



Flood Risk Assessment (FRA)

Land at Roundwood, Stevenage, Hertfordshire

Croudace Homes

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Basis of Report

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Table of Contents

1.0	Introduction	1
2.0	Site Description.....	2
3.0	Planning Policy and Guidance	4
4.0	Assessment of Flood Risk	6
5.0	Surface Water Management	9
6.0	Foul Drainage	18
7.0	Conclusions	19

Appendices

Appendix A	Proposed Site Layout Plan
Appendix B	Topographical Survey
Appendix C	Ground Investigation
Appendix D	Thames Water Information
Appendix E	Environment Agency Correspondence
Appendix F	Surface Water Calculations
Appendix G	Drainage Drawings



1.0 Introduction

Authorisation

- 1.1 SLR (formerly Vectos) has been appointed by Croudace Homes to prepare a Flood Risk Assessment (FRA) and drainage strategy to support a detailed planning application for land at Roundwood, Stevenage, Hertfordshire.

Background

- 1.2 The site consists of open grassland which is approximately 11.4 hectares (ha) in size and is located at the northern end of the town of Stevenage, in Hertfordshire (see Figure 2-1).
- 1.3 According to the Environment Agency (EA) Flood Map for Planning, the site is entirely located in Flood Zone 1. This is defined as land having a less than 1 in 1,000 annual probability of river or sea flooding and is therefore considered to be a low risk from these sources.
- 1.4 Given the size of the site (i.e. greater than 1 ha), an FRA is required by the National Planning Policy Framework (NPPF) to support the planning application. This FRA has been developed in accordance with the guidelines set out in the NPPF and informed by regional and local planning policy.
- 1.5 The previous version of this report informed the planning application submitted in 2023. Whilst key statutory consultees were satisfied, this latest version (dated 6th December 2024) has been prepared to reflect latest proposed site layout plan.

Development Proposal

- 1.6 The development is described as the erection of 281 dwellings and associated roads, parking, drainage, landscaping, open space and servicing facilities.
- 1.7 The Proposed Site Layout Plan is enclosed in Appendix A.

Aims and Objectives

- 1.8 The aim of this FRA is to demonstrate that the site can be developed safely for residential purposes, without exposing it to an unacceptable degree of flood risk and/or increasing the flood risk to third parties. The objectives of this FRA are to:
- Review the relevant planning policy documents to ensure that the development proposals are in accordance with this and other regional and local guidance.
 - Summarise relevant stakeholder consultation used to inform this FRA.
 - Undertake a desk-based review of the available flood risk information to assess past, current and future flood risk issues, taking into consideration the anticipated impacts of climate change.
 - Identify flood mitigation requirements, if any, to ensure the development is safe from flooding, without impacting third parties.
 - Assess whether the development will result in an increase of surface water runoff and how this can be mitigated through the incorporation of Sustainable Drainage Systems (SuDS) into the proposed development, which are informed through Lead Local Flood Authority (LLFA) guidance.
 - Evaluate a conceptual foul water drainage solution.
 - Summarise the above into an FRA report including a plan showing the proposed SuDS features associated with the surface water drainage strategy.



2.0 Site Description

Site Location and Description

- 2.1 The site is located on land at the northern end of the town of Stevenage, in Hertfordshire, and is centred at an approximate grid reference of TL 25139 27726. The site comprises of a field which is currently used for agriculture. The total site area is approximately 11.4 ha. The approximate red line boundary of the site is shown in Figure 2-1.
- 2.2 Back Lane is located alongside the east and south boundary of the site. Medium-density residential housing is located beyond Back Lane. The area to the north and west of the site is rural, and mainly comprises agricultural fields. The centre of Stevenage is approximately 2.5 km south-west of the site, whilst the A1(M) motorway is approximately 2 km west of the site.

Figure 2-1: Site Location Plan



Site Topography

- 2.3 The topographical survey is enclosed in Appendix B. It shows that the site generally falls to the west, from a maximum of approximately 144.2 m AOD in the northeast corner. Lowest site levels are identified in the northwest corner at approximately 140.3 m AOD, whilst the southwest corner is elevated at approximately 141.7 m AOD.

Geology and Hydrogeology

- 2.4 The 1 in 50,000 scale British Geological Survey (BGS) online mapping indicates that most of the site is underlain by superficial deposits of the Clay-with Flints Formation and Lowestoft



Formation. The solid geology underlying the site is shown to consist of chalk of the Lewes Nodular Chalk Formation and Seaford Chalk Formation.

- 2.5 A ground investigation was undertaken by Southern Testing in 2010. It was envisaged that poor infiltration rates would be obtained in the superficial deposits, so boreholes penetrating these and down into the underlying more permeable chalk was undertaken. Good flow rates were recorded via the deep boreholes and further detailed are enclosed in Appendix C. The boreholes went to 18 m below ground level and no groundwater was encountered. A nearby well identified groundwater approximately 73 m deep.
- 2.6 Further intrusive works were undertaken as part of the Preliminary Site Investigation undertaken by Southern Testing in 2022 (see Appendix C). This included three BRE 365 infiltration test locations across the site to validate the earlier assumption that shallow ground conditions would not permit infiltration as a means of surface water disposal. This was confirmed because water failed to drain.
- 2.7 The chalk strata beneath the site are classified as a Principal Aquifer. Principal Aquifers provide significant quantities of water and can support water supply and/or baseflow to rivers, lakes and wetlands on a strategic scale.
- 2.8 The site is located within a groundwater Source Protection Zone 3 (SPZIII). Groundwater in this area is assumed to be abstracted for water supply. This further restricts infiltration options as a means of surface water management.

