PROPOSED RESIDENTIAL DEVELOPMENT
OAKCROFT LANE
STUBBINGTON

FLOOD RISK ASSESSMENT & DEVELOPMENT DRAINAGE STRATEGY

PERSIMMON

Date: 12 March 2019
Ref: AMc/19/0161/**5909**
Rev: **B**

DOCUMENT CONTROL RECORD

Revision	Date	Description	Prepared	Approved
A	27.03.19	Updated following Client comments	AMc	
B	15.05.20	Updated following layout amendments and reduction in plot numbers	AMc	

CONTENTS

APPENDICES

REFERENCES

Environment Agency Flood Map Information © and database right www.environment_agency.gov.uk

Technical Guidance to the National Planning Policy Framework - NPPF (2012)
Department for Communities and Local Government ISBN: 978-1-4098-3410-6

Contains British Geological Survey materials © NERC (2014)

1 Executive Summary

SITE INFORMATION	CLIENT	Persimmon Homes Ltd
	SITE NAME	Land off Oakcroft Lane, Stubbington
	SITE LOCATION	Oakcroft Lane, Stubbington PO14 3EZ SU 55419 04333
	SITE AREA	7.75 ha
	CURRENT LAND USE	Greenfield – Arable / agricultural grassland
	PROPOSED LAND USE	209 No. Residential Dwellings
	SITE GEOLOGY	River Terrace Deposits overlying Sand, silts and Clay
	SOIL INFILTRATION RATE	Low permeability found
	GROUNDWATER LEVELS	Groundwater levels varied between 0.75 – 3.0m deep below ground level
	GROUNDWATER SPZ / AQUIFER	Not in Source Protection Zone
	GROUND CONTAMINATION	TBC – None anticipated
FLOOD RISK	ENVIRONMENT AGENCY FLOOD ZONE	Flood Zone 1 - Lowest Risk < 0.1% (<1:1000) Residential area
	FLUVIAL (RIVERS & WATERCOURSES)	Not a risk. Development lies outside of Flood Zone 3
	PLUVIAL (SURFACE WATER)	Minor risk which can be mitigated
	GROUNDWATER	Not a risk
	EXISTING/PROPOSED SEWERS & MAINS	Not a risk
	ARTIFICIAL	Not a risk
	TIDAL	Not a risk
FOUL & SURFACE	PROPOSED SURFACE WATER STRATEGY	Onsite cellular tank & attenuation basin with outfall to watercourse.
	PROPOSED SUDS TYPE	Permeable block paving (sealed system) Open attenuation basin
	EXISTING SW PEAK FLOW RATE	Greenfield QBar - 24.0 l/s
	PROPOSED SW PEAK FLOW RATE	1:100y +40%cc - 24.0 l/s
	FOUL WATER STRATEGY	Gravity to Southern Water Foul Sewer
	EXISTING FW PEAK FLOW RATE	N/A
	PROPOSED FW PEAK FLOW RATE	9.68 l/s (SFA 4000 l/unit/d) for 209 Units
MISC	FURTHER INVESTIGATIONS	

2 Introduction

2.1 Scope

Persimmon Homes Ltd South Coast is seeking planning permission for residential development on land south of Oakcroft Lane and north of Stubbington, Hampshire.

The proposed development comprises of the construction of circa 209 no residential dwellings and associated infrastructure works. Refer to Appendix A for a development layout.

2.2 MJA Consulting has been appointed to undertake a Flood Risk Assessment and Development Drainage Strategy to determine the potential flood risks associated with the site and to provide a suitable strategy for the disposal of surface and foul water from the proposed development.

2.3 Report Structure

The National Planning Policy Framework (NPPF) and the Flood Risk and Coastal Planning Practice Guidance (PPG) is the current guidance on development and flood risk in England and Wales.
The Flood Risk technical guidance for the National Planning Policy Framework requires a Flood Risk Assessment (FRA) to be carried out on sites over 1ha to consider all potential forms of flooding including that from river, sea, estuarial, land drainage, groundwater, overland flow, surface water run-off, sewer systems, and artificial water bodies (lakes, reservoirs, canals etc.) to both the development site and to offsite parties and land.

2.4 This report will take the structure of a 'Flood Risk Assessment' in accordance with the National Planning Policy Framework, the Flood Risk and Coastal Planning Practice Guidance, Environment Agency's Flood Risk Assessment Guidance and CIRIA Report 624 'Development and Flood Risk.

