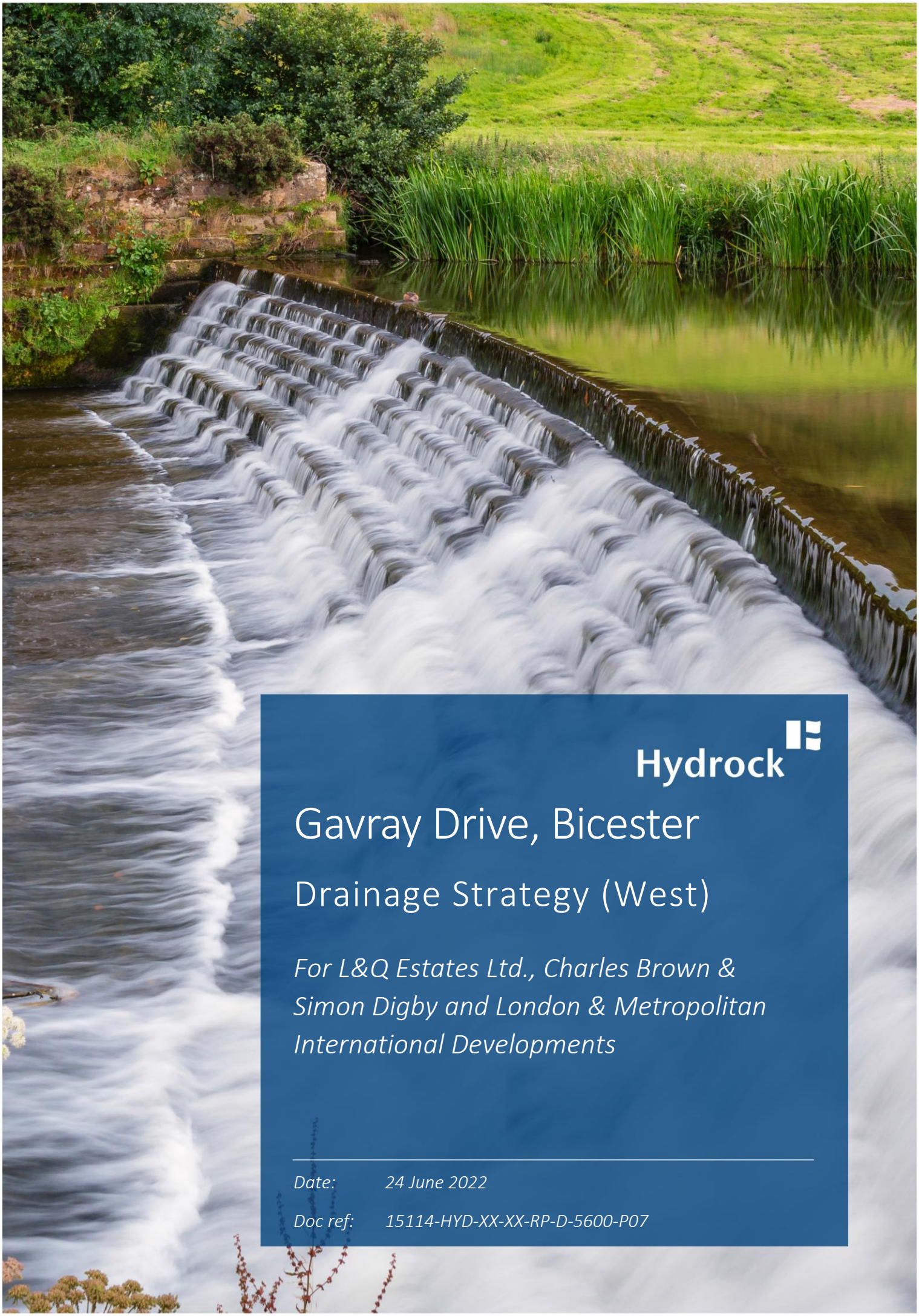

Hydrock

Gavray Drive, Bicester

Drainage Strategy (West)

For L&Q Estates Ltd., Charles Brown & Simon Digby and London & Metropolitan International Developments

Date: *24 June 2022*

Doc ref: *15114-HYD-XX-XX-RP-D-5600-P07*

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CONTENTS

Tables

Figures

Appendices

1. INTRODUCTION

This report has been prepared by Hydrock on behalf of L&Q Estates Ltd, Charles Brown and Simon Digby, and London & Metropolitan International Developments in support of the planning application for the proposed residential development and associated parking, highways and infrastructure at the site known as Gavray Drive.

