PROPOSED RESIDENTIAL DEVELOPMENT,
LAND TO THE SOUTH OF WEST ROAD, SAWBRIDGEWORTH

Flood Risk Assessment and
Surface Water Drainage Strategy

Project 12-039
May 2014
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Surface Water Drainage Strategy

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EXECUTIVE SUMMARY

This Flood Risk Assessment and Surface Water Drainage Strategy has been prepared with respect to the promotion of Land to the South of West Road, Sawbridgeworth for residential development on behalf of Barratt Homes. It sets out how the proposed residential development of approximately 300 dwellings on this land at Chalks Farm, Sawbridgeworth could be brought forward and be both deliverable and acceptable in flood risk and drainage terms, the site having been allocated under Policy SAWB3 of the East Herts Council Draft District Plan.

In accordance with the National Planning Policy Framework 2012 the site requires a site specific Flood Risk Assessment as the area is in excess of 1 hectare.

Whilst the site is subject to a very small area of Flood Zones 2 and 3, the development can be wholly constructed within Flood Zone 1 as required by the Sequential Test providing the maximum flood protection available in terms of flood zoning.

The risk of flooding by fluvial, tidal, groundwater, drainage systems and overland flow sources has been reviewed and considered to be low. Through mitigation measures, the development will not increase flood risk to the surrounding area. In addition the risk of pollution to the aquifer and Sawbridgeworth Brook is deemed to be low.

A Surface Water Drainage Strategy can be provided which meets the requirements of all Government Policy and best practice through the provision of a Sustainable Drainage System (SuDS) system which mimics the natural environment. The drainage system will be designed to cater for surface water up to the 1 in 100 year event plus a climate change allowance of 30%, thus minimising the risk of flooding to the development and surrounding area.
The analysis contained within this Flood Risk Assessment and Drainage Strategy clearly demonstrates that the Land to the South of West Road, Sawbridgeworth is suitable for residential development in a sustainable and deliverable manner and can meet the requirements of the Local Plan.
1.0 INTRODUCTION

1.1 Odyssey Markides (OM) has been commissioned by Barratt Homes to prepare a Flood Risk Assessment (FRA) incorporating a Surface Water Drainage Strategy (SWDS) to support the promotion of the Chalks Farm site for a residential development of up to 300 residential dwellings with associated supporting infrastructure.

1.2 The purpose of this report is to show that the site can be developed in a sustainable manner with regard to surface water drainage and flood risk to the acceptance of the Planning Authority, Environment Agency, Thames water and other relevant stakeholders. This report will also aid in the application of the Sequential Test by the East Herts District Council in allocating land for residential development.

1.3 The site is located approximately 0.6km to the west of Sawbridgeworth town centre.

1.4 The site is bounded by West Road to the north, the Sawbridgeworth Brook to the east (followed by residential development) and open fields to the south and west.

1.5 The site is currently cleared greenfield supporting arable cultivation with a total area of 14 hectares.

1.6 The site generally falls to the south east towards the Sawbridgeworth Brook.

1.7 This report will consider any flooding implications to the site and surrounding area and any mitigation measurements required. The majority of the site can be proven to be located within Flood Zone 1; Low Probability, having less than 1 in 1000 annual probability of flooding from rivers or sea, <0.1%. All the development will be in Flood Zone 1.
1.8 This report will also advise on surface water drainage requirements for the proposed development and propose an outline strategy to address surface water run-off.

1.9 The scope of this report comprises the following elements:

- To review existing legislation, policy and supporting documents in relation to flood risk and foul and surface water,

- To review all elements which may cause or increase the risk of flooding to and from the development, and propose mitigation measures to address any residual flood risk,

- To prepare a Surface Water Drainage Strategy based upon development proposals in accordance with current government policy and best practice.
2.0 DEVELOPMENT PROPOSALS

2.1 The development proposals are for the construction of approximately 300 residential dwellings and associated infrastructure. The site has been allocated for the residential dwellings as per Policy SAWB3 of East Hertfordshire District Council’s (EHDC) ‘Draft District Plan’.

2.2 For the purposes of this report it is assumed that 60% of the total site area will be impermeable surfacing, equating to an area of 8 hectares.
3.0 BASELINE CONDITIONS

Sources of Information

3.1 The baseline conditions for the site have been established using the following sources and references:

- British Geological Borehole Logs TL41NE29 & TL41SE39;
- Environment Agency Aquifer Mapping;
- Environment Agency Ground Water Source Protection Zones;
- Environment Agency Flood Risk Mapping from Rivers and Seas;
- Environment Agency Correspondence; and
- Thames Water Asset Plans.

Site Description

3.1 The site is approximately 14 hectares of cleared greenfield land currently used for arable cultivation. A site location plan is provided in Appendix A.

Topography

3.2 The site generally falls to the south east. Ground levels range from approximately 70m AOD to the west to approximately 55.50m AOD to the south east. A plan showing survey levels in the area of the Sawbridgeworth Brook is contained in Appendix F.

Existing Foul and Surface Water Sewers

3.3 Mapping received from Thames Water shows that there are both foul and surface water sewers serving the existing residential areas in close proximity to the site. An existing 150mm diameter foul water sewer is shown to run along the western side of the Sawbridgeworth Brook. A surface water sewer is shown to serve a part of the existing residential area to the east of the site prior to outfalling to the Brook.
3.4 The foul water sewer adjacent to Sawbridgeworth Brook will require a 6m easement, 3.0m either side of the centre line of the pipe, to allow for Thames Water access for maintenance. Any development layout will be required to accommodate this sewer easement.

3.5 Thames Water Asset Plans are provided in Appendix B.

**Geology, Hydrology and Hydrogeology**

3.6 The British Geological Survey (BGS) borehole logs contained in Appendix C indicate that the upper strata levels consist of the following makeup:

- Boulder Clay;
- Glacial Sand and Gravel (Clayey Gravel);
- London Clay; and
- Woolwich and Reading Beds (Clay).

3.7 The above indicates that the use of infiltration techniques may not prove viable. It is recommended however that soakage testing to BRE365 is undertaken prior the detail design stage to determine the suitability of infiltration techniques. This report ignores the effects of infiltration and is therefore conservative in its approach to attenuation and onsite storm water storage.