2.5 The objectives of this report are:

- To confirm whether the proposed site is affected by current or anticipated future flooding from all sources for the lifetime of the development.
- To confirm that this development will not increase the risk of flooding to any offsite properties and land or increase the population within a floodplain.
- To undertake calculations to establish the foul and surface water runoff rates from the existing site and to assess the potential foul and surface water runoff from the proposed development.
- To detail a suitable strategy for the management of foul and surface water generated from the proposed development allowing for future climate change and in accordance with the LPA polices relevant to the management of flood risk.
- To satisfy the approving planning authority that the most sustainable foul and surface water drainage solutions have been considered, in line with Environment Agency guidance, The Building Regulations (Document H 2002) and government legislation such as the Flood and Water Management Act 2010 (Defra) and The National Planning Policy Framework (NPPF & PPG).

3 The Development Site

Figure 1: Site Location

Image courtesy of: @2018 Microsoft Corporation Image courtesy of Ordnance Survey

Figure 2: Development site boundary

Image courtesy of: Imagery @ 2018 Google Map Data

3.1 Site Location and Description

The application site is located to the south of Oakcroft Lane towards the northern extent of the village of Stubbington. Development area is bounded by
The site is currently accessed from Oakcroft Lane and is bounded by mature trees, vegetation and hedgerow with existing residential development to the eastern boundary.

3.2 Topography

A topographical survey of the site undertaken by Encompass Surveys in November 2017 indicates the site generally falls in a southerly direction with levels ranging from 11.90m to 8.45mAOD (metres above Ordnance Datum).
Refer to Appendix B for a topographical survey of the existing site.

3.3 Geology

The British Geological Survey (BGS) indicates that the site is underlain by the following geological sequence:
Drift: River Terrace Deposits of Sand, Silt and Clay
Solid: Wittering Formation Sand, silt and Clay

A geological investigation was undertaken at the site by Enzygo Ltd in February 2018. The site investigation works were undertaken between 16th and 24th October 2017 and comprised window sampler holes and trial pits.

The investigations undertaken identify the following strata:

Strata	Summary Description	Thickness (m)
Topsoil	Grass over soft brown clay and clayey flint gravel with roots.	0.1 to 0.5
River Terrace Deposits	Medium dense brown sandy and clayey flint gravel varying to firm gravelly clay	0.4 to >3.0
Wittering Formation	Firm, becoming stiff with depth orange brown sandy clay and clayey sand	>3.9
Groundwater	Not Encountered (at time of investigation)	

3.4 Groundwater

Groundwater was not encountered during the site investigation. The depth to groundwater measured from installations during monitoring visits, depths varied between 0.75m and 3.08m.
It is likely that groundwater within standpipes is due to slow ingress of water perched within sand and silt layers within the soils.

3.5 Hydrogeology

The Environment Agency has classified the site as not located within a Groundwater Source Protection Zone for groundwater abstractions.
The site is not located on or near to a SSSI.

The site lies within the catchment of the River Meon with a tributary lying to the south of the site.
Environment Agency records show that the south-western corner of the site is located within a Flood Zone 3; however, this lies outside of the developable area and relates to the existing watercourse.

3.6 Hydrology and Existing Site Drainage Characteristics

The site mainly comprises of grass covered fields; as such rainfall that lands on this site infiltrates directly at source and into the underlying unsaturated layer of topsoils and River Terrace Deposits naturally draining to the watercourse to the south.

This are no formal foul or surface water drainage infrastructure serving the existing site. The surrounding housing developments are served by separate foul & surface water systems.

3.7 Due to the topography of the site which falls from the northern boundary in a southerly direction, the natural greenfield drainage pathway is towards the existing field drainage ditch located on the southern boundary of the site.

This field drainage ditch which runs parallel with the southern boundary of the site and outfalls to the River Meow.

3.8 Soil Permeability

Infiltration testing in accordance with BRE Digest 365 was carried out by Enzygo during the ground investigations, it was identified that the permeability of the sub strata wasn't suitable for infiltration.

Due to the presence of groundwater at a high level the use of shallow type infiltration drainage would also be precluded.

4 Flood Risk Assessment

4.1 A Flood Risk Assessment requires that an evaluation of all potential forms of flood risk to the site are considered.
In accordance with the Environment Agency's Flood Risk Assessment Guidance, NPPF, PPG and CIRIA Report 624, sources of flooding to be assessed include tidal, fluvial (rivers, streams and watercourses), pluvial (overland rainfall runoff), groundwater, artificial sources (canals and reservoirs) and existing / proposed sewerage and water mains infrastructure.

4.2 History of Flooding

During the data collection process, it is important to consider the information which already exists for the site location with respect to flood risk.
The primary sources of data for flood risk and recorded incidents of flooding for this site have been the Gosport Borough Council Strategic Flood Risk Assessment (SFRA) Level 1 & 2 (2014) along with *PUSH (Partnership for Urban South Hampshire).* The Borough Council also prepared the SFRA reports with the support of officers from the Environment Agency and the Eastern Solent Coastal Partnership.