Local Planning Authorities are advised by the Government's National Planning Policy Framework (NPPF) to consult the Environmental Agency (EA) on development proposals in areas at risk of flooding and/or for sites greater than 1ha in area.

This Drainage Strategy has been prepared to address the requirements of the NPPF, through:

- Assessing whether the site is likely to be affected by flooding.
- Assessing whether the proposed development is appropriate in the suggested location.
- Presenting any flood risk mitigation measures necessary to ensure that the proposed development and occupants will be safe from flooding, whilst ensuring flood risk is not increased elsewhere.

This report considers the requirements for undertaking a Drainage Strategy as detailed in the NPPF however it does not constitute as a Flood Risk Assessment.

Pre-application advice has been taken prior to the production of this document and is available in Appendix A for reference.

2. SITE INFORMATION

2.1 Location and Setting

The site in its entirety, Gavray Meadows, is approximately 22.545ha, greenfield in nature and has been allocated as part of the Cherwell Local Plan 2011. The proposed Gavray Drive West development occupies circa. 6.798ha and the Gavray Drive East development occupies circa. 2.545ha with the remaining circa 13.202ha retained as Gavray Meadows.

The Gavray Drive West site is bounded by railway lines and associated embankment directly to the north and west with Langford Brook located to the east, dividing the west and east sides of the development land. Gavray Drive runs parallel along the southern boundary of the development.

The Gavray Drive West site is currently used for farming.

The site address and location are shown below in Table 1: Site Address and Figure 1: Site Location.

Table 1: Site Address

Address	Land north of Gavray Drive, Bicester
Post Code	OX26 6UG
OS Grid Reference	SP5982200 / SP5989922063

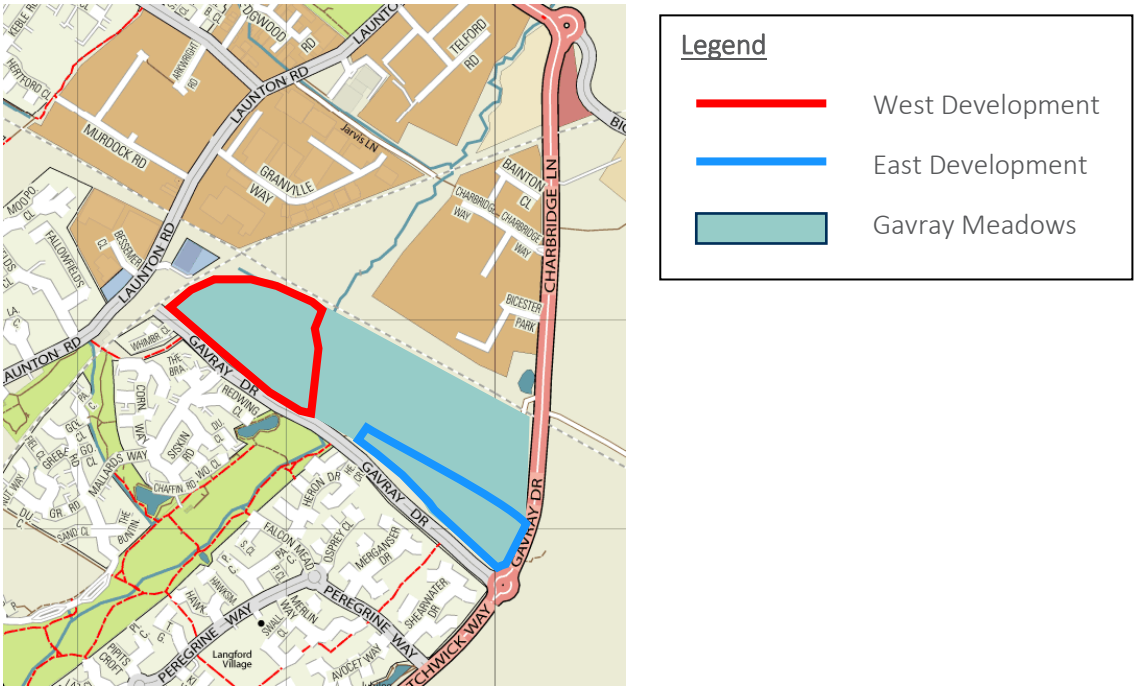

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Figure 1: Site Location

Note: For detailed boundary outline please refer to Site Location plans.

2.2 Topography

The site topography ranges from an approximate 69mAOD to 66mAOD fall gradually from the north west to the south east.

2.3 Proposed Development

The proposed development is residential in nature and covers an approximate 6.798ha of the 22.54ha of the overall site as indicated in the submitted masterplan.

