Local Flood Risk Management Strategy for Hertfordshire

Strategic Environmental Assessment

Environmental Report -

Annex B: Baseline Information

Prepared June 2012

Hertfordshire

Produced by Place Services on behalf of Hertfordshire County Council

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Glossary of Acronyms

AADT	Annual Average Daily Flow
AMR	Annual Monitoring Report
ANGSt	Accessible Natural Green Space Standard
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
CAMS	Catchment Area Management Strategy
CET	Central England Temperature
CFMP	Catchment Flood Management Plans
CHP	Combined Heat and Power
CLG	Communities and Local Government
CRF	Congestion Reference Flow
Defra	Department for Environment, Food and Rural Affairs
DPD	Development Plan Document
EC	European Commission
EEDA	East of England Development Agency
EERA	East of England Regional Assembly
EU	European Union
FWMA	Flood and Water Management Act
GCR	Geological Conservation Review
HBAP	Hertfordshire Biodiversity Action Plan
HHER	Hertfordshire Historical Environment Record
IMD	Index of Multiple Deprivations
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
LFRMS	Local Flood Risk Management Strategy
LNR	Local Nature Reserve
LoWS	Local Wildlife Site
NNR	National Nature Reserve
ODPM	Office of the Deputy Prime Minister
ONS	Office for National Statistics
PSA	Pubic Service Agreement
RBD	River Basin District
RBMP	River Basin Management Plan
RSS	Regional Spatial Strategy

SAC	Special Area for Conservation
SEA	Strategic Environmental Assessment
SM	Scheduled Monument
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPZ	Special Protection Zone
SSSI	Site of Special Scientific Interest

1 INTRODUCTION

1.1 Background

In July 2011 Hertfordshire County Council commissioned Essex County Council's Strategic Environmental Assessment Team, now part of Place Services, to undertake a Strategic Environmental Assessment (SEA) on the proposed Local Flood Risk Management Strategy (hereafter referred to as LFRMS) for Hertfordshire. Place Services continues to act as consultants for this work; therefore the content of the Strategic Environmental Assessment should not be interpreted or otherwise represented as the formal view of Essex County Council.

This document is Annex B to the Environmental Report of the draft LFRMS. It details the evidence base used to inform the SEA framework for assessing the LRFMS. The summaries of each topic have been included within the main Environmental Report.

1.2 Baseline Information

The SEA Directive requires "the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme;" Annex 1(b);

"the environmental characteristics of areas likely to be significantly affected;" Annex 1(c); and

"any existing problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance such as areas designated pursuant to Directives 79/409/EEC and 92/43/ECC" Annex 1(d).

The baseline information provides a basis for predicting and monitoring the effects of implementing the LFRMS. To ensure the data collected was relevant and captured the full range of environmental issues it was categorised within 13 thematic topics in line with the relevant plans and programmes annex. They cover all the topics referred to in Annex 1(f) of the SEA Directive and follow the order of:

- Flooding
- Water
- Population and Social
- Climatic Factors
- Housing
- Biodiversity and geodiversity
- Cultural Heritage
- Soil, Minerals and Waste
- Transport
- Air Quality
- Economy
- Health
- Landscape

2 FLOODING

Flooding is a natural process that plays an important role in shaping the natural environment. However flooding threatens quality of life and causes substantial damage to property and can consequently incur significant costs. The effects of heavy and/or prolonged rainfall can be increased in severity as a result of planning decisions relating to the location, design, nature of development and land use. Increasingly, flooding is viewed as a potential consequence of future climate change. More frequent surface water flooding is one such issue predicted for Hertfordshire. Although flooding cannot be completely prevented, its impacts can be avoided and reduced through good planning and land management. In Hertfordshire, all local authorities have completed Strategic Flood Risk Assessments (SFRAs) in order to identify and manage catchment wide flooding issues within their area as part of the planning process. Data compiled on this subject is useful to identify whether broad potential future locations for development represent the most appropriate choices.

2.1 Impacts of Flooding in Hertfordshire

2.1.1 Surface Water Flooding

Periods of heavy rainfall can create conditions where local infiltration and drainage capacity is insufficient to cope with the volume of precipitation and so water flows across the surface. Such flooding is magnified in intensity during an intense rainfall event or due to a reduction in capacity potentially created by some form of blockage. Historic records in Hertfordshire show surface water flooding can have a number of origins, from natural overland flow draining towards low points and causing localised flooding to a blockage of a highway gully which resulted in reports of flooding affecting a footway or carriage.

2.1.2 Groundwater Flooding

This occurs when water held underground rises to a level where it breaks the surface in areas away from usual channels and drainage pathways. The presence of the chalk aquifer in Hertfordshire and other underground water bearing areas such as the river gravel deposits means that there is potential for groundwater flooding and that it needs to be considered as a potential source of flood risk.

Groundwater flooding generally results from exceptional and extended periods of heavy rain, but more local derivations include reduced abstraction, underground leaks or the displacement of underground flows. It may manifest as generalised flooding where the water table is close to the ground, or where a spring develops and water flows along unexpected pathways.

Confirmed cases of groundwater flooding arose in the winter of 2000–01 when groundwater levels were exceptional and peaked at record measured levels. Much of this emergence was in dry river valleys and mostly affected areas of agricultural land although roads were also affected.

Another example of groundwater flooding was the re-emergence of the River Kym in Kympon. This was generally considered to be dry but it re-emerged and followed its historic route through the village, requiring its diversion at a cost of £500,000.

2.1.3 Sewer Flooding

Sewer flooding can be caused by excess surface water entering the drainage network. Water companies keep a register of when this occurrence causes the flooding of properties. A 10 year period up to 2007 shows that there were 291 records of sewer flooding of which 77 could be attributed to surface water and 25 to combined sewers. Records are however limited to postcode areas and as such are of limited use here.

Within the Rye Meads catchment, which covers the entirety of Stevenage Borough as well as significant proportions of Welwyn Hatfield, East Hertfordshire District and Broxbourne Borough as well as a small proportion of North Hertfordshire District, the sewage network is known to be close to capacity in certain areas. This increases the risk of sewer flooding, particularly during storm events. This necessitates the need to ensure that strategic scale new developments are subject to appropriate planning conditions unless it can be explicitly shown that sufficient sewage capacity exits. Apart from in Stevenage (and Harlow), no major strategic sewage upgrades are anticipated to be required elsewhere in the Rye Meads catchment provided that development is directed to identified sustainable locations, and that developments in neighbouring authorities are able to bypass the local network of existing towns and villages. Local Authorities are also recommended to ensure that surface water drainage from new developments does not enter the existing foul sewage network to reduce the risk of sewer flooding. Regarding the catchment incorporating the LAs of Dacorum, St Albans, Three Rivers, Watford and Welwyn Hatfield, it is stated that the majority of sewer systems are separated for foul and surface waters although foul sewers may be influenced by periods of heavy rainfall due to infiltration and misconnections. Capacity in this area is considered to be limited, particularly in the upstream extents of the Maple Lodge sewerage network.

2.1.4 Historic Flooding Episodes

Flooding of properties in the past in Hertfordshire has occurred from a range of sources, including surface water, groundwater, ordinary watercourses and sewers. Earliest records include that of a flood caused by frost thaw in 1795 and flooding within Watford in 1903 following an exceptionally severe winter. Further accounts of flooding within Hertfordshire exist from 1947, again following thawing after prolonged bad weather. From the 1980s onwards historical records kept by Local Authorities become significantly more detailed. The largest flooding events in Hertfordshire which can be attributed to surface water flooding, groundwater and ordinary watercourses have affected in the order of 30 – 80 properties, several orders of magnitude below the threshold set for the identification of Flood Risk Areas as required by the Flood Risk Regulations 2009. It is noted however that part of the London indicative Flood Risk Area extends into some areas in the south of Hertfordshire, but there will be little synergy between actions taken by Hertfordshire and the London Authorities in mitigating against flood risk as the range of partners and indicative timetables are not shared.

Historic flooding events caused by occasional high flows in the River Beane have been recorded as affecting the villages of Walkern and Watton at Stone in East Hertfordshire District. Whilst the River Beane typically shows a low flow, extreme rainfall events can lead to an increase in flood risk. This can be a particular issue where the River Beane converges with the Stevenage Brook which also conveys runoff from urban locations.

There are historic episodes of flooding within the town of Hertford in East Hertfordshire, and this town is considered to be 'especially at risk' by the Rye Meads Water Cycle Study, 2009. This is due to the fact that the Rivers Mimram, Beane and Rib all converge with the River Lee in the town centre. Downstream of Ware, also in East Hertfordshire, the River Lee is joined by the River Ash at the Amwell Quarry SSSI and then the River Stort at the Rye Meads SSSI. These confluences have significant areas of flood risk although they also support some key areas of wetland habitats. These sites are reliant on inundation by water in order to maintain the wetland habitat for important species which are present, and any change in water regime may affect the integrity of these sites.

2.1.5 Recent Flooding Episodes

The most severe flooding in recent times within Hertfordshire occurred in October 2000. Flooding was particularly severe in London Colney where 72 properties were affected and residents had to be evacuated.

Between 28 and 30 2000 October Hertfordshire Fire and Rescue dealt with 300 weather related 999 calls compared with a daily average of 50. Hertfordshire Police received 1800 calls on 30 October, equating to 600 more than usual, and dealt with 507 emergencies, or 200 more than usual. The nature of the calls highlighted that emergencies relating to flooding events are not just confined to issues of flood waters, but also falling trees and road accidents caused by delayed motorists speeding. Damage to the highway network alone equated to £7.6m as flooding and subsequent freezing caused the equivalent of 2 years worth of decay over a single winter. It was ascertained that more than 50 sites across the County's road network were under water with some roads completely closed. The HCC executive committee were required to divert funding away from other highway projects to ensure that the existing network was maintained to safe and efficient levels. Away from the road network, potable water supplies were compromised, as surface water forced sediment through the ground into underground boreholes which meant 3 Valleys Water were unable to use 120 million litres of identified drinking water per day.

The last widespread fluvial floods in Hertfordshire occurred in October 2001. This event was particularly severe along the rivers Ash and Rib which flow into the River Lee around Bishops Stortford and Hertford. In Little Hadham 44 properties were affected with 24 of those having internal flooding.

There have been intermittent occurrences of fluvial flooding across the county over the last few years but in particular events in February 2009 lead to some internal and external property flooding from the River Colne, and the River Lee and its tributaries.

2.2 District / Borough Strategic Flood Risk Assessments

2.2.1 Broxbourne Borough SFRA

The primary source of flood risk in the Borough is identified as originating from the extensive culverting of watercourses, and the lack of maintenance of these culverts. The SFRA recommends a steering of development to areas of lowest flood risk. The proposed growth within the Rye Meads catchment is unlikely to create a significant increase to flood risk in Broxbourne as the River Lee has flood risk mitigated by a number of structures in this location, most notably the River Lee Flood Relief Channel and associated weirs / sluices. The largest recent flood event was in October 2000 where numerous properties were affected due to the flooding of the Lower Lee and its tributaries. Flooding typically occurs after heavy storm events,

partly due to the urbanised nature of the catchment and the high runoff in many areas due to the smaller flashy tributary streams which drain the west of the catchment into the River Lee. The risk of flooding posed to properties is not just fluvial; however properties are also at risk from groundwater, surface water and sewers. Surface water flooding has been highlighted as the primary cause of frequent flooding in the borough. Areas known to experience surface flooding include parts of Hoddesdon and Walthem Cross. Groundwater flooding has been observed in a number of locations including Rye Park and the town of Broxbourne. Historical evidence of sewer flooding exists but in recent years very few properties have been affected by sewer flooding. In the last ten years two properties have been recorded as having flooded from this source.

2.2.2 Dacorum Borough Council, St Albans City & District, Three Rivers District and Watford Borough SFRA

This SFRA considers that the risk from flooding within the study area is relatively low, particularly along the chalk tributaries (Rivers Ver, Gade, Bulbourne and Chess). It is assessed that the catchment topography is such that river flooding will affect only narrow and well defined corridors. The main issue found by the SFRA related to the capacity of surface water and sewer drains, which can result in localised flooding following heavy rainfall. This localised flooding can cause disruption to traffic as well as damage to property. The main pockets of flood risk from rivers tends to be localised across the study areas. They are located along the Upper River Lee through Harpenden and Wheathampstead and the River Colne through Colney Heath, London Colney and Watford. Within these areas it is important to ensure that future development does not contribute to increased flood risk.

2.2.3 East Hertfordshire District SFRA

The East Hertfordshire SFRA makes reference to a number of historic flood events arising from watercourses in the town of Hertford, particularly around the confluence of the Rivers Beane and Lee. A similar cluster can be seen at Watton-at-Stone, near the confluence of the River Beane and Stevenage Brook. The towns of Hertford and Ware are particularly at risk due to the convergence of five rivers in their general vicinity. Historic fluvial flooding events have also been recorded for the River Rib, Stort, and Mimram in the study area. The SFRA states that all the major settlements in East Hertfordshire are at risk of a flooding of the river corridor. The risk from sewer flooding is considered to be rare and those events that do happen have been rapidly dealt with by Thames Water. Regarding surface water flooding, incidents are widely distributed, but the majority are isolated incidents. Multiple incidents have however been recorded in central Buntingford and the Hockerill area of Bishop's Stortford. Isolated ground water events have occurred but these are rare and tend to affect small areas or individual gardens. The SFRA notes that many previously dormant springs become active as a result of nearby construction or groundwork operations.

2.2.4 Hertsmere Borough SFRA

Flooding in the Borough has increased over the last century due to urban development, road construction, land drainage and agriculture which have all altered water and sediment discharges. Rivers are now no longer in their natural form having been altered to meet development and agricultural demands. The Borough has a history of fluvial flooding although some areas are affected more than others. Regarding the River Colne, flooding has mostly been in open spaces and recreational areas with limited property damage. Flooding of the Potters Bar Brook

has been attributed to confluence with the Billy Lows Drain combined with surcharge of the Thames Water drainage system. Properties have been flooded due to insufficient channel capacity and difficulty of maintenance work due to the proximity of existing development. Flooding has also been recorded in the Radlett Brook, Mimmshall Brook and Hilfield Brook which all resulted in damage to properties. Surface water flooding has been highlighted as a major cause of flooding in the Borough and often occurs in combination with surface waters and groundwater flooding. Known areas of surface and groundwater flooding are Radlett, Bushey, Borehamwood and Potters Bar.

2.2.5 North Hertfordshire District SFRA

Fluvial flooding is the dominant source of flood risk within the district and will have the greatest influence upon land-use planning although a number of potential strategic flood mitigation opportunities are presented, in Hitchin, Letchworth Garden City and Kimpton. Historic fluvial flooding events have included snow melt affecting the River Kim and heavy rainfall affecting the River Hiz and River Purwell.

The SFRA identified an area of South Hitchin as being prone to flooding from the River Purwell where some properties are at risk of flooding during a 1 in 20 event. This is due to road and railway culverts causing the River Purwell and Ash Brook to back up during storm events. Also within North Hertfordshire District, the River Riz flows through a built up area of the town of Hitchin. It is assessed that an increase in river flow, either from increased surface runoff or sewage flow could lead to an increase in flood risk to the properties in either rural or urban areas. Further, it describes the interconnectivity between groundwater and surface water to the west of Stevenage as ‘complex’, and that as this area is the source of the Ash Brook / River Purwell, monitoring will be required to be undertaken as part of site specific flood risk assessments to ensure that surface water runoff does not increase flood risk on the River Purwell.

There are also historic records of sewage flooding. These are detailed as being caused by significant rainfall, blockages or a combination of the two. Sewage flooding has been recorded in Baldock, Hitchin and Letchworth Garden City.

Groundwater flow is generally from north to south but is locally complicated due to the presence of buried chambers. High groundwater levels have been measured in the chalk and overlying drift aquifers at the Almshoe Bury Swallow Hole and where the Ippolitis Brook emerges. The highest groundwater levels are found on the interfluve between the Ippolitis and Mimram valleys. Historic records of groundwater flooding have been detailed in Kimpton and Royston. Within Kimpton, groundwater flooding reactivated old springs and the normally ‘dormant’ River Kim whilst within Royston, it is stated that groundwater flooding created floodwater up to 3 feet deep where there had been no significant flooding for 30 years.

2.2.6 Stevenage Borough SFRA

The Stevenage SFRA indicates two study areas where a detailed assessment of the implications of proposed development has been carried out. One of these covers the ‘West of Stevenage’ development site where approximately 5,000 new dwellings are planned in three inter-linked villages. The site has a ridge running through the centre which indicates the boundary of the Anglian and Thames catchment areas. The SFRA highlights that the geology is mainly impermeable glacial clay which causes high surface water runoff until the chalk strata is reached where the water in intercepted. The eastern side of the site drains to the catchment of the Stevenage

Brook which could create a significant obstruction to the nearby motorway. The SFRA states that no part of this area has a significant risk of flooding but highlights the need for adequate surface water drainage and that temporary storage in public places may be required to attenuate peak runoff as substantial surface runoff could cause increases in flooding downstream. The western side of the development drains into Langley Brook and is generally not considered to result in any issues. However there was flooding of the Langley Brook in 2007 for the first time in 15 years and it is stated that unattenuated discharges could cause this to happen more frequently.

The 'North of Stevenage' development site has a geology comprising predominantly exposed chalk and is also bisected by the Anglian / Thames boundary. The eastern portion of the site drains into the Stevenage Brook. An increase in urbanisation will lead to a reduction in infiltration and also increase the amount of water in the surface water system. The western half drains into the head waters of the Ash Brook.

The urbanised western tributaries of Aston End Brook are all now surface water sewers. The urban area in the northeast corner of Stevenage is outside of this catchment and surface water sewers in this area discharge direct to the River Beane. These surface water sewer systems have all been designed to accommodate flows expected to occur in a rainfall event of a specific return period and duration. During severe events the system can become surcharged and overflow, resulting in overland flow along the line of the sewer and these are a potential flood risk.

Regarding flood risk from the sewer system, as a modern town Stevenage has almost entirely separate foul and surface water sewage systems although some surface runoff will inevitably find its way into foul sewers during heavy rainfall. Generally the volume of this will likely be small but the very large Stevenage Trunk Sewer, which conveys the whole of the town's foul drainage, should also be considered to be a possible risk of flooding along the downstream portion of its route through the southern end of the town. Minor sewer flooding has occurred historically but local solutions are thought to have alleviated this risk.

Flooding has also been recorded from groundwater sources in chalk areas although fluvial flooding remains the primary source of flood risk in the borough. Whilst the borough is situated on chalk strata and chalk is associated with groundwater flooding, Stevenage lies at the upstream end of the Chiltern chalk outcrop, close to the watershed and well upstream of places where groundwater flooding would be expected to appear in typical chalk bourne or valley localities. It is subsequently stated that as such, groundwater flooding is not an issue for Stevenage.

2.2.7 Welwyn Hatfield Borough SFRA

It is stated that in Welwyn Hatfield, the floodplain needs to be considered the most important asset for reducing flood risk. The extent of the flood plain is small and generally confined to existing green space and as such development should be kept away from the flood plain. Flooding from overland flow is not recorded or reported to be a flood source within the study area and there is no identified record of historical overland flow flooding in the borough. Regarding groundwater flooding, whilst the study area is underlain by extensive aquifers and the fact that watercourses are spring fed which indicated that groundwater levels are at or close to the surface, groundwater flooding is not a major issue in the borough. Since 2000, the EA have identified just four occurrences of this, at Brookmans Park, East Hatfield and two at Cuffley. There is a single reported incidence of sewer flooding caused by an overloaded combined sewer although insufficient evidence is available to predict severity or a return period.

The main sources of fluvial flooding in the study area are the Rivers Lee, Mimram, Upper Colne and Mimmshall Brook, draining from the north west to the south east. Proximal development has meant that their respective flood plains are relatively constrained. Mimmshall Brook has caused serious flooding to properties on five occasions since 1928. It is assessed that further culverting of rivers should be discouraged and where possible, to remove culverts to return the system to a more natural state.

2.3 Flood Zones

PPS 25 seeks to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Annex D of PPS 25 sets out a risk-based sequential test to be applied at all stages of the planning process with the aim being to steer new development to areas with the lowest probability of fluvial flooding.

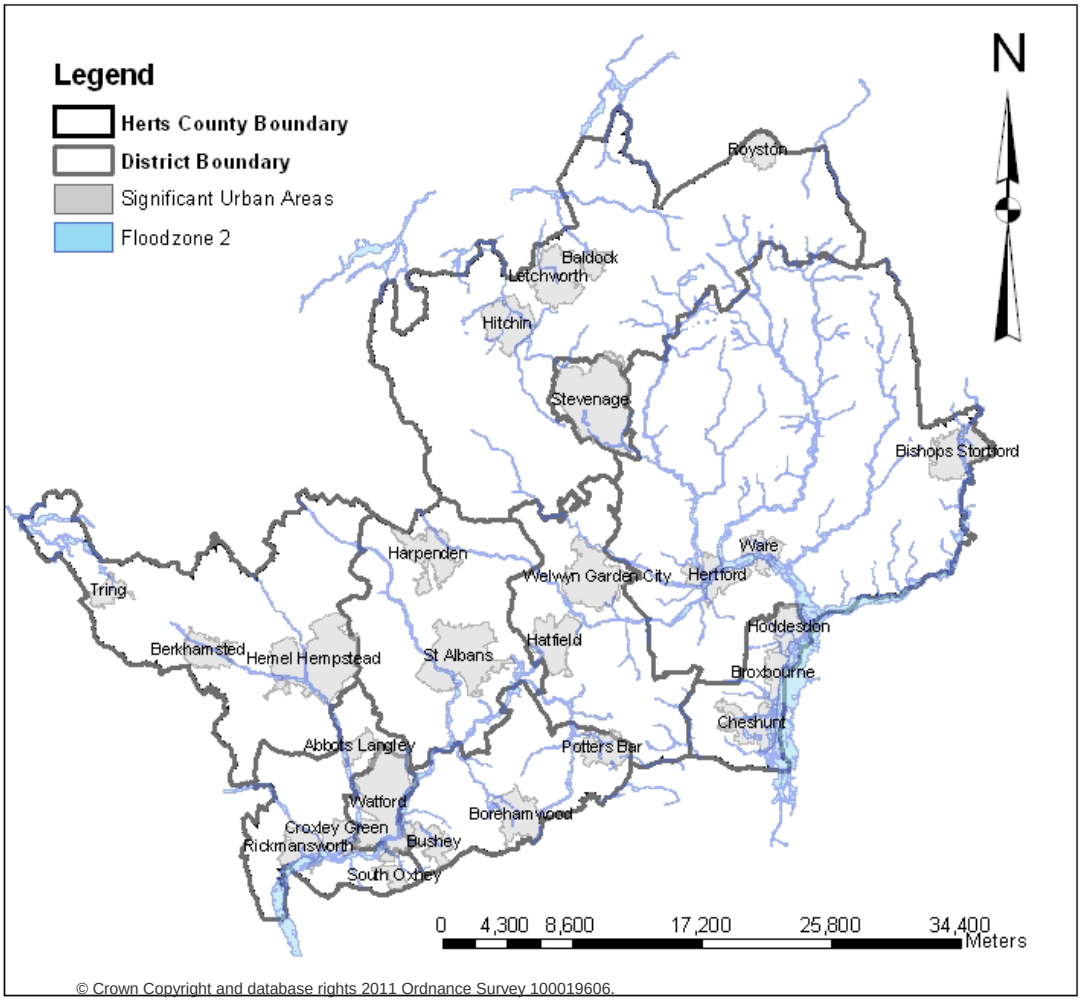
The Exception test may also be required to ensure that the vulnerability of a proposed development is compatible with the flood zone. Different land uses have varying vulnerability to flooding.

A hierarchy of flood zones for application of the sequential test is defined as:

- Zone 1 - Low Probability: Encompasses land assessed as having a less than 1 in 1000 annual probability of flooding in any year (<0.1 per cent).
- Zone 2 - Medium Probability: Comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1 per cent – 0.1 per cent).
- Zone 3a - High Probability: Covers land assessed as having a 1 in 100 or greater annual probability of river flooding (>1 per cent) in any year.
- Zone 3b - The Functional Floodplain: This zone comprises land where water has to flow or be stored in times of flood and should be identified by local planning authorities in their SFRA in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5 per cent) or greater in any year, or is designed to flood in an extreme (0.1 per cent) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

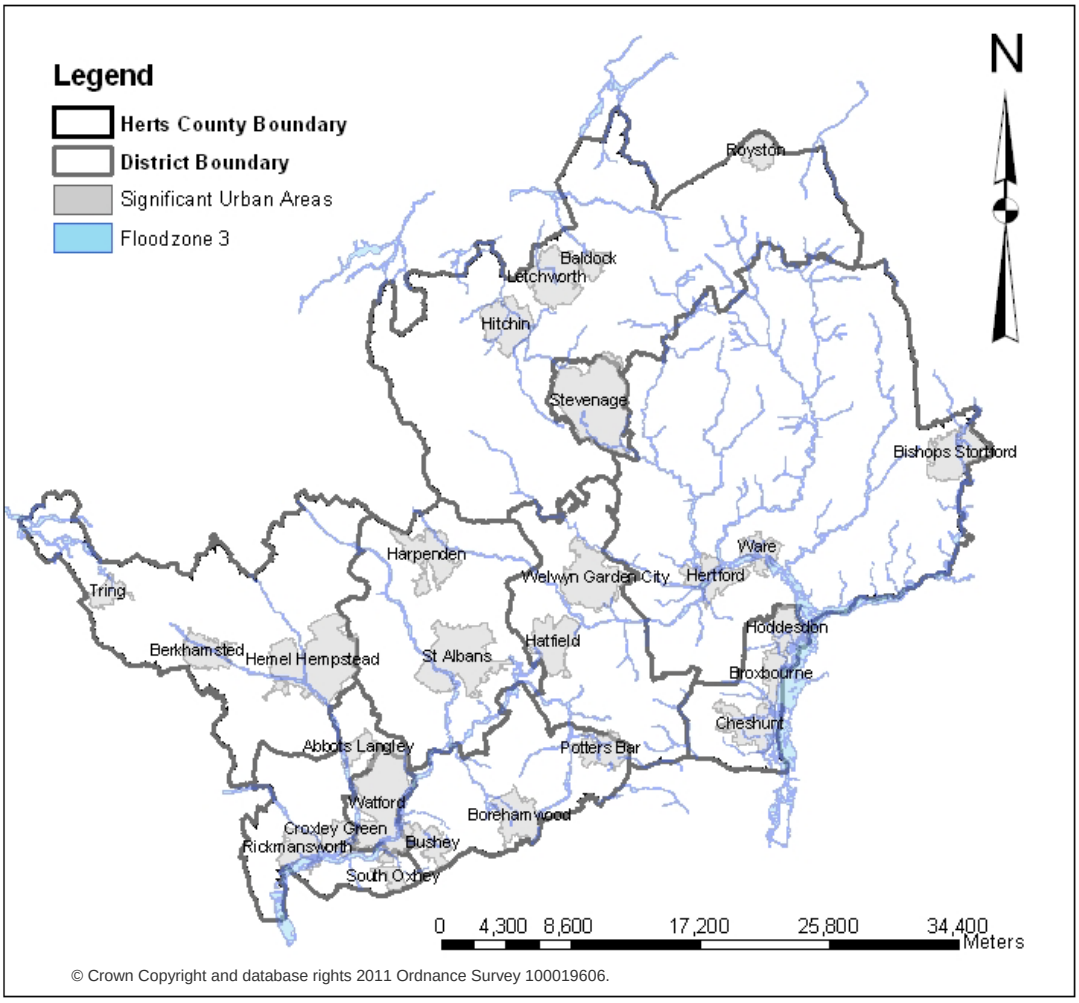
Figure 1 and Figure 2 show the locations in Hertfordshire which are within flood zone 2 and flood zone 3. Whilst pluvial flooding and ground water flooding are the main sources of flooding within the county, for which flood zones are not delineated, there is still flood risk from fluvial flooding. Flood Risk Management Strategies have been devised for the Lower Lee, Upper Lee, Upper Colne, River Ash and River Rib catchment areas as well as the town of Hereford. As climate change continues, flood risk is likely to increase.

FIGURE 1: SPATIAL EXTENT OF FLOOD RISK ZONE 2 IN HERTFORDSHIRE



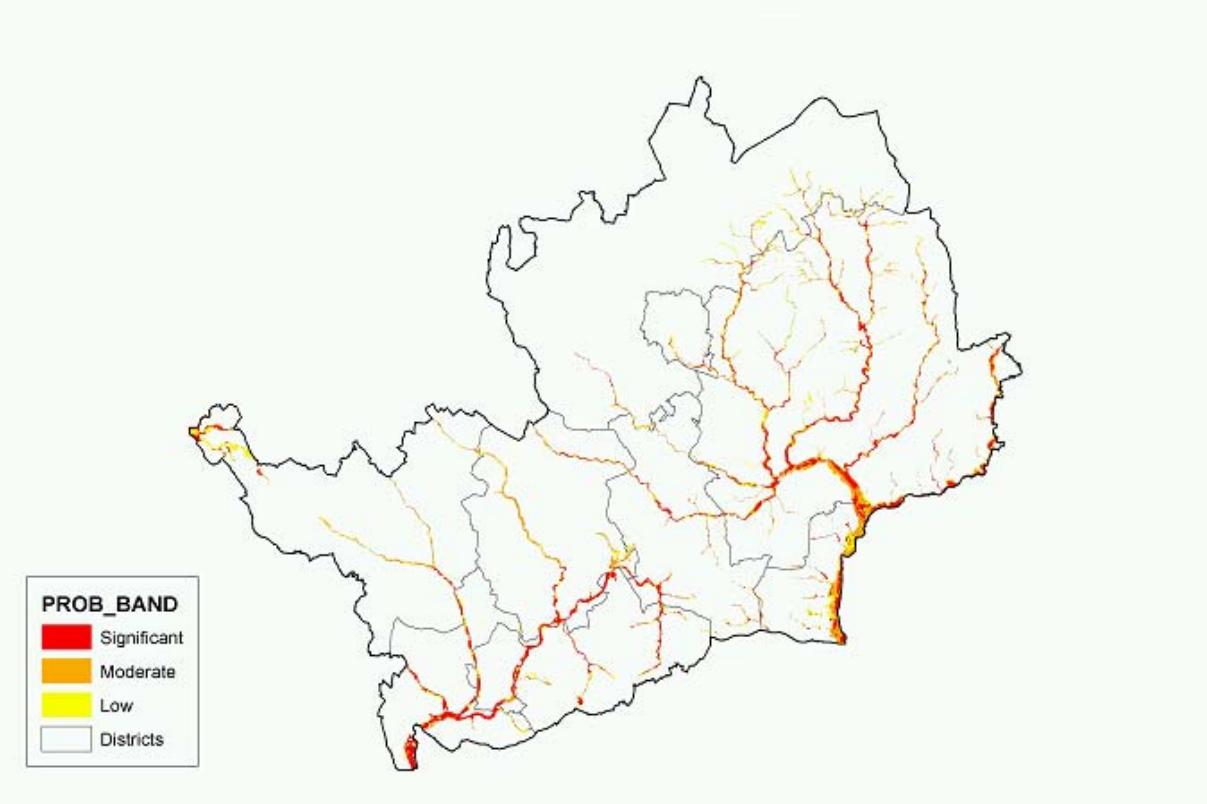
Source: Hertfordshire County Council, 2010

FIGURE 2: SPATIAL EXTENT OF FLOOD RISK ZONE 3 IN HERTFORDSHIRE



Source: Hertfordshire County Council, 2010

FIGURE 3: LIKELIHOOD OF FLOODING IN HERTFORDSHIRE



Source: Environment of Hertfordshire, Environment Agency, 2011

Significant levels of flood risk have been identified in the south and south east of the county in particular. The last widespread floods in Hertfordshire occurred in October 2001. This event was particularly severe along the rivers Ash and Rib which flow into the River Lee around Bishops Stortford and Hertford. In Little Hadham, 44 properties were affected with 24 of those having internal flooding.

There have been intermittent occurrences of flooding across the county over the last few years but in particular events in February 2009 lead to some property flooding. Flooding from the River Colne, the River Lee and its tributaries led to some internal and external property flooding.

2.4 Catchment Flood Management Policy Units

Each river catchment area is subdivided into policy units within Catchment Flood Management Plans (CFMPs) which relate to parts of a river which can be said to have shared characteristics. Hertfordshire contains 8 such units. Six of these are within the Thames catchment and 2 within the Great Ouse catchment, as detailed below:

TABLE 1: THAMES RIVER CATCHMENT AREAS AND CFMP POLICY UNITS COVERING HERTFORDSHIRE

River Catchment Area	CFMP Policy Unit	Unit Characteristics	District / Borough Coverage
Thames Region	Colne	Generally urban areas with some river flood defences.	Hertsmere, St Albans, Three Rivers, Watford
	Colne Tributaries and Wye	Newer and expanding urban areas often towards the headwaters of river catchments.	Dacorum, St Albans, Three Rivers, Watford
	Lower Lee & Lower Lee Tributaries	Developed floodplain with major built flood defences.	Broxbourne
	Middle Lee & Stort	Mainly natural floodplain with market towns and villages.	Broxbourne, East Herts, St Albans, Welwyn Hatfield
	Thame	Mainly natural floodplain, with market towns and villages.	Dacorum
	Upper Lee	Mainly natural floodplain, with market towns and villages	East Herts, North Herts, St Albans, Stevenage, Welwyn Hatfield
Great Ouse	Bedford Ouse Rural	Predominantly rural with market towns and villages	North Herts, Stevenage
	Hitchin	Predominantly urban, consisting of the town of Hitchin and the village of Ickleford.	North Herts

Taken from Hertfordshire Strategic Flood Assessment, November 2010

Each CFMP policy unit will have risk management approaches and policy recommendations set out in both their relevant CFMP and lower level Flood Risk Management Strategies. These will be referred to as appropriate within the SEA.

