Proposed Mixed Use Development

Heyford Park, Upper Heyford, Oxfordshire

Flood Risk Assessment and Drainage Strategy

Final Report for

DORCHESTER LIVING

September 2017

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Issued by: Hydrock Consultants Limited
Over Court Barns
Over Lane
Almondsbury
Bristol
BS32 4DF

Tel: 01454 619533
Fax: 01454 614125
www.hydrock.com

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Prepared		Simon Mirams BSc, MCIWEM, C.WEM, CSci *Senior Flood Risk Consultant*	[redacted]
Checked		David Lloyd BSc, PhD *Technical Director – Flood Risk*	
Approved		David Lloyd BSc, PhD *Technical Director – Flood Risk*	

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APPENDICES

1.0 INTRODUCTION

This report has been prepared by Hydrock Consultants Limited (Hydrock) on behalf of our client, Dorchester Living, in support of a Planning Application to be submitted to Oxfordshire County Council for a proposed mixed use development at Heyford Park, Upper Heyford, Oxfordshire.

This Flood Risk Assessment report has been prepared to address the requirements of the *National Planning Policy Framework* (*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, whilst ensuring flood risk is not increased elsewhere.

The report considers the requirements for undertaking a Flood Risk Assessment as detailed in *NPPF* guidance.

2.0 SITE INFORMATION

2.1 Existing Situation

2.1.1 Location

Table 1 provides the summary site location details.

Table 1: Site Referencing Information

Site Address	Former RAF Upper Heyford, Oxfordshire, OX25 5HA
Grid Reference	451497, 226743 SP514267

2.1.2 Existing Land Use

The Masterplan Area covers an area of 455.5ha around the former RAF Upper Heyford. For the purpose of this report the Application Site to referred to as Heyford Park.

Heyford Park comprises an unused flying field (runway, taxi areas, control tower etc.) with a large portion of the remaining site area currently developed with former personnel living quarters, administrative office buildings, aircraft hangers, storage facilities, and areas of hardstanding working yards. Many of the former buildings are currently to commercial and industrial uses and these are currently accessed via internal site roads linked to main site entrance off Camp Road which runs through the middle of the site. The remainder of the site is undeveloped and is predominantly grassed.

Heyford Park has the B430 to the east and the B4030 to the south, with another B class road, Camp Road, running through the approximate centre of the site. The A43 is approximately 1.6km to the east of the site. Upper Heyford village is located to the west of the site and beyond Station Road. The next nearest urban centre is Bicester which is around 5.8km to the south east of the site.

2.1.3 Topography

A detailed topographical survey has been provided for the areas to the south of the flying field and existing runway areas. This survey shows that there are a number of different falls through the site but, in general, a ridge runs through the approximate centre of the site with site levels falling away from this. The approximate level of the ridge is around 125m AOD. Levels fall in a generally westerly direction with levels dropping along Camp Road to around 108m AOD at the junction with Somerton Road. The topographical survey also shows that site levels to the west of

the ridge fall in a southerly direction with levels falling from Camp Road to a surveyed low of around 115.50m AOD.

Levels to the east of the of the high point are shown to generally fall from a level of around 126m AOD on the south eastern apron of the runway to around 118.50m AOD at the southern limit of the survey.

Where topographical information isn't available for the flying field and area to the north, Ordnance Survey contour mapping has been used to inform the general topography and falls.

These contours mimic the general trends deduced from the topographical survey. The flying field is shown as being the local high points with the levels falling in all directions.

2.1.4 Proposed Development

Planning permission is sought for a hybrid planning application consisting of:

- demolition of buildings and structures as listed in Schedule 1;
- outline planning permission for up to:
    - 1,175 new dwellings (Class C3);
    - 60 close care dwellings (Class C2/C3);
    - 929 m^2 of retail (Class A1);
    - 670 m2 comprising a new medical centre (Class D1);
    - 35,175 m^2 of new employment buildings, (comprising up to 6,330 m2 Class B1a, 13,635 m2 B1b/c, 9,250 m2 Class B2, and 5,960 m2 B8);
    - 2.4 ha site for a new school (Class D1);
    - 925 m^2 of community use buildings (Class D2); and 515 m2 of indoor sports, if provided on-site (Class D2);
    - 30m in height observation tower with zip-wire with ancillary visitor facilities of up of 100 m2 (Class D1/A1/A3);
    - 1,000 m^2 energy facility/infrastructure with a stack height of up to 24m (sui generis);
    - 2,520 m^2 additional education facilities (buildings and associated external infrastructure) at Buildings 73, 74 and 583 for education use (Class D1);
    - creation of areas of Open Space, Sports Facilities, Public Park and other green infrastructure.
- the change of use of the following buildings and areas:
    - Buildings 357 and 370 for office use (Class B1a);
    - Buildings 3036, 3037, 3038, 3039, 3040, 3041, and 3042 for employment use (Class B1b/c, B2, B8);
    - Buildings 217, 3102, 3136, 3052, 3053, 3054, and 3055 for employment use (Class B8);