3. ASSESSMENT OF FLOOD RISK

For full details of flood risk please refer to the site-specific FRA (ref: 15114-HYD-XX-XX-RPFR-0001) in accordance with the requirements of the NPPF. The following has been provided to provide a broad overview only.

3.1 Surface Water Flooding

The EA's flooding from surface water mapping (Figure 2: EA's Flood Risk from Surface Water Mapping below) shows that the site is classified as a mix of medium, low and very low risk.

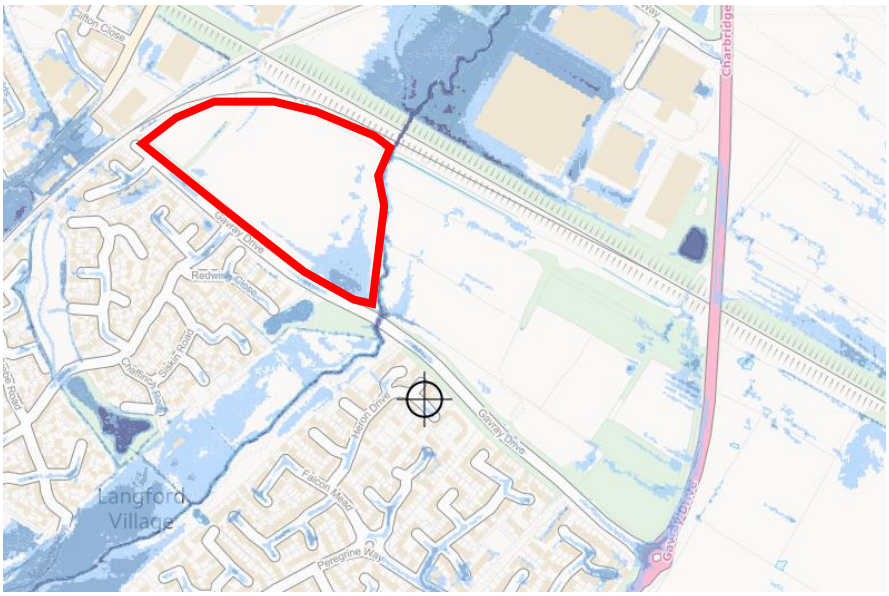

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Figure 2: EA's Flood Risk from Surface Water Mapping

The areas shown at risk from surface water flooding within the site originate from within the site itself. As such, the proposed development will mitigate any risk generated from the site through the introduction of the proposed Drainage Strategy.

3.2 Groundwater Flooding

British Geological Survey mapping shows the central portion of the site, immediately adjacent to Langford Brook, to be underlain by superficial Alluvium deposits comprising Clay, Silt, Sand and Gravel. The superficial deposits are classified as a Secondary A Aquifer (defined as 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers', and, 'generally aquifers formerly classified as minor aquifers').

In terms of bedrock geology, broadly: the eastern portion of the site is shown to be underlain by the Peterborough Member comprising Mudstone; the central portion of the site by the Kellaways Sand Member, having a 'high' vulnerability (defined as 'areas able to easily transmit pollution to groundwater', and, 'likely to be characterised by high leaching soils and the absence of low permeability

superficial deposits'); and the western portion of the site by the Kellaways Clay Member, which is defined as 'unproductive'.

The groundwater table will be hydraulically linked to water levels of the adjacent Langford Brook and, as such, there is potential for groundwater emergence, but this would be expected to be consistent with predicted flood outlines and to impact only a small area of the site. It is likely that any groundwater emergence would be at the boundaries in geology and therefore probably limited to the immediate river corridor. It is, however, possible that 'near surface' groundwater may be encountered within lower lying areas of the site.

3.3 Fluvial Flooding

The EA's flooding from fluvial sources mapping (Figure 3: EA's Flood Risk from Fluvial Source below) shows that the site is predominantly classed as Flood Zone 1 with areas of Flood Zone 2 and 3 located adjacent the watercourse to the west.

