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LAND WEST OF TURNERS HILL ROAD AND SOUTH OF HUNTSLAND, CRAWLEY DOWN

DRAINAGE STRATEGY

LAND WEST OF TURNERS HILL ROAD AND SOUTH OF HUNTSLAND, CRAWLEY DOWN DRAINAGE STRATEGY

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EXECUTIVE SUMMARY

Ramboll UK Limited (Ramboll) has been appointed by Wates Developments Limited (Wates) to develop both surface water and foul water drainage strategies for the Proposed Development at Turners Hill Road, Crawley Down, Crawley. The site is located at approximate coordinates 533813E, 137310N, at postcode RH10 4HB.

The Proposed Development is for a mixed residential scheme of up to 200 units. As part of the development, the site has been divided up into five fields numbered 3 – 7.

The proposed surface water drainage strategy consists of a series of swales and surface water attenuation areas that have been strategically located across the site.

Across Fields 4, 6 and 7, a connecting network of swales, surface water attenuation areas, and gravity driven surface water sewers where necessary, have been located adjacent to the proposed area of development to the north and south, to be subsequently directed toward the west and southwest and ultimately into the main watercourse running approximately east to west across the southern part of the site. In Field 5 in the east of the site, runoff is proposed to discharge to two separate locations: to the main east to west watercourse to the south, and to a tributary watercourse to the east.

Surface water features have been sized appropriately to accommodate the additional runoff expected from the Proposed Development.

Discharge rates out of the attenuation features will be limited to the 1 in 1 year greenfield runoff rate, thereby considerably reducing the peak flows presently emanating from the site area. The strategy will therefore improve upon the current situation with regard to surface water management and flood risk.

Specific mitigation and maintenance works have been recommended at the site for existing ditches in the wooded area adjacent to Field 5, as well as along roadside ditches adjacent to Huntsland.

The proposed foul strategy is for separate connections with the majority of the foul drainage being directed into an existing foul sewer running through the central development area. Field 5 is proposed to discharge separately to an existing foul sewer within Turners Hill Road.

The Indicative Drainage Strategy Plan visualises the proposed drainage strategy and is presented in Figure 3.1 at the rear of the report.

1. INTRODUCTION

1.1 Background

1.1.1 Ramboll UK Limited (Ramboll) has been appointed by Wates Developments Limited (Wates) to develop both surface water and foul water drainage strategies for the Proposed Development at Turners Hill Road, Crawley Down, Crawley. The site is located at approximate coordinates 533813E, 137310N, at postcode RH10 4HB.

1.1.2 The Proposed Development is for a mixed residential scheme of up to 200 dwellings.

1.1.3 The latest Site Illustrative Masterplan is presented in Appendix A at the rear of the report.

1.2 Scope and Objectives

1.2.1 The aim of this report is to provide a detailed overview of the surface water and foul water drainage strategies for the Proposed Development. This includes the proposed management and disposal of surface water, and how calculated surface discharge rates are to be controlled and discharged. This report includes the following:

- Review of existing drainage conditions at the site;
- Review of site topography;
- Determination of existing surface water runoff rates at the site and required storage volumes;
- High level calculation of anticipated foul water generation from the Proposed Development;
- Review of existing sewer records for the site and its surrounds;
- Options appraisal of Sustainable Urban Drainage Systems (SuDS) and their suitability for the Proposed Development; and
- Proposals for measures to mitigate the generation of surface water runoff from the Proposed Development.

1.3 Ramboll and Climate Change

1.3.1 Ramboll UK Ltd is a Partner for Sustainable Change, and as such sustainability is central to our assessments and reporting. We have made specific considerations for climate change throughout this report, to ensure that our planning and design advice is supportive of an approach to ensure robust and sustainable societies.

1.4 Consultation

1.4.1 Foul water enquiries were issued to Thames Water in March and May 2024. The initial enquiry in March proposed two separate foul connections into an existing foul water sewer running across the central part of the site. The second enquiry, submitted in May, was for a single area in the east of the site which proposed a separate discharge to Turners Hill Road. Both enquiries were approved. West Sussex County Council, the Lead Local Flood Authority (LLFA), were engaged in November 2024 regarding pre-application discussions. The LLFA were content overall with the drainage proposals.

1.5 General Limitations and Reliance

1.5.1 This report has been prepared by Ramboll exclusively for the intended use by the client in accordance with the agreement between Ramboll and the client defining, among others, the purpose, the scope and the terms and conditions for the services. No other warranty, expressed or implied, is made as to the professional advice included in this report or in respect of any matters outside the agreed scope of the services or the purpose for which the report and the associated agreed scope were intended, or any other services provided by Ramboll.

1.5.2 In preparation of the report and performance of any other services, Ramboll has relied upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions in this report are valid only to the extent that the information provided to Ramboll was accurate, complete, and available to Ramboll within the reporting schedule.

1.5.3 Ramboll's services are not intended as legal advice, nor an exhaustive review of site conditions and/or compliance. This report and accompanying documents are intended solely for the use and benefit of the client for this purpose only and may not be used by or disclosed to, in whole or in part, any other person without the express written consent of Ramboll. Ramboll neither owes nor accepts any duty to any third party, unless formally agreed by Ramboll through that party entering into, at Ramboll's sole discretion, a written reliance agreement.

1.5.4 Unless otherwise stated in this report, the scope of services, assessment and conclusions made assume that the site will continue to be used for its proposed end-use without further significant changes onsite. Unless stated otherwise, the geological information provided is for general environmental interpretation and should not be used for geotechnical and/or design purposes.

2. SITE DETAILS

2.1 Site Location and Description

2.1.1 The site is located on land to the west of Crawley Down, a village in the Mid Sussex district of West Sussex, England. The site is located at approximate coordinates 533813E, 137310N, at postcode RH10 4HB. The Proposed Development is for up to 200 dwellings.

2.1.2 The site currently consists of undeveloped greenfield land, with adjacent and surrounding land uses as follows:

- North: Intermittent woodland and greenspace, and Huntsland (private road);
- East: Turners Hill Road and immediately beyond the wider residential area of Crawley Down;
- South: Worth Way, a footpath and bridleway linking the West Sussex towns of Crawley and East Grinstead via the village of Crawley Down. Most of the route follows the track bed of a disused railway. It is part of the National Cycle Network and is surrounded by multiple areas of woodland and greenspace; and
- West: Intermittent woodland and a series of farms/smallholdings and cottages. Rowfant Vineyard is located approximately 150 m west of the site. The 'Fish Ponds' are located approximately 290 m west of the site.

2.1.3 The wider residential area of Crawley is located approximately 3.1 km west of the site.

2.1.4 The Site Location Plan is presented in Figure 2.1 at the rear of the report. The Plan includes labels of the five different 'Fields' that presently form the site.

2.2 Site Topography

2.2.1 A site topographical survey[1] was previously undertaken at the site. A description of the topography is summarised as follows:

Field 3

2.2.2 The levels within Field 3 are shown to fall steeply from north to south, toward an existing watercourse that marks the southern boundary of the field. Levels are shown to fall from approximately 118.8 m AOD in the northwest of the field to approximately 99.9 m AOD adjacent to the watercourse.

Field 4

2.2.3 Field 4 is located on the south side of the watercourse that marks the southern boundary of Field 3. It is bounded by the same watercourse to the west and by existing hedgerows/trees to the south and east. The field is shown to fall approximately east to west with the highest level of approximately 115.1 m AOD shown to be present adjacent to the eastern boundary of the field. Levels are shown to fall away to the north, south and west from this high point approximately midway up the eastern boundary. The lowest level of approximately 102.4 m AOD is located in the far west of the field.

Field 5

2.2.4 Field 5 is located to the northeast of Field 4, on the north side of the watercourse and west of Turners Hill Road to the east of the site. The levels within Field 5 are shown to typically fall from north to south toward the existing watercourse, with the fall steadier across the northernmost 200 m of the site, and steeper for the remaining (approximately) 50 m before the watercourse. The maximum level in the north of the field is approximately 123.6 m AOD. At the southern end of the field levels are at approximately 113.9 m AOD at a minimum. Approximately 50 m north of this point levels are at approximately 119 m AOD. A ditch network is indicated to be present in the wooded area to the east of Field 5 and is presumed to be collecting surface water runoff from Turners Hill Road and transferring it into the existing watercourse at the southern end of the field.

