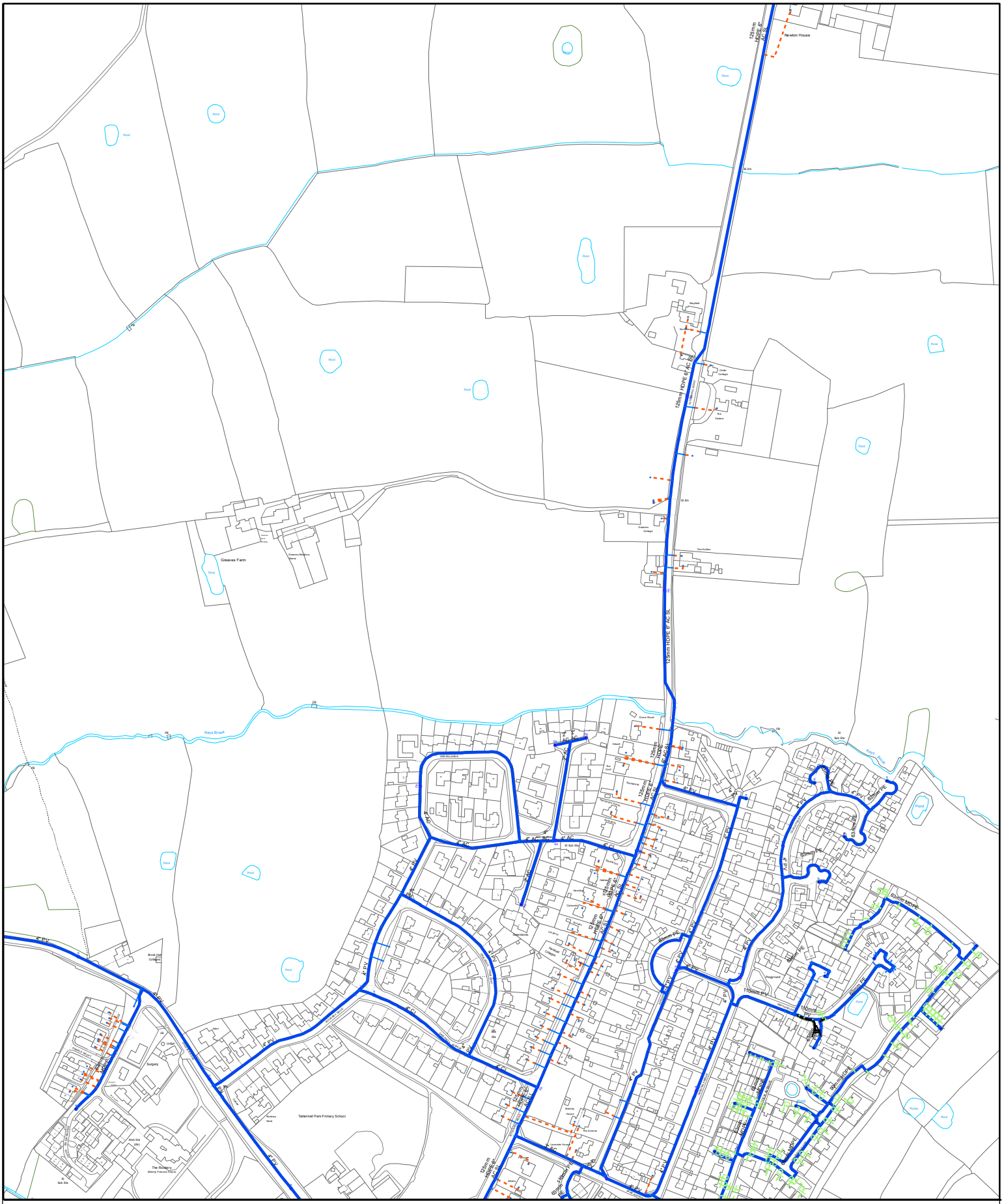
I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please contact us .

Yours Faithfully,

Karen McCormack
Property Searches Manager

United Utilities Water Limited
Registered In England & Wales No. 2366678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP



Date: 09/10/2023

Printed By:
Property Searches

Extract from Map Of Water Mains

Site off Tattenhall Road Tattenhall Chester

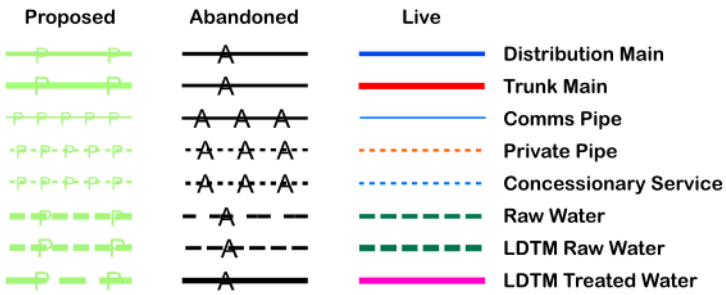
United Utilities
Water for the North West

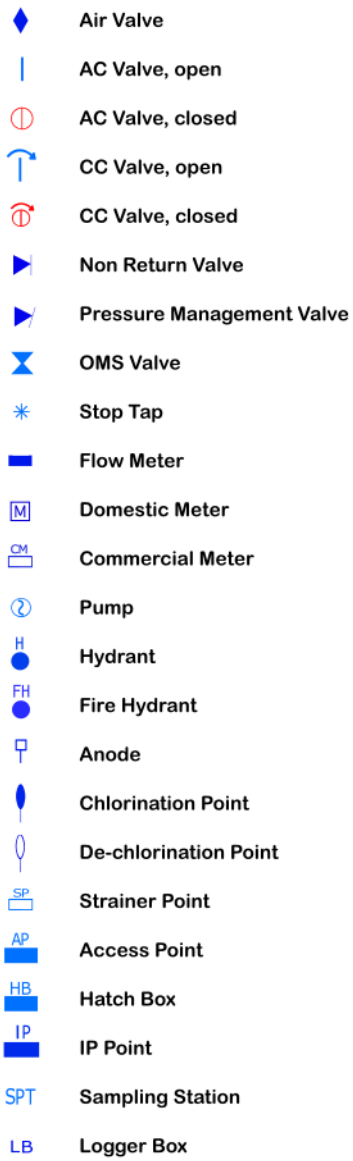
The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded. United Utilities Water PLC will not accept any liability for any damage caused by the actual positions being different from those shown.

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United Utilities
Water for the North West

Clean Water Symbology







Symbology for proposed assets is the same as above, but shown in green
Symbology for abandoned assets is the same as above, but shown in **black**

Water for the North West

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

United Utilities Water Limited
Registered In England & Wales No. 2366678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP

Appendix 6 - BGS Borehole Records

British Geological Survey

BGS ID: 162782 : BGS Reference: SJ45NE14
British National Grid (27700) : 348606,359405

(*11932) Wt.30370/0370 10,000 9/39 A.& E.W.Ltd. Gp.685 25 45NE/14

Name and Number of Shaft or Bore given by Geological Survey:
Water bore at TATTENHALL

County Cheshire
6" Quarter Sheet 47SW

SJ 45NE 47SW 14.

