CASCADE

Letchworth Garden City Heritage Foundation

Housing Development Technical Report - Hydrology and Flood Risk Assessment

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Produced By	**Authorised for Release By**
K Pearson	Thomasine Rudd
.....	.....
Katie Pearson	**Dr Thomasine Rudd**
Senior Environmental Scientist	**Director**

CONTACT DETAILS

CASCADE CONSULTING
The Courtyard
Ladycross Business Park
Hollow Lane
Dormansland
Surrey
RH7 6PB

Tel: 01342 871 659

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EXECUTIVE SUMMARY

The hydrology and flood risk technical appraisal report is required to provide the Letchworth Garden City Heritage Foundation Board with information on the constraints and opportunities associated with the potential development site to enable them to make a decision on the site and to provide information to the local community.

There is no risk of flooding to the development site from rivers or the sea and a low risk from groundwater and surface water (rainfall runoff), which will need to be considered further at the detailed design stage. There will be a significant increase in the volume and amount of rainwater runoff from the developed site due to increased areas of hard surfaces, and therefore a surface water management strategy will be needed to prevent this causing flooding further downstream. This should focus on using sustainable urban drainage methods to ensure that the amount and rate of runoff from the developed site is no greater than from the existing Greenfield site, and may include storage ponds or underground tanks. A full Flood Risk Assessment for the site would be required to support any planning application for the development.

1 INTRODUCTION

1.1 BACKGROUND

Letchworth Garden City Heritage Foundation is a self-funding charitable organisation with a significant landholding in Letchworth Garden City. The Heritage Foundation manages its property portfolio to generate income which is invested back into the community for the long term benefit of Letchworth Garden City.

North Hertfordshire District Council identified a number of potential housing development sites in their Local Development Framework for 2011 to 2031, which underwent consultation in early February 2013. Land to the north of Letchworth Garden City was included within this consultation. In addition to the land identified by North Hertfordshire District Council, Letchworth Garden City Heritage Foundation has identified additional sites with potential to support housing growth, which are identified on **Figure 1.1**. This study is concerned with land parcels 4 and 10 to the north and west of the Grange Estate.

Cascade Consulting was commissioned by Letchworth Garden City Heritage Foundation to provide the Foundation's Board with a strategic understanding of the key hydrology and flood risk constraints to this potential development. This information is required by the Board to enable them to identify whether or not they can support the development proposals. Therefore, the study has sought to identify potentially significant constraints within the study area and environmental impacts which could arise as a result of these development proposals for the site.

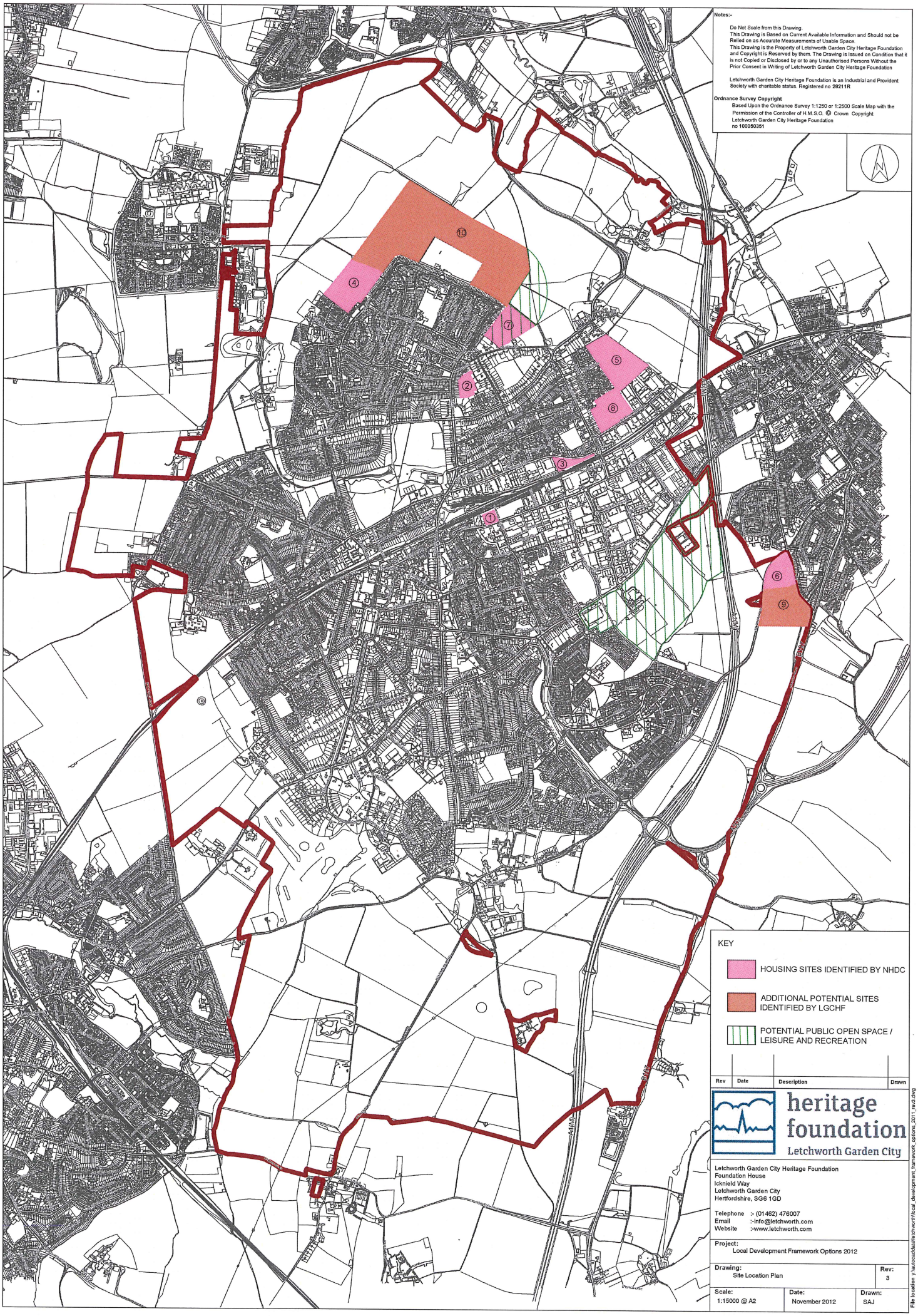
A review of the Environment Agency Flood Map (online) shows that the site is at low risk of flooding from rivers and the sea and therefore the hydrology and flood risk assessment will cover other sources of flooding, primarily surface water and groundwater. Despite the low risk, a Flood Risk Assessment (FRA) would be required by the National Planning Policy Framework (NPPF) with any planning application due to the size of the site.

