Land North of East Street
Rusper, West Sussex

Flood Risk Assessment and Drainage Strategy

For

Devine Homes PLC

Document Control Sheet

Land North of East Street

Rusper, West Sussex

Devine Homes PLC

This document has been issued and amended as follows:

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10th February 2025	Final A	Phil Allen MCIWEM C.WEM	Neil Jaques
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1.0 Introduction

1.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been produced by Motion on behalf of their client, Devine Homes PLC. It supports the planning application for the proposed 18-unit residential development on the Land North of East Street, Rusper. The proposed development layout can be seen in Appendix A.

1.2 According to the Environment Agency's (EA's) Flood Map for Planning, the site is within Flood Zone 1 so is not at risk of fluvial (or tidal) flooding. The updated (January 2025) EA Risk of Flooding from Surface Water (RoFSW) mapping shows surface water flood risk adjacent to the site and in its southeastern corner and, as such, an FRA is required to discuss the flood risks to the site.

1.3 As a major development, a drainage strategy is also required to demonstrate how the development will manage and discharge surface water generated in all rainfall events up to and including the 1 in 100-year + 45% storm, with inclusions for urban creep also considered.

1.4 Therefore, this FRA and Drainage Strategy has been produced to discuss the flood risks to the proposed development, from all sources. This FRA and Drainage Strategy will also define how the development will manage its surface water and foul sewage so that the development does not increase flood risk in the area or to neighbouring properties/land.

1.5 This FRA and drainage strategy follows the guidance set out in:

- West Sussex LLFA Policy for the Management of Surface Water (November 2018)
- National Planning Policy Framework (NPPF)
- Planning Practice Guidance (PPG) to the National Planning Policy Framework
- CIRIA SuDS Manual 2015 (C753)
- Environment Agency Rainfall Runoff Management for Developments
- Non-Statutory Technical Standards for SuDS (NSTSfS)

1.6 The proposed development falls within the administrative boundary of Horsham District Council (HDC) and West Sussex County Council (WSCC).

1.7 This FRA and drainage strategy report pertains only to the drainage strategy for the development. It does not provide details of how the site will be drained during the construction phase. This report is also not a drainage verification report, which can only be produced post-construction.

1.8 Similarly, this report does not provide information on how the drainage infrastructure will be protected during the construction phase of the project. The provision of this information is the responsibility of the appointed contractor.

2.0 Site Description

Table 2.1 – Site Summary

Site Name	Land North of East Street
Location	Rusper, West Sussex.
Grid Reference	TQ207372 (6 figure, centre of site)
Site Area	0.903 ha
Development Type	An 18-unit residential development including access, parking and landscaping
Flood Zone	1
Surface Water Flood Risk	Predominantly very low, but with areas of low and medium risk on the East Street boundary and in the site's southeastern corner
Local Water Authority	Southern Water
Local Planning Authority	Horsham District Council (HDC)
Lead Local Flood Authority	West Sussex County Council (WSCC)

Site Location and Description

2.1 The development site comprises an approximately rectangular shaped, greenfield parcel of land that is located to the north of East Street in Rusper, West Sussex. It is bounded to the north and east by open land, by properties to the west and by East Street to the south. A site location plan can be seen in Appendix B of this report.

2.2 The site is currently undeveloped grassland, with mature trees and hedges on the East Street frontage. The north and east boundary is marked by post and rail fencing that separates it from surrounding land.

2.3 The site can be accessed from its southeast corner via East Street.

Topography

2.4 A topographic survey of the site has been carried out by P Stubbington Land Surveys Ltd, and this shows that the site has a consistent gradient from west to east of 1 in 14. The highest levels are in the northwest of the site at circa 121.4 metres Above Ordnance Datum (mAOD). The lowest site levels are in the vicinity of the site access, where levels are in the region of 110.7 mAOD.

2.5 The topographic survey can be seen in Appendix C.

Geology

2.6 The British Geological Survey (BGS) online 1:50,000 Geoindex maps show that the site's geology is in an area of Weald Clay bedrock geology. The nearest BGS borehole record (TQ23NW4) is from 150m to the southeast of the site and this confirms 'Wealden Clay' geology to depth (see Appendix D).

Hydrogeology and Groundwater

2.7 Groundwater Source Protection Zones (SPZ's) are defined around groundwater abstraction sources such as wells, boreholes and springs that are used for public drinking water supply.

2.8 SPZ's show the risk of contamination to groundwater from any activities that might cause pollution in the area. The closer the activity to the source of abstraction, the greater the risk. The maps show three main zones; inner – Zone 1; outer – Zone 2 and; total catchment – Zone 3.

2.9 Defra's Magic Map was reviewed, and the site is not within in any SPZ's.

2.10 The Weald Clay geology is not a designated aquifer and can be considered as hydraulically unproductive.

2.11 BGS borehole TQ23NW4 records a resting water level of 113 feet below surface (with an Ordnance Datum of circa 350 feet). This provides an approximate groundwater level of 237 feet above Ordnance Datum (or 73.9 mAOD). As described above, the site levels are at 110 mAOD at their lowest, thus are well above the recorded groundwater levels in the area.

2.12 Because infiltration is not proposed, groundwater levels will not be prohibitive to the drainage strategy, and because groundwater levels are far below surface there cannot be any concern regarding ingress into any attenuation features.

Infiltration Potential

2.13 Because the site is underlain by Weald Clay to depth, the local soils are not expected to have infiltration coefficients that are conducive to the discharge of surface water to ground. On this basis, infiltration has not been explored at this stage of the development and the drainage strategy.

2.14 It is noted that WSCC as the Lead Local Flood Authority (LLFA) would ordinarily require site specific BRE365 soakage testing results to support the decision not to use infiltration, but noting that soakage testing is very unlikely to offer a solution for the drainage strategy, our client would be willing to accept a condition on this matter

2.15 Defra's Magic Map confirms that the site is in an area of hydraulically unproductive geology and that there is no groundwater vulnerability.

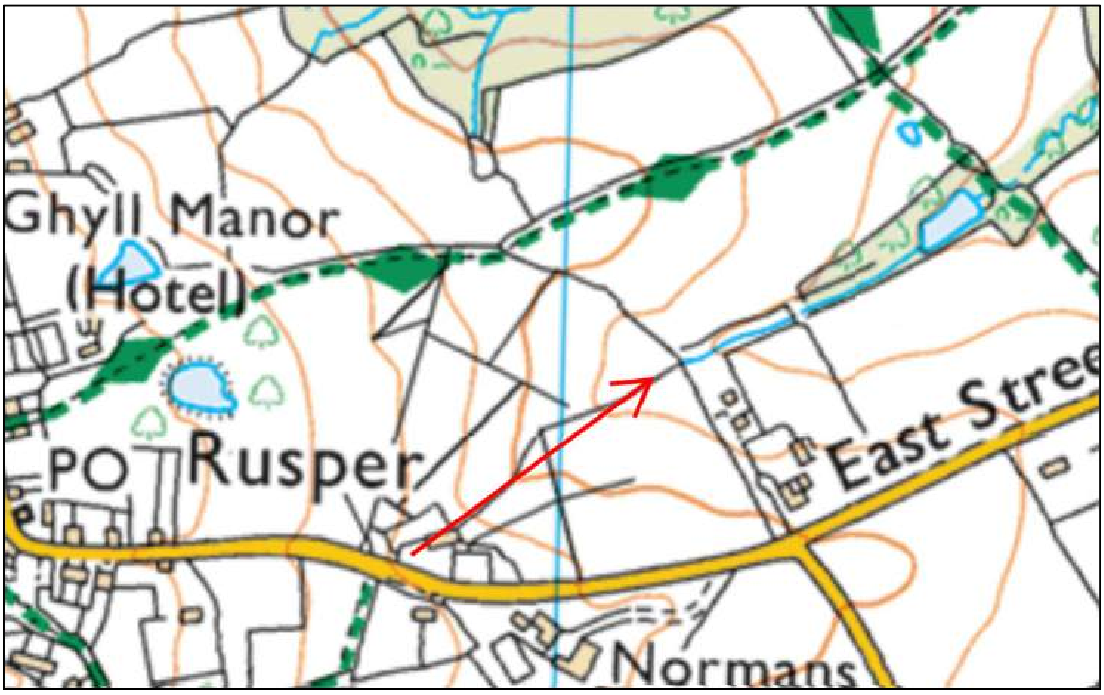
Existing Drainage Regime

2.16 As the site is greenfield, there is no existing formal surface water drainage system in place. The site will currently drain naturally, and the topography and local drainage features suggest that the site drains to the south and east. There is a drainage ditch that flows west-east on the southern boundary of the site. This ditch is culverted in sections but is predominantly open and is culverted under the current access to the site. The site visit revealed this drainage ditch to be heavily silted and blocked in places, which causes surface water to drain overland to the north (and back into the site) as a result.

2.17 In terms of ongoing connectivity, the drainage ditch is thought to connect to an ongoing ordinary watercourse on the site to the east. LiDAR data and Ordnance Survey Mapping shows that there is a natural valley in the topography that leads from the site's eastern boundary to a watercourse that is shown on both Ordnance Survey mapping and Google Maps. (see Figures 2.1 and 2.2, below). Whether the natural drainage that this topographical feature creates has been preserved by surrounding development and land management is to be confirmed.

Figure 2.1: LiDAR Data Showing Start of Drainage Ditch

Figure 2.2: Topography and watercourse east of the site.



2.18 A surface water pipe traverses the site from west to east, with three access chambers being present within the site. These are visible from aerial photography and are clouded red in Figure 2.3, below

Figure 2.3: The three surface water chambers

2.19 The surface water sewer enters the site from beyond the site's western boundary and it is uncertain to what this pipe connects/drains, but it is expected that it is associated with the uphill properties to the west.

2.20 As part of site investigations, the chambers for this drain were opened and found to be heavily silted (see site drainage investigation in Appendix F). Additionally, where the pipe exits the site to the eastern boundary, it was excavated and found to have partially collapsed. This existing drain would be replaced and diverted through the site to suit the layout of the proposed development.

2.21 This pipe continues off-site to the east under the adjacent access track prior to outfalling to the watercourse to the east, as described above.

2.22 Thames Water's Asset Location Plans in Appendix E show that there is a network of public foul sewers present in Rusper. There is a public foul sewer present in East Street at the western end of the development, which diverts south and back towards southern Rusper. Because this foul sewer is only adjacent to the site at the upper end of East Street before diverting south, it may not be a suitable connection point for all of the proposed development's foul water, but there is another public foul sewer that enters East Street from the south adjacent to the eastern end of the development, which is the topographically lowest point. This public foul sewer would be suitable for the connection of the site's foul waste.

The Proposed Development

2.23 The proposed development is for 18no. residential dwellings and the proposed site layout can be seen in Appendix A. The following housing mix is proposed as in Table 2.2.

Table 2.2: Proposed Housing Mix

Open Market	
Unit Type	**No. of Units**
2-Bed	2
3-Bed	6
4-Bed	2
Total:	10
Affordable	
Unit Type	**No. of Units**
2-Bed	6
3-Bed	2
Total:	8
Grand Total:	18

2.24 The proposed development also includes access, parking and landscaping.

3.0 Flood Risk Legislative and Policy Framework

3.1 LLFA's including WSCC have a responsibility under the FWMA to develop, maintain, apply and monitor the application of a strategy for local flood risk in their area. Local flood risk is defined as flood risk arising from local sources, such as surface water run-off, groundwater and ordinary watercourses (i.e. non main rivers). The EA plays a role in managing the watercourses designated as 'main rivers'.

The Environment Agency Flood Map for Planning

3.2 The Environment Agency's Flood Map for Planning gives an indicative prediction of areas at risk of fluvial and tidal flooding. The mapping is an amalgamation of modelled flood levels and historical flood event outlines.

3.3 The Flood Map is split into 'Flood Zones', which demarcate the extent of flooding from rivers or the sea for different return periods. The Flood Map for Planning shows the extent of the natural floodplain if there were no defences or other man-made structures. They do not provide a definitive picture of where flooding would occur; rather, they provide an indicative prediction of areas at risk.

3.4 Table 3.1, below, lists the flood zone categories and explains the flood risk probabilities they represent.

Table 3.1 – Flood Zone Categories

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of tidal flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of tidal flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water must flow or be stored in times of flood, which is typically the 1 in 30-year flood event or greater. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map, but may be distinguished in Product 4 information, for example)

The National Planning Policy Framework

3.5 The NPPF sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. The Planning Practice Guidance (PPG) to the NPPF provides further information on the policies set out in the NPPF. It encourages development to take place in areas of lower flood risk wherever possible and stresses the importance of preventing increases in flood risk off-site to the wider catchment area. This includes ensuring that flood risk is considered at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from those areas where risks are highest.

3.6 The process of directing development away from those areas where risks are highest is the sequential test. It covers all forms of flooding, and this is covered in Paragraphs 23 and 24 of the NPPF. Following the December 2024 update to the NPPF, Paragraph 175 was added that states that development can be appropriate on sites with flood risk "*in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from* *any source, now and in the future*". This essentially means that, as long as a sequential approach is applied within the site boundary, and areas of flood risk now and in the future are avoided, that flood risk should not prevent the development coming forward.

3.7 A site-specific FRA is required for proposals of 1ha or greater in Flood Zone 1, all proposals for development in Flood Zones 2 and 3, or in an area within Flood Zone 1 that has critical drainage problems (as notified to the local planning authority by the EA). The site is located within Flood Zone 1 and is greater in size than one hectare and, therefore, an FRA is required.

3.8 The FRA should identify and assess the risks of all forms of flooding to and from the development and demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

3.9 Within each Flood Zone, a key factor in determining planning applications for development is the flood risk vulnerability of a development. Table 2 of the PPG to the NPPF categorises different development types according to their vulnerability to flooding. These categories are:

- Essential infrastructure;
- Highly vulnerable development;
- More vulnerable development;
- Less vulnerable development, and;
- Water-compatible development.

3.10 Within the different Flood Zones each of the above development categories are considered appropriate or not permissible. The Technical Guidance to the NPPF lists these as:

Flood Zone 1:

- All the development categories listed above are appropriate.

Flood Zone 2:

- Water-compatible, less vulnerable development, more vulnerable development and essential infrastructure is appropriate in this zone.

Flood Zone 3a:

- Water-compatible and less vulnerable development is appropriate in this zone. Highly vulnerable development should not be permitted in this zone.

Flood Zone 3b:

- Only water-compatible development and essential infrastructure that has to be there should be permitted in this zone.

3.11 The above information sets out the basis by which developments must be assessed in terms of flood risk.

3.12 Later in this document, the site will be reviewed against the Flood Zone in which it is located. Whilst at an early stage, an assessment will be made of the appropriateness of the proposed development, as per the advice within the PPG to the NPPF, and taking account of the proposed site layout in Appendix A.

Lead Local Flood Authority

3.13 As of April 2015, the LLFA became a statutory consultee on all major planning applications. The LLFA is required to assess planning applications in respect of surface water drainage and sustainable drainage systems. WSCC is the LLFA for the Rusper and Horsham area.

4.0 Current Flood Risk

4.1 Flooding can arise from a variety or combination of sources. These may be natural or artificial and may be affected by climate change. These are discussed, below, in the following two sections and summarised in Table 6.1. The probability of any likely impacts is also assessed, where necessary.

Flooding from Rivers and the Sea

4.2 The Environment Agency's Flood Map for Planning (Appendix G) shows that the site is within Flood Zone 1. Consequently, it can be summarised that the proposed development will not be within any fluvial flood risk areas, now or in the future, and the residual flood risk to the site is zero.

Fluvial Flood Risk and the Appropriateness of the Development in this Location

4.3 The proposed residential development is considered to be 'more vulnerable' according to the classifications in the NPPF.

4.4 Table 3 of the PPG to the NPPF (see below) states that 'more vulnerable' development is appropriate in Flood Zone 1, thus the proposed development is appropriate in this location and with the current and future level of flood risk.

Table 3 of the NPPF - Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Surface Water Flooding

4.5 Surface water, or pluvial flooding, results from rainfall-generated overland flow, where rainwater has not yet reached a watercourse or sewer and where the local drainage systems become overwhelmed. Pluvial flooding often occurs during short, very intense storms, but can also occur during longer periods of rainfall when the ground is already saturated, or where land has low permeability due to development.

4.6 In these conditions surface water can build up where the topography allows it to converge or pond. Where it gathers it will travel down prevailing gradients. Pluvial flooding then occurs at locations where significant surface water flow paths converge, at localised low points and/or due to overland obstructions. In urban areas pluvial flooding often occurs where the built environment channels overland flow routes (down roads that are bounded by kerbs, for example) or where there are obstacles to the natural overland flow routes. Boundary walls and buildings are often the main causes and, hence, the likelihood of pluvial flooding to impact property and gardens.

4.7 Pluvial flooding is exacerbated in many cases by the mistreatment or failure of the below ground infrastructure (including partial or full blockages of gullies and/or within the combined sewers and the accumulation of fats, oils and greases within the sewer networks).

4.8 The EA's Risk of Flooding from Surface Water (RoFSW) map was updated and refined in January 2025. The map uses improvements in data, technology and modelling and includes information and input from LLFAs, where this is available. This New National Model (NNM) for surface water represents a significant improvement over previous national-scale models and, generally speaking, has shown a reduction in overall surface water flood risk (when compared with the previous RoFSW mapping) with more targeted risk areas that tie in better with local land features and overall topography.