Hydrology and Existing Drainage

- 2.9 A highway drain is present alongside Back Lane, adjacent to the south site boundary. However, there is no apparent outfall from this feature, and it appears to be used to store highway runoff and encourage it to slowly soak into the ground.
- 2.10 The Stevenage Brook is located approximately 1 km west of the site. No Main Rivers are present in the vicinity of the site.
- 2.11 The site currently comprises arable farmland. Runoff from the existing site either infiltrates into the ground or follows the ground contours and flows towards the west.
- 2.12 Asset records obtained from Thames Water and are enclosed in Appendix D. There are no sewers present on site, but a network of surface water and foul water sewers are present in the residential areas to the south and east.



3.0 Planning Policy and Guidance

National Planning Policy Framework

- 3.1 The National Planning Policy Framework (NPPF) sets out the Government's national policies for flood risk management in a land use planning context within England and how these are expected to be applied. It states the requirement for a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impact of climate change – so as to avoid, where possible, flood risk to people and property.
- 3.2 The aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the development in areas with a lower risk of flooding.
- 3.3 If it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the Exception Test may have to be applied. The need for the Exception Test will depend on the potential vulnerability of the site and of the development proposed.
- 3.4 In accordance with Annex 3: Flood risk vulnerability classification of the Planning Practice Guidance (PPG), the proposed residential development is classified as More Vulnerable.
- 3.5 Table 3 of the PPG sets out the 'incompatibility' of the vulnerability classification with the identified flood zones. All of the site is located in Flood Zone 1, which is compatible with More Vulnerable development, and application of the Sequential and Exception Test is therefore not required.

North Hertfordshire Local Plan 2011 - 2031

- 3.6 The North Hertfordshire Local Plan 2011 – 2031 sets out the key elements of the vision for the development of North Hertfordshire until 2031. It includes Policy SP9: Design and Sustainability, which includes the requirement to 'ensure the effective use of sustainable urban drainage and sustainable water management'. Policy SP11: Natural Resources and Sustainability includes the requirement to 'take a risk based approach to development and flood risk, directing development to areas at lowest risk in accordance with the NPPF and ensuring the provision of SuDS and other appropriate measures'.

Hertfordshire Strategic Flood Risk Assessment (SFRA)

- 3.7 The SFRA for Hertfordshire was prepared in July 2022, and identifies the flood risk within the borough from rivers, surface water groundwater, sewers and other artificial sources. Guidance for planners and developers is also included. The SFRA refers to the including of SuDS within developments, including the use of infiltration SuDS where practicable.

LLFA SuDS Guidance

- 3.8 The LLFA (Hertfordshire Council) are a statutory consultee to the planning process to assess major planning applications for their surface water drainage implications. Hertfordshire County Council assess surface water drainage designs using their document 'Management of Surface Water Drainage' (August 2021) which is available online.
- 3.9 The guide is intended to assist developers in the design of surface water drainage systems, providing specific information on the planning, design and delivery of surface water drainage, designed to reduce the risk of flooding and maximise environmental gain, including water quality, water resources, biodiversity, landscape and amenity. The guide also aims to



ensure that all new developments and redevelopments are designed to mitigate the effects of climate change.

- 3.10 The guide has informed the surface water drainage strategy discussed in Section 5.

The SuDS Manual (CIRIA C753) 2015

- 3.11 The CIRIA SuDS Manual provides comprehensive guidance for the design and incorporation of SuDS. The manual sets out the process by which appropriate SuDS options may be selected for a site.
- 3.12 The guidance within the CIRIA SuDS Manual (2015) will be used for the planning, design, operation and maintenance of the proposed SuDS.

Policy Conclusions

- 3.13 The development proposals are consistent with the policies within the NPPF, Local Plan and supporting national, regional and local guidance documents. This is because all built development has been located within Flood Zone 1 and because surface water will be managed using SuDS. This is discussed in the following chapters.



