

**WADDOW VIEW
CLITHEROE**

FLOOD RISK ASSESSMENT

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For

The Huntroyde Estate
C/o Ingham & Yorke LLP,
Padiham,
Lancashire,
BB12 7QX

August 2011

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CHEWS FARM
CLITHEROE
Flood Risk Assessment
October 2011

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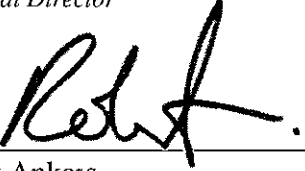
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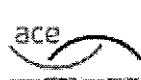

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EXECUTIVE SUMMARY

The Environment Agency Online Flood Maps indicated that the site is located in an area classified as Flood Zone 1 and at low risk of flooding from Fluvial or Tidal sources. PPS 25 confirms that the land use falls into 'more vulnerable' and this is appropriate for Flood Zone 1.

The primary option for surface water disposal is for discharge to the watercourse that runs along the southern boundary. The proposed discharge rate is the Greenfield run-off rate 9.3 l/s (Qbar).

Storm water storage is required to prevent flooding for storm events up to and including the 100 year return period storm event, with a 30% allowance for climate change. The estimated storage volumes for the 30 and 100(+30%CC) year return period storm events are; 87-158 m³ and 192-319 m³ respectively.

In summary, the development can be considered appropriate for Flood Zone 1 in accordance with PPS 25.

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Abbreviations / Acronyms

BGL	Below Ground Level
CC	Climate Change
CDA	Critical Drainage Area
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
Ha	Hectare
FZ	Flood Zone
LPA	Local Planning Authority
mAOD	Metres Above Ordnance Datum
PPS25	Planning Policy Statement: 25
QSE	Quick Storage Estimate (WinDES)
ReFEH	Revitalised FSR/FEH Rainfall Run-off Method
RVBC	Ribble Valley Borough Council
SuDS	Sustainable Urban Drainage Systems
TWL	Top Water Level
UKCIP	UK Climate Impacts Programme
UUW	United Utilities Water

Specialist Drainage/Flood

Risk Management Software

- WinDES by MicroDrainage v12.6 – Quick Storage Estimates (QSE)
- Flood Estimation Handbook (FEH) CD-ROM v.3.0– Rainfall generation and Catchment Data

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1.0 INTRODUCTION

- 1.1 Government policy with respect to development in flood risk areas is contained within the Department of Communities and Local Government Planning Policy Statement 25 (PPS25) 'Development and Flood Risk' which was issued on 07 December 2006.
- 1.2 PPS 25 builds on the previous guidance contained in the Planning Policy Guidance Note 25 (PPG 25) 'Development and Flood Risk' which was issued on 17 July 2001.
- 1.3 This report was commissioned by the client to support a planning application for the construction of a residential development of approximately 45 units complete with estate roads, external works, footpaths, car parking, external lighting, landscaping, boundary walls, fencing, external services and drainage.
- 1.4 The Local Planning Authority (LPA), Ribble Valley Borough Council (RVBC), will make the final decision with regard to any planning permission. PPS 25 advises that a local planning authority should consult with the Environment Agency (EA) who are a statutory consultee and provide advice on flood issues at a strategic level and in relation to planning applications.