4.9 The updated RoFSW mapping for the site can be found in Appendix H and includes a present-day risk prediction as well as one for the 2040 – 2060 scenario, i.e., with an inclusion for climate change. Both these maps are included in Appendix H.

4.10 The site is predominantly at 'very low' risk of surface water flooding. The updated RoFSW mapping shows that in the present-day scenario that there is a 'low' risk flow path that runs westwards down the gradient of East Street and along the southern site boundary, where the risk increases to 'medium' and 'high'. In the southeastern corner of the site, the flow path is shown to cross into the red line boundary. It is felt that this pattern of surface water flooding is influenced by the silted-up and culverted sections of the drainage ditch, which would not have been picked up in the digital terrain model that has informed the surface water flood risk mapping. With this in mind, the surface water flood risk in the southeastern corner of the site will be less than indicated.

4.11 There is also a disconnect between two areas of 'low' risk that exist within the southeastern corner of the site, which then flows eastwards out the site and joins the natural valley feature and watercourse that was discussed earlier in this report.

4.12 It appears that the present-day and future surface water flood risk scenarios are very similar, with no increase in flood risk within the site's red line boundary.

4.13 Referring to Paragraph 175 of the NPPF, which was discussed in Paragraph 3.6 of this report, no built development (as per the site layout in Appendix A) is within any areas of risk and the SuDS basin is located in the area of the 'disconnect' between two areas of 'low' surface water flood risk. Therefore, the development has followed the sequential approach to the layout and allocation of development within the site and is in accordance with the NPPF. Additionally, the surface water flood risk within the site boundary (in the southeastern corner) is 'low' and the slight disconnect between the upstream and downstream flow paths suggests that this is not a significant area of surface water flood risk.

4.14 On that basis, surface water flood risk should not be an impediment to the development.

Groundwater Susceptibility

4.15 There are no flood risk maps for groundwater, as stated by the Environment Agency in their 2011 guidance note 'flooding from groundwater'. Mapping products currently available only show areas where the geological and hydrogeological conditions *may* combine to cause groundwater flooding, but they should not be considered as groundwater flood risk maps. They only show *susceptibility* to groundwater flooding.

4.16 Therefore, it is beneficial to refer to and review other information to assess likely groundwater flood risk. As discussed in Section 2 of this report the site is located in an area of thick Weald Clay from surface to depth, which Defra's Magic Map lists as hydraulically unproductive and not an aquifer of any kind. It was also discussed that a local borehole record demonstrated that groundwater levels are approximately 36 metres below the ground level of the site, thus are deep and would never be at risk of emergence on site.

4.17 On the basis of the above, the site can reasonably be concluded as being a very low risk of groundwater flooding.

Flooding from Infrastructure Failure

4.18 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or because of a reduction in capacity due to collapse, siltation, blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.

4.19 Typically, sewer systems are constructed to accommodate rainstorms with a 30-year return period or less, depending on their age. Consequently, rainstorm events greater than 1 in 30-years would be expected to result in surcharging of some parts of the sewer system. In fact, due to most gullies being poorly maintained and often partially blocked with silt, leaves and other debris, their capacity is often estimated to be closer to the 1 in 10-year storm.

4.20 The site is currently undeveloped, thus there is no existing risk of flooding due to the failure of infrastructure. With regards to the proposed development's drainage system and risk of failure, it will be designed to attenuate the 1 in 100-year + 45% rainfall event. A drainage management and maintenance plan will also be provided, which will prescribe how the onsite drainage infrastructure should be looked after so that it works at optimum capacity. This will ensure that residual flood risks to the site from its internal drainage systems will be minimised.

Flooding from Artificial sources

4.21 The EA provides a map showing the maximum potential flood extent should all reservoirs with a capacity of greater than 25,000 cubic metres fail and release the water they hold.

4.22 The map shows that the East Street site would not experience flooding in this scenario.

4.23 There are no canals in the local area to create flood risk either.

5.0 Future Flood Risk & Climate Change

5.1 The NPPF and the supporting Planning Practice Guidance document sets out how flood risk should be considered over the lifetime of a development. This requires an increase in flood risk due to climate change to be taken into account. Both peak river flows and rainfall intensity should be assessed.

Peak River Flows

5.2 The site is within Flood Zone 1 and there are no significant watercourses within or on the site boundary. Therefore, the site will continue to be at low risk of fluvial flooding in the future and peak river flows do not need to be discussed any further.

Peak Rainfall Intensity and Climate Change

5.1 With climate change, peak rainfall intensities are expected to increase, which would result in increased surface water flows and, potentially, flooding.

5.2 The discussion of surface water flooding in this report referred to both the present-day and future surface water flood risk scenarios and the data in the updated RoFSW mapping shows that surface water flood risk on the site is not expected to increase. Therefore, future peak rainfall intensity has already been addressed in terms of surface water flood risk.

5.3 The drainage strategy for the development will also be designed to fully account for future peak rainfall intensities. A climate change increase for the 1 in 30-year and 1 in 100-year rainfall events will be applied to the hydraulic model and drainage design, plus additional hydraulic inputs due to urban creep will be included, to ensure that all surface water loads, for the lifetime of the development, are full considered.

5.4 This approach ensures that the development will not be at risk of flooding from surface water now or in the future.

6.0 Summary of Flood Risk

6.1 Table 6.1, below, summarises the level of flood risk to the site.

Table 6.1: Summary of Flood Risk

Flood Source	Risk Level				Comment
	High	Medium	Low	Very Low	
Fluvial				X	Flood Zone 1 (present day and in the future)
Tidal				X	Not within a tidal flood risk area
Groundwater				X	Hydraulically unproductive geology and with deep groundwater levels.
Surface Water			X		Site generally at very low risk of surface water flooding. Where risk is higher, no development is proposed.
Canals				X	There are no canals in the vicinity
Reservoirs				X	The Reservoir Flood Risk Map places the site well outside a maximum extent of flooding
Infrastructure Failure				X	The site's infrastructure will be properly managed and maintained, as per the prescription in the drainage management and maintenance plan, which will minimise the risk of flooding due to infrastructure failure.
Increase due to Climate Change			X		Future fluvial flood risk has been discussed, and the drainage strategy will accommodate surface water generated in the 1 in 100 + 45% rainfall event.

7.0 Surface Water Drainage Strategy

Sustainable Drainage Overview

7.1 Current planning policy and Environment Agency guidance requires developments to employ SuDS (Sustainable Drainage Systems) techniques wherever feasible. Careful design of SuDS features can ensure that a development's surface water drainage closely reflects the natural hydrology of the pre-developed site.

7.2 SuDS will attenuate and treat surface water run-off quantities at the source (source control) in line with current guidance and best practice.

7.3 Source control systems treat surface water close to the point of origin, in features such as soakaways, permeable paving and swales, to name a few.

7.4 The key benefits of SuDS are as follows:

- Improving water quality over a conventional piped system by removing pollutants from diffuse pollutant sources (e.g., roads);
- Improving amenity through the provision of open green space;
- Improving biodiversity through increased areas for wildlife habitat; and
- Enabling a natural drainage regime that recharges groundwater (where possible).

7.5 SuDS provide a flexible approach to drainage, with a wide range of components from soakaways to large-scale basins or ponds. The individual techniques should be used where possible in a management train that mimics the natural pre-developed pattern of drainage.

Site Areas

7.6 Of the 0.903 ha site, the current site layout proposes 0.393 ha of impermeable areas. This figure is inclusive of WSCC's requirements to consider an uplift of 10% to areas within private curtilages, which includes dwellings, garages and driveways. The site's impermeable areas prior to urban creep were 0.370 ha, thus urban creep provides a 230m^2 uplift to the total impermeable areas on site.

Greenfield Runoff Rate

7.7 The greenfield runoff rates have been calculated using the QMED value, which is the index flood in the Flood Estimation Handbook (FEH). QMED has been calculated for rural and urban values in MicroDrainage using the catchment descriptors methodology, which includes the following input variables:

- Site Location
- SAAR – Standard Average Annual Rainfall 1961 – 1990 (mm)
- SPR Host - Standard percentage runoff derived from HOST soils data
- URBEXT - The extent of urban and suburban cover
- BFIHOST - Baseflow index derived from Hydrology of Soil Types (HOST) soils data
- FARL - Index of flood attenuation due to reservoirs and lakes
- Catchment Area - Hectares

7.8 The QMED calculation sheet from MicroDrainage can be seen in Appendix I, but the outputs for the 57.5 ha (0.58 km^2) catchment is summarised in Table 7.2, below.

Table 7.2 – QMED Rural/Urban Values

QMED Rural (l/s)	QMED Urban (l/s)
453.1	457.2

7.9 The calculated QMED Rural value of 453.1 l/s is equivalent to a rate of 7.88 l/s/ha over the 57.5 ha catchment.

7.10 7.88 l/s/ha is equivalent to 2.92 l/s for the 0.370 hectares of impermeable areas on the proposed development that are to be positively drained (prior to the inclusion of urban creep). Therefore, it is proposed to reduce off-site surface water discharge from the development to a maximum of 2.9 l/s for all storms, inclusive of climate change.

Drainage Strategy Overview

7.11 The drainage strategy for the proposed development will use a mixture of SuDS features to provide all four SuDS pillars, namely quantity benefits through attenuation and source control, quality benefits through adequate pollution mitigation, and amenity and biodiversity benefits by specifying a SuDS basin in the site's greenspace that will compliment the natural space in which it is located. The below overview of the development's drainage strategy should be read in conjunction with the drainage strategy plan in Appendix J of this report.

7.12 It is proposed that properties will be fitted with water butts. These will reduce the reliance on potable water supplies during activities such as gardening and car washing. Water butts can also provide small amounts of storage for surface water and can often assist in achieving zero discharge for rainfall depths up to 5mm, which covers 50% of annual rainfall events (according to the EA's Rainfall Runoff Management for Developments report – SC030219).

7.13 The access roads will utilise System C (tanked) permeable paviours, which will be a composite structure that uses both 30% void crushed stone in its subbase and will also use geocellular crates within the subbase. This approach has been taken to increase the overall attenuation, which is required to manage the surface water volumes generated by the current regulatory and LLFA modelling requirements (see 'Design Criteria', below).

7.14 The permeable paved areas will provide attenuation for surface water falling directly onto them, which will penetrate to the subbase via the joints in the block paviours. Surface water that falls onto the roofs and driveways of the surrounding dwellings will be able to discharge directly into the subbase of the paviours via diffuser crates/pipes, thus this surface water load will also be captured and attenuated by the permeable paviours.

7.15 Because the site is sloping, all sections of composite permeable paving will use terracing of the subbase and baffles/check-dams to ensure maximum attenuation is provided.

7.16 The permeable paviours cannot provide the full attenuation requirements for the site in the 1 in 100-year + 45% rainfall event, thus further opportunities for surface water attenuation are required. Some of this additional attenuation will be provided through a geocellular storage tank that will be positioned under the eastern-most access road serving Plots 3 and 4. Please refer to the drainage strategy plan in Appendix J to see the location and details of the geocellular attenuation tank.

7.17 In accordance with WSCC's LLFA Policy for the Management of Surface Water the geocellular attenuation tank will be preceded by silt traps and will use a distribution pipe (rather than direct entry) to stop silt entering the units. This will keep the maintenance requirement to a minimum.

7.18 There is an area of greenspace to the southeastern corner of the site, and a SuDS basin is proposed in this location. This SuDS basin receives restricted flow from two sections of permeable paviours, as well as the geocellular attenuation tank, prior to discharging at a maximum restricted discharge rate of 2.9 l/s into the drainage ditch to the east of the site, as discussed in Paragraph 2.17. This ditch is clearly shown on LiDAR data (as shown in Figure 2.1 in Section 2) and is at a level that can easily be connected to by gravity, as well as having ongoing connectivity.

Figure 7.1: LiDAR Data and Evidence of Drainage Ditch

7.19 The total attenuation volume available on site is 438.8m^3, not including pipes or manholes.

7.20 By providing three different types of attenuation across the site, from source control to mid-system and end of system storage, it makes the drainage system more resilient. This means that there is less residual risk of failure and flooding due to poor system performance.

7.21 The hydraulic modelling of the proposed drainage strategy is discussed later in this report.

Design Criteria

7.22 The drainage strategy has been designed in accordance with the design criteria outlined in West Sussex County Council's LLFA Policy for the Management of Surface Water[1].

7.23 This ensures that the current drainage strategy accords with local policy requirements (as well as those of the NPPF). In brief, this includes:

- Using FEH 2022 Annual Maximum Catchment data rather than FSR data. It should be noted that the dropdown menu in MicroDrainage's Network module only allows the choice of 1999 data and 2013 data but allows the upload of any data – including FEH 2022. Therefore, the user can use FEH 2022 data but is forced to do it under the label of 2013 data. As such, the MicroDrainage results included with this report state that FEH 2013 data has been used, but we would like to assure that LLFA that FEH 2022 has been used. The LLFA are aware of this issue as it has been discussed with them on a number of other sites.
- Using a runoff coefficient (CV) value of 1.0 in all hydraulic modelling (for both summer and winter storms)
- Reducing the MADD Factor (which assumes 10m^3 of pipe storage per hectare) to zero.
- Urban Creep at a rate of 10% has been considered and included in the parts of the site to which it applies.
- The full suite of rainfall events has been used (up to the 5,760-minute storm, which is maximum allowable when using FEH data).
- The maximum rainfall intensity has been raised to 550mm/hr to ensure that the full hydrograph is included in the hydraulic calculations.]
- The maximum half-drain time is 1,224-minutes, thus less than the 1,440-minute (24-hour) requirement for this metric.
- The geocellular attenuation tank will be preceded by silt traps and will use a distribution pipe (rather than direct entry) to stop silt entering the units. This will keep the maintenance requirement to a minimum

[1] https://www.horsham.gov.uk/__data/assets/pdf_file/0019/65017/West-Sussex-Surface-Water-Management-Policy.pdf

Urban Creep

7.24 An appropriate allowance should be made for urban creep throughout the lifetime of the development as per 'BS 8582:2013 Code of Practice for Surface Water Management for Developed Sites'.

7.25 WSCC have produced their own guidance on the percentage of urban creep that should be applied. They state that the consideration of urban creep should be assessed on a site-by-site basis but is limited to individual residential development only. The allowances set out in Table 5.2 of WSCC LLFA Policy for the Management of Surface Water must be applied to the impermeable area within the property curtilage according to the proposed development density. Table 5.2 of WSCC LLFA Policy is shown below.

Table 5.2 of WSCC LLFA Policy for the Management of Surface Water

Residential development density (Dwellings per hectare)	Change allowance (% of impermeable area)
≤25	10
30	8
35	6
45	4
≥50	2
Flats & Apartments	0

7.26 A full increase of 10% has been used as a precautionary approach. The 10% uplift has been applied to the proposed private impermeable areas and how they have been uplifted is detailed in Table 7.3, below, and has been presented in terms of which pipes in the hydraulic model the uplift has been applied.

Table 7.3 – Urban Creep Increases Applied in Hydraulic Model

Pipe No.	Total Impermeable Area (ha)	Private Impermeable Areas (ha)	10% of Private Impermeable Areas (ha)	Increased Impermeable Area Applied to Pipe (ha)
1.001	0.041	0.030	0.003	0.044
2.001	0.137	0.080	0.008	0.145
3.001	0.091	0.060	0.006	0.097
2.002	0.019	0.010	0.001	0.020
2.003	0.039	0.020	0.002	0.041
4.001	0.044	0.020	0.002	0.046

Summary

7.27 The approach to the layout and design of the surface water drainage strategy for the development has been outlined and the drainage strategy layout has been presented in Appendix J of this report. With specific reference to the drainage hierarchy, the proposed drainage strategy is discussed, below.

The Drainage Hierarchy

7.28 The NPPF states that opportunities to reduce overall flood risk should be sought and achieved through sustainable development and careful drainage design. This can be achieved through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems (SuDS). SuDS are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. They provide opportunities to:

- Reduce the causes and impacts of flooding;
- Remove pollutants from urban run-off at source;
- Combine water management with green space with benefits for amenity, recreation and biodiversity.

7.29 To deliver SuDS benefits and ensure that a development reduces overall flood risk, there is an established hierarchy of surface water drainage methods that should be considered. The most preferable and sustainable are at the top and the least preferable and least sustainable at the bottom.

7.30 The drainage hierarchy is a sequential check that intends to ensure that all practical and reasonable measures are taken to manage surface water as high up the hierarchy (with '1' being the highest) as possible, and that the amount of surface water managed at the bottom of the hierarchy is minimised. The Planning Practice Guidance to the National Planning Policy Framework (NPPF) states that "*Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable*".

7.31 The drainage hierarchy presented in the NPPF presents only four tiers of drainage options. This has been expanded on and adopted by others and now can be viewed as the following:

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to the combined sewer
8. Discharge rainwater to the foul sewer

7.32 Developers should not choose the method that is the most convenient or represents the lowest cost. LPA's, LLFA's and Water Authorities may enforce the surface water drainage hierarchy and demand that the highest practicable tier of the hierarchy is used.

7.33 The first two tiers of the drainage hierarchy ensure that surface water is retained within the site boundary and does not increase flood risk to others. This is always the most preferable method of surface water management.