Geological Classification	Description	Thickness			Depth		
	GREAVES FARM See 1" & 6" maps.						
	Bore made for Mr. P. Barlow. 2/9/1935 by Messrs Wyatt Bros, Wayland Works, Whitchurch.						
	1" map: 109.						
	6" map: Cheshire 47SW.						
	Surface c. 100ft. O.D.						
	Clay	-	60	0	-	60	0
	clay and marl, soft patches.	-	29	0	-	89	0
	Sandstone	-	26	0	-	115	0
	Rock	-	11	6	-	126	6
	Rest water level 20ft. (6.10m) (not tested).						
	Water level 27ft. (8.23m) when pumping 1000 g.p.h. Lower Rest water level not tested.						
	Lining tubes: 5" diameter to 104ft. (31.70m)						

ft	m
	18.29
	27.13
	35.05
	38.40

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 162782 : BGS Reference: SJ45NE14
British National Grid (27700) : 348606,359405

(°11988) Wt.80870/0870 10,000 9/39 A.& E.W.Ltd. Gp.685

SJ45/6

Name and Number of Shaft or Bore given by Geological Survey:
Water bore at TATTENHALL

County Cheshire
6" Quarter Sheet 47SW

47SW 14

Geological Classification	Description	Thickness			Depth		
					ft		
	GREAVES FARM						
	See 1" & 6" maps.						
	Bore made for Mr. P. Barlow. 2/9/1935 by Messrs Wyatt Bros, Wrexham Works, Whitchurch.						
	1" map: 107.						
	6" map: Cheshire 47SW.						
	Surface c. 100ft. O.D.						
	Clay	-	60	0	-	60	0
	clay and marl, soft patches	-	29	0	-	89	0
	Sandstone	-	26	0	-	115	0
	Rock	-	11	6	-	126	6
	Rest water level 25ft. (not tested).						
	Water level 27ft. when pumping 100 cub.ft. per hour. Rest water level not tested.						
	Lining tubes: 5" diameter to 104ft.						

Contact BGS: ngdc@bgs.ac.uk

Appendix 7 - Drainage Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	1	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.047	5.00	32.697	1200	348831.943	359403.772	1.425
2	0.084	5.00	32.650	1200	348860.234	359393.286	1.630
3	0.060	5.00	32.638	1200	348913.327	359384.850	1.934
4	0.074	5.00	32.516	1200	348950.487	359376.670	2.036
5	0.017	5.00	31.187	1500	348950.487	359329.586	1.575
17	0.046	5.00	31.109	1200	348919.878	359322.431	1.425
18	0.044	5.00	32.376	1200	349018.122	359344.655	1.425
19	0.078	5.00	31.584	1200	349018.270	359316.672	1.425
20	0.031	5.00	30.953	1200	348968.674	359316.410	1.500
6	0.097	5.00	30.899	1500	348949.158	359318.818	1.712
21	0.018	5.00	30.101	1200	349008.844	359267.836	1.425
22	0.017	5.00	29.688	1200	349009.076	359256.282	1.425
23	0.092	5.00	29.403	1200	348999.802	359250.247	1.500
7	0.047	5.00	28.900	1500	348941.578	359257.389	1.544
8	0.037	5.00	28.851	1500	348911.944	359261.024	1.614
24	0.023	5.00	29.906	1200	348884.431	359284.199	1.425
25	0.030	5.00	29.413	1200	348882.614	359269.474	1.425
9	0.007	5.00	28.766	1500	348890.045	359251.811	1.624
10	0.020	5.00	28.706	1500	348885.652	359249.962	1.583
11	0.027	5.00	28.671	1500	348872.828	359247.607	1.600
12	0.018	5.00	28.653	1500	348856.914	359253.446	1.650
13	0.100	5.00	28.951	1500	348849.470	359262.236	1.994
26	0.060	5.00	32.546	1200	348815.875	359397.508	1.425
27	0.049	5.00	31.798	1200	348817.213	359359.121	1.425
31	0.059	5.00	31.189	1200	348886.865	359326.505	1.500
32	0.046	5.00	31.206	1200	348849.531	359331.111	1.738
28	0.032	5.00	30.960	1200	348820.478	359327.933	1.664
29	0.033	5.00	30.350	1200	348822.624	359307.436	1.500
33	0.038	5.00	29.663	1200	348795.901	359289.647	1.425
34	0.023	5.00	29.698	1200	348834.527	359284.239	1.425
30	0.072	5.00	29.683	1200	348819.725	359286.311	1.662
35	0.047	5.00	32.532	1200	348798.319	359403.829	1.425
36	0.032	5.00	32.301	1200	348769.007	359398.065	1.425
37	0.127	5.00	31.884	1200	348758.164	359381.022	1.500
38	0.078	5.00	29.610	1200	348764.993	359300.555	1.500
14			28.185	1500	348786.001	359255.436	1.300
15			28.185	2100	348780.765	359247.618	1.324
16			27.200	1500	348757.331	359212.621	0.930