2.0 PROPOSED DEVELOPMENT SITE

2.1 Site Location and Description

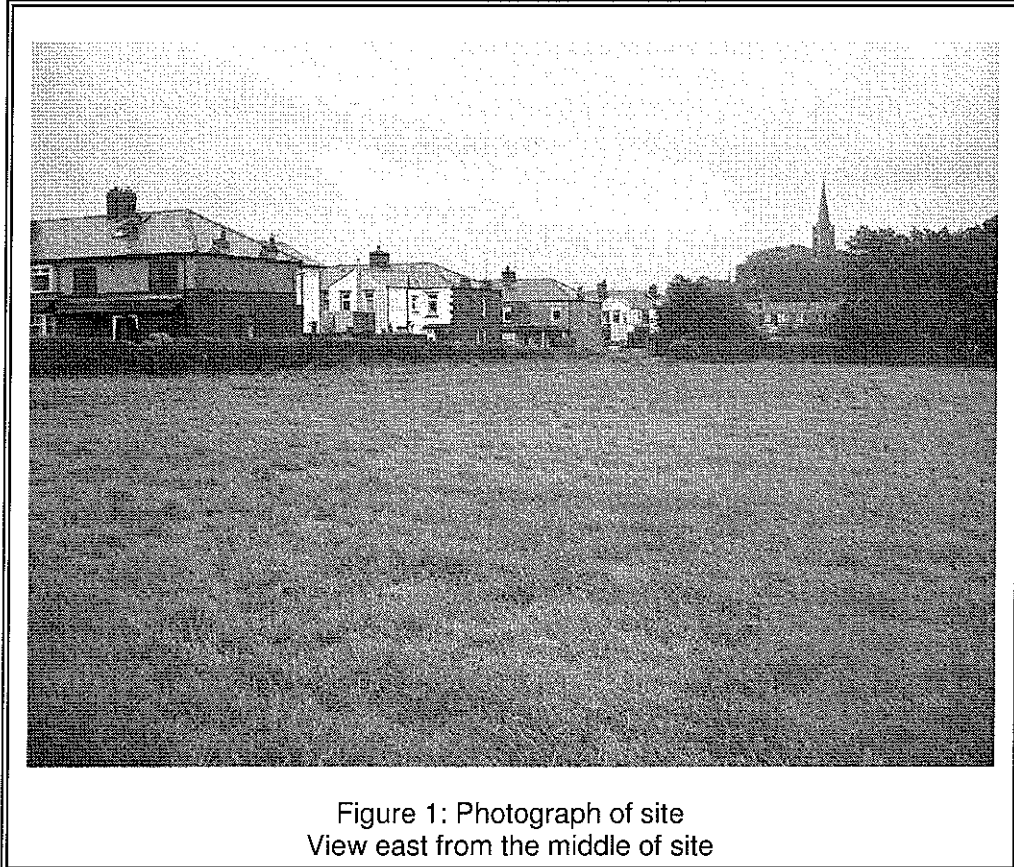
- 2.1.1 The site is located just off Milton Avenue, Clitheroe. The National Grid Reference for the site is 374096 E, 442181 N. The site location plan is shown in Appendix A. The site covers approximately 1.23 hectares (Ha).
- 2.1.2 The site is accessed via Milton Avenue which runs along the northern site boundary. It is currently an open grassed field with a public footpath along the northern site border. The site is generally square, levels slope gently from northwest to southeast. Existing mature trees line the eastern site border, and hedgerows line the northern, southern and western borders.
- 2.1.3 There is an existing derelict building immediately beyond the northwest corner of site. Surrounding area is predominantly residential to the north and south, fields to the west and a public car park to the east. A small stream was noted approximately 40m southwest of the site emerging from a culvert and running north-northeast. A railway line is shown 100m south of site.
- 2.1.4 Historic maps suggest a watercourse that flowed along the eastern boundary, then the southern boundary before heading offsite in a west/northwest direction; however there was no evidence of a watercourse above ground along the eastern boundary. The watercourse is understood to still run below ground (culverted) along the southern boundary.

2.2 Site Levels

- 2.2.1 The site is reasonably level with no significant levels features and no major boundary level issues. The site generally falls to the southern boundary with a high point on site to the northern corner. The recent residential development to the south is elevated by comparison to the site.

2.3 Development Proposals

- 2.3.1 The proposed development consists of the construction of a residential development of approximately 50 units complete with estate roads, external works, footpaths, car parking, external lighting, landscaping, boundary walls, fencing, external services and drainage. A recent photograph is shown in Figure 1.

