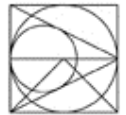




Woods Hardwick

Infrastructure LLP

Civil Engineering Consultants



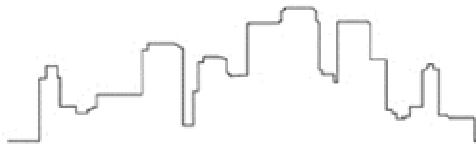
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Flood Risk Assessment

**For
Camp Road, Upper Heyford
Phase 6**

**Version 4
August 2016**

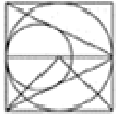
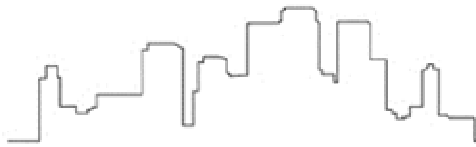


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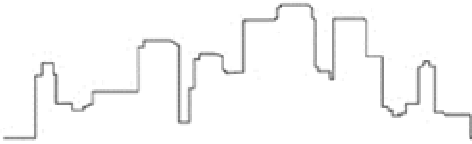
Appendices

Appendix A	Residential Parcel Plan
Appendix B	Proposed level and drainage layouts
Appendix C	Proposed Microdrainage Calculations
Appendix D	Residual Flooding Masterplan



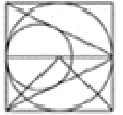
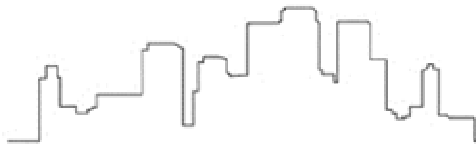
1.0 **Introduction**

- 1.1 Woods Hardwick Infrastructure LLP have been appointed by Dorchester Group to undertake a Flood Risk Assessment in respect of Phase 6 development proposals at the Upper Heyford development site.
- 1.2 The wider development site comprises of approximately 76 hectares and has outline planning consent for residential and commercial use.
- 1.3 A Flood Risk Assessment was prepared and approved in support of the outline application. The report was produced by Waterman in October 2010.
- 1.4 The site is currently live and a number of development parcels have received reserved matters consent. These parcels have been supported by individual Flood Risk Assessment Compliance Notes to demonstrate that the detailed drainage design accords with those principles approved at the outline stage.
- 1.5 The purpose of this report is to support a new detailed planning application in support of the development at Phase 6.
- 1.6 This report does not seek to undo the principles of the approved Flood Risk Assessment but to clarify them within a self-contained Flood Risk Assessment.
- 1.7 A copy of the residential parcel Plan is contained within **Appendix A**.



2.0 Overview of Approved FRA

- 2.1 The entire site is located within Flood Zone 1.
- 2.2 The FRA sets out a detailed approach to attenuation across the Upper Heyford site which comprises of areas identified for retention, areas for refurbishment and areas for redevelopment to provide new residential dwellings.
- 2.3 The Environment Agency (EA) has confirmed that areas identified solely for retention and refurbishment do not require attenuation of existing surface water discharge.
- 2.4 The fundamental principle of the FRA is that runoff from proposed areas of redevelopment should be attenuated to existing 1 in 100 year flows with a 30% allowance for climate change.
- 2.5 Attenuation is to be provided through the use of balancing ponds, permeable paving and attenuation tanks where necessary. Swales will be incorporated through the site where appropriate.
- 2.6 The FRA splits the development into four main catchment areas and provides a series of calculations for each.
- 2.7 The FRA also requires a 10% betterment of existing flows entering the eastern tributary of the Gallos Brook.



3.0 Existing Site

3.1 Site Description

- 3.1.1 Phase 6 (parcel D4b) consists of approximately 1.395 hectares of land located to the south of Camp Road.
- 3.1.2 Phase 6 is located within Catchment Area 2 as identified in the approved FRA figure 5.

3.2 Ground Conditions

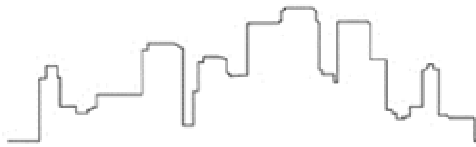
- 3.2.1 Extensive intrusive site investigations have been undertaken which covered the entire site.
- 3.2.2 The general ground conditions comprise of layers of silt and clay. This is underlain by weathered limestone bedrock at an average depth of 1.5m.

3.3 Hydrology

- 3.3.1 The wider site includes a number of watercourses and tributaries.
- 3.3.2 A tributary of the Gallos Brook runs to the east of Phase 6.
- 3.3.4 There is anecdotal evidence of flooding associated with this tributary at the caravan park to the south of the proposed development parcel
- 3.3.3 The Gallos Brook joins the River Ray approximately 11km to the south of the site. The River Cherwell is the nearest Main River and is some 1.2km to the west of the site.