4.0 Assessment of Flood Risk

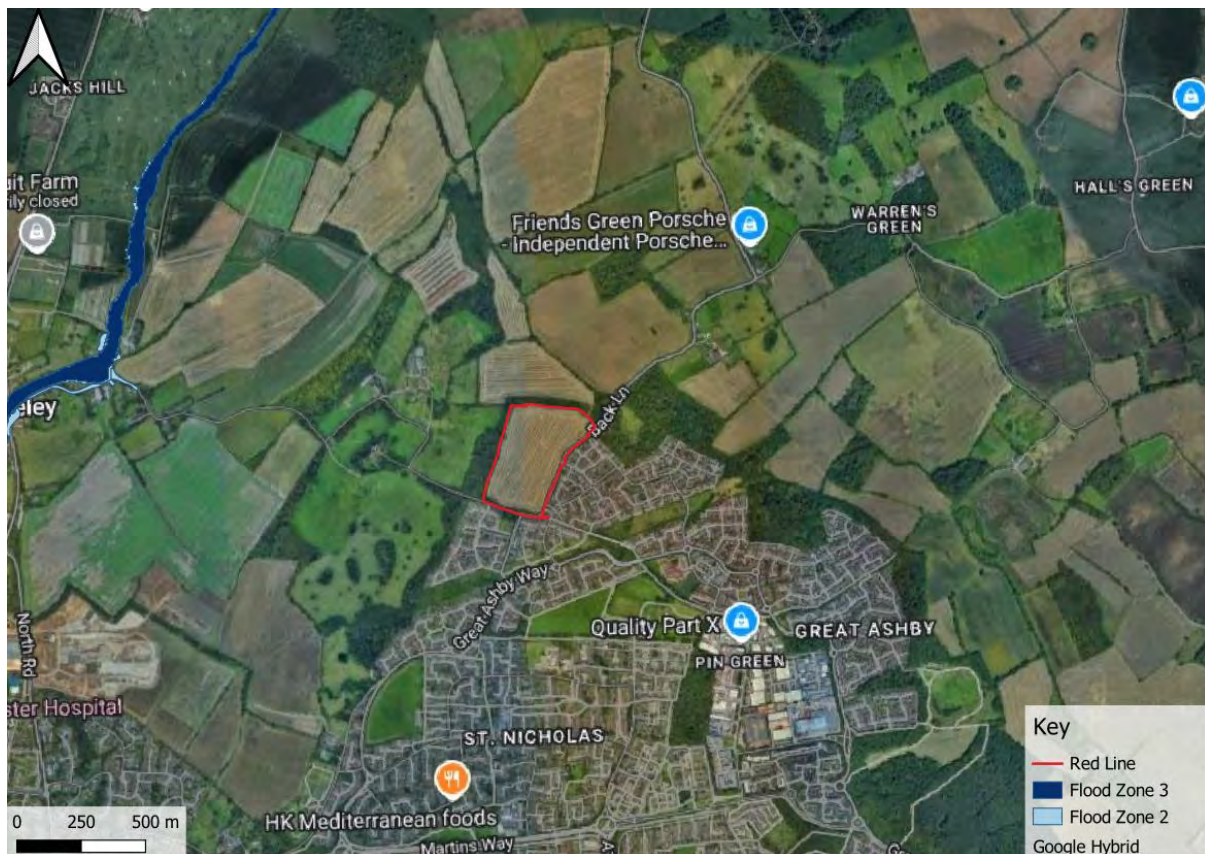
Historic Flooding

- 4.1 The Strategic Flood Risk Assessment (SFRA) (September 2016) for North Hertfordshire District Council (NHDC) and the Local Flood Risk Management Strategy (LFRMS) 2019 – 2029 for Hertfordshire County Council (HCC) do not record any historic flooding at the site or the immediate vicinity of the site.
- 4.2 The EA Historic Flood Map dataset was consulted, which shows that no historic flood events have been recorded in the vicinity of the site.

Risk from Fluvial and Coastal/Tidal Flooding

- 4.3 The EA Flood Map for Planning shows the risk of flooding from both rivers and the sea. It identifies that that site is in Flood Zone 1. Land in Flood Zone 1 is defined as land having a less than 1 in 1,000 annual probability of river or sea flooding. The Flood Map for Planning is shown in Figure 4-1.

Figure 4-1: EA Flood Map for Planning



- 4.4 The site is inland and is elevated over 140 m AOD. It is therefore not susceptible to flooding from the sea.
- 4.5 Given that all built development is located in Flood Zone 1, the risk of fluvial and tidal flooding is low.

Risk from Surface Water Flooding

- 4.6 Surface water flooding is a result of overland flow and ponding of water that can follow a rainfall event, from local catchment areas, hillsides and associated with minor ditches or



streams. The Risk of Flooding from Surface Water map is available online and is shown in Figure 4-2.

- 4.7 The EA's 'Risk of Flooding from Surface Water' map shows that the site is at a very low risk of surface water flooding (defined as an area with less than 1 in 1,000 chance of flooding each year). Flood risk from surface water is therefore considered to be low.

Figure 4-2: EA Flood Map for Surface Water



Risk from Groundwater Flooding

- 4.8 Groundwater flooding typically occurs in low-lying areas, close to hills which are underlain by permeable rocks. This source of flooding generally only becomes a problem in these areas after long periods of extensive and significant rainfall, resulting in a rise in groundwater level.
- 4.9 The SFRA for HCC (July 2022) indicates that groundwater flooding is an issue across Hertfordshire, and that the site is within an area susceptible to groundwater flooding.
- 4.10 As noted in Chapter 2, groundwater is at least 18 m below ground level and is expected to be much deeper based on evidence from a nearby well. Flood risk from groundwater is therefore considered to be low.

Risk from Drainage and Infrastructure Flooding

- 4.11 Drainage and infrastructure flooding occurs when sewerage systems are overwhelmed and result in flooding, which may occur alone or be combined with other flood sources (e.g. fluvial or surface water).
- 4.12 There are no sewer on the site and nearby assets are located down gradient. Therefore, no flood pathway onto the site exists. The risk of flooding from existing sewers is considered to be low.



Risk from Other Sources of Flooding

- 4.13 According to EA mapping, the site is not at flood risk from reservoirs. There are no impounded canals within the vicinity of the site that could pose a potential flood risk. Other sources of flood risk at the site are therefore negligible.

Flood Mitigation

- 4.14 Whilst the various potential sources of flood risk in the development parcels are not considered to represent a constraint, finished floor levels (FFL) of all dwellings should be elevated above the surrounding ground levels by at least 150 mm in accordance with building regulations. This will protect against the possibility of shallow ponding of water which is inevitable following heavy or prolonged rainfall.