4.3 Within the SFRA studies, consultation was carried out with all relevant authorities and organisations including the Environment Agency, Southern Water, Gosport Borough Council, Stubbington Parish Council and local community stakeholders to identify known or perceived problem areas with respect to flooding.

4.4 Within the context of the proposed development, there have been no recorded issues of flooding from all potential sources including:

- Pluvial (Surface Water)
- Tidal
- Fluvial (Main rivers and Ordinary watercourses) & Tidal
- Groundwater
- Existing sewers and potable water main infrastructure
- Artificial infrastructure (ponds, sewerage treatment plants, canals etc.).

Although the proposed residential element of the site is not located within an area at risk from flooding, the new development as a whole must also not create or exacerbate the level of flood risk elsewhere.

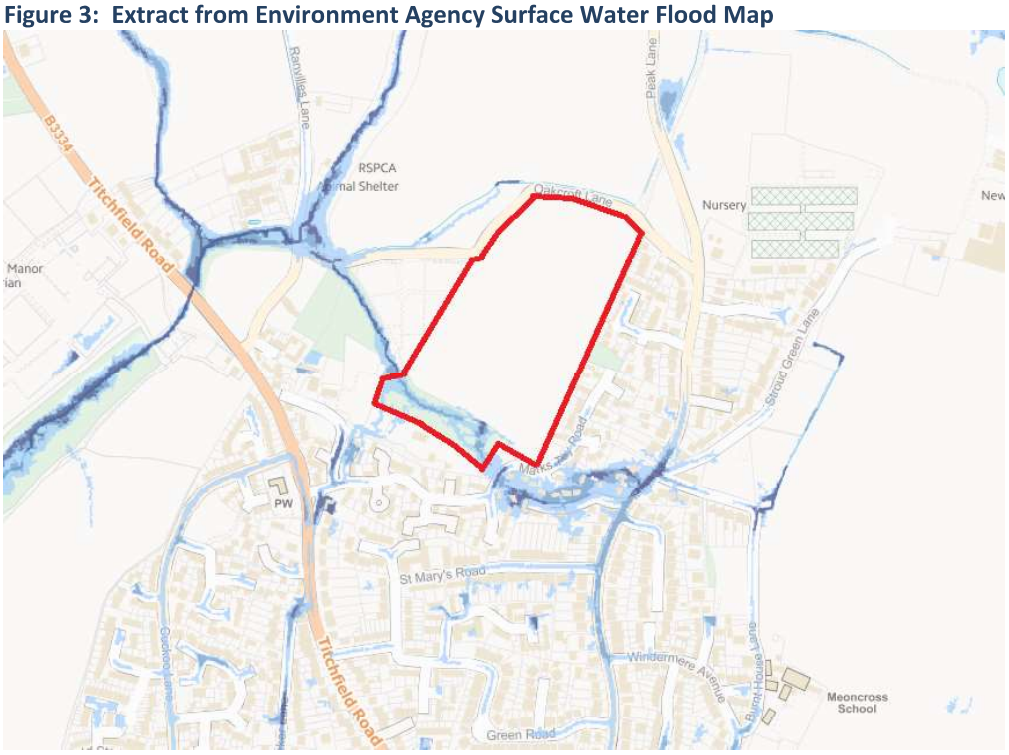
4.5 Surface Water

The Environment Agency's 'uFMfSW' (updated Flood Map for Surface Water) (Figure 3) is a theoretical assessment of potential overland flow paths, ground levels and drainage systems using information from Gosport Borough Council as the LLFA and the Environment Agency to highlight areas that may be susceptible to surface water flooding.

4.6 This map indicates that the existing site has a 'very low' (less than a 1:1000 or 0.1%) risk of flooding from surface water runoff.
There are minor areas identified towards the south of the site which relate to the existing watercourse and are outside of the residential areas of the proposed site.

The Surface Water Flood Risk map confirms that no additional incidents of flooding from surface water runoff have been recorded within the site boundary. Since the SFRA reports was published, no further evidence of additional surface water flooding at the site has been identified.

Figure 3: Extract from Environment Agency Surface Water Flood Map



Contains Environment Agency information © Environment Agency 2018

Key:

- High (Greater than 1:30(3.3%) chance of flooding)
- Medium (Between 1:100(1%) and 1:30(3.3%) chance of flooding)
- Low (Between 1:1000 (0.1%) and 1:100 (1%) chance of flooding)