4.0 Proposed Development

- 4.1 Phase 6 (parcel D4b) comprises 43 dwellings within 1.395 hectares of land. Refer to **Appendix B** for the proposed layout.



5.0 Flood Risk Assessment

5.1 Background

- 5.1.1 The purpose of this section of the report is to identify the risk of flooding to and by the development.
- 5.1.2 Following the increased frequency of flooding during recent years, much work has been undertaken at a national level to assess the relationship between new development and flood risk. This work resulted in the publication of Planning Policy Statement 25 (PPS25) in early 2007 with an update being released in March 2010.
- 5.1.3 Alongside the release of the NPPF in March 2012 the TGNPPF was released serving as a flood risk based addendum to the national planning guidance. These documents replace PPS25; however, many of the principles set out in PPS25 remain relevant. The TGNPPF was withdrawn in late 2014 and replaced with the online Planning Practice Guidance (PPG) albeit much of the advice relating to flood risk remains unchanged
- 5.1.4 Table 1 of PPG: Flood Risk and Coastal Change seeks to define different flood risk Zones where: Zone 1 is considered to be low risk since it is outside of the area which is likely to suffer inundation from a 0.1% probability rainfall event; Zone 2 is considered to be medium risk lying between the 0.1% probability flood contour and the 1% or 100 year flood area; Zone 3 is divided into 2 categories with Zone 3A having a >1% annual probability of river flooding or a >0.5% probability of flooding from the sea and Zone 3B being the functional floodplain. This guidance reaffirms the guidance and categorisation included within PPS25.
- 5.1.5 The Environment Agency's (EA) flood map demonstrates that this site lies within Flood Zone 1 and is therefore at low risk.
- 5.1.6 Table 2 of the PPG: Flood Risk and Coastal Change seeks to classify the vulnerability of different land uses. The residential dwellings fall under the More Vulnerable classification.
- 5.1.7 Finally Table 3 of the PPG: Flood Risk and Coastal Change brings Table 1 and 2 together to provide a matrix defining the level of Flood Risk Assessment required based on the flood zone and vulnerability class of a development.
- 5.1.8 Table 3 of the PPG: Flood Risk and Coastal Change therefore demonstrates that this land use is appropriate for the site given the flood zone and vulnerability class.

5.2 Risk of Flooding to the Development from Known Sources

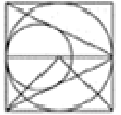
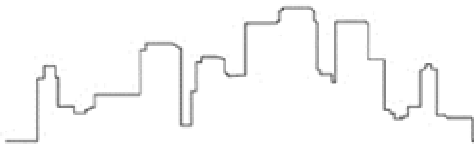
- 5.2.1 Presented below is an analysis and summary of the potential for the site to flood from known sources.

Flooding from Rivers

- 5.2.2 The Environment Agency's (EA) flood map demonstrates that the site lies within Flood Zone 1.

Flooding from the Sea

- 5.2.3 Given the site's location some 100km inland there is considered to be no risk of flooding from this source.



Flooding from Land

- 5.2.4 The EA's surface water flood map demonstrates areas that are at risk of surface water flooding should there be an accumulation at ground level. The map demonstrates that the proposed development is not at risk of surface water flooding.

Flooding from Groundwater

- 5.2.5 The EA's groundwater flood risk maps demonstrate areas that are at risk of flooding from high groundwater. The site is noted as not at risk.
- 5.2.6 This is also confirmed on site and via ground water monitoring which noted ground water level some 1.2m below ground level.

Flooding from Sewers

- 5.2.7 There are no public sewers within the site and all sewers are currently privately owned. There are no reported incidents of flooding from these private sewers.

Flooding from Reservoirs, Canals and Other Artificial Sources

- 5.2.8 There are no man made features within the vicinity of the development site.

5.3 Risk of Flooding Caused by the Development

- 5.3.1 Presented below is a summary and analysis of the potential for the site to exacerbate the risk of flooding to third parties both upstream and downstream.

Encroachment onto Floodplain

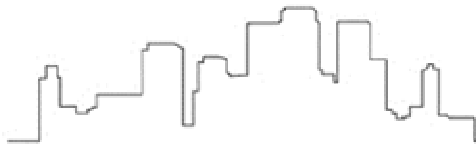
- 5.3.2 The entirety of the site lies outside of the floodplain, there is therefore no risk of encroachment.

Impedance of Flood Flows

- 5.3.3 As the site lies outside of the flood plain there is no risk of the site impeding flood flows.