7.34 The next six tiers of the hierarchy provide regional control, but with decreasing levels of pollution removal and reduced potential for amenity and habitat creation.

7.35 Within the lower six tiers of the drainage hierarchy, there must be some form of flow restriction, so that off-site surface water discharge is reduced, as much as is reasonably practicable. This requires on-site storage facilities, which may include ponds, swales, subsurface storage tanks and System C (non-infiltration) permeable paviours with flow control devices. Again, methods that provide the most potential for amenity and pollution removal should be favoured.

7.36 With regards to the proposed development, the tiers of the drainage hierarchy that have been achieved are outlined in Table 7.4, below:

Table 7.4: Compliance with the Drainage Hierarchy

Tier	Discharge Method	Used?	Notes
1	Store rainwater for later use	ü	Water Butts are to be used in parts of the development.
2	Use infiltration techniques	û	The site is in an area of thick Weald Clay, which is hydraulically unproductive and not conducive to infiltration.
3	Attenuate rainwater in ponds or open water features	ü	A SuDS basin has specified within the drainage strategy.
4	Attenuate rainwater by storing in tanks or sealed water features	ü	The drainage strategy will use 'System C' (tanked) composite permeable paviours.
5	Discharge rainwater direct to a watercourse	ü	The drainage strategy will discharge to an ordinary watercourse and will maintain the existing hydraulic regime.
6	Discharge rainwater to a surface water sewer/drain	û	This tier of the drainage hierarchy will not be required.
7	Discharge rainwater to the combined sewer	û	This tier of the drainage hierarchy will not be required.
8	Discharge rainwater to the foul sewer	û	This tier of the drainage hierarchy will not be required.

Summary

7.37 The drainage strategy uses the 1^{st}, 3^{rd}, 4^{th} and 5^{th} tiers of the drainage hierarchy, which are the highest available and site-suitable methods of surface water management and discharge.

MicroDrainage Hydraulic Modelling

7.38 The drainage strategy outlined above has been designed in MicroDrainage's Network hydraulic modelling module.

7.39 The results of the MicroDrainage hydraulic modelling for the proposed development can be seen in Appendix K.

7.40 The results of the hydraulic modelling show that the drainage strategy as outlined above can attenuate and discharge all surface water generated in the 1 in 100-year + 45% rainfall event, inclusive of urban creep, and without flooding.

7.41 The maximum half drain time of the system is 1,224 minutes, which is less than the 1,440-minute (24-hour) requirement for this metric.

7.42 The MicroDrainage hydraulic model has been built using the specific modelling requirements of WSCC as the LLFA and these have already been discussed in Paragraph 7.23 of this report.

8.0 Foul Water Drainage

8.1 Thames Water's Asset Location Plans in Appendix E show that there is a network of public foul sewers present in Rusper. It was discussed in Section 2 the foul sewer that is adjacent to the site for a short distance at the western end of East Street may not be a suitable connection point for all of the proposed development's foul water, but there is another public foul sewer that enters East Street from the south adjacent to the eastern end of the development, which is the topographically lowest point. This public foul sewer would be suitable for the connection of the site's foul waste, and it is this foul sewer that will be explored for a connection of the site's foul waste with Thames Water.

8.2 Thames Water's peak foul flow calculation follows that of the Design and Construction Guidance (The DCG, or 'The Code') which assumes a conservative rate of 4,000 litres per dwelling per day. With the proposed development including 18 dwellings, this means that the peak flow is 72,000 litres/day, or 0.83 litres/second.

8.3 All Water and Sewerage Companies (WaSC's) have a legal obligation under Section 94 of the Water Industry Act 1991 (the Act) to provide developers with the right to connect to a public sewer regardless of capacity issues. This, in conjunction with Section 91(1) of the Act effectively means that Southern Water cannot object or for the LPA to refuse to grant planning permission on the grounds of insufficient capacity or that no improvement works are planned for an area. The case precedent for this is a Supreme Court decision in Barratt Homes vs Welsh Water, in which the court held that the developer has an absolute right to connect to the existing sewer, whether or not it overloads the system. It ruled that the specific wording of the legislation allows for this right to be exercised, at no cost to the developer, apart from the normal connection charges.

8.4 Where local sewerage infrastructure constraints are identified, network reinforcements are delivered by the WaSC through New Infrastructure Charges on developers. For non-strategic sites, the WaSC company have a maximum of 24 months to deliver sewerage improvements from the point of commitment to the development, which is stated as date of the outline or full planning consent.

9.0 Surface Water Runoff Quality

9.1 The NPPF states that development should not have a detrimental impact on the environment, including the water environment. The technical guidance to the NPPF provides further advice on the benefits of ensuring runoff quality is to an appropriate standard.

9.2 The CIRIA SuDS Manual provides guidance on the treatment of surface water runoff. With regards to the proposed development, Table 4.3 of the CIRIA SuDS Manual rates the pollution hazard from roof water runoff as 'very low'. The only requirement for roof water runoff is the removal of gross solids and sediments, which would be achieved using catchpits and silt traps upstream of the permeable paviours and throughout the drainage network.

9.3 With regards to the property driveways and the access road, Table 4.3 of the CIRIA SuDS Manual rates the pollution hazard from residential car parking and low traffic roads as 'low'. To mitigate a 'low' pollution hazard, the CIRIA SuDS Manual recommends using a simple index approach in line with Section 26.7.1. This is discussed, below.

9.4 Table 26.2 of the CIRIA SuDS Manual provides pollution hazard indices for different land use classifications. The land use classification that requires consideration for low traffic roads and parking areas is in Table 9.1 below.

Table 9.1: Excerpt from Table 26.2 of CIRIA SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, homezones and general access roads) with less than 300 traffic movements per day.	Low	0.5	0.4	0.4

9.5 To deliver adequate pollution treatment and mitigation, the CIRIA SuDS Manual recommends using a SuDS component that has a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type).

9.6 Table 26.3 of the CIRIA SuDS Manual provides indicative SuDS mitigation indices for each SuDS type when discharging to surface waters. Table 9.2, below, which is an excerpt from Table 26.3, shows the mitigation index for permeable paviours.

Table 9.2: Pollution Mitigation Indices for Permeable Pavements

Type of pollution removal component	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Permeable Pavements	0.7	0.6	0.7

9.7 The mitigation indices for permeable pavements exceed those of the highest pollution hazard index figures from Table 9.1.

9.8 Parts of the site will drain through permeable pavements before outfalling to the SuDS basin, thus surface water will pass through two mitigation components. Where two mitigation components are used in series, the C753 SuDS manual states that:

Total SuDS mitigation index = mitigation index (component one) + 0.5 mitigation index (component two)

9.9 Thus, the SuDS basin when it has followed the permeable paviours will provide the below mitigation indices as in Table 9.3:

Table 9.3: Pollution Mitigation Indices for Secondary SuDS Feature (SuDS Basin)

Type of pollution removal component	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
SuDS Basin	0.25 (0.5 ÷ 2)	0.25 (0.5 ÷ 2)	0.30 (0.6 ÷ 2)

9.10 And the total mitigation indices for the site is as per Table 9.4, below:

Table 9.4: Total Pollution Mitigation Offered by Permeable Paviours and SuDS Basin:

Contaminant Type	Pollution Hazard Index	Pollution Mitigation Index	Difference
Total Suspended Solids	0.5	0.95 (0.7 + 0.25)	+ 0.45
Metals	0.4	0.85 (0.6 + 0.25)	+ 0.45
Hydrocarbons	0.4	1.00 (0.7 + 0.30)	+ 0.60

9.11 The above evidence shows how the permeable paviours and SuDS Basin combine to ensure all pollution hazards are completely mitigated.

10.0 Residual Risk

10.1 Whilst the drainage strategy for the development has been designed to attenuate surface water from the 1 in 100-year plus 45% rainfall event, plus an inclusion for urban creep, there could be a small residual risk of flooding due to blockage or failure or poor performance of on-site infrastructure. Therefore, appropriate and regular maintenance of the drainage infrastructure should be undertaken by the site management company or their agents.

10.2 To assist with this process, a Drainage Management and Maintenance Plan has been prepared, which sets out the principles for the long-term management and maintenance of the proposed surface water drainage system on the development. The Drainage Management and Maintenance Plan can be seen in Appendix L.

10.3 The purpose of this document is to ensure that those responsible for site maintenance have a robust inspection and maintenance plan going forwards. This will help ensure the optimum operation of the surface water drainage system and that it will be regularly maintained for the lifetime of the development. This will contribute to reducing the risk of surface water flooding both on- and off-site.

11.0 Exceedance Events

11.1 Exceedance events are those greater than the design rainfall event (i.e., greater than the 1 in 100-year rainfall event plus 45% for climate change).

11.2 Any rainfall events greater than the design rainfall event may cause flooding due to them ‘exceeding’ the capacity of the drainage system. In this situation it is imperative to check whether flooding would occur and, if so, whether it needs to be contained on site. Exceedance flows should not ingress into any properties on site and should not cause nuisance to any neighbouring sites or buildings.

11.3 The drainage system as designed has a large attenuation capacity available and, because of the LLFA’s design criteria, it assumes zero losses due to vegetation interception, evaporation and surface roughness, and cannot include for storage/conveyance within the pipes around/between the plots and the main drainage system. Therefore, the drainage system, as designed, represents an *extremely* conservative strategy that, in a real-world scenario, would not receive the surface water that has been catered for in the MicroDrainage hydraulic model. As such, the designed drainage system would, in operation, have capacity for events beyond that of the 1 in 100-year rainfall event plus 45% for climate change, i.e. ‘exceedance events’.

11.4 Notwithstanding this, a high-level plan of exceedance flows has been produced to show the pathway that exceedance flows would take across the site. This can be seen in Appendix M.

12.0 Summary and Conclusion

12.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been produced by Motion on behalf of their client, Devine Homes PLC. It supports the planning application for the proposed 18-unit residential development on the Land North of East Street, Rusper.

12.2 The EA's Flood Map for Planning shows that the site is within Flood Zone 1 and is not at risk of fluvial (or tidal) flooding.

12.3 The updated RoFSW mapping for the site shows that the site is predominantly at 'very low' risk of surface water flooding. In the southeastern corner of the site, the flow path is shown to cross into the red line boundary. There is a slight disconnect to a 'low' risk flow path that exists within the southeastern corner of the site, which then flows eastwards out the site and joins the natural valley feature and watercourse that was discussed earlier in this report.

12.4 Referring to Paragraph 175 of the NPPF, no built development is within any areas of risk. Therefore, the development has followed the sequential approach to the layout and allocation of development within the site and is in accordance with the NPPF and the minimal areas of surface flood risk within the red line boundary should not form an impediment to the progress of this development.

12.5 The drainage strategy for the proposed development has been produced in line with the drainage hierarchy and WSCC's LLFA design criteria. It will use a mixture of SuDS features to provide attenuation, source control and pollution mitigation. The site's surface water will discharge at the QMED Rural greenfield runoff rate of 2.9 l/s to the adjacent ordinary watercourse on the site's southern boundary.

12.6 The access roads will utilise composite System C (tanked) permeable paviours. Additional storage will be provided through a geocellular attenuation tank and a SuDS basin in the greenspace to the east of the site. The drainage strategy as proposed can successfully mitigate the expected pollution hazards that will be generated on site and provides amenity and biodiversity benefits.

12.7 This drainage strategy has been hydraulically modelled in MicroDrainage's Network module and has shown that it can attenuate the 1 in 100-year + 45% rainfall event without flooding, with an inclusion for urban creep.

12.8 A drainage management and maintenance plan has been produced that shows how the proposed drainage system will be maintained in perpetuity.

12.9 Exceedance flows have been considered and an exceedance plan produced.

12.10 Foul waste from the site will connect to the existing public foul sewer in East Street.

12.11 In conclusion, this drainage strategy has shown that the proposed development is at a very low residual risk of flooding, and this makes it appropriate in this location. Similarly, the drainage strategy has shown that the development can manage its foul and surface water sustainably. Therefore, flood risk and surface water management should not form an impediment to the progress of this application.

Appendix A

Proposed Development Layout

CDM 2015 Health & Safety Information:

This information relates only to 'Significant Hazards' identified on this drawing and is to be read in conjunction with the Designer's Hazard Register.

Accommodation Schedule

SITE (outlined in RED) - 0.9Ha

Affordable	**Approx. Area**		**6 dwellings**
4 no. 2Bed	79.0m²	(850ft²)	2-Bedroom House
1 no. 2Bed	79.6m²	(857ft²)	2-Bedroom House
1 no. 3Bed	98.2m²	(1057ft²)	3-Bedroom House
Open Market	**Approx. Area**		**12 dwellings**
2 no. 2Bed	79.0m²	(850ft²)	2-Bedroom House
1 no. 2Bed	79.6m²	(857ft²)	2-Bedroom House
1 no. 3Bed	98.0m²	(1055ft²)	3-Bedroom House
1 no. 3Bed	98.2m²	(1057ft²)	3-Bedroom House
1 no. 3Bed	100.4m²	(1,081ft²)	3-Bedroom House
4 no. 3Bed	112.6m²	(1,212ft²)	3-Bedroom House
2 no. 4Bed	137.1m²	(1,476ft²)	4-Bedroom House
Grand Total:	**1753m²**	**(18, 865ft²)**	**18 Dwellings**

KEY

	Site Boundary
Cbf	1.8m Close board fence
Bw	1.8m Brick wall
Pf	Existing post & rail fence
	Trees to be removed
	RPAs

Car Parking;	2 spaces per 2 bedroom dwelling 2 spaces per semi-detached 3 bedroom dwelling 2 spaces plus a garage per detached 3 bedroom dwelling 3 spaces plus a garage per 4 bedroom dwelling 4 visitor spaces
Cycle Parking;	2 spaces per dwelling within garages, or rear garden stores
Refuse Storage;	Within rear gardens to be brought to property fronts on collection days only

Rev	Date	Revision Details	Dr	Ch
B	30.01.25	Updated to include consultant input	GP	PA
A	08.01.25	Updated to client's comments	GP	PA

Client's Name: Devine Homes

Drawing Title: Site Layout

Drawn: GP | Checked: PA | Date: 26.11.24

Job Title: East Street, Rusper

Scale: 1:500 @ A3

metres 5 10 15 20

Job No: 7522 | Drawing No: PL-03 | Rev: B

Status: PRELIMINARY

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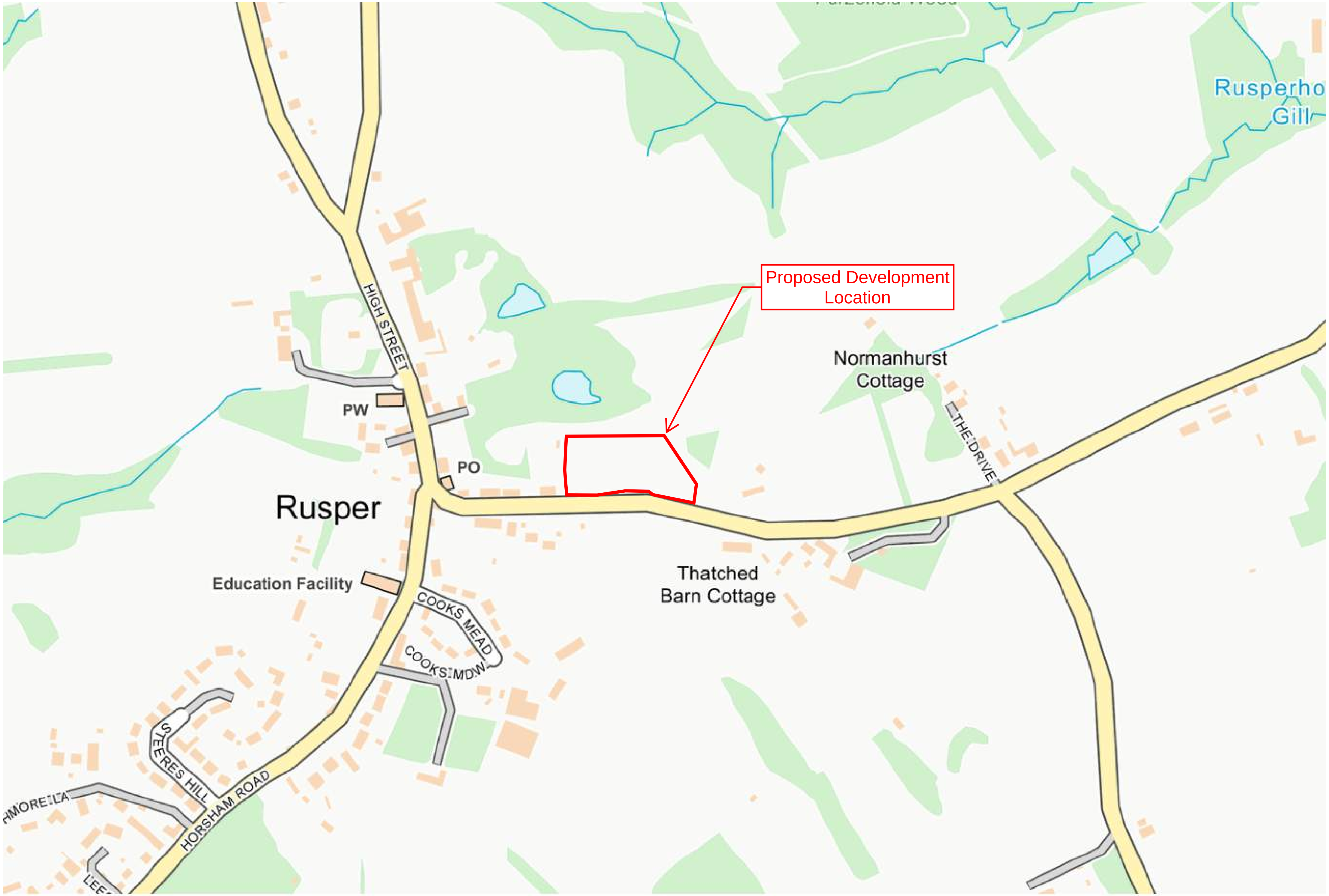
ECE Architecture
www.ecearchitecture.com