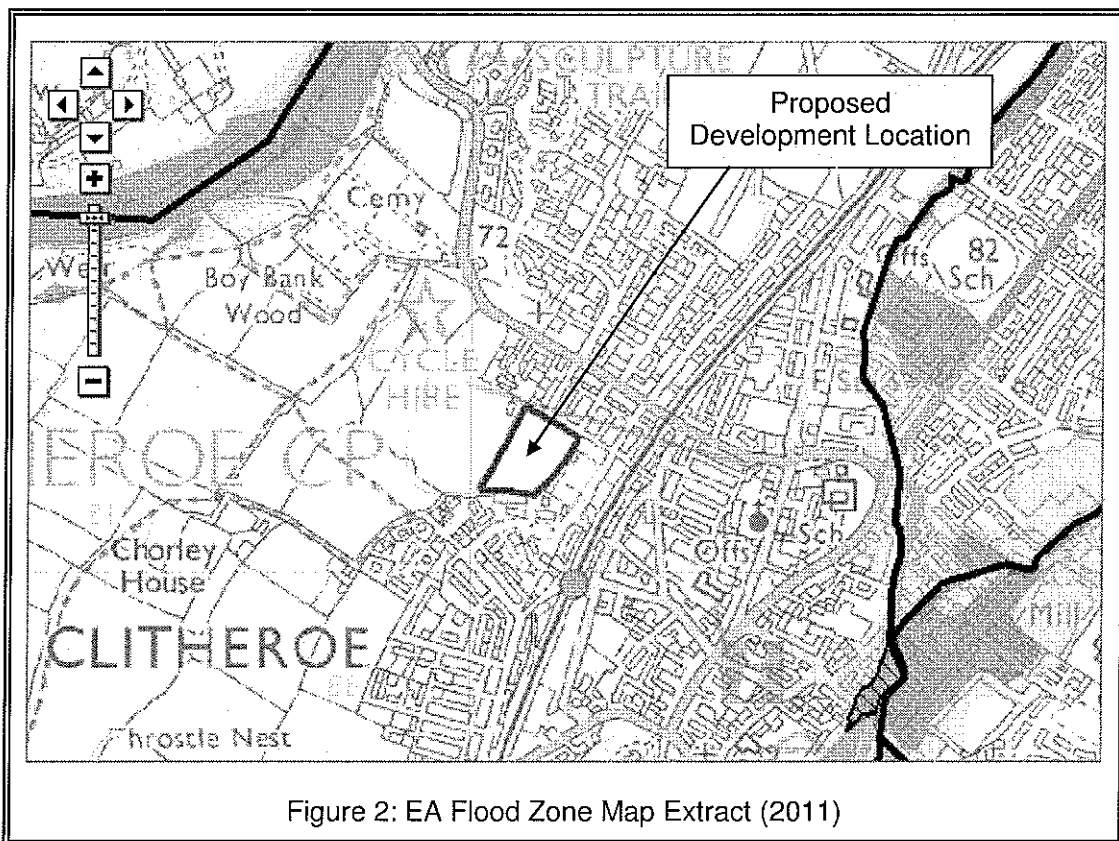


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3.0 FLOOD RISK ASSESSMENT

3.1 Environment Agency Information on Flood Risk

- 3.1.1 Information relating to the flood risk at the site has been obtained from the Environment Agency's (EA) website and online Flood Map, an extract of which is shown in figure 2 (below).
- 3.1.2 Examination of the Flood Map shows that the site is located wholly within Flood Zone 1. This is based on the EA Flood Map and is classified Flood Zone 1 with regards to the risk of flooding from Rivers or the Sea; Appendix B shows the online flood map and statement in full.



3.2 Strategic Flood Risk Assessment (SFRA) Information

- 3.2.1 The SFRA also indicates that the overall site is not located within functional flood plain and there are no specific risks to the site area indicated within the SFRA.

3.3 Anecdotal Flooding Information

- 3.3.1 An Internet based search for flooding events did not recall any historical flooding in the immediate site area.

3.4 Watercourses

- 3.4.1 Historic maps suggest a watercourse that flowed along the eastern boundary, then the southern boundary before heading offsite in a west/northwest direction; however there was no evidence of a watercourse above ground along the eastern boundary. The watercourse is understood to still run below ground (culverted) along the southern boundary.
- 3.4.2 The watercourse appears to be fed by a public surface water sewer (UUW asset) at UUW node ref. 1104 (900mm dia. pipe).
- 3.4.3 The culvert (c.900mm dia.) discharges in to an open channel a distance of approximately 40m to the southwest of the western corner of the development area. A photograph of the outfall is shown in figure 3.
- 3.4.4 The culvert is thought to be located around the southern site boundary although its exact location needs to be confirmed (sonar trace or similar). The outfall is located offsite under adjacent residential development.
- 3.4.5 The land through which the downstream open channel watercourse flows is also owned by the land owner of the development area.