The main focus of this appraisal is on surface water to understand the level of existing risk, to present the constraints and requirements for surface water management on site (both in terms of quantity and quality) and to suggest broad options for managing surface water on what is currently a Greenfield site.

1.2 STUDY AREA

The flood risk and hydrology appraisal was also predominantly focussed on the potential development site with consideration given to downstream areas to ensure

that the development would not increase flood risk to people, property and infrastructure downstream.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KEY
HOUSING SITES IDENTIFIED BY NHDC
ADDITIONAL POTENTIAL SITES IDENTIFIED BY LGCHF
POTENTIAL PUBLIC OPEN SPACE / LEISURE AND RECREATION
Rev
Date
Description
Drawn
heritage foundation
Letchworth Garden City
Letchworth Garden City Heritage Foundation
Foundation House
Icknield Way
Letchworth Garden City
Hertfordshire, SG6 1GD
Telephone :- (01462) 476007
Email :-info@letchworth.com
Website :-www.letchworth.com
Project:
Local Development Framework Options 2012
Drawing:
Site Location Plan
Rev:
3
Scale:
1:15000 @ A2
Date:
November 2012
Drawn:
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2 EXISTING CONDITIONS

The development site is located in an area of agricultural land (arable farmland) to the north of Letchworth Garden City in Hertfordshire. The site is predominantly farmland with some features including hedgerows, linear tree lines and woodland copses of mature trees.

The site lies within the catchment of the Great Ouse in the Environment Agency's Anglian Region. The nearest watercourses to this site are the Pix Brook and the River Ivel. Pix Brook is the closer of these two watercourses to the development site and at its closest point lies approximately 400m from the site. The principal source of flow into these two watercourses appears to be urban surface water drainage. A review of the local topography (OS contours and site walkover) suggests that this site lies across the watershed between these two catchments. The western and northern parts of the site appear to drain north-westerly towards the Pix Brook and the eastern part is expected to drain in a north-easterly direction down to the River Ivel. The confluence of the River Ivel and the Pix Brook is to the north of the site, from where the River Ivel flows in a northerly direction through Biggleswade and onwards.

Letchworth Sewage Treatment Works (STW) is located a short distance south west of this proposed development on the Pix Brook. At the time of preparing the North Hertfordshire District Council Strategic Flood Risk Assessment[1] (NHDC SFRA 2008, Anglian Water confirmed that there was sufficient capacity within the STW to accommodate the growth in population predicted over the period covered by the Local Plan that the 2008 SFRA was supporting (i.e. 2006-2021). This is still expected to be the case but should be confirmed with Anglian Water as part of the detailed development of a planning application for the site. There is a flood storage reservoir and flood gates on the Pix Brook adjacent to the Letchworth STW which is managed by the Bedfordshire and River Ivel Internal Drainage Board (IDB) and reduces risk to downstream urban areas in mid-Bedfordshire.

The site is underlain by chalk bedrock with overlying drift deposits of till and alluvial clay, silt and sand and glacial sands and gravel[2]. This geology is likely to have some permeability but this will vary locally depending on the composition of the drift deposits. To the north of Letchworth Garden City soils are typically lime-rich, loams and clays with impeded drainage[3]. These soils are quite clayey, highly fertile and suited to arable land uses. This desktop review suggests that the soils and geology of

[1] http://www.north-herts.gov.uk/index/environment_and_planning/planning/planning_policy_and_projects-2/evidence_base/strategic_flood_risk_assessment-2.htm
[2] https://www.bgs.ac.uk/data/mapViewers/home.html
[3] https://www.landis.org.uk/soilscapes/

the site are not highly permeable and therefore are unlikely to be suited to infiltration based SuDS[4] methods for surface water management (see below for further information).