CAD Plot date: 4/02/2025 - 09:32:48

7522 - site layout.dwg

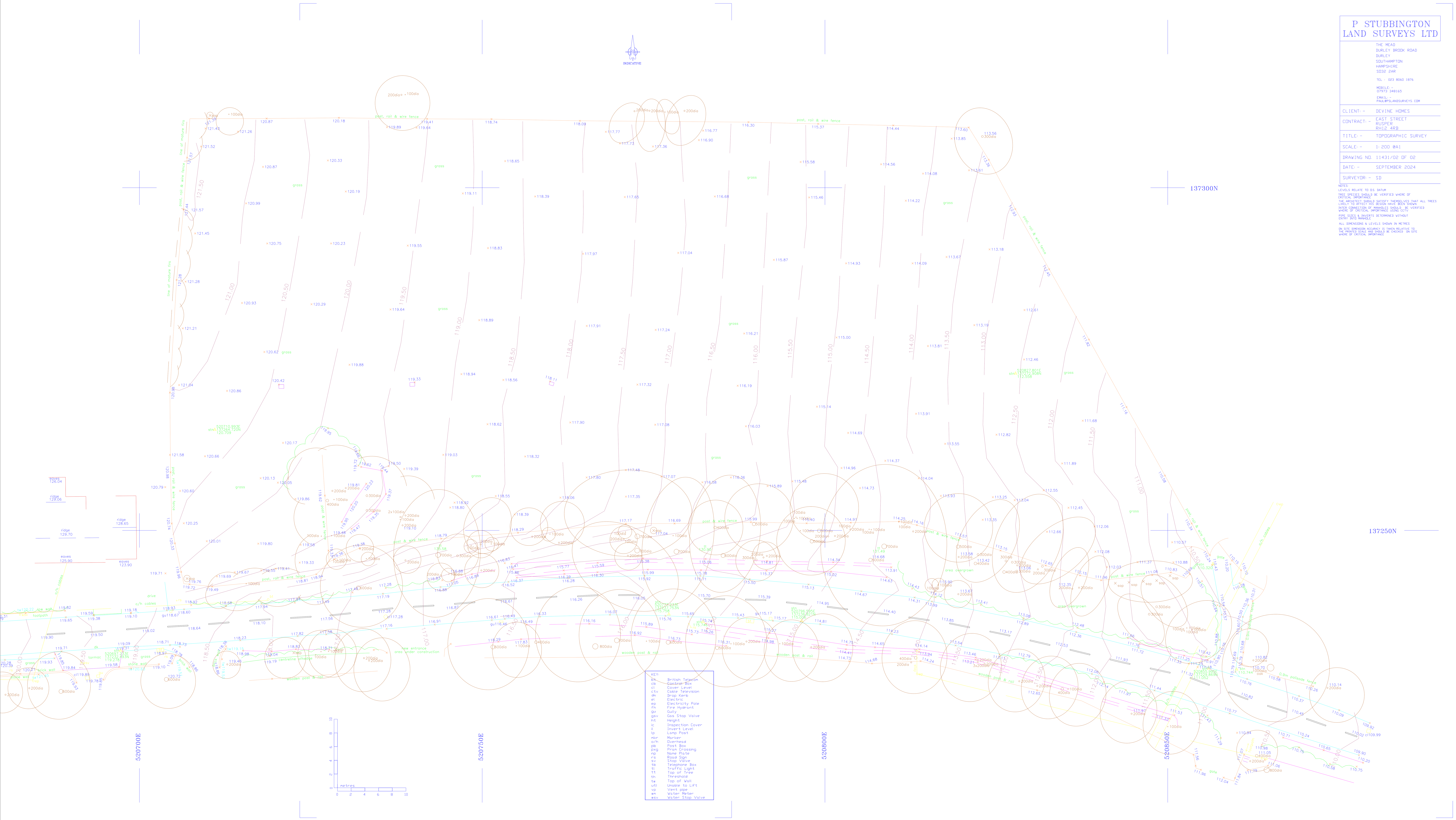
Appendix B

Site Location Plan


Proposed Development Location
Normanhurst Cottage
Thatched Barn Cottage
Rusper
HIGH STREET
PW
PO
Education Facility
COOKS MEAD
COOKS MDW
STEERES HILL
HORSHAM ROAD
THE DRIVE

Appendix C

Topographic Survey


P STUBBINGTON
LAND SURVEYS LTD
THE MEAD
DURLEY BROOK ROAD
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SOUTHAMPTON
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TEL : 023 8060 1876
MOBILE: -
07973 348165
EMAIL: -
PAUL@PSLANDSURVEYS.COM
CLIENT: - DEVINE HOMES
CONTRACT: - EAST STREET
RUSPER
RH12 4RB
TITLE: - TOPOGRAPHIC SURVEY
SCALE: - 1: 200 @A1
DRAWING NO. 11431/02 OF 02
DATE: - SEPTEMBER 2024
SURVEYOR: - SD
NOTES:
LEVELS RELATE TO O.S. DATUM
TREE SPECIES SHOULD BE VERIFIED WHERE OF CRITICAL IMPORTANCE
THE ARCHITECT SHOULD SATISFY THEMSELVES THAT ALL TREES LIKELY TO AFFECT HIS DESIGN HAVE BEEN SHOWN
INTER CONNECTION OF MANHOLES SHOULD BE VERIFIED WHERE OF CRITICAL IMPORTANCE USING CCTV
PIPE SIZES & INVERTS DETERMINED WITHOUT ENTRY INTO MANHOLE
ALL DIMENSIONS & LEVELS SHOWN IN METRES
ON SITE DIMENSION ACCURACY IS TAKEN RELATIVE TO THE PRINTED SCALE AND SHOULD BE CHECKED ON SITE WHERE OF CRITICAL IMPORTANCE
137300N
137250N
520700E
520750E
520800E
520850E
INDICATIVE
KEY:
bt British Telecom
cb Control Box
cl Cover Level
ctv Cable Television
dk Drop Kerb
el Electric
ep Electricity Pole
fh Fire Hydrant
gu Gully
gsv Gas Stop Valve
ht Height
ic Inspection Cover
il Invert Level
lp Lamp Post
mkr Marker
o/h Overhead
pb Post Box
pxg Pram Crossing
np Name Plate
rs Road Sign
sv Stop Valve
tb Telephone Box
tl Traffic Light
tt Top of Tree
th Threshold
tw Top of Wall
utl Unable to Lift
vp Vent pipe
wm Water Meter
wsv Water Stop Valve
metres
0 2 4 6 8 10

Appendix D

BGS Borehole Log

TQ 23 NW 4

WELL BORING at Rusper County Sussex 286/13
Geol. map 1 in. map New Series 302 6 in. map TQ 23/13
Made by Duke & Ockenden Date 1928
Sunk 34 feet. Bored 216 feet.
Communicated by Sir Evelyn de la Rue.
Height above Ordnance Datum Rest level of water 113
Yield 500 gph.
Quality (with copy of analysis on separate sheet) Suitable for drinking purposes
GR 2094 3716

GEOLOGICAL FORMATION.	NATURE OF STRATA.	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
	(Dug well	34	-)		
	Weald Clay	250	-	250	
	Rocky shale at base				
	Water cut at 70 ft., unfit for use	(84.7° of hardness)			
	" " " 240 ft.				
	Lined 6in. tubes to 87				
	" 4½" " " 170				
	3" " " 250 (perforated)				
	Pumps at 160 ft				

Rusper—Maps O.S.G. 8, N.S. 302.

534. NORMANS, ¼ mile E.S.E. of church. 1928. Ht. above O.D. about 350 ft. Map ~~3 S.W.~~ 3 SW.

	Thickness Ft.	Depth Ft.
Dug well ...	—	34
Weald Clay ...	216	250

Rocky shale was encountered at the bottom of the boring, which most probably was the top of the Tunbridge Wells Sand.

1st water cut at 62 ft.–74 ft., with 84·7 degrees of hardness, and unfit for use. 2nd water at 180 ft.–200ft. R.L.W. 113 ft. down. Yield 500 g. p. hour. Lined 6 in. tubes to 87 ft., 4½ in. tubes to 170 ft., and 3 in. tubes to 250 ft. (perforated 170 ft.–218 ft.). Pumps at 160 ft. down. Analyses of water on p. 240. Information from Messrs. Duke and Ockenden, Ltd.

P

GSM 28/2423

Analysis on [illegible]

Rusper

NORMANS. Well No. 534.

	Grains per gallon.
Total solids ...	105
Chlorine ...	17·3
Ammonia ...	0·0343
Albuminoid ammonia ...	absent.
Nitrogen as nitrates ...	absent
Nitrogen as nitrites ...	absent.
Lead ...	absent.
Total hardness (Clark) ...	6°

This water is free from sewage pollution and may be regarded as quite suitable for drinking purposes. The water is strongly alkaline and the degree of 'hardness' is very low, hence it is well suited for general domestic uses.

By Mr. R. A. Cripps, F.I.C.

Published in 'Wells & Springs of Sussex. page 219

M of H notified 4/5/28

Disused visited S Buchan 16.2.40.

Visited. Sited. Disused since house on mains Sussex 3 SW/W Z. 29.5.47.

TQ23NW/4

TQ23/13

302

44

2 WELL BORING at Rusper County Sussex
Geol. map 1 in. map New Series 302 6 in. map
Made by Duke & Ockenden Date 1928
Sunk 34 feet. Bored 216
Communicated by Duke & Ockenden
Height above Ordnance Datum Rest level of water 113
Yield Tested at 500 g.p.h.
Quality (with copy of analysis on separate sheet)

GEOLOGICAL FORMATION.	NATURE OF STRATA.	THICKNESS. Feet.	THICKNESS. Inches.	DEPTH. Feet.	DEPTH. Inches.
	Dug well	34	—	34	—
	Wealden clay	216	—	250	—
	Lined 6" tubes to 87 ft.				
	4½" " " 170 ft.				
	3" " " 250 ft.				
	(3" tubes perforated 170' — 218')				
	First water cut at 62'–74'				
	84.7° of hardness				
	Water cut at 180'–200'.				
	Alkaline with 6° of hardness				
	Site Normans for Sir Evelyn de la Rue.				

Rusper At Normans. Sussex
for Sir Evelyn de la Rue DEC 1928

Dug well .. .. 34' 0"
Bored to .. .. 250' 0"
Lined. 6" tubes to 87' 0"
" 4½ . . 170' 0"
" 3" . . 250' 0"
3" tubes perforated from 170' to 218'
Water level .. .. 113' 0"
Tested at 500 g.p.h.

Stratum
Wealden Clay
First water cut at 62' to 74'
84.7° degrees of hardness
Water cut at 180 to 200
Water alkaline with 6° of hardness.

WSB 4/324.

M of H notified 2/7/28

1 **302/44 Normans, Rusper.** (Disused) TQ23/13

W.S.Sx.III, p. 219. Surface +353. Shaft 34; rest bore. Lining tubes: 87 × 6 in from surface; × 4½ in to 170 down; × 3 in to 250 down (perforated 170 to 218). Water struck at +291 to +279 (Hardness: total 1,210), +173 to +153 (Hardness: total 86) and at +113. R.W.L. +240. Suction +193. Yield 500 g.p.h. (test). *Dando, 1928.*

WC	...	...	250	250

NO DETAILS KNOWN

TQ23/13

289

302

4

WELL BORING at Rusper County Sussex

l. map 1 in. map New Series 302 6 in. map

de by Duke & Ockenden Date 1928

Sunk 34 feet. Bored 216 feet.

Communicated by Sir Evelyn de la Rue.

Height above Ordnance Datum 353 Rest level of water 113

Yield 500 gph.

Quality (with copy of analysis on separate sheet) Suitable for drinking purposes

TQ 2093 3718

GEOLOGICAL FORMATION.	NATURE OF STRATA.	THICKNESS. Feet.	Inches.	DEPTH. Feet.	Inches.
	(Dug well	34	-)		
WC	Weald Clay	250	-	250	
	Rocky shale at base				
	Water cut at 70 ft., unfit for use (84·7° of hardness)				
	" " " 240 ft.				
	Lined 6in. tubes to 87				
	4½" " " 170				
	3" " " 250 (perforated)				
	Pumps at 160 ft				

Rusper—Maps O.S.G. 8, N.S. 302.

534. NORMANS, ½ mile E.S.E. of church. 1928. Ht. above O.D. about 350 ft. Map ~~3 S.W.~~ 3SW.

	Thickness Ft.	Depth Ft.
Dug well	—	34
Weald Clay	216	250

Rocky shale was encountered at the bottom of the boring, which most probably was the top of the Tunbridge Wells Sand.

1st water cut at 62 ft.–74 ft., with 84·7 degrees of hardness, and unfit for use. 2nd water at 180 ft.–200ft. R.L.W. 113 ft. down. Yield 500 g. p. hour. Lined 6 in. tubes to 87 ft., 4½ in. tubes to 170 ft., and 3 in. tubes to 250 ft. (perforated 170 ft.–218 ft.). Pumps at 160 ft. down. Analyses of water on p. 240. Information from Messrs. Duke and Ockenden, Ltd.

Gfm 28 2427

Analysis on file

P

Rusper

NORMANS. Well No. 534.

	Grains per gallon.
Total solids	105
Chlorine	17·3
Ammonia	0·0343
Albuminoid ammonia	absent.
Nitrogen as nitrates	absent
Nitrogen as nitrites	absent.
Lead	absent.
Total hardness (Clark)	6°

This water is free from sewage pollution and may be regarded as quite suitable for drinking purposes. The water is strongly alkaline and the degree of 'hardness' is very low, hence it is well suited for general domestic uses.

By Mr. R. A. Cripps, F.I.C.

Published in 'Wells & Springs of Sussex, II, page 219

M. of H notified 4/5/28.

~~Disused~~ visited S Buchan 16·2·40.

Visited. Disused since house on mains. Sited on Sussex 3 SW/W E. 29.5.47.

O.D. + 353. Visited 20·11·57. RW.

GEOLOGICAL SURVEY AND MUSEUM, JERMYN STREET, LONDON. S.W. 1. (B10619). Wt. 15824—S123. 2500. 11/25. Gp. 169. O.A.

WELL BORING at Rusper County Sussex TQ23/13

Geol. map 1 in. map New Series 302 6 in. map

Made by Duke + Ockenden Date 1928

Sunk 34 feet. Bored 216 feet.

Communicated by Duke + Ockenden 302

Height above Ordnance Datum Rest level of water

Yield Tested at 500 g.p.h.

Quality (with copy of analysis on separate sheet)

GEOLOGICAL FORMATION.	NATURE OF STRATA.	THICKNESS. Feet.	Inches.	DEPTH. Feet.	Inches.
	Dug well	34	—	34	—
	Wealden clay	216	—	250	—

Lined 6" tubes to 87 ft.
4½" " " 170 ft.
3" " " 250 ft.
(3" tubes perforated 170'—218')

First water cut at 62'–74'
84.7° of hardness

Water cut at 180'–200'
Alkaline with 6° of hardness

Site
Normans
for Sir Evelyn de la Rue.

Rusper — At Normans. for Sir Evelyn de la Rue — Sussex — D&O 1928

Dug well .. .. 34' 0"
Bored to .. .. 250' 0"
Lined. 6" Tubes to 87' 0"
" 4½ . . 170' 0"
" 3" . . 250' 0"
3" tubes perforated from 170' to 218'
Water level .. .. 113' 0"
Tested at 500 g.p.h.

Stratum
Wealden Clay
First water cut at 62' to 74'
84.7° degrees of hardness
Water cut at 180 to 200
Water alkaline with 6° of hardness.

WSB 4/324.

M. of H notified 2/7/28

Geological Survey and Museum, Jermyn Street, London, S.W. 1.

(B10619). Wt. 15824—S123. 2500. 11/25. Gp. 160. O.A.

letter of the 10th inst., addressed to Duke & Ockenden, Ltd., which was referred to our Littlehampton Office as the record came from there.

From what I can gather the report that we sent in to you was the final and correct version. I have had nothing to do with this job, nor have I had access to the records, but I am assured that the statement sent in is reliable for insertion in the Memoirs.

I am writing this in case you have not received a reply direct from Littlehampton.

Yours truly,

TELEPHONE: HOP 1768.

289

TQ23/13

302

126, SOUTHWARK STREET,
LONDON, S.E. 1.

20th July, 1928.

44

Dear Mr. Edmunds,

Normans, Rusper, Sussex.

This letter is addressed to you personally in regard to your letter of the 10th inst., addressed to Duke & Ockenden, Ltd., which was referred to our Littlehampton Office as the record came from there.