3.8 Flood Mapping obtained from the EA shows the majority of the site to be within Flood Zone 1, low probability 0.1% of flooding. A very small section of the site is shown to be with Flood Zones 2 and 3 along the length of the Sawbridgeworth Brook. A copy of the EA flood maps is provided in Appendix D. It should be noted that all of the development proposals will be cited in Flood Zone 1.
4.0 LEGISLATION, POLICY AND SUPPORTING DOCUMENTS

Legislation

Flood and Water Management Act 2010

4.1 The Flood and Water Management Act 2010 (FWMA) received Royal Assent on 8th April 2010. The Act was introduced to enforce some of the key proposals set out within UK Government flood and water strategies along with UK Government’s response to the Sir Michael Pitt’s Review of the Summer 2007 floods.

4.2 Relevant to development sites, the FWMA is intended to encourage the uptake of Sustainable Drainage Systems (SuDS) by removing the automatic right to connect to sewers and providing for Unitary and County Council’s to adopt SuDS for new developments through SuDS Approval Bodies.

4.3 The development proposals will adhere to the FWMA through the provision of SuDS as a fundamental element of the surface water drainage system. Furthermore, Barratt Homes is committed to working with the relevant stakeholders, such as the EA and EHDC, in implementing the requirements of the FWMA.

National Policy

National Planning Policy Framework 2012

4.4 The National Planning Policy Framework 2012 (NPPF) sets out the Government’s planning policies for England and how these policies should be applied. The Technical Guidance to the National Policy Planning Framework 2012 (TGNPPF) published in unison with the NPPF provides additional guidance and retains the key elements of the now superseded PPS25.

4.5 The NPPF states that “inappropriate development in areas at risk of flooding should be avoided by directing development away from areas of
highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere."

4.6 When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider appropriate development in areas at risk of flooding where, following application of the Sequential Test (and if required, the Exception Test) it can be demonstrated that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and,

- Development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of Sustainable Drainage Systems. (NPPF, 2012)

4.7 All land in England and Wales is classified into three main Flood Zones which refer to the probability of river or sea flooding (ignoring the existence of defences). The TGNPPF identifies and describes the EA Flood Zones:

- Flood Zone 1: Low Probability defined as land assessed as having less than 1 in 1,000 annual probability of river or sea flooding (<0.1%),

- Flood Zone 2: Medium Probability defined as land assessed as having between 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%) or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%),

- Flood Zone 3a: High Probability defined as land assessed as having a 1 in 100 or greater annual probability of river flooding
(>1%), or a 1 in 200 or greater annual probability of sea flooding (>0.5%),

- Flood Zone 3b: The Functional Floodplain defined as land where water has to flow or be stored in times of flood (as identified by local planning authorities in their SFRAs).

4.8 In accordance with the NPPF. A site specific FRA is required for:

- Proposals of 1 hectare or greater in Flood Zone 1,
- All proposals for development in Flood Zones 2 and 3,
- An area within Flood Zone 1 which has critical drainage problems,
- Development or change of use to a more vulnerable class that may be subject to other sources of flooding.

4.9 Given the above, the site requires a site-specific FRA on the basis that the site area is in excess of 1 hectare and a very small portion of the site is located within flood zones 2 and 3a, although all development will be in Flood Zone 1.

4.10 Greenfield sites rely on natural drainage to convey or absorb rainfall. In general, site development can reduce the permeability of the site if not well designed, increasing the volume and rate of water running off the site to nearby watercourses. This in turn potentially increases flood risk to downstream areas. Therefore appropriate drainage flow regulation arrangements may be required for new developments to ensure that flood risk to others is not increased.

4.11 Importantly, Government policy increasingly requires this regulation to attempt to mimic the existing characteristics of the site in the form of Sustainable Drainage Systems (SuDS) wherever practicably possible.
National Standards for Sustainable Drainage Systems 2011

4.12 The National Standards for Sustainable Drainage Systems (NSSDS) was published in draft format in December 2011. The Department for Environment, Food and Rural Affairs (DEFRA) document provides guidance on designing, constructing, operating and maintaining drainage for surface run-off.

4.13 The NSSDS are to be used in order to manage surface run-off in accordance with Schedule 3 of the FWMA.

4.14 The NSSDS states that the run-off destination should be considered in the following order of preference:

- Discharge into the ground (infiltration);
- Discharge to a surface water body;
- Discharge to a surface water sewer; and finally
- Discharge to a combined sewer.

4.15 Although yet to be formally adopted, the NSSDS provides guidance on run-off destination, peak flow rate, volume and control of water quality and function.

4.16 The NSSDS sets out the requirements in order to obtain approval from the SuDS Approving Body for operating and maintaining SuDS. In addition to the standards, the Local Planning Authority may set local requirements for planning permission that have the effect of more stringent requirements than that of the standards.

The Water Industry Act 1991

4.17 The Water Industry Act (WIA) 1991 (HMSO, 1991) was introduced to consolidate previous water supply and wastewater services enactments in the
UK. Section 94 sets out the principal duties and standards of performance to sewerage undertakers which include the duty ‘to provide, improve and extend such a system of public sewers (whether inside its area or elsewhere) and so to cleanse and maintain those sewers as to ensure that that area is and continues to be effectually drained’.

4.18 Relevant to new development, Section 104 of the WIA provides the mechanism for adoption of sewers at a future date, subject to an agreement with the sewerage undertaker (e.g. Thames Water Services Ltd).

4.19 Section 106 provides the mechanism to ‘communicate with a public sewer’. The Section 106 provision has been amended under the FWMA to restrict the right to connect with regard to surface water drainage, subject to the provision of an approved drainage scheme incorporating SuDS.

4.20 Section 98 of the WIA provides the requisition process in which the appropriate drainage infrastructure (foul or surface water) can be requested by the developer or property owner to be provided by the relevant drainage undertaker (at cost to the developer or property owner).

4.21 Section 98 allows the sewerage undertaker a 21 day notice period prior to the works being undertaken. During this time the application may be refused if the undertaker considers that the connection mode or condition of the connecting sewer does not satisfy the required standards. The undertaker cannot refuse the connection based on inadequate capacity.

**Water Act 2003**

4.22 The Water Act 2003 (HMSO, 2003) introduced some changes to the regulation of the water industry in England and Wales under the Water Industry Act 1991 by transferring responsibility for economic regulation from an individual Director General to an Authority (Ofwat).