Field 6

2.2.5 Field 6 is located to the east of Field 4, on the south side of the watercourse and west of Turners Hill Road to the east of the site. The levels within Field 6 are shown to typically fall from east to west from a high of approximately 127.5 m AOD in the far east of the field to a low of approximately 110.2 m AOD in the southwest. The field also falls toward a low of approximately 112.8 m AOD in the northwest.

Field 7

2.2.6 Field 7 is located in the far south of the site, to the south of Fields 4 and 6. Levels are shown to fall from a high of approximately 118.5 m AOD in the east, to a low of approximately 99.2 m AOD in the southwest. Levels are shown to typically fall toward the existing watercourse/ditch network to the west of the field.

Existing Watercourse

2.2.7 An existing watercourse is located in the south of the site flowing approximately east to west, dividing Fields 3 and 4, and Fields 5 and 6. The watercourse is indicated in the survey to be fed by an existing ditch network to the east of Field 5, which is indicated to be taking runoff from Turners Hill Road. Between Fields 3 and 5, the watercourse passes through a pond located at the southern end of the property boundary of Huntsland House. The watercourse then flows west and south where it separates Field 3 from Fields 4 and 7.

2.2.8 At the upstream end of the ditch network to the east of Field 5, levels are at approximately 125 m AOD. At the downstream end where the ditch joins the main watercourse, levels are at approximately 111.7 m AOD.

2.2.9 Where the watercourse emerges from the west side of the pond to the south of Huntsland House, levels are at approximately 106.3 m AOD at the channel centre. At the downstream end of the watercourse where it leaves the site in the west, levels are at approximately 96.5 m AOD.

Summary and Surrounding Area

2.2.10 The site topographical survey is presented in Appendix B at the rear of the report.

2.2.11 A site visit was undertaken in March 2024 by representatives from both Ramboll and Wates. The topography was observed to be in line with that shown by the topographical survey. A series of photographs taken while onsite are presented in Appendix C at the rear of the report.

2.2.12 Light Detection and Ranging (LiDAR) data[2], is shown to broadly agree with the findings of both the topographical survey and the site visit. Outside the site boundary, the topography is as follows:

- North: Land is shown to rise approximately 5 – 6 m AOD over approximately 150 m toward the north before steadily falling again;
- East: Land is shown to rise steadily within residential areas of Crawley Down to the east of Field 5. Levels are indicated to rise approximately 3 m AOD over approximately 200 m;
- South: Land is shown to rise approximately 6 – 10 m AOD toward the south and southeast, with a steep rise and fall present at the location of Worth Way approximately 20 to 30 m south of the site; and
- West: Land is typically shown to fall toward the west. Land is shown to fall approximately 1 to 2 m AOD over approximately 200 m.

[1] CD Surveys Ltd, Topographical Survey Overall, W/2401010, February 2024.

[2] Department for Environment Food & Rural Affairs, Data Services Platform, LIDAR Composite Digital Terrain Model (DTM) – 1m [online]. Available at: https://environment.data.gov.uk/dataset/13787b9a-26a4-4775-8523-806d13af58fc. Accessed September 2024.

2.2.13 LiDAR Topography is presented in Figure 2.2 at the rear of the report.

2.3 Hydrological Setting

2.3.1 A review of the EA Statutory Main River Map[3] indicates there are no EA Main Rivers located within the boundary of the site. The nearest is located approximately 1.9 km northwest of the site. Ordnance Survey (OS) mapping[4] does identify the existing ordinary watercourse located within the centre of the site flowing approximately east to west that was previously identified in the topographical survey1 and observed during the March 2024 site visit. The tributary ditch located adjacent to Field 5 is also identified in the mapping.

2.3.2 The site drains to the existing watercourse flowing approximately east to west through the site. This watercourse ultimately drains northwards to become a tributary of the River Mole. The Mole then flows northwest through Surrey for 80 km (approximately 50 miles) to the River Thames at Hampton Court Palace.

2.3.3 The existing watercourse flowing from east to west is indicated to serve a small catchment area upstream, which constitutes the westernmost extent of Crawley Down. The catchment upstream is largely urban.

2.3.4 The Hydrological Setting is presented in Figure 2.3 at the rear of the report.

March 2024 Site Visit - Observations

2.3.5 Flow within the main channel of the existing east to west watercourse was observed to be restricted at crossing points between Fields 3 and 4, and between Fields 5 and 6.

2.3.6 In the northeast corner of Field 5 within the existing ditch network located adjacent to the field's eastern boundary, flow was observed to be restricted. The ditch network in the area was observed to be shallow and full of debris. Approximately 40 to 50 m downstream the ditch widened and deepened. At this location a culvert and headwall were observed. These were considered to be from another ditch coming off Turners Hill Road that was previously identified in the topographical survey[1].

2.4 Geological and Hydrogeological Setting

2.4.1 Geology and ground conditions at the site were investigated by Geo-Environmental[5] in November 2023. The ground conditions typically encountered across the boreholes comprised a mantle of Topsoil overlying the Upper Tunbridge Wells Sand Formation.

[3] Department for Environment Food & Rural Affiars, Data Services Platform, Statutory Main River Map [online]. Available at: https://environment.data.gov.uk/dataset/25dde009-ba7d-40de-8380-c5c3bb32ccdc. Accessed September 2024.

[4] Ordnance Survey, Data Hub, OS OpenMap – Local [online]. Available at: https://osdatahub.os.uk/downloads/open/OpenMapLocal. Accessed September 2024.

[5] Geo-Environmental, Ground Appraisal Report, Land Off Turners Hill Road, Crawley Down, West Sussex, RH10 4HB, January 2024, GE21953-GAR-JAN24.

2.4.2 Groundwater monitoring investigations were previously undertaken by Geo-Environmental[6] between November 2023 and April 2024. They indicate a site-wide groundwater level typically shallower than 2 m Below Ground Level (BGL). In many areas of the site the level is shallower than 1 m BGL.

2.4.3 According to the Cranfield University LandIS soils map[7], the soil at the site is described as 'slightly acid loamy and clayey soils with impeded drainage'.

2.4.4 According to British Geological Survey (BGS) GeoIndex Onshore data[8], the underlying rock unit beneath the site is defined as a moderately productive aquifer and is summarised as sandstones of the Ashdown Formation yielding up to 60 L/s and Tunbridge Wells Sand yielding up to 10 L/s; separated by Wadhurst Clay.

2.4.5 According to the BGS Geology Viewer[9], the underlying geology beneath the site is defined as the Upper Tunbridge Wells Sand. This is typically described as interbedded sandstone and siltstone, with a narrow band described as mudstone indicated to be running through the centre of the site. No superficial geology layers are recorded.

2.5 Existing Drainage

2.5.1 At present, the site is comprised of undeveloped, greenfield land with no impermeable surfaces.

Surface Water

2.5.2 According to the LandIS soils map[7], the site is stated to drain to the 'stream network'. This statement is backed up by observations made during the site visit undertaken in March 2024, where saturated ground and pooling of water were observed in many places across the site, as well as the drainage of surface water to existing watercourses both on and offsite.

2.5.3 During the March 2024 site visit, surface water was observed to flow into the existing east to west watercourse running across the site. This was either directly or via a tributary ditch or watercourse. In Field 5 flow was observed in the tributary ditch located adjacent to the eastern boundary of the field. In the southwest of Field 7, surface water was observed flowing from south to north in a shallow ditch that was directed into the existing east to west watercourse where it leaves the site.

[6] Geo-Environmental, Land off Turners Hill Road, Crawley Down, West Sussex, RH10 4HB – Ground Gas Assessment & Winter Groundwater Monitoring, May 2024, GE21953 – LRv1AP240203.

[7] LandIS, Soilscapes Viewer [online]. Available at: https://www.landis.org.uk/soilscapes/. Accessed September 2024.

[8] BGS British Geological Survey, GeoIndex Onshore [online]. Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html. Accessed September 2024.

[9] BGS Geology Viewer [online]. Available at: https://geologyviewer.bgs.ac.uk. Accessed September 2024.