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Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	30.172	0.600	31.272	31.095	0.177	170.0	225	5.50	32.2
1.001	2	3	53.759	0.600	31.020	30.704	0.316	170.0	300	6.25	30.6
1.002	3	4	38.050	0.600	30.704	30.480	0.224	170.0	300	6.78	29.4
1.003	4	5	47.084	0.600	30.480	29.687	0.793	59.4	300	7.16	28.7
1.004	5	6	10.850	0.600	29.612	29.262	0.350	31.0	375	7.21	28.5
2.000	17	6	29.502	0.600	29.684	29.412	0.272	108.5	225	5.39	32.5
3.000	18	19	27.983	0.600	30.951	30.159	0.792	35.3	225	5.21	32.9
3.001	19	20	49.597	0.600	30.159	29.528	0.631	78.6	225	5.77	31.6
3.002	20	6	19.664	0.600	29.453	29.337	0.116	170.0	300	6.04	31.0
1.005	6	7	61.895	0.600	29.187	27.506	1.681	36.8	450	7.52	28.0
4.000	21	22	11.556	0.600	28.676	28.263	0.413	28.0	225	5.08	33.2
4.001	22	23	11.065	0.600	28.263	27.978	0.285	38.8	225	5.17	33.0
4.002	23	7	58.660	0.600	27.903	27.656	0.247	237.5	300	6.13	30.8
1.006	7	8	29.856	0.600	27.356	27.237	0.119	250.0	600	7.85	27.4
1.007	8	9	23.758	0.600	27.237	27.142	0.095	250.0	600	8.10	26.9
5.000	24	25	14.837	0.600	28.481	27.988	0.493	30.1	225	5.10	33.1
5.001	25	9	19.162	0.600	27.988	27.517	0.471	40.7	225	5.26	32.8
1.008	9	10	4.766	0.600	27.142	27.123	0.019	250.0	600	8.16	26.8
1.009	10	11	13.038	0.600	27.123	27.071	0.052	250.0	600	8.30	26.6
1.010	11	12	16.951	0.600	27.071	27.003	0.068	250.0	600	8.48	26.3
1.011	12	13	11.519	0.600	27.003	26.957	0.046	250.0	600	8.61	26.1
1.012	13	14	18.040	0.600	26.957	26.885	0.072	250.0	600	8.80	25.7
6.000	26	27	38.410	0.600	31.121	30.373	0.748	51.4	225	5.35	32.6
6.001	27	28	31.358	0.600	30.373	29.371	1.002	31.3	225	5.57	32.1
7.000	31	32	37.617	0.600	29.689	29.468	0.221	170.0	300	5.52	32.2
7.001	32	28	29.226	0.600	29.468	29.296	0.172	170.0	300	5.93	31.3
6.002	28	29	20.609	0.600	29.296	28.850	0.446	46.2	300	6.07	31.0
6.003	29	30	21.323	0.600	28.850	28.021	0.829	25.7	300	6.19	30.7
8.000	33	30	24.056	0.600	28.238	28.096	0.142	170.0	225	5.40	32.5
9.000	34	30	14.946	0.600	28.273	28.096	0.177	84.4	225	5.17	33.0
6.004	30	14	13.351	0.600	28.021	27.285	0.736	18.1	300	6.25	30.6
10.000	35	36	29.873	0.600	31.107	30.876	0.231	129.3	225	5.43	32.4
10.001	36	37	20.200	0.600	30.876	30.459	0.417	48.4	225	5.61	32.0
10.002	37	38	80.756	0.600	30.384	28.110	2.274	35.5	300	6.12	30.9
10.003	38	14	20.905	0.600	28.110	27.285	0.825	25.3	300	6.23	30.6
1.013	14	15	9.409	0.600	26.885	26.861	0.024	400.0	600	8.93	25.5
1.014	15	16	42.118	0.600	26.861	26.270	0.591	71.3	600	9.17	25.2

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	✓	Check Discharge Rate(s)	✓
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	✓
Winter CV	1.000	Additional Storage (m³/ha)	20.0	100 year 360 minute (m³)	

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m^3)	

Node 15 Online StormBrake™ Control

Flap Valve	x	Design Flow (l/s)	14.1
Replaces Downstream Link	x	Product Code	FPM-SB1-01000-01410-1100
Invert Level (m)	26.861	Min Outlet Diameter (m)	0.225
Design Depth (m)	1.000	Min Node Diameter (mm)	1200

Node 14 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	26.885
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	1108.4	0.0	1.000	1616.8	0.0	1.001	0.0	0.0

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Results for 1 year Critical Storm Duration. Lowest mass balance: 96.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	31.326	0.054	5.1	0.0974	0.0000	OK
15 minute summer	2	11	31.101	0.081	13.9	0.1746	0.0000	OK
15 minute summer	3	11	30.805	0.101	19.9	0.1777	0.0000	OK
15 minute summer	4	11	30.569	0.089	27.5	0.1654	0.0000	OK
15 minute summer	5	11	29.688	0.076	28.5	0.1508	0.0000	OK
15 minute summer	17	11	29.732	0.048	5.0	0.0853	0.0000	OK
15 minute summer	18	10	30.986	0.035	4.8	0.0620	0.0000	OK
15 minute summer	19	11	30.231	0.072	13.2	0.1610	0.0000	OK
15 minute summer	20	11	29.545	0.092	16.0	0.1415	0.0000	OK
15 minute summer	6	11	29.288	0.101	59.3	0.2937	0.0000	OK
15 minute summer	21	10	28.698	0.022	2.0	0.0306	0.0000	OK
15 minute summer	22	10	28.296	0.033	3.8	0.0456	0.0000	OK
15 minute summer	23	11	27.990	0.087	13.7	0.2058	0.0000	OK
15 minute summer	7	11	27.536	0.180	75.8	0.4266	0.0000	OK
15 minute summer	8	12	27.428	0.191	78.9	0.4253	0.0000	OK
15 minute summer	24	10	28.506	0.025	2.5	0.0364	0.0000	OK
15 minute summer	25	10	28.029	0.041	5.8	0.0635	0.0000	OK
15 minute summer	9	12	27.368	0.226	85.2	0.4180	0.0000	OK
15 minute summer	10	12	27.335	0.212	86.5	0.4276	0.0000	OK
15 minute summer	11	12	27.285	0.214	88.4	0.4513	0.0000	OK
15 minute summer	12	12	27.239	0.236	89.2	0.4686	0.0000	OK
15 minute summer	13	11	27.211	0.254	98.0	0.7027	0.0000	OK
15 minute summer	26	10	31.166	0.045	6.5	0.0887	0.0000	OK
15 minute summer	27	11	30.427	0.054	11.7	0.0987	0.0000	OK
15 minute summer	31	10	29.743	0.054	6.4	0.1045	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	5.0	0.682	0.125	0.2196	
15 minute summer	2	1.001	3	13.8	0.769	0.162	0.9733	
15 minute summer	3	1.002	4	19.8	1.033	0.233	0.7312	
15 minute summer	4	1.003	5	26.7	1.562	0.185	0.8075	
15 minute summer	5	1.004	6	28.2	1.878	0.078	0.1638	
15 minute summer	17	2.000	6	4.9	0.798	0.098	0.1803	
15 minute summer	18	3.000	19	4.7	0.682	0.054	0.2090	
15 minute summer	19	3.001	20	12.8	1.182	0.219	0.5393	
15 minute summer	20	3.002	6	16.0	0.912	0.189	0.3462	
15 minute summer	6	1.005	7	57.9	2.225	0.108	1.6189	
15 minute summer	21	4.000	22	2.0	0.710	0.020	0.0326	
15 minute summer	22	4.001	23	3.7	1.050	0.045	0.0395	
15 minute summer	23	4.002	7	13.0	0.776	0.181	0.9830	
15 minute summer	7	1.006	8	75.7	1.031	0.175	2.2011	
15 minute summer	8	1.007	9	79.6	0.916	0.183	2.0658	
15 minute summer	24	5.000	25	2.5	0.690	0.026	0.0542	
15 minute summer	25	5.001	9	5.7	1.171	0.069	0.0925	
15 minute summer	9	1.008	10	84.8	0.914	0.195	0.4422	
15 minute summer	10	1.009	11	86.1	0.967	0.198	1.1677	
15 minute summer	11	1.010	12	87.7	0.954	0.202	1.6375	
15 minute summer	12	1.011	13	91.3	0.974	0.210	1.2361	
15 minute summer	13	1.012	14	101.4	2.157	0.234	1.0552	
15 minute summer	26	6.000	27	6.4	0.994	0.088	0.2478	
15 minute summer	27	6.001	28	11.5	1.589	0.124	0.2274	
15 minute summer	31	7.000	32	6.2	0.574	0.073	0.4153	