4.23 Ofwat (the Water Services Regulation Authority) is the body responsible for economic regulation of the privatised water and sewerage
industry in England and Wales. Every five years, Ofwat set limits on the prices UK water companies charge to their customers and set their capital investment budgets for infrastructure maintenance and improvements for the following 5 years. Thames Water is in the 5th Asset Management Plan (known as the AMP5) which is set to expire in 2015.

4.24 Under the framework for competition set out in the Water Industry Act 1991, the Competition and Services (Utilities) Act 1992, the Competition Act 1998 and the Water Act 2003, any Ofwat licensed water / multi-utility companies are able to provide services to developments, operating ‘out of area’ through inset agreements. Inset agreements allow for the existing utility provider to be replaced by another, for a specific area. In this case, Thames Water as the statutory undertaker for the area could be replaced by an Ofwat licensed company.

**Sewers for Adoption 7th Edition**

4.25 Sewers for Adoption 7th Edition provides guidance on the requirements of the design and construction of both surface and foul water sewers to be offered for adoption. The guidance is provided in consultation with Water and Sewerage Undertakers.

**Building Regulations**

4.26 The Building Regulations 2002, Part H ‘Drainage and Waste Disposal’ gives guidance on the design of private sewers. Specific information on foul water flows is contained within Parts H1 and H2.

4.27 It should be noted that regulations published by the Government have transferred private sewers into the ownership of statutory sewerage companies in England since 2011. Sewers for Adoption (7th Edition) requirements may therefore take precedence over the Building regulations in many cases.
5.0 THE SEQUENTIAL TEST AND THE EXCEPTION TEST

The Sequential Test

5.1 The EA flood zones are the starting point for the Sequential approach promoted by the NPPF, and are shown on the EA flood mapping. The TGNPPF identifies that the overall aim of the Sequential Test is to steer new development to Flood Zone 1 (NPPF, 2012).

5.2 As stated by the NPPF, development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with lower probability of flooding. The SFRA will provide the basis for applying this test. (NPPF, 2012).

5.3 Following application of the Sequential Test, if it is not possible for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied (NPPF, 2012).

The Exception Test

5.4 For the Exception Test to be passed:

- The development must provide wider sustainability benefits that outweigh the flood risk informed by a SFRA where possible,

- A site-specific FRA must show that the development will be safe for its lifetime taking into account the vulnerability of its users, without increasing flood risk elsewhere, and where possible reducing flood risk overall.

5.5 As indicated, it can be proven that the majority of the site is located within Flood Zone 1. Development will be steered away from the very small area of Flood Zones 2 and 3 adjacent to the Sawbridgeworth Brook. As such, the development will meet the philosophy of the Sequential Test and no application of the Exception Test will be required.
6.0 ASSESSMENT OF FLOOD MECHANICS AND ASSOCIATED RISK

6.1 In accordance with the NPPF requirement, all forms of flooding must be considered within an FRA to satisfy the EA. The following is a review of the various types of flooding and an overview of their risk to the site, if any.

Fluvial Flooding

6.2 Fluvial flood sources include rivers, streams and ditches. In this case the Sawbridgeworth Brook will be the direct source of any fluvial flooding.

6.3 The Sawbridgeworth Brook is located along the eastern boundary of the site as shown in Appendix A.

6.4 As identified, EA flood mapping shows the majority of the site to be within Flood Zone 1 with a very small section of the site shown to be within Flood Zones 2 and 3. A copy of the EA flood maps is provided in Appendix D.

6.5 These flood maps reflect work undertaken by MTC who prepared detailed modelling of the Sawbridgeworth Brook and found the extent of Flood Zones 2 and 3 to be smaller than indicated in previous EA flood mapping. The relevant EA correspondence is contained in Appendix E whilst a copy of the MTC flood model is provided in Appendix F, which informed the updated EA flood mapping.

6.6 Any increase in flows from the site will result in increased flows into the Sawbridgeworth Brook which will impact on the extent of the flood zone. The site will be limited to at least greenfield run off flow rates and will therefore not increase flows offsite.

Groundwater Flooding

6.7 Groundwater flooding can occur when groundwater levels rise above existing ground levels. Groundwater flooding is most likely to occur in low-lying areas underlain by permeable aquifers. Periods of prolonged rainfall
may also be a cause of groundwater flooding with aquifers and soil becoming saturated.

6.8 The EA has advised that the site is located within a Zone 2 Groundwater Source Protection Zone.

6.9 The British Geological Society borehole logs contained in Appendix C show that no water was struck within the borehole to a depth of 22.4 metres. Based on this information it is unlikely that the site will be at risk from groundwater flooding.

**Tidal Flooding**

6.10 Tidal flood sources include the sea and estuaries, and tidal flooding is often caused by high tides and storm events. Tidal flooding can be extremely rapid and its effects severe; deep fast-flowing water can create an extreme hazard.

6.11 The site is located significantly inland and beyond the effects of tidal flooding. Therefore no risk from tidal flooding is anticipated.

**Surface Water Flooding/Overland Flows**

6.12 Surface water flooding (also known as overland flow flooding) is caused by rainfall levels exceeding the natural infiltration properties of the surrounding soils. It will occur where there is a lack of either a formalised drainage network or where there is no natural method of drainage (where soil infiltration rates are low, such as clayey soils, or there are no local watercourses). Surface water flooding can often cause ponding of water at low points or backing up of water behind obstructions.

6.13 The EA have advised that their records do not indicate that the site is an area susceptible to surface water flooding though request that the development proposals do not increase the risk of pluvial flooding through the increase in hardstanding areas by utilising sustainable drainage systems.
within the surface water design. A copy of the EA correspondence (dated 17th August 2012) is provided in Appendix E.

6.14 Surface water flows within the development site will require assessment at the detail design stage to determine the impact of overland flood flows.

**Sewer Infrastructure Flooding**

6.15 Flooding can occur due to the failure of an existing foul or surface water drainage system. Where flows within the drainage system exceed the system design capacity or foreign matter causes blockages, flooding at ground level may occur.

6.16 Thames Water is the sewerage undertaking for the area. Mapping received from Thames Water shows that there are both foul and surface water sewers serving the existing residential areas in close proximity to the site.