From what I can gather the report that we sent in to you was the final and correct version. I have had nothing to do with this job, nor have I had access to the records, but I am assured that the statement sent in is reliable for insertion in the Memoirs.

I am writing this in case you have not received a reply direct from Littlehampton.

Yours truly,

Maurice Ockenden

F. H. Edmunds, Esq.,
The Geological Survey & Museum,
Jermyn Street,
S.W.1.

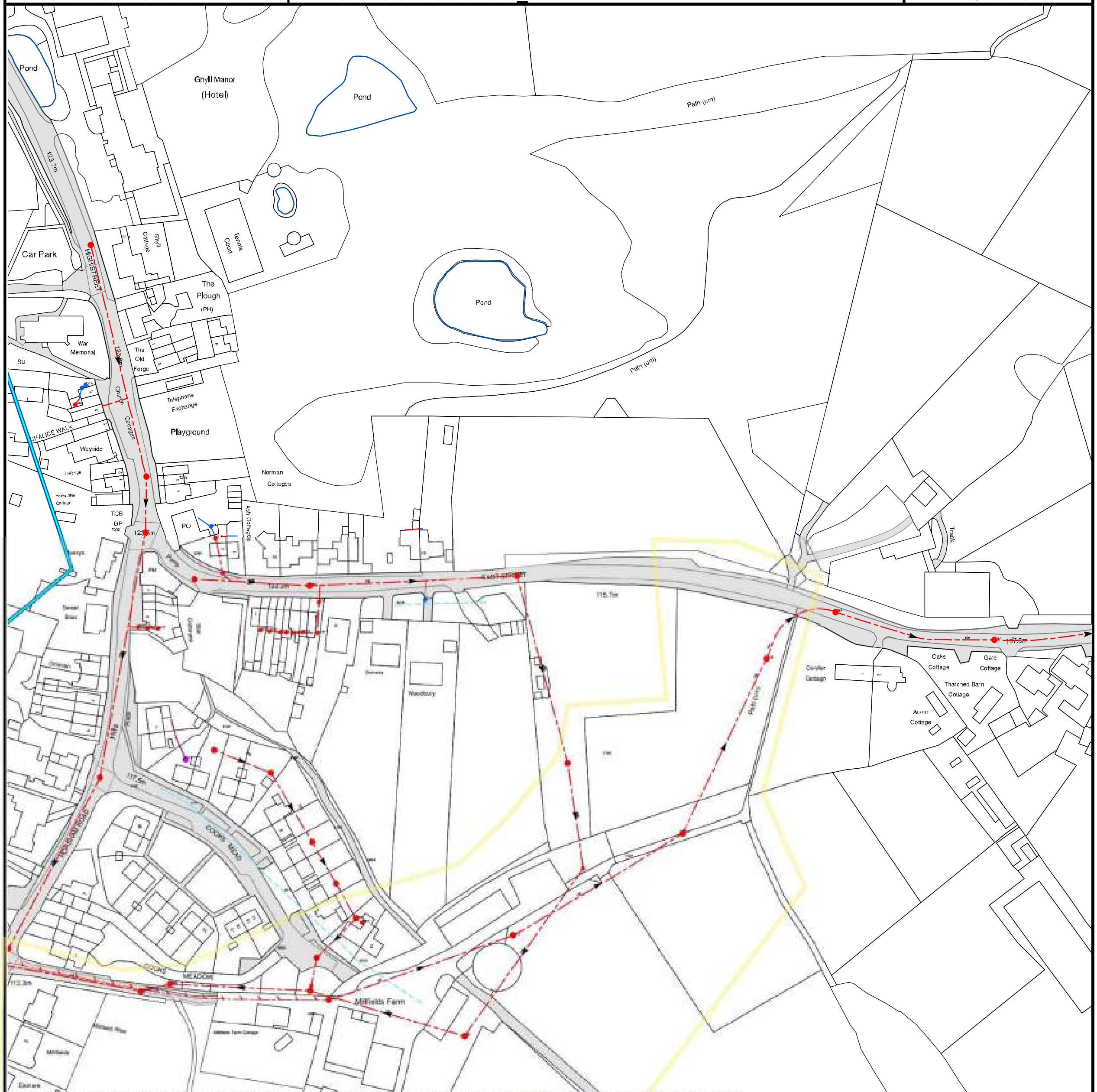
Page 219

MAO/K.

Appendix E

Thames Water Asset Location Plan

Asset Location Search Sewer Map - ALS/ALS Standard/2023_4884414	TQ2037SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 520750,137250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6001	119.57	114.55
6101	120.99	119.72
6002	119.7	118.64
621H	n/a	n/a
621I	n/a	n/a
601D	118.55	117.28
6004	n/a	n/a
6003	119.85	118.98
601B	n/a	n/a
601A	n/a	n/a
621B	n/a	n/a
621A	n/a	n/a
7001	n/a	n/a
701A	117.83	115.01
7201	117.16	115.88
7102	118.29	115.47
7101	116.93	115.29
811A	114.2	112.24
811B	112.93	109.76
821A	109.88	108.44
921A	107.22	105.4
621D	n/a	n/a
621C	n/a	n/a
521D	n/a	n/a
521E	n/a	n/a
521F	n/a	n/a
6201	121.66	120.04
5201	122.87	121.27
521C	n/a	n/a
521B	n/a	n/a
5202	123.47	121.51
521A	n/a	n/a
5203	123.48	121.74
531C	n/a	n/a
531B	n/a	n/a
531A	n/a	n/a
5301	123.75	122.33
5001	n/a	n/a
5101	118.79	116.92
5002	117.69	114.22
5003	118.56	114.3
511B	n/a	n/a
511A	n/a	n/a
5102	122.14	120.7
6102	122.05	120.32
621E	n/a	n/a
601C	n/a	n/a
621J	n/a	n/a
621F	n/a	n/a
621G	n/a	n/a

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Inlet
- Outfall
- Undefined End

Other Symbols

Symbols used on maps which do not fall under other general categories.

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement
- Conduit Bridge
- Subway
- Tunnel

Ducts may contain high voltage cables. Please check with Thames Water.

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

Appendix F

Site Drainage Investigation

LAND NORTH OF EAST STREET, RUSPER – SW DRAINAGE INVESTIGATIONS

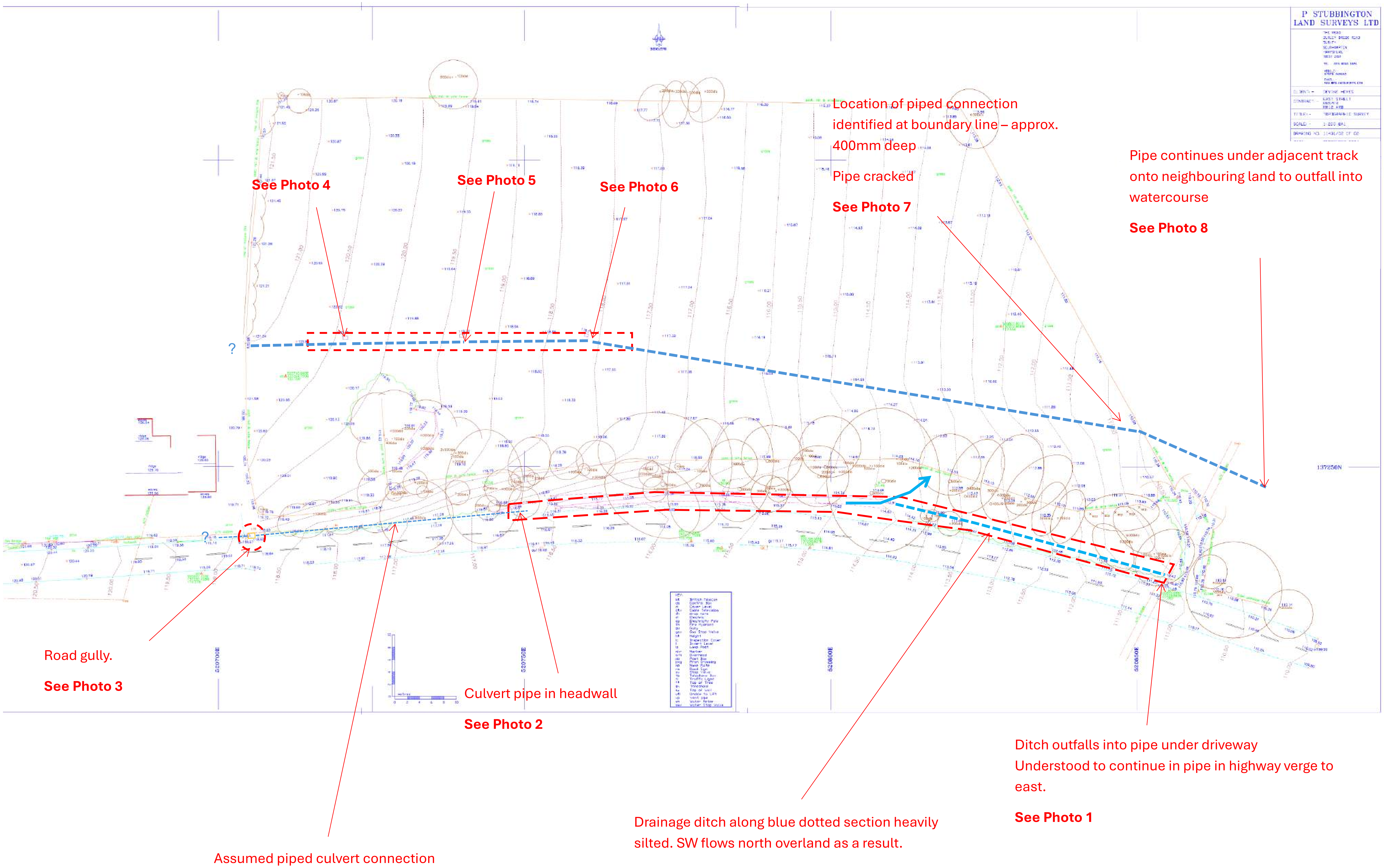


PHOTO 1

PHOTO 2

PHOTO 3

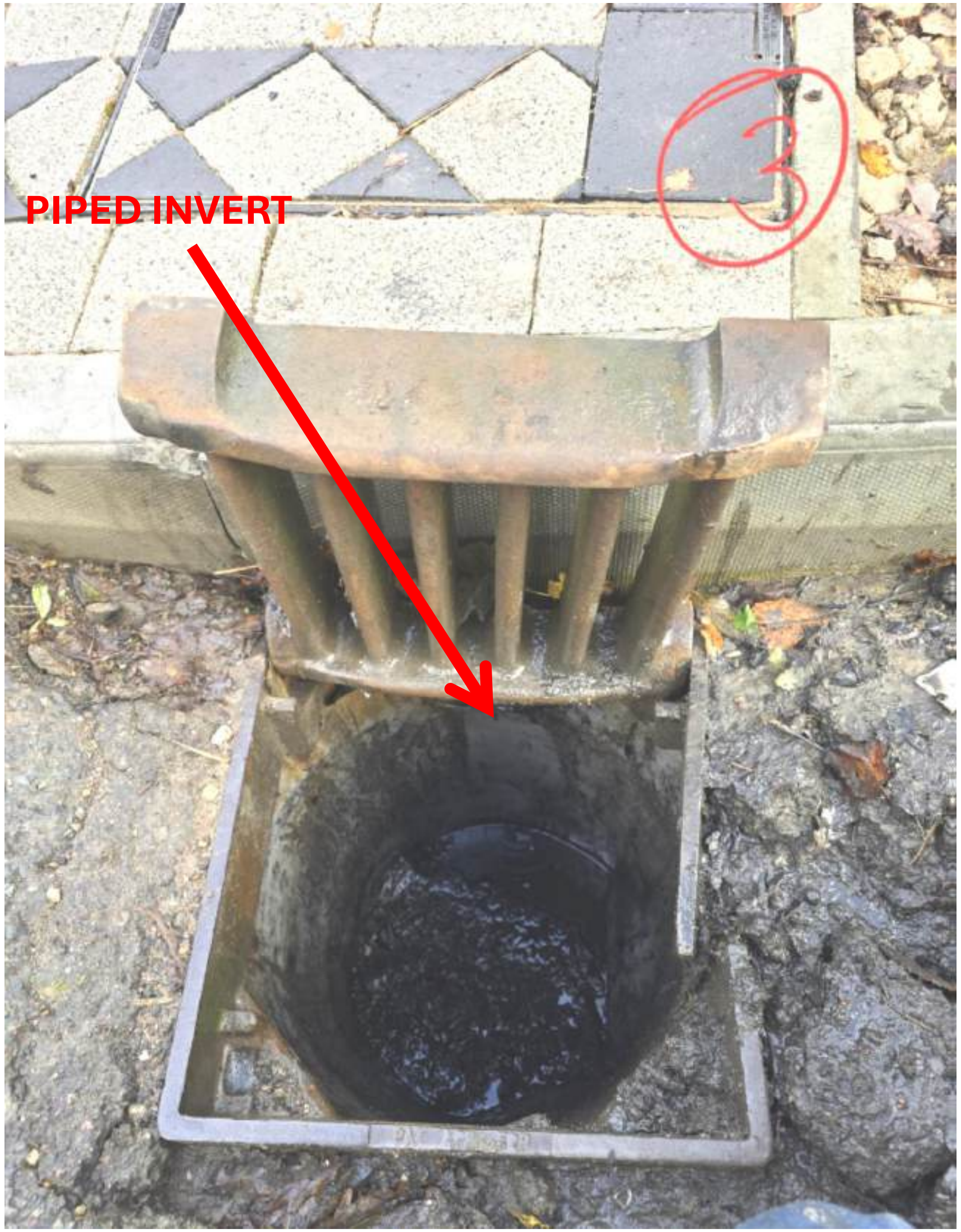


PHOTO 4

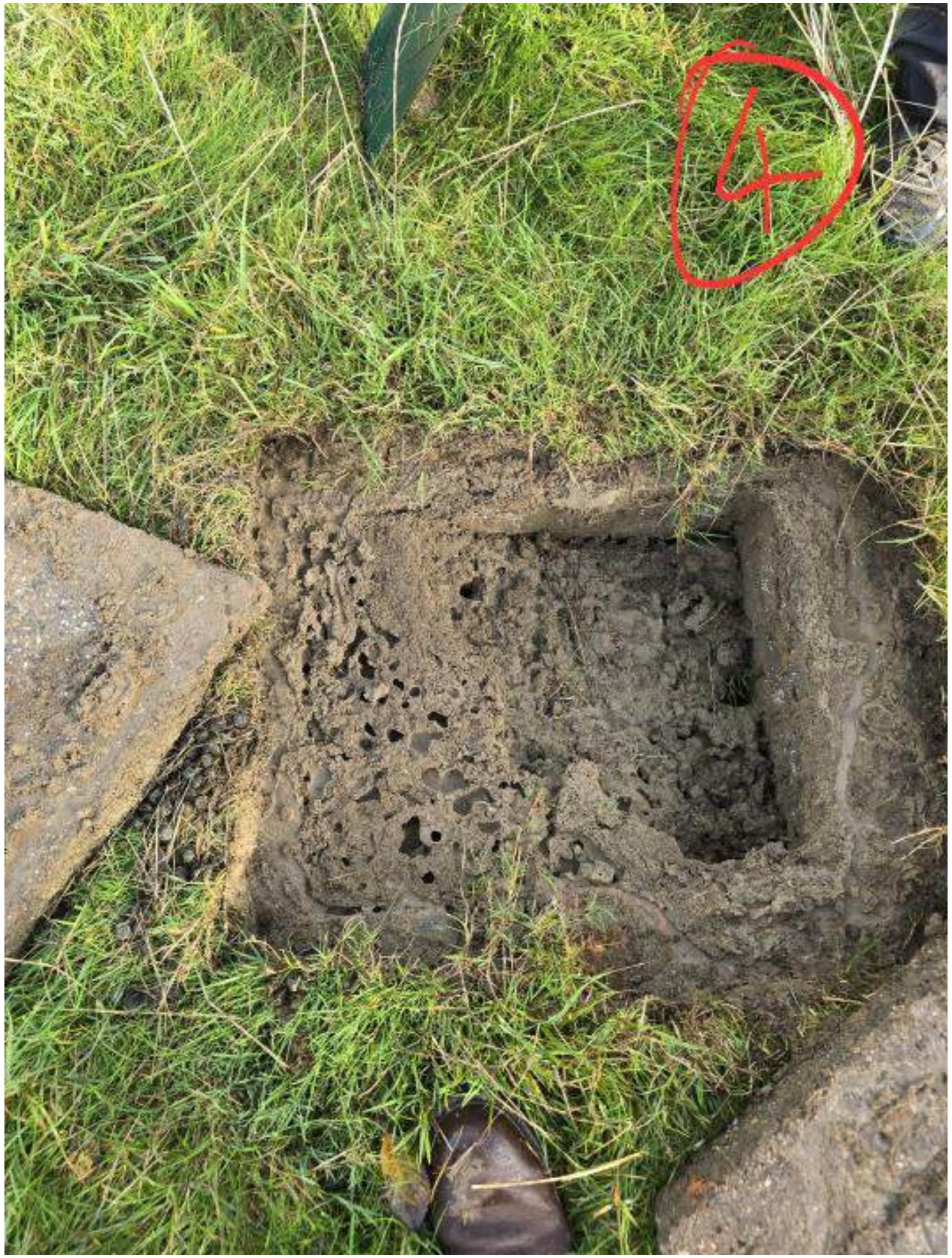


PHOTO 5

PHOTO 6

PHOTO 7

PHOTO 8

PHOTO 8 (CONTINUED)