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Figure 3: Photograph of outfall
View east at the outfall headwall location southwest of the development

3.5 Sewer Flooding

- 3.5.1 There are no known sewer capacity issues with the surface water system in the immediate vicinity that have given rise to flooding issues.
- 3.5.2 No specific flood risk issues from the public sewer network have been identified. It was intimated by UUW that the most likely source of flood risk from the sewer network was surcharging of the sewer system in periods of intense rainfall.
- 3.5.3 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water known as "combined sewers". Foul water flooding often occurs in areas prone to overland flow and can result when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away. It can also occur when the sewer becomes blocked or is of inadequate capacity, this could lead to there being a high risk of internal property flooding with contaminated water.

3.6 Overland Flooding

- 3.6.1 Intense rainfall, that is unable to soak into the ground or enter drainage systems can run-off land and result in flooding. Local topography and the land use can have a strong influence on the direction and depth of flow. Large catchment areas are particularly prone to this type of flooding. The volume and rate of overland flow from land can be exacerbated if development increases the percentage of impermeable area.

- 3.6.2 The topography of the development and surrounding area means there is little likelihood of significant flows impacting on the proposed development or on land and property adjacent to the development. The only flows that are likely to be present on site are from direct rainfall on areas of hardstanding.
- 3.6.3 Any flows generated by the proposed development must be directed away from the adjacent existing residential properties on the western boundary; safe avenues of overland flow away from the proposed dwellings are advised.

3.7 Groundwater Flooding

- 3.7.1 In general terms groundwater flooding can occur from three main sources: - raised water tables, seepage and percolation and groundwater recovery or rebound.
- 3.7.2 Raised water tables – at the current time there are no reported problems associated with rainfall raising the local water table and flooding occurring.
- 3.7.3 Seepage and percolation – Seepage and percolation occur where embankments above ground level hold water. In these cases water travels through the embankment material and emerges on the opposite side of the embankment. Due to the distance of the proposed development area relative to any watercourse the likelihood of flooding from this source is low.
- 3.7.4 Groundwater recovery / rebound – occurs where the water table has been artificially depressed by abstraction. When the abstraction stops the water table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level. As with the seepage scenario the likelihood of flooding from this source is low.

3.8 Flood Risk Vulnerability and Flood Zone Compatibility

- 3.8.1 The development is classified as a residential development and as such 'more vulnerable' in Table D.2 of PPS 25. Table D.3 in PPS 25 confirms that this type of land use is appropriate for Flood Zone 1 (see Appendix H for tables).

4.0 SURFACE WATER MANAGEMENT

4.1 Impermeable Area and Surface Water Run-off

- 4.1.1 The total site area of 1.23 hectares currently consists of 100% pervious area.
- 4.1.2 The existing permeable area (Greenfield) generates a run-off rate of approximately 9.3 l/s based on the IH124 / ICP-SUDS methodology.
- 4.1.3 The proposed development will increase the impermeable area of the development to approximately 40% of the total site area (0.44 Ha).
- 4.1.4 The proposed impermeable area generates a run-off rate of 61.1 l/s based on a rainfall of 50mm/hr.
- 4.1.5 It is proposed that the development be restricted to the pre-development Greenfield run-off rate QBar 9.3 l/s.
- 4.1.6 The resultant storage volume generated by the restricted outfall needs to cater for rainfall events up to and including the 100 year return period storm event (plus 30% allowance for Climate Change). The main surface water system being offered for adoption (UU) is likely to be sized to suit a 30 year return period storm event with volumes greater than this being contained within the public highway or an area designated public open space for a brief period of time for the 100 year extreme rainfall event (plus 30% allowance for Climate Change). This is an accepted method of dealing with the extreme rainfall event provided depths of resulting storage are shown to be minimal.
- 4.1.7 The site would have historically drained to the watercourse on the southern boundary that would have historically been an open channel.

4.2 Sustainable Drainage Systems (SuDS)

- 4.2.1 In accordance with PPS25, Sustainable Drainage Systems (SuDS) should be specified wherever possible to manage surface water. This in turn reduces the burden downstream on both watercourses and sewerage systems.
- 4.2.2 SuDS have the ability to address three core objectives; water quantity, water quality and amenity value. With the appropriate system specified, all three core objectives can be satisfied. Where possible, peak surface water discharge rates to watercourses and sewers should be reduced.
- 4.2.3 Preference should always be given to SuDS over the traditional methods of buried sewers wherever possible and practical. Runoff from car parking areas and roads could be conveyed through swales, permeable pavements, bio-retention areas and petrol interceptors to provide a degree of treatment before flows are carried to public sewers.
- 4.2.4 Opportunities should be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off. Added benefits include biodiversity and visual enhancements.