6.17 As the EA have indicated that no records exist of flooding to the site, it is assumed that these sewers function sufficiently and will not affect the proposed development.

6.18 The proposed development surface water drainage strategy will require design to avoid risk from flooding related to extreme events or blockage.

**Pollution to the Aquifer and Sawbridgeworth Brook**

6.20 The EA have advised the site is within a Groundwater Source Protection Zone. Consideration will be given to the EA document GP3, Groundwater Protection Policy to ensure the groundwater related to the site will not become polluted during and post construction. Elements of the main core objectives and aims of the policy are as follows:

- To ensure the needs of the environment and people are met;
• To manage the surface water and ground water as an integrated whole; and
• To use robust measures to prevent the pollution of groundwater.

6.21 The most common sources of pollution to the aquifer from any residential development is related to highway vehicles during construction, storage of chemicals on site during construction (e.g. oil) and highway traffic during the life of the development.

6.22 In addition, these pollutants along with general rubbish may find its way into watercourses through drainage systems.

6.23 Consideration will therefore be required to mitigate against these impacts during the design stage of the proposed development.

6.24 A summary of the identified risks are as shown below.

Table 1 - Summary of Risk

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<tr>
<td>Tidal</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Overland Flow</td>
<td>Low</td>
<td>Low (with mitigation)</td>
<td>Low (with mitigation)</td>
<td>Low (with mitigation)</td>
</tr>
<tr>
<td>Sewer Infrastructure</td>
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<td>Low</td>
<td>Low</td>
<td>Low (with mitigation)</td>
</tr>
<tr>
<td>Pollution</td>
<td>Low</td>
<td>Low (with mitigation)</td>
<td>Low (with mitigation)</td>
<td>Low (with mitigation)</td>
</tr>
</tbody>
</table>
7.0 MITIGATION MEASURES

Mitigation Against Flood Risk from the Proposed Development

7.1 With the development of any parcel of land, changes occur to the current drainage regime. The effects of these changes can be mitigated with appropriate design standards in accordance with current Government Policy and best practice.

7.2 As identified in Table 1, the proposed development can be provided with a low risk of flooding from the identified sources with the incorporation of mitigation measures to the following sources:

Fluvial Flooding

7.3 The MTC modelling shows a minimal degree of flooding to the site from the Sawbridgeworth Brook. As identified, any increase in surface water flows to the brook will impact on the extent of flood zones. To maintain the status quo, surface water runoff from the site will be restricted to Greenfield rates to minimise flood risk to the receiving watercourse and adjacent residential areas.

Overland Flows

7.4 The site slopes towards the Sawbridgeworth Brook and as such, overland flows will naturally follow this path.

7.5 The drainage system shall be designed to contain all surface water within the site and discharge at Greenfield runoff rates, thus minimising risk to the surrounding area.

Pollution to the Aquifer and Sawbridgeworth Brook

7.6 To provide the most sustainable drainage system, SuDS features will be incorporated into the development to provide a management and treatment
train of all surface water within the site. SuDS features such as permeable paving, swales and attenuation ponds will provide a high level of pollutant removal through settling and filtration processes.

7.7 In addition, the existence of significant layers of clay may reduce the likelihood of a contaminate pathway to the aquifer. Additional investigation will be required regarding existing ground conditions to enable the design of highways, drainage and building foundations.

7.8 The piped drainage system will comprise features such as trapped gullies and silt traps will allow for the collection and removal of debris prior to discharge from site.

7.9 The removal of debris from these features will be undertaken as part of an approved maintenance program.

7.10 In addition to the above, Sections 8.18 to 8.21 should be read in relation to pollution prevention.

Mitigation Against Flood Risk to the Development

Fluvial Flooding

7.11 As identified above, the site is subject to a very small degree of flooding from the Sawbridgeworth Brook. The restriction of surface water runoff from the site to Greenfield rates will minimise flood risk to the proposed development.

Overland Flows

7.12 To mitigate surface water flow, a formalised surface water drainage system will be installed, with gullies at low points to catch runoff. The drainage system will be designed with attenuation at source to contain all surface water within the drainage system up to the 1 in 100 year storm event plus 30% climate change.
7.13 During the detail design stage, flow paths shall be assessed for conditions of exceedance. This assessment will permit site levels and the drainage system to be designed to ensure surface water flows are routed to areas of lowest impact (i.e. highways or surface drainage systems).

**Sewer Infrastructure Flooding**

7.14 As indicated, the drainage system will be designed with attenuation at source to contain all surface water within the drainage system up to the 1 in 100 year storm event plus 30% climate change.

7.15 In addition, to deal with the residual risk of blockage to all on-site drainage features, the developer, local flood risk authority and SuDS Approving Body and/or adopting Water Company will ensure maintenance of their respective drainage system in line with the manufacturers’ recommendations by the production of a Maintenance Management Plan. This will ensure that over the lifetime of the proposed development the drainage system will be properly maintained to ensure proper functionality.

**Pollution to the Aquifer and Sawbridgeworth Brook**

7.16 As outlined above, the impact of the proposed development on the Brook and aquifer will be minimised as follows:

- SuDS features will provide a treatment train process in which pollutants are removed through settlement and filtration;
- The predominantly clay soils may inhibit the pollutant pathway to the aquifer; and
- Trapped gullies and silt traps will prevent debris from entering the Brook.

7.17 In addition to the above, Sections 8.16 to 8.21 should be read in relation to pollution prevention.
8.0 PROPOSED SURFACE WATER DRAINAGE STRATEGY

Stakeholder Responsibilities

8.1 The surface water drainage strategy will ultimately require approval from the Environment Agency and East Herts District Council as the lead local flood authority and default SuDS ‘Approving Body’.

8.2 The SuDS ‘Approving Body’ will be required to adopt and maintain the drainage system upon satisfactory completion. Where a publically maintained road forms part of the drainage system, the road maintaining authority (the local highway authority) must exercise its functions in accordance with the approved drainage plan and under the responsibilities identified in The Highways Act 1980.

8.3 Thames Water will have regard to relevant local and regional strategies and guidance in exercising any flood risk management functions.