- Buildings 2010, 3008, and 3009 for filming and heritage activities (Sui Generis/Class D1);
- Buildings 2004, 2005 and 2006 for education use (Class D1);
- Buildings 366, 391, 1368, 1443, 2007, 2008 and 2009 (Class D1/D2 with ancillary A1-A5 use);
- Building 340 (Class D1, D2, A3);
- 20.3ha of hardstanding for car processing (Sui Generis); and
- 76.6ha for filming activities (Sui Generis).

- the continuation of use of areas, buildings and structures already benefiting from previous planning permissions, as specified in Schedule 2.

- Associated infrastructure works, including surface water attenuation provision and upgrading Chilgrove Drive and the junction with Camp Road.

3.0 ASSESSMENT OF FLOOD RISK

3.1 Fluvial and Tidal Flooding

The Environment Agency's (EA's) Flood Zone Mapping shows that the site is entirely within Flood Zone 1 which comprises land assessed as having a less than 1 in 1,000 annual probability of fluvial or tidal flooding (<0.1%) in any year.

Being categorised as Flood Zone 1, it is therefore concluded that the site is suitably elevated above all surrounding watercourses to be above the extreme 1 in 1,000 year flood level. As such, the site is concluded as being at low risk from fluvial flooding. The closest watercourse to the site is the River Cherwell.

Owing to the location and elevation of the site it is also concluded to be at negligible risk from tidal flooding.

3.2 Surface Water Flooding

The EA's flooding from surface water mapping shows that the site is predominantly classified as being at 'very low' risk from this source of flooding.

Whilst the site has been shown as being predominantly at low risk, some areas are shown as being at higher risk with two potential surface flow routes identified. One of these flows in an easterly direction along the northern site boundary and away from the site and poses little risk to the site.

The second flow route starts within the existing buildings at the south eastern corner of the site and drains across the site in a southerly direction with depths typically being below 300mm and only impacts a small area of the site. As such, the area immediately affected could be at an increased risk from this source.

In addition to the two identified surface flow routes there are a number of sections within the site shown to be at an increased risk. These areas are not shown to have connectivity (i.e. act as a flow route) with the wider area and are therefore only representative of locally lower sections within the site.

Apart from two localised areas where two flow routes have been identified the site is concluded as being at low risk from this source of flooding.

3.3 Groundwater Flooding

British Geological Survey mapping shows the site to be underlain by the White Limestone Formation.

Noting the potentially permeable nature of the underlying geology, and as detailed within the Oxfordshire County Council Strategic Flood Risk Assessment, groundwater has been known to result in localised issues but these are restricted to locally lower lying areas. For the purpose of this assessment, the Flood Zone 3 extent is considered representative of the 'worst case' groundwater flood risk.

As the site has been confirmed as being within Flood Zone 1, the site is concluded as being sufficiently elevated above the worst case groundwater risk and to therefore conducted to be at low risk from this source.

3.4 Infrastructure Failure Flooding

Owing to the generally developed nature of the site there is considered to be an existing sewer network (both surface and foul drainage systems). In the event of the surcharging of any of this network, overland flows will likely be conveyed by topography and contained within the existing road network and directed away from/around the site and not pose any significant risk to the site.

The site is therefore considered to be at low risk from sewer flooding.

3.5 Flooding from Artificial Sources

A review of the EA's Flooding from Reservoirs map indicates that the site is not within the maximum extent of flooding in the event of a failure of any artificial source. There are also no raised large waterbodies identified in the near vicinity of the site (the closest being the Oxford Canal to the west which is at significantly lower elevation to the site).

The site is therefore concluded to be at negligible risk of flooding from artificial sources.

3.6 Summary

EA data for the area indicates that the entirety of the site is at low risk of flooding from fluvial and tidal sources and entirely within Flood Zone 1.

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

4.0 *NPPF* REQUIREMENTS

4.1 Planning Policy Requirements

The proposed development has been confirmed as being located within Flood Zone 1.