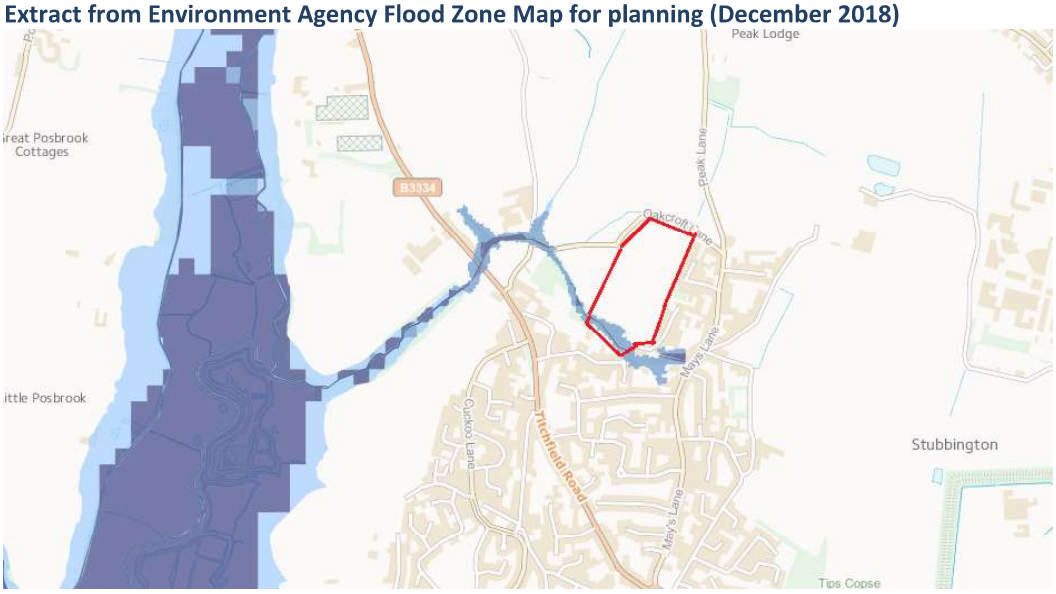
4.7 Fluvial

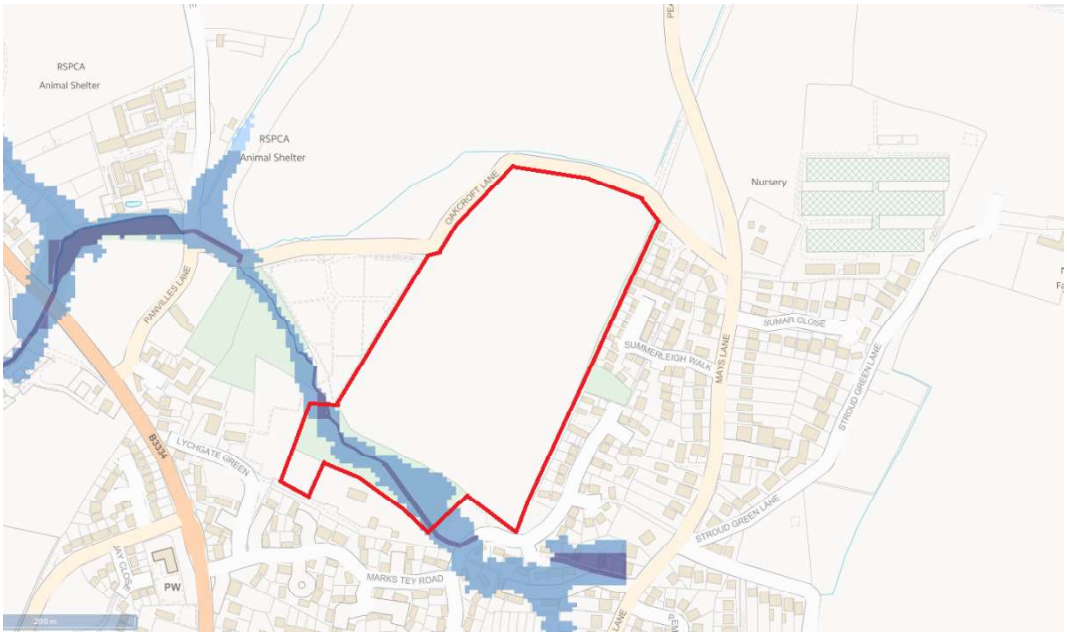
Fluvial flood risk within the Stubbington Area is concentrated along the River Meon and tributary lying to the south of the site.
The Environment Agency is the principal flood risk management operating authority in England. The information provided by them is based on JFlow modelling and not a detailed specific river model; floodplain extent and level information has been provided s outlined within the appendices.

4.8 As indicated by the latest Environment Agency 'Flood Zone Maps, the majority of the site and proposed residential area is located within the lowest risk category - Flood Zone 1. 'Flood Zone 1' is land assessed as having a less than 1 in 1000 (<0.1%) annual probability of flooding from a main river in each year and is not within an area of recorded river flooding.

4.9 The nearest risk of fluvial flooding (Flood Zone 2 & 3) to the site is located within the southern boundary along the watercourse corridor and area of land to the south of the watercourse which is associated with the River Meon.