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Results for 1 year Critical Storm Duration. Lowest mass balance: 96.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	32	11	29.542	0.074	11.2	0.1223	0.0000	OK
15 minute summer	28	11	29.381	0.085	25.9	0.1290	0.0000	OK
15 minute summer	29	11	28.924	0.074	29.4	0.1164	0.0000	OK
15 minute summer	33	11	28.287	0.049	4.1	0.0809	0.0000	OK
15 minute summer	34	10	28.306	0.032	2.5	0.0473	0.0000	OK
15 minute summer	30	11	28.110	0.089	43.3	0.1768	0.0000	OK
15 minute summer	35	10	31.158	0.051	5.1	0.0912	0.0000	OK
15 minute summer	36	11	30.928	0.052	8.5	0.0822	0.0000	OK
15 minute summer	37	11	30.453	0.069	22.0	0.1938	0.0000	OK
15 minute summer	38	11	28.187	0.077	29.9	0.1680	0.0000	OK
600 minute summer	14	390	27.060	0.175	35.1	201.6857	0.0000	OK
600 minute summer	15	390	27.059	0.198	10.5	0.6861	0.0000	OK
600 minute summer	16	390	26.317	0.047	10.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	32	7.001	28	11.1	0.745	0.130	0.4357	
15 minute summer	28	6.002	29	26.0	1.738	0.159	0.3084	
15 minute summer	29	6.003	30	29.4	1.909	0.134	0.3290	
15 minute summer	33	8.000	30	4.0	0.641	0.100	0.1494	
15 minute summer	34	9.000	30	2.5	0.708	0.043	0.0518	
15 minute summer	30	6.004	14	43.3	2.636	0.165	0.2197	
15 minute summer	35	10.000	36	5.0	0.740	0.110	0.2031	
15 minute summer	36	10.001	37	8.4	1.234	0.112	0.1374	
15 minute summer	37	10.002	38	21.8	1.654	0.116	1.0695	
15 minute summer	38	10.003	14	30.0	2.153	0.135	0.2913	
600 minute summer	14	1.013	15	10.5	0.161	0.031	0.7016	
600 minute summer	15	1.014	16	10.5	1.020	0.013	0.4325	267.0

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Results for 30 year Critical Storm Duration. Lowest mass balance: 96.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	31.386	0.114	19.5	0.2034	0.0000	OK
15 minute summer	2	10	31.190	0.170	53.9	0.3665	0.0000	OK
15 minute summer	3	11	30.938	0.234	78.0	0.4102	0.0000	OK
15 minute summer	4	11	30.681	0.201	106.5	0.3741	0.0000	OK
15 minute summer	5	11	29.780	0.168	113.0	0.3323	0.0000	OK
15 minute summer	17	10	29.783	0.099	19.1	0.1755	0.0000	OK
15 minute summer	18	10	31.020	0.069	18.3	0.1209	0.0000	OK
15 minute summer	19	11	30.323	0.164	50.6	0.3642	0.0000	OK
15 minute summer	20	11	29.658	0.205	61.6	0.3164	0.0000	OK
15 minute summer	6	11	29.391	0.204	231.8	0.5905	0.0000	OK
15 minute summer	21	10	28.718	0.042	7.5	0.0578	0.0000	OK
15 minute summer	22	10	28.326	0.063	14.6	0.0863	0.0000	OK
15 minute summer	23	11	28.096	0.193	52.6	0.4542	0.0000	OK
15 minute summer	7	12	27.834	0.478	301.3	1.1357	0.0000	OK
15 minute summer	8	12	27.769	0.532	308.6	1.1848	0.0000	OK
15 minute summer	24	10	28.529	0.048	9.5	0.0694	0.0000	OK
15 minute summer	25	10	28.068	0.080	21.9	0.1248	0.0000	OK
15 minute summer	9	12	27.706	0.564	323.3	1.0445	0.0000	OK
15 minute summer	10	12	27.654	0.531	331.8	1.0727	0.0000	OK
15 minute summer	11	12	27.581	0.510	342.0	1.0734	0.0000	OK
15 minute summer	12	11	27.487	0.484	350.0	0.9613	0.0000	OK
15 minute summer	13	11	27.390	0.433	385.2	1.1992	0.0000	OK
15 minute summer	26	10	31.211	0.090	24.9	0.1771	0.0000	OK
15 minute summer	27	10	30.487	0.114	44.9	0.2072	0.0000	OK
15 minute summer	31	10	29.797	0.108	24.5	0.2075	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	19.0	0.979	0.478	0.5884	
15 minute summer	2	1.001	3	53.1	1.069	0.625	2.6842	
15 minute summer	3	1.002	4	77.3	1.410	0.909	2.0795	
15 minute summer	4	1.003	5	106.3	2.191	0.736	2.2836	
15 minute summer	5	1.004	6	112.9	2.629	0.313	0.4661	
15 minute summer	17	2.000	6	18.7	1.150	0.375	0.4808	
15 minute summer	18	3.000	19	18.2	0.916	0.207	0.5738	
15 minute summer	19	3.001	20	49.4	1.635	0.841	1.4970	
15 minute summer	20	3.002	6	62.0	1.271	0.729	0.9581	
15 minute summer	6	1.005	7	231.7	2.861	0.434	5.9098	
15 minute summer	21	4.000	22	7.5	1.066	0.076	0.0817	
15 minute summer	22	4.001	23	14.4	1.276	0.173	0.1651	
15 minute summer	23	4.002	7	51.1	1.128	0.712	2.6562	
15 minute summer	7	1.006	8	294.0	1.236	0.677	7.5387	
15 minute summer	8	1.007	9	302.9	1.122	0.698	6.4036	
15 minute summer	24	5.000	25	9.5	1.023	0.099	0.1398	
15 minute summer	25	5.001	9	22.6	1.649	0.277	0.4448	
15 minute summer	9	1.008	10	325.3	1.207	0.749	1.2835	
15 minute summer	10	1.009	11	333.2	1.283	0.768	3.3838	
15 minute summer	11	1.010	12	344.1	1.380	0.793	4.2253	
15 minute summer	12	1.011	13	352.7	1.560	0.813	2.6576	
15 minute summer	13	1.012	14	389.4	3.036	0.897	2.3547	
15 minute summer	26	6.000	27	24.7	1.414	0.339	0.6704	
15 minute summer	27	6.001	28	44.5	2.245	0.477	0.6215	
15 minute summer	31	7.000	32	24.1	0.805	0.284	1.1315	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 96.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	32	10	29.625	0.157	43.2	0.2605	0.0000	OK
15 minute summer	28	11	29.484	0.188	99.9	0.2846	0.0000	OK
15 minute summer	29	11	29.010	0.160	113.3	0.2509	0.0000	OK
15 minute summer	33	10	28.337	0.099	15.8	0.1646	0.0000	OK
15 minute summer	34	10	28.335	0.062	9.5	0.0898	0.0000	OK
15 minute summer	30	11	28.228	0.207	166.6	0.4137	0.0000	OK
15 minute summer	35	10	31.212	0.105	19.5	0.1883	0.0000	OK
15 minute summer	36	10	30.985	0.109	32.6	0.1724	0.0000	OK
15 minute summer	37	10	30.523	0.139	84.7	0.3932	0.0000	OK
15 minute summer	38	11	28.278	0.168	116.0	0.3656	0.0000	OK
720 minute summer	14	510	27.362	0.477	81.1	587.8943	0.0000	OK
720 minute summer	15	510	27.362	0.501	14.3	1.7364	0.0000	OK
120 minute summer	16	162	26.324	0.054	14.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	32	7.001	28	42.6	1.019	0.502	1.2223	
15 minute summer	28	6.002	29	100.2	2.370	0.611	0.8705	
15 minute summer	29	6.003	30	113.7	2.520	0.517	0.9595	
15 minute summer	33	8.000	30	15.8	0.817	0.397	0.4848	
15 minute summer	34	9.000	30	9.4	0.805	0.167	0.2457	
15 minute summer	30	6.004	14	167.4	3.564	0.639	0.6261	
15 minute summer	35	10.000	36	19.3	1.035	0.422	0.5564	
15 minute summer	36	10.001	37	32.0	1.758	0.428	0.3695	
15 minute summer	37	10.002	38	83.6	2.309	0.447	2.9286	
15 minute summer	38	10.003	14	115.2	3.010	0.520	0.7997	
720 minute summer	14	1.013	15	14.3	0.172	0.042	2.3144	
720 minute summer	15	1.014	16	14.1	1.118	0.017	0.5313	593.6