[4] Sustainable drainage systems

3 SCOPE OF APPRAISAL

This appraisal has been undertaken to review readily available information relating to hydrology and flood risk for this existing Greenfield site on the north of the town. The appraisal has reviewed the existing planning context in relation to hydrology and flood risk at a national, regional and local scale. The technical appraisal covers all sources of flood risk with the potential to impact on this site. The outcomes of this appraisal will inform the scope of Flood Risk Assessment required to support any planning application for the site and may also be of potential use in any scoping required as part of an Environmental Impact Assessment (EIA) for the site.

This initial technical appraisal does not include any detailed assessment or calculations of surface water runoff from the site. The appraisal sets out the requirements of the Environment Agency and local planning authority on the management of surface water and some strategic level suggestions of the types of measures that could be used in the development to manage surface water (covering quantity and quality).

This technical appraisal does not constitute a full Flood Risk Assessment of the site as required by the National Planning Policy Framework. As described in this report, a full FRA will be needed to support any planning application for the site. This initial technical appraisal can form the starting point of the FRA and much of the background information within it could be used in a FRA but further development and analysis would be required, including quantification of surface water runoff rates and volumes from the site pre and post-development.

4 PLANNING CONTEXT

This section provides a brief overview of the national and local planning context relating to flood risk and development. A more detailed review of the planning policy and guidance would be required as part of any Flood Risk Assessment prepared to support development on the site.

4.1 NATIONAL

The National Planning Policy Framework requires that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at higher risk, but where development is necessary, making it safe without increasing flood risk elsewhere. The National Planning Policy Framework requires local authorities, in the preparation of Local Plans, to apply a sequential, risk based approach to the location of development.

The Technical Guidance to the National Planning Policy Framework [5] sets out the requirements for a site specific Flood Risk Assessment. The Technical Guidance has also been used to inform this appraisal and should also be referred to in the preparation of a Flood Risk Assessment to accompany any planning applications submitted for this development. The overall aim of the National Planning Policy Framework technical guidance is to steer development into areas of low risk, i.e. Flood Zone 1 (low probability of flooding).

To meet the requirements of National Planning Policy Framework, the local planning authority will be required to demonstrate the application of the Sequential Test (i.e. the steering of new development into areas of low flood risk). This development would not require the application of the Exception Test as it is wholly located within Flood Zone 1, (low probability of flooding) and all development types are considered appropriate in Flood Zone 1[6].

4.2 LOCAL

Following adoption of the National Planning Policy Framework, North Hertfordshire District Council (NHDC) is now working on the preparation of a new Local Plan. The Council has saved most policies from earlier versions of the plan, except where there are inconsistencies with the National Planning Policy Framework. Development Policy 8 of the NHDC Development Policies: Preferred Options[7] (September 2007)

[5] Technical Guidance to the National Planning Policy Framework, Communities and Local Government, March 2012.
[6] Technical Guidance to the National Planning Policy Framework, Communities and Local Government, March 2012.
[7] http://www.north-herts.gov.uk/02._development_policies_preferred_options_september_2007.pdf

covered Water Resources and of particular concern to this site is the section which states:

"To assist in the reduction of water consumption and runoff, development proposals must include sustainable drainage solutions and must demonstrate that the highest levels of water efficiency possible for the site have been achieved."

This policy is referred to in the North Hertfordshire District Council Strategic Flood Risk Assessment which provides further interpretation and guidance on the use of sustainable drainage solutions. The Strategic Flood Risk Assessment states that SuDS should be designed to take into account surface water runoff quantity, rates and water quality ensuring their effective operation up to and including the 1 in 100 year design event (including an allowance for climate change). SuDS techniques should seek to contribute to the three goals of reducing flood risk (on site and downstream); reducing pollution; and providing landscape and biodiversity benefits. The Strategic Flood Risk Assessment provides further information on the feasibility of infiltration based SuDS measures across the local authority area and guidance on suitable methods where infiltration may not be possible. This is referred to below in discussion about the opportunities for surface water management on this development site.