Residential development is considered 'more vulnerable' in terms of flood risk and all other forms of the proposed development are considered as 'less vulnerable' in terms of flood risk.

The *NPPF* Flood Risk Vulnerability and Flood Zone Compatibility matrix (Table 3) indicates that 'more vulnerable' and 'less vulnerable' development is appropriate in Flood Zone 1 and accordingly the proposed development is concluded to meet the requirements of the Sequential Test.

4.2 Exception Test

Whilst the site is demonstrated to pass the Sequential Test, the following section details potential measures necessary to mitigate any residual flood risks, to ensure that the proposed development and occupants will be safe, and that flood risk will not be increased elsewhere within the design life of the proposed development, akin to the requirements of the second section of the Exception Test.

4.2.1 Resistance and Resilience of Site

No specific measures are considered necessary to protect the proposed development from flooding (as no significant sources of potential flood risk have been identified).

4.2.2 Safe Access and Egress

Safe / dry access is demonstrated to be possible via all directions onto Camp Road on the northern site boundary.

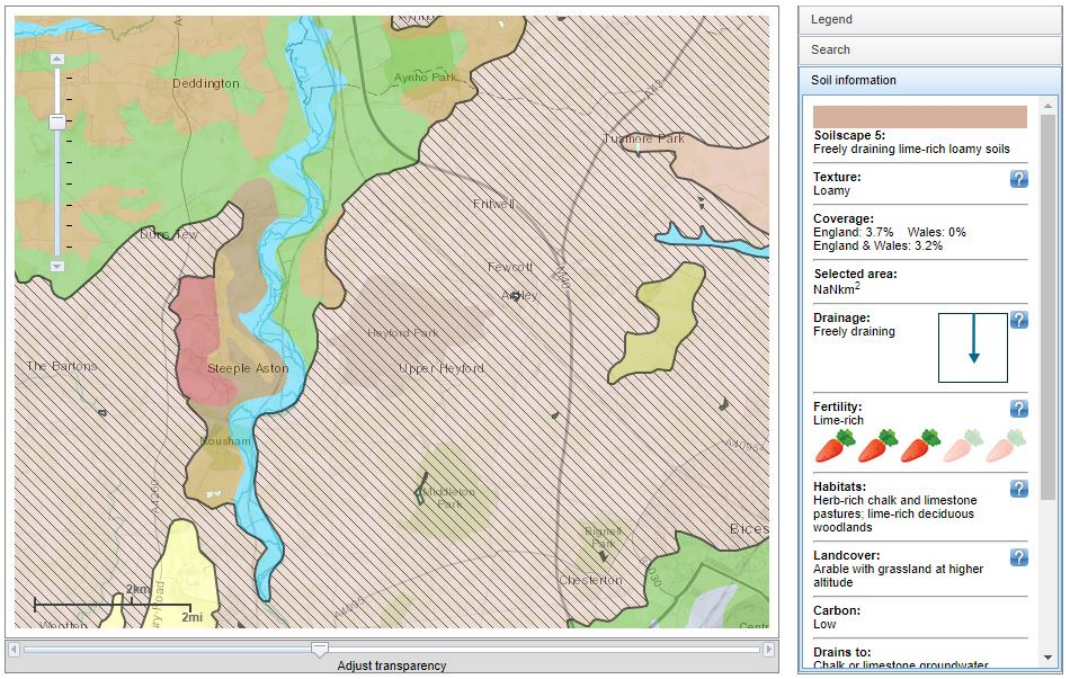
5.0 SURFACE WATER MANAGEMENT

5.1 Existing Surface Water Drainage

The existing site consists of approximately 455.5ha formed from the former RAF Upper Heyford airfield. The site comprises an unused flying field, personnel living quarters, administrative buildings, aircraft hangers and areas of hardstanding. The site is served by an extensive site wide private surface water drainage network with thirteen individual discharge locations to the surrounding water courses. The surrounding watercourses are the Gallos Brook and other unnamed brooks in the south, which are tributaries of the River Cherwell. In the north east there is the Padbury Brook. The current catchment for the site is roughly split in to five separate catchment zones due to the natural topography of the land. The majority of the area discharges in a southerly direction to the Gallos Brook and unnamed watercourses, with the north-eastern area draining in an easterly direction to the Padbury Brook.

An initial investigation in to the underlying bedrock shows predominantly White Limestone formation. This suggests that surface water discharge via infiltration may be a possibility.

Figure 3: Cranfield University Soilscape Mapping



Infiltration solutions will need to be confirmed via a full ground investigation and infiltration testing in accordance with BRE 365 to determine infiltration rates and groundwater levels.