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 96.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	12	32.218	0.946	35.8	1.6949	0.0000	SURCHARGED
15 minute summer	2	12	32.094	1.074	94.5	2.3213	0.0000	SURCHARGED
15 minute summer	3	12	31.740	1.036	122.5	1.8142	0.0000	SURCHARGED
15 minute summer	4	12	31.186	0.706	170.7	1.3126	0.0000	SURCHARGED
15 minute summer	5	11	29.842	0.230	179.6	0.4562	0.0000	OK
15 minute summer	17	10	29.829	0.145	35.0	0.2568	0.0000	OK
15 minute summer	18	12	31.166	0.215	33.5	0.3758	0.0000	OK
15 minute summer	19	11	31.072	0.913	90.7	2.0318	0.0000	SURCHARGED
15 minute summer	20	11	29.800	0.347	100.4	0.5359	0.0000	SURCHARGED
15 minute summer	6	12	29.547	0.360	383.4	1.0427	0.0000	OK
15 minute summer	21	12	29.103	0.427	13.7	0.5913	0.0000	SURCHARGED
15 minute summer	22	12	29.096	0.833	26.6	1.1411	0.0000	SURCHARGED
15 minute summer	23	12	29.064	1.161	91.6	2.7377	0.0000	SURCHARGED
15 minute summer	7	12	28.726	1.370	482.0	3.2561	0.0000	FLOOD RISK
15 minute summer	8	12	28.506	1.269	504.4	2.8250	0.0000	SURCHARGED
15 minute summer	24	10	28.546	0.065	17.5	0.0944	0.0000	OK
15 minute summer	25	12	28.399	0.411	40.3	0.6378	0.0000	SURCHARGED
15 minute summer	9	12	28.296	1.154	544.2	2.1386	0.0000	SURCHARGED
15 minute summer	10	12	28.171	1.048	557.2	2.1166	0.0000	SURCHARGED
15 minute summer	11	12	27.985	0.914	574.6	1.9242	0.0000	SURCHARGED
960 minute winter	12	795	27.823	0.820	42.5	1.6268	0.0000	SURCHARGED
960 minute winter	13	795	27.816	0.859	46.9	2.3795	0.0000	SURCHARGED
15 minute summer	26	10	31.249	0.128	45.7	0.2528	0.0000	OK
15 minute summer	27	12	30.629	0.256	82.7	0.4661	0.0000	SURCHARGED
15 minute summer	31	12	30.174	0.485	45.0	0.9293	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	33.4	0.979	0.841	1.2000	
15 minute summer	2	1.001	3	83.4	1.184	0.980	3.7857	
15 minute summer	3	1.002	4	121.8	1.730	1.433	2.6795	
15 minute summer	4	1.003	5	168.6	2.395	1.167	3.2821	
15 minute summer	5	1.004	6	179.4	2.801	0.498	0.8707	
15 minute summer	17	2.000	6	34.4	1.326	0.689	0.7668	
15 minute summer	18	3.000	19	31.3	1.012	0.357	1.1036	
15 minute summer	19	3.001	20	78.3	1.970	1.335	1.9725	
15 minute summer	20	3.002	6	100.1	1.442	1.178	1.2987	
15 minute summer	6	1.005	7	376.3	2.769	0.705	9.1057	
15 minute summer	21	4.000	22	14.5	1.246	0.147	0.4596	
15 minute summer	22	4.001	23	28.6	1.261	0.341	0.4401	
15 minute summer	23	4.002	7	78.2	1.111	1.089	4.1308	
15 minute summer	7	1.006	8	482.3	1.713	1.111	8.4098	
15 minute summer	8	1.007	9	506.0	1.797	1.166	6.6921	
15 minute summer	24	5.000	25	17.4	1.204	0.183	0.3633	
15 minute summer	25	5.001	9	37.3	1.787	0.456	0.7621	
15 minute summer	9	1.008	10	545.4	1.936	1.256	1.3425	
15 minute summer	10	1.009	11	558.5	1.983	1.287	3.6725	
15 minute summer	11	1.010	12	575.9	2.045	1.327	4.7747	
960 minute winter	12	1.011	13	42.0	0.635	0.097	3.2446	
960 minute winter	13	1.012	14	46.5	0.971	0.107	5.0815	
15 minute summer	26	6.000	27	45.4	1.617	0.625	1.1546	
15 minute summer	27	6.001	28	78.7	2.301	0.843	1.2471	
15 minute summer	31	7.000	32	40.9	0.901	0.481	2.6490	