5.0 Surface Water Management

Overview

- 5.1 It is well understood that one of the effects of development is typically to reduce the permeability of a site and consequently change its response to rainfall. Therefore, a drainage strategy is required to ensure that the surface water runoff regime is managed appropriately and that the proposed development does not increase flood risk on the site and/or to surrounding areas.
- 5.2 The NPPF states that flood risk to land and property must not be increased as a result of development. The NPPF also states that flood risk should not increase for events up to and including a 1 in 100-year return period, including an appropriate allowance for climate change. These requirements have formed the basis of the surface water drainage strategy, which is described in this section.
- 5.3 The proposed surface water management strategy has been derived based upon the principles of SuDS, in accordance with NPPF and the LLFA SuDS guide. It has subsequently been used to inform the Proposed Site Layout (Appendix A).

Proposed Surface Water Discharge Receptor

- 5.4 The drainage hierarchy presented in the PPG states the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:
- into the ground (infiltration),
 - to a surface water body,
 - to a surface water sewer, highway drain, or another drainage system,
 - to a combined sewer.
- 5.5 Discharge options were investigated in the order of preference specified in the drainage hierarchy. As noted in Chapter 2, conventional infiltration measures (i.e. soakaways), will not be possible due to the impermeable ground conditions. Deep infiltration may offer a means of surface water disposal but given the SPZIII status of the site, the EA have confirmed that they would not permit this (see Appendix E).
- 5.6 There are no streams or ditches on site, which would offer an appropriate means of surface water disposal. Therefore, in 2021 a connection to the public surface water sewer to the south of the site (ref MH9409) was agreed with Thames Water (refer to Appendix D for further details).

Existing Greenfield Runoff Rates

- 5.7 The FEH method was used to determine greenfield runoff rates. The parameters utilised are detailed in Table 5-1, which shows the calculation was undertaken for a developable area of 8.14 ha. The calculated rates are presented in Table 5-2. The calculation summary sheets are enclosed in Appendix F.

Table 5-1: Calculation Parameters

Parameter	Value	Unit
Area	8.14	ha
SAAR	628	mm
Region	5	-
BFI HOST	0.596	-



Table 5-2: Greenfield Runoff Rates

Return Period	Peak Greenfield Discharge (l/s)
QBAR	14.3
Q1	12.4
Q30	35.0
Q100	50.9

- 5.8 A discharge rate of 14.3 l/s was previously agreed with Thames Water, which has informed the surface water drainage strategy (see Appendix D). The restriction of runoff to the QBAR rate has been adopted to ensure that the long-term storage volume has been accommodated, so that the volume of surface water that is discharged from the site (as well as the rate that it is discharged at) has been managed.

Proposed Surface Water Drainage Strategy

- 5.9 The surface water management strategy proposed for the site has been derived based upon the principles of sustainable drainage as detailed in the CIRIA SuDS Manual (2015) and the LLFA SuDS guide.
- 5.10 SuDS will be utilised to manage surface water runoff from the entire site. It is proposed to collect runoff from the site via a network of rain gardens, tree pits, swales (with underlying filter drains) and pipes, which will be discharged to two attenuation ponds. Attenuation tanks will be used to supplement the attenuation storage requirements. Surface water will be released slowly, at the QBAR rate, into the nearby public surface water sewer, as agreed with Thames Water. This is shown on the Surface Water Drainage Strategy, enclosed in Appendix G.
- 5.11 The concept of sustainable drainage is that environmental and social factors such as the quantity and quality of runoff and amenity value of surface water in the urban or developed environment are considered when making decisions about drainage. SuDS can be used to complement or replace conventional piped urban drainage to recreate the natural water cycle.
- 5.12 This process can be used in to reduce the existing problems associated with conventional piped systems, which can include the risk of flooding, the potential of pollution or poor water quality and damage to the natural environment.

Attenuation Volumes

- 5.13 The surface water drainage strategy has been based on providing attenuation up to and including the 1 in 100 year plus a 40% allowance climate change event, which is in accordance with the latest national planning policy.
- 5.14 A Causeway Flow network model has been constructed for the site, which represents the key conveyance and attenuation features. This has been informed using the values presented in Table 5-3.
- 5.15 The impermeable area has been calculated based on measurements extracted from the Proposed Site Plan. In accordance with the SuDS Manual, an additional 10% allowance has been made to account for the potential of urban creep, which has been applied to house and garage roof surfaces.



Table 5-3: Network Model Parameters

Parameter	Value	Units
Impermeable area	4.897	ha
Urban creep	10	%
Future impermeable area	5.082	ha
Pond freeboard	0.3	m
Climate change	40	%
Pond average side slope	1 in 3	-
Discharge rate	14.3	l/s

- 5.16 The network model has been used to define a surface water strategy that provides sufficient attenuation storage, which are largely been provided in above ground features. However, attenuation requirements have got significantly larger over recent years and attenuation ponds can often appear disproportionately large. Therefore, a single attenuation tank has been used to supplement the storage requirements, which has been placed under a private parking court. The tank will only fill with water in the more extreme events and all surface water runoff will drain via the ponds.
- 5.17 The conveyance and attenuation capacity of the filter drain (beneath the swales) was represented using large diameter pipes.
- 5.18 The Surface Water Drainage Strategy is enclosed in Appendix G. The calculations are enclosed in Appendix F.
- 5.19 The Causeway Flow network model has also been used to understand if any land raising is likely to be needed as part of the development to facilitate a gravity arrangement to the ponds. Proposed cover levels are presented on the Surface Water Drainage Strategy (Appendix F). These were compared to existing ground levels, which showed that some ground raising up to approximately 1.85 m is required in the northwest part of the site.