Design Principles and Surface Water Strategy

8.4 The current planning policy document NPPF and Environment Agency guidance requires developments to employ Sustainable Drainage Systems (SuDS) techniques in the management of site run-off and surface water drainage. Careful design of SuDS features can ensure that the site storm water drainage closely reflects the natural hydrology and hydrogeology of the site.

8.5 The key benefits of the proposed SuDS on-site are as follows:

- Improving water quality over a conventional piped system by removing pollutants from diffuse pollutant sources (e.g. roads).
- Improving amenity through the provision of open green space and wildlife habitat.
• Enabling a natural drainage regime which recharges groundwater and water courses (where possible).

8.6 The Flood and Water Management Act 2010 (FWMA) has amended Section 106 of the Water Industry Act to remove the automatic right to connect surface water to a public sewer without prior consideration of SuDS.

8.7 Based upon a desktop study of the site conditions, it is anticipated that the site may not be suitable for the utilisation of infiltration drainage techniques.

8.8 As existing surface levels fall towards the Sawbridgeworth Brook, it is anticipated that the development drainage system will continue to outfall site generated surface water to the Brook.

8.9 Attenuation will be provided through the provision of ponds, swales and permeable paving. Where necessary, online storage will be provided within the piped system as the lowest priority.

8.10 To aid in the conservation of water resources, butts will be provided where practicably possible.

8.11 All surface water drainage systems, including SuDS features, will be designed to cater up to the 1 in 100 year plus an allowance of 30% for climate change.

8.12 Greenfield runoff rates have been calculated using the Windes suite of design software. Based upon the Flood Studies Report method the following rates have been determined:

- Qbar – 39.8 l/s
- 1 year – 33.8 l/s
- 30 year – 90.1 l/s
- 100 year – 126.9 l/s
8.13 Copies of the Windes calculations are contained in Appendix G.

8.14 Preliminary calculations show that based upon the Qbar rate, a storage volume of between 4882m$^3$ to 6385m$^3$ will be required for the 1 in 100 year event with 30% climate change.

8.15 The above figures are indicative at this stage of the planning process and subject to the completion of appropriate soakage testing; the surface water drainage design is to be amended accordingly. In addition, the consideration of complex controls at the outfalls to the Sawbridgeworth Brook should be investigated at the detail design stage.

8.16 An outline drainage strategy is contained in Appendix H.

Ecology

8.17 The proposed attenuation ponds and swales will provide the opportunity to create natural habitats which will contribute to the overall biodiversity and aesthetic nature of the proposed development.

Contamination

8.18 The contractor will be advised on the removal of any hotspots of contaminated ground established through an intrusive soil investigation. Construction works must be undertaken in a manner to prevent pollution to the groundwater. Contractors are to make reference to current legislation, planning policy and Environment Agency guidelines in respect of construction pollution prevention and working on ground above an aquifer.

8.19 All stocks of materials, oils and fuels are to be stored in a manner preventing spillage and seepage to ground. Wastewater will not be freely discharged to the ground or watercourses. All hydrocarbons and chemical spillages will be contained and thoroughly cleaned by excavation of the polluted ground and disposed of to a licensed waste depot.
8.20 The Groundwater Directive (80/68/EEC) aims to protect groundwater from pollution by controlling discharges and disposals of certain dangerous substances to groundwater. In the UK, the directive is implemented through the Environmental Permitting Regulations (EPR) 2010 (EA Website, 2011).

8.21 The list of guidelines below are initial recommendations and not exhaustive. It will be the responsibility of the contractor to ensure they obtain and understand the latest legislation and guidelines.

9.0 CONCLUSIONS

9.1 The proposed development can be located wholly within Flood Zone 1 and satisfies the requirements of NPPF with regard to flood risk, surface water management and the Sequential Test.

9.2 Fluvial, groundwater, tidal, drainage system and overland flow flooding have been considered and have been shown to not pose a significant hazard to the development.

9.3 The proposed development will not increase flood risk to the surrounding area.

9.4 Current information indicates that the site may not be suitable for infiltration drainage, however soakage testing should be undertaken prior to the detail design stage to accurately determine infiltration possibilities.

9.5 A Surface Water Drainage Strategy can be provided which incorporates SuDS techniques such as water harvesting water butts, cellular storage, permeable paving and attenuation basins providing on-site attenuation, treatment, infiltration and conveyance. These SuDS systems will provide areas of aesthetic beauty and ecological opportunity.

9.6 Through the use of trapped gullies and silt traps combined with SuDS systems hydrocarbons and pollutants will be removed prior to outfall to the Sawbridgeworth Brook. Protection from pollution will also be provided to the aquifer.

9.7 The on-site sustainable drainage system will be designed to cater for flood events up to and including a 1 in 100 year storm event plus 30% climate change and will not present an increased flood risk to the site or surrounding properties.
9.8 In respect of the residual flood risk of drainage system blockage, drainage system maintenance will be adhered to by the relevant lead local water authority and/or the SuDS ‘Approving Body’ through the implementation of an approved maintenance management plan. This will ensure that over the lifetime of the proposed development the drainage system will be properly maintained to ensure proper functionality.

9.9 This Flood Risk Assessment has demonstrated that the Land to the South of West Road is ideally suited for the provision of a residential development in terms of flooding and drainage and can meet the requirements of Local Plan Policy SAWB3.
APPENDIX A

Site Location Plan
APPENDIX B

Thames Water Asset Plans
Asset Location
Search

Thames Water Property Searches
12 Vastern Road
READING
RG1 8DB

Search address supplied
Chalks Farm
Chalks Farm
Sawbridgeworth
Hertfordshire
CM21 0DH

Your reference
12-039 Chalks Farm, Sawbridgeworth

Our reference
ALS/ALS/24/2012_2310094

Search date
6 September 2012

You are now able to order your Asset Location Search requests online by visiting www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13
T 0845 070 9148
E searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 547 2147 50.

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The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search Sewer Map - ALS/ALS/24/2012_2310094
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 547250,215250.

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

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<td>821B</td>
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</table>

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.
ALS Sewer Map Key

**Public Sewer Types** (Operated & Maintained by Thames Water)

- **Foul**: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
- **Surface Water**: A sewer designed to convey surface water (e.g., rain water from rooftops, yards, and car parks) to rivers or watercourses.
- **Combined**: A sewer designed to convey both waste water and surface water from domestic and industrial sources to treatment works.