Appendix G

Environment Agency Flood Map for Planning

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**520780/137272**	**5 Feb 2025 12:07**

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

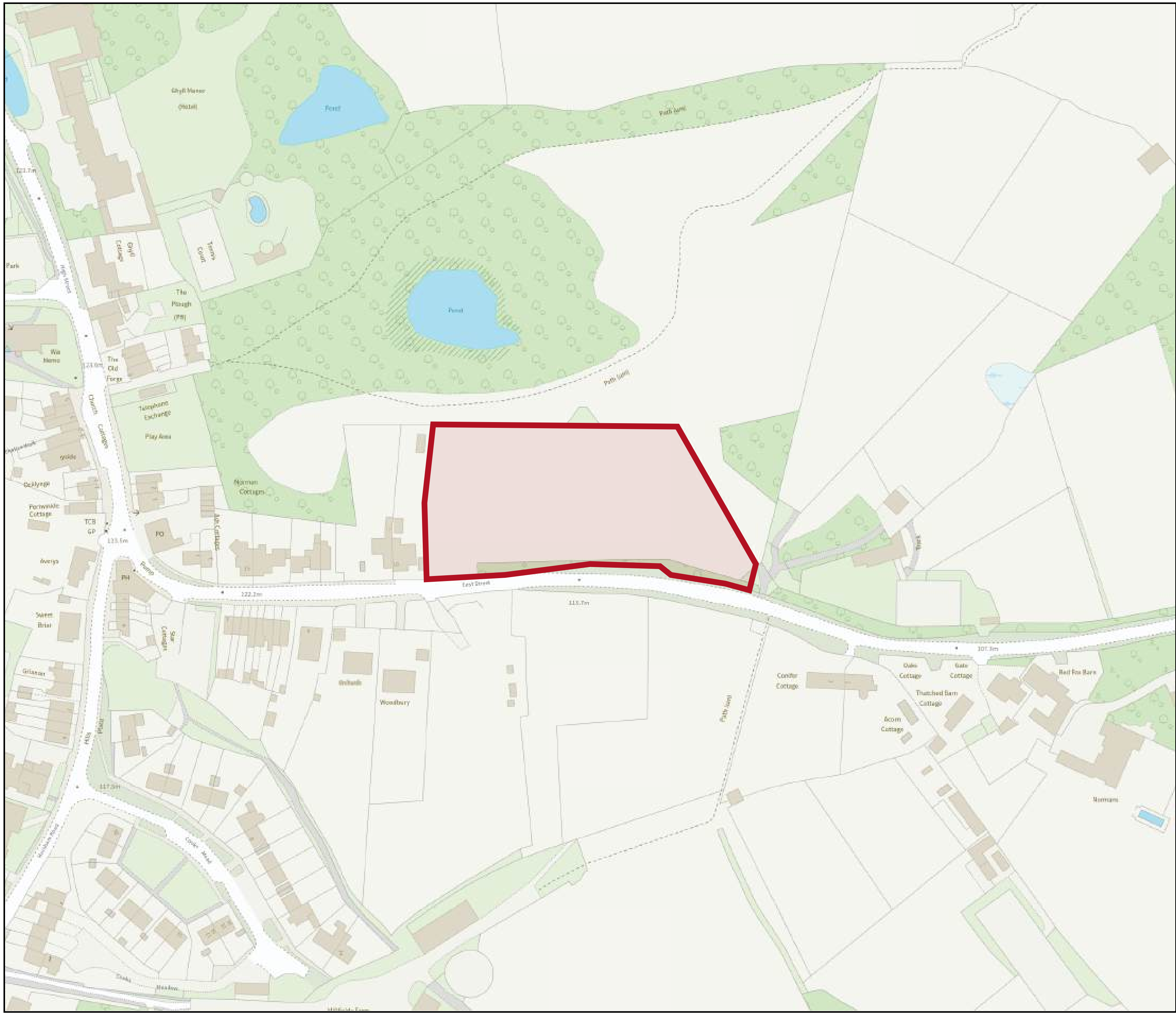
You will need to do a flood risk assessment if your site is **any of the following:**

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

Notes

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

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



Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
520780/137272

Scale
1:2500

Created
5 Feb 2025 12:07

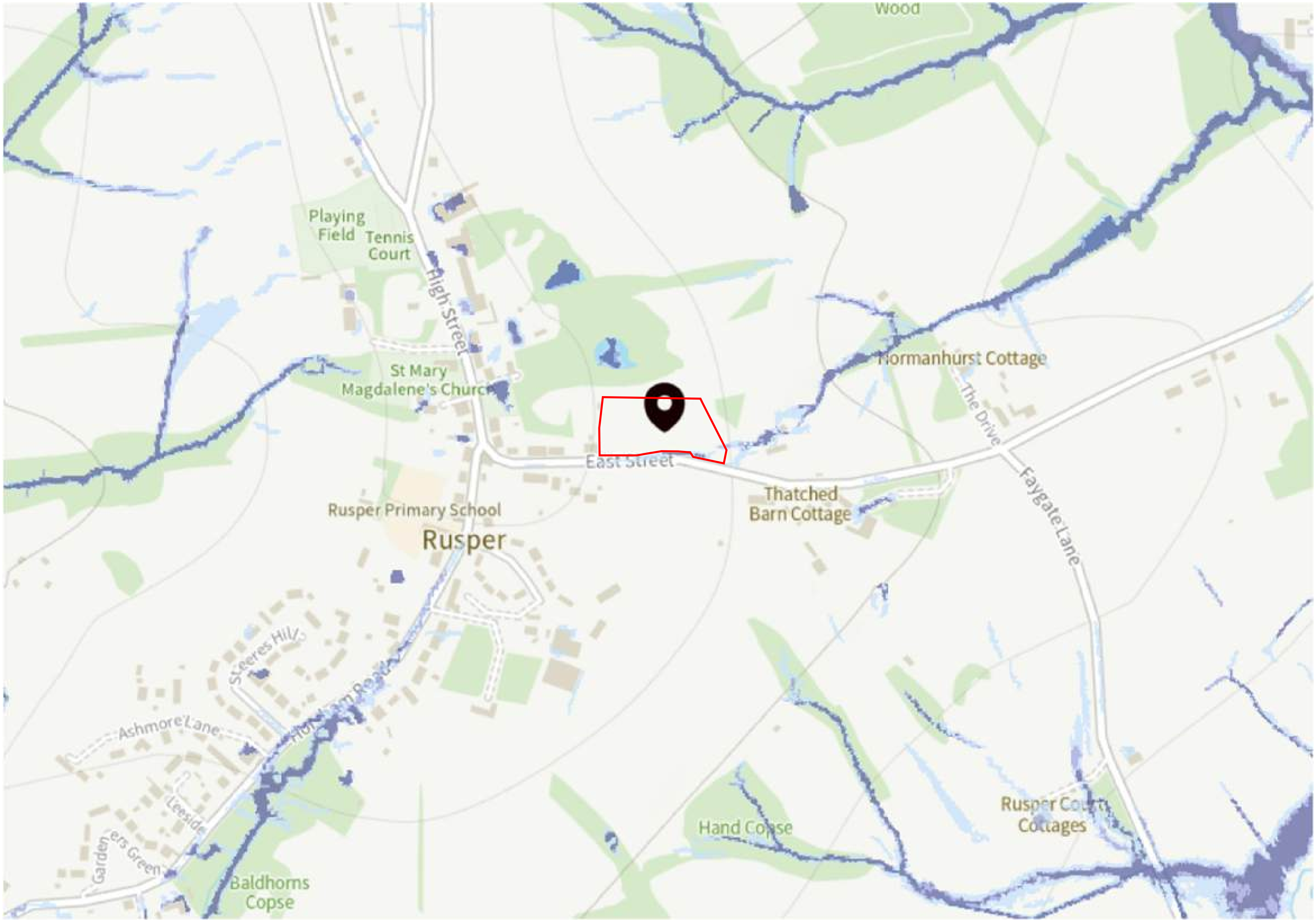
Selected area
Flood zone 3
Flood zone 2
Flood zone 1
Flood defence
Main river
Water storage area

0 20 40 60m

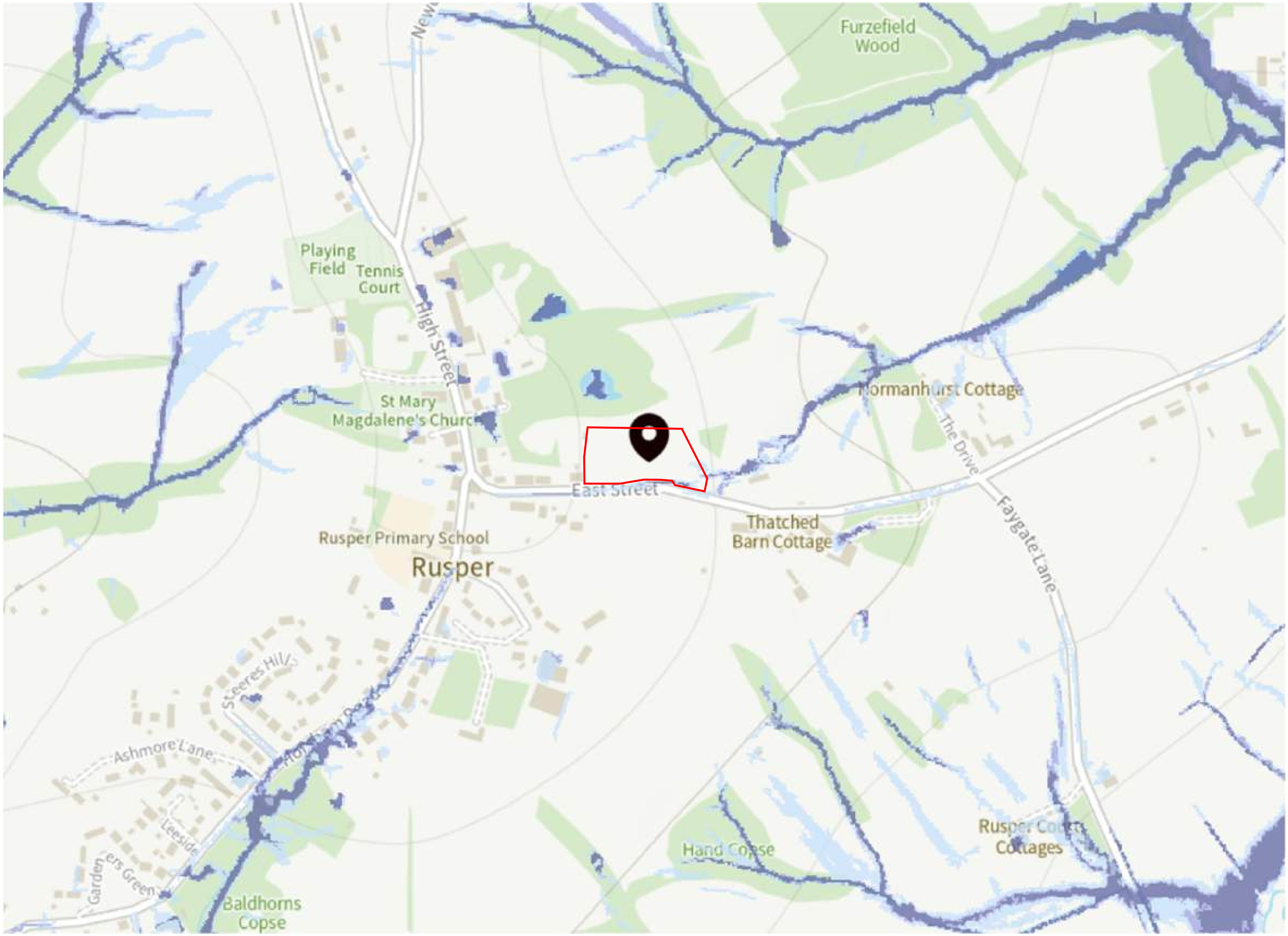
Appendix H

Environment Agency 2025 Risk of Flooding from Surface Water Maps

Present Day Surface Water Flood Risk



Yearly Chance of Surface Water Flooding between 2040 and 2060



Appendix I

QMED Greenfield Runoff Calculation

FEH Mean Annual Flood

Input

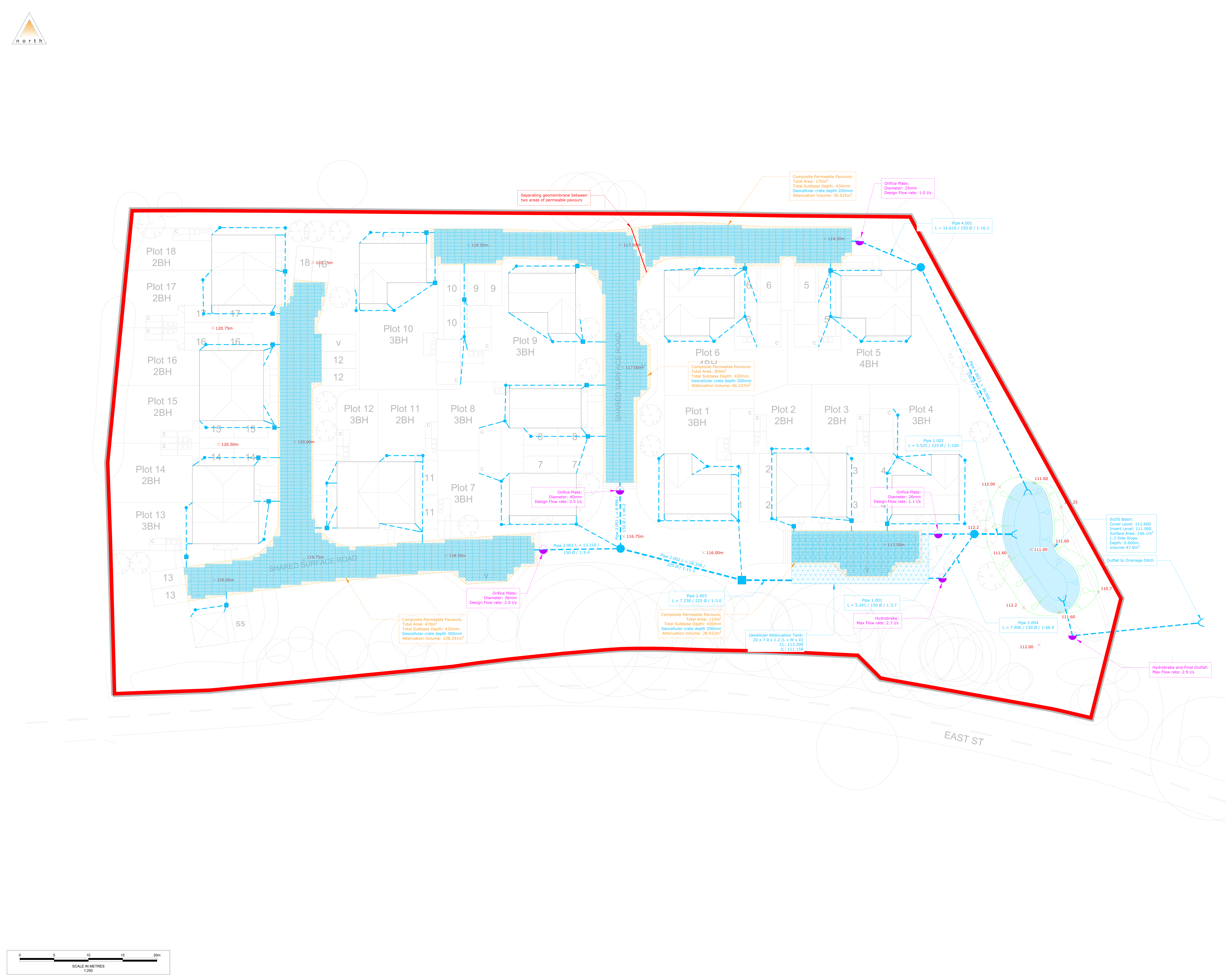
QMED Method	2008	URBEXT (1990)	0.0087
Site Location	GB 521150 137750 TQ 21150 37750	SPRHOST	52.490
Area (ha)	57.500	BFIHOST	0.227
SAAR (mm)	822	FARL	1.000

Results

QMED Rural (l/s)	453.1	QMED Urban (l/s)	457.2

Appendix J

Drainage Strategy Plan



Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. Any discrepancies shall be reported to the engineer immediately, so that clarification can be sought prior to the commencement of works.
3. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specification.
4. The exact location of all private rainwater pipes & internal foul soil pipes are to be confirmed with the architect details prior to works commencing.
5. The contractor is to keep a record of any variations made on site, including the relocation of sewers or drains, for their "as built" drawings to be prepared upon project completion.
6. All works to the adopted system are to be carried out in accordance with Sewers for Adoption, 7th Edition.
7. All works to the private drainage system to be in accordance with the Building Regulations Approved Document Part "H" 2015 edition.
8. 350mm min cover to be provided for private pipes laid in soft/paved areas. 900mm min cover to be provided for private pipes laid beneath roads/driveways unless not practicable. Where unachievable, shallow private drains may require protection using concrete surround or paving slabs bridging the trench, subject to the NHBC inspector's requirements.
9. All pipes shall be laid soffit to soffit with outgoing pipes unless otherwise stated.
10. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.