Wider SuDS Proposals

Swales

- 5.20 Swales are shallow (i.e. around 0.5 m deep) vegetated open channels designed to convey, treat and in certain circumstances attenuate surface water runoff. They enhance the natural landscape and provide aesthetic and biodiversity benefits. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath.
- 5.21 It is proposed to incorporate a network of dry swales across the site for the conveyance of surface water (see Appendix G). It is recommended that the swales (and wider source control features) are unlined to allow runoff from small rainfall events to infiltrate and provide some localised interception.

Other SuDS Features

- 5.22 Other more local, or source control, SuDS features will be included to contribute to the management of surface water across the site. These can comprise rain gardens and tree pits, which also have amenity and biodiversity benefits. These opportunities have been identified on the Surface Water Drainage Strategy is enclosed in Appendix G.

Amenity and Biodiversity

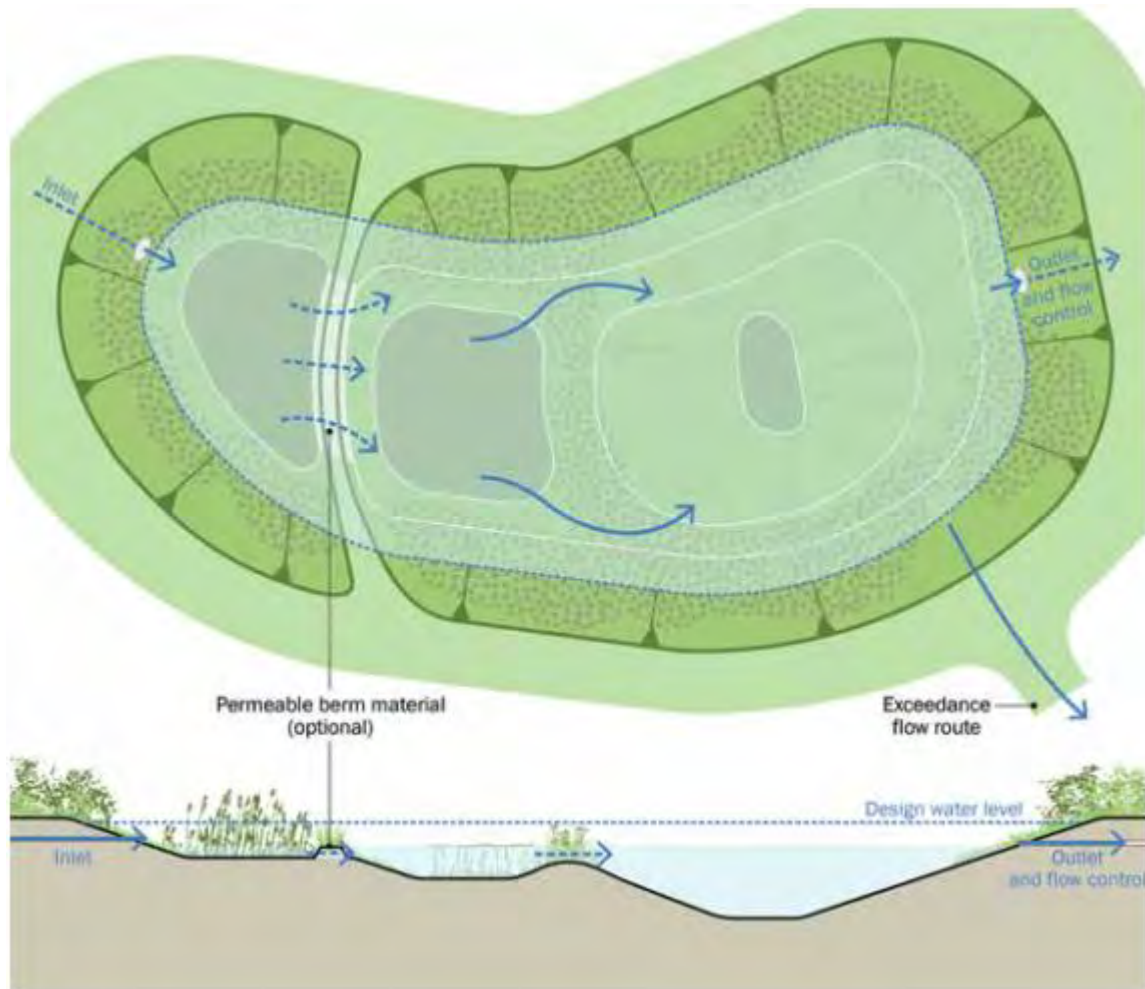
- 5.23 In addition to their drainage function, SuDS can be designed to deliver significant community and environmental benefits. They provide an opportunity to create high value



habitat and contribute an important biodiversity, aesthetic and recreational function for the site.

- 5.24 The CIRIA SuDS Manual (2015) provides some useful insight into effective design of both ponds and swales etc. These opportunities will be considered at detailed design stage. However, for the ponds, an average 1:4 side slope will allow for variation and will help to ensure that they appear as natural as possible.
- 5.25 The CIRIA SuDS Manual (2015) provides an example of a typical plan view of an attenuation pond illustrating how the feature could look on the site, as shown in Figure 5-1.