**Sewer Fittings**

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Dam Chase
- Fitting
- Meter
- Vent Column

**Operational Controls**

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Control Valve
- Drop Pipe
- Ancillary
- Weir

**End Items**

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Outfall
- Undefined End
- Inlet

**Other Symbols**

Symbols used on maps which do not fall under other general categories

- ▲ / ▼ Public/Private Pumping Station
- ✦ Change of characteristic indicator (C.O.C.I.)
- □ Invert Level
- ▲ Summit

**Areas**

Lines denoting areas of underground surveys, etc.

- Agreement
- Operational Site
- Chamber
- Tunnel
- Conduit Bridge

**Other Sewer Types** (Not Operated or Maintained by Thames Water)

- Foul Sewer
- Surface Water Sewer
- Combined Sewer
- Gulley
- Culverted Watercourse
- Proposed

**Notes:**

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) ‘na’ or ‘0’ on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.
IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:
- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code’s core principles
Firms which subscribe to the Search Code will:
- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints
If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm’s final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details
The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE
APPENDIX C

British Geological Survey Borehole Logs
### Glacial Sand and Gravel

#### a. "Clayey" pebbly sand, clayey sand grading to gravel.
- Sand: medium to fine, with a trace of fine, predominantly rounded quartz, with a trace of angular quartz, fine gravel, fine sand and silt; coarse, mixed, occasional, rounded gravel, with some chalk, and a trace of rounded quartz, with a trace of sandstone.

#### b. "Sand" pebbly silt.
- Sand: medium to fine, with a trace of fine, predominantly quartz, with a trace of gravel; fine gravel, fine sand and silt; bounding to rounded gravel, with some rounded quartz and sandstone, with a trace of sandstone.

### London Clay
- Clay, silty, brown, firm.
- Clay, silty, grey, firm.
- Clay, silty, grey, firm.

### Sediment Thickness and Depth

<table>
<thead>
<tr>
<th>Sediment Type</th>
<th>Max Depth (m)</th>
<th>Min Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>0.8</td>
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### Grading

#### Mean for depth

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<th>Silt Percentage</th>
<th>Clay Percentage</th>
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### Compaction

#### Depth below surface (cm)

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<th>Flint</th>
<th>Quartz and Sandstone</th>
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<tbody>
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<td>7</td>
<td>70</td>
<td>17</td>
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</table>

### Additional Notes

**Report an issue with this borehole**

### Geology

**Locality**: 4710 1548 Jumble Lodge, Sawbridgeworth

**Surface level**: +66.2 m

**Water not struck**

**Shell 152 mm Diameter**

**October 1975**

#### Lithology

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<tr>
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<tr>
<td></td>
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#### Gradation

| Fraction | Gravel
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<tr>
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### Composition

#### Depth below surface (m)

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APPENDIX D

Environment Agency Flood Maps
Updated Flood Zones for Chalks Farm created 13/08/2013

Legend
- Main Rivers
- Flood Zones
  - Flood Zone 3
  - Flood Zone 2

Flood Map Areas (assuming no defences)
Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Produced by:
Partnerships & Strategic Overview
South East (Luton, Herts and Essex)
Flood Map for Surface Water 1 in 30 created on 17 September Ref:NE32189MR

Legend

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Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Flood Likelihood (taking into account defences)

Low: The chance of flooding each year is 0.5% (1 in 200) or less.
Moderate: The chance of flooding each year is 1.3% (1 in 75) or less, but greater than 0.5% (1 in 200).
Significant: The chance of flooding each year is greater than 1.3% (1 in 75).

Outside Blue Areas: Generally this means that the chance of flooding each year from rivers or the sea is less that 0.1% (1 in 1000).

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk
Legend

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Scale 1:10,001

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Flood Likelihood (taking into account defences)

Low: The chance of flooding each year is 0.5% (1 in 200) or less.

Moderate: The chance of flooding each year is 1.3% (1 in 75) or less, but greater than 0.5% (1 in 200).

Significant: The chance of flooding each year is greater than 1.3% (1 in 75).

Outside Blue Areas: Generally this means that the chance of flooding each year from rivers or the sea is less that 0.1% (1 in 1000).

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk
Surface water map centres on CM21 0DH Ref: NE32189MR 17 Sept 2012

Legend

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Scale 1:15,000

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Areas Susceptible to Surface Water

- Less
- Intermediate
- More
- Out of range
APPENDIX E

Environment Agency Correspondence
Flood Risk Modelling and Hydrology Model Review

Site: Chalks Farm, Sawbridgeworth

Items reviewed: Hydraulic Modelling Report for Land in the Vicinity of Chalks Farm, Sawbridgeworth, and HEC-RAS model

Date of Review: 08/08/2012

Approval Status: Approved (subject to the comments below)

Hydraulic Model –

Please confirm if a sensitivity test has been carried out on the downstream boundary and report the findings.

There is glass walling in the model just upstream of the bridge at the top of the model. Although this does not appear to affect the flood extents at the site, the modelling cannot be used to update the Flood Map.

Action: Provide results of downstream boundary tests.

Hydrology –

The ReFH method has been used to calculate the inflows to the model without any justification of the choice of method. We usually require a few different hydrological methods to be calculated and compared and the results from the most appropriate method used in the hydraulic modelling.

In this case, the calculated inflows are reasonable when compared with other studies. In future studies however, other methods and justification for the choice of method will be required.

Action: Please justify the use of the ReFH method.

Update 20th September 2012

More information has been provided relating to the hydrology and the sensitivity testing. The above actions and queries have been addressed and the model is considered suitable for use in assessing flood risk to the site.
For use in the Flood Map the flood outlines could be improved by intersecting the modelled water levels with a finer resolution terrain model such as LiDAR data.

To enable Flood Zone 2 to be updated however, a 0.1% AEP event will also be required. Flood Zone 2 is created from a combination of the worst historical flood event outline and the 0.1% AEP event.

The flood outlines would need to be provided in GIS format to enable the information to be incorporated into the Flood Map. In many locations only one side of the flood outline has been presented. Is this because the water level is within the channel on the opposite bank? A complete flood outline is required to be entered into the Flood Map.
K Mitchell Esq.,
Planning Liaison Officer,
Environment Agency,
Thames North East Area Office
Apollo Court, 2 Bishops Square Business Park
St Albans Road West,
Hatfield, Hertfordshire,
AL10 9EX

Dear Mr Mitchell,

Re: Chalks Farm, Sawbridgeworth

Thank you for your response to the revised Hydraulic Modelling Report produced in relation to the above site, confirming that following the additional information provided the model is now considered suitable for use in assessing the flood risk to the Chalks Farm site.