2.5 Properties at Risk from Flooding

The following data is for the period up to 2008. Please note that this section will be updated when more up-to-date data becomes available

TABLE 2: NUMBER OF DEVELOPMENTS WITHIN FLOOD ZONE 2 IN HERTFORDSHIRE BY DISTRICT, 2008

Local Authority	Residential Flood Zone 2	Residential Flood Zone 2 %	Non-residential Flood Zone 2	Non-residential Flood Zone 2 %	Additional Features Flood Zone 2	Additional Features Flood Zone 2 %	Total Flood Zone 2
Broxbourne	3,763	8.3%	583	1.3%	58	0.1%	4,404
Dacorum	29	0.0%	25	0.0%	4	0.0%	58
East Hertfordshire	3,548	4.5%	1,452	1.8%	105	0.1%	5,105
Hertsmere	10	0.0%	27	0.1%	7	0.0%	44
North Hertfordshire	467	0.7%	107	0.2%	23	0.0%	597
St. Albans	57	0.1%	66	0.1%	16	0.0%	139
Stevenage	103	0.3%	18	0.0%	3	0.0%	124
Three Rivers	5	0.0%	5	0.0%	10	0.0%	20
Watford	0	0.0%	3	0.0%	2	0.0%	5
Welwyn Hatfield	35	0.1%	26	0.0%	8	0.0%	69

Source: Environment Agency, 2011

TABLE 3: NUMBER OF DEVELOPMENTS WITHIN FLOOD ZONE 3 IN HERTFORDSHIRE BY DISTRICT, 2008

Local Authority	Residential Flood Zone 3	Residential Flood Zone 3 %	Non-residential Flood Zone 3	Non-residential Flood Zone 3 %	Additional Features Flood Zone 3	Additional Features Flood Zone 3 %	Total Flood Zone 3
Broxbourne	1,550	3.4%	488	1.1%	60	0.1%	2,098
Dacorum	162	0.2%	104	0.1%	54	0.1%	320
East Hertfordshire	2,323	2.9%	1,183	1.5%	291	0.4%	3,797
Hertsmere	83	0.2%	20	0.0%	45	0.1%	148
North Hertfordshire	348	0.5%	227	0.3%	74	0.1%	649
St. Albans	76	0.1%	108	0.2%	62	0.1%	246
Stevenage	228	0.6%	38	0.1%	14	0.0%	280
Three Rivers	0	0.0%	32	0.1%	68	0.2%	100
Watford	0	0.0%	19	0.0%	29	0.1%	48
Welwyn Hatfield	109	0.2%	57	0.1%	45	0.1%	211

Source: Environment Agency, 2011

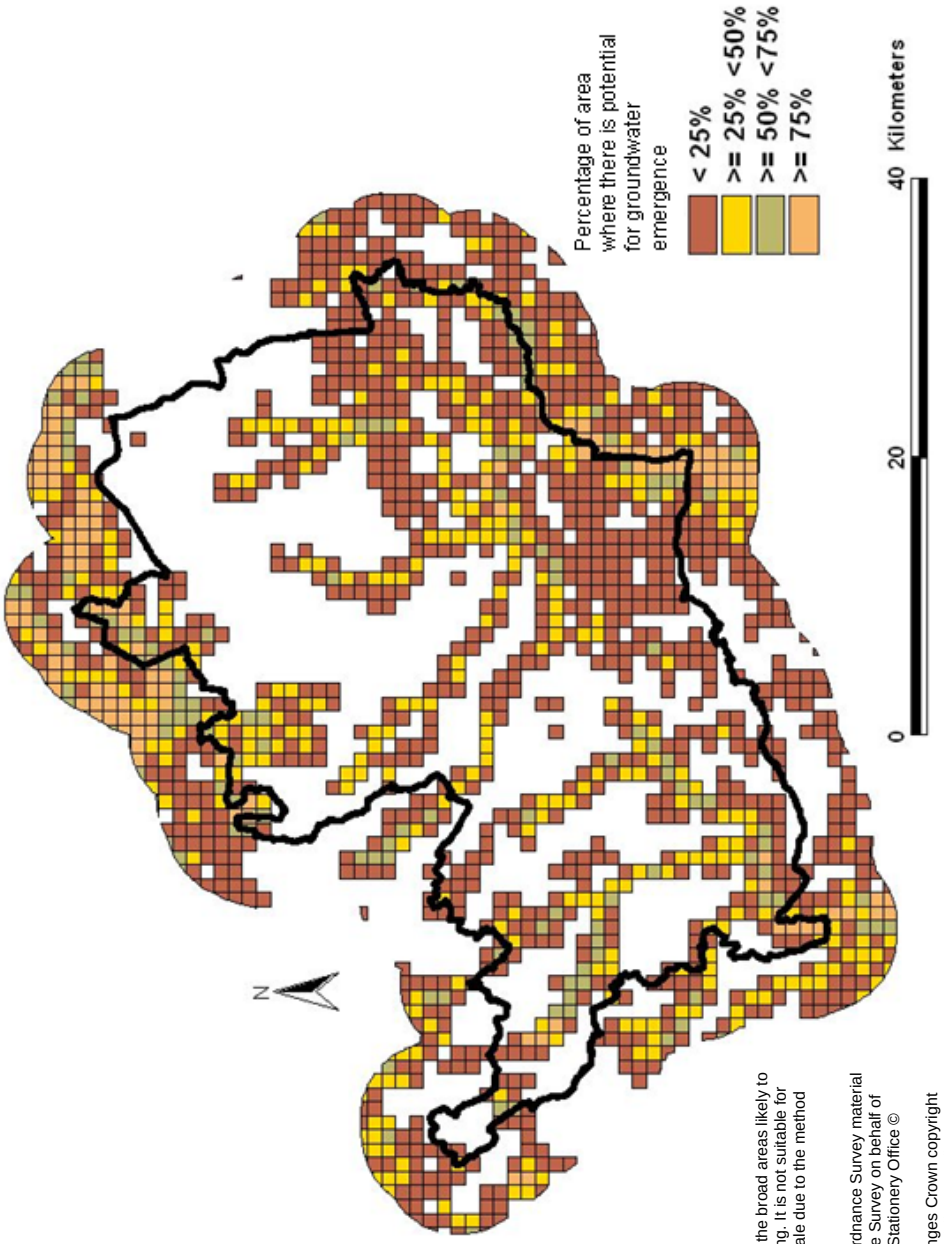
At 8.3%, Broxbourne District has the highest proportion of residential properties situated in Flood Zone 2. In numerical terms, East Hertfordshire District has the highest number of properties at 3,763 which equates to 4.5% of total dwelling stock. All other local authorities show a proportion of less than 1% of properties being located in Flood Zone 2, with Dacorum, Hertsmere and Three Rivers having a proportion approaching 0% and Watford having an actual proportion of 0%

Broxbourne and East Hertfordshire are also the local authorities with the highest proportion of dwellings situated in Flood Zone 3 at 3.4% and 2.9% respectively. East Hertfordshire again reports the highest number of actual properties within the flood zone at 2,323. All other local authorities have a proportion of dwellings within a Flood Zone 3 recorded as less than 1%, with Three Rivers and Watford reporting a proportion of 0%.

2.6 Areas Susceptible to Groundwater Flooding

The following Figure highlights the percentage of area within the county for where there is the potential for groundwater emergence:

FIGURE 4: AREAS SUSCEPTIBLE TO GROUNDWATER FLOODING IN HERTFORDSHIRE



Source: Hertfordshire County Council Preliminary Flood Risk Assessment, 2011

Much of the north, central and west parts of the county appear to be at low risk from groundwater flooding although there are a number of exceptions to this case. Particular exceptions are parts of Dacorum showing units where the proportion of land area at risk from groundwater flooding is greater than 75 per cent, and Three Rivers, Watford and Hertsmere showing a number of units where the proportion of areas where there is potential for groundwater flooding assessed as being under 25 per cent. Other parts of the county show a higher level of risk. Much of East Hertfordshire however shows some level of risk, with a large number of units assessed as having less than 25 per cent area susceptible to groundwater emergence and between 25 but less than 50 per cent. Broxbourne is the district assessed as being most at risk with much of the district shown to be at risk from groundwater flooding. At the southernmost boundary of Broxbourne there are units assessed as having over 75 per cent of their area susceptible to groundwater flooding.

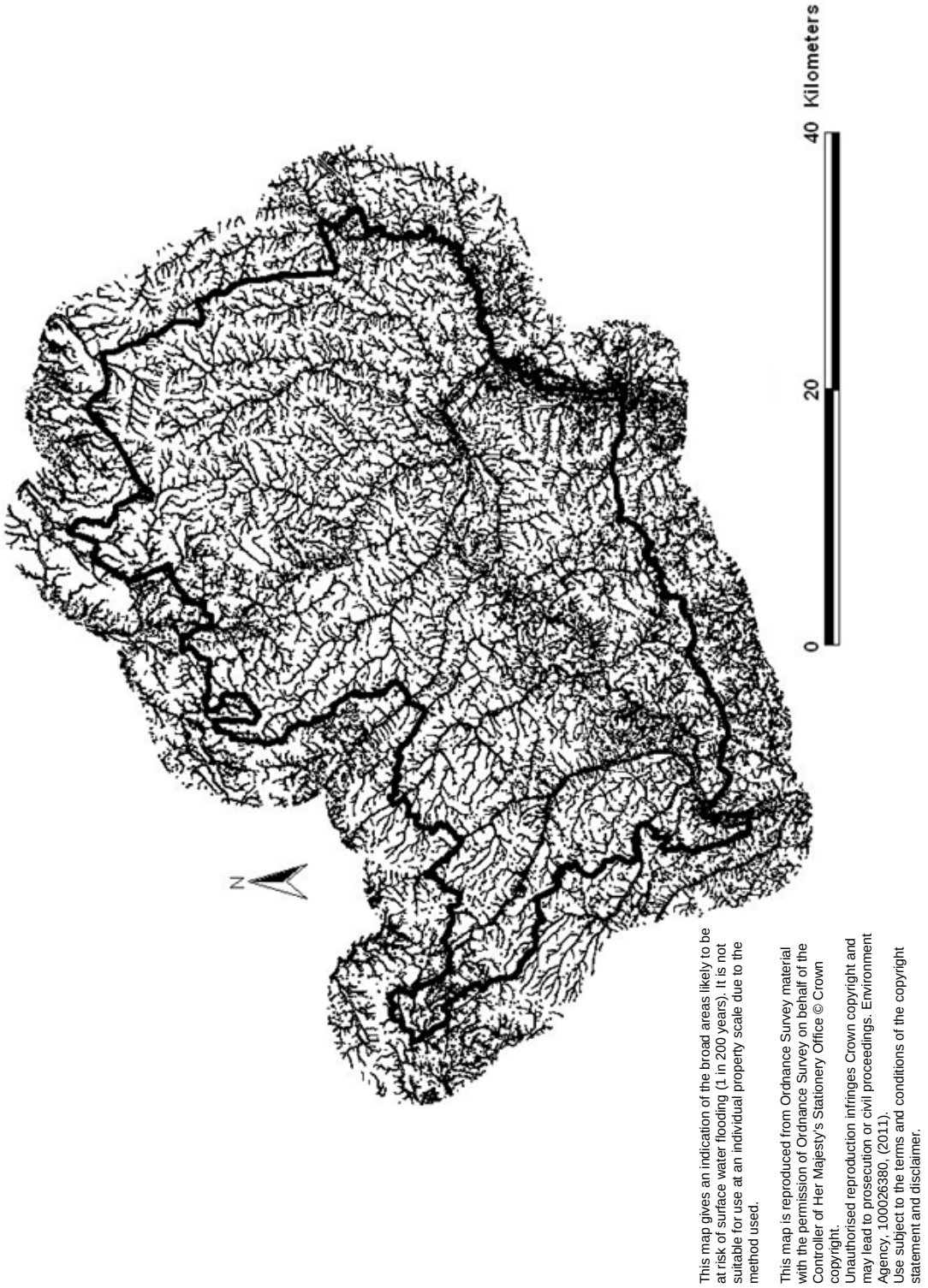
Areas predicted to be at risk from groundwater or ordinary watercourses may be at risk from that source alone, or a combination of ground water or ordinary watercourse flooding and surface water flooding. It is unlikely that groundwater flooding would be experienced to any appreciable depth without the interaction of surface water. Therefore properties at risk of groundwater flooding are encompassed by the surface water statistics.

2.7 Surface Water Flood Map of Hertfordshire

The HCC Preliminary Flood Risk Assessment (PFRA) states that there is no comprehensive information on surface water flood risk in Hertfordshire outside of Local Flood Risk Assessments developed in support of planning proposals. The Flood Map for Surface Water does not give an absolute picture as surface water catchments will have differing sensitivities to storm duration and intensity as well as differing attributes relating to drainage and infiltration.

Figure 5 below details the surface water flood map which has been constructed for the county

FIGURE 5: SURFACE WATER FLOOD MAP OF HERTFORDSHIRE



Source: Hertfordshire County Council Preliminary Flood Risk Assessment, 2011

Despite the aforementioned issue, the Flood Map for Surface Water correlates well with local flood risk studies undertaken across Hertfordshire, indicating that it is suitable to use for assessment of the county. 53,400 properties are predicted to be at risk of deep flooding (up to 0.3 metres) in a high risk (1 in 200 chance in any year) event.

2.8 EA Objections to Development in Hertfordshire

Each year the Environment Agency (EA) produces a national list of planning applications which the EA raised objection to on the grounds of flood risk.

The EA will object to planning applications on the grounds of flood risk when:

- the proposed development is not consistent with Government Planning Policy,
- there is a lack of evidence that the sequential test and (where needed) the exception test have been applied correctly,
- it is not supported by a flood risk assessment, or
- the flood risk assessment does not demonstrate that the development and its occupants/users will be safe for the lifetime of the development, does not increase flood risk elsewhere and does not seek to reduce risk overall.

The number of planning permissions granted contrary to the advice of the Environment Agency on either flood defence grounds or water quality is one of the Governments Core Output Indicators. Published data covers the period April 2010 to February 2011.

TABLE 4: NUMBER OF PLANNING APPLICATIONS APPROVED CONTRARY TO EA ADVICE APRIL 2010 – MAR 2011

Authority	Number of Planning Applications Objected to by EA	Number of Applications Approved by LPA despite EA Objection
Broxbourne	2	1
Dacorum	1	1
East Hertfordshire	6	3
Hertsmere	4	0
North Hertfordshire	1	0
St Albans	4	2
Stevenage	2	1
Three Rivers	1	0
Watford	0	0
Welwyn Hatfield	4	1
Hertfordshire CC	5	4
Total	30	13

Source: The Environment Agency, 2011

In Hertfordshire, during April 2010 – March 2011 there were thirteen planning applications that were approved contrary to objections by the Environment Agency on the grounds of flood risk. These are as follows:

TABLE 5: PLANNING PERMISSION APPROVED CONTRARY TO EA ADVICE APR 2010 – MAR 2011

Local Planning Authority (LPA)	LPA Reference	Nature of Proposed Development	Site Address	Reason For Objection
Broxbourne Borough Council	07/10/0526/F	Change of use of vacant industrial site to open storage, parking and container storage, use of existing gantry for local advertising purposes.	Plots F & L RD Park, Essex Road, Hoddesdon, Hertfordshire.	Unsatisfactory FRA/FCA submitted (Surface Water) (Approved with conditions)
Dacorum Borough Council	4/00745/10/MFA	Residential Development Of 37 Dwellings	Land At The Manor Estate, Apsley, Hemel Hempstead.	Unsatisfactory FRA/FCA submitted (Surface Water)
East Hertfordshire District Council	3/10/0386/FP	Redevelopment Of 2.15 Ha Brownfield Sire To Include New Asda Foodstore (2601 Sqm Net), 13 Dwellings 5 Affordable, Retention And Redesign Of Children's Nursery, Retention And Refurbishment Of Kiln And Maltings Buildings, Together With Associated Access, 283 Car Parking Spaces, Servicing And Landscaping, Associated Highways Pedestrian Improvements.	Asda, Cintel Site, Watton Road, Ware	Unsatisfactory FRA/FCA Submitted (Approved with conditions)
East Hertfordshire District Council	3/10/1416/FP	Replacement of 3 no. portacabins/containers to the rear of property.	Langley House, Station Road, Standon, Ware, Herts, SG11 1QN	PPS25/TAN15 - Request for FRA/FCA (Approved with conditions)
East Herts District Council	3/10/2040/OP	Residential Development	Land off, Longmead, Buntingford, Herts	Unsatisfactory FRA/FCA submitted (Surface Water)
St Albans District Council	5/2010/2381	Extension of time limit for implementation of outline planning permission 5/06/2729. Retirement community.	Former playing fields and 47 King Harry Lane, St Albans	Unsatisfactory FRA/FCA submitted (Surface Water)
St Albans District Council	05/10/2698	Outline Planning Application - Demolition Of Existing Blocks And Erection Of Three Blocks Comprising Of 33 One-Bedroom, 69 Two-Bedroom And 5 Three-Bedroom Flats And Associated Landscaping And Access.	Ridgeview Lodge, Barnet Road, London Colney	Unsatisfactory FRA/FCA submitted (Surface Water) (Approve subject to s106)

Local Planning Authority (LPA)	LPA Reference	Nature of Proposed Development	Site Address	Reason For Objection
Stevenage Borough Council	10/00343/FPM	Erection of 2no three storey research and development buildings with associated car parking and hard and soft landscaping.	Glaxo SmithKline, Research And, Development Ltd, Gunnels Wood Road, Stevenage, Herts, SG1 2NY	Unsatisfactory FRA/FCA submitted (Surface Water)
Welwyn-Hatfield District Council	S6/2010/1359	Re-configuration of yard to provide additional tractor parking spaces	DHL, Frobisher Way, Hatfield Business Park	PPS25/TAN15 - Request for FRA/FCA
Hertfordshire County Council	2/0457-10	The expansion of the Nobel School to 8 forms of entry (1600 pupil places) and it's co-location with the Stevenage Music Centre, plus related works.	The Nobel School, Mobbsbury Way, Stevenage, Herts	Unsatisfactory FRA/FCA Submitted
Hertfordshire County Council	2/0457-10	Proposed single storey extension to provide three classrooms, a new glazed link between the proposed extension and existing school building and 9 additional car parking spaces at Cowley Hill School, Winstre Road, Borehamwood, Hertfordshire, WD6 5DP	Cowley Hill Primary School, Winstre Road, Borehamwood, Hertfordshire.	Unsatisfactory FRA/FCA submitted (Surface Water)
Hertfordshire County Council	7/****-10	Proposed Sustainable Energy Facility (SEF) comprising an Advanced Thermal Treating facility (ATT) and Anaerobic Digestion (AD) facility to enable the composting and treatment of co-mingled or source separated municipal and commercial and industrial waste, together with the creation of a wharf and eco-zone comprising landscaping, ecological enhancement and flood attenuation ponds on land at Ratty's Lane, Hoddesdon	Land at Ratty's Lane, Hoddesdon, EN11 0FD	Unsatisfactory FRA/FCA Submitted

Local Planning Authority (LPA)	LPA Reference	Nature of Proposed Development	Site Address	Reason For Objection
Hertfordshire County Council	CDU/CM08880/ ****-09	Application for proposed change of use of land to a green waste recycling and composting operation, including the siting of temporary structures including skip, machinery, portaloo and erection of a steel portal framed building at Elstree Hill South, Adjacent to A41 Bypass. Submission of FRA.	Land at Elstree Hill South, Adjacent to A41 Bypass, Elstree, Hertfordshire	Unsatisfactory FRA/FCA Submitted

Source: The Environment Agency, 2011

2.9 Summary

The main sources of flood risk within the county include pluvial flooding, groundwater flooding and fluvial flooding.

Hertfordshire's Preliminary Flood Risk Assessment found that historic records of flooding from local sources across the county came from a range of sources including surface water, ground water, ordinary watercourses and sewers. Variability of recorded flooding data means that consistent records of flooding do not exist, making it difficult to quantify past flooding with any certainty.

The best available information on predicted surface water flood risk in Hertfordshire is the Flood Map for Surface Water. The Flood Map for Surface Water correlates well with local flood risk studies undertaken across Hertfordshire, indicating that it is suitable to use for assessment of the county. 53,400 properties are predicted to be at risk of deep flooding (up to 0.3 metres) in a high risk (1 in 200 chance in any year) event.

Areas predicted to be at risk of flooding from groundwater are shown by potential for groundwater emergence on the Areas Susceptible to Groundwater Flooding maps. Areas predicted to be at risk from groundwater or ordinary watercourses may be at risk from that source alone, or a combination of ground water or ordinary watercourse flooding and surface water flooding. It is unlikely that groundwater flooding would be experienced to any appreciable depth without the interaction of surface water. Therefore properties at risk of groundwater flooding are encompassed by the surface water statistics.

Parts of the county are covered by fluvial Flood Zones 2 and 3, with a total of 8,017 dwellings in Hertfordshire being located in Flood Zone 2 and 4,879 in Flood Zone 3 as of 2008. Significant levels of fluvial flood risk have been identified in the south and south east of the county in particular.

At 8.3%, Broxbourne District has the highest proportion of residential properties situated in Flood Zone 2. In numerical terms, East Hertfordshire District has the highest number of properties at 3,763 which equates to 4.5% of total dwelling stock.

Broxbourne and East Hertfordshire are also the local authorities with the highest proportion of dwellings situated in Flood Zone 3 at 3.4% and 2.9% respectively. East

Hertfordshire again reports the highest number of actual properties within the flood zone at 2,323.

The last widespread fluvial floods in Hertfordshire occurred in October 2001. This event was particularly severe along the rivers Ash and Rib which flow into the River Lee around Bishops Stortford and Hertford. In Little Hadham 44 properties were affected with 24 of those having internal flooding.

There have been intermittent occurrences of fluvial flooding across the county over the last few years but in particular events in February 2009 lead to some internal and external property flooding from the River Colne, and the River Lee and its tributaries.

Each river catchment area is subdivided into policy units within Catchment Flood Management Plans (CFMPs) which relate to parts of a river which can be said to have shared characteristics. Hertfordshire contains 8 such units. Six of these are within the Thames catchment and 2 within the Great Ouse catchment.

Flood Risk Management Strategies have been devised for the Lower Lee, Upper Lee, Upper Colne, River Ash and River Rib catchment areas as well as the town of Hertford. As climate change continues, flood risk is likely to increase.

In Hertfordshire, during April 2010 – March 2011 there were thirteen planning applications that were approved contrary to objections by the Environment Agency on the grounds of flood risk.

Further information on flooding from all sources in relation to each District or Borough is contained within their Level 1 Strategic Flood Risk Assessment.

3 WATER RESOURCES

Water policy in England aims to protect both public health and the environment by maintaining and improving the quality of water. In addition to the ever increasing demand from human uses, water contributes to the natural environment and is an influential factor in the protection of wildlife species and sites, especially wetlands and estuaries.

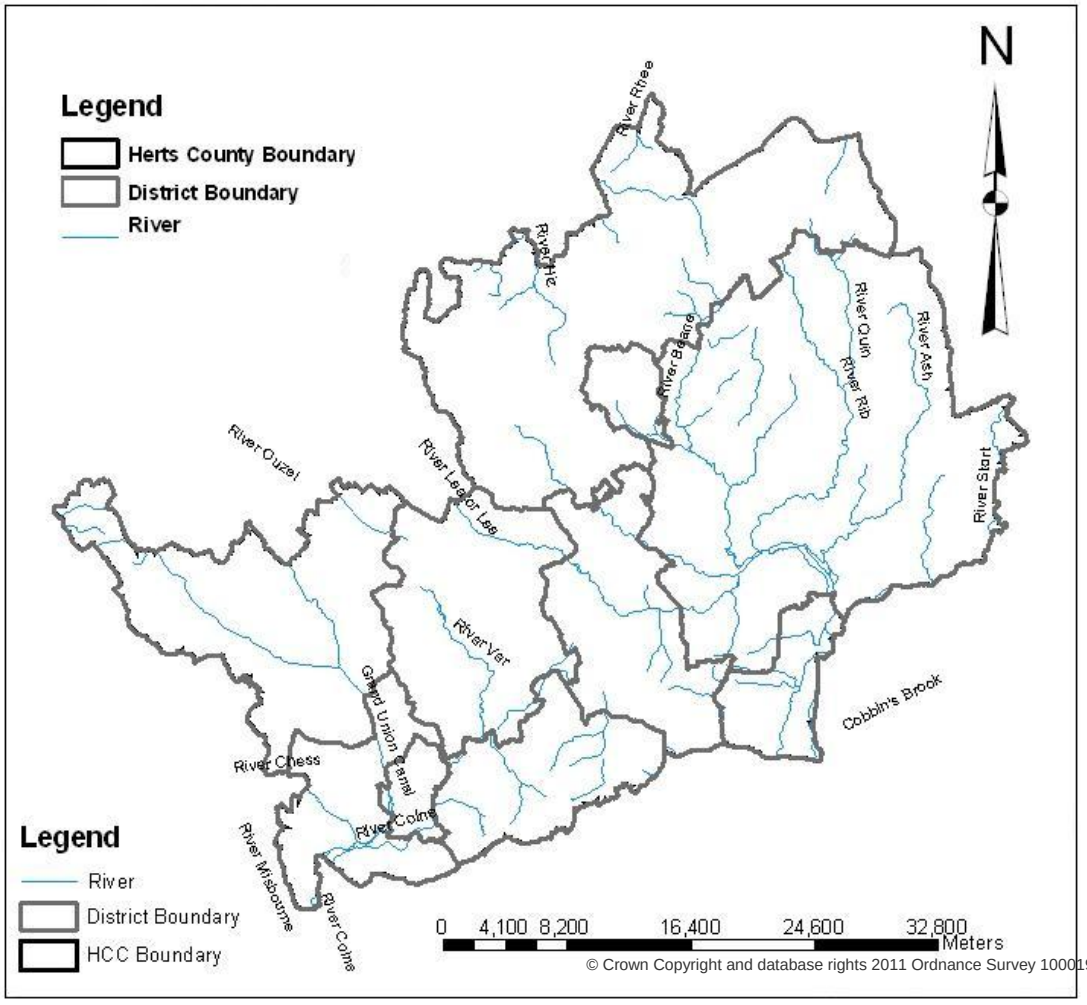
In England, the Department for Environment, Food and Rural Affairs (Defra) oversees water policy. The Environment Agency (EA) makes sure that these policies are carried out. The Agency has a responsibility to protect and enhance the environment as a whole, monitoring and enforcing aspects not only of water quality, but of air quality and waste management as well. (PPS23, Annex 1)

3.1 Inland Water Resources in Hertfordshire

3.1.1 Main Rivers

Figure 6 shows the location of the main water courses running through Hertfordshire. The main rivers within Hertfordshire are the River Lee in the north, Rivers Ash and Rib in the north east, the River Stort in the East and River Colne in the south.

FIGURE 6: MAIN RIVERS WITHIN HERTFORDSHIRE



Source: Hertfordshire County Council, 2011

3.1.2 Aquifers

Water resources are extracted from major rivers, reservoirs and a large number of groundwater sources. Chalk aquifers provide the majority of water within the county although water is also extracted from the Thames Gravel at Chertsey and from the Greensand to the north of the county.

The largest concentration of groundwater sources are in the River Colne valley and on the Chalk escarpment. Yields and concentrations of sources are lower to the north and east whilst groundwater flow is roughly down dip into the Colne and Lee catchments. In some areas, including the Rivers Mimram and Lee downstream of Welwyn Garden City, the chalk aquifer is overlain with alluvium soils and river terraces that readily transmit liquid discharges because they are shallow or susceptible to rapid flow directly to rock, gravel or groundwater.

The southern half of Welwyn Hatfield Borough is underlain by numerous minor aquifers, important for local water supplies, with variable permeability and superficial deposits of sand and grave. The major chalk aquifer in this area is confined by the London Clay and as such has little interaction with surface water, but is still of local significance to water supply.

Groundwater within the chalk feeds many rivers, streams and wetlands within Hertfordshire. Flow rates vary due to the large number of fissures in the rock which presents difficulties when trying to model water flow. However it can be said that winter rainfall percolates into the underlying chalk where it is stored, and then slowly released as base flow to watercourses, attenuating the response of river flows to rainfall events.

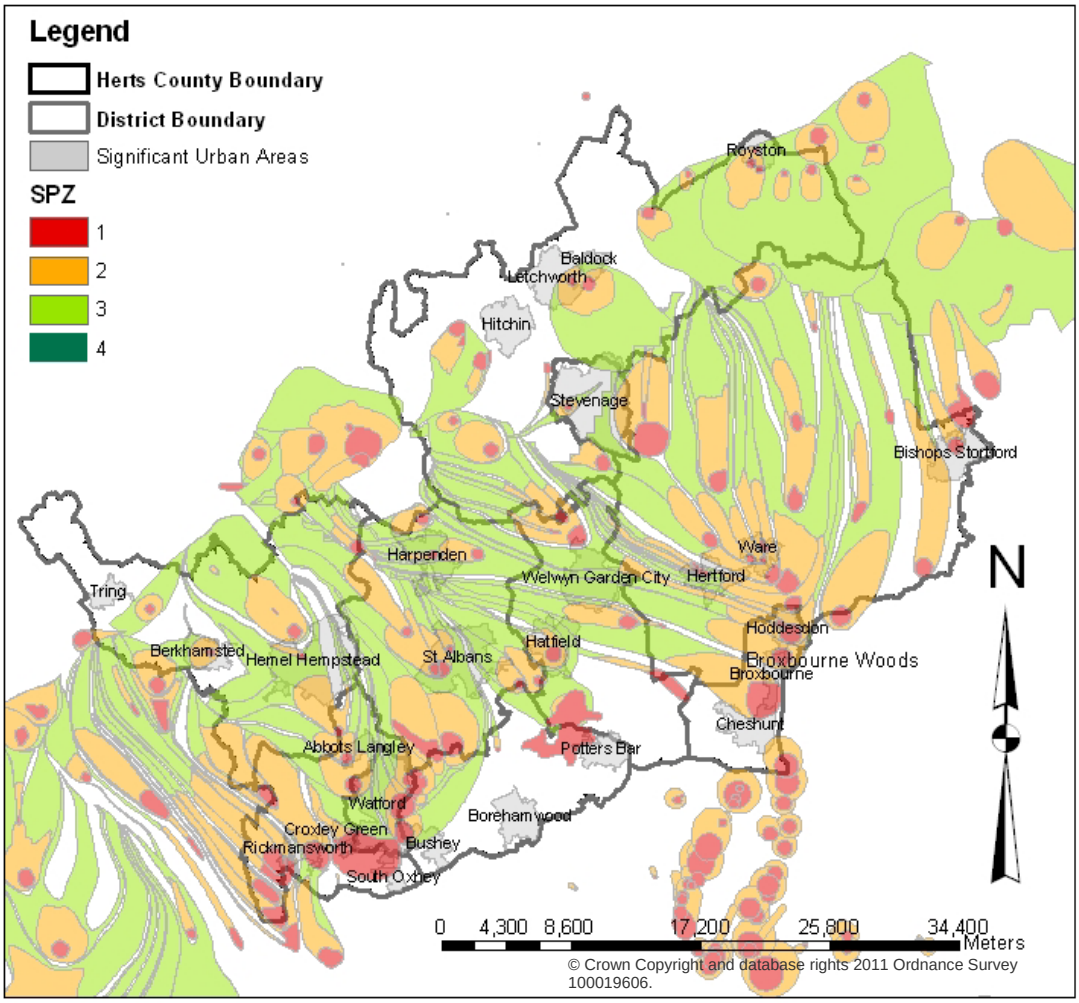
In order to ensure that drinking water is healthy and clean, the Environment Agency (EA) have declared Source Protection Zones (SPZ). These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. SPZ's are defined as being in one of three different categories as shown below:

TABLE 6: DEFINITION OF SOURCE PROTECTION ZONES

SPZ	Definition
1	The 50 day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres.
2	Defined by a 400 day travel time from a point below the water table. This zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction.
3	Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. There is still the need to define individual source protection areas to assist operators in catchment management.

Source: Environment Agency, 2011

FIGURE 7: GROUNDWATER SOURCE PROTECTION ZONES IN HERTFORDSHIRE



Source: Hertfordshire County Council, 2011

There have been a number of contamination events affecting aquifers within the county.

- Bromate and Bromide groundwater contamination from a former chemical works site in Sandridge (near St. Albans) which occurred in the mid-2000s caused the largest contaminant plume in the UK and has rendered 50km^2 of the chalk aquifer unusable for drinking water supply. This plume stretches eastwards for 20km to the Lee Valley, has caused the closure of the public supply borehole in Hatfield and imposed constraints on a further ten boreholes, including several in the area of the New River close to Broxbourne, although the effects are being mitigated.
- The Mid Chilterns Chalk around Watford has been assessed as having a poor status due to elevated levels of chlorinated solvents.
- An incident at Buncefield oil refinery in 2005 has resulted in contamination of water by PFOS which is a component of fire-fighting foam. The potential impact of this event on groundwater issues has not yet been fully realised.
- Further concerns regarding Hertfordshire relate to elevated levels of ammonium from landfill leachate and leaking sewers.

Two further pressures have been assessed for aquifers within the county:

- The main pressure is that of population growth. Growth will need to be sustainable, while impacts on wastewater, water quality and infrastructure quality and capacity will all need to be carefully managed. Wastewater infrastructure should be in place before new residential development is occupied.
- The aquifer is predominantly unconfined and is therefore susceptible to groundwater contamination from the surface. Several locations have the potential to be affected by a number of different pollutants that would require additional water treatment to enable the source to remain in service for public supply.
- Fractures within chalk, where the aquifers from which the majority of water is drawn from lie, may allow contaminants from pollution events to move rapidly and extensively. As such there is a need to ensure levels of protection and control accidental releases.

3.2 Water Supply in Hertfordshire

The EA is responsible for managing water resources in England and Wales. One of the ways that this is done is through licensing water abstraction. The EA developed Catchment Abstraction Management Strategies (CAMS) to:

- inform the public on water resources and licensing practice.
- provide a consistent approach to local water resources management.
- help to balance the needs of water-users and the environment.

There are two CAMS covering the county of Hertfordshire. The majority of Hertfordshire lies within the Thames River Catchment Area whilst some areas of North Hertfordshire and Stevenage Borough are within the Great Ouse River Catchment Area which also covers parts of East Anglia and the South Midlands.

Some of the issues that the CAMS cover are as follows:

- Are existing water resources adequate to meet future demands?
- Is the current level of abstraction having a significant impact on flows?
- How much water is needed to protect the river environment, including the fish?
- What are the most suitable options for managing the rivers?