5 HYDROLOGY AND FLOOD RISK APPRAISAL

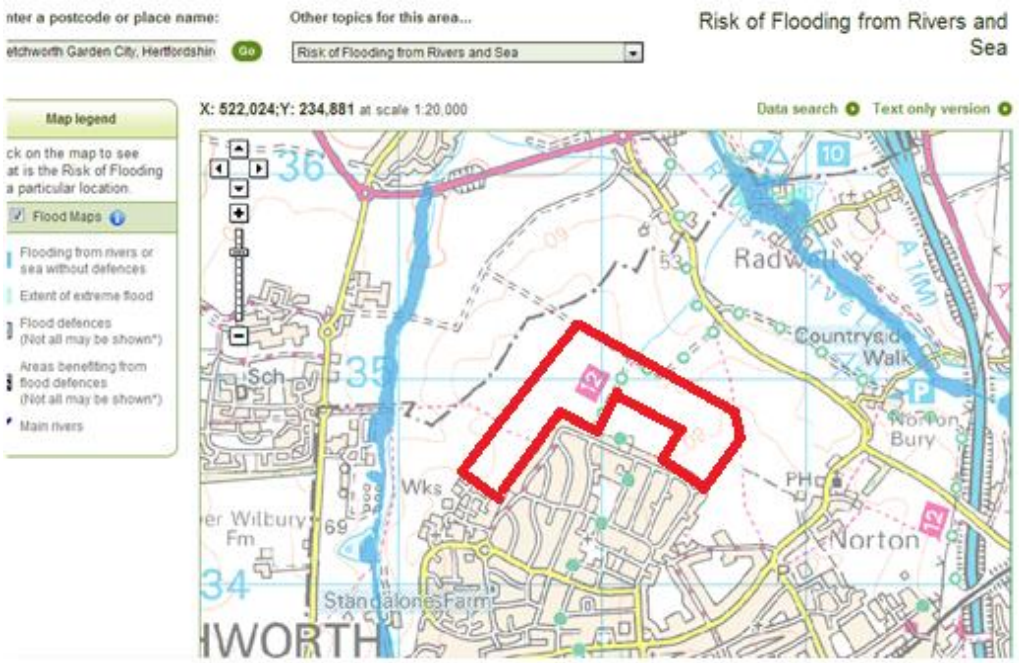
5.1 DATA SOURCES

The primary sources of data used to inform this appraisal have been the Environment Agency online flood map, North Hertfordshire District Council Strategic Flood Risk Assessment and Hertfordshire County Council Preliminary Flood Risk Assessment. Consultation with the Environment Agency, North Hertfordshire District Council, Hertfordshire County Council, Bedfordshire and River Ivel Internal Drainage Board and Anglian Water would be required as the design of the site progresses and in the preparation of a full Flood Risk Assessment.

5.2 FLUVIAL AND TIDAL FLOOD RISK

The Environment Agency Flood Map (online) shows that the proposed development site is in Flood Zone 1 and has a low risk of flooding from either rivers or the sea, see **Figure 5.1**. A low risk is considered as being less than a 0.1% chance of flooding from rivers or the sea in any given year.

Figure 5.1. Environment Agency Flood Map[8] showing areas at risk of flooding from rivers and the sea (approximate site location shown by red polygon)



8 http://maps.environment-agency.gov.uk/wiyby/wiybyController?value=Letchworth&submit.x=-240&submit.y=-188&submit=Search%09&lang=_e&ep=map&topic=floodmap&layerGroups=default&scale=9&textonly=off#x=522024&y=234881&lg=1,&scale=9

The low risk of fluvial or tidal flooding is confirmed by a review of the North Hertfordshire District Council Strategic Flood Risk Assessment[9] which shows that the nearest area of flood risk is approximately 0.4km from the site.

Therefore fluvial and tidal flooding does not pose any constraints to the development of this site for residential purposes. Any Flood Risk Assessment prepared to support a planning application for this site would need to present evidence of low risk, as summarised above.