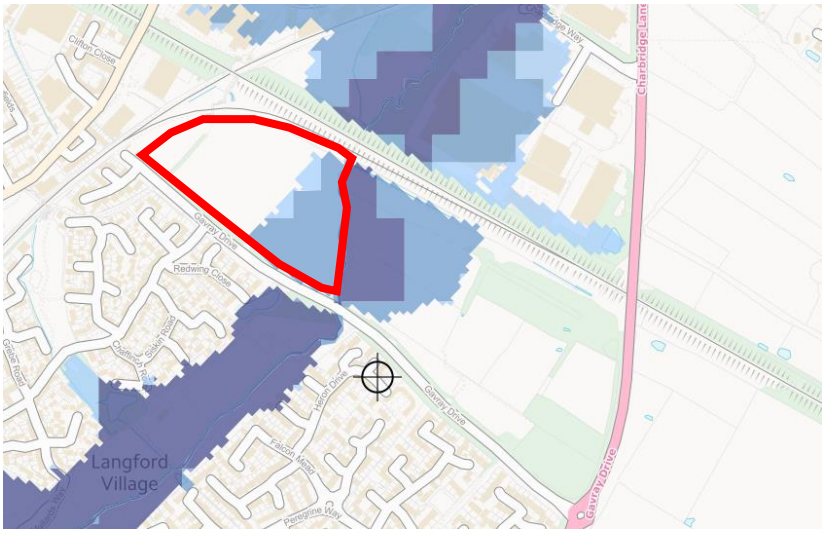

Figure 3: EA's Flood Risk from Fluvial Source

The mapping shows the site area of proposed development to be located within Flood Zone's 1, 2 and 3. As such, compensatory storage is to be provided, with ground levels adjusted to bring areas of development above flood levels whilst providing adequate volumes to offset loss of flood storage by lowering an area of surrounding ground.

Pre- and post-development flood modelling has been conducted to demonstrate no detrimental impact. Full details of the flood modelling are supplied within the Flood Risk Assessment (FRA) document.

A volumetric assessment has also been conducted based on the maximum pre- and post-development fluvial flood levels during the 1 in 100 year event plus 35% climate change. This assessment indicates a storage of 21,603m^3 and 23,569m3, of flood water, pre- and post-development respectively. As such, an additional 1,966m3 of storage is achieved in the post-development scenario.

4. SURFACE WATER MANAGEMENT

4.1 Pre-Development

As described in Section 2.1, the existing site is greenfield in nature, being utilised for farming, and as such no hard infrastructure is present.

As such, rainfall will infiltrate the ground until infiltration capacity is reached at which point flows will travel overland following the topography. Site investigation works demonstrate the soils to be of low infiltration. As such rainfall will predominantly result in the generation of overland flows which will travel east ultimately discharging into the watercourse.

4.2 Post-Development

In accordance with the Sustainable Drainage Systems (SUDS) hierarchy, rainfall run-off should be managed in the following preferential order:

1. Infiltrated to ground.
2. Discharged to local watercourse.
3. Discharged to a local surface water sewer network.
4. Discharged to a local combined water sewer network.

As described in the ground investigation report, infiltration has been shown to not be viable. Therefore, considering the sites close proximity to a watercourse, option two is the most sustainable method of surface water discharge.

In line with NPPF requirements, to ensure no detrimental effect downstream of the proposed development, all attenuation structures have been designed to accommodate up to and including the 1 in 100 year storm event plus an allowance of 40% for climate change in accordance with the upper end of the UKCP18 allowance whilst discharging at a Qmed greenfield runoff rate.

4.2.1 Catchment

The Flood Estimation Handbook (FEH) as published by the UK Centre for Ecology and Hydrology indicates the site falls within the catchment of the adjacent watercourse (as shown in Figure 4: FEH Catchment below).

Figure 4: FEH Catchment

Of the circa. 6.798ha that forms the west development site, the proposed development has an impermeable area of circa. 2.127ha.

4.2.2 Discharge

As agreed with the Lead Local Flood Authority (LLFA) and in accordance with the NPPF to ensure no detrimental downstream effect, all storm events up to and including the 1 in 100 year storm plus an allowance of 40% for climate change shall be limited to a discharge rate not greater than that of Qmed (Median Annual Maximum Flood Event) at 0.8l/s/ha as per the calculations located in Appendix B.

Therefore, given the impermeable area of 2.127ha, discharge for events up to and including the 1 in 100 year storm event plus 40% climate change allowance, is to be restricted to 1.7l/s.

4.2.3 Hydraulic Modelling

A surface water MicroDrainage model has been constructed detailing the full proposed surface water network including SuDS features. Rainfall simulations have been conducted for storm events up to and including the 1 in 100 year event plus a 40% climate change allowance.

All models have been simulated with a Run-off Coefficient (CV) for impermeable areas of 0.95. This satisfies the requirements set out by the LLFA in the pre-application correspondence (Appendix A) and subsequent discussions.

Further to this, in accordance with CIRIA non-statutory guidance, an additional allowance is to be made within the designed system to cater for an impermeable area increase of 10% to accommodate any future 'urban creep' of the residential areas.

FEH Rainfall Models have been used in all simulations and calculations as per the FEH catchment data shown below.