2.5.4 Thames Water sewer records are presented in Appendix D at the rear of the report. While no formal surface water sewers are indicated to be present at the site, the records do indicate the presence of a surface water sewer that crosses Turners Hill Road and discharges into the ditch adjacent to the eastern boundary of Field 5. Observations made onsite of the culvert and headwall in this location, and of a manhole further upstream within the woods evidence the presence of this sewer.

Foul Water

2.5.5 The Thames Water sewer records indicate the presence of a 225 mm diameter foul (wastewater) sewer crossing the site from south to north and from east to west, in the central part of the site. Within the site, the sewer crosses Fields 7, 6, 4 and 3. Foul manholes were observed onsite along the route of the existing sewer at the locations indicated by the sewer records. The sewer is gravity driven and is joined by a smaller 100 mm diameter connection flowing north to south from Huntsland House.

2.6 Surface Water and Sewer Flood Risk

2.6.1 The topography of the site and surrounding area is detailed in Section 2.2. Levels across the site and in the surrounding area are suggestive of a typical east to west sloping pattern, with the fall more apparent across the south of the site. The topography of the site and surrounds is therefore suggestive of the potential for overland flow paths leading onto the site from the east.

2.6.2 The EA publishes geo-spatial data[10] describing the suitability of the modelling for a range of types of assessment for given locations. At the site location it is confirmed that the mapping was produced by the JFlow National Surface Water model, which was run in March 2013 at a 2 m resolution. It is stated that the assumption at this location was that any drainage systems are at capacity. Therefore, the model does not allow for losses (departure) of surface water runoff during the modelled storm event via the natural drainage at the site and in the vicinity of the site.

2.6.3 The Suitability[11] of the results at this location are stated to be 'National to County'. This suggests that whilst suitable for identifying which parts of countries or counties are at risk, or which countries or counties have the most risk, the results at this location are *"Very unlikely to be reliable for a local area"* and *"Extremely unlikely to be reliable for identifying individual properties at risk"*.

[10] Department for Environment Food & Rural Affairs, Data Services Platform, Risk of Flooding from Surface Water Input Model Details [online]. Available at: https://environment.data.gov.uk/dataset/926e600f-d465-11e4-95fe-f0def148f590. Accessed September 2024.

[11] Department for Environment Food & Rural Affairs, Data Services Platform, Risk of Flooding from Surface Water Suitability [online]. Available at: https://environment.data.gov.uk/dataset/92912a4f-d465-11e4-8687-f0def148f590. Accessed September 2024.

2.6.4 According to the EA long term flood risk mapping[12], approximately 75% of the site is located in an area considered to be at a Very Low risk from surface water flooding. Areas at High risk are present in the southwest of the site and are surrounded by areas at Medium and Low risk. Further areas at Medium and Low risk are present in Field 5 and adjacent to the existing east to west watercourse running across the centre of the site. The different surface water risk categories are defined below:

- High – Greater than a 1 in 30 (3.3%) annual probability;
- Medium – Between a 1 in 30 and 1 in 100 (3.3% to 1%) annual probability;
- Low – Between a 1 in 100 and a 1 in 1,000 (1% to 0.1%) annual probability; and
- Very Low – Less than a 1 in 1,000 (0.1%) annual probability.

2.6.5 It is noted that the EA mapping indicates areas at risk of flooding from surface water in addition to flood risk from rivers or the sea. It does not however account for building removal, ground raising, or site levelling. In addition, it does not consider specific drainage assets such as sewers, drains or ditches when calculating extents.

2.6.6 Whilst the surface water mapping indicates where there could be heightened surface water flood risks in some surrounding areas, this does not account for public surface water drainage measures which would be expected to significantly reduce surface water flood risks from that assumed and presented by the mapping. The EA's data confirms that the mapping at this location should not be used for site-specific assessment of risk.

2.6.7 EA Surface Water Flood Risk is presented in Figure 2.4 at the rear of the report.

2.6.8 In Field 5, the overland flow path shown in the surface water mapping to be running across the field is considered to be the result of flow within the existing (tributary) ditch in the northeast corner of the catchment spilling over into the main part of the catchment under heavy rainfall conditions. While clearance works and subsequent maintenance are proposed to be undertaken, the reality is that no significant overland flow path was observed onsite, and it is considered that the majority of surface water runoff falling on the catchment is likely to be directed into the existing ditch network by the existing topography.

[12] GOV.UK, Check the long term flood risk for an area in England [online]. Available at: https://check-long-term-flood-risk.service.gov.uk. Accessed September 2024.

2.6.9 The mapping also indicates a potential flow path running adjacent to the existing east to west watercourse on its south side. This was not observed during the site visit. Water was generally observed to remain confined to the existing channels. Large areas of the watercourses present at the site were covered by dense woodland which likely meant that the surface water model was unable to accurately map the underlying channels. Furthermore, culverts were observed to be present beneath the crossings that joined Fields 3 and 4, and Fields 5 and 6. Given the very low likelihood that the modelling would have identified these features, their presence is considered to be another factor contributing to the incorrect surface water flow paths indicated by the mapping.

2.6.10 Surface water in the southwest of Field 7 was observed to be flowing from south to north directly into the existing watercourse and was not observed to be part of the indicated flow path shown in the EA mapping[12]. Outside the site boundaries, the flow path is indicated by the mapping to be directed onto the site via three separate tributary flow paths, located both on and to the south of Worth Way which runs adjacent to the southern boundary of the site.

2.6.11 On a subsequent site visit undertaken in June 2024, roadside ditches on the southeast side of Huntsland, adjacent to Field 5, were inspected. It was determined that previous works, undertaken with the intent to divert surface water away from Huntsland House, had led to the possibility of surface water being diverted onto Field 5 under heavy rainfall conditions.

2.6.12 Surface water and sewer flood risk at the site is expected to be managed by the proposed surface water drainage strategy detailed in Section 3.

3. SURFACE WATER DRAINAGE STRATEGY

3.1 Overview

3.1.1 The following section sets out a high-level strategy for the management of surface water emanating from the new development. The strategy has been developed through use of the sustainable drainage guidance for the South East of England[13], along with the National Statutory guidance outlined in the Non-Statutory Technical Standards for Sustainable Drainage Systems[14].

3.1.2 The Indicative Drainage Strategy Plan is presented in Figure 3.1 at the rear of the report and should be read in conjunction with this section.

3.2 Surface Water Catchments

3.2.1 In order to retain the existing hydrological characteristics of the site, it is proposed to manage surface water based on existing catchments and their associated drainage routes.

3.3 Disposal of Surface Water

3.3.1 Part H of the Building Regulations[15] establishes a hierarchy for surface water disposal, which encourages a SuDS approach. The hierarchy is that surface runoff must be discharged to one or more of the following in the following order of priority:

1. To ground via an adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
2. To a watercourse; or where that is not reasonably practicable,
3. To a sewer.

3.3.2 A review of the existing drainage, hydrology, and underlying ground conditions at the site (as described in Section 2), indicates that permeability is likely to be low across the site, and as such infiltration is unlikely to be a feasible option for the disposal of surface water.

3.3.3 On the assumption that infiltration would not be viable, the most convenient point of connection for surface water to a watercourse would be as follows:

- The development is proposed to make use of the existing site hydrology and make a series of new discharges to the existing unnamed watercourse that runs through the site from east to west.

[13] AECOM, Water. People. Places. A guide for master planning sustainable drainage into developments. Prepared by the Lead Local Flood Authorities of the South East of England [online]. Available at: https://www.westsussex.gov.uk/media/2270/suds_design_guidance.pdf. Accessed September 2024.

[14] Department for Environment, Food and Rural Affairs [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf. Accessed September 2024.

[15] GOV.UK, Statutory guidance, Drainage and waste disposal: Approved Document H, 2010 [online]. Available at: https://www.gov.uk/government/publications/drainage-and-waste-disposal-approved-document-h#:~:text=The%20current%20edition%20covers%20details%20of. Accessed September 2024.

3.4 Runoff Rates and Storage

3.4.1 The site is almost entirely greenfield in its current state, and as such runoff from the site post-development will need to be controlled to the equivalent greenfield 1 in 1-year rate. Surface water attenuation and flow control will need to be of sufficient design and capacity to ensure the 1 in 100-year plus 40% climate change event can be attenuated within the site, restricting onward flow to the 1 in 1-year greenfield rate.