Figure 5: Fluvial Flood Zone Map
Extract from Environment Agency Flood Zone Map for planning (December 2018)





Contains Environment Agency information © Environment Agency 2018

Main Rivers

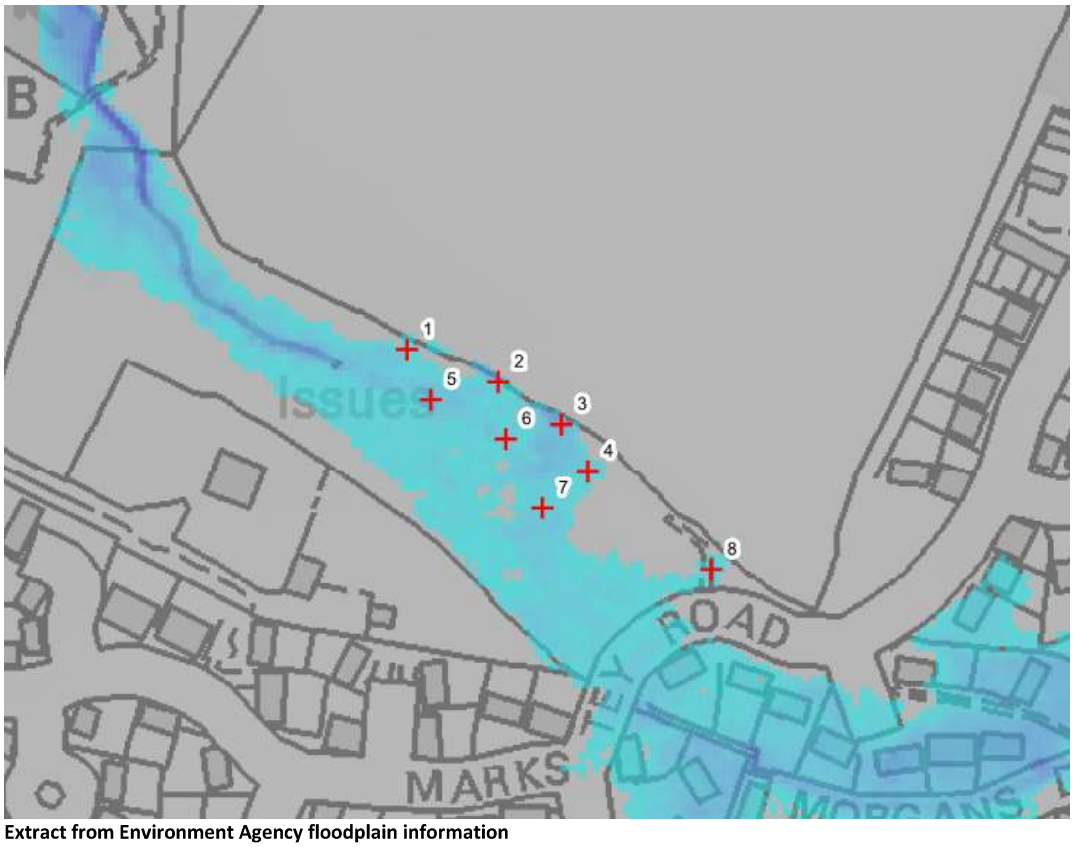
Dark Blue : (Flood Zone 3)
Shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded: from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light Blue : (Flood Zone 2)
Shows the additional extent of an extreme flood from rivers or the sea.
These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.
These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

Clear : (Flood Zone 1)
Shows the area where flooding from rivers and the sea is very unlikely.
There is less than a 0.1% (1 in 1000) chance of flooding occurring each year.

4.10 The Environment Agency has provided modelled flood levels for the Main River on the southern end of the which include various scenarios including allowances for future climate change for the floodplain. Included within the information provided was details of local flood defences.

The modelled flood data provided for the site is as follows:



Extract from Environment Agency floodplain information

Point	1% Annual Probability 1 in 100 Year (Flood Zone 3)	1% Annual Probability 1 in 100 + Climate Change 35%	1% Annual Probability 1 in 100 + Climate Change 45%	1% Annual Probability 1 in 100 + Climate Change 105%	0.1% Annual Probability 1 in 1000 Year (Flood Zone 2)	Ground Level
1	7.43	7.44	7.44	7.48	7.45	7.38
2	8.04	8.05	8.05	8.07	8.06	7.79
3	8.25	8.28	8.28	8.30	8.29	7.79
4	8.19	8.22	8.23	8.26	8.24	8.06
5	7.66	7.69	7.70	7.75	7.73	7.44
6	8.03	8.04	8.05	8.05	8.04	7.91
7	8.22	8.23	8.24	8.27	8.25	8.12
8	No Data	No Data	No Data	8.54	8.52	8.51

Extract from Environment Agency floodplain information

The above modelled floods levels have been added to the development topographical survey via our ground modelling software. By interpolating the location of the levels shown on your plan and transferring that point onto the topographic survey, confirming ground levels are correct we've then replicated the floodplain including the 100 yr + CC, 105% event.