Legend

- New Surface Water Gravity Pipe
- Permeable Paviours
- New SW Inspection Chamber
- New Flow Control Structure
- New Inlet Headwall / Outfall Headwall
- Polystorm Diffuser Crate
- SuDS Basin
- Catchpit 1200Ø / Silt Trap 600Ø
- Composite Permeable Paviours
- Gecellular Attenuation Tank
- Separating Geomembrane

Rev.	Description	Drn	Chk	App	Date
P01	For Planning	PA	RW	PA	07/02/2025

Drawing Status:
FOR PLANNING
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

Client:
Devine Home PLC

Project:
Land North of East Street, Rusper

Title:
Drainage Strategy Layout & Details

Scale: 1:250 (@ A1)

Drawing: 2409002-0500
Revision: P01

Appendix K

MicroDrainage Modelling Outputs

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 521150 137750 TQ 21150 37750
Data Type	Catchment
Maximum Rainfall (mm/hr)	550
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	0.300
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.339	4-8	0.054

Total Area Contributing (ha) = 0.393

Total Pipe Volume (m³) = 3.131

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	2.443	0.039	63.3	0.000	15.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	11.342	1.420	8.0	0.044	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	3.031	0.052	58.3	0.000	15.00	0.0	0.600	o	100	Pipe/Conduit	
2.001	13.110	1.400	9.4	0.145	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	93.03	15.03	113.209	0.000	0.0	0.0	0.0	1.27	22.4	0.0
1.001	92.87	15.08	113.170	0.044	0.0	0.0	0.0	3.59	63.4	14.8
2.000	92.97	15.05	117.722	0.000	0.0	0.0	0.0	1.01	7.9	0.0
2.001	92.78	15.12	117.670	0.145	0.0	0.0	0.0	3.31	58.5	48.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.000	3.024	0.052	58.2	0.000	15.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	8.996	0.224	40.2	0.097	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.002	18.328	1.621	11.3	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.003	7.230#	2.417	3.0	0.041	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.004	11.821	0.118	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	4.000#	0.040	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	1.903	0.033	58.2	0.000	15.00	0.0	0.600	o	100	Pipe/Conduit	
4.001	11.616	0.720	16.1	0.046	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.002	36.000#	2.200	16.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	11.816	0.118	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	92.97	15.05	116.472	0.000	0.0	0.0	0.0	1.01	7.9	0.0
3.001	92.69	15.14	116.420	0.097	0.0	0.0	0.0	1.59	28.1«	32.5
2.002	92.46	15.22	116.121	0.262	0.0	0.0	0.0	3.91	155.6	87.5
2.003	92.41	15.24	114.500	0.303	0.0	0.0	0.0	7.62	303.0	101.1
2.004	91.83	15.43	111.158	0.303	0.0	0.0	0.0	1.00	17.8«	101.1
1.002	91.68	15.48	111.040	0.347	0.0	0.0	0.0	1.31	52.0«	114.9
4.000	93.03	15.03	114.203	0.000	0.0	0.0	0.0	1.01	7.9	0.0
4.001	92.80	15.11	114.170	0.046	0.0	0.0	0.0	2.52	44.5	15.4
4.002	92.08	15.35	113.200	0.046	0.0	0.0	0.0	2.50	44.2	15.4
1.003	91.11	15.68	111.000	0.393	0.0	0.0	0.0	1.00	17.8«	129.3

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.044	0.044	0.044
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.145	0.145	0.145
3.000	-	-	100	0.000	0.000	0.000
3.001	-	-	100	0.097	0.097	0.097
2.002	-	-	100	0.020	0.020	0.020
2.003	-	-	100	0.041	0.041	0.041
2.004	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.000	0.000	0.000
4.001	-	-	100	0.046	0.046	0.046
4.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.393	0.393	0.393

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003	Outfall	112.000	110.882	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	6	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	100	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 521150 137750 TQ 21150 37750	Cv (Winter)	0.840
Data Type	Catchment	Storm Duration (mins)	30

Online Controls for Storm

Orifice Manhole: 11, DS/PN: 1.001, Volume (m³): 0.7

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 113.170

Orifice Manhole: 2, DS/PN: 2.001, Volume (m³): 0.7

Diameter (m) 0.036 Discharge Coefficient 0.600 Invert Level (m) 117.670

Orifice Manhole: 9, DS/PN: 3.001, Volume (m³): 0.7

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 116.420

Hydro-Brake® Optimum Manhole: 5, DS/PN: 2.004, Volume (m³): 2.5

Unit Reference	MD-SHE-0070-2700-1600-2700
Design Head (m)	1.600
Design Flow (l/s)	2.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	111.158
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	2.7	Kick-Flo®	0.626	1.8
Flush-Flo™	0.307	2.2	Mean Flow over Head Range	-	2.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	0.800	2.0	2.000	3.0	4.000	4.1	7.000	5.4
0.200	2.1	1.000	2.2	2.200	3.1	4.500	4.4	7.500	5.5
0.300	2.2	1.200	2.4	2.400	3.3	5.000	4.6	8.000	5.7
0.400	2.2	1.400	2.5	2.600	3.4	5.500	4.8	8.500	5.9
0.500	2.1	1.600	2.7	3.000	3.6	6.000	5.0	9.000	6.0
0.600	1.9	1.800	2.8	3.500	3.9	6.500	5.2	9.500	6.2

Orifice Manhole: 13, DS/PN: 4.001, Volume (m³): 0.7

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 114.170

Hydro-Brake® Optimum Manhole: 7, DS/PN: 1.003, Volume (m³): 1.4

Unit Reference	MD-SHE-0087-2900-0600-2900
Design Head (m)	0.600
Design Flow (l/s)	2.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes

Hydro-Brake® Optimum Manhole: 7, DS/PN: 1.003, Volume (m^3): 1.4

Diameter (mm)	87
Invert Level (m)	111.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**	**Control Points**	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	0.600	2.9	Kick-Flo®	0.409	2.4
Flush-Flo™	0.181	2.9	Mean Flow over Head Range	-	2.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	2.6	0.800	3.3	2.000	5.1	4.000	7.0	7.000	9.1
0.200	2.9	1.000	3.7	2.200	5.3	4.500	7.4	7.500	9.5
0.300	2.8	1.200	4.0	2.400	5.5	5.000	7.8	8.000	9.8
0.400	2.5	1.400	4.3	2.600	5.7	5.500	8.1	8.500	10.1
0.500	2.7	1.600	4.6	3.000	6.1	6.000	8.5	9.000	10.4
0.600	2.9	1.800	4.8	3.500	6.6	6.500	8.8	9.500	10.7

Storage Structures for Storm

Complex Manhole: 11, DS/PN: 1.001

Cellular Storage

Invert Level (m) 113.170 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	110.0	110.0	0.200	110.0	120.2	0.201	0.0	120.2

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.5
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	30.6	Slope (1:X)	50.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	113.170	Cap Volume Depth (m)	0.230

Complex Manhole: 2, DS/PN: 2.001

Cellular Storage

Invert Level (m) 117.670 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	470.0	470.0	0.300	470.0	504.2	0.301	0.0	504.2

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	47.0
Max Percolation (l/s)	130.6	Slope (1:X)	50.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	117.970	Cap Volume Depth (m)	0.130

Complex Manhole: 9, DS/PN: 3.001

Cellular Storage

Invert Level (m) 116.420 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Cellular Storage

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	300.0	300.0	0.200	300.0	316.0	0.201	0.0	316.0

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	30.0
Max Percolation (l/s)	83.3	Slope (1:X)	50.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	116.620	Cap Volume Depth (m)	0.230

Cellular Storage Manhole: 5, DS/PN: 2.004

Invert Level (m)	111.158	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	140.0	140.0	1.200	140.0	204.8	1.201	0.0	204.8

Complex Manhole: 13, DS/PN: 4.001

Cellular Storage

Invert Level (m)	114.170	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	170.0	170.0	0.200	170.0	185.6	0.201	0.0	185.6

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	34.0
Max Percolation (l/s)	47.2	Slope (1:X)	50.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	114.370	Cap Volume Depth (m)	0.230

Tank or Pond Manhole: 7, DS/PN: 1.003

Invert Level (m) 111.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.5	0.600	106.1

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	10	0.612	0.043	0.000	0.655
1.001	11	0.656	0.200	28.422	29.278
2.000	1	0.597	0.024	0.000	0.621
2.001	2	0.656	0.232	138.291	139.179
3.000	8	0.597	0.024	0.000	0.621
3.001	9	0.656	0.159	66.237	67.052
2.002	3	0.994	0.729	0.000	1.723
2.003	4	1.131	0.287	0.000	1.418
2.004	5	2.309	0.209	159.644	162.163
1.002	6	1.934	0.159	0.000	2.093
4.000	12	0.619	0.015	0.000	0.634
4.001	13	0.656	0.205	36.925	37.786
4.002	14	0.905	0.636	0.000	1.541
1.003	7	0.679	0.209	45.970	46.858
Total		13.001	3.131	475.490	491.622

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	6	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 521150 137750 TQ 21150 37750	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	10	480 Summer	2	+0%	30/240 Summer				113.249	-0.110
1.001	11	480 Summer	2	+0%	30/60 Summer				113.249	-0.071
2.000	1	1440 Summer	2	+0%	30/120 Summer				117.752	-0.070
2.001	2	1440 Summer	2	+0%	30/120 Summer				117.752	-0.068
3.000	8	960 Summer	2	+0%	30/120 Summer				116.492	-0.080
3.001	9	960 Summer	2	+0%	30/120 Summer				116.492	-0.078
2.002	3	15 Summer	2	+0%					116.144	-0.202
2.003	4	15 Summer	2	+0%					114.531	-0.194
2.004	5	960 Summer	2	+0%	30/30 Summer				111.260	-0.048
1.002	6	960 Summer	2	+0%	30/480 Summer				111.095	-0.170
4.000	12	960 Summer	2	+0%	30/120 Summer				114.232	-0.071
4.001	13	960 Summer	2	+0%	30/240 Summer				114.232	-0.088
4.002	14	960 Summer	2	+0%					113.205	-0.145
1.003	7	960 Summer	2	+0%	30/240 Summer				111.091	-0.059

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	10	0.000	0.00			0.0	OK	
1.001	11	0.000	0.01		344	0.4	OK	
2.000	1	0.000	0.00			0.0	OK	
2.001	2	0.000	0.01		888	0.7	OK	
3.000	8	0.000	0.00			0.0	OK	
3.001	9	0.000	0.03		512	0.8	OK	
2.002	3	0.000	0.02			3.2	OK	
2.003	4	0.000	0.04			9.8	OK	
2.004	5	0.000	0.11		592	1.8	OK	
1.002	6	0.000	0.07			2.2	OK	
4.000	12	0.000	0.00			0.0	OK	
4.001	13	0.000	0.01		560	0.3	OK	
4.002	14	0.000	0.01			0.3	OK	
1.003	7	0.000	0.15			2.4	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	6	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 521150 137750 TQ 21150 37750	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	10	480 Summer	30	+40%	30/240 Summer				113.395	0.036
1.001	11	480 Summer	30	+40%	30/60 Summer				113.395	0.075
2.000	1	1440 Summer	30	+40%	30/120 Summer				117.879	0.057
2.001	2	1440 Summer	30	+40%	30/120 Summer				117.879	0.059
3.000	8	480 Summer	30	+40%	30/120 Summer				116.605	0.033
3.001	9	480 Summer	30	+40%	30/120 Summer				116.605	0.035
2.002	3	15 Summer	30	+40%					116.169	-0.177
2.003	4	15 Summer	30	+40%					114.566	-0.159
2.004	5	1440 Summer	30	+40%	30/30 Summer				111.620	0.312
1.002	6	1440 Summer	30	+40%	30/480 Summer				111.424	0.159
4.000	12	960 Summer	30	+40%	30/120 Summer				114.334	0.031
4.001	13	960 Summer	30	+40%	30/240 Summer				114.334	0.014
4.002	14	960 Summer	30	+40%					113.208	-0.142
1.003	7	1440 Summer	30	+40%	30/240 Summer				111.423	0.273

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	10	0.000	0.00			0.0	SURCHARGED	
1.001	11	0.000	0.01		488	0.7	SURCHARGED	
2.000	1	0.000	0.00			0.0	SURCHARGED	
2.001	2	0.000	0.02		1128	1.2	SURCHARGED	
3.000	8	0.000	0.00			0.0	SURCHARGED	
3.001	9	0.000	0.05		496	1.4	SURCHARGED	
2.002	3	0.000	0.10			13.9	OK	
2.003	4	0.000	0.19			41.0	OK	
2.004	5	0.000	0.14		960	2.2	SURCHARGED	
1.002	6	0.000	0.09			2.8	SURCHARGED	
4.000	12	0.000	0.00			0.0	SURCHARGED	
4.001	13	0.000	0.01		736	0.5	SURCHARGED	
4.002	14	0.000	0.01			0.5	OK	
1.003	7	0.000	0.18			2.9	FLOOD RISK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	6	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 521150 137750 TQ 21150 37750	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	10	480 Summer	100	+45%	30/240 Summer				113.743	0.384
1.001	11	480 Summer	100	+45%	30/60 Summer				113.743	0.423
2.000	1	1440 Summer	100	+45%	30/120 Summer				117.956	0.134
2.001	2	1440 Summer	100	+45%	30/120 Summer				117.956	0.136
3.000	8	960 Summer	100	+45%	30/120 Summer				116.971	0.399
3.001	9	960 Summer	100	+45%	30/120 Summer				116.971	0.401
2.002	3	15 Summer	100	+45%					116.175	-0.171
2.003	4	15 Summer	100	+45%					114.575	-0.150
2.004	5	1440 Summer	100	+45%	30/30 Summer				111.984	0.676
1.002	6	1440 Summer	100	+45%	30/480 Summer				111.598	0.333
4.000	12	960 Summer	100	+45%	30/120 Summer				114.584	0.281
4.001	13	960 Summer	100	+45%	30/240 Summer				114.584	0.264
4.002	14	960 Summer	100	+45%					113.214	-0.136
1.003	7	1440 Summer	100	+45%	30/240 Summer				111.596	0.446

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	10	0.000	0.00			0.0	FLOOD RISK	
1.001	11	0.000	0.02		504	1.1	FLOOD RISK	
2.000	1	0.000	0.00			0.0	FLOOD RISK	
2.001	2	0.000	0.03		1224	1.4	FLOOD RISK	
3.000	8	0.000	0.01			0.1	FLOOD RISK	
3.001	9	0.000	0.10		640	2.4	FLOOD RISK	
2.002	3	0.000	0.13			18.4	OK	
2.003	4	0.000	0.25			53.8	OK	
2.004	5	0.000	0.14		1176	2.2	SURCHARGED	
1.002	6	0.000	0.10			3.1	SURCHARGED	
4.000	12	0.000	0.01			0.0	FLOOD RISK	
4.001	13	0.000	0.02		816	0.8	FLOOD RISK	
4.002	14	0.000	0.02			0.8	OK	
1.003	7	0.000	0.18			2.9	FLOOD RISK	

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Appendix L

Drainage Management and Maintenance Plan

Land North of East Street, Rusper

Drainage Management & Maintenance Plan

For

Devine Homes PLC

motion

Document Control Sheet

Land North of East Street, Rusper

Devine Homes PLC

This document has been issued and amended as follows:

Date	Issue	Prepared by	Approved by
7th February 2025	FINAL	Phil Allen MCIWEM C.WEM	Neil Jaques

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Contents

1.0 Introduction

1.1 This document sets out the suggested principles for the long-term management and maintenance of the surface water drainage system on the proposed residential development on Land North of East Street, Rusper, West Sussex.

1.2 The purpose of this document is to ensure that the adopting site management company has a robust inspection and maintenance plan in place for the lifetime of the development. This ensures the optimum operation of the surface water drainage system and that it will be maintained in perpetuity. This will contribute to reducing the risk of surface water flooding both on- and off-site.

1.3 All those responsible for maintenance should follow relevant health and safety legislation for all activities listed within this report (including lone working, if relevant). Method statements and risk assessments should always be undertaken and made available, if requested.

1.4 This document has been produced by Motion on behalf of their client, Devine Homes PLC. This document describes the typical management and maintenance tasks that are known at the design stage (maintenance frequencies and typical tasks, for example). These have been drawn from industry guidance such as CIRIA C753 - The SuDS Manual – and manufacturer's own guidance.

1.5 Maintenance is considered as a construction activity under the CDM Regulations 2015. Under the CDM Regulations, it is a requirement that a competent person be appointed to carry out a required role. CDM defines a competent person as an individual with sufficient knowledge of the specific tasks to be undertaken, as well as sufficient experience and ability to carry out their duties in relation to the task in a way that secures health and safety on site.

1.6 In recognition of the requirements of the CDM Regulations 2015, this drainage management and maintenance plan expects that the maintenance work will be carried out by a competent person who must have prior knowledge of the drainage components and SuDS systems on site.