3.4.2 The existing site runoff was calculated using the Rainfall-Runoff calculator in the Source Control module of Micro Drainage 2020.1. The ICP SuDS Method was used, due to the less than 50 ha site area. Table 3.1 details the initial greenfield runoff calculations.

Table 3.1: Greenfield Runoff Calculation

Area (ha)	SAAR (mm)	Soil	Region	*Runoff rate (L/s)
18.7	865	0.45	6	89.4

3.4.3 Based on the requirement for attenuating to 89.4 L/s, the following storage volume was calculated. This is summarised in Table 3.2 which provides the schedule of the required storage, assuming a 35:65 ratio of impermeable to permeable areas. The arrangement of all the proposed storage is indicated on Figure 3.1 (Indicative Drainage Strategy Plan). Impermeable areas have been estimated based on the site masterplan.

Table 3.2: Storage Calculation

Imp Area (ha)	M5-60 (mm)	Ratio R	Allowable Discharge (L/s)	Design Storm Event	Required Storage (m^3)
6.55	20.00	0.350	89.4	1 in 100 +40%	4,853

3.4.4 Please see Appendix E for further information/figures.

3.5 SuDS Options

3.5.1 Table 3.3 below provides an overview of potentially suitable SuDS options available for attenuating surface water runoff.

3.5.2 It is noted that within the Indicative Drainage Strategy Plan, as presented in Figure 3.1 at the rear of the report, the larger surface water storage areas proposed at the site are collectively referred to as Proposed Surface Water Attenuation Areas. At detailed design, these areas could alternately form balancing ponds or wetlands, depending on which is most appropriate to each individual location.

Table 3.3: Sustainable Drainage Options

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site?
Retention	Balancing pond		Provides both storm water attenuation and treatment. Runoff from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation.	Good removal of pollutants, can be used where groundwater is vulnerable, good community acceptability, high ecological, and amenity benefits.	No reduction in runoff volume, land take may limit use in high density sites.	✓ Potential for inclusion in lower-lying areas before discharge from the site.
	Sub-surface storage		Oversized pipes, tank systems and modular geocellular systems that can be used to create a below ground storage structure.	Modular and flexible, dual usage (infiltration/storage, high void ratios), can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.	✗ Better options available considering nature and character of the development.
Wetland	Shallow wetland Extended detention wetland Pond wetland Pocket wetland Submerged gravel wetland Wetland channel		Wetlands provide stormwater attenuation and treatment. They comprise shallow ponds and marshy areas, covered in aquatic vegetation. Wetlands detain flows for an extended period to allow sediments to settle and to remove contaminants. They can provide significant ecological benefits.	Good pollutant removal and if lined can be used where groundwater is vulnerable. Good community acceptability, ecological and amenity benefits.	Land take is high, requires baseflow, little reduction in runoff volume, not suitable for steep sites.	✓ Potential for inclusion in lower-lying areas before discharge from the site. Impermeable ground would be well suited to wetlands.
Infiltration	Infiltration trench Infiltration basin		Surface water runoff can be discharged directly to ground for infiltration by soakaways, basins, or trenches. A	Reduces the volume of runoff, effective at pollutant removal, contributes to groundwater	Requires appropriate pre-treatment, basins require	✗ Unlikely to be viable due to underlying ground.

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site?
	Soakaway		prerequisite is that both groundwater and ground conditions are appropriate to receive the quality and quantity of water generated.	recharge, simple and cost-effective, easy performance observation.	a large flat area, offset from foundations.	
	Porous paving Permeable paving		Block or porous paving allows runoff to infiltrate through to sub-base layer. Water can then be infiltrated into ground or conveyed into storage or drainage systems.	Reduces the volume of runoff and if designed for infiltration contributes towards groundwater recharge. Easy to install and retrofit. Simple to manage. If lined can be used where groundwater is sensitive.	Not suitable for heavily trafficked areas or adoptable roads. Requires regular sweeping to prevent clogging with dirt.	✓ Should be incorporated for parking areas and access roads where appropriate.
Filtration	Surface sand filter Sub-surface sand filter Perimeter sand filter		Structures designed to treat surface water runoff through filtration using a sand bed filter medium. The filters can be designed with or without infiltration. Temporary storage of runoff is achieved through ponding above the filter layer. They are used where particularly high pollutant removal is required.	Flexibility of design, efficient in removing pollutants, suitable for retrofits and in tightly constrained urban locations.	Not for high sediment content, detention times can support algae growth, minimum hydraulic head of 1.2 m required, possible odour problems, high capital, and maintenance cost.	✗ Unlikely to be viable due to impermeable nature of the site.
	Bioretention/filter swale		Vegetated strips of land designed to accept runoff as overland sheet flow between a hard-surfaced area and a receiving system.	Landscaping features, effective in removing pollutants, flexible layout to fit into landscape, suited for highly impervious areas, good retrofit capability, effective pre-treatment option.	Requires landscaping and management, large land requirement, not suitable for steep sites; no significant attenuation or reduction of flows.	✓ Could be used alongside highway areas for treatment of highway runoff.
	Filter trench/drain		Shallow excavations filled with rubble or stone that create temporary subsurface storage for filtration of storm water runoff.	Hydraulic benefits achieved with filter trenches, trenches can be incorporated into site landscaping and fit well beside roads and car parks.	High clogging potential without effective pre-treatment, limited to small catchments, high cost of replacing filter material.	✗ Better options available considering nature and character of the development.

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site?
			Receive lateral inflow from an adjacent impermeable surface.			
Detention	Detention basin		Surface storage basins that provide flow control through attenuation. Normally dry and in certain situations the land may also function as a recreational facility.	Cater for a wide range of rainfall events, can be used where groundwater is vulnerable, potential for dual land use, easy to maintain.	Land take, little reduction in runoff volume, detention depths constrained by levels.	✗ Better options available considering nature and character of the development.
	Enhanced dry swale Enhanced wet swale		Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate.	Incorporate into landscaping, good removal of pollutants, reduces runoff rates and volumes, low cost.	Not suitable for steep areas, significant land take, not suitable in areas with roadside parking.	✓ Should be used to form the spine of the blue-green network.
Conveyance	Conveyance swales Rills		Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in runoff volume via plant uptake and infiltration.	Potential trip/wheel hazard, disabled access issues.	✗ Better options available considering nature and character of the development.
Source control	Green/blue roof		Multi-layered system that covers the roof of a building with vegetation cover/landscaping over a drainage layer. Designed to intercept and retain precipitation, reducing the volume of runoff and attenuating peak flows.	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation.	✗ Not suitable for private dwellings.

3.6 Preferred SuDS Options

3.6.1 Table 3.4 outlines briefly the suitability of each of the SuDS options in consideration of the site conditions. The following section provides more detail on the preferred SuDS options, and how these will combine to form the overall strategy for managing surface water.

3.6.2 The most effective approach to incorporating SuDS into the development is to plan for and include them from the outset, and ensure SuDS and blue-green corridors for the transfer of surface water are represented in the masterplan development. There are good opportunities to do this within the proposed development, due to the relatively low-density of housing proposed, the large amount of amenity and open-space (which is highly suitable for 'doubling up' as SuDS storage), and the good drainage falls across the northern and southern development areas.

3.6.3 The most value can be added by SuDS through adoption of a hierarchical model, whereby measures are incorporated at each level of the development, forming a tiered approach to managing surface water. Table 3.4[16] below summarises how this approach could work at the site.

Table 3.4: Proposed SuDS Hierarchy

Hierarchy	Measures	Flow Control Detail	Design Considerations
Street Level	Permeable paving for all driveways. Permeable tarmac for all internal roads. Rain gardens, serving 2-6 properties as a destination for roof water.	Check dams, small diameter pipes, low gradients, flow baffles. Hydrobrakes should be avoided for street level flow control.	Street level SuDS could be highly effective in managing the flow of surface water through the development, ensuring runoff is diverted away from dwellings. Parking areas and driveways are particularly suitable for permeable paving. Rain gardens can be easily incorporated into grass verges and provide enhancement to green open space.
Neighbourhood Level	Swales to form the basis of connectivity for blue-green corridors. Small storage ponds.	Flow to be controlled through a system of regular check dams, orifices, natural weirs/informal overflows, and engineered levels. Formal/engineered flow control should be avoided at this stage.	Swales would be especially suitable for the controlled transmission of surface water through the site. Drop kerbs can be used to facilitate movement of surface water off highway areas towards SuDS/blue-green infrastructure. Blue-green corridor routes should be used in parallel as overland flow routes for extreme surface water events. Given the identified flood risk, opportunities for storing/slowing the rate of runoff should be adopted.