The CAMS assessments for Hertfordshire state that the vast majority of rivers and groundwater in the country are ‘over-abstracted’. The assessed exceptions are the Stort catchment in the East and the Bedford Ouse catchment in the north which are ‘over-licensed’ and the Thames catchment to the West where there is ‘no water available’. Whilst these groundwater terms are different and have different implications for groundwater management, they all point towards there being no further sustainable sources of water in the county

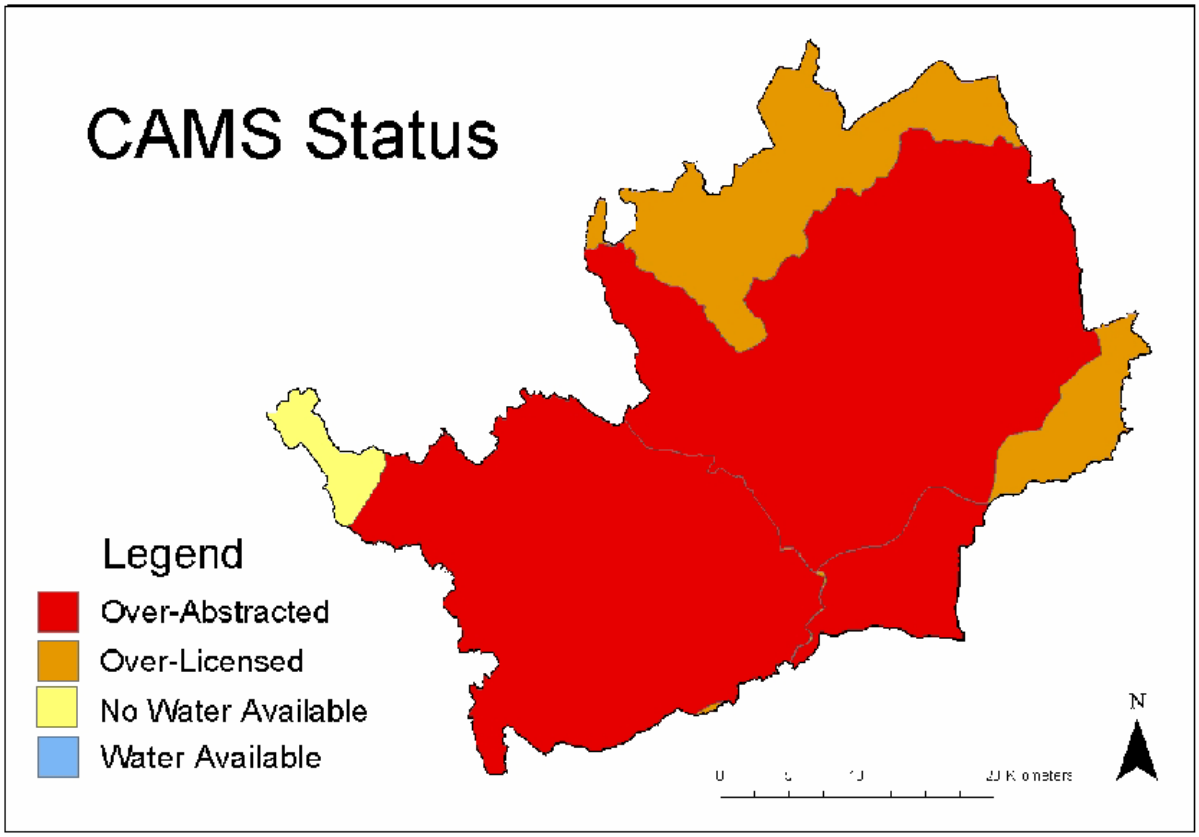
A further explanation of these terms is given in the table below:

TABLE 7: EXPLANATION OF GROUNDWATER STATUS TERMINOLOGY

Status	Explanation
Over-abstracted	At times of low flow there is not enough water for the environment
Over-licensed	At times of low flow there would not be enough water for the environment if all licenses were used to their capacity
No water available	At times of low flow there is enough water for the environment but no additional water is available for abstraction
Water available	At times of low flow there is enough water for the environment and additional water is also available for abstraction

The Environment in Hertfordshire, Environment Agency, 2010

FIGURE 8: CAMS STATUS IN HERTFORDSHIRE



The Environment in Hertfordshire, Environment Agency, 2010

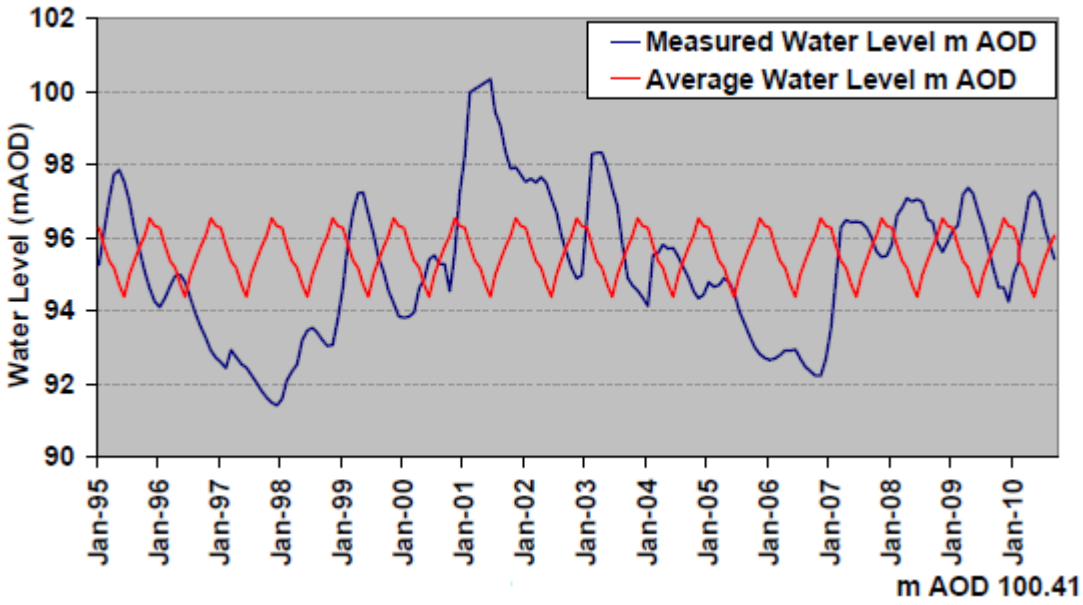
Seven sites are currently within the Restorable Sustainable Restoration programme, with the majority of these sites being related to public water supply abstractions which are being investigated due to concerns over the environmental sustainability of their abstraction licences.

A number of external pressures have been assessed as acting upon abstraction rates within the county:

- Climate change and population growth will likely see licensed abstraction rates being maximised to meet the demand for more water. It is assessed that it is necessary for domestic uses of water to be reduced.
- A lack of new sources and rising consumption could mean that water will have to be pumped into the county from greater distances. This is likely to have higher carbon costs and a financial implication.
- There is an assessed imbalance in where abstraction sites are located and where water is returned to the river from sewage treatment works. With sewage works typically occupying the lower end of catchments and abstractions the upper end, many main tributary rivers do not benefit from significant returning flows from these major sewage treatment works.

3.3 Groundwater Levels

FIGURE 9: GROUNDWATER LEVELS AT LILLEY BOTTOM



Source: Hertfordshire Quality of Life, 2010 (Veolia Water data)

Groundwater levels fluctuate based on the amount of rainfall which manages to permeate through the soil and recharge the aquifers. Most recharge occurs in the autumn and winter, giving rise to the highest levels of groundwater in April and the lowest in October.

The measured water level remained above average during 2007–09 due to good winter recharge in 2006-07, where rainfall was approximately 20 per cent more than usual, and there followed a wet summer. The dry September and October of 2009 delayed the onset of recharge and consequently groundwater levels dropped slightly below average. However the winter of 2009-10 was wet, with rainfall in November 2009 and February 2010 reaching over 70 per cent more than the long term average. This resulted in rapid recharge which retained water levels above average in 2010.

3.4 River Basin Management Plans

Water in rivers, estuaries, coasts and aquifers will improve under measures set out in River Basin Management Plans (RBMPs), drawn up for river basin districts across England and Wales under the Water Framework Directive. They contain the main issues for the water environment and the actions to deal with them. The RBMPs were submitted to the Secretary of State for Environment, Food and Rural Affairs and Welsh Ministers for approval. These submission versions are available to view at: http://www.environment-agency.gov.uk/research/planning/33106.aspx

Hertfordshire falls largely within the Thames River Basin District but also within the Anglian River Basin District. There are a number of significant water management issues identified in both River Basin Districts. These are:

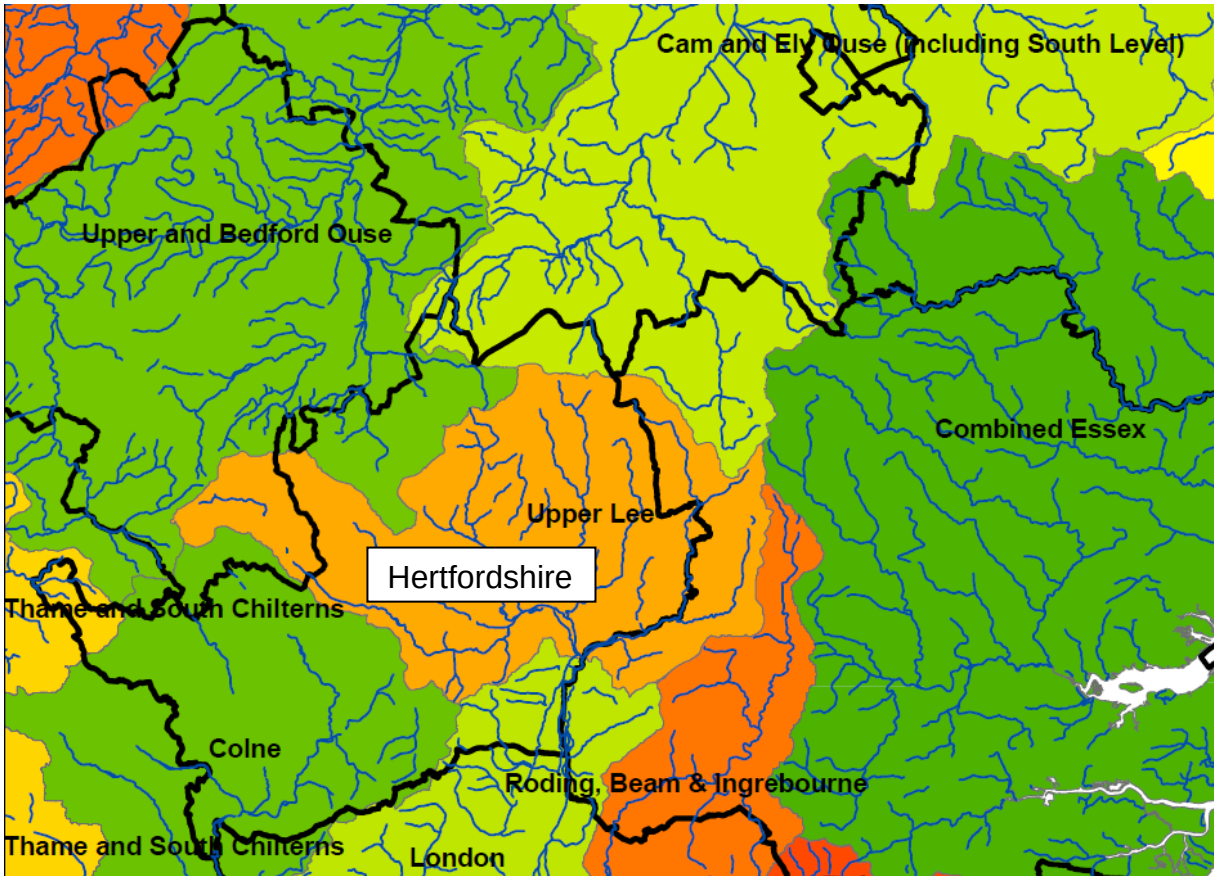
- **abstraction and other artificial flow regulation** – problems related to taking water from rivers, lakes and groundwater;
- **alien (non-native) species** - invasive non-native species are plants and animals that have deliberately or accidentally been introduced outside their natural range, and by spreading quickly threaten native wildlife;
- **organic pollution** – an excess of organic matter such as manure or sewage which depletes the oxygen available for wildlife;
- **pesticides** – chemical and biological products used to kill or control pests;
- **phosphate** – a nutrient in sewage and fertiliser that can cause too much algae to grow in rivers when in excess quantities;
- **physical modification** – changes to the structure of water bodies such as for flood defence purposes;
- **sediment** – undissolved particles of organic or inorganic material that can be suspended in a water body or accumulate on the surface. Some sedimentation occurs naturally however, excessive sedimentation can result from human activities; and
- **urban and transport pollution** – a range of pollutants related to urban areas and the transport network.

The following issue is affecting the Thames River Basin District only:

- **chemicals (including priority hazardous substances, priority substances & specific pollutants)** - such chemicals that may affect the physiology, growth, development and reproduction of aquatic organisms.

The River Basin Districts are subdivided into catchment areas, for which the Catchment Management Strategies (CAMS) are produced. There are five catchment areas covering different parts of Hertfordshire and the status of waters in each catchment is reported separately. These catchment areas are shown below:

FIGURE 10: RIVER CATCHMENT AND COUNTY BOUNDARIES



Source: Environment Agency, 2011

For surface waters there are two separate classifications for water bodies, namely ecological and chemical. Ecological status is measured on a 5 point scale from 'high' to 'bad'. 'Good' ecological status, the second highest category, is defined by the Environment Agency as showing a slight variation from undisturbed, natural waters. Physio-chemistry (e.g. pH, dissolved oxygen), biological elements present (shown separately by the Environment Agency), the presence of specific listed pollutants (e.g. metals and their compounds) and hydromorphology can all impact on this score. With regard to chemical status, this is measured on a 'good' or 'fail' basis, and relates to the presence of priority substances which present a significant risk to the water environment.

Table 8 and Table 9 detail the monitoring results of the catchment areas within Hertfordshire. Please note that the numbers in brackets refer to the number of waterbodies assessed under that particular criterion

TABLE 8: STATUS OF WATERS IN THE CATCHMENT AREAS OF THE ANGLIAN RIVER BASIN DISTRICT WITHIN HERTFORDSHIRE

Cam and Ely Ouse Catchment	Proportion	
Criteria	As Dec 09	2015
At good ecological status or potential	17%	18%
At good or high biological status (61)	27%	29%
At good chemical status (17)	94%	94%
At good status overall (chemical and ecological)	17%	18%

Improving for one or more elements in rivers	n/a	22%

Source: River Basin Management Plan: Anglian River Basin District, 2009

Upper and Bedford Ouse Catchment	Proportion	
Criteria	As Dec 09	2015
At good ecological status or potential	26%	29%
At good or high biological status (46)	39%	39%
At good chemical status (21)	100%	100%
At good status overall (chemical and ecological)	26%	29%
Improving for one or more elements in rivers	n/a	17%

Source: River Basin Management Plan: Anglian River Basin District, 2009

The chemical status of waters in the Anglian River Basin Area which are located in Hertfordshire is strongly positive, with 94 per cent of waters in the Cam and Ely Ouse Catchment having a good chemical status, and all waters in the Upper and Bedford Ouse Catchment also reporting this status. The proportion of waters with a good ecological status or potential is however far smaller and has lead to 17 per cent of waters in the Cam and Ely Ouse Catchment having a good chemical and ecological status, and 26 per cent within the Upper and Bedford Ouse Catchment. It is considered that by 2015, 22 per cent of sampled waterbodies in the Cam and Ely Ouse Catchment will show improvement in one or more of the delineated categories, with a figure of 17 per cent being reported for the Upper and Bedford Ouse Catchment.

TABLE 9: STATUS OF WATERS IN THE CATCHMENT AREAS OF THE THAMES RIVER BASIN DISTRICT WITHIN HERTFORDSHIRE

Colne	Proportion	
Criteria	As Dec 09	2015
At good ecological status or potential	18%	23%
At good or high biological status (17)	20%	30%
At good chemical status (7)	71%	71%
At good status overall (chemical and ecological)	18%	23%
Improving for one or more elements in rivers	n/a	35%

Source: River Basin Management Plan: Thames River Basin District, 2009

London	Proportion	
Criteria	As Dec 09	2015
At good ecological status or potential	18%	20%
At good or high biological status (21)	23%	23%
At good chemical status (9)	44%	67%
At good status overall (chemical and ecological)	18%	20%
Improving for one or more elements in rivers	n/a	32%

Source: River Basin Management Plan: Thames River Basin District, 2009

Upper Lee	Proportion	
Criteria	As Dec 09	2015
At good ecological status or potential	16%	19%
At good or high biological status (21)	10%	14%
At good chemical status (6)	67%	67%
At good status overall (chemical and ecological)	16%	19%
Improving for one or more elements in rivers	n/a	44%

Source: River Basin Management Plan: Thames River Basin District, 2009

A similar pattern to that described within the Anglian River Basin emerges for the watercourses within the Thames River Basin which flow through Herefordshire. Whilst the proportion of rivers attaining a good chemical status is smaller than that seen in the Anglian River Basin, the proportions are still higher than the reported proportions for waterbodies attaining good ecological status or potential. The three catchments applicable to Hertfordshire and within the Thames Basin show a similar proportion of waterbodies with good chemical and ecological status as that displayed by the Cam and Ely Ouse Catchment in the Anglian River Basin, with all four showing a smaller proportion than the 26 per cent reported in the Upper and Bedford Ouse Catchment.

3.5 Sustainable Drainage Systems

New developments can affect natural surface runoff rate, cause more water to pass through treatment works and therefore discharge more treated effluent to receiving

water courses, increase the discharge of poorly or un-attenuated storm water runoff into storm sewers or receiving watercourses and cause the discharge of storm flows in to the existing network and increase the risk of Combined Sewer Overflows (CSOs). All major developments should seek to integrate sustainable drainage systems (SuDS) rather than allow surface water drainage to be linked to the sewage system as this increases the potential for surface water and sewage flooding. SuDS have the potential to discharge good quality surface water into local rivers or groundwater rather than directly discharging surface water into rivers, as exists at Stevenage Brook, or conveying the flow to treatment works via the sewage system. The retrofitting of SuDS to existing developments is also possible and should be considered to mitigate against the relatively high amount of surface runoff which occurs in urban areas.

There is SuDS hierarchy that the EA currently suggests, showing the preferred order in which SUD techniques should be considered. This is repeated below:

FIGURE 11: SUDS HIEARCHY

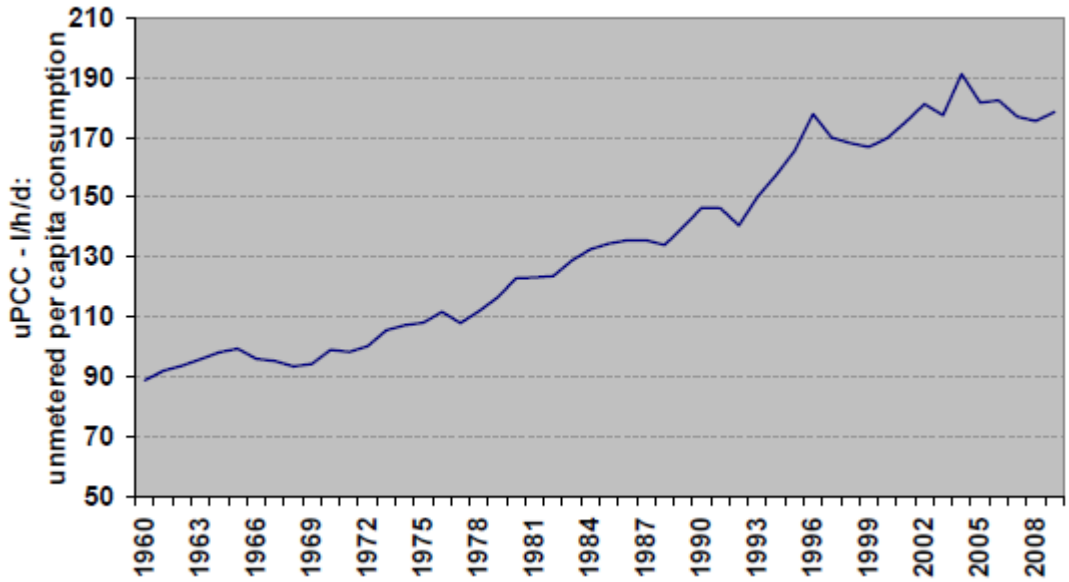
Most Sustainable	*SUDS technique*	*Flood Reduction*	*Pollution Reduction*	*Landscape & Wildlife Benefit*
	Living roofs	✔	✔	✔
↑	**Basins and ponds** - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✔	✔	✔
	Filter strips and swales	✔	✔	✔
	Infiltration devices - soakaways - infiltration trenches and basins	✔	✔	✔
↓	**Permeable surfaces and filter drains** - gravelled areas - solid paving blocks - porous paviors	✔	✔	
Least Sustainable	**Tanked systems** - over-sized pipes/tanks - storms cells	✔		

Source: Rye Meads Water Cycle Strategy, 2009

An opportunity exists to link the design of SUDS with Green Infrastructure Strategies, to provide an integrated network that relieves flood risk whilst enhancing biodiversity. Attenuation basins and wetlands can provide valuable habitats for wildlife, as well as forming parts of green corridors between environmentally important sites.

3.6 Water Consumption

FIGURE 12: WATER CONSUMPTION (VEOLIA WATER)



Source: Hertfordshire Quality of Life, 2010 (Veolia Water data)

There is a clear upward trend with regard to the consumption of water within the county. Veolia Water's domestic, non-metered customers increased their water usage last year to an average consumption of 179 litres per person per day in 2009-10. Metered customers used less, at 147 litres per person per day. This compares to a UK non-metered average of 150 litres per person per day. Increased water efficiency will contribute towards less water needing to be abstracted and/or treated at Sewage Treatment Works before being discharged back into our rivers and streams.

3.7 Summary

The main rivers within Hertfordshire are the River Lee in the north, Rivers Ash and Rib in the north east, the River Stort in the East and River Colne in the south.

Water resources are extracted from major rivers, reservoirs and a large number of groundwater sources. Chalk aquifers provide the majority of water within the county although water is also extracted from the Thames Gravel at Chertsey and from the Greensand to the north of the County. The largest concentration of groundwater sources are in the River Colne valley and on the Chalk escarpment. Yields and concentrations of sources are lower to the north and east whilst groundwater flow is roughly down dip into the Colne and Lee catchments. There have been a number of contamination events affecting aquifers within the county. This has strong implications for water resources in the county as chalk aquifers, as described above, provide the majority of water within the county and fractures within the chalk may allow contaminants from pollution events to move rapidly and extensively.

Hertfordshire falls largely within the Thames River Basin District but also within the Anglian River Basin District. There are a number of significant water management issues identified in both River Basin Districts. These include too great a rate of abstraction, invasive species, organic pollution, pesticides, sediment, and pollution

from urban and transport sources. In addition the Thames River Basin District is affected by chemical pollutants.

The River Basin Districts are subdivided into catchment areas, for which the Catchment Management Strategies (CAMS) are produced. There are five catchment areas covering different parts of Hertfordshire and the status of waters in each catchment is reported separately.

The majority of Hertfordshire lies within the Thames River Catchment Area whilst some areas of North Hertfordshire and Stevenage Borough are within the Great Ouse River Catchment Area which also covers parts of East Anglia and the South Midlands. The CAMS assessments for Hertfordshire state that the vast majority of rivers and groundwater in the county are 'over-abstracted'. The assessed exceptions are the Stort catchment in the East and the Bedford Ouse catchment in the north which are 'over-licensed' and the Thames catchment to the West where there is 'no water available'. Whilst these groundwater terms are different and have different implications for groundwater management, they all point towards there being no further sustainable sources of water in the county. A number of further external pressures have been assessed as acting upon abstraction rates within the county, namely climate change and population growth. Despite this, retained groundwater levels were recorded as being above average in 2010 due to the rapid recharge caused by rainfall being over 70% more than the long-term average in late 2009 and early 2010. Groundwater levels in Hertfordshire do however fluctuate, with measured levels being below average immediately preceding this period due to a dry autumn in 2009.

Hertfordshire falls largely within the Thames River Basin District but also within the Anglian River Basin District. There are a number of significant water management issues identified in both River Basin Districts. These include too great a rate of abstraction, invasive species, organic pollution, pesticides, sediment, and pollution from urban and transport sources. In addition the Thames River Basin District is affected by chemical pollutants.

Abstraction rates have already been identified as being too great to be truly sustainable, and there is a clear upward trend with regard to the consumption of water within the county. Veolia Water's domestic, non-metered customers increased their water usage last year to an average consumption of 179 litres per person per day in 2009-10. Metered customers used less, at 147 litres per person per day. This compares to a UK non-metered average of 150 litres per person per day. Increased water efficiency will contribute towards less water needing to be abstracted and/or treated at Sewage Treatment Works before being discharged back into our rivers and streams.

4 POPULATION AND SOCIAL ISSUES

Understanding the context of local demographic trends is important in planning for the future of an area, to account for the changing needs of the population, and the needs of people who live and work in Hertfordshire.

4.1 Population

The Office for National Statistics (ONS) publishes annual mid year estimates and biannual projections for population which is important to many facets of sustainable planning because they indicate the number of people likely to be living in an area and provide a base for estimating development levels and necessary service provision.

4.1.1 Population Structure

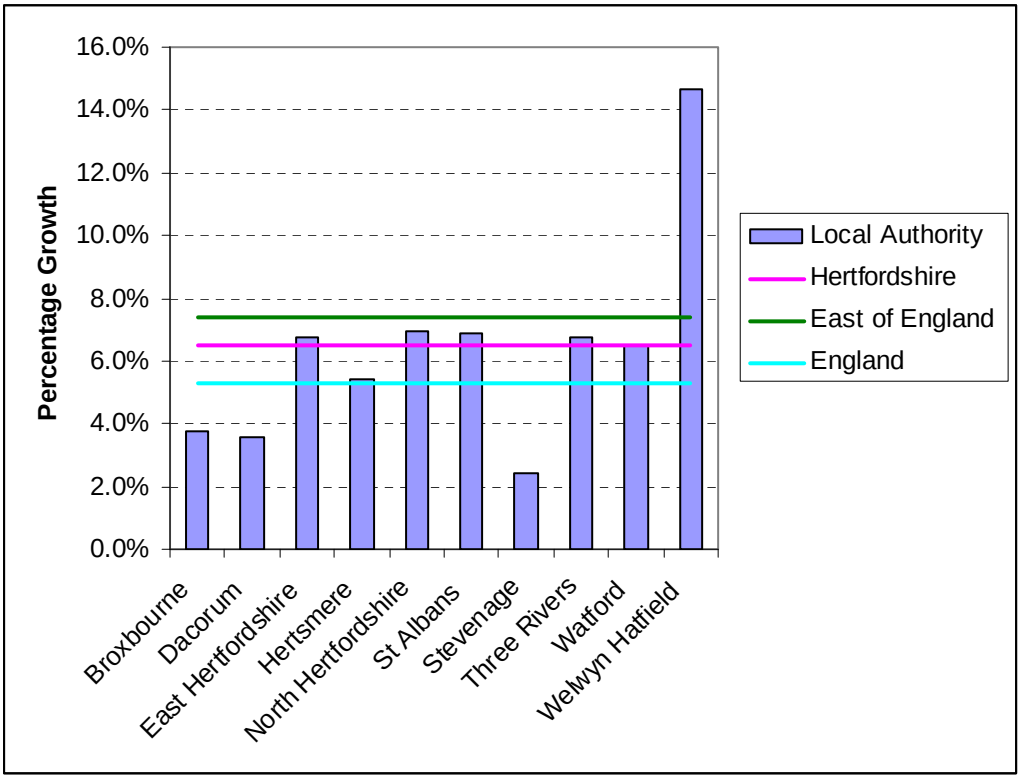
Table 10 shows the 2010 mid-year estimated population structure of Hertfordshire, East of England and England.

TABLE 10: MID-YEAR POPULATION ESTIMATES, 2010

Local Authority	2001	2010	Difference	Percentage Change
Broxbourne	87,200	90,609	3,409	3.8%
Dacorum	137,800	142,881	5,081	3.6%
East Hertfordshire	129,100	138,476	9,376	6.8%
Hertsmere	94,500	99,924	5,424	5.4%
North Hertfordshire	117,100	125,809	8,709	6.9%
St Albans	129,200	138,753	9,553	6.9%
Stevenage	79,800	81,766	1,966	2.4%
Three Rivers	82,900	88,932	6,032	6.8%
Watford	80,400	86,003	5,603	6.5%
Welwyn Hatfield	97,600	114,368	16,768	14.7%
Hertfordshire	1,035,600	1,107,521	71,921	6.5%
East of England	5,400,500	5,831,845	431,345	7.4%
England	49,449,700	52,234,045	2,784,345	5.3%

Source: ONS, 2011

FIGURE 13: MID-YEAR POPULATION ESTIMATES, 2010



Source: ONS, 2011

The above table shows that Hertfordshire had an estimated population 1,107,521 people as of 2010, an increase of 71,921 people from 2001. At 6.5 per cent this rate of increase is slightly below the equivalent regional figure but above that seen at the national level. In 2010, Dacorum had the largest estimated population in 2010 within Hertfordshire at 142,881 people. The smallest population estimate was made for Stevenage at 81,766.

The largest percentage increase in population between 2001 and 2010 was expected to have occurred in Welwyn Hatfield at 14.69 per cent and the lowest proportional population increase was reported for Stevenage at 2.44 per cent.

4.1.2 Population Projections by ONS

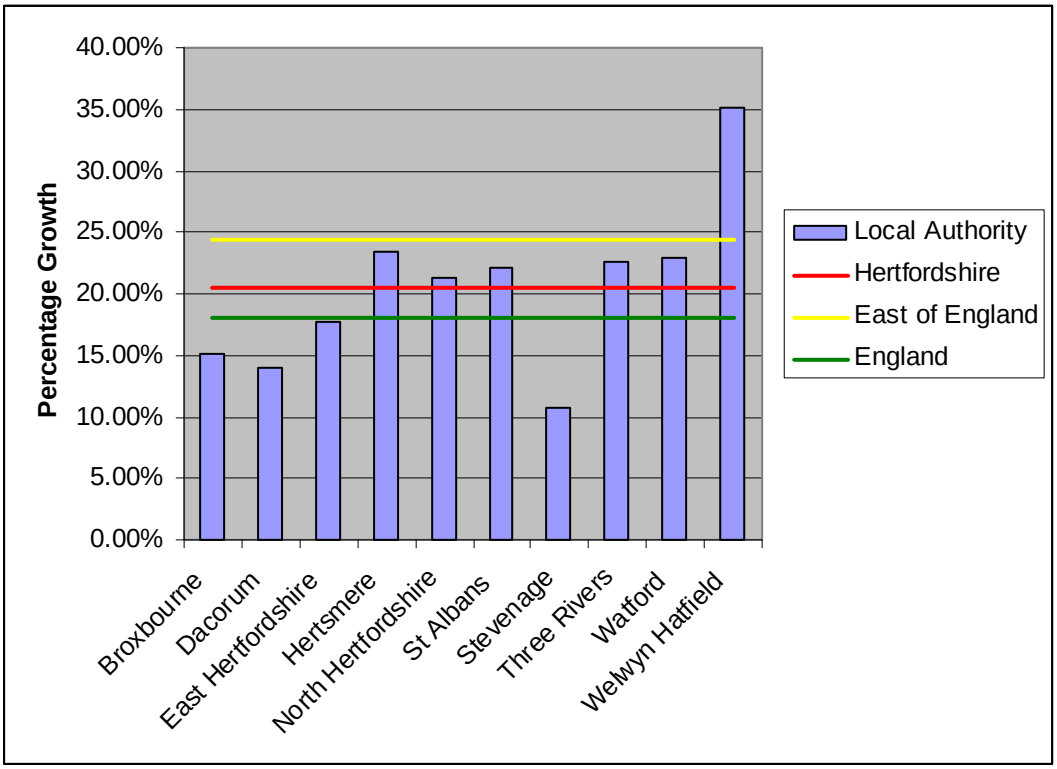
The ONS projections for 2021 are trend based projections. Generally this means that future populations are based on assumptions that births, deaths and migration will continue observed trends over the previous five years. They show what the future population of an area will be if these trends continue. They do not reflect any future policy intentions.

TABLE 11: REVISED 2008-BASED POPULATION PROJECTIONS, 2008 - 2033

Local Authority	2008	2033	Percentage Change
Broxbourne	89,600	103,200	15.18%
Dacorum	139,900	159,400	13.94%
East Hertfordshire	135,700	159,800	17.76%
Hertsmere	97,900	120,800	23.39%
North Hertfordshire	123,700	150,100	21.34%
St Albans	135,200	165,100	22.12%
Stevenage	80,500	89,200	10.81%
Three Rivers	87,100	106,800	22.62%
Watford	82,500	101,400	22.91%
Welwyn Hatfield	111,700	151,000	35.18%
Hertfordshire	1,083,900	1,306,800	20.56%
East of England	5,717,400	7,114,300	24.43%
England	51,464,600	60,715,200	17.97%

Source: ONS, 2011

FIGURE 14: REVISED 2008-BASED POPULATION PROJECTIONS, 2008–33



Source: ONS, 2011

The greatest population increases are projected to occur within Welwyn Hatfield (35.18 per cent) and Hertsmere (23.39 per cent). A further 3 districts are expected to

have population increases of between 22 per cent and 23 per cent over the period 2008– 33. Stevenage is expected to have the smallest population increase at 10.81 per cent.

Overall Hertfordshire is projected to increase its population by 20.56 per cent between 2008 and 2033. This percentage change is greater than the national level but below that of the region. It is important to ensure that housing requirements can be provided in areas which won't exacerbate flood risk issues.

4.2 Indices of Multiple Deprivation

Indices of Multiple Deprivation (IMD) are a tool that can be used to measure the level of deprivation in any given area. The Indices are comprised of a number of indicators focussed across a range of social, economic and housing issues. Each indicator can be analysed separately or combined to give a score of relative deprivation in any single main topic area. Each indicator or group result is ranked against all other areas in England in order to ascertain a relative performance. The latest figures relate to the year 2010 whilst the (rank) relates to relative performance against all other districts and boroughs in the country. A rank of one equates to the most deprived local authority under that measure. Preceding the data table is a brief explanation of terms. Please note that there are considerably more indicators available than presented here which detail specific housing, economic and social / environmental issues. These will be utilised if it is considered that they are required for the assessment of the LFRMS and in that event will be included in the Baseline Report accompanying the SEA Environmental Report.