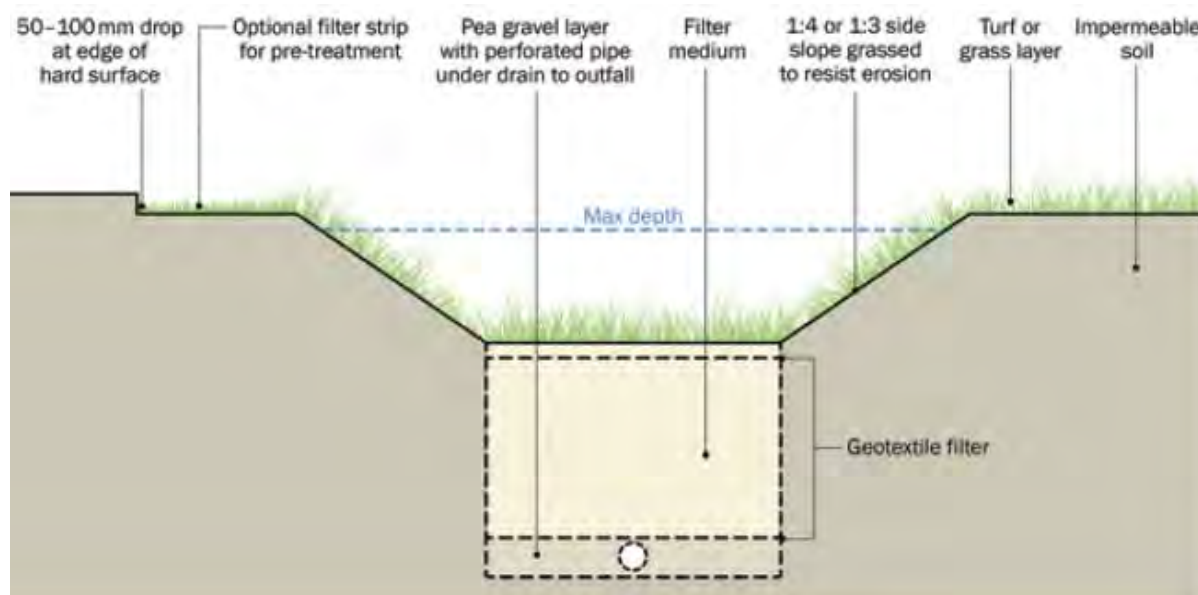
Figure 5-1: Schematic of Attenuation Pond



- 5.26 Figure 5-2 presents a cross section of a dry swale extracted from the CIRIA SuDS Manual (2015). It identifies how these can be designed to offer biodiversity, landscape, and associated water quality benefits, through pre-treatment and planting.



Figure 5-2: Typical Dry Swale Cross Section



Conveyance of Exceedance Surface Water Flooding

- 5.27 The surface water drainage strategy must consider an exceedance scenario, i.e. for flows in excess of the 1 in 100 year plus climate change rainfall event. Exceedance flows must be managed in conveyance routes across a site that minimise the risk to people and property.
- 5.28 The design for exceedance will be addressed further at detailed design stage. However, in an exceedance scenario, roads would be designed to convey any exceedance flows away from people and property using appropriate kerbing for channelling. Exceedance flow routes will ultimately be directed towards the network of swales and attenuation ponds, and away from nearby properties.

Water Quality

- 5.29 In accordance with the CIRIA SuDS Manual (2015), SuDS components must have a total pollution index that equals or exceeds the pollution hazard index for different land use classifications. The highest Pollution Hazard Index for the site is Low (individual property driveways and low traffic roads). Refer to Table 5.4 (as informed by Table 26.2 of the CIRIA SuDS Manual 2015)).

Table 5-4: Pollution Hazard Indices for the Site

Land Use	Pollution Hazard Indices for Different Land Use Classifications			
	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.20	0.20	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change	Low	0.50	0.40	0.40
Total	-	0.70	0.60	0.45

- 5.30 It is considered that the proposed attenuation ponds alone would provide sufficient water quality mitigation for the proposed site. Refer to Table 5-5 (as informed by Table 26.3 of the



CIRIA SuDS Manual (2015)). However, the swales, rain gardens and tree pits would provide significantly more water quality benefits.

Table 5-5: Pollution Mitigation Indices for Discharge to Surface Water

Type of SuDS	Pollution Mitigation Indices		
	TSS	Metals	Hydro-carbons
Swale	0.50	0.50	0.60
Pond ¹	0.35	0.35	0.25
Total	0.85	0.85	0.85

Operation and Maintenance

SuDS

- 5.31 It is anticipated that the proposed SuDS devices will remain private, and would be managed by a private maintenance company acting on behalf of the future property owners. Where privately maintained, the general maintenance requirements should be undertaken in accordance with the recommendations outlined in the CIRIA SuDS Manual (2015), as replicated in Figures 5-3 and 5-5.

Other Assets

- 5.32 Various other smaller assets of the surface water drainage strategy consist of gutters, down water pipes, manholes, pipes and drainage channels. These assets should be checked annually and after large storm events, in order to remove debris and inspect the condition.
- 5.33 Jet washing may be required on occasion to remove any blockages within the pipe network. If the condition is found to be poor, replacement or repairs may be required.