[16] The proposals presented in Table 3.4 present both outline measures as indicated on the Indicative Drainage Strategy Plan presented in Figure 3.1, and more detailed measures which may or may not be taken forward at detailed design stage.

Catchment Level	Wetlands, larger storage ponds. Swales.	Controlled via formal flow control, either hydrobrake or overflow weir.	The areas of surface water flooding identified onsite should be retained as more formal areas for surface water storage. Large amenity areas would be suitable for storage ponds and could be used to provide biodiversity net gain. Overland flow routes for exceedance events should be engineered to naturally flow to these areas. Would take up typically 10% of the site area, although this can be reduced through effective use of street and neighbourhood level measures.

3.6.4 The preferred configuration of the SuDS/blue-green infrastructure design has been agreed as part of the detailed site master-planning to be submitted as part of the planning application. The drainage strategy has been informed by the site masterplan and is illustrated in Figure 3.1. The strategy proposes the use of swales and larger storage or attenuation areas across the site, connected via surface water sewers where it is deemed necessary to do so. The intention is for ultimate disposal of surface water to the locations as stated in Section 3.3.

3.7 Biodiversity Net Gain

3.7.1 Biodiversity net gain (BNG) is an approach to development. It makes sure that habitats for wildlife are left in a measurably better state than they were prior to the development[17]. In England, BNG is mandatory under Schedule 7A of the Town and Country Planning Act 1990[18], unless exempt.

[17] GOV.UK, Guidance, Understanding biodiversity net gain, 2024 [online]. Available at: https://www.gov.uk/guidance/understanding-biodiversity-net-gain. Accessed September 2024.

[18] Legislation.gov.uk, Environment Act 2021, Schedule 14, Biodiversity Gain as Condition of Planning Permission [online]. Available at: https://www.legislation.gov.uk/ukpga/2021/30/schedule/14/enacted. Accessed September 2024.

3.7.2 The benefit of including SuDS measures across an effective hierarchy is that much of the BNG requirements can be fulfilled through the implementation of certain measures. The use of wetlands, rain gardens, swales, and blue-green corridors in particular, are beneficial in terms of BNG, and their inclusion can reduce the onus elsewhere in the site.

3.8 Treatment of Runoff

3.8.1 The proposed treatment of runoff and removal of contaminants is summarised in Table 3.5.

Table 3.5: Treatment of Runoff

<table>
<tr><th>Development Component</th><th>Existing Contaminant Profile</th><th>Primary Treatment</th><th>Secondary Treatment</th></tr>
<tr><td>Low Traffic Roads/Individual Property Driveways</td><td>Runoff likely to have light hydrocarbon contamination.

Using the CIRIA Report C753[19] indices, the pollutant loading profile will be as follows:
• TSS = 0.5
• Metals = 0.4
• Hydrocarbons = 0.4</td><td rowspan="2">Permeable Paving

Will treat surface water through filtration of silt and the attached pollutants; biodegradation of organic pollutants like petrol and diesel; adsorption of pollutants; and settlement and retention of solids.

Storage Ponds/Swales

Will treat surface water runoff through pollutant retention. Will help to reduce the contaminant load discharged to surface waters. Coarse to medium sediments and associated pollutants can be removed by filtration through surface vegetation and groundcover. Fine particulates and associated contaminants can be removed by infiltration.</td><td rowspan="2">Storage Ponds/Wetlands

Will provide treatment of surface water runoff through settling and biological uptake. Dense stands of vegetation facilitate the adhesion of contaminants to vegetation, aerobic decomposition of pollutants and can help stabilise settled sediment and prevent resuspension.</td></tr>
<tr><td>Residential Roof Areas</td><td>Using the CIRIA Report C753[19] indices, the pollutant loading profile will be as follows:
• TSS = 0.2
• Metals = 0.2
• Hydrocarbons = 0.05</td></tr>
</table>

3.9 Drainage System Performance

3.9.1 The storage values calculated at this stage are indicative and are intended to provide enough detail to inform the next stage of development. When the detailed layout of the site is being undertaken, the performance of the SuDS system should be modelled, with adequate storage within the system being provided to ensure flooding does not occur:

- On any part of the site for a 1 in 30-year rainfall event.

- During a 1 in 100-year rainfall event in any part of:
    - a building (including a basement); or
    - a utility plant susceptible to water (e.g., a pumping station or electricity sub-station).
- On neighbouring sites during a 1 in 100-year rainfall event.

3.9.2 The performance of the system should also consider the occurrence of an extreme storm event over and above that for which the system was designed (i.e., the 1 in 100-year plus climate change storm event).

3.10 Adoption and Maintenance

3.10.1 At this stage, no definitive plan or agreement has been entered into regarding the future adoption of surface water drainage. All SuDS features situated in private land (i.e., permeable paving, small rain gardens etc.) would be the responsibility of the homeowner. Surface water drainage in the form of sewers and SuDS features, located in public areas, are proposed to be placed under the responsibility of a private management company. Sufficient access space for maintenance has been provided in the design and this is indicated on the Indicative Drainage Strategy Plan.

3.10.2 In order to support future adoption by West Sussex County Council, all drainage should be constructed in accordance with the following technical guidance:

- Sewers for Adoption 8th Edition[20]; and
- CIRIA report C753 The SuDS Manual[19].

3.10.3 Irrespective of eventual ownership, in order to ensure the long-term performance of the site drainage all aspects of the system should be periodically inspected and maintained with the indicative schedule outlined below. The following provides a summary of the typical maintenance activities associated with the drainage features:

- **Permeable Paving** - Brushing and vacuuming three times per year; removal of weeds, repair of any broken blocks/damaged areas; maintenance of vegetation; three monthly inspections for poor operation and/or weed growth; annual inspection of inspection chambers; annual inspection for silt accumulation.
- **Swales/Rain Gardens** - Monthly removal of litter, grass cutting and vegetation management; annual re-seeding and pruning; repairs due to erosion, reinstatement of design levels, scarification and spiking of topsoil, removal of sediment, and removal of oils or petrol residues as required; monthly inspection for blockages, ponding, compaction and silt accumulation; monthly inspection for blockages and physical damage; six monthly inspection for silt accumulation and functioning of mechanical devices (where necessary).

[19] CIRIA, The SuDS Manual (C753F), 2015 [online]. Available at: https://www.ciria.org/CIRIA/Item_Detail.aspx?iProductCode=C753F&Category=FREEPUBS&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91&OrderLineId=315a5390-84ff-4072-9e87-0a360394b238. Accessed September 2024.

[20] Water UK, Sewers for Adoption, A Design and Construction Guide for Developers, 2018 [online]. Available at: https://www.water.org.uk/wp-content/uploads/2018/10/SfA-8-Master-2.pdf. Accessed September 2024.

- **Flow Control Devices** – To be inspected every three - six months, after a large storm event, or after an observed deterioration in system performance.
- **Attenuation Basins** – Main requirements include mowing along maintenance access routes, amenity areas and across any formed embankments. The remaining areas can be managed as 'meadow'. Grass clippings should be disposed of offsite to remove nutrients and pollutants. Sediment will occasionally require removal when reaching 25 mm depth.
- **Wetlands** – Monthly removal of litter and debris, cutting of grass in public areas; monthly inspection of inlets, outlets, banksides, structures, pipework etc. for evidence of blockage and/or physical damage; monthly inspection of waterbody for signs of poor water quality (May – October); six monthly cutting of meadow grass; six monthly inspection of silt accumulation rates; six monthly inspection of any mechanical devices; annual hand cut of submerged and emergent aquatic plants; annual removal of bank vegetation and tidying of dead growth; remedial repair, replanting, aeration, and realignment as required.

3.10.4 The above represents a typical maintenance schedule; a site-specific schedule should be fully developed and agreed upon detailed design of the site drainage.