Table 2: FEH Catchment Data

C1 (1km)	-0.022	D3 (1km)	0.249
D1 (1km)	0.323	E (1km)	0.289
D2 (1km)	0.315	F (1km)	2.478

A full set of modelling results and calculations are in Appendix B of this report.

4.2.4 Storage

In accordance with the NPPF all surplus flows generated onsite for storm events up to and including those of the 1 in 100 year event plus 40% for climate change allowance, must be retained within the site until such time they are discharged. Further to this, no flooding is to be present in storms up to and including the 1 in 30 year event across the proposed drainage network.

Storage is to be provided within a series of basins. Outflow of each basin is controlled by orifice prior to discharge with the outfall from the final basin within the series to be controlled by a vortex flow control. An additional Tank is required to accommodate excess flows generated in events exceeding the 1 in 30 year storm event. The below table indicates the volumes and water levels of each basin.

Table 3: Basin Storage

	Basin 1	Basin 2	Basin 3	Basin 4	Tank
Volume (m^3)	414	755	861	1145	665
CL (mAOD)	69.00	68.50	68.00	68.10	67.99
IL (mAOD)	68.000	66.900	66.400	65.575	65.873
WL_{max} (mAOD)	68.394	67.943	67.741	67.764	
Control	100mm Orifice	100mm Orifice	100mm Orifice	1.7l/s Vortex	

4.2.5 *Sustainable Drainage Systems*

In accordance with NPPF requirements, Sustainable Drainage Systems (SuDS) have been applied across the site where practicable.

Source control is to be applied in the form of rainwater harvesting and permeable paving located in gardens and large, shared driveways respectively. Proposed highways will be impermeable in nature due to the lack of infiltration prospects, topography and ground conditions detailed in the ground investigation (Appendix B).

Flows will be stored in a vegetated basin prior to discharge offering treatment to all flows. Upon discharge, flows will be conveyed by swale to the watercourse offering further treatment.

4.2.6 *Maintenance*

The relevant drainage structures are to be offered for adoption to the local authorities. As such they will be maintained by the local authority.

All main sewers and manholes are to be constructed following the Sewer Sector Guidance and offered to Thames Water for adoption under a Section 104 Agreement of the Water Industries Act including the proposed surface water pump system. As part of the Section 104 Agreement the attenuation basin and discharge swale will also be offered for adoption.

If the systems are not acceptable under a Section Agreements then they shall remain private. A management company will be appointed by the developer and prior to this they shall be responsible for the maintenance of all systems.

4.2.7 *Overland and Exceedance Flows*

As demonstrated by the overland flows and exceedance drawing located in Appendix B, overland flows are directed towards the attenuation basin. In event of failure of the basin flows will be allowed to pond within the open space before egressing through the basin and ultimately discharging to the Langford Brook.

5. FOUL WATER MANAGEMENT

5.1 Pre-Development

As described in Section 2.1, the existing site is greenfield in nature, being utilised for farming, and as such no hard infrastructure is present.

Therefore, it is concluded that no foul effluence is generated by the existing site.

5.2 Post-Development

In accordance with the Sewerage Sector Guidance as published by Water UK peak foul effluent flows should be calculated based on 4000l/dwelling/day.

As such peak foul effluent flows can be calculated based on an assumed maximum unit density of 35 units/ha of developable area. This equates to an assumed upper end of 127 units and respectively a peak flow of 5.9l/s.

An existing public Thames Water foul sewer is located within the bounding Gavray Drive. Sewer records (Appendix B) demonstrate the sewer to be at a level of 63.15mAOD (manhole 5201) with a cover of 67.80mAOD. Given the proposed discharge from site at a level of 64.26mAOD, discharge to the public sewer by gravity is achievable.

6. CONCLUSIONS

This report has considered the flood risk posed to the site from surface water sources of flooding, as defined by the NPPF.

The site has also been concluded as being at low or negligible risk from all other assessed sources of potential flooding.

Owing to the fact that no significant sources of flood risk were identified, no specific mitigation measures are considered necessary.

This report therefore demonstrates that provided a suitable, sustainable drainage system is employed, as described in this document, the proposed scheme:

- Is suitable in the location proposed.
- Will be adequately flood resistant and resilient from surface water sources.
- Will not place additional persons at risk of flooding, and will offer a safe means of access and egress.
- Will not increase flood risk elsewhere as a result of the proposed development through the loss of floodplain storage or impedance of flood flows.
- Will put in place measures to ensure surface water is appropriately managed.

As such, the proposals are concluded to meet the surface water flood risk and management requirements of the NPPF.