¹ As per the CIRIA SuDS Manual (2015), where the mitigation index of an individual component is insufficient, two components (or more) will be required. However, a factor of 0.5 is used to account for the secondary or tertiary components associated with the already reduced inflow concentrations



Figure 5-3: Operation and Maintenance Requirements for Rain Gardens

TABLE 18.3 Operation and maintenance requirements for bioretention systems		
Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years



Figure 5-4: Operation and Maintenance Requirements for Swales

TABLE 17.1 Operation and maintenance requirements for swales		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeded	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required



Figure 5-5: Operation and Maintenance Requirements for Ponds

TABLE 23.1 Operation and maintenance requirements for ponds and wetlands		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices, eg penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1 m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay.	Every 1–5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, eg every 25–50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets and overflows.	As required

Summary

- 5.34 The surface water drainage strategy has been prepared to demonstrate that the proposed development of the site can meet national and local requirements for the management of surface water runoff. This will be achieved through the principles of SuDS but is subject to detailed design once planning permission has been approved.
- 5.35 The SuDS will offer wider benefits including biodiversity and recreational opportunities, as well as aesthetic improvements.



6.0 Foul Drainage

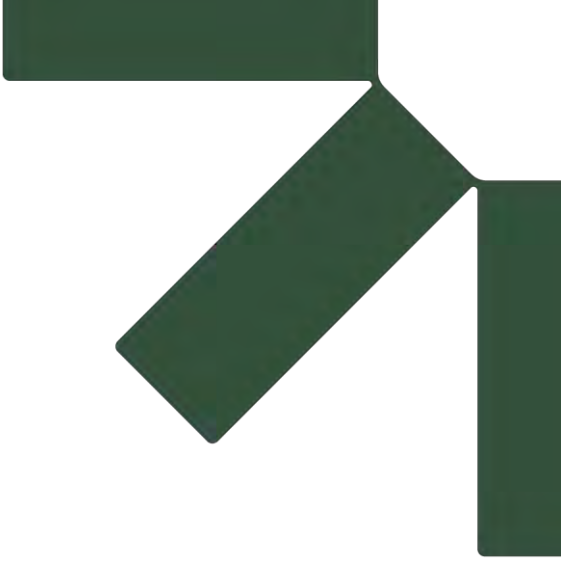
- 6.1 In April 2018 Ofwat changed the rules with respect to new sewer connections. Developers may now connect to the nearest public sewer on a size for size basis at their cost and, in this case, Thames Water will provide capacity in the network to accommodate domestic type flows from granted development which is funded by infrastructure charging arrangements.
- 6.2 A connection to a public foul sewer has been agreed with Thames Water (refer to Appendix D). Whilst a pumping station is required for the site, part of the site can be drained by gravity. An indicative foul water drainage strategy is enclosed in Appendix G.



7.0 Conclusions

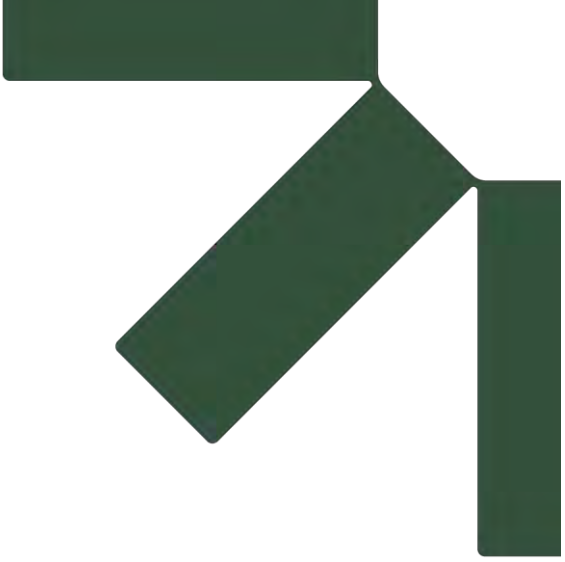
- 7.1 This Flood Risk Assessment (FRA) and drainage strategy has been undertaken to accompany the detailed planning application for a proposed residential development for land at Roundwood, Stevenage, Hertfordshire.
- 7.2 This report has been prepared by SLR on behalf of Croudace Homes in accordance with the guidelines set out in the National Planning Policy Framework, regional and local guidance documents.
- 7.3 The site lies entirely within Flood Zone 1 (i.e. land having a less than 1 in 1,000 annual probability of river or sea flooding, with this considered to be low risk). No significant sources of flood risk have been identified in the proximity of the site.
- 7.4 An attenuation led surface water drainage strategy has been proposed to manage the surface water runoff from the site. Attenuation will be provided to limit runoff to a heavily restricted greenfield rate before discharging into a nearby public surface water sewer. The attenuation ponds will be supplemented with a network of swales, tree pits, rain gardens and a tank, but is subject to detailed design once planning permission has been approved.
- 7.5 Foul water is to be disposed to a Thames Water foul network to the east of the site, subject to a S106 agreement.