3.10.5 The following maintenance measures are noted regarding specific locations within the site:

- An earthen bund is located between Fields 3 and 4 and currently serves as a watercourse crossing. It has been agreed as part of the development that this bund will be removed and replaced with a clear span bridge.
- Clearance works are being undertaken in the existing tributary ditch on the east side of Field 5 that was identified during the March 2024 site visit as being heavily silted in certain areas. A regular inspection and maintenance regime for all the ditches in this area has been recommended as part of the development proposals. The proposed swale/surface water attenuation area network for Field 5 has been strategically located to capture any overland flow in the event that flows within the ditch come out of bank.
- Roadside ditches alongside Huntsland on the northwest side of Field 5 are proposed to be cleared and a surface water sewer installed at their downstream end to pass down the west side of Field 5 and join the proposed directional drilled sewer in the south of the field. The development of a regular maintenance regime for these roadside ditches is recommended as part of the Proposed Development.

3.11 Management of Runoff from Construction

3.11.1 During the stages of site preparation, earthworks, and construction there is the potential for contaminants and/or suspended sediments in surface water runoff entering the surrounding watercourses and existing drainage.

3.11.2 A strategy for managing surface water runoff during the construction phase, including specific measures tailored to the level of risk should be developed and agreed with West Sussex County Council. The extent of sediment/contaminant runoff will vary across the construction cycle, and a strategy should be developed to encompass potential pollution from all stages of construction.

3.11.3 The strategy should include details of how during the earthworks and site preparation stages the contracting engineer will employ the approaches outlined in CIRIA C532 Control of Water Pollution from Construction Sites[21]. This will require a proper understanding of the sensitivity of the downstream watercourses in terms of existing water quality and the potential impact of change. It is expected potential mitigation measures will include:

- Avoiding mass overburden stripping at the site; exposing only that part of the site essential for operation;
- Placing silt fences of geo-fabric or similar material around open or exposed ground and stockpiles; and
- Re-seeding any exposed ground and stockpiles to stabilise the ground and reduce erosion and gullying of such features.

3.11.4 The strategy should be developed and agreed during detailed design and should be implemented prior to the commencement of any enabling and/or construction works onsite.

3.11.5 A strategy for managing surface water runoff during the construction phase, including specific measures tailored to the level of risk at the site should be developed and agreed with West Sussex County Council during detailed design.

[21] CIRIA, Control of water pollution from construction sites. Guidance for consultants and contractors (C532D), 2001 [online]. Available at: https://www.ciria.org/ItemDetail?iProductCode=C532D&Category=DOWNLOAD.

4. SURFACE WATER FLOODING MITIGATION

4.1.1 As part of our development of mitigation options, and in consideration of future site development, Ramboll has considered climate change in the following ways:

- Consideration of climate change allowances when considering peak fluvial flood levels – this is also a policy requirement of the EA for all NPPF-compliant FRAs;
- Consideration of greater frequency and higher magnitude of surface water flooding events and overland flow, and assessing how a site and building layout can be designed to manage this risk; and
- Consideration of the likely increased risk of seasonal groundwater flooding as a result of wetter winters.

4.1.2 Each of the above will be considered when assessing the mitigation measures, which are summarised as follows:

- Finished Floor Levels (FFLs) – All FFLs and threshold levels should be at least 150 mm above the surrounding ground to manage future risk from surface water flooding and overland flow.
- Planning for Exceedance Events - This risk relates to the occurrence of intensive rainfall events (expected to become more frequent with the advent of climate change) which could cause overland flow and surface water flooding or cause the capacity of the site drainage system to be exceeded and result in flooding. To manage this risk, the development should consider exceedance overland flow routes during extreme flood events, adopting the principles set out in CIRIA C634, Designing for Exceedance in Urban Drainage[22]. The design of exceedance routes should correlate with the proposed swales/surface water attenuation areas, which will make highly suitable exceedance flow paths. The overall volumes for the surface water attenuation features presented in the Indicative Drainage Strategy Plan have been determined based on calculations where an allowance for the potential impacts of climate change was made.
- External Gradients - Along with the planning of exceedance routes, external gradients where possible, are to be designed to fall away from buildings, so that any overland flow resulting from extreme events would be channelled away from building entrances. Where this is not possible, linear interceptor drains should be located at all building entrances towards which there is a positive gradient for surface water to flow.
- Management of Flood Extents – Areas at risk from surface water were investigated during the March 2024 site visit and have been accounted for in the proposed surface water drainage strategy. Proposed surface water attenuation areas, connected by a network of proposed swales to convey surface water runoff, have been strategically located across the site.

[22] CIRIA, Management of accelerated low water corrosion in steel maritime structures (C634), 2005 [online]. Available at: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C634&Category=BOOK.

5. FOUL DRAINAGE STRATEGY

5.1.1 Thames Water sewer records presented in Appendix D at the rear of the report, indicate the presence of a foul water sewer running across the centre of the site. The presence of this sewer was confirmed during the March 2024 site visit.

5.2 Foul Flow Calculations

5.2.1 The expected peak flows have been calculated based on the British Water Code of Practice 4[23] which states that for a standard residential dwelling a flow rate of 150 L/Person/Day should be assumed.

5.2.2 Based on the number of proposed units, an occupancy of 480 people has been estimated for the Proposed Development (200 dwellings with an average occupancy of 2.4 people per household). This would mean the following:

(150 x 480)/24 (hours in a day)/60 (minutes in an hour)/60 (seconds in a minute) = 0.83 L/s.

5.2.3 To account for the diurnal variation of WC and kitchen facilities use, a peak rate of 6 times the average flow rate will be considered, giving a peak rate of 5 L/s.

5.3 Proposed Foul Strategy

5.3.1 The intended foul strategy for the site proposes to connect the majority of the site into the existing 225 mm diameter Thames Water gravity sewer crossing the site from south to north and from east to west, in the central part of the site. The exact route of the sewer is presented in the Thames Water sewer records in Appendix D, and in Figure 3.1, at the rear of the report. For development proposed within Field 6, drainage is proposed to connect into the existing Thames sewer via conventional gravity sewers. In Field 4, development is proposed to connect into the first of two foul pumping stations proposed for the site, located in the west of Field 4. This pumping station would deliver flows into the existing sewer via a proposed rising main.

5.3.2 In Field 5, foul water is proposed to connect into the second foul pumping station, located in the southwest of the field. The pumping station would deliver flows into an existing Thames sewer in Turners Hill Road. Thames Water did previously confirm capacity in the existing sewer that crosses the site, for the entire development. It was however concluded that due to ecological considerations, it would not be possible to cross the existing east to west watercourse with a new connection.

5.3.3 Thames Water have confirmed capacity in the sewer network for the strategy proposed above. Letters of confirmation are presented in Appendix D at the rear of the report.

[23] British Water, Code of Practice, Flows and Loads – 4, Sizing Criteria, Treatment Capacity for Sewage Treatment Systems [online]. Available at: https://cdn.ymaws.com/www.britishwater.co.uk/resource/resmgr/publications/codes_of_practice/flows_and_loads___bw_cop_18..pdf. Accessed September 2024.

5.3.4 Each of the two foul pumping stations are proposed to be adoptable. Each will therefore require a compound area of approximately 8x12 m, will be required to be 20 m from any dwellings, and will need to allow for tanker access. Additionally, an allowance of 24 hours of storage will be required for attenuation of foul flows at each pumping station for periods of maintenance/power failure/breakdown.

5.3.5 The drainage strategy is presented in Figure 3.1 at the rear of the report.

6. SUMMARY

6.1.1 The site located on land to the west of Crawley Down is to be brought forward for development. The Proposed Development will consist of up to 200 residential dwellings.