1.7 There are limitations on what this document can prescribe at the planning stage (outline or full). This document cannot name the specific company or individuals who will carry out the maintenance and what equipment is to be used. Related to this, this document is unable to provide method statements for exactly how maintenance practices will be carried out. These can only be determined at the time of the maintenance being carried out through the exact maintenance need and the safe systems of work held by the company carrying out the work. Therefore, this is to be the responsibility of the adopting site management company and/or the individuals carrying out the work. We urge those who are carrying out the maintenance to record this information and make it available to the Local Planning Authority (LPA), if required to do so. This drainage management and maintenance plan needs to be a living document that is owned and maintained by the adopting site management company and should be adhered to for the lifetime of the development.

2.0 Maintenance Categories

2.1 There are three categories of maintenance activities referred to in this report. These are:

Inspection and Monitoring

- Inspection and monitoring tasks should be carried out frequently, nominally once a month, and should include a visual inspection of all components including all inlets and outlets.

Regular Maintenance (Monthly)

- Regular maintenance consists of basic tasks done on a frequent and predictable schedule, including vegetation management and litter removal.

Seasonal Maintenance (Quarterly)

- Seasonal maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (leaf litter and sediment removal is an example).

Remedial Maintenance

- Remedial maintenance comprises of intermittent tasks that may be required to rectify faults associated with the system that have been identified through visual inspections. The likelihood of faults can be minimised by correct installation, regular inspection and timely maintenance. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events and, as such, timings are difficult to predict.

3.0 The Surface Water Drainage System

3.1 The proposed surface water drainage system is made up of a number of components/structures. These include:

- Composite permeable paving
- A Geocellular attenuation tank
- A SuDS basin
- Catchpit manholes/silt traps
- Hydrobrakes/Orifice flow controls
- Manholes
- Pipes
- Water butts (although these will be in private ownership)

3.2 All components should be installed in accordance with the manufacturer's instructions and to the levels/arrangement as defined on the designer's drawings. Not doing so will invalidate any warranty provided by the manufacturer.

3.3 All maintenance and cleaning must be carried out in accordance with manufacturer's recommendations and by competent and suitably qualified staff, as defined in the CDM regulations 2015.

3.4 This document should be read in conjunction with the design drawings of the drainage system, so that the location and type of each feature can be recognised and understood.

3.5 Manufacturer's instructions should be added to this document once specific products have been selected and installed by the contractor. This document will subsequently form the basis for a drainage maintenance regime.

4.0 General Maintenance Principles

4.1 All surface water drainage systems, whether piped gravity systems, Sustainable Drainage Systems (SuDS), or flow control devices and pumps, require regular maintenance to keep them working at optimum efficiency and capacity. The maintenance of the surface water drainage system on the Land North of East Street, Rusper should be carried out alongside other regular maintenance tasks on site.

4.2 Timely and adequate maintenance will increase the lifespan of all the drainage components. Inadequate maintenance will do the reverse. Therefore, the projected lifespan and anticipated replacement date of each drainage component cannot be forecast at the time of this document being produced.

4.3 The site management company (or their agents) are responsible for the maintenance of the surface water drainage system for the lifetime of the development.

4.4 Construction activities can create and discharge significant quantities of sediment that will quickly clog the surface water drainage system. Therefore, construction-stage sediment removal is required immediately post-construction. The construction site manager should assess this and carry out cleaning as necessary.

4.5 Catchpit manholes/silt traps will be specified upstream of the permeable paved areas, as well as other locations on site. They will remove gross solids and the majority of silts. It is important that any debris build-up in the catchpit manholes/silt traps is removed at regular intervals. This will reduce the risk of the permeable paved areas becoming silted up. It will maintain the design capacity and function of this part of the drainage system.

4.6 Cleaning should also take place after large storms when there have been increased surface water flows and visible entrainment and deposition of debris.

4.7 An increased frequency of inspection and maintenance should be programmed into the autumn and winter months in acknowledgement that:

- Leaf fall from deciduous trees in autumn will result in an increased amount of leaf litter and an elevated blockage risk of drainage infrastructure.
- Increased rainfall during winter months will result in greater quantities of water moving through the drainage system and a greater input of silt and other debris.

4.8 Table 4.1, below, gives an overview of required maintenance tasks and the frequency at which they need to be undertaken. Section 5 – Inspection and Maintenance Frequency of Components – will assign typical maintenance frequencies and tasks to the specific components used within the surface water drainage system proposed for the development on Land North of East Street, Rusper.

Table 4.1: Typical maintenance tasks and frequencies

Activity	Indicative Frequency	Typical Tasks
Inspection and Monitoring	Monthly	▸ Inspection of all inlets, outlets and control structures
Regular Maintenance	Monthly, for the lifetime of the development	▸ Litter picking and debris removal ▸ Weed removal and invasive plant control
Seasonal Maintenance	Quarterly, for the lifetime of the development	▸ Vegetation management around components ▸ Sweeping of pavement areas to remove surface silt ▸ Silt removal from system, including catchpits, cellular storage structures and control structures
Remedial maintenance	As required as a result of inspections, for the lifetime of the development.	▸ Inlet/outlet repairs ▸ Erosion repairs ▸ Reinstatement of edgings ▸ Reinstatement following pollution incidents ▸ Removal of silt build-up and leaf litter after storms ▸ Repair of vandalism ▸ Replacement of any blocked filter membranes/materials

5.0 Inspection and Maintenance Frequency of Components

5.1 Table 5.1 below lists each of the components used within the site's surface water drainage system. It suggests an indicative maintenance frequency for each component and ascribes typical maintenance tasks to them.

5.2 This list is not exhaustive, nor is it prescriptive. As mentioned in Section 3, additional, unscheduled maintenance may be required following adverse weather conditions or after autumn leaf falls. Additional maintenance tasks may be required to adequately clean and maintain individual components.

5.3 The list of components should be cross-referenced with the designer's drawings so that the location of each component can be identified.

5.4 It is the responsibility of the adopting site management company (or their agents) to ensure that all necessary maintenance activities are carried out in a timely manner and that the design performance of each drainage component is preserved.

5.5 If there is any uncertainty regarding the correct and safe methods of cleaning, or what equipment should be used, the manufacturer should be consulted.

Table 5.1: Maintenance Frequency and Task for Drainage Components

Activity	Indicative Frequency	Anticipated Tasks
Pipes	As required	▸ Identify any pipes that may not be operating properly and employ a competent, qualified contractor to inspect using CCTV. ▸ If the pipe is blocked with silt or debris, the pipe should be jetted clean from an upstream access point. All silt and debris should be captured and removed at a downstream access point. ▸ Inspect once clean. ▸ If any other defects are encountered (cracks, displaced joints, root ingress), appropriate solutions should be discussed with a competent and qualified contractor. These services are usually provided by the same companies that offer CCTV surveys and pipe jetting services.
Manholes	Annually and as required, for the lifetime of the development.	▸ Inspect/identify any damage or areas that are not operating correctly ▸ Remove silt, litter, leaves and other detritus. ▸ Inspect once clean.
Catchpit Manholes/Silt Traps	Annually and as required, for the lifetime of the development.	▸ Inspect/identify any damage or areas that are not operating correctly ▸ Remove silt, litter, leaves and other detritus. ▸ Inspect once clean.
Orifice Plates	Inspections at regular intervals (every 3 – 6 months).	▸ Orifice plates have no moving parts to fail and quality units are made of stainless steel to resist scour, degradation and chemical attack. ▸ The orifice plates in this scheme are to be downstream of the permeable paviours, so all contributing flows should be heavily filtered and free of any debris.

		▸ Debris and silt should be removed if present ▸ Check wear on orifice to ensure no enlargement is taking place. ▸ Any visible fixing bolts should be checked. ▸ If there is a suspected blockage, the housing chamber can be inspected internally, the blockage cleared and the orifice returned to its working position.
Hydrobrake chambers	Every three months for the first year, then annually thereafter for the lifetime of the development.	▸ Contact manufacturer for instruction on approved and safe inspection and maintenance practices. ▸ Inspect Hydrobrake and check functionality. Remove any detritus as required. ▸ Inspect once clean.
SuDS Basin	Monthly in Summer, as required in Winter	▸ Responsibility should be with landscape contractors. ▸ Maintenance tasks are not that different from standard public open space. ▸ Adequate access needs to be provided to the area. ▸ Regular mowing should take place across maintenance access routes, amenity areas, across embankments and the main storage area. Remaining areas can remain as 'meadow'. Mowed grass lengths of 75 – 100mm are appropriate. ▸ Grass clippings should be disposed of off-site. ▸ Any dead growth should be cleared before the start of the growing season. ▸ Any permanently wet areas with emergent aquatic vegetation should be managed as ponds or wetlands. ▸ Remove any sediment build-up as required. ▸ Check any inlets and outlets for blockages and clear as required. ▸ Check any flow control devices, if present.
Geocellular Attenuation Tank	Annually	▸ Contact manufacturer for instruction on approved and safe inspection and maintenance practices. ▸ Inspect/identify any areas that are not operating correctly. ▸ Remove debris from catchment surface. ▸ Remove sediment from pre-treatment structures. ▸ Check for silt build-up and flush and remove as required (in accordance with manufacturer's instructions). ▸ Inspect once clean. ▸ See Table 21.3 of CIRIA C753 for more information. ▸ Most geocellular units have a 60-year creep limited life expectancy, so they should be planned for replacement by 2075 (approx.)

Water Butts (not the responsibility of the adopting site management agency, but individual homeowners)	Annually in Autumn to Winter	▸ Remove falling leaves and seeds from guttering or those that have found their way into the water butt. ▸ Water may stagnate slightly. If so, use a water butt cleaning disc into the tank. ▸ In autumn and winter, drain water off every 10 days (or less) to make sure that water butts don't overflow and that water is kept moving. This will stop larvae and flies from using the water butt. ▸ Use safe products such as vinegar to clean the outside of the tank and the inside of the lid and be careful not to contaminate water with chemicals. ▸ At least once a year, completely empty the water butt and scrub it out with warm soapy water and then rinse thoroughly. This is best done at a time when the water butt is already nearly empty (end of summer) or when it can readily refill (winter).
Composite permeable paviours	Once a year after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations. It should be noted that as a composite system, some of the maintenance tasks associated with geocellular tanks, specified above, can also be applied to the composite permeable paviours.	▸ Agitate surface by means of mechanical sweeping or vacuuming to ensure no vegetation or moss is allowed to establish and grow in the joints. ▸ Mechanical sweeping of paviours and refilling of joints with the correct aggregate need only be carried out at intervals of 5 years or so ▸ Remove weeds from the surface through the application of glyphosate-based weed killers ▸ Stabilise and mow contributing and adjacent areas. ▸ Inspect once clean. ▸ See Table 20.15 of CIRIA C753 for more information. ▸ Permeable paving has a nominal 25-year lifespan, if correctly and regularly maintained. ▸ When subjected to low level oil drips permeable paviours can continue to biodegrade hydrocarbons indefinitely. ▸ Major oil spills have the potential to contaminate the surface and the underlying crushed stone. In the event of a major oil spill, the area of block paviours and crushed stone that is affected should be removed, cleaned and reinstalled.

5.6 Upon completion of maintenance activities, a record should be kept of the work carried out. This should be retained and an annual maintenance report should be compiled, which should include the following:

- Observations resulting from inspections

- Maintenance and operation activities undertaken during the year
- Recommendations for inspections and maintenance programmes for the following year

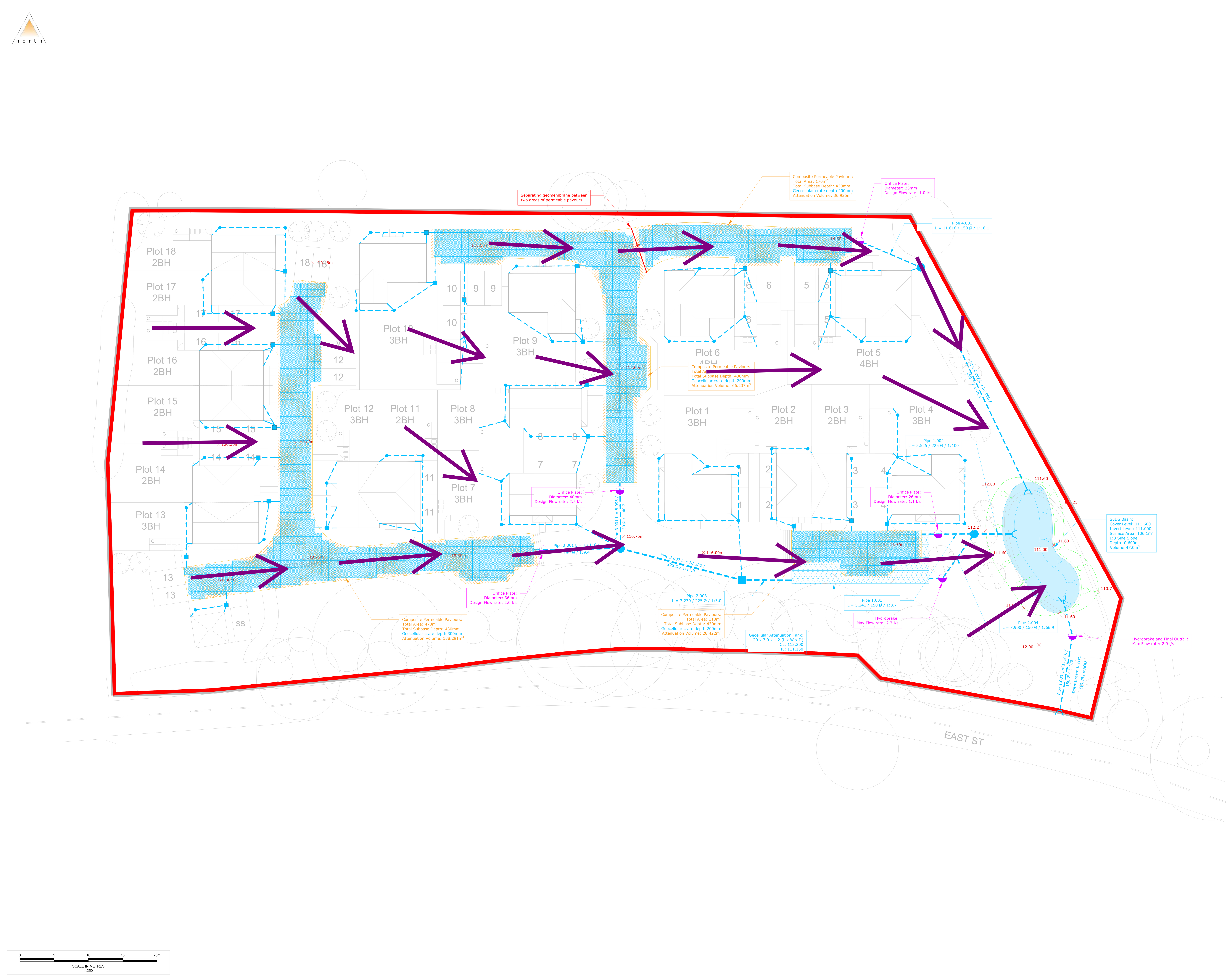
5.7 On the next page is a table with suggested information should be recorded and included with the maintenance plan. As mentioned in the introduction to this document, this should be a living document and regularly updated, as required and should be kept for the lifetime of the development.

5.8 The Local Planning Authority (Horsham District Council) may request to check and sign off any maintenance activities. Therefore, it is the recommendation that the LPA is contacted prior to any scheduled routine maintenance. The table mentioned above and on the next page, as well as the annual maintenance report, should be offered to the LPA for their records and approval.

Date	Component requiring maintenance	Issues prompting maintenance	Scheduled maintenance (Y/N)	Maintenance carried out	Additional works required (Y/N). If yes, please detail	Next scheduled date of inspection and maintenance

Appendix M

Exceedance Plan



Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. Any discrepancies shall be reported to the engineer immediately, so that clarification can be sought prior to the commencement of works.
3. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specification.
4. The exact location of all private rainwater pipes & internal foul soil pipes are to be confirmed with the architect details prior to works commencing.
5. The contractor is to keep a record of any variations made on site, including the relocation of sewers or drains, for their "as built" drawings to be prepared upon project completion.
6. All works to the adopted system are to be carried out in accordance with Sewers for Adoption, 7th Edition.
7. All works to the private drainage system to be in accordance with the Building Regulations Approved Document Part "H" 2015 edition.
8. 350mm min cover to be provided for private pipes laid in soft/paved areas. 900mm min cover to be provided for private pipes laid beneath roads/driveways unless not practicable. Where unachievable, shallow private drains may require protection using concrete surround or paving slabs bridging the trench, subject to the NHBC inspector's requirements.
9. All pipes shall be laid soffit to soffit with outgoing pipes unless otherwise stated.
10. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.

Legend

- New Surface Water Gravity Pipe
- Permeable Paviours
- New SW Inspection Chamber
- New Flow Control Structure
- New Inlet Headwall / Outfall Headwall
- Polystorm Diffuser Crate
- SuDS Basin
- Catchpit 1200Ø / Silt Trap 600Ø
- Composite Permeable Paviours
- Gecellular Attenuation Tank
- Separating Geomembrane

Rev.	Description	Drn	Chk	App	Date
P01	For Planning	PA	RW	PA	07/02/2025

Drawing Status:

FOR PLANNING
NOT FOR CONSTRUCTION

motion

Guildford - Reading - London
www.motion.co.uk

Client:
Devine Home PLC

Project:
Land North of East Street, Rusper

Title:
Drainage Strategy Layout & Details

Scale: 1:250 (@ A1)

Drawing: 2409002-0500

Revision: P01