The modelled flood including climate change do not affect the development area. The floodplain is as shown within the area of land south of the site.

4.11 It is demonstrated that the development site lies wholly within Flood Zone 1 and has safe and dry access and egress at the site is achievable to a publicly accessible location outside the 1:100 year (plus climate change) flood event extent, in accordance with DEFRA Report FD2320/TR2 - 'Flood Risk Assessment Guidance for New Developments'.

4.12 Tidal

The development area and its local river networks do not encounter a risk from tidal flooding as confirmed by the SFRA and the Environment Agency.

4.13 Artificial Sources

With reference to the SFRA/PFRA there have been no recorded incidents of flooding to the site or surrounding areas from artificial sources.

4.14 Planning Policy

In accordance with the Flood Risk and Coastal Planning Practice Guidance (PPG); *Table 3 - Flood risk vulnerability and flood zone 'compatibility'*; (Figure 4) all development classed is considered appropriate within Zone 1.

Figure 4 - DGLC Flood risk and coastal change Table 3: flood risk vulnerability and flood zone 'compatibility' DGLC Flood risk and coastal change

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

Key:

✓ Development is appropriate

✗ Development should not be permitted.

4.15 Sequential Test

The NPPF guidance states that planning authorities should complete a risk based 'Sequential Test' at all stages of the planning process, to steer new development to areas with the lowest probability of flooding. Under the requirements of the 'Sequential Test' and as the proposed development is already located within Flood Zone 1 (lowest risk), there are no more suitable, developable and deliverable alternative sites, better located from a flood risk perspective which could accommodate the proposed development.

5 Existing and Proposed Site Runoff

5.1 This section calculates the estimated peak rate of surface water runoff from the existing site area. These discharge figures are then used to establish the post-development constraints to inform the preliminary design of the surface water drainage strategy.

5.2 An assessment of the estimated Greenfield runoff rate from the has been carried out using the Institute of Hydrology Report 124 (QBar) methodology.

Site Area 7.75 Hectares

1 Year	20.29 l/s
30 Year	54.91 l/s
100 Year	76.15 l/s
QBar	23.87 l/s

Detailed Micro Drainage & HR Wallingford Greenfield Runoff Assessment provided in appendices

5.3 As a result of this development, the peak rate and volume of surface water that could potentially runoff the proposed site if not effectively managed, will be greater than in its current state.

To mitigate this increase in runoff volume and provide a level of betterment in the peak rate of runoff, it is proposed that the surface water runoff from the redevelopment for all storm senereo up to the 100 year + 40% climate change rainfall event, will be restricted to the maximum rate of **QBar 24.0 l/s** equivalent to the greenfield runoff rate for the site.

6 Surface Water Drainage Strategy

6.1 The National Planning Policy Framework (NPPF) requires that developments do not exacerbate flood risks both to the development site and to offsite parties and land, which means there is a need to control surface water drainage and overland runoff to ensure there are no increases in peak rates and volumes of runoff as a result of the development.

6.2 The NPPF, Environment Agency guidance and government legislation such as the Flood and Water Management Act (Defra 2010) states that this should be achieved by requiring surface water drainage strategies for major developments to be in accordance with the ideals of 'sustainable development' via the provision of Sustainable Drainage Systems (SuDS).

6.3 SuDS are more sustainable than conventional drainage methods because they can mitigate many of the adverse effects of urban stormwater runoff on the environment, mimicking the natural Greenfield runoff regime.

This can be achieved through reducing runoff rates and volumes to sewer networks and watercourses, reducing the risk of downstream flooding.
Where appropriate SuDS can reduce pollutant concentrations in stormwater, protecting the quality of the receiving water body.

6.4 The Building Regulations Document H (2015) and The SuDS Manual CIRIA 753 (2015) details the appropriate hierarchy of potential methods for disposing of surface water from a development:

1. Discharge into the ground via a soakaway or some other adequate infiltration system, or where that is not practicable;
2. Discharge to a surface water body such as a watercourse, or where that is not practicable;
3. Discharge to a surface water sewer, practicable;
4. Discharge to a combined sewer.

6.5 The ground investigation has highlighted that due to presence of high groundwater infiltration will not be a feasible as a method to dispose of the surface water runoff generated from the proposed development.

6.6 Overland flow from the current site discharges naturally to the adjacent watercourse. Therefore the controlled surface water runoff from the development will follow this and discharge to the watercourse. The remaining surface water discharge options on the hierarchy have been discounted.