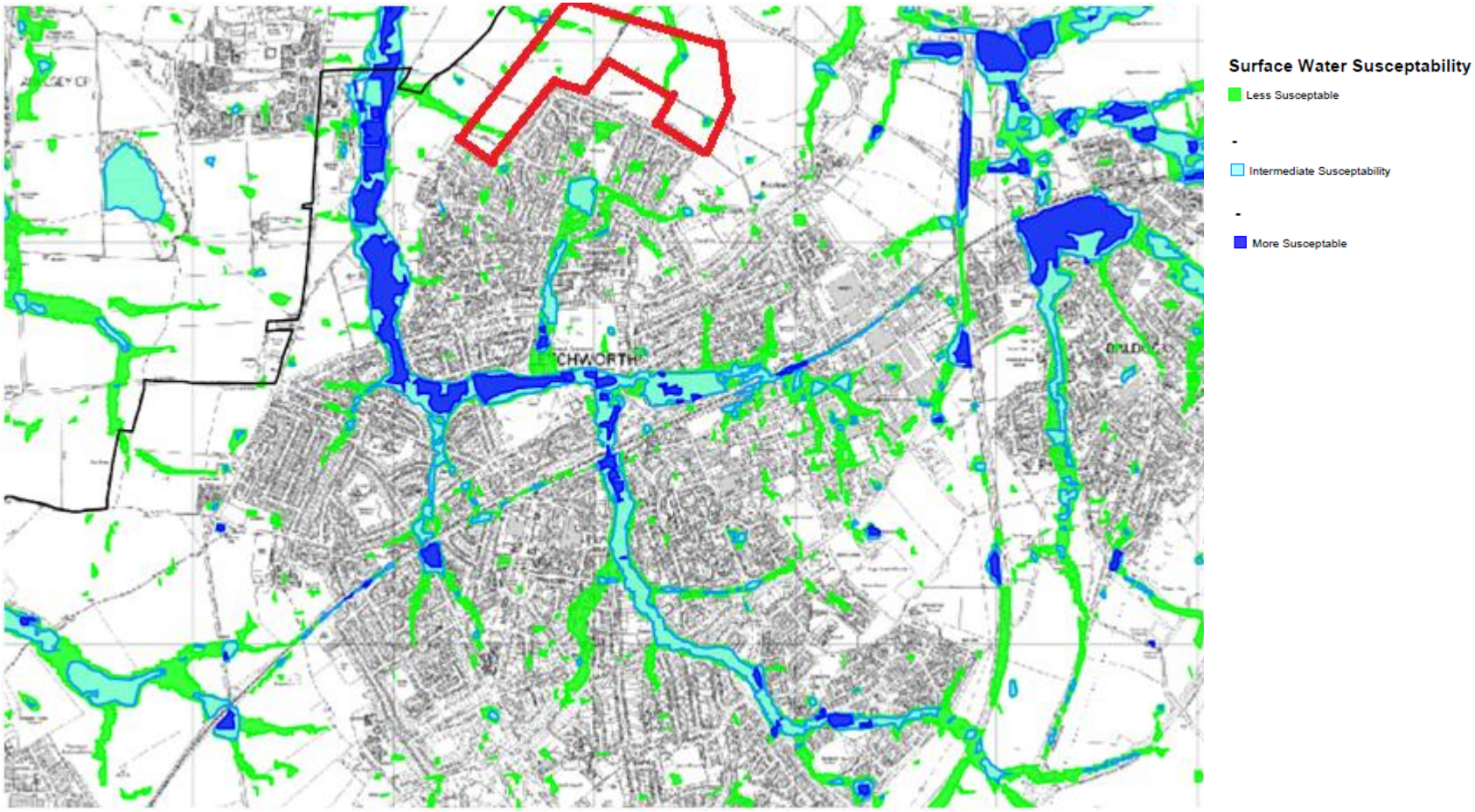
5.3 SURFACE WATER FLOODING

The best available maps of surface water flooding in the Letchworth area are from the Environment Agency's two national datasets, one showing "areas susceptible to surface water flooding" (considered most suitable for rural areas as it does not consider the impacts of buildings) and another showing the "flood map for surface water" which shows 1:200 and 1:30 extents and has been mapped taking some account of drainage, buildings and infiltration. There are no locally produced, more detailed maps of surface water flood risk in Letchworth, although the North Hertfordshire District Council webpage on Strategic Flood Risk Assessment notes that District Council will be working with the County Council in the future to produce a Surface Water Management Plan which would be expected to included more detailed surface water risk mapping.

As an interim assessment, the two national Environment Agency datasets have been reviewed and excerpts of these datasets are provided below in **Figures 5.2** and 5**.3**. Within the site boundary there are some areas shown on **Figure 5.2** as being less susceptible to surface water but no areas shown to be of intermediate susceptibility or more susceptible to surface water flooding.

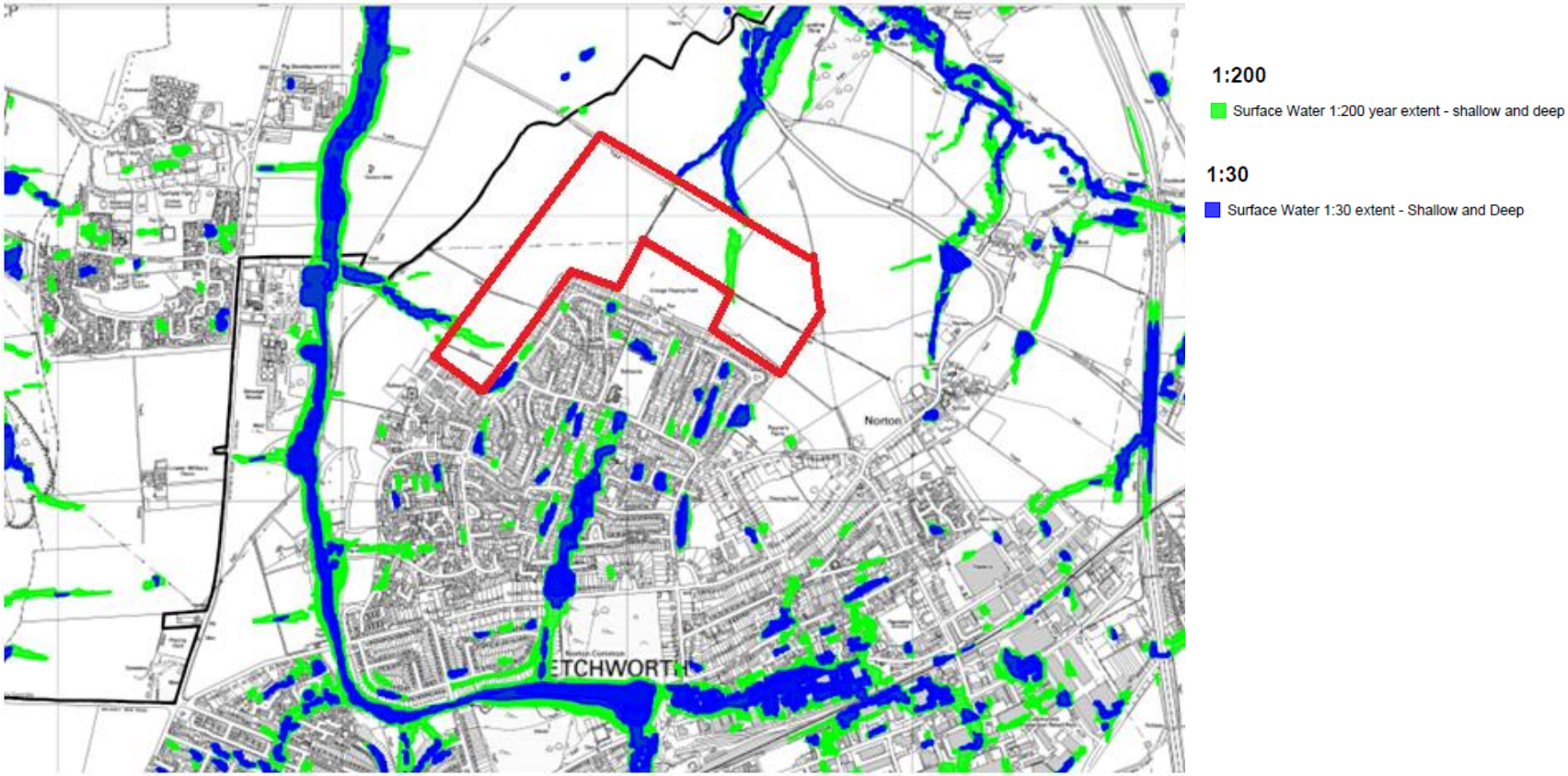
[9] North Hertfordshire District Council Strategic Flood Risk Assessment, July 2008: http://www.north-herts.gov.uk/index/environment_and_planning/planning/planning_policy_and_projects-2/evidence_base/strategic_flood_risk_assessment-2.htm