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 96.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	32	12	30.122	0.654	74.4	1.0856	0.0000	SURCHARGED
15 minute summer	28	12	29.987	0.691	165.3	1.0475	0.0000	SURCHARGED
15 minute summer	29	12	29.434	0.584	178.2	0.9172	0.0000	SURCHARGED
15 minute summer	33	11	28.793	0.555	29.0	0.9240	0.0000	SURCHARGED
15 minute summer	34	11	28.733	0.460	17.5	0.6695	0.0000	SURCHARGED
15 minute summer	30	11	28.715	0.694	266.1	1.3855	0.0000	SURCHARGED
15 minute summer	35	10	31.264	0.157	35.8	0.2819	0.0000	OK
15 minute summer	36	10	31.041	0.165	59.8	0.2613	0.0000	OK
15 minute summer	37	10	30.589	0.205	155.6	0.5778	0.0000	OK
15 minute summer	38	11	28.483	0.373	213.2	0.8090	0.0000	SURCHARGED
960 minute winter	14	765	27.814	0.929	80.5	1250.1240	0.0000	SURCHARGED
960 minute winter	15	765	27.814	0.953	14.4	3.2995	0.0000	SURCHARGED
4320 minute winter	16	3540	26.324	0.054	14.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	32	7.001	28	67.7	1.321	0.796	2.0581	
15 minute summer	28	6.002	29	156.5	2.533	0.955	1.4513	
15 minute summer	29	6.003	30	177.9	2.526	0.809	1.5016	
15 minute summer	33	8.000	30	26.4	0.833	0.664	0.9567	
15 minute summer	34	9.000	30	16.9	0.823	0.298	0.5944	
15 minute summer	30	6.004	14	264.9	3.762	1.011	0.9402	
15 minute summer	35	10.000	36	35.4	1.161	0.775	0.9103	
15 minute summer	36	10.001	37	58.8	1.995	0.786	0.5974	
15 minute summer	37	10.002	38	153.8	2.548	0.822	4.8909	
15 minute summer	38	10.003	14	203.7	3.231	0.919	1.3155	
960 minute winter	14	1.013	15	14.4	0.197	0.042	2.6503	
960 minute winter	15	1.014	16	14.1	1.118	0.017	0.5313	780.8

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Appendix 8 - Cheshire West and Chester Council SuDS Proforma

Cheshire West and Chester

4. SuDS Discharge Proposals & Agreements			Details Required For:				Current Submission Stage:				Developer Response	Local Authority Review	
Ref.	Required Details Please provide all relevant details. Insufficient detail or evidence may lead to delay or refusal.	Cheshire Councils SuDS Guidance Reference	Pre-Application	Minor Development	Outline	Full	Pre-Application	Minor Application	Outline	Full	Developer's response including reference to supporting information and documents	Local Authority Review Comments	Acceptable Y / N / TBC
4.1	**ALL PROPOSALS**												
4.1.1	What is the level of hazard associated with surface runoff. *(Developer to confirm low, medium or high)*	Volume 1. Section 4.7.8	✓	✓	✓	✓					in FRA		
4.1.2	Confirm how is runoff to be discharged? *(Developer to complete Section 4.2, 4.3 or 4.4)*	Volume 1. Section 4	c	✓	✓	✓					in FRA		
4.1.3	Please detail how proposed SuDS proposals take account of the runoff destination triangle? *(Developer to confirm)*	Volume 1. Section 4.4	c	✓	✓	✓					in FRA		
4.1.4	Confirm Permits to discharge and Consents. *(Provide response letter/email)*	Volume 1. Section 4.6.2	c	✓	✓	✓					in FRA		
4.1.5	Provide details of Consultation with Local Authority	Volume 1. Section 3	✓	✓	✓	✓					in FRA		
4.1.6	Provide evidence been provided of formal consultation with the Council Planning Department or the Council Pre-Planning Advice Service?	Volume 1. Section 3	✓	✓	✓	✓					in FRA		
4.2	**PROPOSED DISCHARGE TO GROUND**												
4.2.1	What infiltration method or methods are proposed? *(To include appropriate plans and supporting documents and reports)*	Volume 1. Section 4 & 5	c	✓	✓	✓					N/A		
4.2.2	Soakaway testing in accordance with 'BRE Digest 365: Soakaway Design'. *(Provide details and summary)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.2.3	Confirmation of groundwater levels? *(Provide details)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.2.4	Provide evidence of formal consultation with the Environment Agency regarding the presence of aquifers, groundwater and potable water? *(Provide response letter/email)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.2.5	Provide evidence of formal consultation with the National Coal Authority regarding the presence of coal and mining activities. *(Provide response letter/email)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.2.6	Where appropriate, provide evidence of formal consultation with the Cheshire Brine Subsidence Compensation Board regarding the presence of salt mining or brine pumping activities. *(Provide response letter/email)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.2.7	Provide evidence of formal consultation with the British Geological Survey regarding contaminated land been provided? *(Provide response letter/email)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.2.8	Provide evidence of consultation regarding waterbody sensitivity / landscape designations i.e. SSSI. OR confirmation that this is not applicable? *(Provide supporting information)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.2.9	What level of surface water treatment is proposed? *(Provide supporting information)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.2.10	Confirm agreements with any 3rd party land owners? *(Provide response letter/email)*	Volume 1. Section 4 & 5	✓	✓	✓	✓							
4.2.11	Details of risk assessment assessing potential impacts on buildings or other structures of proposed discharge method? *(Provide supporting information)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.3	**PROPOSED DISCHARGE TO SURFACE WATER BODIES INCLUDING CULVERTED WATERCOURSES**												
4.3.1	What discharge method or methods are proposed? *(To include appropriate plans and supporting documents and reports)*	Volume 1. Section 4 & 5	c	✓	✓	✓					Section 6 FRA		
4.3.2	Is proposed discharge to a main river or ordinary watercourse? *(To include supporting documents and mapping)*	Volume 1. Section 4 & 5	c	✓	✓	✓					Section 6 FRA		
4.3.3	As part of the site specific FRA, confirm impacts on the receiving watercourse. Interactions need to be fully appraised to ensure that surface water runoff is effectively managed without increasing flood risk elsewhere. *(Provide FRA, details and summary)*	Volume 1. Section 3.3	c	✓	✓	✓					Section 6 FRA		
4.3.4	Provide evidence of consultation regarding waterbody sensitivity / landscape designations i.e. SSSI. OR confirmation demonstrating that this is not applicable? *(Provide supporting information)*	Volume 1. Section 4 & 5	c	✓	✓	✓					Section 6 FRA		
4.3.5	What level of surface water treatment is proposed? *(Provide supporting information)*	Volume 1. Section 4 & 5	c	✓	✓	✓					Section 6 FRA		
4.3.6	Confirm agreements with any 3rd party land owners. *(Provide response letter/email)*	Volume 1. Section 4 & 5	✓	✓	✓	✓					Section 6 FRA		
4.3.7	Provide evidence of formal consultation & agreement with the Environment Agency (for a main river) or Council (for an ordinary watercourse) regarding discharge volumes *(Provide response letter/email)*	Volume 1. Section 4 & 5	c	✓	✓	✓					Section 6 FRA		
4.4	**PROPOSED DISCHARGE TO SURFACE WATER SEWER OR COMBINED SEWER OR CULVERT OR DRAIN**												
4.4.1	What discharge method or methods are proposed? *(To include appropriate plans and supporting documents and reports)*	Volume 1. Section 4 & 5	c	✓	✓	✓					N/A		
4.4.2	What level of surface water treatment is proposed? *(Provide supporting information)*	Volume 1. Section 4 & 5	c	✓	✓	✓							
4.4.3	Confirm agreements with any 3rd party land owners. *(Provide response letter/email)*	Volume 1. Section 4 & 5	✓	✓	✓	✓							
4.4.4	Provide evidence of formal consultation & agreement with United Utilities / Welsh Water / sewerage undertaker regarding discharge consent? *(Provide response letter/email)*	Volume 1. Section 4 & 5	c	✓	✓	✓							