TABLE 12: EXPLANATION OF INDICES OF MULTIPLE DEPRIVATION INDICATORS

Indicator	Explanation
Average Score	Population weighted average of the combined scores for the SOAs in a district.
Average Rank	Population weighted average of the combined ranks for the SOAs in a district.
Extent	Proportion of the district's population living in the most deprived SOAs in the country.
Local Concentration	Population weighted average of the ranks of a district's most deprived SOAs that contain exactly 10 per cent of the district's population.
Income Scale	Number of people in the district who are income deprived.
Employment Scale	Rank of number of people in the district who are employment deprived, where 1 is most deprived.

Source: ONS, 2011

TABLE 13: HERTFORDSHIRE PERFORMANCE AGAINST HEADLINE IMD2010 INDICATORS BY DISTRICT, 2010

Local Authority	Average Score (Rank)	Average Rank (Rank)	Extent (Rank)	Local Concentration (Rank	Income Scale (Rank)	Employment Scale (Rank)
Broxbourne	14.61 (207)	12,319.90 (205)	0.03 (211)	24,665.5 (208)	11,119 (201)	3,694 (245)
Dacorum	10.9 (267)	8,949.31 (266)	0.00 (277)	21,910.11 (255)	13,396 (167)	5,119 (189)
East Hertfordshire	7.84 (314)	5,811.46 (313)	0.00 (294)	17,541.49 (305)	8,907 (251)	3,579 (254)
Hertsmere	13.62 (221)	11,514.1 (222)	0.02 (223)	24,085.16 (219)	9,916 (225)	3,627 (247)
North Hertfordshire	10.43 (277)	8,354.47 (282)	0.01 (246)	22,074.18 (251)	11,222 (199)	4,057 (225)
St Albans	7.75 (317)	5,743.84 (31)	0.00 (282)	19,690.28 (286)	9,648 (232)	3,811 (242)
Stevenage	16.76 (173)	14,893.57 (158)	0.02 (221)	23,403.31 (228)	10,855 (208)	3,989 (235)
Three Rivers	9.66 (291)	7,447.09 (297)	0.02 (230)	22,122.23 (250)	7,013 (284)	2,484 (292)
Watford	15.33 (197)	13,212.69 (189)	0.02 (231)	23,868.19 (221)	9,006 (247)	3,411 (261)
Welwyn Hatfield	12.41 (243)	10,608.11 (238)	0.01 (261)	21,872.1 (257)	10,411 (212)	4,003 (233)

Source: ONS, 2011

Table 13 shows the national rankings of Hertfordshire's districts, ranked out of the 354 districts and unitary authorities in England. Stevenage, Watford and Broxbourne are the least strongly performing local authority areas in Hertfordshire when measured by average score. When measured against the rest of the country, the least well performing borough, Watford, is still in the top 50 per cent of districts.

The IMD2010 results show that different types of deprivation are more prevalent in some areas than others. For example, whilst Watford is identified as the least strongly performing borough / district in Hertfordshire across all measures, the borough reports the second strongest performance under economic deprivation across the county. Dacorum, whilst one of the strongest performers on average, has one of the higher levels of economic deprivation.

4.3 Summary

Hertfordshire had an estimated population 1,107,521 people as of 2010, an increase of 71,921 people from 2001. At 6.5 per cent this rate of increase is slightly below the equivalent regional figure but above that seen at the national level.

Overall Hertfordshire is projected to increase its population by 20.56% between 2008 and 2033. This percentage change is greater than the national level but below that of the region. The greatest population increases are projected to occur within Welwyn Hatfield (35.18%) and Hertsmere (23.39%). A further 3 districts are expected to have population increases of between 22–23% over the period 2008-33. Stevenage is expected to have the smallest population increase at 10.81%.

Stevenage, Watford and Broxbourne are the least strongly performing local authority areas in Hertfordshire when measured by average score on the Indices of Multiple Deprivation (IMD) 2010. On a national scale, the least well performing borough, Watford, is still identified as being within the 50% of least deprived districts nationally. However relative deprivation within the County should still be considered.

The IMD 2010 results show that different types of deprivation are more prevalent in some areas than others. For example, whilst Watford is identified as the least strongly performing borough / district in Hertfordshire across all measures, the borough reports the second strongest performance under economic deprivation across the county. Conversely, Dacorum, whilst identified as having relatively low levels of deprivation, has one of the higher levels of economic deprivation within the County.

5 CLIMATIC FACTORS

Planning's role is not only to shape sustainable communities which are resilient to future climates, but to reduce emissions and minimise the human impact on the environment. Changes in climate are inevitable and 'PPS: Planning and Climate Change' acknowledges that in the future "*we are likely to see more extreme weather events, including hotter and drier summers, flooding and rising sea-levels increasing the risk of coastal erosion*" in the UK.

5.1 Climate Change Projections

The UK Climate Impact Programme has developed the UK Climate Change Projections 2009 (UKCP09) which models future climate scenarios for the UK. The projections that are made within the UKCP09 are based on subjective probabilities, meaning that they give an indication of the relative strength of scientific evidence for any particular scenario. For example, a subjective probability of 50 per cent means that any given change is 'as likely as not' to happen, in that there is a 50 per cent probability of the prediction being exceeded and a 50 per cent probability of it being lower than expected. Figures of 10 per cent and 90 per cent translate as an event being unlikely to be less than presented (10 per cent) or unlikely to be greater than presented (90 per cent).

There now follows a summation of the expected changes in Hertfordshire with regard to changing temperatures and levels of snowfall and rain due to the impacts of climate change. In general it can be said that Hertfordshire currently experiences temperate annual summer and winter temperatures although across the 2020s, 2050s and 2080s Hertfordshire is predicted to get warmer and will experience more variable summer and winter temperatures. With regard to rainfall and snow, the distribution is assessed as currently being even throughout the year. By the 2020s Hertfordshire is expected to have similar annual average rainfall to that of the 1961-90 baseline with increased variability in summer and more rainfall or snow in the winter. By the 2050s patters of precipitation are predicted to change. Whilst annual average rain and snowfall is predicted to be the same as experienced currently, there is expected to be increased variability in the summer and much more rainfall or snow in the winter. By the 2080s, patterns of precipitation are expected to change dramatically from that reported in the baseline. Winters are predicted to be much wetter and summers much drier, although considerable variation is predicted for summer precipitation. It is possible that increases in winter precipitation could potentially dramatically exacerbate any identified flooding issues in the county. Temperature and precipitation changes as assessed by the UKCP09 project are expanded upon in Table 14 and Table 15, whilst Figure 15 and Figure 16 highlight how precipitation is predicted to evolve. Regarding the different scenarios presented in the figures, a low emissions scenario relates to an eventuality where released emissions are lower that is currently predicted, with a high emissions scenario translating to an eventuality where emissions are above 'business-as-usual

TABLE 14: MEASURED AND PREDICTED CHANGES IN TEMPERATURE WITHIN HERTFORDSHIRE 1961 – 2099

Baseline Climate 1961 - 1990	2010 - 2039	2040 - 2069	2070 - 2099
Annual average temperature in Hertfordshire is 10°C.	Change in mean annual average temperature suggests a 1°C warming, but could be up to 2°C at the extreme.	Change in mean annual average temperature suggests a 2°C warming, but could be up to 5°C at the extreme.	Change in mean annual average temperature suggests a 3°C warming, but could be up to 7°C at the extreme.
Daily minimum temperatures in winter are 1°C.	Summer mean daily max temperature shows increase from 21°C to 23°C but could reach 24°C at the extreme.	Summer mean daily max temperature shows increase from 21°C to 24°C but could reach 27°C at the extreme.	Summer mean daily max temperature shows increase from 21°C to 24°C but could reach 31°C at the extreme.
Daily maximum temperatures in summer are 21°C on average	Temperature on warmest day in summer expected to increase by 1°C but may increase by up to 5°C at the extreme.	Temperature on warmest day in summer expected to increase by 2°C but may increase by up to 9°C at the extreme.	Temperature on warmest day in summer expected to increase by 3°C but may increase by up to 12°C at the extreme.
	Temperature on warmest night in summer expected to increase by 1°C but may increase up to 3°C at the extreme.	Temperature on warmest night in summer expected to increase by 2°C but may increase up to 5°C at the extreme.	Temperature on warmest night in summer expected to increase by 2°C but may increase up to 8°C at the extreme.
	The temperature on the coldest night in winter is expected to increase by 2°C but may increase up to 4°C at the extreme.	The temperature on the coldest night in winter is expected to increase by 3°C but may increase up to 5°C at the extreme.	The temperature on the coldest night in winter is expected to increase by 3°C but may increase up to 7°C at the extreme.

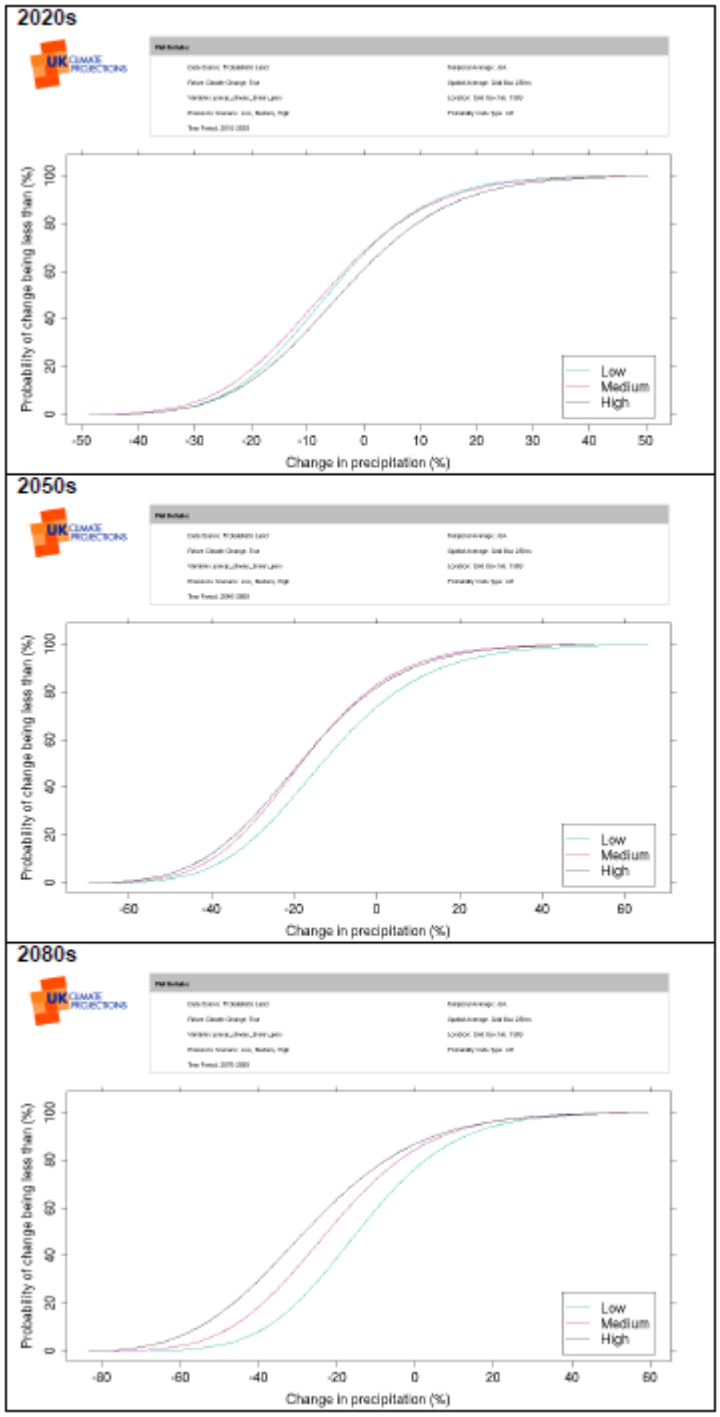
Source: Hertfordshire UKCP09 headlines report, 2010

TABLE 15: MEASURED AND PREDICTED CHANGES IN RAINFALL AND SNOW WITHIN HERTFORDSHIRE 1961 – 2080S

Baseline Climate 1961 - 1990	2010 - 2039	2040 - 2069	2070 - 2099
Annual average rainfall is 2mm/day.	Change in annual average rain or snow is minimal by the 2020s	Change in annual average rain or snow is minimal by the 2050s	Change in annual average rain or snow shows minimal to a slight incline by the 2080s
Summer rainfall is 2mm/day on average.	Summer rainfall could decrease by 7 per cent	Summer rainfall could decrease by 13 per cent	Summer rainfall could decrease by 15 per cent
Winter rainfall or snow is 2mm/day on average.	Summer rainfall shows much more variability within the season and could reduce by as much as 25 per cent or potentially increase by up to 17 per cent at the extremes.	Summer rainfall shows much more variability with the season and could reduce by as much as 42 per cent or potentially increase by up to 15 per cent at the extremes.	Summer rainfall shows much more variability with the season and could reduce by as much as 55 per cent or potentially increase by up to 13 per cent at the extremes.
	Rainfall (or snow) on the wettest day in winter may increase by 6 per cent, with the potential to increase by 22 per cent at the extreme.	Rainfall (or snow) on the wettest days in winter may increase by 12 per cent, with the potential to increase by 35 per cent at the extreme.	Rainfall (or snow) on the wettest day in winter may increase by 16 per cent, with the potential to increase by 56 per cent at the extreme.

Source: Hertfordshire UKCP09 headlines report, 2010

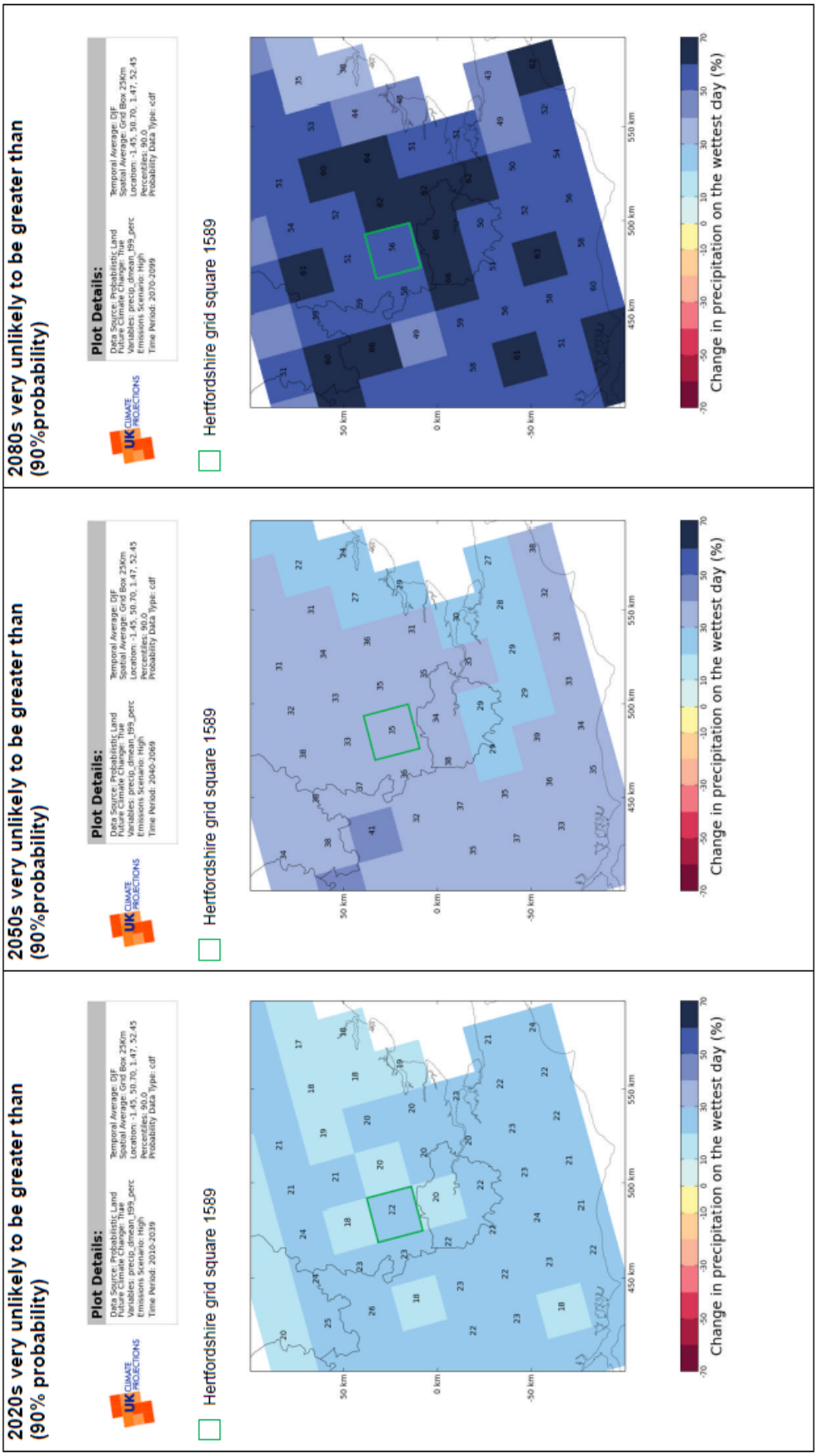
FIGURE 15: SUMMER AVERAGE CHANGE IN PRECIPITATION



Source: Hertfordshire UKCP09 headlines report, 2010

By the 2050s it is assessed that there is a 50 per cent probability of precipitation in Hertfordshire reducing in the summer by approximately 10 per cent under a low emissions scenario rising to approximately 20 per cent under the medium and high emission scenarios. By the 2080s there is predicted to be a 50 per cent chance of summer average precipitation dropping by approximately 20 per cent under a low emission scenario and approximately 30 per cent under a high emissions scenario.

FIGURE 16: CHANGE IN PRECIPITATION ON THE WETTEST DAY IN WINTER (PER CENT) FOR HIGH EMISSION SCENARIO

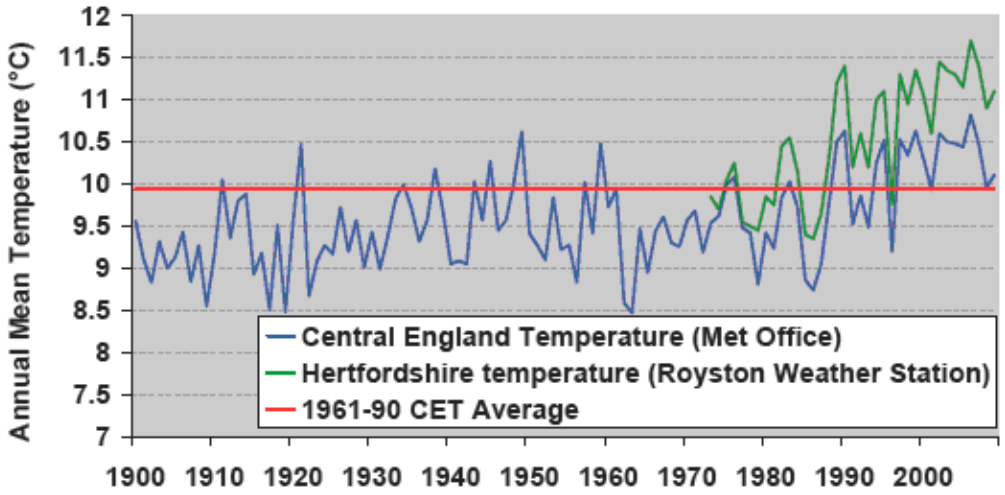


Source: Hertfordshire UKCP09 headlines report, 2010

By the 2020s it is predicted that it is unlikely (90 per cent probability) that precipitation levels will exceed an increase of approximately 22 per cent compared to the baseline figure on the wettest winter day under a high emission scenario. By the 2080s, Hertfordshire is expected to witness an increase in precipitation of approximately 56 per cent. Such figures evidently have implications for flooding events within the county, with existing flood risk expected to multiply in severity and occurrence.

5.2 Annual Mean Temperature

FIGURE 17: ANNUAL MEAN TEMPERATURE

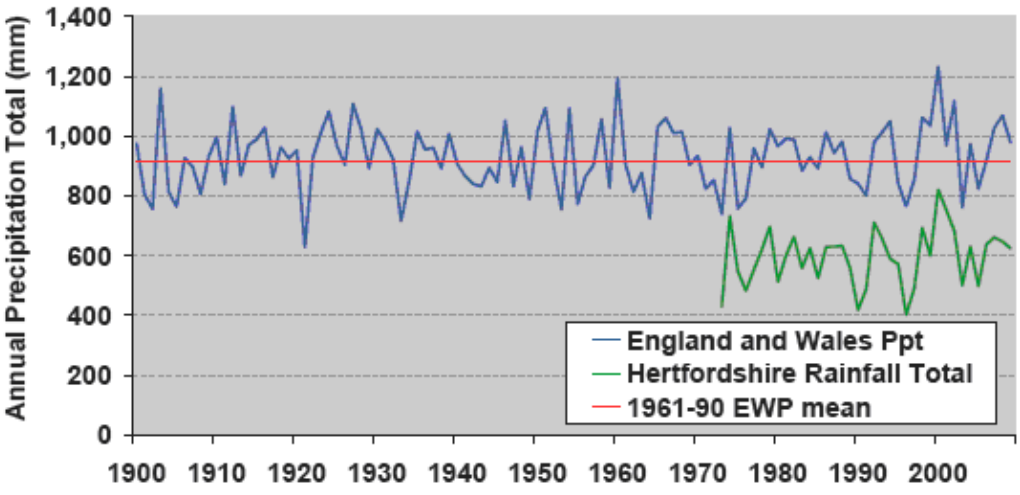


Source: Hertfordshire Quality of Life, 2010

The Central England Temperature (CET) presents the monthly mean surface air temperatures within the Midlands region of England and is the longest monthly series of observations available. Both Hertfordshire and the CET show a long-term warming trend. Annual mean temperatures in Hertfordshire are slightly higher than the CET. It is considered that this may be due to the influence of warmer weather systems from the European continent or the urban heat island effect, potentially caused by Hertfordshire's proximity to London.

5.3 Annual Mean Precipitation

FIGURE 18: ANNUAL TOTAL PRECIPITATION



Source: Hertfordshire Quality of Life, 2010

No obvious trend is possible to ascertain in annual total precipitation measurements at either the county or national level. Seasonal variations are also hidden when looking at annualised totals although it is known through modelling carried out by the UKCP09 project that summers will get drier and winters will get wetter. It can also be stated that precipitation in Hertfordshire is lower than the national average. Hertfordshire is located in the East of England, the driest region in the UK, and it is possible that additional growth and the effects of climate change could increase water stresses in the region in the summer.

5.4 Key Projections for the Thames and Anglian River Basin Districts

An understanding of current and future vulnerability to flooding will allow the county as a whole the opportunity to increase its resilience and build in the capacity to adapt. Local decisions will however need to be made under a degree of uncertainty and as such a flexible range of measures will need to be devised.

5.4.1 Implications of Flooding within the Thames River Basin District

Whilst impacts will depend on local conditions and vulnerability, it can be stated that wetter winters, and an increase in precipitation falling during wet spells, may increase river flooding in both rural and heavily urbanised catchments. Rainfalls of higher intensity will create an increase in surface runoff, increasing localised flooding and erosion. In turn, this may increase pressures on drains, sewers and water quality. Storm intensity in the summer could increase even during drier summers, creating its own issues. There is a particular risk of flooding from groundwater-bearing chalk and limestone aquifers across the district. Recharge may increase in wetter winters but decrease in drier summers.

5.4.2 Implications of Flooding within the Anglian River Basin District

Similar to the situation in the Thames Region, realised impacts will depend on local conditions and vulnerability although again it is predicted that wetter winters and an increase in the amount of rain falling during wet spells may increase river flooding. More intense rainfall will likely result in an increase in surface runoff, increasing localised flooding and erosion. In turn, this may increase pressures on drains, sewers and water quality. Again, storm intensity in summer could increase even in drier summers. Drainage systems within the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently.

5.5 CO_2 Emissions

The burning of fossil fuels, changes in land use, and various industrial processes are adding heat-trapping gases, particularly carbon dioxide (CO_2), to the atmosphere. There is now roughly 40 per cent more CO_2 in the atmosphere than there was before the industrial revolution. One of the main causes of increased CO_2 in the atmosphere is through the burning of fossil fuels for electricity; heating dwellings and other buildings; and transportation (via the internal combustion of fossil fuels and fossil fuel products).

Table 16 sets out the CO_2 emissions per capita for the districts within Hertfordshire, with the East of England figure given for comparison. The following table amalgamates CO_2 emissions from industrial and commercial sources, domestic practices, road transport and land use change.

TABLE 16: CO_2 EMISSIONS PER CAPITA, 2008

Local Authority	2008 per Capita CO2 Emissions (tonnes)	Percentage Change Since 2005
Broxbourne	5.7	-1.75%
Dacorum	6.3	-14.29%
East Hertfordshire	6.9	-8.70%
Hertsmere	9	-6.67%
North Hertfordshire	7.2	-2.78%
St Albans	8	-10.00%
Stevenage	7	-4.29%
Three Rivers	7.9	-8.86%
Watford	6.4	-4.69%
Welwyn Hatfield	7.6	-7.89%
Hertfordshire County	7.2	-7.08%
East of England	7.6	-7.89%

Source: DECC, 2010

There was a 7.08 per cent per capita reduction in Hertfordshire CO_2 emissions per capita between 2005 and 2008, a per capita reduction below that of the East of England at 7.89 per cent. All of the ten local authorities in Hertfordshire experienced a reduction in CO_2 emissions per capita between 2005 and 2008. The greatest CO_2 emissions reduction per capita was in Dacorum who achieved a 14.29 per cent per capita reduction between 2005 and 2008. The smallest reductions were in North Hertfordshire (2.78 per cent) and Stevenage (4.29 per cent). At 9t and 8t respectively, Hertsmere and St Albans report the highest per capita CO_2 emissions.

Table 17 provides separate figures for domestic and transport emissions.

TABLE 17: DOMESTIC AND ROAD TRANSPORT CO_2 EMISSIONS PER CAPITA, 2008

Local Authority	Domestic Practices		Road Transport	
	2008	per cent Change since 2005	2008	per cent Change since 2005
Broxbourne	2.3	-4.35%	1.4	-7.14%
Dacorum	2.4	-4.17%	2	-10.00%
East Hertfordshire	2.4	-4.17%	2.3	-4.35%
Hertsmere	2.5	-8.00%	3.8	-10.53%
North Hertfordshire	2.4	-4.17%	2.6	0.00%
St Albans	2.5	-8.00%	3.6	-16.67%
Stevenage	2.1	-4.76%	1.6	-12.50%
Three Rivers	2.6	0.00%	3.7	-10.81%
Watford	2.4	-4.17%	1.3	-7.69%
Welwyn Hatfield	2.2	-4.55%	2.6	-3.85%
Hertfordshire County	2.4	-4.17%	2.5	-8%
East of England	2.3	-8.7%	2.4	-8.33%

Source: DECC, 2010

The county of Hertfordshire reported lower proportional reductions in CO_2 emissions from domestic practices (4.17 per cent) and road transport (8 per cent) than the East of England (8.7 per cent and 8.33 per cent respectively). At 2.4t per capita, Hertfordshire also has higher per capita CO_2 emissions than the East of England which reports 2.3t per capita. At 8 per cent Hertsmere and St Albans reported the greatest drop in domestic emissions per capita whilst at 16.67 per cent and 12.5 per cent, St Albans and Stevenage reported the biggest per capita reduction in CO_2 emissions sourced from road transport.

Three Rivers (2.6t) has the highest per capita CO_2 emissions sourced from domestic practices, with Stevenage the lowest at 2.1t. Per capita transport emissions are highest in Hertsmere (3.8t) and lowest in Broxbourne (1.4t).

TABLE 18: CO_2 EMISSIONS IN KILOTONNES (KT) BY SECTOR, 2008

Authority	Industrial & Commercial	Domestic	Transport	Total
Broxbourne	178	207	125	509
Dacorum	254	340	282	880
East Hertfordshire	309	330	307	941
Hertsmere	255	249	371	877
North Hertfordshire	277	295	319	893
St Albans	244	343	491	1,080
Stevenage	257	171	131	560
Three Rivers	142	224	320	687
Watford	232	194	104	531
Welwyn Hatfield	320	245	287	850
Hertfordshire County	2,469	2,597	2,738	7,806

Source: DECC, 2010

TABLE 19: PROPORTIONAL CO_2 EMISSIONS BY SECTOR, 2008

	Percentage of Total Emissions		
Authority	Industrial & Commercial	Domestic	Transport
Broxbourne	34.97%	40.67%	24.56%
Dacorum	28.86%	38.64%	32.05%
East Hertfordshire	32.84%	35.07%	32.62%
Hertsmere	29.08%	28.39%	42.30%
North Hertfordshire	31.02%	33.03%	35.72%
St Albans	22.59%	31.76%	45.46%
Stevenage	45.89%	30.54%	23.39%
Three Rivers	20.67%	32.61%	46.58%
Watford	43.69%	36.53%	19.59%
Welwyn Hatfield	37.65%	28.82%	33.76%
Hertfordshire County	31.63%	33.27%	35.08%

Source: DECC, 2010

In Hertfordshire the largest proportion of energy consumption in 2008 was within the transport sector, accounting for 35.08 per cent of the total energy consumed, followed by the domestic sector which consumed 33.27 per cent. Four local authorities within Hertfordshire reported that transport sources account for the

highest proportion of CO_2 emissions with domestic and industrial and commercial practices accounting for the highest proportions of three local authorities each.

5.6 Renewable Energy Resources

The following tables highlight renewable energy projects which are either in operation or submitted for approval within the planning system as of December 2009. Off-shore wind projects are not included.

TABLE 20: INSTALLED GENERATING CAPACITY (MW) FROM RENEWABLES AS OF DEC 2009

Technology Type	Hertfordshire
Onshore Wind	0.225
Biomass	2.88
Others - Landfill gas	6.155
Others - sewage gas	1.48
Micro-generating (<50kw)	0.55
Total	11.29

Source: Renewables East, 2010

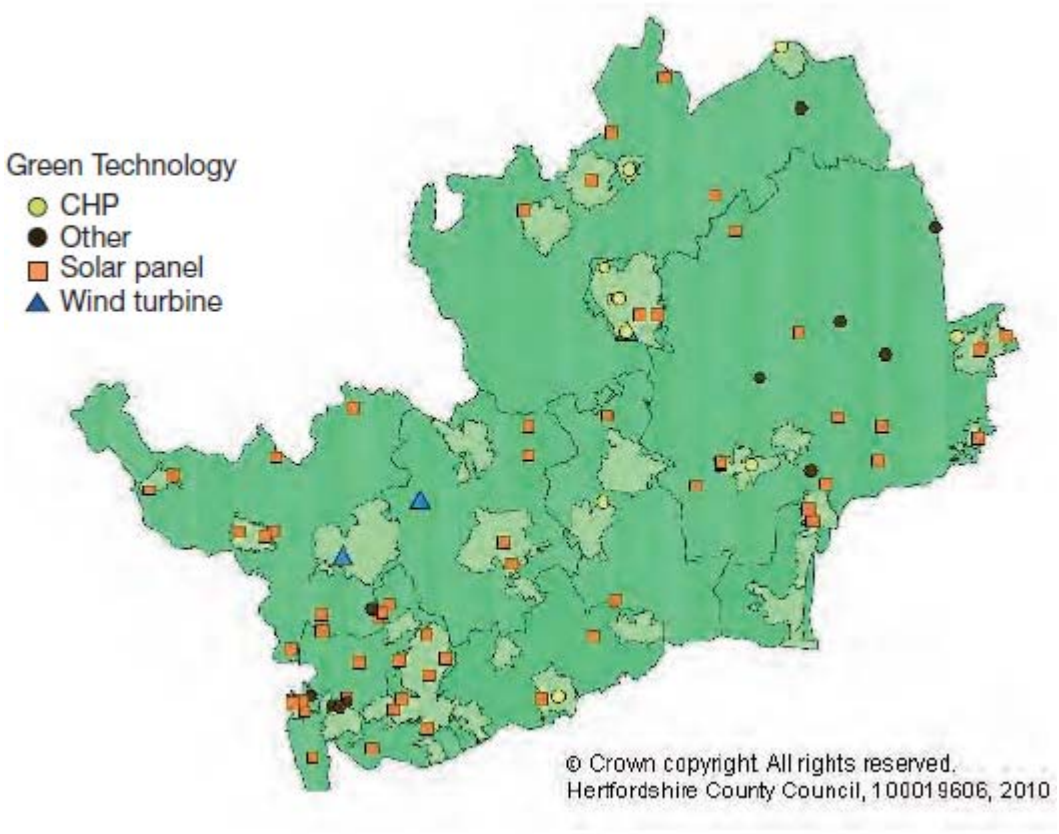
Hertfordshire has the capacity to generate 11.29MW of energy using renewable energy resources. The largest amount of installed generating capacity is from landfill gas at 6.155 MW.

TABLE 21: PLANNING APPLICATIONS CONTAINING RENEWABLE ENERGY TECHNOLOGIES, 2009 - 2010

Technology Type	Number of Decisions	Number of Approvals
Solar panels	73	63
Wind turbines	7	3
Combined Heat and Power (CHP)	11	11
Other	15	12
Total	106	89

Source: Hertfordshire Quality of Life Report, 2010

FIGURE 19: LOCATION OF PLANNING APPLICATIONS MADE FEATURING RENEWABLE ENERGY TECHNOLOGIES, 2010



Source: Hertfordshire Quality of Life Report, 2010

The planning application approval rate for green technologies can be seen to vary. 100 per cent of CHP applications were approved, 86 per cent for solar panels and 42 per cent for wind turbines. Regarding windfarm proposals, between 2009 and 2010 there were no new applications whilst the single outstanding windfarm application, to be located at Bennington, was refused at appeal.