Figure 5.2. Areas susceptible to surface water flooding (showing approximate site boundary)[10]



[10] http://www.north-herts.gov.uk/map_a_-_rural_use-5.pdf

Figure 5.3. Flood map for surface water (showing approximate site boundary)[11]



[11] http://www.north-herts.gov.uk/map_b_-_urban_use-6.pdf

The map above shows the results of a national surface water modelling assessment. The areas shown in blue might be affected by surface water flooding in a heavy rainfall event with a probability of occurence of once in every thirty years. The larger green area is the area which might be affected by surface water flooding in a more severe heavy rainfall event (likely to occur, on average, once in ever 200 years).

Figure 5.3 indicates that some of the low parts of this site may be at risk of shallow or deep flooding in a heavy rainfall event with a probability of occurring, on average, once in every 200 years (i.e. a 0.5% probability of occurrence in any given year) heavy. The site is not shown to be at risk in a 1 in 30 (3% annual probability) pluvial flooding event.

Based on these two national datasets it appears that there is no significant risk of surface water flooding on the site. Where possible, built development should avoid the area shown to be at potential risk of surface water flooding in a 1 in 200 year heavy rain event. It is recommended that if this site is taken forward to a full planning application, that consultation with North Hertfordshire District Council and Hertfordshire County Council is undertaken to understand the timetable for more detailed surface water mapping from the Surface Water Management Plan. More detailed mapping should be used in the Flood Risk Assessment for the site if available at the time of preparation.

The SuDS viability plan in the North Hertfordshire District Council Strategic Flood Risk Assessment shows that the geology/soils of this site suggest that it is not suitable for infiltration-based SuDS techniques. Where infiltration-based SuDS techniques are not suitable, then attenuation-based SuDS techniques should be considered instead. The North Hertfordshire District Council Strategic Flood Risk Assessment provides guidance on possible SuDS techniques that may be suitable on a development such as this.

A surface water management strategy for the site will need to be developed in consultation with the Environment Agency, Anglian Water, Hertfordshire County Council, North Hertfordshire District Council and the Bedfordshire and River Ivel Internal Drainage Board. In developing the surface water management plan, the following considerations should be made:

- As the site is currently under agricultural use, the areas of impermeable surfaces are insignificant. Any development on this site would be likely to result in a significant increase in impermeable areas on the site with the potential to significantly increase the rate and volume of surface water runoff from the site;

- The Environment Agency response to the North Hertfordshire District Council Options Growth Levels and Locations (2011-31) consultation states that development to the north of Letchworth Garden City would require a surface water management strategy to demonstrate that the development would cause no increase in surface water flooding, and that surface water flooding should be managed in accordance with the National Planning Policy Framework and Technical Guidance with preference given to infiltration methods over discharge to watercourses or sewers. Discharge from this site is likely to be into nearby watercourses[12];

- Surface water runoff should be managed as close to the source as possible. It is expected that the local planning authority would want to see surface water runoff from the site managed so that rates do not exceed the existing Greenfield runoff rate and so that runoff in events up to the 1 in 100 year return period event (including an allowance for climate change) can be safely managed on site;

- The solid and drift geology of the site is relatively impermeable and therefore is not suited to infiltration-based SuDS techniques, so it is expected that the surface water management strategy would be built up of attenuation methods with outflow controls designed to restrict the rate of runoff from the site to existing rates;