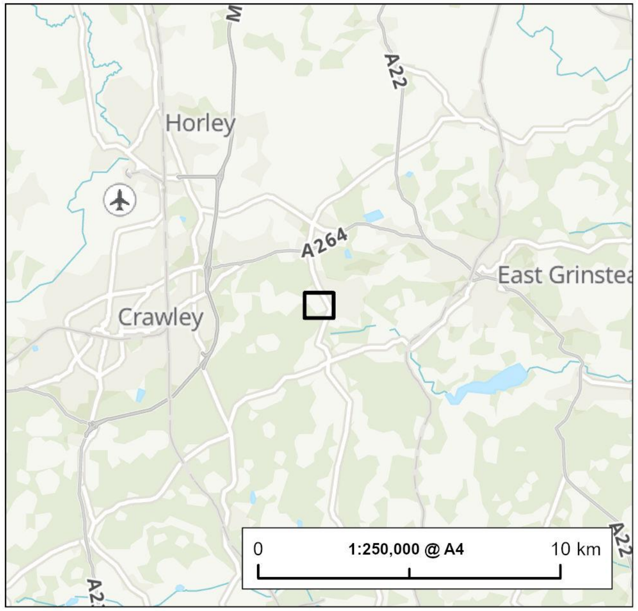
6.1.2 The site is currently undeveloped, greenfield land, and as such a drainage strategy is required to demonstrate how newly introduced impermeable areas will collect, treat, and discharge runoff in a manner which does not cause a detrimental impact downstream, in terms of both water quality and quantity (i.e., not increase flood risk).

6.1.3 The intent is to discharge via a proposed network of swales and surface water attenuation areas to the existing watercourse flowing approximately east to west across the centre of the site. The overall 1 in 1-year greenfield runoff rate, to which discharge from the Proposed Development intends to be limited, is calculated at 89.4 L/s.

6.1.4 This represents a considerable reduction in the peak flows presently emanating from the site area. The strategy will therefore improve upon the current situation with regard to surface water management and flood risk.

6.1.5 Foul water will be collected and discharged via conventional means to existing Thames Water sewers, one located within Turners Hill Road, the other within the site. Two separate foul water pumping stations are proposed to be located across the site to direct foul flow to its intended destination. Thames Water have confirmed capacity in the existing sewer network for the proposed foul water strategy.

FIGURES



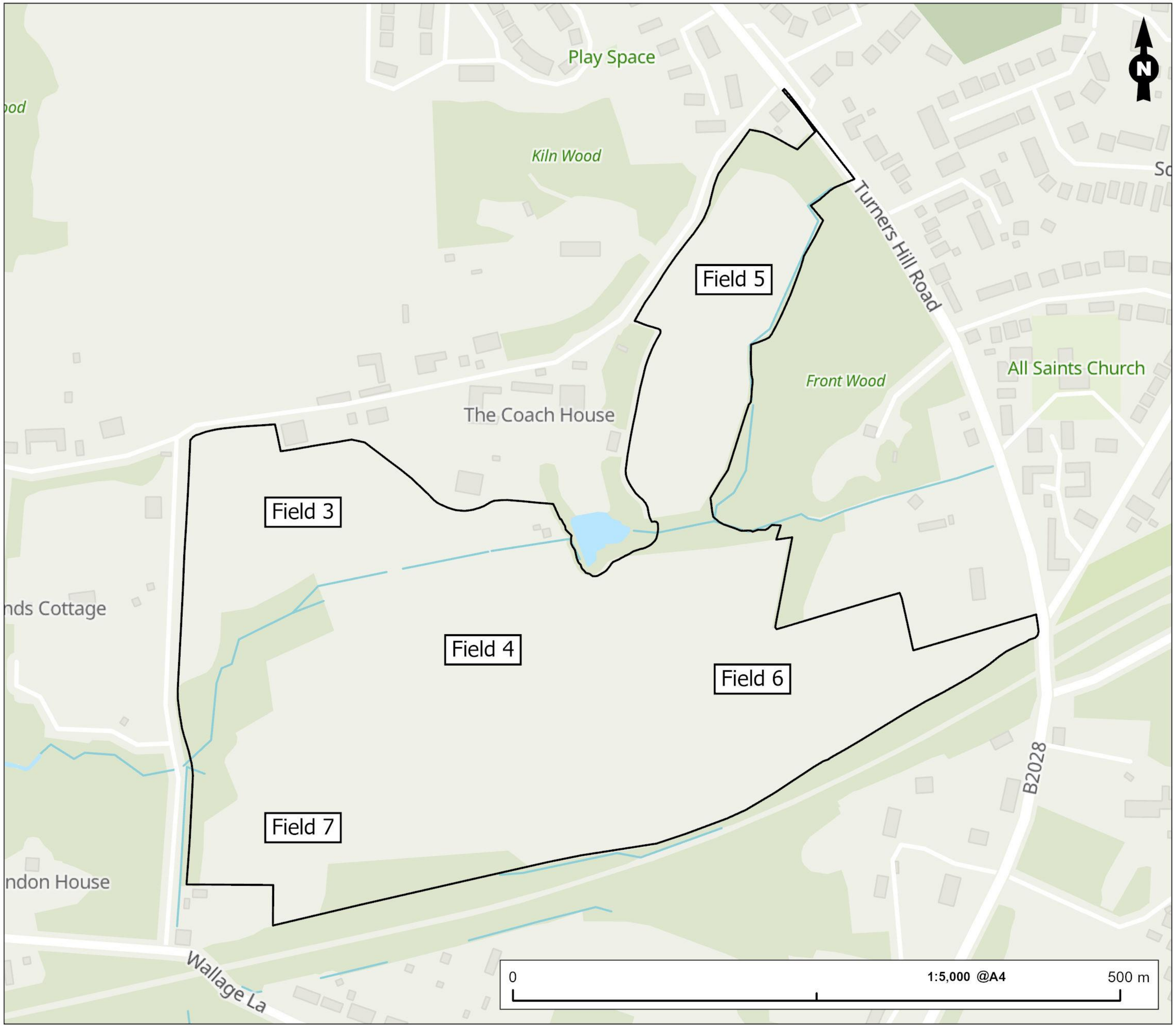
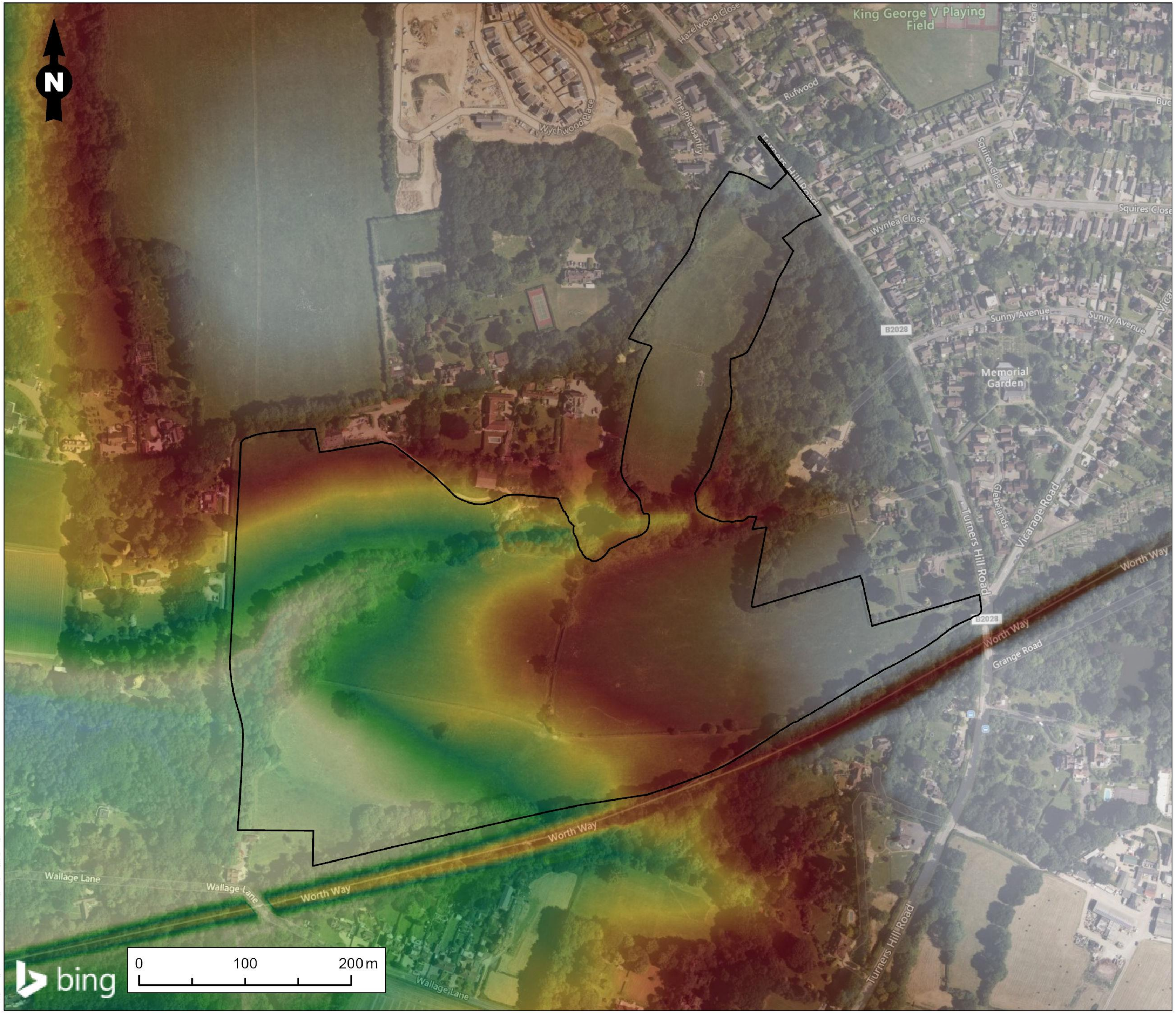