5.7 Summary

The UK Climate Impact Programme has developed the UK Climate Change Projections 2009 (UKCP09) which models future climate scenarios for the UK. The projections that are made within the UKCP09 are based on subjective probabilities, meaning that they give an indication of the relative strength of scientific evidence for any particular scenario. For example, a subjective probability of 50 per cent means that any given change is 'as likely as not' to happen, in that there is a 50 per cent probability of the prediction being exceeded and a 50 per cent probability of it being lower than expected. Figures of 10 per cent and 90 per cent translate as an event being unlikely to be less than presented (10 per cent) or unlikely to be greater than presented (90 per cent).

In general it can be said that Hertfordshire currently experiences temperate annual summer and winter temperatures although across the 2020s, 2050s and 2080s Hertfordshire is predicted to get warmer and will experience more variable summer and winter temperatures.

By the 2020s Hertfordshire is expected to have similar annual average rainfall or snow to that of the 1961-90 baseline with increased variability in summer and more

rainfall or snow in the winter. By the 2050s patters of precipitation are predicted to change. Whilst annual average rain and snowfall is predicted to be the same as experienced currently, there is expected to be increased variability in the summer and much more rainfall or snow in the winter. By the 2080s, patterns of precipitation are expected to change dramatically from that reported in the baseline. Winters are predicted to be much wetter and summers much drier, although considerable variation is predicted for summer precipitation.

By the 2050s there is an assessed 50 per cent probability of precipitation in Hertfordshire reducing in the summer by approximately 10 per cent under a low emissions scenario, rising to approximately 20 per cent under the medium and high emission scenarios. By the 2080s, there is predicted to be a 50 per cent chance of summer average precipitation dropping by approximately 20 per cent under a low emission scenario and approximately 30 per cent under a high emissions scenario.

By the 2020s it is predicted that it is unlikely (90 per cent probability) that precipitation levels will exceed an increase of approximately 22 per cent compared to the baseline figure on the wettest winter day under a high emission scenario. By the 2080s, Hertfordshire is expected to witness an increase in precipitation of approximately 56 per cent. Such figures evidently have implications for flooding events within the county, with existing flood risk expected to multiply in severity and occurrence from the current situation.

The Central England Temperature (CET) presents the monthly mean surface air temperatures within the Midlands region of England and is the longest monthly series of observations available. Both Hertfordshire and the CET show a long-term warming trend. Annual mean temperatures in Hertfordshire are slightly higher than the CET. It is considered that this may be due to the influence of warmer weather systems from the European continent or the urban heat island effect potentially caused by Hertfordshire's proximity to London.

No obvious trend is possible to ascertain in current annual total precipitation measurements at either the county or national level. Seasonal variations are also hidden when looking at annualised totals although it is known through modelling carried out by the UKCP09 project that summers will get drier and winters will get wetter. It can also be stated that precipitation in Hertfordshire is lower than the national average. Hertfordshire is located in the East of England, the driest region in the UK, and it is possible that additional growth and the effects of climate change could increase water stresses in the region in the summer, whilst higher levels of precipitation in the winter could exacerbate flooding issues.

Within the Thames and Anglian River Basin District, flooding impacts will depend on local conditions and vulnerability although it can be stated that wetter winters, and an increase in precipitation falling during wet spells, may increase river flooding in both rural and heavily urbanised catchments. Rainfalls of higher intensity will create an increase in surface runoff, increasing localised flooding and erosion. In turn, this may increase pressures on drains, sewers and water quality. Within the Thames River Basin District there is the additional risk of flooding from groundwater-bearing chalk and limestone aquifers.

6 HOUSING

The latest population trend data shows that the population in Hertfordshire is growing and therefore the provision of adequate housing is a key issue. Not only should there be sufficient housing for the growing population, there should also be suitable housing to meet a wide range of needs. Affordable housing should be factored into housing provision, especially in major housing developments, and all these will need to be located in areas which minimise flood risk. Future Dwelling Completion Trajectories in Hertfordshire

TABLE 22: NET ADDITIONAL DWELLING COMPLETIONS IN HERTFORDSHIRE

Local Authority	Completions 2010/11	Expected Completions						AMR Target	
		2011/12	2012/13	2013/14	2014/15	2015/16	Expected Completions 2011 - 2016	5 Year Target	Annualised 5 Year Completion Rate
Broxbourne	152	278	282	281	338	282	1,461	1,350	270
Dacorum	425	717	666	678	559	394	3,014	1,800	360
East Hertfordshire	271	375	466	648	791	718	2,998	3,300	660
Hertsmere	147	312	312	312	312	311	1,559	1,250	250
North Hertfordshire	336	330	330	330	453	453	1,896	3,950	790
St Albans	285	430	392	383	244	133	1,582	1,800	360
Stevenage	240	265	333	520	664	659	2,441	2,015	403
Three Rivers	49	247	206	106	199	172	930	1,000	200
Watford	527	381	440	294	297	102	1,514	1,300	260
Welwyn Hatfield	205	246	254	392	434	343	1,669	1,400	280
Hertfordshire	2,637	3,581	3,681	3,944	4,291	3,567	19,064	19,165	3,833

Source: Hertfordshire County Council, 2011

In the period 2010-11 Hertfordshire delivered a net increase of 2,637 dwellings across all districts and boroughs. Completions can be seen to vary across the county, with Watford (527), Dacorum (425) and North Hertfordshire (336) delivering the most completions with Three Rivers (49) and Hertsmere (147) the least.

Within their Annual Monitoring Report (AMR), each district and borough in Hertfordshire is required to present future targets for the amount of housing to be delivered within their administrative area on an annual basis. A summation of the housing targets presented by all the districts and boroughs in Hertfordshire results in a figure of 19,165 additional net dwellings to be provided in the county over the next 5 years (up to 2016). However, current delivery indicates that 19,064 net completions will be delivered. There is variation in performance against AMR targets however. With an expected total of 3,014 completions over the period 2011-16, Dacorum greatly exceeds its AMR target of 1,800. Conversely, additional housing completions

are expected to total 1,896 in North Hertfordshire against an AMR 5 year total of 3,950.

The districts with the highest 5 year AMR targets are East Hertfordshire (3,300) and North Hertfordshire (3,950). The lowest are in Three Rivers (1,000) and Hertsmere (1,250).

The districts expected to physically deliver the highest number of net additions are Dacorum (3,014) and East Hertfordshire (2,998). The lowest numbers of net additions are expected in Three Rivers (930) and Broxbourne (1,461).

TABLE 23: LONG TERM HOUSING TRAJECTORY, 2016-17 – 2030-31

Local Authority	2016/17	2017/18	2018/19	2019/2020	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	Total
Broxbourne	153	133	133	133	133	104	104	104	104	104						1205
Dacorum	305	297	267	314	292	401	384	284	314	252	288	345	308	293	179	4523
East Herts	300	300	300	300	300	300	300	300	300	0	0					2100
Hertsmere																0
North Herts	683	683	683	683	651	1,113	1,113	1,113	1,113	1,113	600	600	600	600	600	11948
St Albans	221	221	221	221	221	390	390	390	390	390	256	256				3567
Stevenage	678	644	618	593	579											3112
Three Rivers	202	220	195	134	165	103	168	208	151	38						1584
Watford	321	460	450	400	400	209	58	58	58	58	58	58	58	58	58	2762
Welwyn Hatfield	251	174	147	199	91	28	64	40	11	11	23	23	0	0	0	1062
Hertfordshire	3,114	3,132	3,014	2,977	2,832	2,648	2,581	2,197	2,141	1,966	1,225	1,282	966	951	837	31,863

Source: Hertfordshire County Council, 2011

Across the period 2016-17 to 2030-31, Hertfordshire is expecting to experience a net gain of at least 31,863 additions to its dwelling stock. As can be seen, information is not currently available for a number of districts and as such any further analysis is problematic.

6.1 Summary

In the period 2010-11 Hertfordshire delivered a net increase of 2,637 dwellings across all districts and boroughs. The number of houses built can be seen to vary across the county, with Watford (527), Dacorum (425) and North Hertfordshire (336) delivering the most and Three Rivers (49) and Hertsmere (147) the least.

Within their Annual Monitoring Reports (AMR), each district and borough in Hertfordshire is required to present future targets for the amount of housing to be delivered within their administrative area on an annual basis. A summation of the housing targets presented by all the districts and boroughs in Hertfordshire results in a figure of 19,165 additional net dwellings to be provided in the county over the next 5 years (up to 2016). However, expected current delivery indicates that 19,064 net completions will be delivered. The amount of future housing intended to be provided varies across the county. The districts with the highest 5 year AMR targets are East Hertfordshire (3,300) and North Hertfordshire (3,950), with the lowest being Three Rivers (1,000) and Hertsmere (1,250). Of the 10 districts in Hertfordshire, 7 have a higher 5 year AMR target than required by the RSS.

The districts expected to actually deliver the highest number of net additions to their dwelling stock up to 2016 are Dacorum (3,014) and East Hertfordshire (2,998). The lowest number of net additions is expected in Three Rivers (930) and Broxbourne (1,461).

7 BIODIVERSITY AND GEOLOGICAL CONSERVATION

Hertfordshire has many important habitats which are protected by natural legislation but its associated biodiversity face many pressures, including housing and commercial development, changes in agriculture, and climate change.

7.1 The Hertfordshire Biodiversity Action Plan

The Hertfordshire Biodiversity Action Plan (HBAP) contains action plans for 17 species and 7 habitats throughout Hertfordshire. It supports the UK Biodiversity Action Plan created as a response to the Convention on Biological Diversity in 1992. Each action plan in the HBAP contains specific and focused objectives concentrating on those species and habitats that are confined to, or are characteristic of, Hertfordshire. The species and habitats are listed below:

TABLE 24: SPECIES AND HABITATS IN HERTFORDSHIRE

Mammals:	• Water vole • Common Dormouse	• Natterer's Bat • Otter
Birds:	• Bittern • Stone-curlew	• Tree Sparrow • Song Thrush
Other vertebrates:	• Great Crested Newt	•
Invertebrates:	• Chalkhill Blue	• White Clawed Crayfish
Plants:	• Great Pignut • Cornflower	• River Water-dropwort • Pasqueflower
Habitats:	• Woodland • Wetlands • Heathland & Acid Grassland • Neutral Grassland	• Chalk Grassland • Farmland • Urban

Source: Hertfordshire Biodiversity Action Plan, 2011

A number of habitats, mammals, plants and vertebrates are of particular relevance to water management issues and therefore the LFRMS.

The habitat with most relevance here are the wetlands. The HPAB sets out a number of targets in order to achieve an improvement within this habitat type. Targets include the requirement to restore 5km of chalk rivers and 30ha of reed beds by 2010, to minimise damage to wetland Wildlife Sites by development and to hold public events and improve access to five of the larger wetlands.

The presence of water voles within the HBAP has implications for the LFRMS. The action plan stresses that high flows, flash flooding rivers and prolonged flooding in general can be detrimental to species numbers and their tolerance to differing types of pollution is generally unknown. Water voles are also affected by the disturbance and fragmentation of their habitats. Otters are also identified within the HBAP as

being a priority species. Otters were recorded as being within the River Colne at Broad Colney in 2004 and were also recorded near the Grand Union Canal near Kings Langley, Dacorum in 1999.

River water dropwort was first recognised as a distinct species in Hertfordshire, and the county contains some of the most important locations in the UK for this plant. River water dropwort can currently be found in the lower River Ash, the lower River Beane and most significantly in the New River. The distribution of River water dropwort is effected by river management and maintenance, water quality and river flows.

Great Crested Newts are found in many locations across Hertfordshire although the population has been found to be declining in recent years. The location with biggest relevance is the population at Frogmore Pit which lies close to the confluence of the River Beane and the Stevenage Brook. Factors which will lead to the decline of Great Crested Newts are a loss of habitat, pond management, a fragmentation of ponds and the pollution of ponds from road and urban runoff.

7.1.1 Hertfordshire Red Data List

In addition to the recognition of priority species there is also a comprehensive inventory of species that are threatened with extinction. Nationally these are compiled into Red Data Books based on specific groups of animals or plants. A Hertfordshire wide Red Data List has been compiled and provides details on the status of the rarest and most threatened plants and animals. Many locally scarce species receive no legal protection at all. Their inclusion on a scientifically based Red Data List can help to highlight the vulnerability of these species. Site identification for these vulnerable species can help to ensure that protection mechanisms can be put in place, particularly through the designation of sites supporting red data book species as Local Wildlife Sites.

It is stated that the Hertfordshire Red Data Book is not currently exhaustive and information gathering is still ongoing. However it represents the best source of information regarding rare and threatened species in the county. The species in the Red Data Books are found in a number of different types of areas across Hertfordshire, and 250 separate sites have been listed within which rare and threatened species have been found. Species accounts are listed by taxonomy and are split into 10 major groups including Mollusca, Arachnida and Aves.

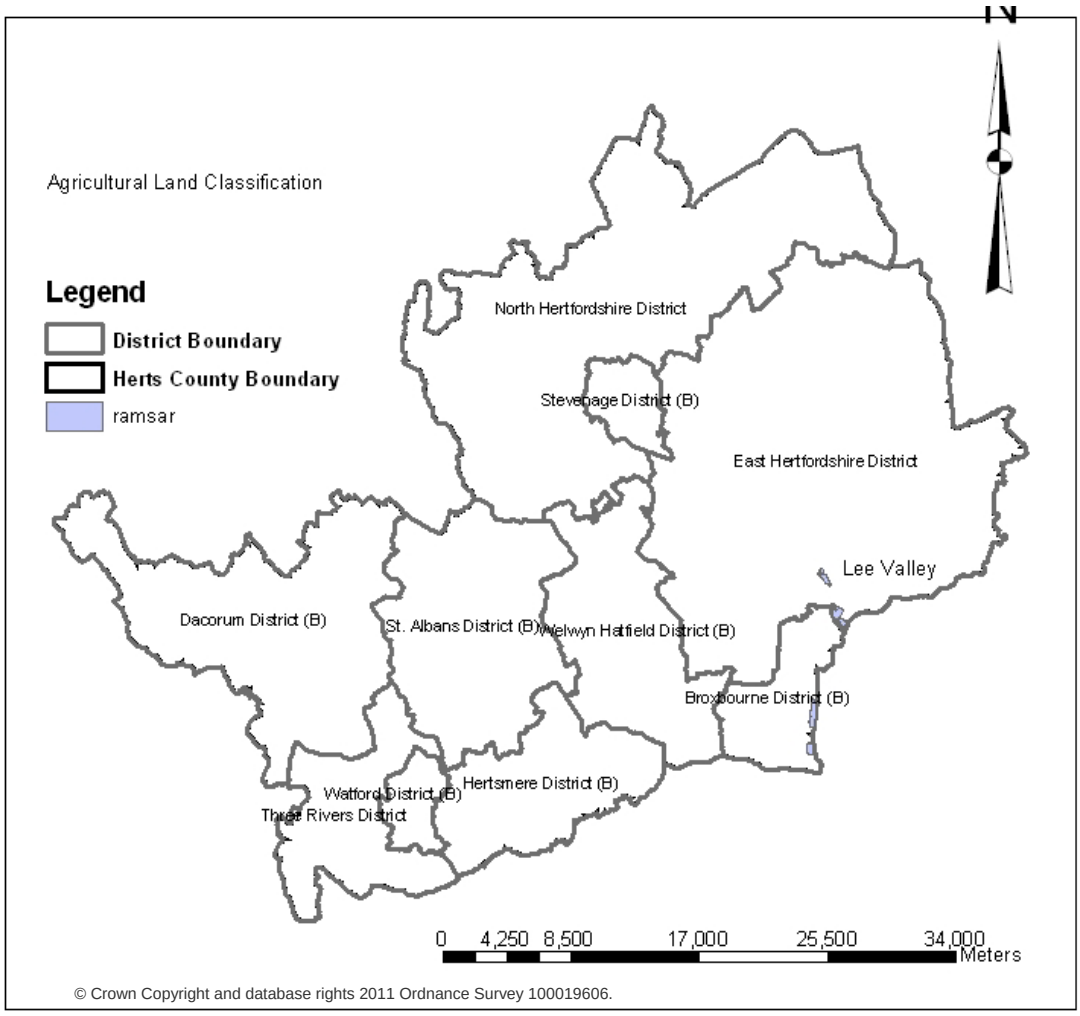
7.2 Land Designations

7.2.1 Ramsar Sites

Ramsar sites are wetlands of international importance designated under the Ramsar Convention and which have a high degree of protection. They often incorporate Special Protection Areas (SPAs) and Special Areas for Conservation (SACs).

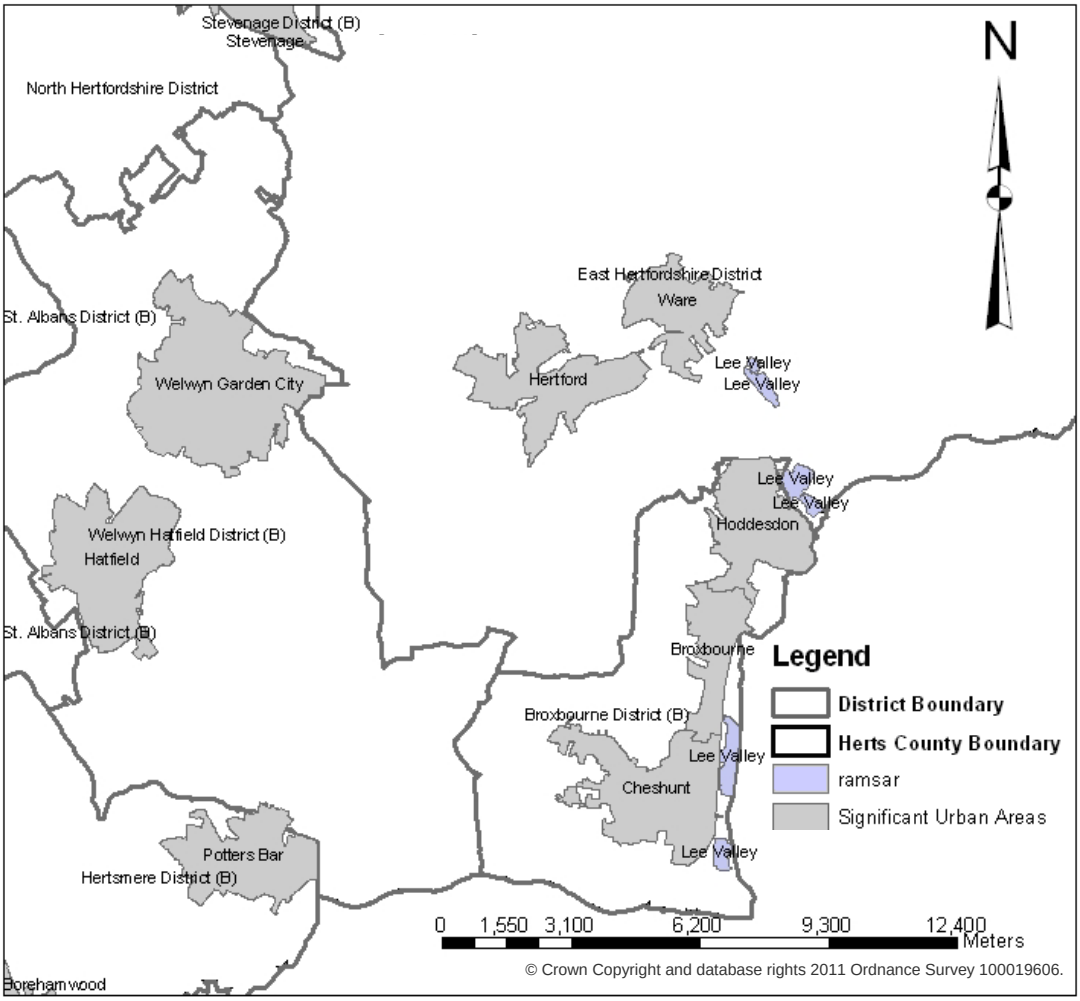
In Hertfordshire there is a single Ramsar as shown in Figure 20 and Figure 21. This is in the Lee Valley Regional Park and covers approximately 447.87ha. The Lee Valley comprises a series of embanked water supply reservoirs, sewage treatment lagoons and former gravel pits along approximately 24 km of the valley. These waterbodies support internationally important numbers of wintering gadwall and shoveler and nationally important numbers of several other bird species. The site also contains a range of wetland and valley bottom habitats, both man-made and semi-natural, which support a diverse range of wetland fauna and flora.

FIGURE 20: LOCATION OF RAMSAR SITE IN HERTFORDSHIRE



Source: Hertfordshire County Council, 2011

FIGURE 21: LOCATION OF RAMSAR SITE IN EAST HERTFORDSHIRE AND BROXBOURNE



Source: Hertfordshire County Council, 2011

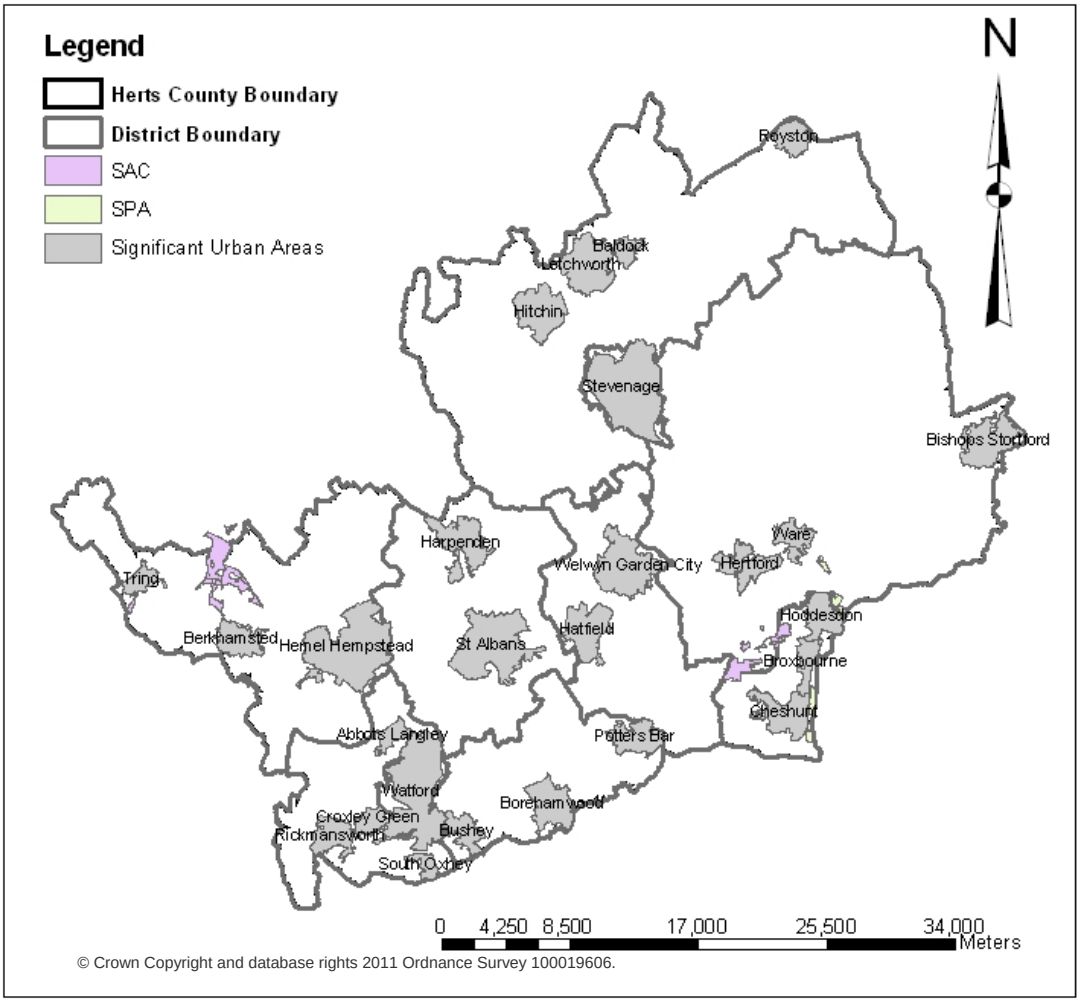
7.2.2 Special Protection Areas and Special Areas for Conservation

Special Protection Areas (SPAs) are internationally protected sites which are classified in accordance with Article 4 of the EC Directive on the Conservation of Wild Birds (79/409/EEC). SPAs are designated to protect rare and vulnerable birds and for regularly occurring migratory species. They are also often designated as Ramsar sites and comprise areas of estuaries and coasts. Within Hertfordshire there is a single SPA which is located in the Lee Valley Regional Park and is also designated as a Ramsar. The site is approximately 447.87ha and has been designated due to the presence of 3 rare bird species. The SPA is under pressure from eutrophic waters although funding has been secured to alleviate this pressure. Other identified threats are identified as human recreational pressure, although the area benefits from zoning, and over-extraction of surface water for public supply, particularly during drought.

Special Areas for Conservation (SACs) are sites of international importance designated under the EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC). There are two SACs in the county: Chilterns Beechwoods and Wormley-Hoddesdonpark Woods and together they comprise approximately 1612.01ha and are primarily broad leaved deciduous woodland.

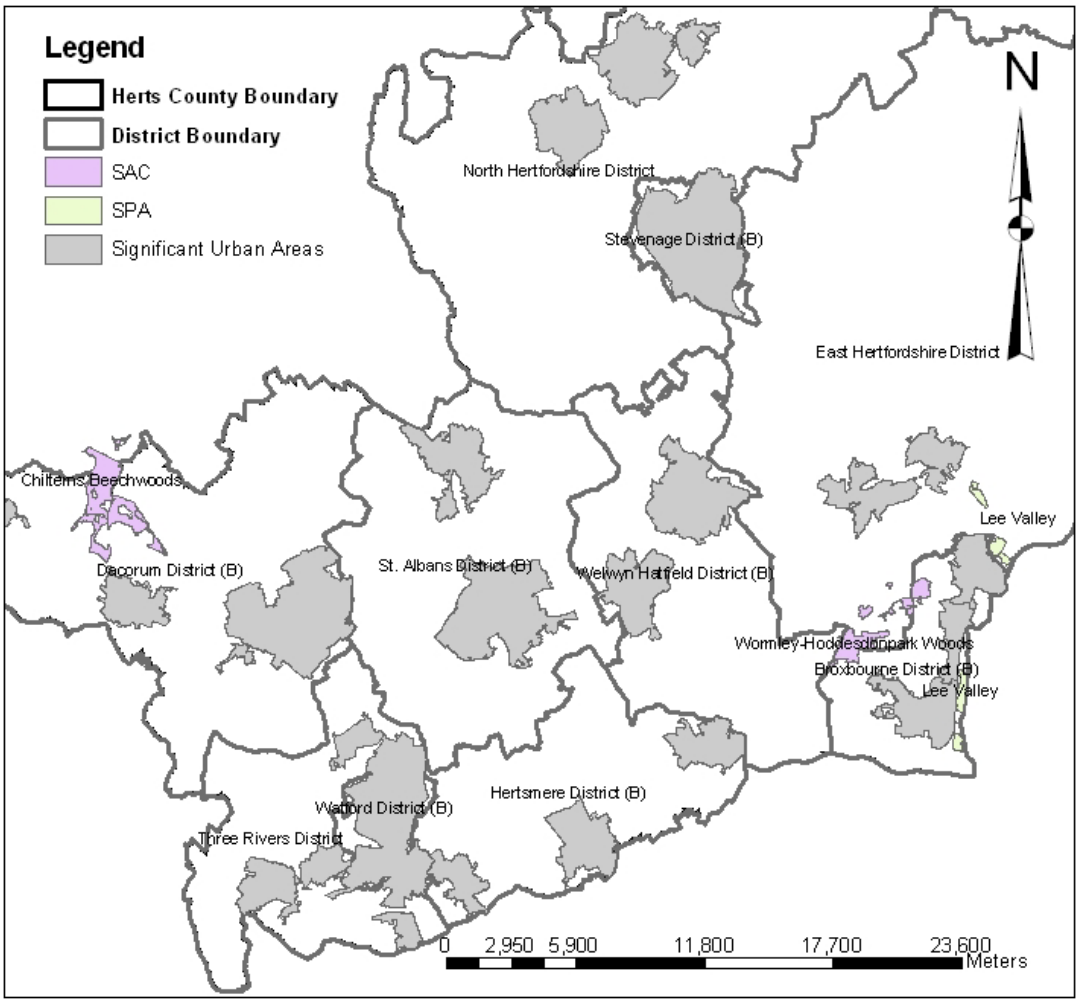
The designated SPAs and SACs are shown in Figure 22 and in more detail in Figure 23. Together the SPAs and SACs form 'Nature 2000', a European wide network of areas of special nature conservation interest. Due to the high level of protection that these designations are given appropriate measures to reduce potential adverse impacts arising from development proposals are required.

FIGURE 22: SPECIAL PROTECTION AREAS AND SPECIAL AREAS FOR CONSERVATION IN HERTFORDSHIRE



Source: Hertfordshire County Council, 2011

FIGURE 23: SPECIAL PROTECTION AREAS AND SPECIAL AREAS FOR CONSERVATION IN HERTFORDSHIRE – FURTHER DETAIL

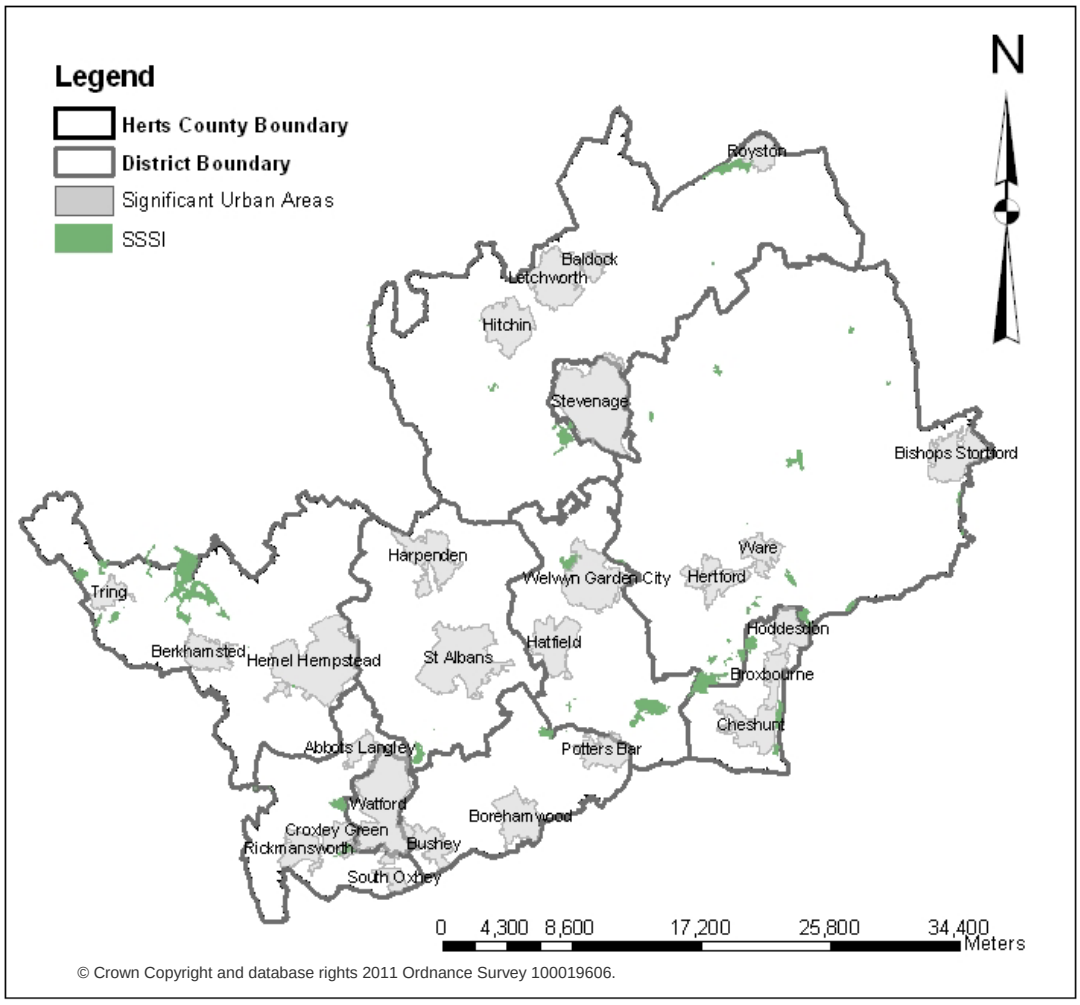


Source: Hertfordshire County Council, 2011

7.2.3 Sites of Specific Scientific Interest

Sites of Special Scientific Interest (SSSIs) are designated areas of land which are considered to be of special interest due to their fauna, flora, geological and/or physiographical features. In total there are over 4,000 SSSIs in England, with 43 recorded wholly or partially in Hertfordshire, and these cover a total of approximately 25.14ha of the county. 28 of these have been designated for their biological interest, six for their geological interest, and nine for both biological and geological interest

FIGURE 24: SITES OF SPECIFIC SCIENTIFIC INTEREST IN HERTFORDSHIRE



Source: Hertfordshire County Council, 2011

The success of SSSIs is monitored by Public Service Agreement (PSA) targets. In accordance with the PSA, SSSIs are categorised on a scale of five alternatives ranging from favourable to destroyed. A SSSI is deemed to be meeting the PSA target by Natural England if 95 per cent or more of the total area is classed as "favourable" or "unfavourable recovering".

As of May 2012, the East of England region had 9419 per cent of its total SSSI areas meeting the PSA target. Of this total, 52.65 per cent is in a favourable condition whilst 41.54 per cent is in an unfavourable condition but recovering. 2.47 per cent of SSSI area is in an unfavourable condition and further declining whilst 0.05 per cent has been destroyed or part destroyed.

Within Hertfordshire, 96.87 per cent of total SSSI area is meeting the PSA target. This figure is made up of 51.13 per cent of total SSSI being in a favourable condition and 45.74 per cent being in an unfavourable but recovering state. 0.89 per cent of total SSSI area is unfavourable and declining condition whilst no SSSI area was destroyed or part destroyed.

This information is presented in Table 25 below:

TABLE 25: CONDITION OF SITES OF SPECIFIC SCIENTIFIC INTEREST AS OF JUNE 2011

Condition of Hertfordshire SSSIs	East of England	Hertfordshire
Meeting PSA target	94.19%	96.87%
Favourable	52.65%	51.13%
Unfavourable recovering	41.54%	45.74%
Unfavourable no change	3.29%	2.25%
Unfavourable declining	2.47%	0.89%
Destroyed/part destroyed	0.05%	0%

Source: Adapted from data published by Natural England, May 2012

7.2.4 Geological Sites

Sites and landscapes that are identified as important for their fossils, minerals or other geological and geomorphological features are also protected and managed. Local Geological Sites (formally known as Regionally Important Geological Sites (RIGS) are non-statutory designations afforded protection through the local planning system and in PPS9: Biodiversity and Geological Conservation.