6.7 Surface water runoff from the site will be fully managed via Sustainable Drainage Systems (SuDS). The SuDS selection process for this site has involved the evaluation of a range of information to enable the feasibility of each SuDS technique to be assessed.

6.8 SUDS Techniques:

SUDS Type	Description	Site Suitability Y/N	Comments
Green Roofs	Green roofs consist of a multi-layered system that covers the roof of a building with vegetated cover over a drainage layer. They are designed to intercept and retain rainfall, reducing the volume of runoff and attenuating peak flows	N	Not appropriate for pitched roofs on residential dwellings and high maintenance costs. Have potential suitability for commercial buildings or retail areas.
Rainwater Harvesting	Re-using rainwater for non-potable uses such as irrigation and toilet flushing	N	Rainwater harvesting cannot be relied upon to guarantee a reduction in volume of runoff. These systems also have a high maintenance cost Have potential suitability for commercial buildings or retail areas
Soakaways	Soakaways provide stormwater attenuation and groundwater recharge	N	Impearmeable sub strata prevents the use of this type of SUDs feature.
Filter Strips / Trenches	Filter strips are vegetated strips of land designed to accept runoff as overland flow from impermeable surfaces. Usually located adjacent to parking areas or roads.	Y Non infiltrating	Impermeable soils prevent infiltration therefore suitable as conveyance systems only.
Permeable Paving	Pervious pavements provide a suitable surface for rainfall to infiltrate through to the underlying layers. Water is temporarily stored before infiltrating to ground. This system is also used as a conveyance method to the drainage system.	Y Non infiltrating	Suitable for use on private drives and parking areas with a connection to the piped drainage system. Permeable type paving is not currently considered acceptable for adoption by West Sussex Highway Authority
Bio Retention	Bio retention areas are shallow landscaped depressions which are typically under-drained and rely on engineered soils, vegetation and infiltration to remove pollution. These systems manage and treat runoff from frequent rainfall events	Y Non infiltrating	For attenuation only due to infiltration as a method of disposal not being suitable.
Swales	Swales are linear grassed or vegetated channels with flat bases that collect, treat, store and convey water.	Y Non infiltrating	Impermeable soils prevent infiltration however these are suitable for conveyance structures taking runoff to attenuation basins
Attenuation Pond / Basins	Attenuation basins are landscaped features used to store and treat runoff. Wet ponds have a constant body of water with runoff being additional. Dry ponds are empty during periods of dry weather.	Y	Suitable for attenuation

6.9 SuDS attenuation will provide the required storage volume to manage the 1:100year (1% AEP) storm event, plus an extra allowance of 40% for the predicted potential increase in peak rainfall up to 2115, with a peak discharge rate restricted to a maximum of **24.0 l/s (QBar)** via a flow control device, prior to discharging offsite into the adjacent watercourse.

6.10 Based on the planning layout the impermeable site area equates to 3450m2, this includes an additional 10% of impermeable area to the plot drainage calculations to allow for any urban creep.
The approximate volume required to store the 1:100y+40% rainfall event, discharging at a maximum rate of 24.0 l/s is approximately 2,250m³.

To balance the volume of attenuation the storage will be split between an on-site attenuation tank reducing flows to the downstream network along with the main attenuation basin. The attenuation basin volumes ad depths are as follows:

Attenuation Basin.

Storm Return Period	Critical Event	Water Depth m	Attenuation Volume m³	Discharge rate l/sec
1 yr	240 min Winter	0.521m	274m³	24.0 l/sec
10 yr	480 min Winter	0.749m	625m³	24.0 l/sec
30 yr	600 min Winter	0.898m	885m³	24.0 l/sec
100 yr + 40%	1440 min Winter	1.358m	1830m³	24.0 l/sec

6.11 The surface water drainage strategy for the development is described below:

Roof Runoff:-
Roof runoff will be collected by a conventional system of guttering and downpipes discharging to the gravity storm drain, where possible it will be discharged into the driveway stone sub base via cellular diffuser cells.

Private Drives & Parking Courts:-
All private drives and parking courts will either drain via a traditional gully system outfalling to a stone sub base prior to outfalling to a the main storm drain or via a permeable block paved system with a stone sub-base to provide some attenuation and an improvement in water quality.
The stone sub-base of the permeable block paving is to be lined with an impermeable membrane to prevent the ingress of groundwater.

Development Roads:-
Runoff from the highway areas will drain via deep trapped road gullies connecting directly to either the main piped storm drain.

Attenuation Tank:-
The attenuation tank has been designed to provide temporary storage to the development runoff, located within an area of open space it will restrict flows to the downstream network reducing the impact on the main end attenuation basin.