4.2.5 The exact type of SuDS will be determined at the detailed design stage.

4.3 Methods of Surface Water Management

4.3.1 At present the site is developed and is being treated as Greenfield. There is approximately 1.23 hectares of existing pervious area, 100% of the total site area.

4.3.2 The proposed impermeable area of the development is approximately 0.440 hectares, 40% of the total site area.

4.3.3 There are three methods that have been reviewed for the management and discharge of surface water detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority listed below.

- Infiltration/soakaway
- Discharge to watercourse
- Discharge to public sewerage system

4.4 Infiltration

4.4.1 Ground conditions are expected to be of a cohesive nature and are unlikely to be favourable, with little to no infiltration expected. As a result surface water discharge via soakaways is not likely to be feasible, however until soakaway testing to BRE365 is undertaken to confirm the infiltration characteristics of the ground this should not be discount as a part or total solution for surface water management.

4.5 Discharge to a Watercourse

4.5.1 A connection to the watercourse is ideal for managing the surface water flows generated by the proposed development. The watercourse should be of sufficient depth to allow a suitable outfall with the necessary cover to any attenuation system. In addition the open channel watercourse that is located outside of the development area is within the ownership of the developer so there should be no third party connection issues.

4.5.2 As an increase in the impermeable area is proposed by approximately 40% (as the site is currently Greenfield) there will be an increase in the resultant volume of surface water run-off being generated compared to the pre-development scenario. This increase in surface water volume means that a discharge rate of Q_{bar} should be applied to the surface water flows.

4.5.3 As a connection is proposed to a watercourse it is an EA requirement that the surface water drainage proposals cater for the 100 year return period storm event with a 30% allowance for climate change.

4.5.4 The main surface water system being offered for adoption (UU) is likely to be sized to suit a 30 year return period storm event with surface water volumes arising from storm events greater than this being contained within the public highway or an area of designated public open space for a brief period of time for the 100 year extreme rainfall event (plus

30% allowance for Climate Change). This is an accepted method of dealing with the extreme rainfall event provided depths of resulting storage are shown to be minimal.

- 4.5.5 The estimated storage volumes for the 30 and 100(+30%CC) year return period storm events are; 87-158 m³ and 192-319 m³ respectively.

4.6 Discharge to a Public Sewer

- 4.6.1 United Utilities Water will not allow connection to the public surface water sewer in light of the watercourse being in close proximity to the development unless a connection is determined to be unfeasible due to practical constraints such as levels etc.

4.7 Foul Water Management

- 4.7.1 A foul water connection to the combined public sewer located in Milton Avenue is proposed for the flows generated by the development. The flows are estimated at 2.3l/s based on 4000 litres/dwelling/24hrs.
- 4.7.2 Confirmation that this connection is feasible needs to be determined from a ground level and invert level perspective.