Nationally important sites of geological conservation have been awarded Site of Special Scientific Interest (SSSI) status which gives them the same protection as areas of high biological value. These geological sites are listed within the Geological Conservation Review (GCR) and in Hertfordshire there are nine such sites. They are located across the county, with six having been designated due to their significance to the Quaternary history of the Thames area.

TABLE 26: GEOLOGICAL CONSERVATION SITES WITHIN HERTFORDSHIRE

Name	Block/ Type	Grid Reference
Castle Lime Works Quarry	Karst	TL228026
Furneux Pelham Gravel Pit (Hillcollins Pit)	Quaternary of the Thames	TL442268
Little Heath Pit	Quaternary of the Thames	TL017082
Moor Mill Quarry	Quaternary of the Thames	TL145027
Oughtonhead Lane, Hitchin	Quaternary of the Thames	TL172299
Water End (Mimmshall Brook)	Fluvial Geomorphology of England	TL230043
Water End swallow holes	Karst	TL231043
Westmill Quarry	Quaternary of the Thames	TL344158
Westwood Quarry	Quaternary of the Thames	TQ072992

Source: Geological Conservation Review Database, 2011 (JNCC)

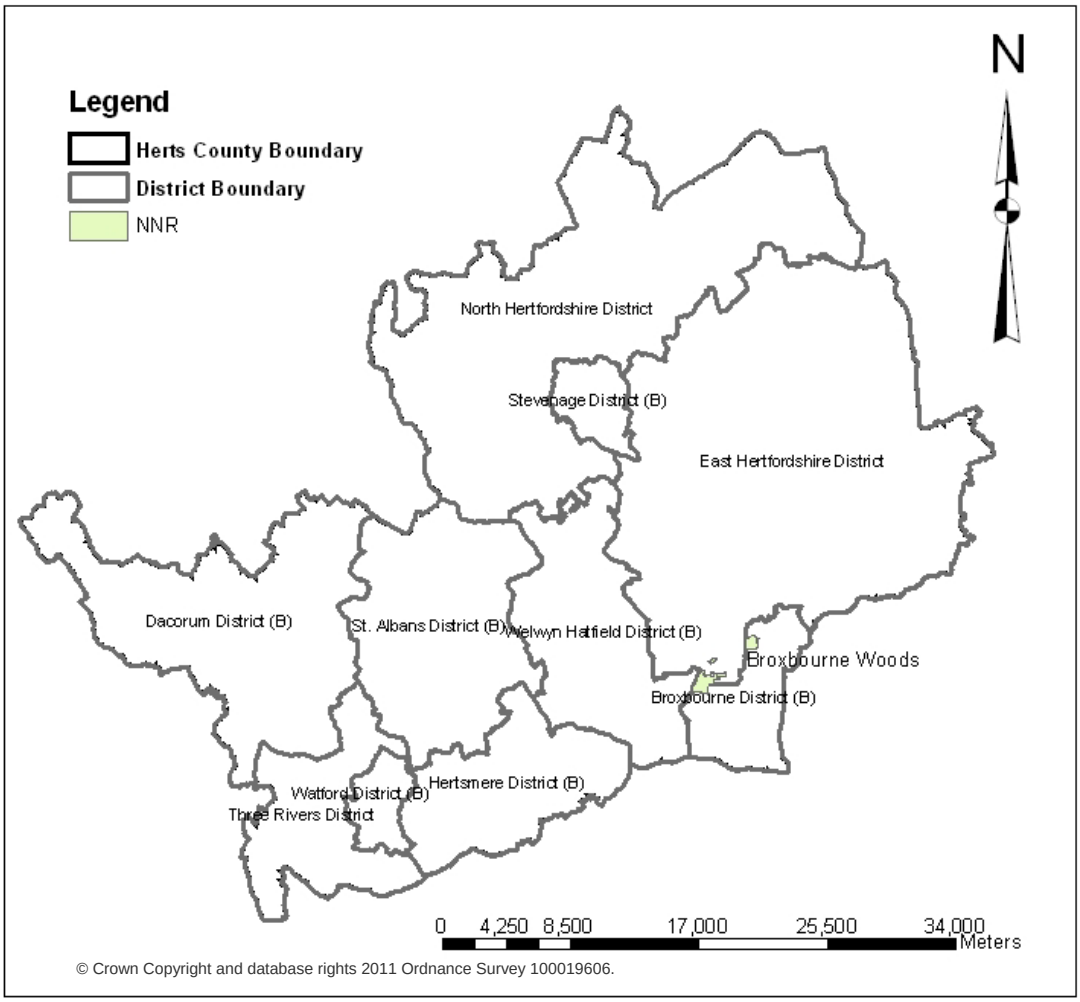
7.2.5 National Nature Reserves

Natural England is the body empowered to declare National Nature Reserves (NNRs) in England. The Reserves are a selection of the very best parts of England's Sites of Special Scientific Interest and they have strong legal protection. The majority also have European nature conservation designations.

There is a single NNR located in Hertfordshire. This is Broxbourne Woods, a site which comprises approximately 237.48ha. The reserve comprises four woods: Bencroft, Broxbourne, Hoddesdon Park and Wormley. All of the woods are ancient, and recent research suggests the area was Roman (or pre-Roman) agricultural land that was abandoned then re-colonised by trees.

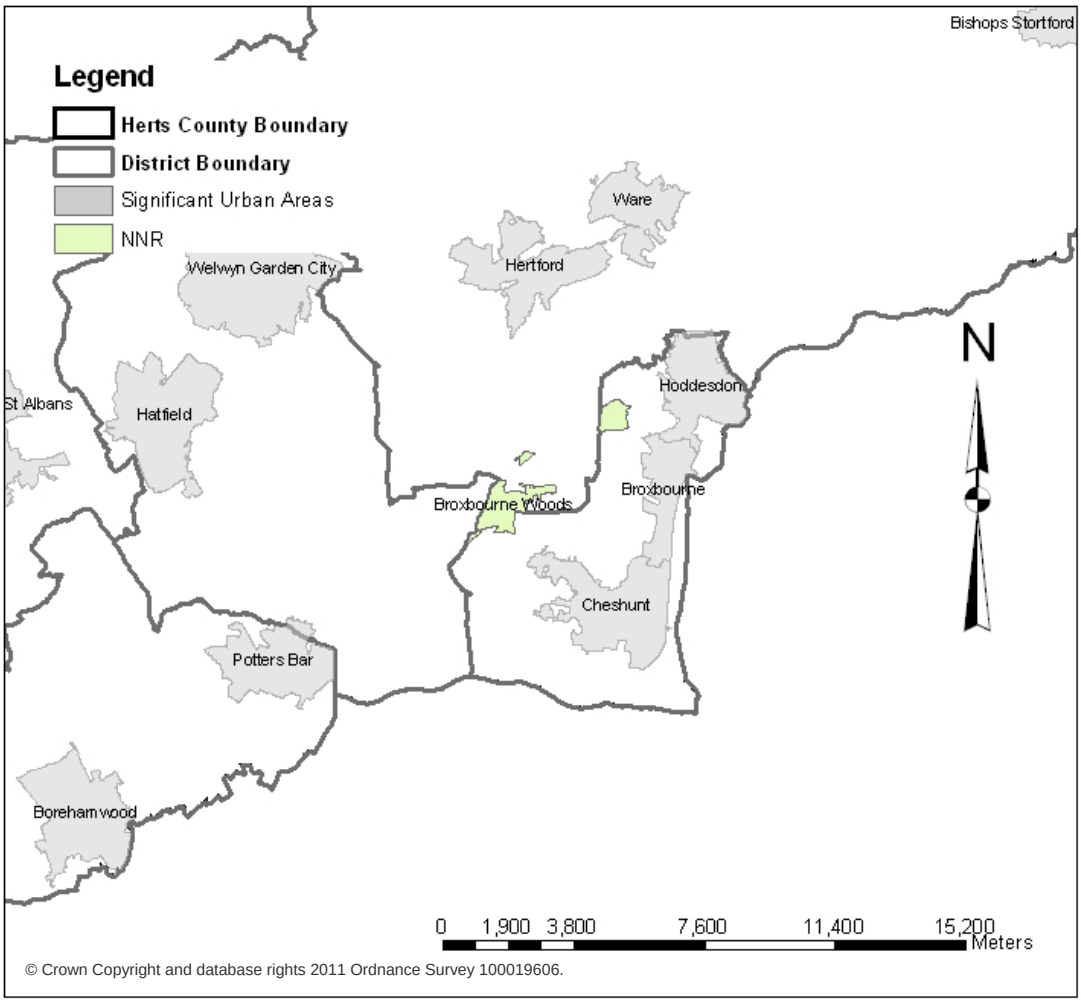
Figure 25 shows the location of Broxbourne Woods.

FIGURE 25: NATIONAL NATURE RESERVE WITHIN HERTFORDSHIRE



Source: Hertfordshire County Council, 2011

FIGURE 26: NATIONAL NATURE RESERVE WITHIN HERTFORDSHIRE – FURTHER DETAIL



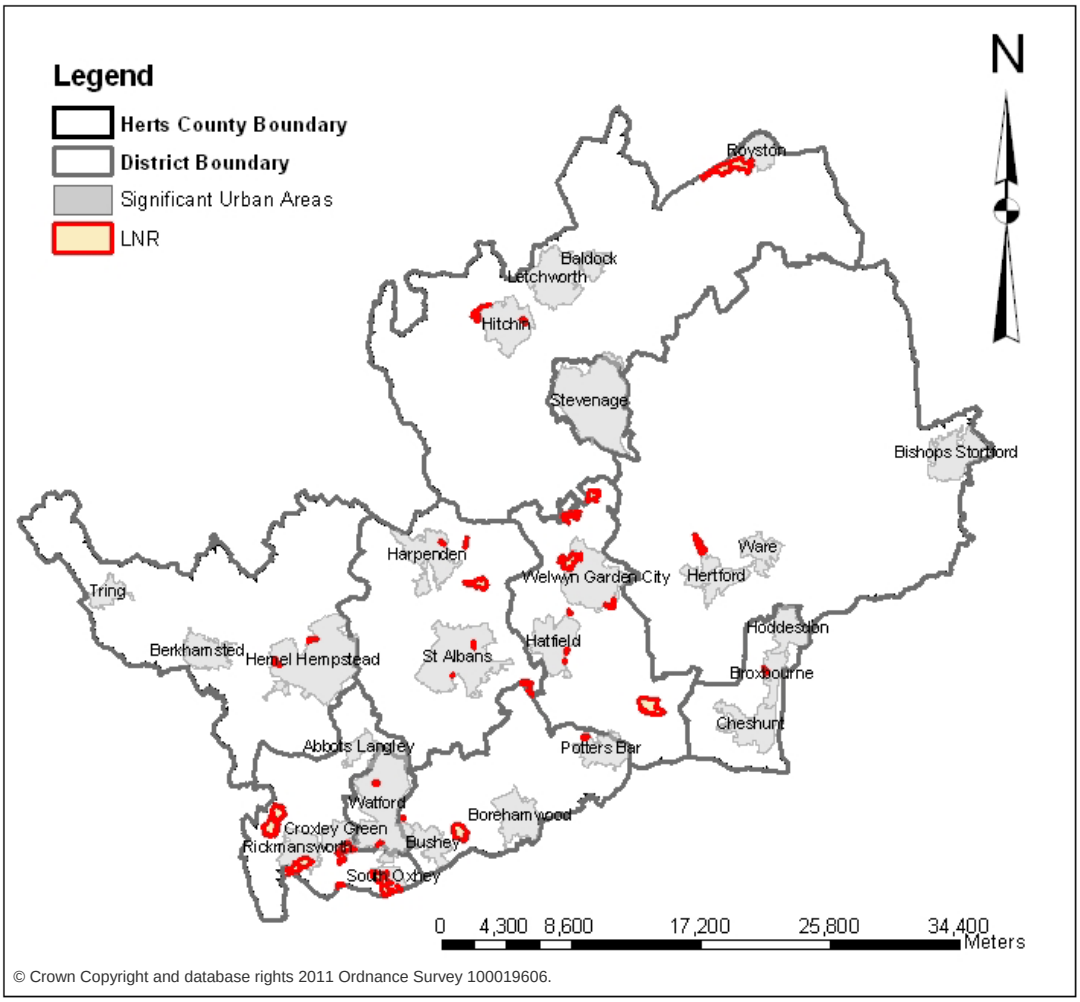
Source: Hertfordshire County Council, 2011

The area's animal life includes badgers, weasels, grass snakes and Muntjac deer; and the woods are also home to woodpeckers, woodcock, tree creepers, hawfinches, buzzards and sparrow hawks. Twenty-seven species of butterfly have been recorded at the site, including grizzled skippers, white admirals and purple hairstreaks.

7.2.6 Local Nature Reserves

Local Nature Reserves (LNRs) are designated by local authorities in conjunction with Natural England in recognition of their high interest relative to local context for their wildlife or wildlife education value; or because they offer an important area for informal enjoyment of nature by the public. There are currently 41 LNRs in Hertfordshire as shown in the figure below:

FIGURE 27: LOCAL NATURE RESERVES WITHIN HERTFORDSHIRE



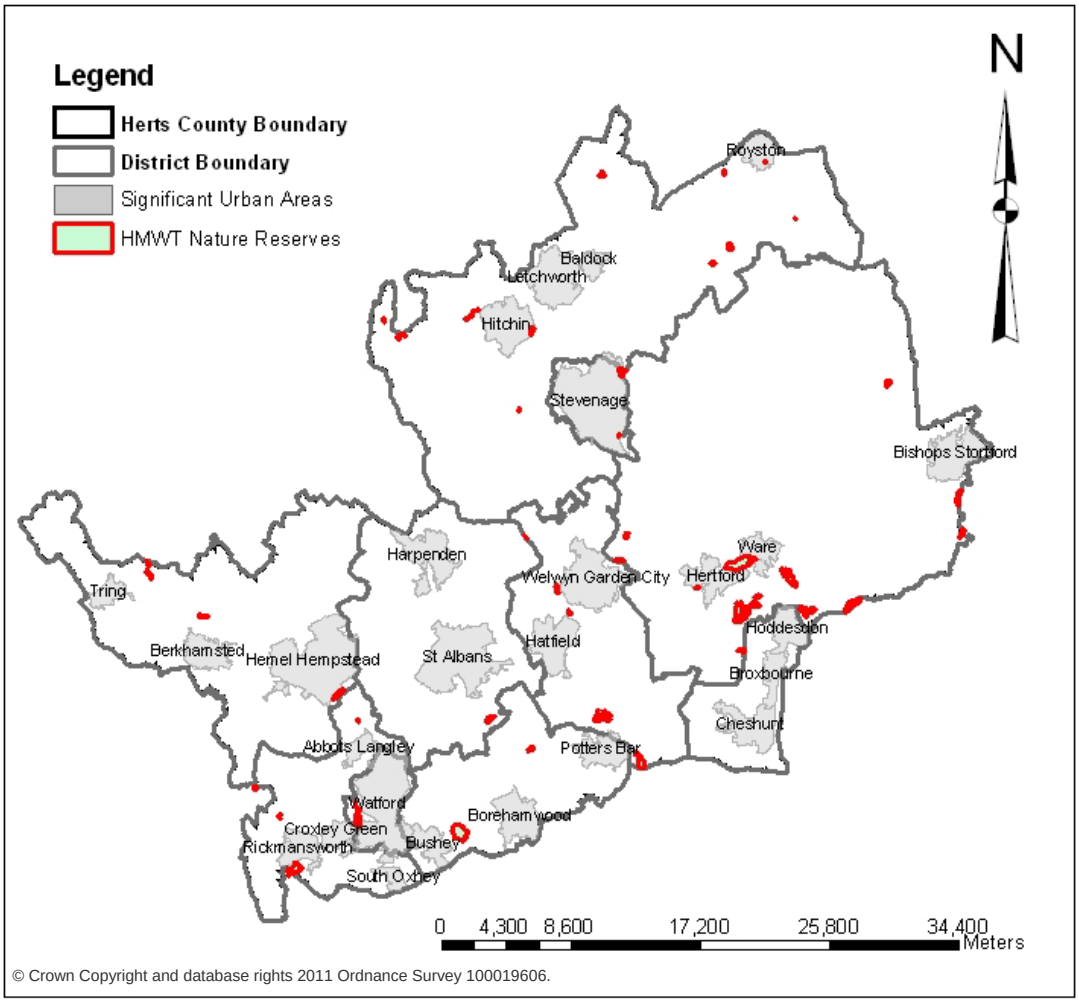
Source: Hertfordshire County Council, 2011

7.2.7 Local Wildlife Sites

Previously known as Sites of Importance for Nature Conservation (SINC), Local Wildlife Sites (LoWs) support both locally and nationally threatened wildlife species and habitats. They are protected within the local planning system and are a 'material consideration' in planning decisions. In Hertfordshire there are nearly 1,994 LOWS which total over 16,000ha. These wildlife sites are the most important places for wildlife outside legally protected areas such as Nature Reserves and Sites of Special Scientific Interest.

Figure 28 highlights the spatial extant of LOWS operated by the Herts and Middlesex Wildlife Trust (HMWT).

FIGURE 28: LOCAL WILDLIFE SITES WITHIN HERTFORDSHIRE

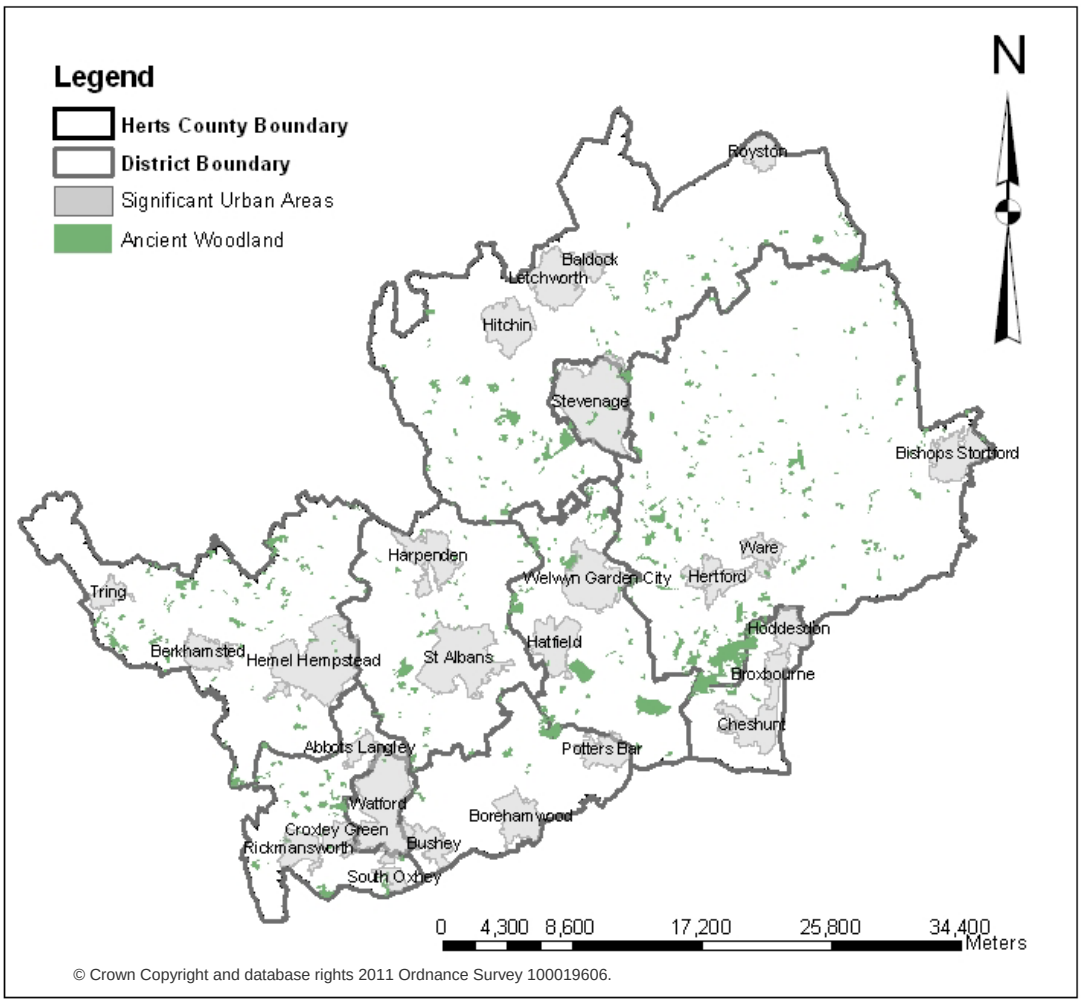


Source: Hertfordshire County Council, 2011

7.2.8 Ancient Woodland

For a wooded area to be deemed ancient woodland, the area of land has had to have had continuous woodland cover since 1600AD. As well as entirely natural ancient woodland, two further types exist. 'Ancient semi natural woodland' is ancient woodland sites where native tree and shrub cover which has not been planted has been retained although the site has been managed by coppicing and felling but allowed to regenerate naturally. 'Ancient replanted woodland' is ancient woodland sites where the original trees have been felled and replaced by planting. Conifer replanting is the most common, and replanting typically occurred this century. Ancient woodland sites total approximately 5834.14ha and their location is shown in Figure 29 below.

FIGURE 29: ANCIENT WOODLAND WITHIN HERTFORDSHIRE



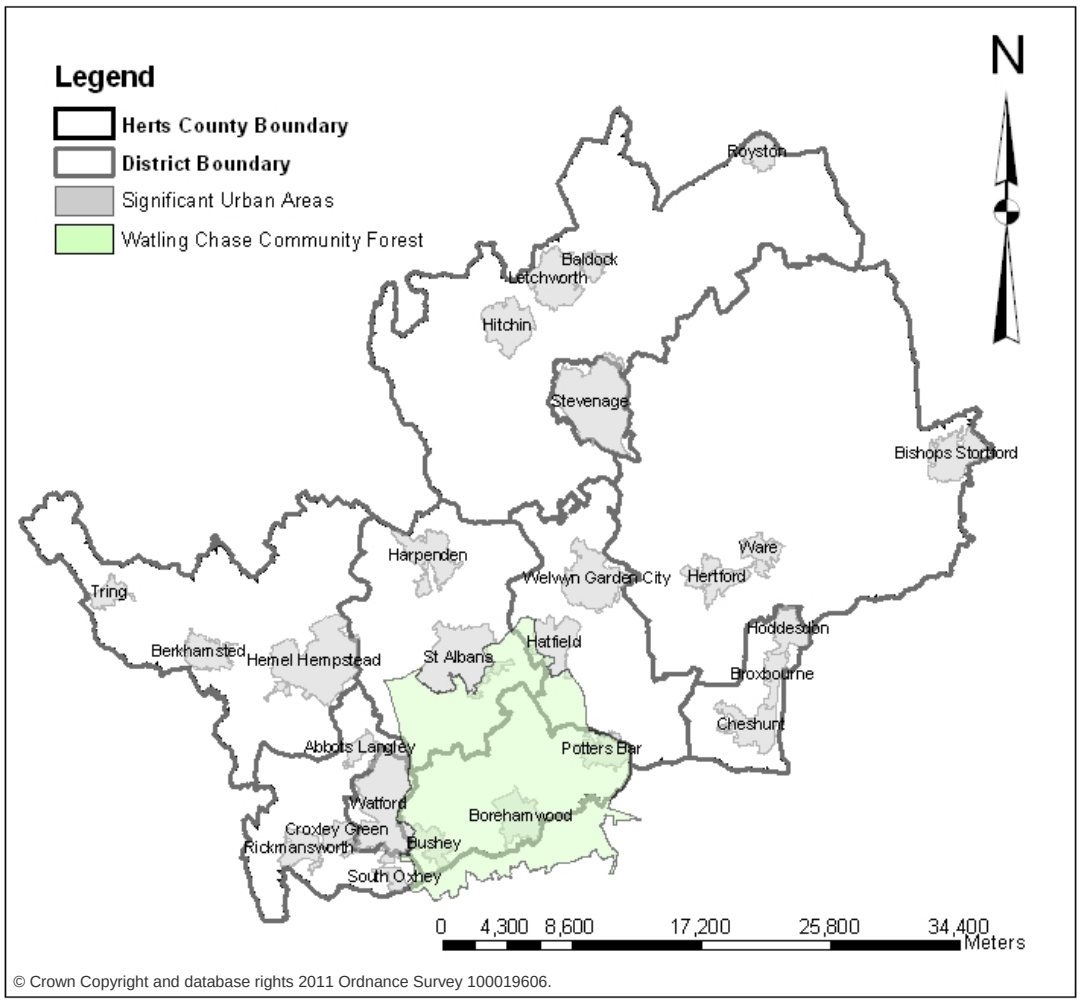
Source: Hertfordshire County Council, 2011

7.2.9 Watling Chase Community Forest

There is a single Community Forest within Hertfordshire, namely Watling Chase. The Community Forest programme was established in 1990 by the then Countryside Commission as a pilot project to demonstrate the potential contribution of environmental improvement to economic and social regeneration. Watling Chase Community Forest is an area of 72 square miles (188 square kilometres) in south Hertfordshire and north London around the towns of Potters Bar, St Albans, Bushey, Borehamwood and Barnet.

Watling Chase was set up in 1991 and is one of 12 Community Forests in England. Watling Chase Forests consist of a mixture of farmland, meadows, wildlife areas, hedgerows and woodland as well as public open space and the urban fringe. The Vision for Watling Chase, described in the Forest Plan, is to see much of the area under positive and appropriate management by 2025. This will include a substantial increase in trees and woodland, achieved through management of existing woodlands and new planting.

FIGURE 30: WATLING CHASE COMMUNITY FOREST



Source: Hertfordshire County Council, 2011

7.3 Summary

The Hertfordshire Biodiversity Action Plan (HBAP) contains action plans for 17 species and 7 habitats throughout Hertfordshire. It supports the UK Biodiversity Action Plan created as a response to the Convention on Biological Diversity in 1992. Each action plan in the HBAP contains specific and focused objectives concentrating on those species and habitats that are confined to, or are characteristic of, Hertfordshire.

In addition to the recognition of priority species there is also a comprehensive inventory of species that are threatened with extinction. Nationally these are compiled into Red Data Books based on specific groups of animals or plants. A Hertfordshire wide Red Data List has been compiled and provides details on the status of the rarest and most threatened plants and animals. Many locally scarce species receive no legal protection at all, and their inclusion on a scientifically based Red Data List can help to highlight the vulnerability of these species. The species in the Red Data Books are found in a number of different types of areas across Hertfordshire, and 250 separate sites have been listed within which rare and threatened species have been found. Species accounts are listed by taxonomy and are split into 10 major groups including Mollusca, Arachnida and Aves.

Ramsar sites are wetlands of international importance designated under the Ramsar Convention and which have a high degree of protection. In Hertfordshire there is a single Ramsar which is located in the Lee Valley Regional Park and covers approximately 447.87ha. The Ramsar comprises a series of embanked water supply reservoirs, sewage treatment lagoons and former gravel pits along approximately 24 km of the valley which support internationally important numbers of wintering gadwall and shoveler and nationally important numbers of several other bird species.

Special Protection Areas (SPAs) are internationally protected sites which are classified in accordance with Article 4 of the EC Directive on the Conservation of Wild Birds (79/409/EEC). SPAs are designated to protect rare and vulnerable birds and regularly occurring migratory species. Within Hertfordshire the part of the Lee Valley Regional Park classified as a Ramsar is also classified as an SPA and has been designated as such due to the presence of 3 rare bird species. The SPA is under pressure from eutrophic waters although funding has been secured to alleviate this pressure. Other threats are identified as human recreational pressure although the area benefits from zoning, and over-extraction of surface water for public supply, particularly during drought.

Special Areas for Conservation (SACs) are sites of international importance designated under the EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC). There are two SACs in the county: Chilterns Beechwoods and Wormley-Hoddesdonpark Woods and together they comprise approximately 1612.01ha and are primarily broad leaved deciduous woodland.

Sites of Special Scientific Interest (SSSIs) are designated areas of land which are considered to be of special interest due to their fauna, flora, geological and/or physiographical features. Forty-three of these are recorded in Hertfordshire and they cover a total of approximately 25.14ha of the county. Twenty-eight of these have been designated for their biological interest, six for their geological interest, and nine for both biological and geological interest.

A SSSI is deemed to be meeting the Public Service Agreement (PSA) target by Natural England if 95 per cent or more of the total area is classed as “favourable” or “unfavourable recovering”. Within Hertfordshire, 96.87 per cent of total SSSI area is meeting the PSA target. This figure is made up of 51.13 per cent of total SSSI being in a favourable condition and 45.74 per cent being in an unfavourable but recovering state. 0.89 per cent of total SSSI area is unfavourable and declining condition whilst no SSSI area was destroyed or part destroyed.

Natural England is the body empowered to declare National Nature Reserves (NNRs) in England. The Reserves are a selection of the very best parts of England’s Sites of Special Scientific Interest and they have strong legal protection. The majority also have European nature conservation designations. There is a single NNR located in Hertfordshire. This is Broxbourne Woods, a site which comprises approximately 237.48ha. The reserve comprises four woods: Bencroft, Broxbourne, Hoddesdon Park and Wormley.

Local Nature Reserves (LNRs) are designated by local authorities in conjunction with Natural England in recognition of their high interest relative to local context for their wildlife or wildlife education value; or because they offer an important area for informal enjoyment of nature by the public. There are currently 41 LNRs in Hertfordshire

Local Wildlife Sites (LoWs) support both locally and nationally threatened wildlife species and habitats. They are protected within the local planning system and are a

'material consideration' in planning decisions. In Hertfordshire there are nearly 1,994 LoWs which total over 16,000ha. These wildlife sites are the most important places for wildlife outside legally protected areas such as Nature Reserves and Sites of Special Scientific Interest.

Ancient woodland sites total approximately 5834.14ha within the county. For a wooded area to be deemed ancient woodland, the area of land has had to have had continuous woodland cover since 1600AD.

There is a single Community Forest within Hertfordshire, namely Watling Chase. The Community Forest programme was established in 1990 by the then Countryside Commission as a pilot project to demonstrate the potential contribution of environmental improvement to economic and social regeneration. Watling Chase Community Forest is an area of 72 square miles (188 square kilometres) in south Hertfordshire and north London around the towns of Potters Bar, St Albans, Bushey, Borehamwood and Barnet.

8 CULTURAL HERITAGE

The historic environment should be effectively protected and valued for its own sake, as an irreplaceable record which contributes to our understanding of both the present and the past. Cultural heritage adds to quality of life by enhancing the local scene and sustaining a sense of local distinctiveness, which is an important aspect of the character and appearance of towns, villages and countryside. It also has an importance for leisure and recreation.

The Hertfordshire Historic Environment Record (HHER), maintained by Hertfordshire County Council, is a computerised database of all listed and other historic buildings and all known archaeological sites, historic parks and gardens and other historic landscape features in the county. It currently holds a large library of surveys, archaeological reports and over 2000 aerial photographs of the county.

As highlighted by English Heritage, it is also important to recognise the importance of undesignated heritage assets.

8.1 Historic Landscapes

The county of Hertfordshire is subjected to enormous pressures from housing and transport infrastructure developments, but many historic elements can be seen to survive in the landscape. A Historic Landscape Characterisation (HLC) project has therefore been carried out as part of the English heritage national programme to assess the rural landscape in terms of its historic origins.

The aim of the project in Hertfordshire was to characterise the distinctive historic dimension of the current rural landscape. This has been carried out as part of, and using the methodology developed for, the East of England Regional HLC project.

In Hertfordshire desk-based research using modern and historic mapping sources was carried out to identify and map the historic character of the landscape through the application of defined Historic Landscape Character types. The result of the project is a comprehensive Geographic Information System (GIS) which provides a complete coverage of the county with information on current and past landscape origins, and reports giving the background to the HLC project with an overview of the Essex Landscape and its development; a summary of the results, and a description of the methodology, database and the terminology developed in appendices.

Also in Hertfordshire HLC has also been used to assess the likely impact of the westward expansion of Stevenage, to suggest the means by which the more sensitive aspects of the historic landscape could be safeguarded by good design, and to encourage developers and planners to think creatively about the way in which the area's historic patterns can be woven into the new development

8.2 Listed Buildings

All buildings built before 1700 which survive in anything like their original condition are listed, as are most of those built between 1700 and 1840. The criteria become tighter with time, so that post-1945 buildings have to be exceptionally important to be listed. A building normally has to be over 30 years old to be eligible for listing.

TABLE 27: COMPOSITION OF LISTED BUILDINGS IN HERTFORDSHIRE, 2011

Admin Area	Grade I	Grade II*	Grade II	Total
Broxbourne	4	11	244	259
Dacorum	12	57	833	902
East Hertfordshire	40	199	2,790	3029
Hertsmere	3	13	305	321
North Hertfordshire	25	105	1,604	1734
St Albans	10	38	777	825
Stevenage	2	10	115	127
Three Rivers	3	14	335	352
Watford	2	3	89	94
Welwyn Hatfield	7	23	395	425
Hertfordshire	108	473	7487	8068

Source: English Heritage, 2011

The total number of listed buildings or groups of buildings in Hertfordshire is 8068. Grade I buildings are of exceptional interest and are sometimes considered to be internationally important. 1.34 per cent of all listed buildings in Hertfordshire are Grade I. Grade II* buildings are particularly important buildings of more than special interest. 5.86 per cent of all listed buildings in Hertfordshire are Grade II*. Grade II buildings are nationally important and of special interest. 92.8 per cent of all listed buildings are in this class.

The distribution of listed buildings around the county is not even. East Hertfordshire houses 37.54 per cent of Hertfordshire's listed buildings and North Hertfordshire 21.49 per cent. At 1.17 per cent and 1.57 per cent respectively, Watford and Stevenage have the least listed buildings in total.