- Possible attenuation methods that may be suitable within a residential development on this site include surface water basins (as part of landscaped areas), geo-cellular boxes and underground storage tanks. The topography and landscaping of the site will need to take account of requirements to safely manage the 1 in 100 year return period event (including climate change) around these attenuation features;

- On a smaller scale measures such as green roofs and water butts will also contribute to the surface water management strategy by reducing rates of runoff and will provide multiple benefits including water quality and biodiversity and also a reduction in water demand, e.g. for watering gardens;

- The detailed design of the site should also consider the potential use of semi-permeable surfaces for car-parking and other suitable communal areas to reduce the area of impermeable surfaces and reduce runoff rates and volumes. These semi-permeable surfaces would need to be connected to attenuation features with control exit discharges; and

[12] To be confirmed in detailed design of site

- A full numerical assessment of surface water runoff and potential mitigation measures would be required as part of the Flood Risk Assessment to support any planning application on the site.

In a short section on Strategic Flood Mitigation Options, the North Hertfordshire District Council Strategic Flood Risk Assessment suggests that there may be some potential for expansion of the existing flood storage at the Pix Brook flood storage reservoir (at Letchworth Sewage Treatment Works, west of this development site) to increase its capacity for surface water from new development. Expansion of this reservoir would facilitate future development to the north of Letchworth and would allow flows to be regulated using the existing flood gates to reduce the risk of flooding to areas downstream of Letchworth on the Pix Brook. This is an opportunity that the Letchworth Garden City Heritage Foundation may wish to discuss further with the Internal Drainage Board and Environment Agency as part of the detailed planning for the site, as an expansion to the capacity of this reservoir may reduce the requirements for on-site surface water management as part of this development.

5.3.1 Groundwater Flooding

The best available source of information in relation to groundwater flood risk is the map of Areas Susceptible to Flooding for Hertfordshire in the Hertfordshire County Council Preliminary Flood Risk Assessment. This map is an extract from a national assessment of groundwater flood risk and shows the percentage of a 1km grid square where there is potential for groundwater flooding. The map is based on the top two susceptibility bands of the British Geological Society 1:50,000 Groundwater Flood Susceptibility Map. The PFRA states that unless an area 'susceptible to groundwater flooding' is also identified as an area 'at risk from surface water flooding' it is unlikely that the location would actually experience groundwater flooding to any appreciable depth, and therefore it is also unlikely that the consequences of such flooding would be significant. The PFRA Groundwater flood risk map is shown in **Figure 5.4**.

Figure 5.4. Map of Areas Susceptible to Groundwater Flooding for Hertfordshire (☆= approximate site location)