Appendix A Proposed Site Layout Plan





Appendix B Topographical Survey

[illegible]

TREE LEGEND			
ALDER	ALD	LARPIE	MAPL
ASPEN	ASH	OWA	ONE
BEECH	BOH	POPLAR	POP
CHERRY	CHW	PRINCED	PRIN
CHERRYBARK	CHWB	SALICEDORNGRNS	SDNG
CYPRESS	CYP	SHALLO	SHAL
DOGWOOD	DGD	SPRICE	SPR
ELDERBERRY	ELD	SPRICE-HEMISTNUT	SHSP
ELDER	ELD	SPRICE-BIRCH	SBSI
EMULPITULUS	EMC	SPECIES UNKNOWN	SPU
FIR	FIR	THORN	THR
FRUIT	FRU	TREE OF HEAVEN	TGH
HAWTHORN	HAW	WALNUT	WAL
HAZEL	HXL	WHITEBARK	WHBK
HOLLY	HOL	WILLOW	WIL
HOLLYBERRY	HOLB	YEW	YEW
HOLLY-NONE TREE	HOLN		
LARCH	LAR	MULTI-TRUNK	MT
LOCUST	LOC		
LONDON PLANE	LPL	REFER TO SCHEDULE	
LIND	LIN		
	LMC		

SIZES AND SPECIES ARE INDICATIVE ONLY, WITH THE MEAN SPREAD DRAWN TO SCALE.

Coordinate Table			Aworth SOUTH CONSULTANTS	
STATION	DESCRIPTION	EASTING	NORTHING	LEVEL
4	PHN	524495.052	227523.899	141.994
12	PHN	525118.437	227540.420	141.994
26	PHN	525222.939	227446.435	141.308
27	PHN	524461.033	227455.895	140.927
100	PEG	523463.627	227423.178	140.455
102	PEG	523118.429	227376.448	140.065
125	PEG	525294.451	227679.427	143.687
133	PEG	525308.068	227640.895	143.581
135	PEG	525208.131	227650.855	143.508
136	PEG	525185.650	227607.024	141.790
137	PEG	525276.319	227679.146	143.941
138	PEG	525263.924	227680.099	143.580
139	PEG	525281.386	227716.365	144.821
140	PHW	525410.872	227828.632	144.723
141	PHW	525268.299	227872.702	143.937

HN = HERS: Holi FXN = Packer Koloni: Holi PGM = Permanent Ground Marker
PW = Punch Mark PN = Pipe Holi W = Washer (used with FXN and PN)

SHEET_LAYOUT

1	2	3
4	5	6
7	8	

NOTES	
LEVELLING	THE SURVEY LEVELS ARE BASED ON OS NEWLYN DATUM BY GPS USING OSGM15.
GRID	THE SURVEY IS ON A PLANE LOCAL GRID RELATED TO OS NATIONAL GRID BY GPS USING OSTN15. THE LOCAL GRID ORIGIN IS STN 102 525284.415E, 227679.427N.
DRAINAGE	INVERT LEVELS, PIPE SIZES AND PIPE CONNECTIONS HAVE BEEN SURVEYED BY VISUAL INSPECTION ONLY, AND THEREFORE THE COMPLETE ACCURACY OF THIS INFORMATION CANNOT BE GUARANTEED.

 Aworth SURVEY CONSULTANTS																	
Norfolk House, Norfolk Way, Uddfield East Sussex, TN22 1EP Tel: 01825 768319																	
The Lansdowne Building, 2 Lansdowne Road Croydon, CR9 2ER Tel: 020 8263 6176																	
www.aworth.co.uk	als@aworth.co.uk																
																	
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Drawing No	6304	Surveyed	CS														
Sheet	3	Drawn	AP														
Revision		Checked	BF														
Scale	1:200 @ A0	Date	16/12/21														
Project LAND AT ROUNDWOOD BLACK LANE GREAT ASHBY STEVENAGE																	
Client CROUDACE HOMES LTD THE SPIRELLA BUILDING BRIDGE ROAD LEITCHWORTH GARDEN CITY HERTFORDSHIRE SG6 4ET																	

[illegible]

Croudace
HOMES.CO.UK

SITE TITLE

SITE TITLE

GENERAL LAYOUT

SCALE : 1/200

DATE : DATE

DRAWN : INITIALS

CHECKED :

DRG.No. : 000/30

DRG.No.: 000/30

TREE LEGEND			
ALDER	ALD	MAPLE	MPL
ASH	ASH	ORCHARD SPRUCE	OSP
ASPEN	ASP	PINE	PIN
BEECH	BEE	POPULAR	POP
CEDAR	CED	PRUNUS	PRU
COCKSCOMB	CCO	RED CEDAR	RED
CYPRESS	CYP	ROWAN	ROW
DECIDUOUS	DEC	SALLOW	SAL
DOUGLASS SPRUCE	DSP	SAPLING	SAP
ELM	ELM	SHED	SHD
FLYBUSH	FBU	SILVER BIRCH	SBC
GUM	GUM	SILVER PINE	SPP
HAWTHORN	HAW	SPRING BIRCH	SPB
HICKORY	HIC	SPRING PINE	SPP
HORSEBANE	HOR	SPRINGWOOD	SPW
HORNED CHESTNUT	HCC	STAGHORN	STG
HOLLY	HOL	THE GREEN	THE
HORNED BARK TREE	HBT	WILLOW	WIL
LARCH	LAR	YEW	YEW
LINDEN	LIN		
LOCUST	LOC		
LYN	LYN		
LODGE POLE	LPO		
MAG	MAG		

HN = HEB® Holi PSN = Parker Kalon® Holi PGM = Permanent Ground Marker
PW = Punch Mark PH = Pipe Holi W = Washer (used with PSN and PH)

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