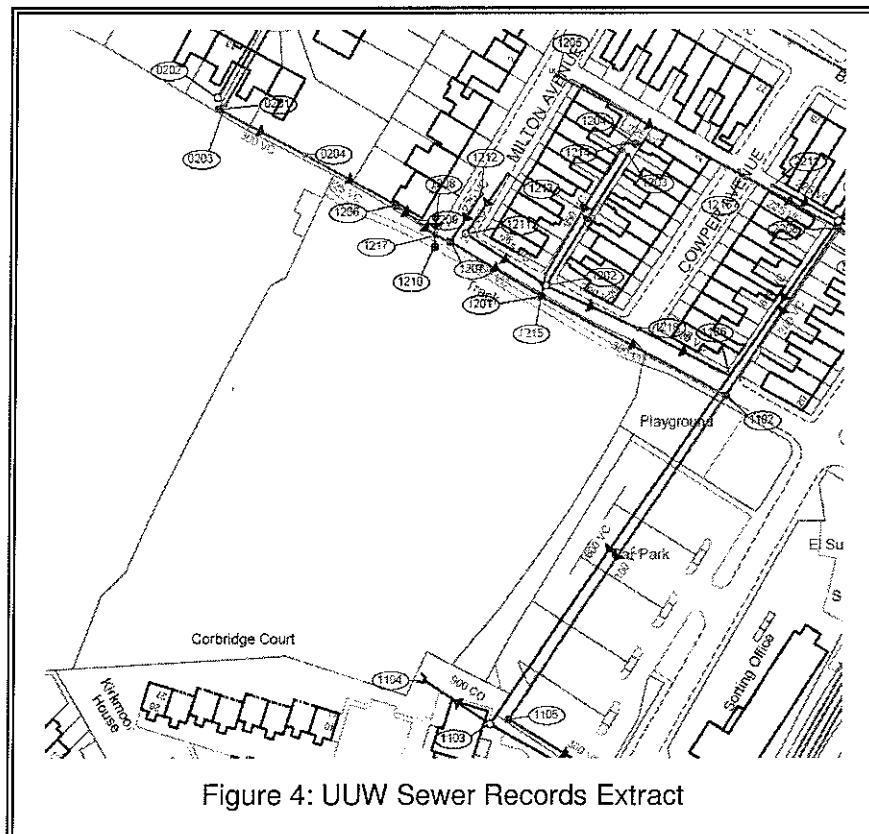


Figure 4: UUW Sewer Records Extract

4.8 Climate Change

- 4.8.1 There are indications that the climate in the UK is changing significantly and it is widely believed that the nature of climate change will vary greatly by region. Current expert opinion indicates the likelihood that future climate change would produce more frequent short duration and high intensity rainfall events with the addition of more frequent periods of long duration rainfall.
- 4.8.2 PPS25 table B.2 states that the recommended national precautionary sensitivity ranges for increase of peak rainfall intensity is 30% until 2115. It is widely believed that the impact of climate change means there is likely to be a long term increase in the average sea levels, with an expectation that sea levels will rise gradually.
- 4.8.3 An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact.
- 4.8.4 Any increase in the level of flood risk to the proposed development from climate change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system.

4.9 Residual Risks

- 4.9.1 The development is accessible for emergency access and egress during times of extreme flooding as the flood plain does not extend into the area proposed for residential development.

5.0 SUMMARY AND CONCLUSIONS

- 5.0.1 The Environment Agency Online Flood Maps indicated that the site is located in an area classified as Flood Zone 1 and at low risk of flooding from Fluvial or Tidal sources.
- 5.0.2 The site falls within Flood Zone 1. PPS 25 confirms that the land use falls into 'more vulnerable' and this is appropriate for Flood Zone 1.
- 5.0.3 The primary option for surface water disposal is for discharge to the watercourse that runs along the southern boundary.
- 5.0.4 The proposed discharge rate is the Greenfield run-off rate 9.3 l/s (Qbar).
- 5.0.5 Storm water storage is required to prevent flooding for storm events up to and including the 100 year return period storm event, with a 30% allowance for climate change.
- 5.0.6 The estimated storage volumes for the 30 and 100(+30%CC) year return period storm events are; 87-158 m³ and 192-319 m³ respectively.
- 5.0.7 In summary, the development can be considered appropriate for Flood Zone 1 in accordance with PPS 25.

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Planning Layout – (MCK Associates Ltd.)

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Cranfield University – <http://www.landis.org.uk/soilscapes/>
Environment Agency – www.environment-agency.gov.uk/
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Flood London – <http://www.floodlondon.com/>
Flood Resilience Group – <http://www.floodresiliencgroup.org/frg/>
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Ribble Valley Borough Council – <http://www.ribblevalley.gov.uk/>
Streetmap – <http://www.streetmap.co.uk/>
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US Army Corps of Engineers – <http://www.hec.usace.army.mil/software/hecras/>
Watertight International – <http://www.watertightinternational.com/>

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Appendix A: Location Plan

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Appendix B: Planning Layout Drawing

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Appendix C: Topographical Survey

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Appendix D: Environment Agency Flooding Information

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Appendix E: United Utilities Sewer Records Extract

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Appendix F: PPS 25 Extracts (Tables D.2. and D.3.)

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Appendix G: Surface Water Run-off Calculations

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Appendix H: WinDES Quick Storage Estimate

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Appendix I: Photographs

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Appendix J: Notes of Limitation

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

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