Figure Title	Project Name	Date	
Site Location Plan	Land West of Crawley Down	January 2025	
		Prepared By: DM	Figure No.: 2.1
Client: **Wates Developments Ltd**	Project No./Filery ID: 162001691-014 / RUK2021N00014	Scale: As Shown	Revision: 2.0

Fig2.1_SiteLocationPlan.pagx

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.



Legend

Site Boundary

LiDAR 1m DTM / m AOD

130

95

Figure Title

LiDAR Topography

Project Name

Land West of Crawley Down

Project No./Filery ID

1620011691-014 / RUK2021N00014

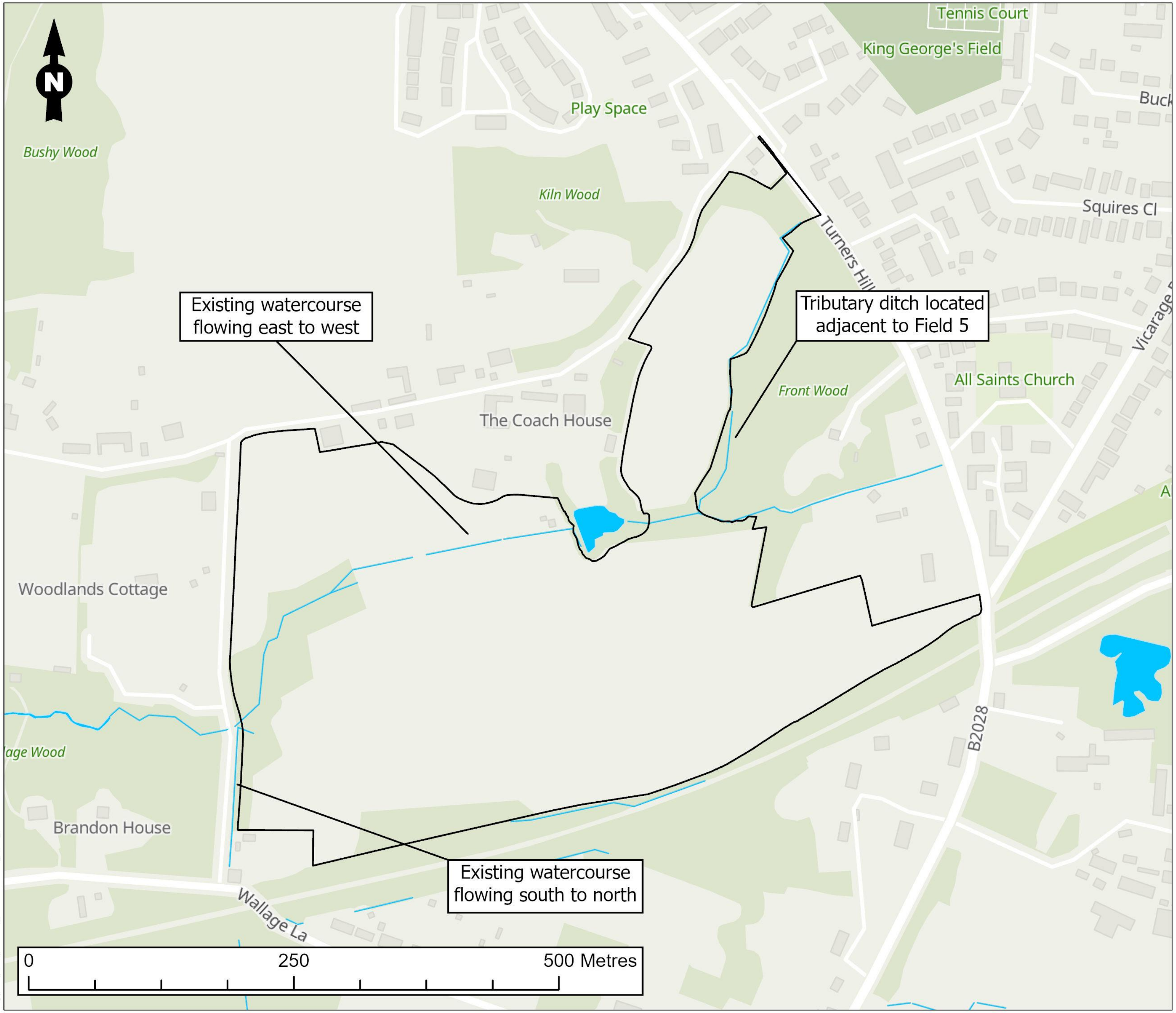
Date	Figure No.	Revision
January 2025	2.2	2.0

Prepared By	Scale
DM	1:5,000 @A4

Client

Wates Developments Ltd

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.



Legend

- Site Boundary
- OS Waterbodies
- OS Watercourses

Figure Title
Hydrological Setting

Project Name
Land West of Crawley Down

Project No./Filery ID
1620011691-014 / RUK2021N00014

Date	Figure No.	Revision
January 2025	2.3	2.0

Prepared By	Scale
DM	1:5,000 @A4

Client
Wates Developments Ltd

Fig2.3_HydrologicalSetting.pagx

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.

Legend

Site Boundary

High Surface Water Flood Risk (Greater than 3.3% Annual Exceedance Probability)

Medium Surface Water Flood Risk (Between 1% and 3.3% Annual Exceedance Probability)

Low Surface Water Flood Risk (Between 0.1% and 1% Annual Exceedance Probability)

Figure Title EA Surface Water Flood Risk		
Project Name Land West of Crawley Down		
Project No./Filery ID 1620011691-014 / RUK2021N00014		
Date January 2025	Figure No. 2.4	Revision 2.0
Prepared By DM	Scale 1:5,000 @A4	
Client **Wates Developments Ltd**		

RAMBOLL

Fig2.4_EASurfaceWaterFloodRisk.pagx

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.

Legend

- Site Boundary
- Existing Foul Water Manhole
- Expected (Existing) Foul Sewer
- Expected (Existing) Foul Sewer 6m Easement Strip
- Proposed Foul Water Manhole
- Proposed Foul Pumped Sewer
- Proposed Foul Pumped Sewer 6m Easement Strip
- Proposed Foul Pumping Station 8x12m Compound Area
- Proposed Surface Water Manhole
- Proposed Surface Water Gravity Sewer
- Proposed Surface Water Manhole (Directional Drilled)
- Proposed Surface Water Sewer (Directional Drilled)
- Surface Water Attenuation Area
- Surface Water Attenuation Area 3m Allowance
- Proposed Swale
- Proposed Swale 5m Corridor
- Discharging Swale
- Approximate Route of Existing Watercourses/Ditches

Figure Title		
Indicative Drainage Strategy Plan		
Project Name: Land West of Crawley Down		
Project No./Filery ID: 162001691-014 / RUK2021N00014		
Date: January 2025	Figure No.: 3.1	Revision: 2.0
Prepared By: DM	Scale: 1:3,000 @A3	
Client: **Wates Developments Ltd**		

RAMBOLL

IndicativeDrainageStrategyPlan.pagx

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.