5.2 Proposed Surface Water Drainage

The existing site is served by a traditional gravity surface water network discharging to local watercourses. However, the underlying soils suggests that surface water may be able to discharge via infiltration, where ground water levels would allow. In the absence of infiltration information and confirmation of any possible contamination requiring the potential for remediation it is therefore proposed to demonstrate that surface water runoff can be reduced

to the existing QBAR greenfield rates. The surface water discharge from the individual parcels will be connected to a swale and attenuation basin network with a restricted flow to the adjacent water courses.

The surface water discharge rate will be restricted to the Mean Annual Flood (QBAR) rate. The greenfield run off rate for the site has been calculated to be 4.3l/s/ha. Greenfield run off calculations can be seen in Appendix B. Attenuation for each parcel will be provided in the form of surface features including detention basins and swales or underground tanks. Table 2 below summarises the required attenuation volumes and discharge rates for each of the parcels. A 65% rate of development has been assumed for each parcel unless otherwise stated to calculate the allowable greenfield run off rate. A 10% allowance for urban creep has also been applied to the residential parcel impermeable areas with the net storage volumes adjusted to suit.

Table 2: Parcel Attenuation Requirements

Phase	Gross Area (Ha)	Impermeable Area & 65% (Ha)	Area Including Urban Creep (Ha)	Discharge Rate (l/s)	Attenuation Volume (m^3)
10	3.5	2.27	2.53	9.8	1929
11 & 12	6.16	4.00	4.40	17.2	3035
13	0.53	0.34	0.38	1.5	310
16	6.36	4.13	4.55	17.8	3728
17	2.4	1.56	1.72	6.7	1529
19	0.89	0.50	0.64	2.5	500
20	0.77			3.0	500
21	2.85	1.85	2.04	8.0	1667
23	10.73	6.97	7.67	30.0	5620

There are two non residential parcels, 19 and parcel 20, which consists of 60 extra care units and a medical centre and retail space. Due to limited space it is proposed that these are served by below ground attenuation tanks in the form of either a geocellular storage system or oversized plastic pipes. To deliver adequate treatment and mitigate pollution downstream, additional treatment trains will be proposed such as a tanked permeable paving system on any parking areas. The SuDS manual sets the requirements for acceptable pollution mitigation measures based on the land use classification.

It is recommended that a ground investigation is carried out including infiltration testing in accordance with BRE 365 to confirm that surface water discharge via infiltration is a possibility. If infiltration is viable, soakaway structures may compliment any attenuation.

Where areas of the site are to operate under their current use or remain undeveloped the existing drainage routes and discharge points will need to be maintained. It may be necessary for elements of exiting surface water drainage network passing through the proposed residential developments to be diverted to maintain a positive connection. Any surface water treatment elements such as petrol interceptors will also need to be maintained and/or relocated.

5.3 Water Quality

The proposed scheme will be designed to satisfy the guidance given in the CIRIA SuDS Manual 2015 and to comply with advice from the LLFA and to do so it is recommended that measures are put in place to improve water discharge quality. Such measures would include the provision of swales alongside proposed highway networks for carriageway run-off to convey water to attenuation storage features, rather than traditional gully systems. In addition to this permeable paving on private drives and tree-pits can be used. Forebay areas can also be included in to attenuation basins to contain accumulating sediments. Consideration will also need to be given to the future maintenance and adoption of any green SuDS features proposed.

5.4 Surface Water & SuDS Maintenance

The CIRIA SuDS Manual (CIRIA C753) highlights the various aspects of maintenance requirements for different sustainable drainage elements. The table below gives an overview of the potential maintenance processes for each individual form of surface water management system. The frequency to which these processes will need to be carried out is dependent on various factors, such as the size of the catchment area the system serves, the size of the feature itself, and the environment in which the feature is situated.

Table 3: Maintenance requirements for various SuDS features

	Pond	Wetland	Detention Basin	Infiltration Basin	Soakaway	Infiltration Trench
Regular maintenance:						
Inspection	● (M)	● (M)	● (M)	● (M)	● (A)	● (A)
Litter & debris removal	●	●	●	●	○	●