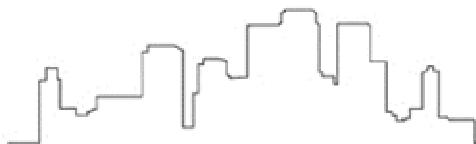
Contribution to Flood Flows by Development Drainage

- 5.3.4 The approved FRA produced in support of the outline condition states in Paragraph 3.20: "In accordance with PPS25, local policy and EA guidance the rate of surface water runoff from new development would be controlled so that it does not increase over the existing situation for the 1 in 100 year even, while taking climate change into account".
- 5.3.7 It is proposed to maintain the existing drainage regime of the site. This will require flows from the proposed development to be restricted to provide the level of improvement required by the EA.
- 5.3.8 It is proposed to maintain the existing catchments and watershed with the site.
- 5.3.9 Restriction of proposed surface water runoff and attenuation will ensure the risk to others, and within the development is mitigated.
- 5.3.10 The detailed drainage strategy is described in more detail in **Section 6** of this report.



5.4 Climate Change

- 5.4.1 There is an increasing body of scientific evidence that suggests that the global climate is changing as a result of human activity. Past, present and future emissions of greenhouse gases are expected to cause significant climate change during this century.
- 5.4.2 The nature of climate change will vary: for the UK, projections of future climate change indicate that more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall can be expected. These kinds of changes will have implications on river-flooding and also localised flash flooding.
- 5.4.3 The PPG requires developments to consider the potential impacts of climate change; as such this assessment makes a 30% allowance for climatic change.



6. SURFACE WATER DISPOSAL

6.1 Principles

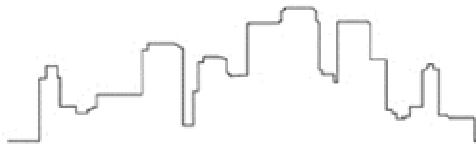
- 6.1.1 In addition to ensuring that the development is not at risk of flooding from external sources, it is also important to ensure that the scheme itself does not exacerbate flood risk for others or within the proposed development. It is therefore essential that the arrangements for storm water disposal are fully assessed to guarantee that the effects are mitigated and that there will be no impact on the existing land drainage regime.
- 6.1.2 All of the recent guidance on the arrangements for storm water disposal from new developments has encouraged the application of a hierarchy for surface water disposal. This has now been formalised in the Building Regulations Part H.
- 6.1.3 The first choice for surface water disposal which should be pursued is via infiltration and only where it has been determined that the ground conditions are not suitable should the second choice of disposal to a ditch or watercourse be considered. If there is no alternative the third and last choice of disposal to public sewer can be considered.

6.2 Discharge Strategy

- 6.2.1 Paragraph 3.20 of the FRA states: "In accordance with PPS25, local policy and EA guidance the rate of surface water runoff from new development would be controlled so that it does not increase over the existing situation for the 1 in 100 year event, while taking climate change into account".
- 6.2.2 It is proposed to connect the phase 6 network, attenuation and flow controls serving the phase to the surrounding drainage network designed during phases 3, 4 and 5.
- 6.2.3 Phase 6 had been allowed for in the phase 3-5 network and is therefore not subject to any additional restriction providing it can be demonstrated that once the refined/ expanded phase 6 network is included, there is no additional flooding generated within the phase 3-5 network and that the discharge rate out of the phase 3-5 network is not increased beyond the allowance rate.
- 6.2.4 The connection points to the phase 3-5 network will be upstream of the pipe runs 21.005, 21.009, 21.011 and 29.009. Slight restrictions on the discharge rates will be required to ensure no flooding to the downstream system.
- 6.2.5 The phase 3-5 network then connects to the existing "central" network upstream of run 1.030 via an appropriately sized flow control device. The existing system conveys both existing and new development flows to the central outfall. The discharge rate out of this is covered in detail in the approved phase 3-5 FRA Compliance note. An updated version of the table is shown below:

Total flow from phases 3, 4, 5b, 5 and 6	
	1 in 100yr Discharge (l/s)
Total allowable rate for phases 3-6	585.4 l/s
Actual rate from phases into existing network (runs 21.020, 43.000 and 44.005 in the calculations)	116.8 + 4.5 + 91.3 = 212.6 l/s

- 6.2.6 The total permissible flow from these phases noted above includes the following information for phase 6 also duplicated from the phase 3-5 Flood Risk Assessment Compliance note:

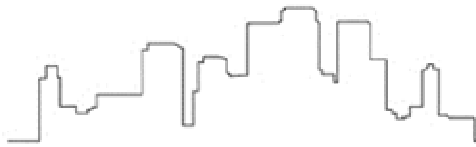


Phase 6		
	Area (m²)	1 in 100yr Discharge (l/s)
Existing Impermeable surfacing	6168	69.6 l/s

- 6.2.7 The full simulated network calculations include runs outside of the phase 3-5 and phase 6 networks, however these elements are not included as part of this report.
- 6.2.8 The purpose of this report is not to revisit the calculation of the allowable rates stated within the FRA or previously approved FRA-Cs.
- 6.2.9 It is understood that the ground conditions to the south of the village green (northern area of this phase) have favorable infiltration rates, therefore it is proposed to use a porous system under the drive in this area. Actual infiltration rate will be confirmed as part of detailed design.