Attenuation Basin:-

The attenuation basins has been designed to provide final element of water cleansing together with the main storage to allow storm water to be temporarily stored within the basin before discharging into the existing watercourse at a controlled rate (Greenfield QBar). The basin will include a permanently wet pond to allow for water based planting.

6.12 The main attenuation pond has been designed to manage the 1 in 100 year return storm plus an extra allowance of 40% for the potential predicted increase in peak rainfall up to 2115. The attenuation basin also includes sufficient volume for the required 10% urban creep.
The proposed surface water drainage strategy offers a sustainable, safe and robust system which will afford complete flood risk protection to residents within the new development.

6.13 Pollution Prevention

In terms of water quality, the proposed surface system offers a suitable level of mitigation in accordance with the Environment Agency pollution prevention guidance GP3, CIRIA C697 and DEFRA guidance.

6.14 The process of sedimentation is the principle pollution removal mechanism in SuDS as pollution in surface water runoff is generally attached to sediment particles.
By reducing flow velocities and capturing sediments, a significant reduction in pollutant loads can be achieved.

6.15 For 'low risk' residential developments where the receiving waterbody is considered non-sensitive, the minimum treatment process is achieved via the permeable block paving and stone sub base within the private access roads, parking areas and driveways.
The permeable paving will provide a high level of treatment through capture of silts, filtration of hydrocarbons and other pollutants through the pavers, filter membrane and media sub-base prior to discharging through the flow control chamber and into the existing watercourse.

6.16 Water Quality Risk Management:

The water quality proposals have been assessed using the simple index within the Ciria SuDS Manual C753.

Pollution hazard indices:

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Individual driveways, low traffic roads and non-residential car parking.	Low	0.5	0.4	0.4

SUDs Mitigation Indices:

Type of SUDs component	Mitigation indices		
	TSS	Metals	Hydrocarbons
Permeable pavement	0.7	0.6	0.7
Attenuation Basin	0.5	0.5	0.6

The maximum pollution hazard is low. The driveway permeable paving & attenuation provides suitable water quality provisions for this element.

The proposed SUDs treatment on the development site is considered suitable in accordance with Ciria SuDS Manual C753.

6.17 Overland Flood Flow / Exceedance

The proposed SuDS features within the development are designed to manage the 1 in 100 year return storm (1% chance of occurrence each year) plus an extra allowance of 40% for the potential increase in peak rainfall predicted up to 2115.
An 'exceedance' or 'extreme' event refers to a storm in excess of this design level.

6.18 The occurrence of an extreme rainfall event exceeding the design storm of the drainage network or failure / blockages of the 'Flow Control' chamber has been considered.
Any flood water that occurs as a result of surcharging of manholes within the upstream piped system will be contained within the road limits by raised kerb edges and driveway entrance levels, where it will be temporarily stored until capacity returns within the drainage system.
To mitigate the residual risk of overland flooding the design levels of hard paved and landscaped areas as part of the proposed design of the development will aim to contain and safely direct any flood flows to areas of the site as to cause minimum flood risk and disruption to properties and residents.

6.19 SuDS Management and Maintenance

It is envisaged that a management company funded by all residents will be given ownership of the shared areas of permeable block paving, filter trench, flow control chambers, outfall headwall and package pumping station /rising main and upstream piped system.
The management company will be entrusted with a robust inspection, de-silting and maintenance programme to ensure the optimum operation of the surface water drainage system is continually maintained in perpetuity.

6.20 Any residual risk of overland flooding to properties is to be mitigated by the provision of raised property slab levels a minimum of 150mm above surrounding ground level.

6.21 The described protection measures ensure that properties both within the proposed development and any offsite parties and land will not be affected by overland runoff in the event of a reasonably extreme rainfall event exceeding the design storm or a failure or a blockage of the SuDS structures within the system.

7 Foul water drainage strategy

7.1 The foul water generated from each property will drain via gravity through the private house drainage before discharging to a new sewer network located typically within the development road system.

The main gravity development sewer will then convey flows to the DN300 public foul sewer located within the scrub land to the south of the site, the proposed connection manhole is located within the development area as shown on the drainage strategy.

7.2 The predicted peak foul sewer discharge from the site to the existing foul sewer based on the Sewers for Adoption 7th figure (4000 l/dwelling/day) for 209 units will be 9.67 l/s.

7.3 The foul sewers within the development will be offered for adoption to Southern Water.

7.4 Under the current Water Authority legislation Southern Water will ensure that capacity is made available for the new development flows; any required sewer modelling work and upgrades will be paid for via the development infrastructure charge. As part of the design process Southern Water will be consulted to confirm that there is adequate capacity within the receiving foul sewer and the downstream catchment to accommodate the proposed foul flows from the development.

This will ensure that the proposed development has a 'no detriment' impact on the local foul sewer system and does not create an increase in flood risk.