Cheshire West and Chester

5. SuDS Maintenance & Management Proposals			Details Required For:				Current Submission Stage:				Developer Response	Local Authority Review	
Ref.	Required Details Please provide all relevant details. Insufficient detail or evidence may lead to delay or refusal.	Cheshire Councils SuDS Guidance Reference	Pre-Application	Minor Development	Outline	Full	Pre-Application	Minor Application	Outline	Full	Developer's response including reference to supporting information and documents	Local Authority Review Comments	Acceptable Y / N / TBC
5.1	Provide and SuDS maintenance & management plan including schedule programme. *(Provide supporting information)*	Volume 1. Section 6	C	✓	C	✓					Section6 FRA		
5.2	Confirm maintenance and management arrangements *(Provide supporting information)*	Volume 1. Section 6	C	✓	C	✓					Section6 FRA		
5.3	Estimate of ongoing maintenance costs *(Provide supporting information)*	Volume 1. Section 6	C	✓	C	✓					Section6 FRA		
5.4	Evidence of formal agreement with the party responsible for undertaking maintenance? *(Provide supporting information)*	Volume 1. Section 6	C	✓	C	✓					Section6 FRA		
5.5	Full instructions for SuDS maintenance including repair and replacement requirements? *(Provide supporting information)*	Volume 1. Section 6	C	✓	C	✓					Section6 FRA		

SuDS SUBMISSION APPLICATION AND APPROVAL CHECKLIST
"THE CHECKLIST"

Cheshire West and Chester

SECTION 1. INSTRUCTIONS & APPLICATION DETAILS

Applications may be made either as:
- Pre Application Advice:
- Minor Developments
- Major Developments
  - Outline Application (with one or more matters reserved for later determination)
  - Full Application

The level of information required will vary depending on stage of the application, the size of the development, flood risk, constraints and proposed sustainable drainage system.

Sections 1 to 5 of this Application and Approval Checklist specifies the information required and should be completed by Applicant.

✓ - A requirement with supporting information to be provided
C - Consideration is to be given to the issue. Available information is required, but it is recognised that full details may not be confirmed at this stage.

Reponses should include reference to supporting information which should be provided.

Applicants are to ensure that the relevant details and supporting information are provided (in both hard and soft copy) before submitting the application to the Council.

TO BE COMPLETED BY DEVELOPER

APPLICATION DETAILS	
Planning Authority:	Cheshire West and Chester Council
Application Reference Number (if known):	
Application Submission Date:	
CURRENT APPLICATION STAGE	
Pre Application Advice	
Minor Application	
Major - Outline Application	Yes
Major - Full Application	
APPLICANT DETAILS	
Applicant / Agent Name	
Applicant /Agent Postal Address	
Applicant / Agent Email	
Applicant / Agent Telephone Number	

I confirm that the SuDS documentation submitted above complies with the Council's SuDS Guidance Documentation, Local Planning Policies and all relevant National Legislation, Policies and Guidance.	
Signed:	**Name:**
Appointment:	**Company**

TO BE COMPLETED BY LOCAL AUTHORITY

APPLICATION DETAILS	
Planning Authority:	
Application Reference Number:	
Date Application Received:	
Date Review Submitted:	
CURRENT APPLICATION STAGE	
Pre Application Advice	
Minor Application	
Major - Outline Application	
Major - Full Application	
LOCAL AUTHORITY REVIEW	
Sufficient information has been provided to inform SuDS review	
Drainage Strategy and design of SuDS is suitable for current Application Stage	
Summary of SuDS proposals	
Key Observations	
Further Information Required	
Recommendations	