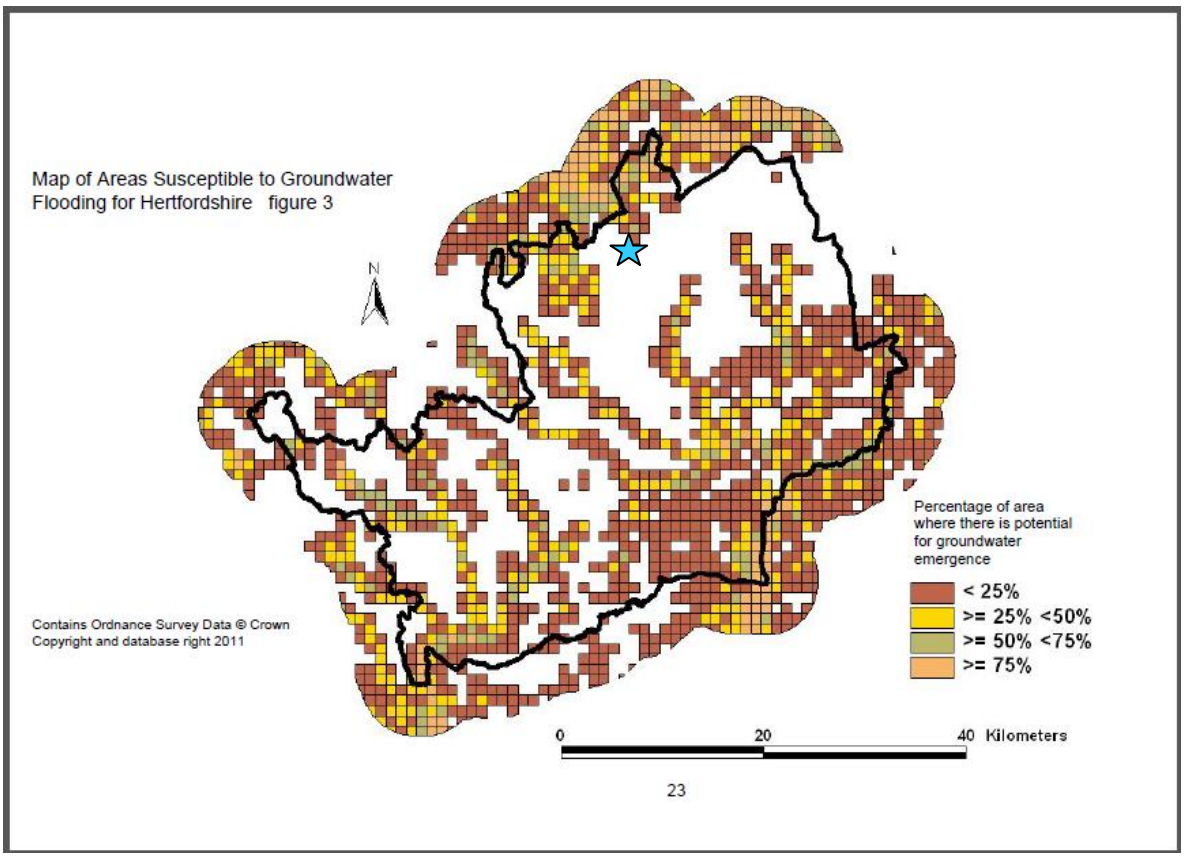


Figure 5.4 shows that this site is not at risk of groundwater flooding, however it is not far to areas where there is potential for groundwater emergence. Evidence of a spring at Norton Well, at the bottom of the hill by the Pix Brook (to the north-east of the site) is an indicator of the potential for groundwater emergence in this area.

Based on this evidence, the risk of groundwater flooding at the site cannot be excluded from this assessment but is not considered significant. More detailed analysis of the risk would be necessary as part of any Flood Risk Assessment for the site but the risk of groundwater flooding is unlikely to require any specific mitigation measures, beyond good construction practice.

5.4 SEWER FLOODING

As the site is currently Greenfield, sewer flooding is unlikely to be a significant risk to development on this site. However in the preparation of a detailed Flood Risk Assessment for the site, maps of existing sewers should be obtained from Anglian Water to enable a full assessment of this potential source of flood risk.

5.5 OTHER SOURCES OF FLOODING

The only potential other source of flooding within the vicinity of this site is the Pix Brook Flood Storage reservoir adjacent to the Letchworth Sewage Treatment Works. Failure of the impounding structure or flood gates at this reservoir is a very low risk to the site – assuming adequate maintenance then failure of the structure is very unlikely and the consequences of any failure would be unlikely to affect the site, given the local topography. This is not considered to represent a significant constraint to development on the site.

There are no other canals or reservoirs in the vicinity of the site that would present a constraint to development.

5.6 WATER RESOURCES

There is currently no water supply to this site (currently Greenfield). The development of the site for c.1,000 new homes would represent a significant additional demand on Anglian Water's water supply and consultation with Anglian Water will be required to discuss this need.

As referred to above the North Hertfordshire District Council's development policy on water resources states that new development must "*demonstrate that the highest levels of water efficiency possible for the site have been achieved*". To reduce the additional demand on water supply from Anglian Water, it is recommended that water efficient fixtures and fittings are used as much as possible in all new buildings.

Measures to maximise water re-use should also be incorporated into the building design, for example the use of greywater recycling systems within bathrooms (e.g. using bath or shower water to flush toilets) and rainwater harvesting (e.g. use of water butts for watering gardens and other landscaped areas).

6 SUMMARY OF CONSTRAINTS AND OPPORTUNITIES

A summary of the key constraints and opportunities is given below in **Table 6.1**.

Table 6.1 Summary of Key Constraints and Opportunities

Key Constraints	Opportunities
Management of surface water on existing Greenfield site	• Development of an innovative surface water management strategy to manage surface water at source using SuDS measures • Will be mostly based on attenuation features e.g. ponds or underground storage tanks; where appropriate these should be incorporated into landscaping and ecological proposals as can provide additional feature/habitat • Might be opportunity to provide additional storage in the Pix Brook flood storage reservoir to reduce demands for surface water management on site
Additional water demand from Anglian Water	• Use of best practice building and construction measures to reduce water demand, e.g. greywater recycling, water butts (rainwater harvesting) and water efficient fixtures and fittings (consistent with local policy requirements)

Based on this appraisal, the main constraint on development at this site in relation to hydrology and flood risk will be surface water management. Development on a Greenfield site will, inevitably, reduce the permeable area on site by introducing buildings and hard-standing. Surface water runoff from the site should be managed to reduce runoff rates to existing conditions in order to meet the requirements of the Environment Agency, Hertfordshire County Council, North Hertfordshire District Council, Anglian Water and the Internal Drainage Board. As outlined above, this is likely to be achieved through a number of SuDS measures controlling runoff at-

source as far as possible.

To reduce the additional demand on water supply from Anglian Water, it is recommended that water efficient fixtures and fittings are used and measures are in place to maximise water re-use.

The site is located in Flood Zone 1 and has a low risk of fluvial / tidal flooding but is greater than 1ha and therefore a full Flood Risk Assessment will be needed to support any planning application for development on this site to meet the requirements of the National Planning Policy Framework. The Flood Risk Assessment will need to assess all sources of flooding, as summarised in this Hydrology and Flood Risk Technical Appraisal and would be focussed primarily on the risk of surface water flooding. Further to the initial review presented in this appraisal, the Flood Risk Assessment will need to include quantification of surface water runoff rates and volumes from the site pre and post-development and an outline drainage strategy (developed in consultation with the infrastructure engineers on the design team) that demonstrates how the requirements of the Environment Agency and North Hertfordshire District Council can be met in relation to the management of surface water runoff.