6.3 Attenuation Strategy

- 6.3.1 The parcels contain attenuation in the form of underground tanks and oversized pipes both within the application boundary.
- 6.3.2 The oversized pipes are proposed for adoption by the Water Company.
- 6.3.3 The underground storage tanks will cater for the majority of the attenuation required and either be maintained by the Water Company or a management company.
- 6.3.4 The discharge into phase 3-5 network from phase 6 will be controlled using hydro-brake vortex controllers and orifices to maximise the efficiency of the storage network and the ensure there is no increased flood risk in the downstream system.
- 6.3.5 Living roofs have been discounted as they are not in keeping with the strict urban planning requirements within a conservation area. Rain water harvesting has also been discounted due to ongoing maintenance issues and integration into domestic plumbing.
- 6.3.6 The porous system located under the northern drive will either be either be maintained by the Water Company or a management company.



7.0 Hydraulic Performance

7.1 Modelling

- 7.1.1 A detailed Microdrainage model has been constructed to simulate the 1 in 100 year (plus climate change) storm for the full network including the phase 6 system.
- 7.1.2 The Microdrainage model (refer to **Appendix C**) demonstrates that the total proposed 1 in 100 year (plus climate change) discharge rate from the phases 3-5 does not exceed 585.4 l/s at runs 21.020, 43.000 and 44.005 once phase 6 details have been refined from those assumed in the original calculations.
- 7.1.3 The 212.6 l/s discharge rate achieved is significantly lower than the allowable discharge rate.

7.2 Exceedance

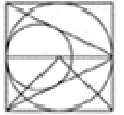
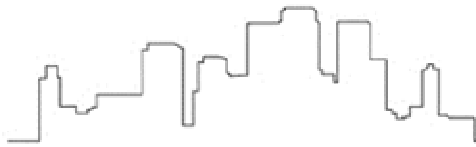
- 7.2.1 During storms in excess of the designated storm, there is the potential for the storage structures and drainage system to be overwhelmed, leading to flooding. Indicative finished levels have been designed so that during these periods, flood water will be directed away from the proposed building entrances and into the roads and soft landscaping areas.

7.3 Pollution prevention

- 7.3.1 As the parking areas are smaller than 800m sq, PPG3 states that trapped gullies will provide suitable protection against contamination.
- 7.3.2 It is noted that the off parcel sewer passes through a petrol interceptor before discharge into the existing watercourse which meets the requirements of PPG3.

7.4 Maintenance

- 7.4.1 Private drainage serving multiple dwellings or located within shared areas will be maintained by the maintenance company.
- 7.4.2 Adoptable drainage will be maintained by the water company.
- 7.4.3 SUDS features (such as storage tanks) contributing to the overall drainage strategy will be maintained by the maintenance company.
- 7.4.4 Refer to "SUDS Maintenance Regime" report dated April 2016 which covers this phase for further details. This document along with relevant designer's risk assessments, calculations and drawings will be made available to the maintenance company.



8.0 Summary and Conclusions

- 8.1 This Flood Risk Assessment has been prepared in support of a detailed planning application for Phase 6 at the Upper Heyford Development.
- 8.2 This FRA has been produced maintaining the same principles as the approved FRA attached to the outline planning consent.
- 8.3 The scheme has been assessed and is deemed not to be at risk of flooding and is also located within Flood Zone 1.
- 8.4 The FRA confirms no attenuation is required for areas being refurbished or retained.
- 8.5 The FRA requires surface water runoff from new development to be restricted to existing 1 in 100 year runoff rates, and flows attenuated including a 30% allowance for climate change.
- 8.6 A Microdrainage model has been created and the results demonstrate a significant betterment in discharge rates.
- 8.7 Based on the detailed assessment of flood risk and betterment in proposed flows we fully support this planning application.

APPENDIX A

Residential Parcel Plan

APPENDIX B

Proposed levels and drainage layout

APPENDIX C

Proposed Microdrainage Calculations

Note: The calculations include the entire network including existing areas upstream and areas downstream of this phase. The runs numbers which relate to Phase 6 (in the order shown in the calculations) are:

Pipe ref

24.000
25.000
24.001
24.002
24.003
28.000
34.000
34.001
37.000
37.001

APPENDIX D

Residual Flooding Masterplan