Cheshire West and Chester

SECTION 2. GENERAL DETAILS & SuDS PROPOSALS			Details Required For:				Current Submission Stage:				Developer Response	Local Authority Review	
Ref.	Required Details Please provide all relevant details. Insufficient detail or evidence may lead to delay or refusal.	Cheshire Councils SuDS Guidance Reference	Pre-Application	Minor Development	Outline	Full	Pre-Application	Minor Application	Outline	Full	Developer's response including reference to supporting information and documents	Local Authority Review Comments	Acceptable Y / N / TBC
2.1	**EXISTING SITE FLOOD RISK**												
2.1.1	Confirm that a Site Specific Flood Risk Assessment has been undertaken to confirm all flood risk interactions. *(Provide supporting documents including an FRA and drainage strategy)*	Volume 1. Section 3.3	C	✓	✓	✓			✓		Yes		
2.1.2	Does the site lie within the coastal / tidal flood outlines shown on the Environment Agency flood map? *(Confirm Flood Zone and interactions with drainage strategy)*	Volume 1. Section 3.3	✓	✓	✓	✓			✓		No		
2.1.3	Does the site lie within the fluvial flood outlines shown on the Environment Agency flood map? *(Confirm Flood Zone and interactions with drainage strategy)*	Volume 1. Section 3.3	✓	✓	✓	✓			✓		Yes - redline, development no		
2.1.4	Does the site lie within the pluvial (surface water) flood outlines shown on the Environment Agency flood map? *(Confirm Flood Zone and offsite interaction with drainage strategy)*	Volume 1. Section 3.3	✓	✓	✓	✓			✓		Yes		
2.2	**PROPOSED SUDS APPROACH**												
The 'management train' concepts aims to highlight how a series of SuDS techniques may be employed in terms of prevention, source control, site control and regional controls. Please indicated how SuDS and surface water runoff is to be managed as part of the development. A brief description is required and a reference to where full information is found in your submission.													
2.2.1	Confirm how surface water runoff will be managed? i.e. reducing / preventing the introduction of impermeable surfaces. *(Provide details and summary)*	Volume 1. Section 4 & 5 & Appendix C SuDS Suitability Matrix	C	✓	✓	✓			✓		Section 6 FRA		
2.2.2	Confirm how surface water will be managed at the source? i.e. restricting / reducing runoff to receptors within the catchment. *(Provide details and summary)*	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		Section 6 FRA		
2.2.3	Confirm how surface water will be managed on the surface? i.e. filter strips, swales etc. *(Provide details and summary)*	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		Section 6 FRA		
2.2.4	Confirm how surface water runoff will be integrated within public spaces? i.e. blue green networks and temporary storage. *(Provide details and summary)*	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		Section 6 FRA		
2.2.5	Confirm any likely environmental or technical constraints to SuDS. *(Provide details and summary)*	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		Section 6 FRA		
2.3	**SITE PLANS - including:** *(Provide details for the following)*												
2.3.1	Site location and red line boundary	Volume 1. Section 4 & 5	✓	✓	✓	✓			✓		In FRA		
2.3.2	Existing watercourses, waterbodies and interactions with proposed drainage strategy	Volume 1. Section 4 & 5	✓	✓	✓	✓			✓		In FRA		
2.3.3	Existing and proposed ground levels and site contours	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		In FRA		
2.3.4	Existing and proposed highways, and access routes including associated drainage	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		In FRA		
2.3.5	Existing and proposed Sewers	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		In FRA		
2.3.6	Existing and residual surface water flood flow routes	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		In FRA		
2.3.7	Borehole / trial pit locations	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		In FRA		
2.3.8	Proposed building locations and finished floor levels	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		In FRA		
2.4	**DRAINAGE STRATEGY - including:** *(Provide details and summary)*												
2.4.1	Confirm SuDS proposals, including storage requirements. *(Developer to confirm design and provide supporting information)*	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		Section 6 FRA		
2.4.2	Provide a SuDS layout site plan including, for example, levels, design water levels and distance from nearest buildings, structure and controls.	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		Section 6 FRA		
2.4.3	Confirm the proposed development area (in hectares)	Volume 1. Section 4 & 5	✓	✓	✓	✓			✓		Section 6 FRA		
2.4.4	Confirm the percentage of the proposed development area which is impervious for both existing and post development scenarios.	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		Section 6 FRA		
2.4.5	Confirm the SuDS management train, clearly stating those parts of drainage system to remain private and those to be adopted.	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		Section 6 FRA		
2.4.6	Provide a plan showing post development surface water flood flow routes.	Volume 1. Section 4 & 5	C	C	✓	✓			✓		Section 6 FRA		
2.4.10	Confirm the proposed discharge locations (including justification) and confirm interactions with the receiving watercourse	Volume 1. Section 4 & 5	C	✓	✓	✓			✓		Section 6 FRA		
2.5	**DETAILED DRAINAGE DESIGN (IN ADDITION TO DETAILS PROVIDED FOR OUTLINE DRAINAGE STRATEGY) including:**												
2.5.1	Provide detail of flow controls	Volume 1. Section 4 & 5	C	✓	C	✓			✓				
2.5.2	Provide details of proposed fencing and planting plan	Volume 1. Section 4 & 5	C	✓	C	✓			✓				
2.5.3	Ground investigation reports including ground percolation rates	Volume 1. Section 4 & 5	C	C	✓	✓			✓		Phase 1 submitted.		
2.5.4	Contaminated land reports and contamination levels assessment	Volume 1. Section 4 & 5	C	C	C	✓			✓				
2.5.5	Provide details of safe design and design risk assessment	Volume 1. Section 4 & 5	C	✓	C	✓			✓				
2.5.7	Estimate the costs *(Provide supporting information)*	Volume 1. Section 4 & 5	C	✓	C	✓			✓				

Cheshire West and Chester

SECTION 3. HYDRAULIC ASSESSMENT OF SuDS PROPOSALS			Details Required For:				Developer Response					Local Authority Review	
							Current Submission Stage:						
Ref.	Required Details Please provide all relevant details. Insufficient detail or evidence may lead to delay or refusal.	Cheshire Councils SuDS Guidance Reference	Pre-Application	Minor Development	Outline	Full	Pre-Application	Minor Application	Outline	Full	Developer's response including reference to supporting information and documents	Local Authority Review Comments	Acceptable Y / N / TBC
3.1	**SURFACE WATER PEAK RUNOFF RATE**												
3.1.1	Confirm simulation modelling has been undertaken to calculate peak runoff rate? *(Provide simulation modelling/calculations/supporting documents)*	Volume 1. Section 4.7	C	✓	C	✓					Section 6 FRA		
3.1.2	For greenfield developments - does the peak runoff rate exceed the 1 in 1 year and 1 in 100 year rainfall events? *(identify in supporting documents)*	Volume 1. Section 4.7	C	✓	✓	✓					Section 6 FRA		
3.1.3	For previously developed sites - is the 1 in 1 year and 1 in 100 year peak runoff rate as close as is reasonably practical to the greenfield runoff rate? *(identify in supporting documents)*	Volume 1. Section 4.7	C	✓	✓	✓					Section 6 FRA		
3.1.4	Using the calculation below, what is the greenfield runoff peak flow? $QBARrural = 1.08(AREA/100)^{0.89}\ SAAR^{1.17}\ SOIL^{2.17}$	Volume 1. Section 4.7 & Appendix B	C	✓	✓	✓					Section 6 FRA		
3.2	**SURFACE RUNOFF DISCHARGE VOLUMES**												
3.2.1	Confirm the estimated greenfield runoff volume up to the 1 in 100 year, 6 hour rainfall event? *(identify in supporting documents)*	Volume 1. Section 4.7	C	✓	✓	✓					Section 6 FRA		
3.2.2	For greenfield developments - does the runoff volume in the 1 in 100 year, 6 hour rainfall event exceed the greenfield runoff volume? *(identify in supporting documents)*	Volume 1. Section 4.7	C	✓	✓	✓					Section 6 FRA		
3.2.3	For previously developed sites - is the runoff volume in the 1 in 100 year, 6 hour rainfall event as close as is reasonably practical to the greenfield runoff volume? *(identify in supporting documents)*	Volume 1. Section 4.7	C	✓	✓	✓					Section 6 FRA		
3.2.4	What method or methods are proposed to attenuate additional volume up to the 100 year event? *(identify in supporting documents)*	Volume 1. Section 4.7	C	✓	✓	✓					Section 6 FRA		
3.2.5	What % allowance has been included for climate change and development creep? *(identify in supporting documents)*	Volume 1. Section 4.7	C	✓	✓	✓					Section 6 FRA		
3.3	**RESIDUAL FLOOD RISK**												
3.3.1	Do the proposed SuDS function without flooding any part of the site at the critical 1 in 30 year flood event? *(identify in supporting documents)*	Volume 1. Section 4.7	C	✓	✓	✓					Section 6 FRA		
3.3.2	Does the proposed SuDS function without flooding a building (including a basement) or utility plant susceptible to water (such as a pumping station or electricity substation) up to the 1 in 100 year flood event? *(identify in supporting documents)*	Volume 1. Section 4.7	C	✓	✓	✓					Section 6 FRA		
3.3.3	Have sensitivity checks for climate change and development creep been considered?	Volume 1. Section 4.7	C	✓	C	✓					Section 6 FRA		

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