The model was produced to aid the Local Development Framework process of East Hertfordshire District Council, who had initial concerns related to the extent of Flood Zone 3 along the eastern edge of the Chalks Farm site. They considered this to be an approximately 50m wide band based upon the Jflow modelling which was the only source of information available at the time. I attach an extract detailing their flood related concern at Chalks Farm, which is the Sawbridgeworth West (B) site.

I note you require the flood lines on both banks to be provided in GIS format in order to allow this information to be incorporated into the Flood Map. With regards the flood line on the western bank, the site sections show this to remain within bank (as can be seen from the sections provided in the modelling report), however as only the section data was available rather than spot levels along the length of the western bank the flood lines were only drawn on the plan in the northern area where levels were available on West Road.

Whilst we can run a 1 in 1000 year model to establish the Flood Zone 2 extent, draw the western flood lines according to the cross section level data, and provide data in GIS format in order to incorporate this data into the Flood Map, this will take a little time. However, East Hertfordshire District Council are requesting that information related to sites being considered under the Local Development Framework be provided for consideration by Friday 28 September.

As such, in the mean time I would be grateful if you could confirm to East Hertfordshire District Council prior to the 28th September that an acceptable hydraulic model assessing the flood risk to the Chalks Farm site has been produced, which successfully demonstrates that the true extent of the 1 in 100 year flood plain on the site is as indicated on Drawings 1244-06 Rev A and 1244-07 Rev A, copies of which are attached.
This is of particular importance as the accepted model demonstrates that the 1 in 100 year flood zone does not form a 50 metre wide band along the eastern edge of the site, but in fact remains in bank and therefore does not give rise to the access concerns raised. Hence the site should be given a classification of green rather than amber with regards flooding according to the East Hertfordshire District Council traffic light system.

I have copied in ............... at East Hertfordshire District Council, to whom confirmation of the current situation should be sent, and would be grateful if you could copy ourselves in on your response.

Yours sincerely

Michael J Brindley
For and on behalf of
Michael Thomas Consultancy LLP

Enc.
Dear Mr Mitchell,

Re: Chalks Farm, Sawbridgeworth

Further to your response in relation to the hydraulic model produced in relation to the above site, we are in the process of running the model with a 1 in 1000 year flow to establish the Flood Zone 2 boundary.

As the FSR/FEH spreadsheet is not calibrated for events in excess of a 150 year return period, and other methods (the catchment descriptors method) produce lower flows, we are proposing to apply a growth factor to the agreed 1 in 100 year flow hydrograph previously agreed to model the 1 in 1000 year simulation.

To calculate an applicable growth factor we have used existing Environment Agency flow data for the River Lee in Sawbridgeworth, a copy of which is attached. The most applicable nodes are considered to be MSR082u and MSR083d, where the full flow within the River Lee is confined to one main channel, and does not occupy flood plain.

The 1 in 100 year flow at these nodes is 25.32 Cumecs, whilst the 1 in 1000 year flow is 36.61 Cumecs, which is equivalent to 1.45 times the 1 in 100 year flow. Checking the total flow at places where the river flow is split between two channels (i.e. either node MSR083u, MSR 084d or MSR 084u plus either node SA001, SA002d, SA002u, SA003, SA004d or SA004u) shows the same growth factor of 1.45 between the 1 in 100 year and 1 in 1000 year flows.

Given that the watercourse at Chalks Farm is part of the River Lee system, we consider that the same growth factor between the 1 in 100 and 1 in 1000 year flows as used by the Environment Agency for the River Lee in Sawbridgeworth should also be applicable to the Chalks Farm watercourse.

As such would be grateful if you could confirm that applying a growth factor of 1.45 to the previously agreed 1 in 100 year flow hydrographs is an acceptable method of modelling the 1 in 1000 year event.
Also, I note you require the data to be provided in GIS format. I believe providing the modelled Flood Zone boundaries in an AutoCAD .dwg file to national coordinates is suitable to import, but perhaps you could confirm this please.

I look forward to receiving a response in the near future in order that we can run the 1 in 1000 year model and provide the Flood Zone 2 boundary details for your use.

Yours sincerely

Michael J Brindley
For and on behalf of
Michael Thomas Consultancy LLP

Enc.,
The following information has been extracted from the Upper & Middle Stort Flood Mapping Model (Halcrow, 2010)

**Caution:**
Although this is a detailed model, please be aware that it was not originally created to assess flood levels at particular development sites.

All flood levels are given in metres Above Ordnance Datum (mAOD)
All flows are given in cubic metres per second (cumecs)

### MODELED FLOOD LEVEL

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Dear Nick

Pre-application enquiry for a residential development at Chalks Farm, Sawbridgeworth, Hertfordshire.

Thank you for consulting us at this early stage we appreciate the opportunity to comment and hope that you can take our comments on board to ensure the planning process proceeds smoothly.

Flood Risk
A small section of the site currently lies in flood zones two and three adjacent to the Sawbridgeworth Brook. However as you are aware the current revised modelling has shown that the risk in this area is less then indicated and when your modelling is finalised and our flood maps have been updated the situation may be mostly flood zones one and two although at this stage this is still subject to change.

We would expect that the site was designed sequentially with housing located outside of the flood zones. Depending on the final outcome of the modelling you may be required to carry out the sequential and exceptions test in conjunction with East Herts LPA. A Flood Risk Assessment will be required at the planning stage either way.

If the site is located within the flood plain it will need to ensure that there is no flood risk on or off site, should the site be located entirely in Flood Zone 1 We will require a surface water Flood Risk Assessment.

In either case we would want you to achieve greenfield run off rates for the whole site and on-site attenuation up to and including the 1 in 100 year plus climate change critical storm. We would also expect you to maximise the use of Sustainable Drainage System (SuDS) in line with the SuDS hierarchy.