8.3 Historic Buildings at Risk Register

The Historic Buildings at Risk Register (BARR) contains details of buildings known to be 'at risk' through neglect and decay, or vulnerable of becoming so. The objective of the register is to outline the state of repair of these buildings with the intention of instigating action towards securing their long term conservation. Table 28 illustrates the number of buildings 'at risk', in 2009, 2010 and 2011.

TABLE 28: NUMBER OF BUILDINGS ON THE BUILDINGS AT RISK REGISTER, 2009 - 2011

Administrative Area	At Risk		
	2009	2010	2011
Broxbourne	1	3	1
Dacorum	1	2	2
East Hertfordshire	4	4	4
Hertsmere	0	0	0
North Hertfordshire	16	17	17

St Albans	1	1	0
Stevenage	1	1	1
Three Rivers	2	2	2
Watford	2	2	2
Welwyn Hatfield	1	1	1
TOTAL	29	33	30

Source: English Heritage, 2011

The Register addresses a 'moving target'. Some buildings are repaired and subsequently taken off, and others which become at risk are added. The success of the Register is reflected in the number of buildings which are removed each year following the completion of successful repair schemes. In 2011 there were 30 listed buildings and scheduled monuments at risk, which is a reduction on the previous year of 33 at risk. Of the 30 buildings currently 'at risk', 57 per cent (17) of these are within North Hertfordshire authority.

8.4 Archaeology, Recorded Sites and Finds in Hertfordshire

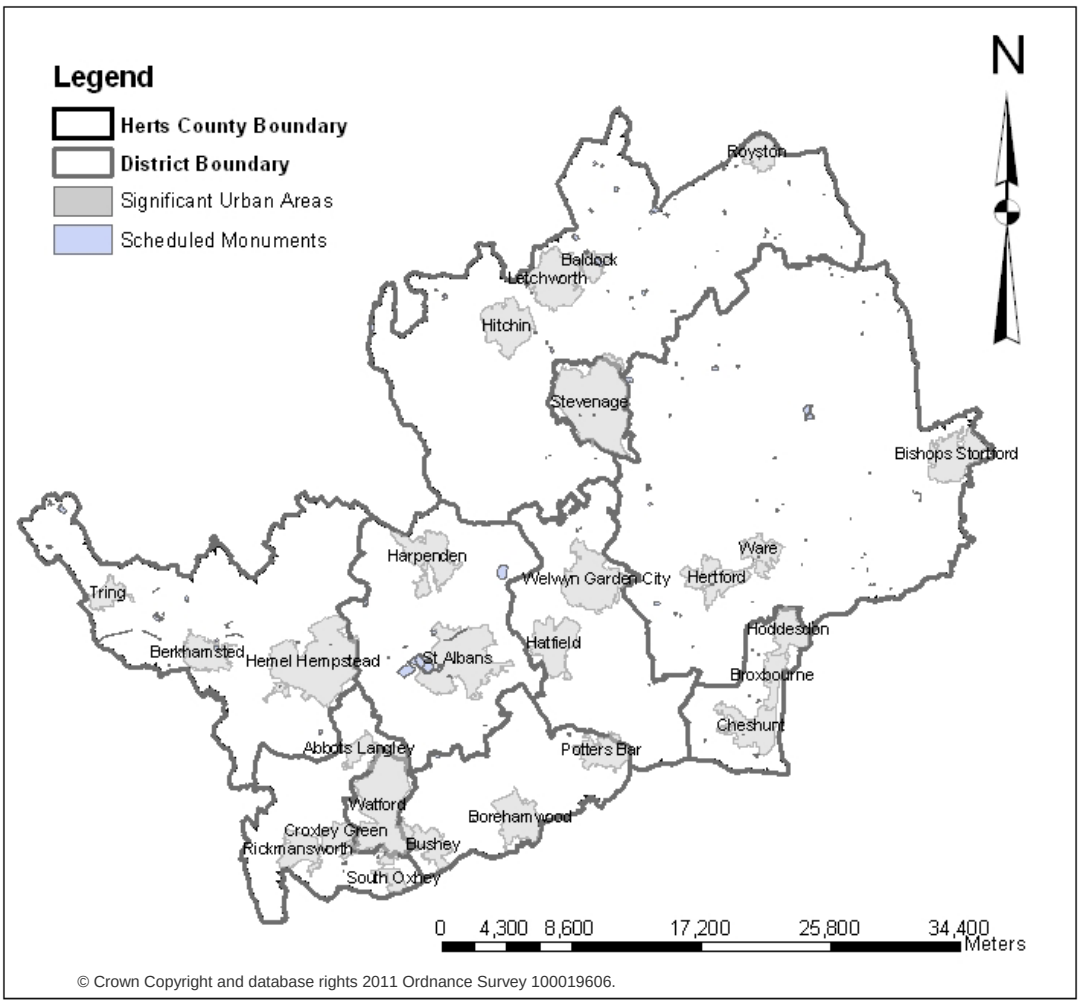
As with the rest of the UK, it is true to say that the majority of archaeological sites and deposits in Hertfordshire remain buried, hidden and thus preserved. However, the known archaeological resource in the county is very varied and highly significant.

There are thousands of archaeological sites and finds recorded on the Hertfordshire Historic Environment Record (HHER) although it should be noted that the HHER represents only those sites which have currently been discovered, with many new sites being identified each year. Archaeological sites (and their setting) constitute a finite, non-renewable resource, vulnerable to damage.

8.5 Scheduled Monuments

Scheduled Monuments (SMs) are sites of national importance and are protected by the Ancient Monuments and Archaeological Areas Act 1979. SM status is designed to preserve the monument for the future and protect it from damage, destruction or any unnecessary interference. There are 207 SMs in Hertfordshire, ranging from ancient mounds and ditches to World War II defensive structures. SMs are distributed throughout the county and are shown in Figure 31.

FIGURE 31: SCHEDULED MONUMENTS WITHIN HERTFORDSHIRE

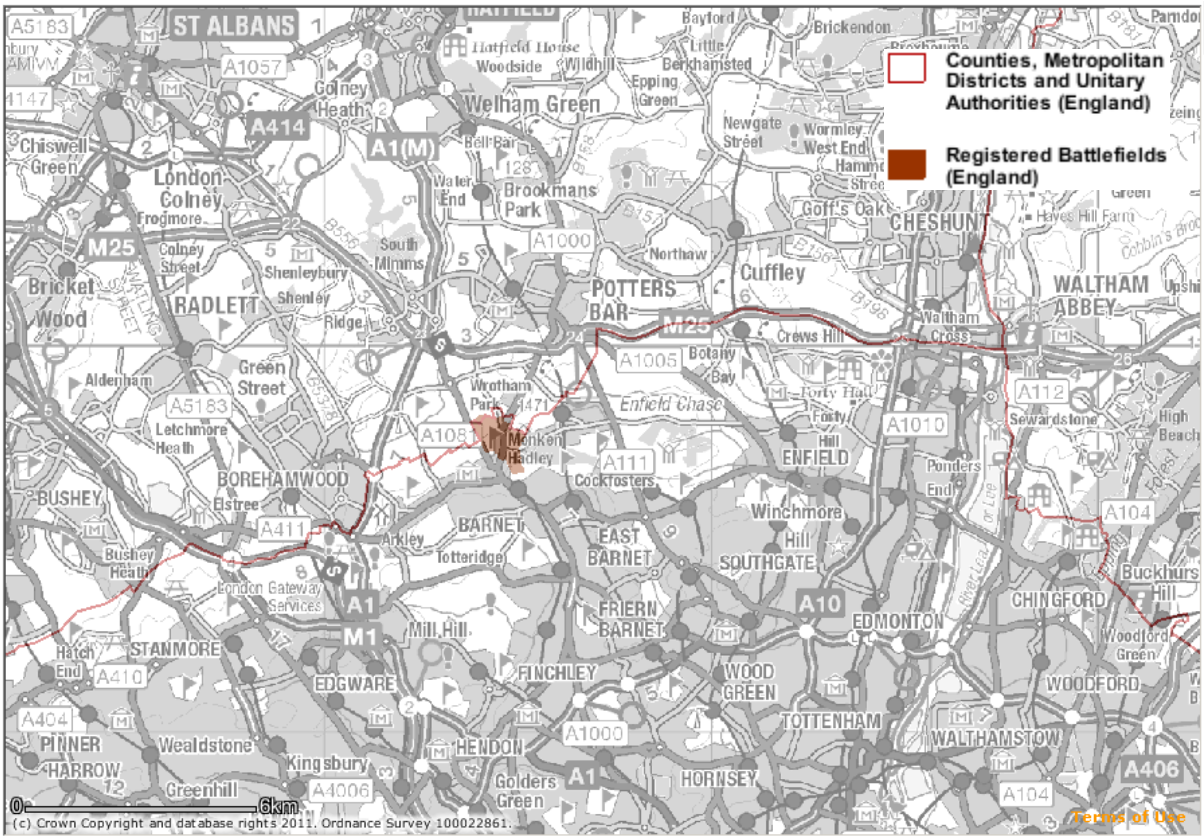


Source: Hertfordshire County Council, 2011

8.6 Historic Battlefields

There is one registered battle site which lies partly in Hertfordshire as well as the Greater London Authority, in an area around South Mimms, Enfield and Monken Hadley. The historic battlefield marks the site of the Battle of Barnet which took place in 1471, and its extant is shown in the figure below:

FIGURE 32: LOCATION OF BATTLE OF BARNET HISTORIC BATTLEFIELD

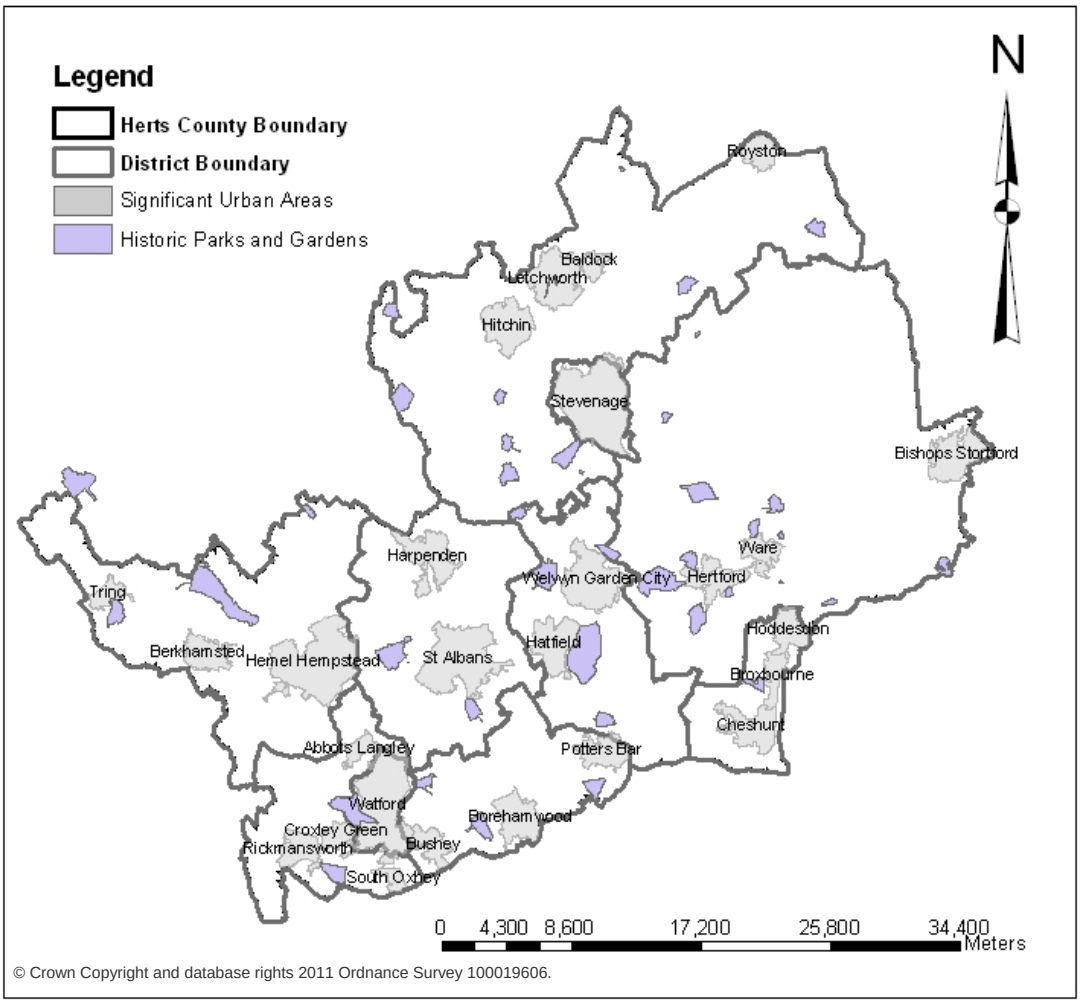


Source: http://magic.defra.co.uk

8.7 Historic Parks and Gardens

These are designated by English Heritage and defined as “a park or garden of special historic interest”. They are graded I (highest quality), II* or II. There are currently 43 historic parks and gardens in Hertfordshire as shown in the figure below:

FIGURE 33: HISTORIC PARKS AND GARDENS WITHIN HERTFORDSHIRE

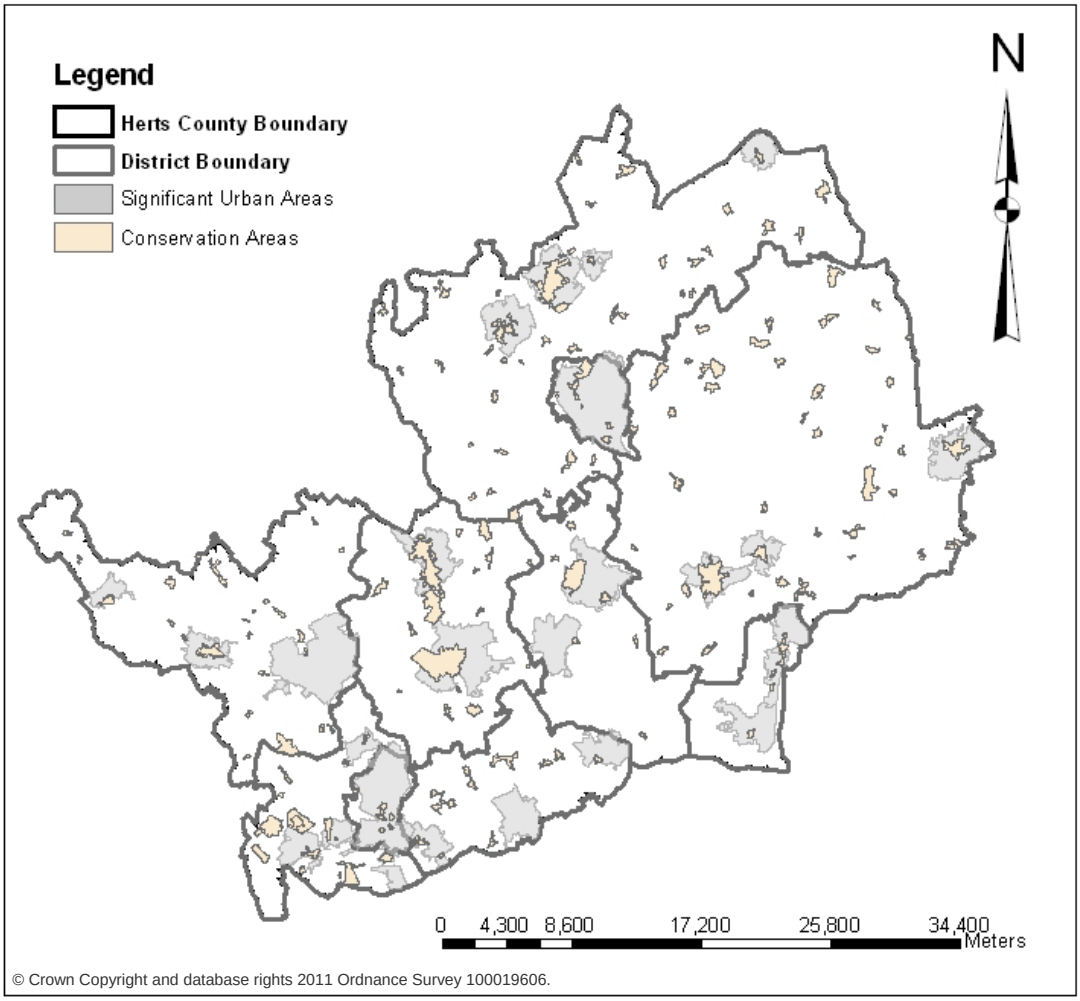


Source: Hertfordshire County Council, 2011

8.8 Conservation Areas

Hertfordshire currently has 196 designated Conservation Areas. Conservation Areas are defined as historical town centres and buildings which have 'special architectural or historical interest, the character of which is desirable to preserve or enhance' which are protected under the Listed Buildings and Conservations Areas Act (1990). The objective of the Conservation Area designation is to ensure that the character of the defined area is preserved from developments which do not preserve or enhance its character. The locations of these are shown in Figure 34 below:

FIGURE 34: CONSERVATION AREAS WITHIN HERTFORDSHIRE



Source: Hertfordshire County Council, 2011

A survey undertaken by English Heritage in 2009 identified two Conservation Areas within Hertfordshire deemed as being 'at risk'. This means that they already have or are threatened with a significant deterioration in their condition. Most commonly, the problems are due to loss of buildings' historic detail, damage to streetscapes and vacancy. Those Conservation Areas 'at risk' in Hertfordshire are both located in St Albans and are:

- Park Street and Frogmore
- St Albans

8.9 Summary

The management of Hertfordshire's historic landscape is important to protect the setting in which people live. There are a large number of sites of cultural and historic importance across Hertfordshire, and these include:

- 8068 Listed Buildings, of which 1.34 per cent are Grade I (exceptional interest and perhaps internationally important), 5.86 per cent are Grade II* (of more than special interest) and 92.8 per cent are Grade II (nationally important and of special interest). The distribution of these is not even around the county. East Hertfordshire houses 37.54 per cent of the county's listed buildings with

Watford and Stevenage housing the least at 1.17 per cent and 1.57 per cent respectively.

- 30 Listed Buildings and Scheduled Monuments at Risk, down from 33 in 2010. Of the 30 Listed Buildings and Scheduled Monuments currently 'at risk', 17 of are within North Hertfordshire.
- 207 Scheduled Monuments. Scheduled Monuments (SMs) are sites of national importance and protected by the Ancient Monuments and Archaeological Areas Act 1979. SM status is designed to preserve the monument for the future and protect it from damage, destruction or any unnecessary interference. SMs can range from ancient mounds and ditches to World War II defensive structures.
- 196 Conservation Areas. Conservation Areas are defined as historical town centres and buildings which have 'special architectural or historical interest, the character of which is desirable to preserve or enhance' which are protected under the Listed Buildings and Conservations Areas Act (1990). The objective of the Conservation Area designation is to ensure that the character of the defined area is preserved from developments which do not preserve or enhance its character. Two of these have been deemed to be 'at risk', namely Park Street and Frogmore and St Albans, which are both located in the district of St Albans.
- 43 Historic Parks and Gardens. Historic Parks and Gardens are designated by English Heritage and defined as "a park or garden of special historic interest". They are graded I (highest quality), II* or II.
- There is one registered battle site which lies partly in Hertfordshire as well as the Greater London Authority in an area around South Mimms, Enfield and Monken Hadley. The historic battlefield marks the site of the Battle of Barnet which took place in 1471

9 SOILS, MINERALS AND WASTE

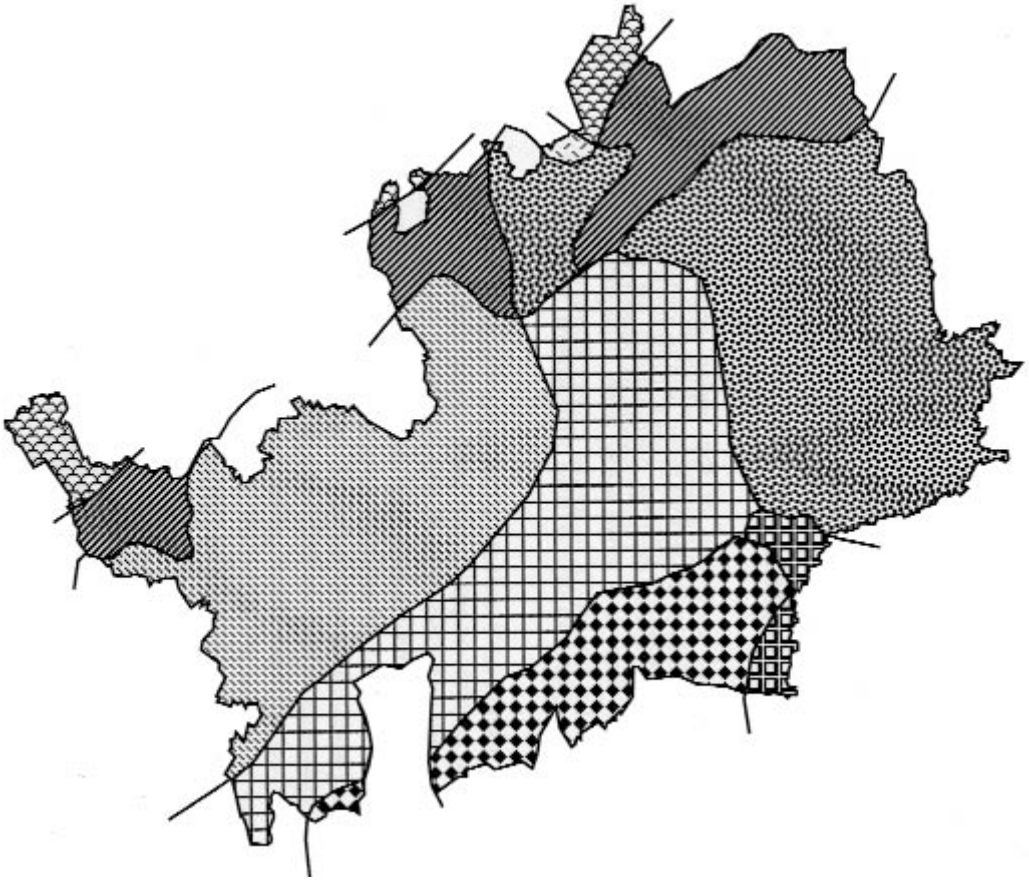
Different types of soil have different implications for water movement. Compaction of soil reduces agricultural productivity and water infiltration, and increases flood risk through higher levels of runoff.

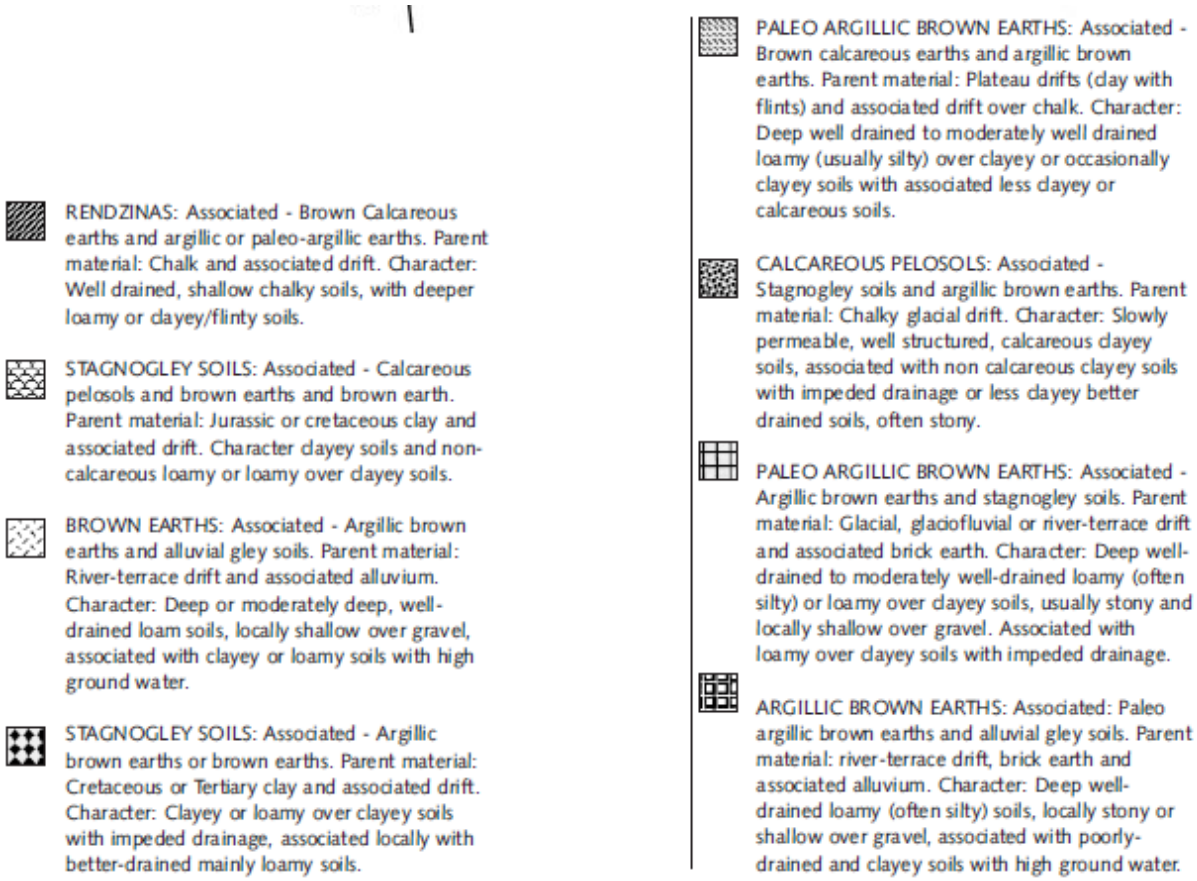
Mineral deposits within Hertfordshire have helped shape the landscape, wildlife and economy of the county and will require continued safeguarding for future use. The safe, efficient and sustainable disposal of waste is a major and growing concern across the whole of the United Kingdom.

9.1 Hertfordshire Soil Type

Figure 35 details the type of soils found within Hertfordshire

FIGURE 35: SOIL TYPE WITHIN HERTFORDSHIRE





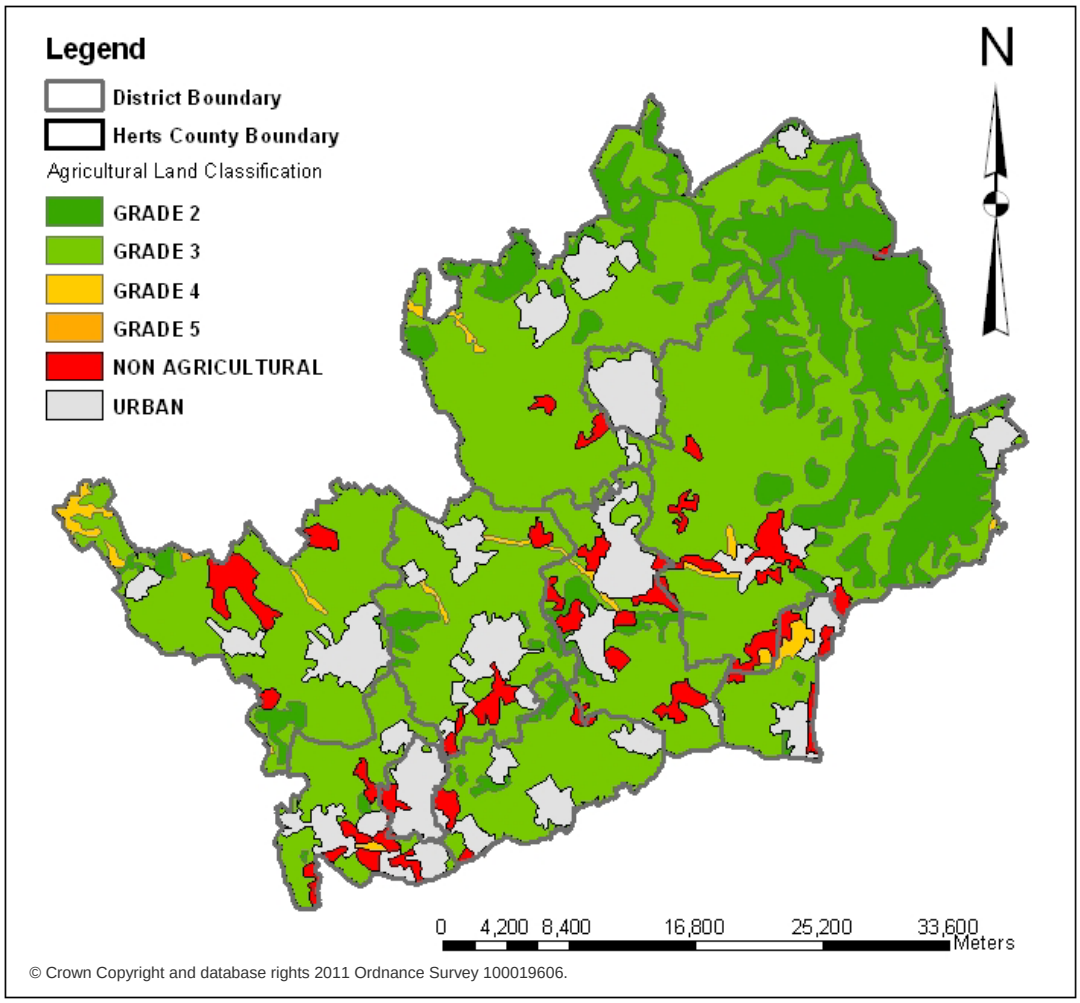
Source: East Hertfordshire Landscape Character Assessment, 2007

9.2 Agricultural Soil Classification

The East of England contains 58 per cent of the country's Grade 1 and 2 land, with 72 per cent of agricultural land in the region under cultivation. This compares to 29 per cent nationally (Our Environment, Our Future: The Regional Environment Strategy for the East of England. East of England Regional Assembly and East of England Environment Forum, July 2003). The East of England contains just 10 per cent of the country's Grade 4 and 5 land.

Agricultural soil composition within Hertfordshire is shown in Figure 36 below:

FIGURE 36: AGRICULTURAL SOIL CLASSIFICATION WITHIN HERTFORDSHIRE



Source: Hertfordshire County Council, 2011

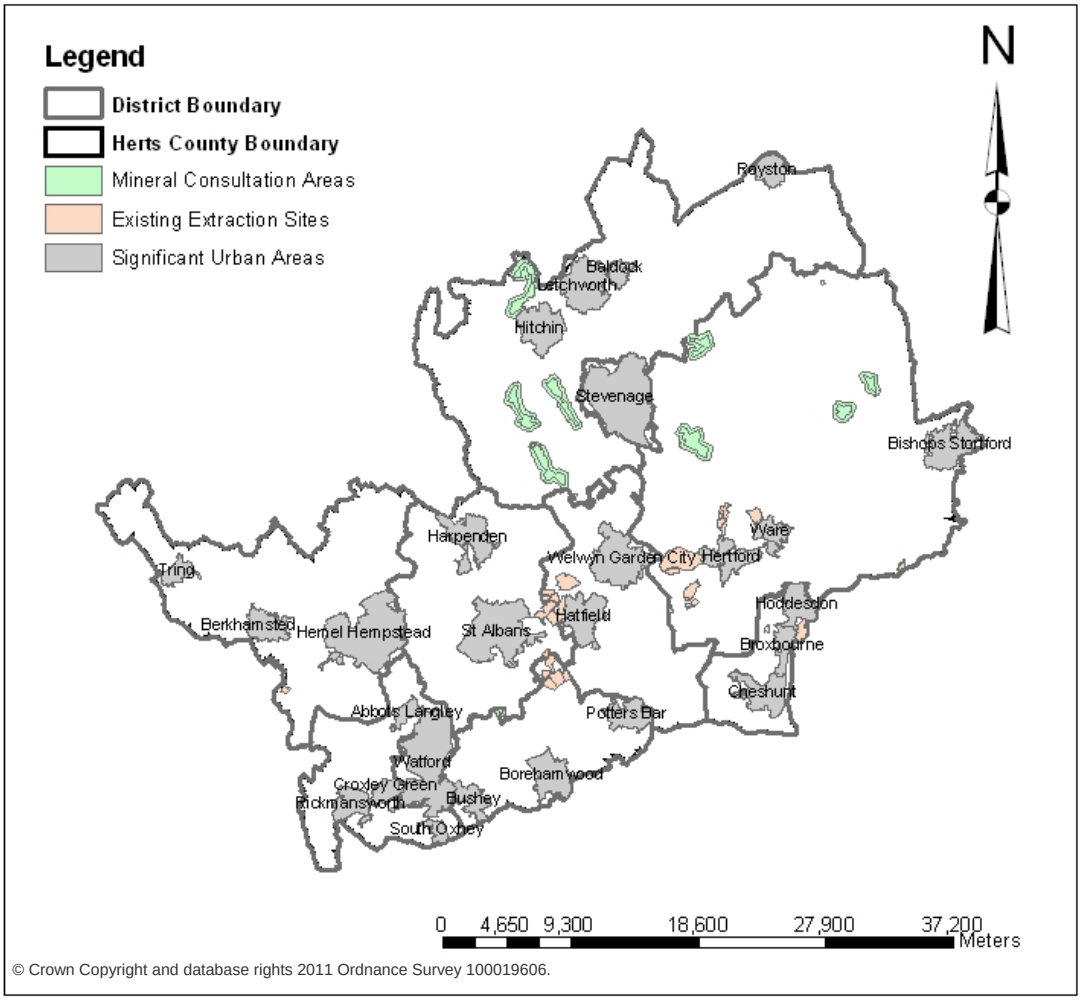
Hertfordshire County is primarily comprised of Grade 3 agricultural soil although the northern and eastern parts of North Hertfordshire and East Hertfordshire are comprised almost solely of Grade 2 soil. A central strip down the county is primarily classified as urban land or otherwise non-agricultural whilst the southern most tip is almost entirely urban or non-agricultural.

9.3 Minerals

The main mineral resources in Hertfordshire are sand and gravel, also known as aggregates, along with chalk and brick clay. Sand and gravels are worked together, are the main minerals extracted in Hertfordshire and are an essential raw material for the construction industry. Sand and gravel is found around much of the county and is concentrated in an area known as 'the sand and gravel belt'. This area covers all of Three Rivers, Watford, Hertsmere, Welwyn Hatfield and Broxbourne, whilst also falling within large parts of St Albans and East Hertfordshire as well as part of Dacorum. North Hertfordshire and Stevenage fall outside of the gravel belt.