	(M)	**(M)**	**(M)**	**(M)**	**(AI)**	**(AI)**
Grass cutting	● **(M)**	● **(M)**	● **(6M)**	● **(M)**	○ **(AI)**	● **(AI)**
Weed & invasive plant control	○ **(A)**	○ **(A)**	○ **(M)**	○ **(M)**		○ **(AI)**
Shrub Management	○ **(A)**	○ **(A)**	○ **(M)**	○ **(6M)**		
Aquatic vegetation management	● **(A)**	● **(A)**	○ **(A)**			
Occasional maintenance:						
Sediment management	● **(6M)**	● **(6M)**	● **(5YR)**	● **(AI)**	● **(A)**	● **(A)**
Vegetation replacement	○ **(5YR)**	○ **(5YR)**	○ **(5YR)**	○ **(A)**		
Remedial maintenance:						
Structure repair **(As inspections require)**	○	○	○	○	○	○
Infiltration surface reconditioning **(As inspections require)**				○	○	○
(A) – Annually, **(M)** – Monthly, **(6M)** – Half Yearly, **(5YR)** – Every 5 years, **(AI)** – As inspections require						

● Will be required ○ May be required

It is proposed that any SuDS features be adopted and maintained by a private management company. The surface water drainage network could be offered to Thames Water under a Section 104 legal agreement.

6.0 FOUL WATER MANAGEMENT

6.1 Existing Foul Water

The site is currently served by an existing foul water system, which consists of pumping stations and a foul treatment plant in the south-east corner of the site. The existing foul network and sewerage treatment plant are all currently under private ownership. There is no record of any other foul sewers within the site boundary or adjacent to the site.

6.2 Proposed Foul Water

Currently all foul drainage from the site discharges to the existing sewerage treatment plant in the south-east corner of the site where the sewerage is treated and discharged to the Gallos Brook. Various elements of the sewerage treatment plant are to be refurbished to address issues of capacity, reliability and monitoring following the redevelopment of the site.

The table below shows the estimated foul discharge rates based on 4000litres/dwelling/day for each of the parcels.

Table 4: Parcel Foul Discharge Rates

Phase	Plots	Foul Discharge (l/s)
10	118	5.4
11	70	3.24
12	163	7.5
13	5	0.23
16 + Changing Facility	178	8.61
17	62	2.9
19	60	2.7
20	600m² Medical Centre 929m² Retail Area	0.158
21	115	5.3

23	400	18.52

The site is currently served by various existing pumping stations. To achieve connections to the existing foul treatment plant from the proposed developments it will be necessary to use some pumped solutions due to the topography of the site. A new pumping station is proposed for parcel 23 which will be pumped to high ground within the creative city. A new gravity sewer will then serve parcels 11, 12 & 21 as well as 23 and connect to an existing pumping station located to the south of parcel 12 with a peak flow rate of 34.56l/s. It is likely that this pumping station will need to be upgraded to receive these proposed flows. A survey of the existing pump rate and overall condition of the pumping station will need to be carried out.

An additional pumping station will be required in the south west corner of parcel 16 to serve both parcel 10 & 16. This will potentially be pumped to a proposed pumping station within the redeveloped site to the east of parcel 16. The peak flow rate from parcel 10, 16 and the changing facilities would be approximately 14.02l/s. Parcels 13, 17, 19 & 20 are proposed to discharge to the treatment plant via gravity. Where possible the existing foul network can be utilised, dependant on the condition and capacity of the existing pipework. A full CCTV assessment of the existing network is recommended if not already carried out.

An overall strategy plan for the proposed foul drainage is provided in Appendix B.

It is proposed that it may be possible for the new foul network, pumping stations and existing treatment plant to be adopted an appropriate water authority further down the line via a Section 104 Legal Agreement.

7.0 CONCLUSIONS

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

EA data for the area indicates that the entirety of the site is at low risk of flooding from fluvial and tidal sources and entirely within Flood Zone 1.

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

The proposed development is therefore concluded to meet the requirements of the Sequential Test.

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, the proposed scheme:

- Is suitable in the location proposed.
- Will be adequately flood resistant and resilient.
- 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 and foul water is appropriately managed.
- Surface water treatment trains in the form of highway swales, permeable paving, tree pits and forebay areas to attenuation basins to be considered.
- Confirmation that improvement works to the treatment plant has taken place and provides enough capacity for the development outlined above.

As such, the Application is concluded to meet the flood risk requirements of the *NPPF*.

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APPENDIX A DRAINAGE STRATEGY

Drawing No.	Title
04583-HYD-INF-XX-C-CA-0001	Greenfield Run-Off Calculations
04583-HYD-INF-XX-C-CA-0002	Attenuation Volume Calculations
HPH-HYD-XX-XX-DR-C-2200	Surface Water Drainage Strategy
HPH-HYD-XX-XX-DR-C-2202	Foul Drainage Strategy