The FRA should show how Sustainable Drainage Systems (SuDS) such as green roofs, ponds, swales and permeable pavements are to be implemented to alleviate surface water runoff and increase attenuation. I have attached a copy of our SuDS guidance, which contains the SuDS hierarchy, to help you with your designs. The methods at the top of the hierarchy are preferred because they are mutually beneficial in terms of sustainability and biodiversity.
The hierarchy should be used in descending order, with any obstacles to the use of SuDS methods clearly justified. The bottom of the hierarchy should only be used as a last resort.

**Sawbridgeworth Brook**

The Swabridgeworth Brook is designated a main river. We will expect you to seek to protect and enhance the watercourses in line with the Thames River Basin Management Plan. We will require a minimum of an eight metre buffer from the top of bank. This buffer should be free from any structures and planted with native species to encourage biodiversity and reduce flood risk.

Please be aware that our prior written consent is required for any proposed works or structures, in, under, over or within eight metres of the top of the bank. This is under the terms of the Water Resources Act and the Thames Region Land Drainage Byelaws. For further information on obtaining a Flood Defence Consent please contact us.

**Contamination**

A key factor to take into account whilst looking at the SuDS to be used is whether the site will have a potentially contaminating use or whether it has previous contamination from a former land use. This may affect whether infiltration methods within the hierarchy can be used. Although the majority of the site is greenfield and thus not likely to be a problem the area of the existing farm may have caused pollutants to enter the ground and as a minimum a preliminary risk assessment (PRA) should be carried out to determine potential sources and receptors of pollution to groundwater, and you should consult Section 4 of our *Groundwater Protection: Policy and Practice (GP3)* for how this could impact on surface water drainage.

**Water Resources**

As this development will be located within an area of serious water stress due to limited water resources in the local area and high and growing demand for water. We strongly suggest you investigate the use of water efficiency measures and aims to achieve 105 litres/head/day (l/h/d), equivalent to level 3/4 for water within the Code for Sustainable Homes.

Achieving a water efficiency standard of 105l/h/d within new homes can be accomplished at very little extra and typically only involves low/dual flush toilets, low flow/aerated taps and showerheads and efficient appliances (dishwasher and washing machines) and does not require more expensive rain or greywater technologies.


More information about water efficiency can be found on our website [www.environment-agency.gov.uk/savewater](http://www.environment-agency.gov.uk/savewater)

We believe you have the opportunity to create a flagship sustainable development for your borough and would encourage you to take every opportunity to make this the case.

Should you have any queries please do not hesitate to contact me.

Yours sincerely
Mr Kai Mitchell
Planning Liaison Officer

Direct dial 01707 632388
Direct e-mail SPHatfield@environment-agency.gov.uk
Dear Mr Dyde

Enquiry regarding site at National Grid Reference  547652, 215100 (nearest postcode CM21 0DH).

Thank you for your enquiry.

We do not hold any modelled flood levels relevant to this site.

The site in question is outside any known main river flood plain. This means that the chance of river flooding is less than 0.1% in any given year. I have no record of river flooding at this site.

We have had no reports of groundwater flooding in this area logged on our database.

The surface water maps currently available give an indication of the broad areas likely to be susceptible to surface water flooding, excluding building and drainage information. They are not suitable for use at an individual property scale due to the method used to create them. It is our aim to produce maps that can be used for individual property purposes, but the process has not yet been completed.

We advise you to contact the local water company regarding previous or potential flooding from sewers. You may also wish to contact the local authority regarding flooding from any non-main rivers, sewers or surface water runoff.

Source Protection Zone

The site in question falls within a Zone 2 groundwater Source Protection Zone (SPZ). These zones show the risk of contamination of a public water supply (taken from an abstraction borehole) from any activities that might cause pollution in the area. We use the zones in conjunction with our Groundwater Protection Policy to set up pollution prevention measures in areas which are at a higher risk. They also help us to monitor the activities of potential polluters nearby.
The shape and size of a zone depends on the condition of the ground, how the groundwater is removed and other environmental factors. We divide groundwater source catchments into three zones based on how long it takes pollution to move through groundwater to the abstraction borehole.

Zone 2 is the area in which pollution takes up to 400 days to travel to the borehole. This is the minimum amount of time that pollutants need to be diluted and reduced in strength before they reach the borehole. We must therefore limit the amount of discharges to groundwater in this area, and monitor any activities that are likely to cause pollution.

The site in question lies over a non-aquifer; therefore the groundwater is not able to sustain abstractions.

I forwarded the pre-planning application form on to Kai Mitchell in our Sustainable Places team on 13 September. Kai will provide a response to you directly with regard to planning criteria.

We would be really grateful if you could spare five minutes to help us improve our service. Please click on the link below and fill in our survey – we use every piece of feedback we receive: https://feedback.environmentagency.uk.com/s/l/n9dsBSh2Gdz7Bp?ssp_reg=South_East&ssp_ar=NE_Tham

If I can be of any further help, please contact me.

Yours sincerely

Michelle Robbins
External Relations Officer
Direct dial 01707 632319
Direct fax 01707 632 610
Direct email NETenquiries@environment-agency.gov.uk

Tell us how you want to be involved in improving your local water environment. View and respond to the consultation online at https://consult.environment-agency.gov.uk/portal/ho/wfd/working/together2012. The consultation closes on the 22 December 2012.
APPENDIX G

Micro Drainage Calculations
ICP SUDS Mean Annual Flood

Input

Return Period (years) 1 Soil 0.400
Area (ha) 14.000 Urban 0.000
SAAR (mm) 600 Region Number Region 6

Results l/s

QBAR Rural 39.8
QBAR Urban 39.8
Q1 year 33.8
Q100 years 126.9
Windes Outline Storage Estimate

**Quick Storage Estimate**

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**Results**

Global Variables require approximate storage of between 4682 m² and 6385 m³. These values are estimates only and should not be used for design purposes.
APPENDIX H

Drainage Strategy Plan
SITE DRAINAGE TO INCORPORATE SWALES, PONDS AND PERMEABLE PAVING AS MUCH AS PRACTICALLY POSSIBLE.

SOAKAGE TESTS TO BE UNDERTAKEN TO DETERMINE ABILITY OF GROUND CONDITIONS TO SUPPORT INFILTRATION TECHNIQUES.

OUTFALLS TO LIMIT FLOWS TO THE SAWBRIDGEWORTH BROOK TO GREENFIELD RATES.