Chalk and brick clay extraction is on a much smaller scale. Chalk is mainly quarried at a small number of sites to the north and west of the sand and gravel belt. The only brick clay extraction occurs at a site in the west of the country. Chalk in Hertfordshire is extracted for use as an agricultural lime on farms both within and outside the county. Brick clay is extracted for use at specialist brickworks in the county.

FIGURE 37: EXISTING MINERAL SITES AND 2008 CONSULTATION AREA WITHIN HERTFORDSHIRE

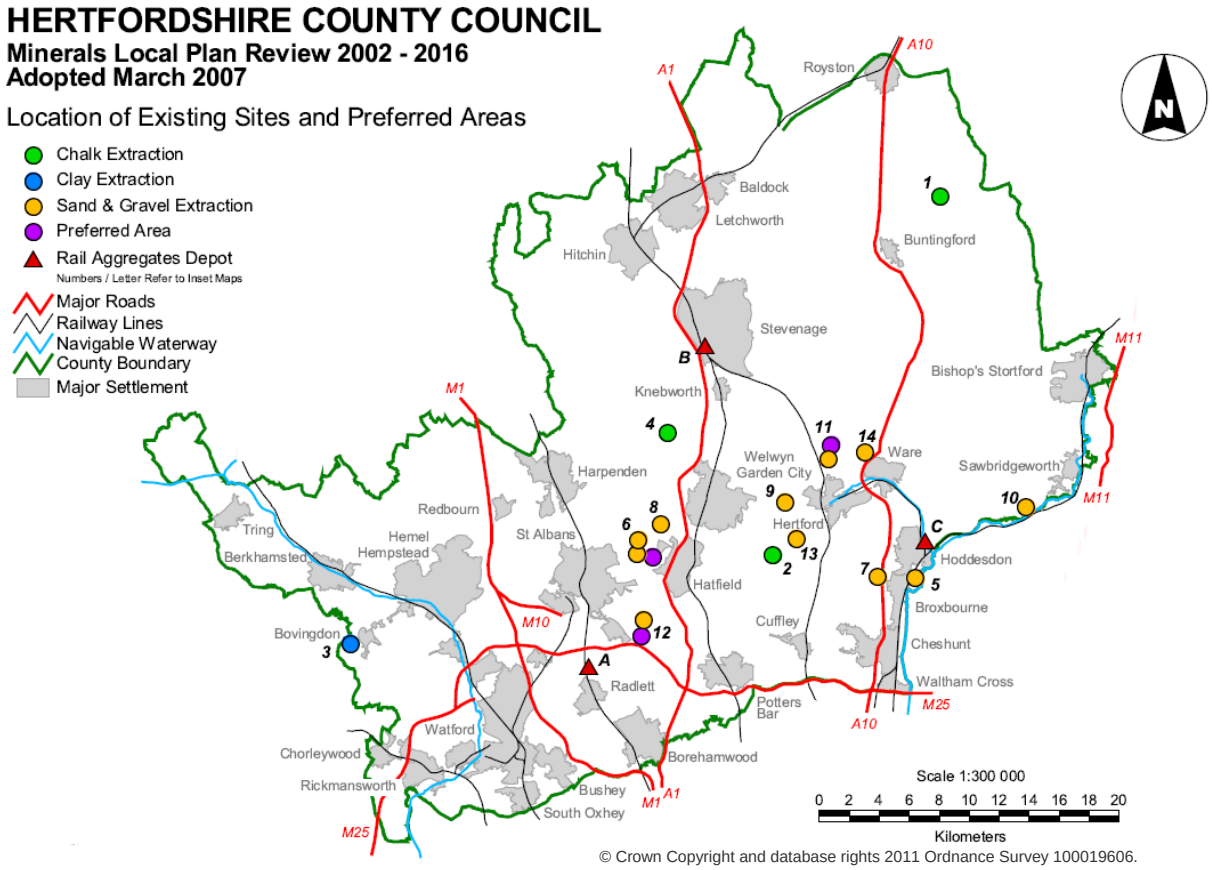


Source: Hertfordshire County Council, 2011

9.4 Mineral Transportation

The main method of transportation of extracted or recycled minerals in Hertfordshire is by road, although for large quantities of minerals being transported over long distances, rail and water transportation is often more economic and offers environmental advantages. Heavy goods vehicles associated with the industry are normally accepted in principle on strategic roads, main distributor roads and secondary distributor roads. However some of these roads may be unsuitable for increased levels of traffic associated with mineral workings. Figure 38 shows how sites are clustered around main roads and railways.

FIGURE 38: ACTIVE MINERAL AND TRANSHIPMENT SITES AS ADOPTED 2007



Source: Hertfordshire Minerals Local Plan Review, 2002 - 2016

9.5 Waste Movements

All households, businesses and industries in Hertfordshire produce waste. Due to the lack of up-to-date waste data, particularly for Commercial & Industrial and Construction & Demolition waste, it is difficult to provide a snapshot of the waste generated in the county in any particular year. Data available in 2009-10 shows that the county generated 543,932 tonnes of municipal waste of which:

• 428,434 tonnes of household waste was collected by District and Borough Councils through kerbside services and bring banks;

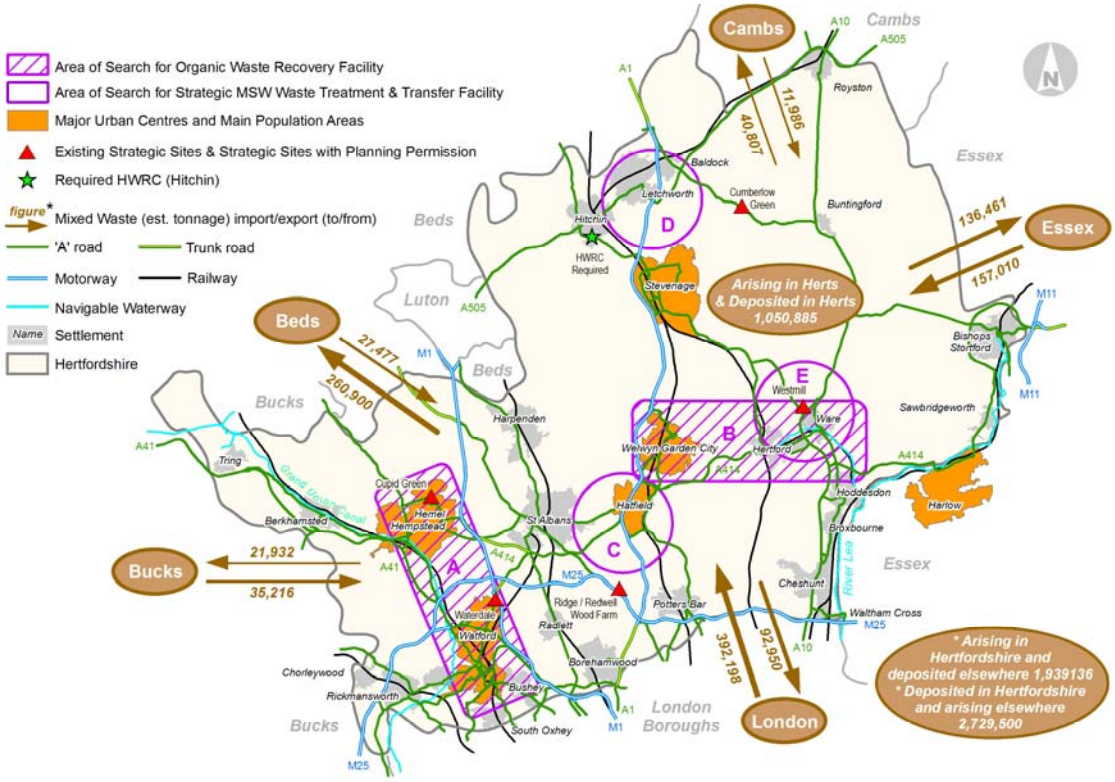
• 30,169 tonnes of collected non-household (commercial) waste

• 74,475 tonnes of waste was collected by the county council at the Household Waste Recycling Centres;

• 10,854 tonnes of non-household waste (construction and demolition, trade and asbestos) collected by the county council.

Measures are already in place to reduce the amount of waste produced and to reuse or recycle material wherever possible. However there is an ongoing challenge to introduce more sustainable ways of dealing with waste to reduce dependence on landfill. Existing waste management facilities in Hertfordshire have insufficient capacity to secure maximum recovery of waste (recycling, composting or energy generation). A number of new facilities will be needed to ensure a more sustainable approach to waste management. (Taken from Hertfordshire Waste Development Document, 2010)

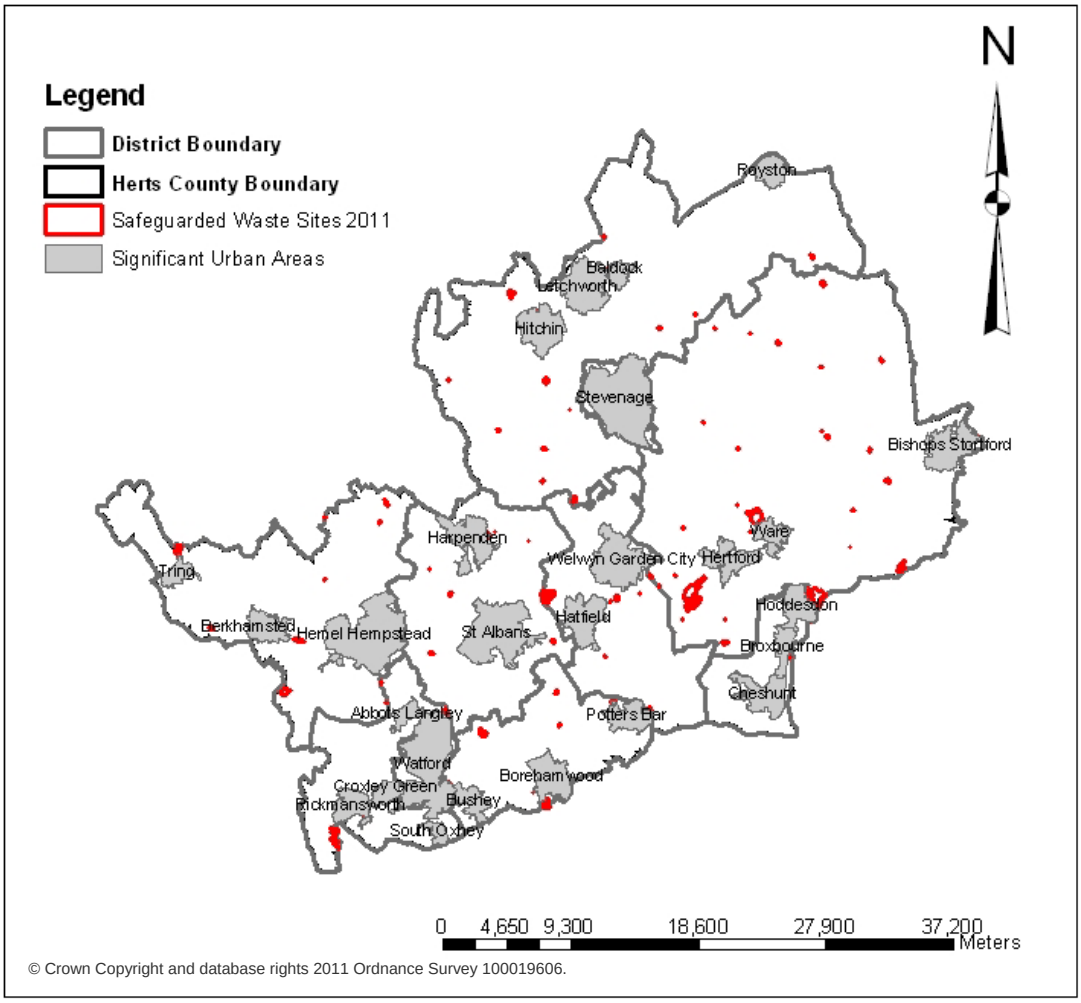
FIGURE 39: WASTE MOVEMENTS WITHIN AND OUTSIDE HERTFORDSHIRE, 2010



Source: Hertfordshire Mineral and Waste Development Framework: Waste Core Strategy & Development Management Policies Pre-submission, 2010

9.6 Active Waste Sites

FIGURE 40: ACTIVE WASTE SITES WITHIN HERTFORDSHIRE



Source: Hertfordshire County Council, 2011

Within Hertfordshire's Vision for Waste Management, 2010 it is stated that facilities will be sensitively located so that they reduce environmental and social impacts, meet the needs of communities and businesses as well as to seek enhancement of the locality. Waste management facilities will be located as close as practicable to the source of the waste, making use of sustainable transport links, where practical, to ensure existing and new communities deal with their own waste, especially in relation to areas where future growth is likely to occur.

Future forecasts of waste production suggest that of the 18 Household Waste Recycling Centres in the county, 11 are identified as in need of improvement or relocation, and that said relocation may then impact on the viability of other centres.

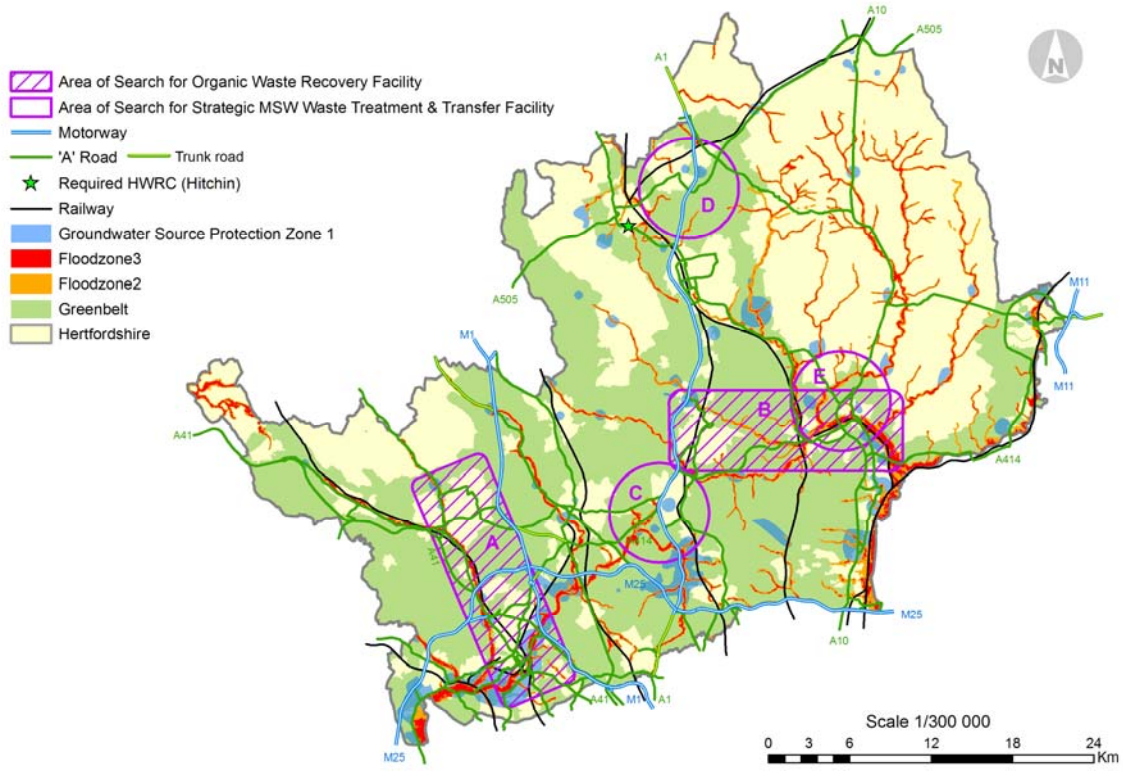
By 2026, it is considered that there will be a 165,000 tonne shortfall in Commercial and Industrial waste capacity. Existing capacity is currently 819,000.

Waterdale Transfer Station is central to the delivery of the Municipal Waste Management Strategy and there is a need for three new waste facilities to complement this and ensure that all parts of the county lie within 20minutes drive time of a major waste treatment facility or a waste transfer station.

9.7 Strategic Waste Sites Area of Search and Constraints

As previously described, waste sites and facilities will be required in order to successfully manage the wastes arising from domestic and economic practice within the county. These waste sites will be subjected to a number of constraints, of which risk from flooding would be one. The constraints that have been identified within Hertfordshire for waste sites are shown below:

FIGURE 41: IDENTIFIED CONSTRAINTS FOR ACTIVE WASTE SITES WITHIN HERTFORDSHIRE, 2010



Source: Hertfordshire Mineral and Waste Development Framework: Waste Core Strategy & Development Management Policies Pre-submission November 2010

9.8 Summary

Hertfordshire County is primarily comprised of Grade 3 agricultural soil although the northern and eastern parts of North Hertfordshire and East Hertfordshire are comprised almost solely of Grade 2 soil. A central strip down the county is primarily classified as urban land or otherwise non-agricultural whilst the southern most tip is almost entirely urban or non-agricultural.

The main mineral resources in Hertfordshire are sand and gravel, also known as aggregates, along with chalk and brick clay. Sand and gravels are worked together, are the main minerals extracted in Hertfordshire and are an essential raw material for the construction industry. Sand and gravel is found around much of the county and is concentrated in an area known as 'the sand and gravel belt'. This area covers all of Three Rivers, Watford, Hertsmere, Welwyn Hatfield and Broxbourne, whilst also falling within large parts of St Albans and East Hertfordshire as well as part of Dacorum. North Hertfordshire and Stevenage fall outside of the gravel belt.

The main method of transportation of extracted or recycled minerals in Hertfordshire is by road, although for large quantities of minerals being transported over long distances, rail and water transportation is often more economic and offers environmental advantages.

All households, businesses and industries in Hertfordshire produce waste. Due to the lack of up-to-date waste data, particularly for Commercial & Industrial and Construction & Demolition waste, it is difficult to provide a snapshot of the waste generated in the county in any particular year. Data available from 2009-10 shows that the county generated 543,932 tonnes of municipal waste

Within Hertfordshire's Vision for Waste Management it is stated that facilities will be sensitively located so that they reduce environmental and social impacts, meet the needs of communities and businesses as well as to seek enhancement of the locality. Waste management facilities will be located as close as practicable to the origin of the waste and make use of sustainable transport links, where practical, to ensure existing and new communities deal with their own waste. This is particularly true for areas where future growth is likely to occur.

Waterdale Transfer Station is central to the delivery of the Municipal Waste Management Strategy and there is a need for three new waste facilities to complement this and ensure that all parts of the county lie within 20minutes drive time of a major waste treatment facility or a waste transfer station.

Future forecasts of waste production suggest that of the 18 Household Waste Recycling Centres in the county, 11 are identified as in need of improvement or relocation, and that said relocation may then impact on the viability of other centres.

By 2026, it is considered that there will be a 165,000 tonne shortfall in Commercial and Industrial waste capacity. Existing capacity is currently 819,000.

10 TRANSPORT

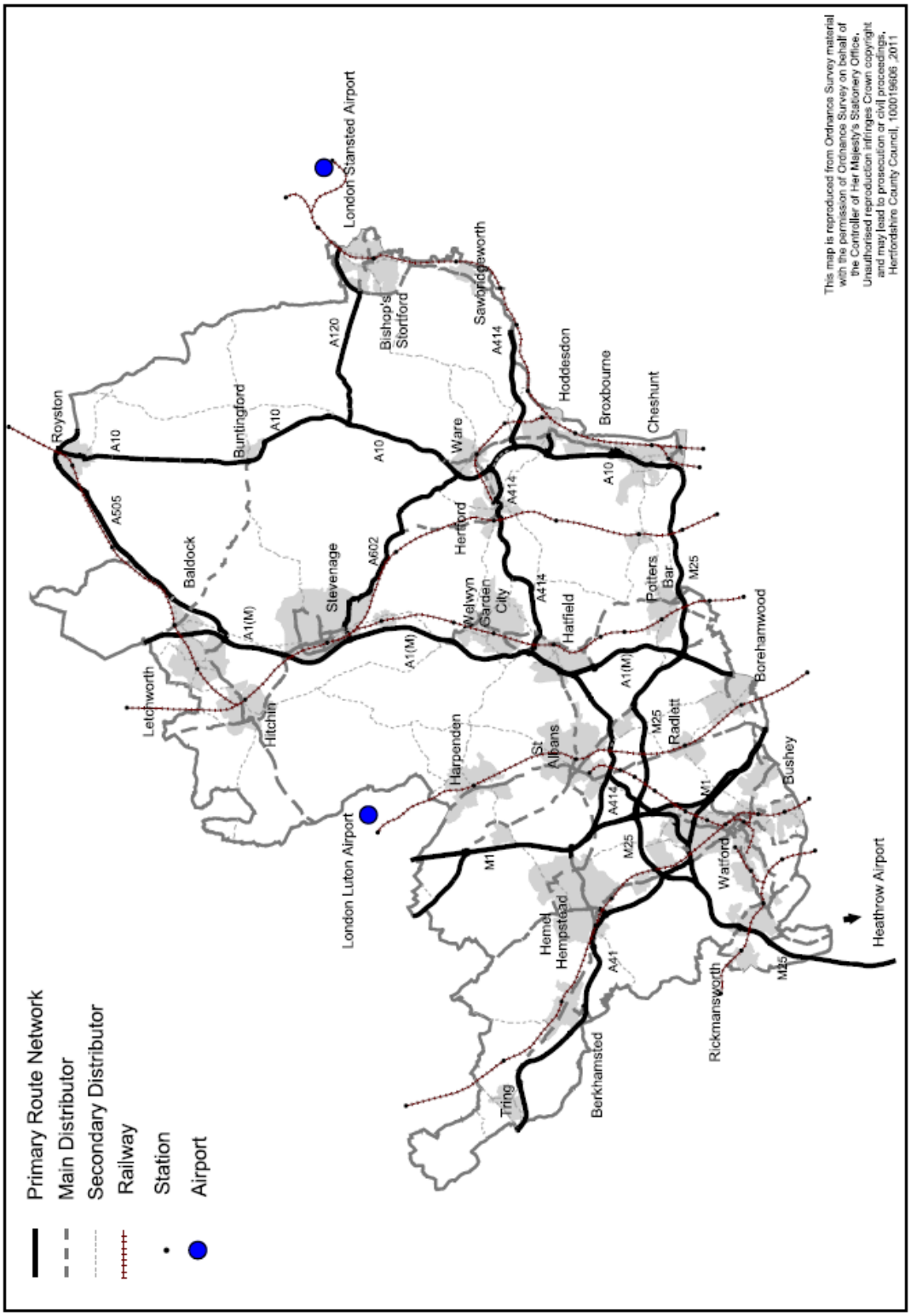
Hertfordshire is located in the East of England and lies to the north of London, the nation's capital and major employment centre. As a result of its proximity to London, there is a large commuter population. Pressures of growth mean increasing levels of traffic can be expected which will add to existing capacity issues during peak times. Major road and rail routes typically run north to south and operate close to capacity during peak hours, whilst east to west movements are characterised by issues relating to public transport.

It is important to assess the importance and location of major transport infrastructure in the county with respect to flooding events.

10.1 Infrastructure Routes

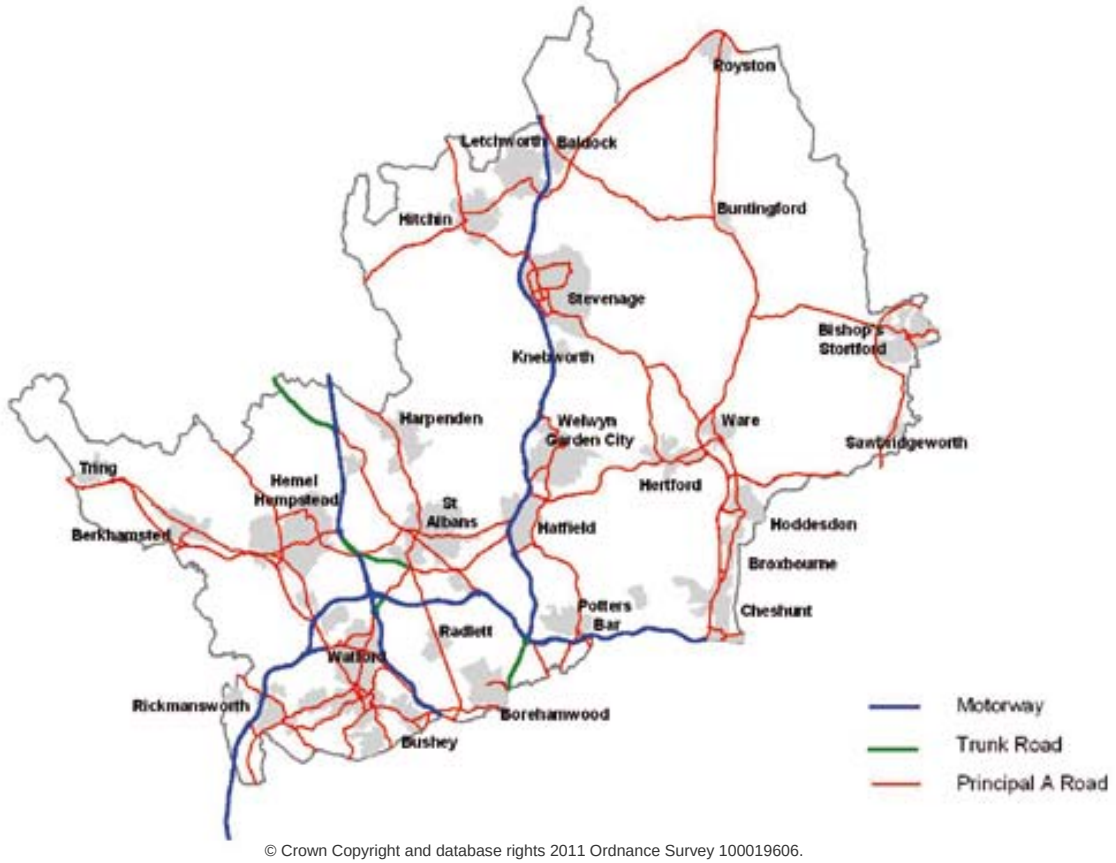
The figures below details the main infrastructure routes within Hertfordshire.

FIGURE 42: PRIMARY ROUTE NETWORK MAP



Source: Hertfordshire County Council Local Transport Plan, 2011 – 2031

FIGURE 43: HERTFORDSHIRE PRIMARY ROAD NETWORK

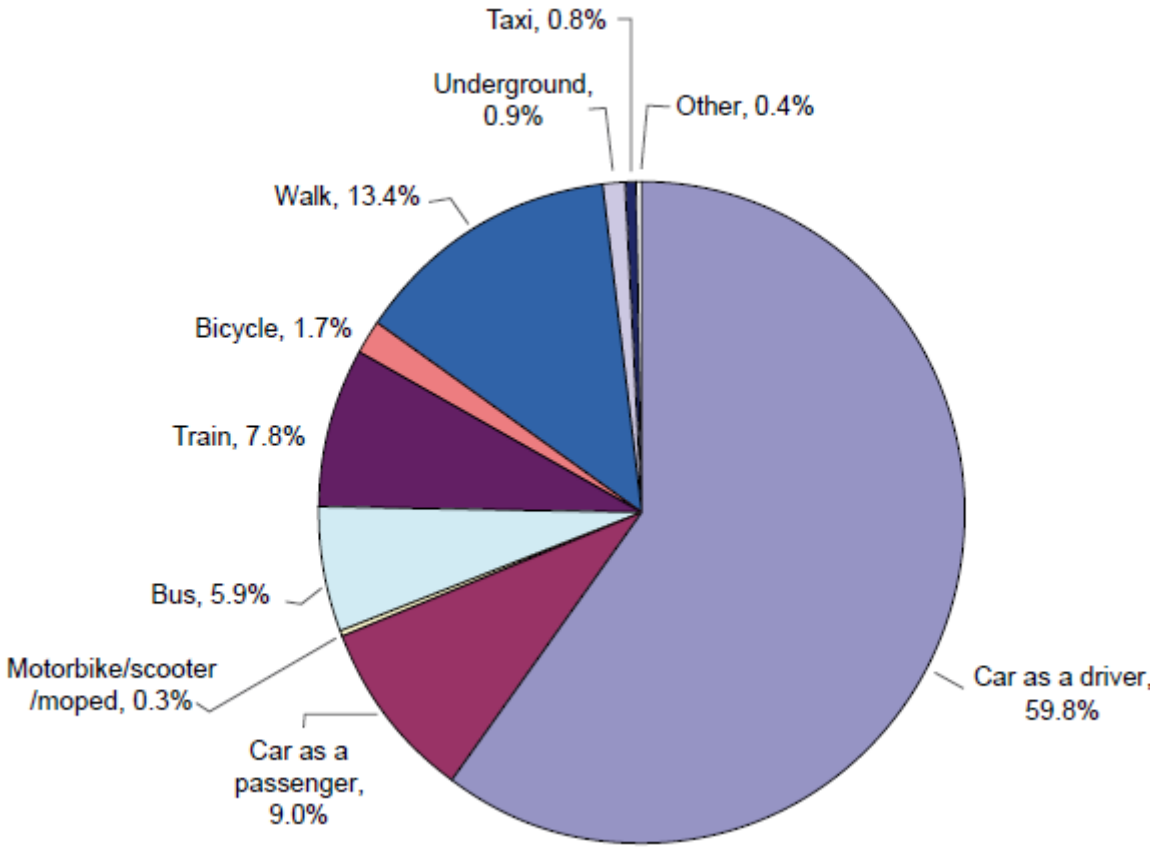


Source: Hertfordshire County Council Local Transport Plan, 2011 – 2031

Major infrastructure routes have a north to south focus and serve London, the Midlands and the North including the A1 (M) and M1 motorways and the East Coast, Midland and West Coast mainline railways. With the exception of the heavily congested M25 and A414 in the south of the country, east west routes are limited.

10.2 Travel Patterns

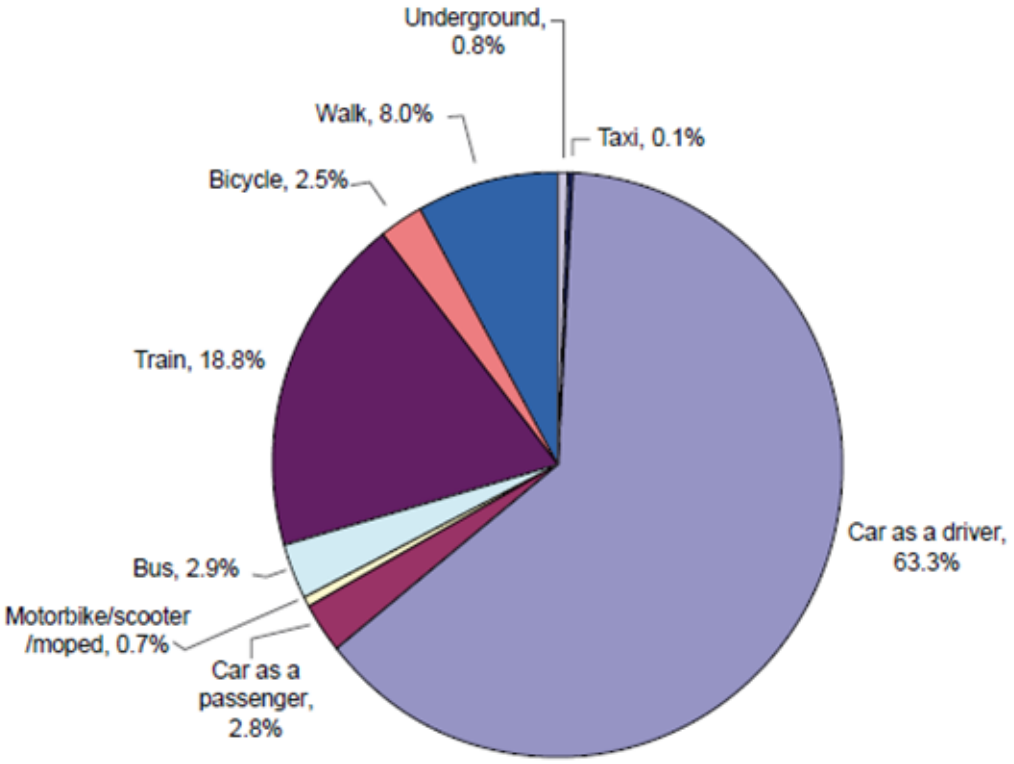
10.2.1 Mode of Travel



Source: Hertfordshire County Council Local Transport Plan, 2011 – 2031

Travel by car, either as a driver or passenger, accounts for 68.9 per cent of modal share for all journeys. The next most common forms of transport are walking (13.4 per cent) and the train (7.8 per cent).

FIGURE 44: PERCENTAGE MODE SHARE FOR JOURNEYS TO WORK



Source: Hertfordshire County Council Local Transport Plan, 2011 – 2031

When analysed separately, journeys to work show a higher proportion of those driving a car (63.3 per cent) although a smaller proportion overall utilising a car as either a driver or passenger (66.1 per cent). At 18.8 per cent the proportion of those using a train is higher for journeys to work than when all journey purposes are summarised together. Journey to work modal share is an important statistic as it highlights the modes of traffic which can be expected at peak hours.

It is important to note that this data represents a yearly average and is seasonal, with the proportion walking and cycling increasing in the summer.

Mode shares are also related to the distance to be travelled, with walking and cycling being more suited to short journeys. Many of Hertfordshire residents' journeys to work are short, a fifth being less than 3 miles, and many of the longer ones, being by train to London, contain a short segment from home to the rail station which would suit walking and cycling. There should therefore be potential to increase the proportion of commuters who walk and cycle.

10.2.2 Distance Travelled to Work

TABLE 29: DISTANCE TRAVELLED TO WORK, 1999, 2002, 2005 AND 2009

	1999	2002	2005	2009
Works at Home	1%	3%	4%	4%
<3miles	24%	20%	19%	19%
3 to <5	13%	10%	10%	9%
5 to <10	16%	20%	14%	16%
10 to <15	10%	12%	11%	11%
15 to <20	6%	6%	8%	7%
20 to <30	12%	12%	13%	13%
30 to <40	7%	8%	8%	8%
40 to <50	2%	2%	3%	3%
50+	2%	2%	2%	2%
Varies	7%	4%	9%	7%
Total Responding	1589	1576	2855	5763

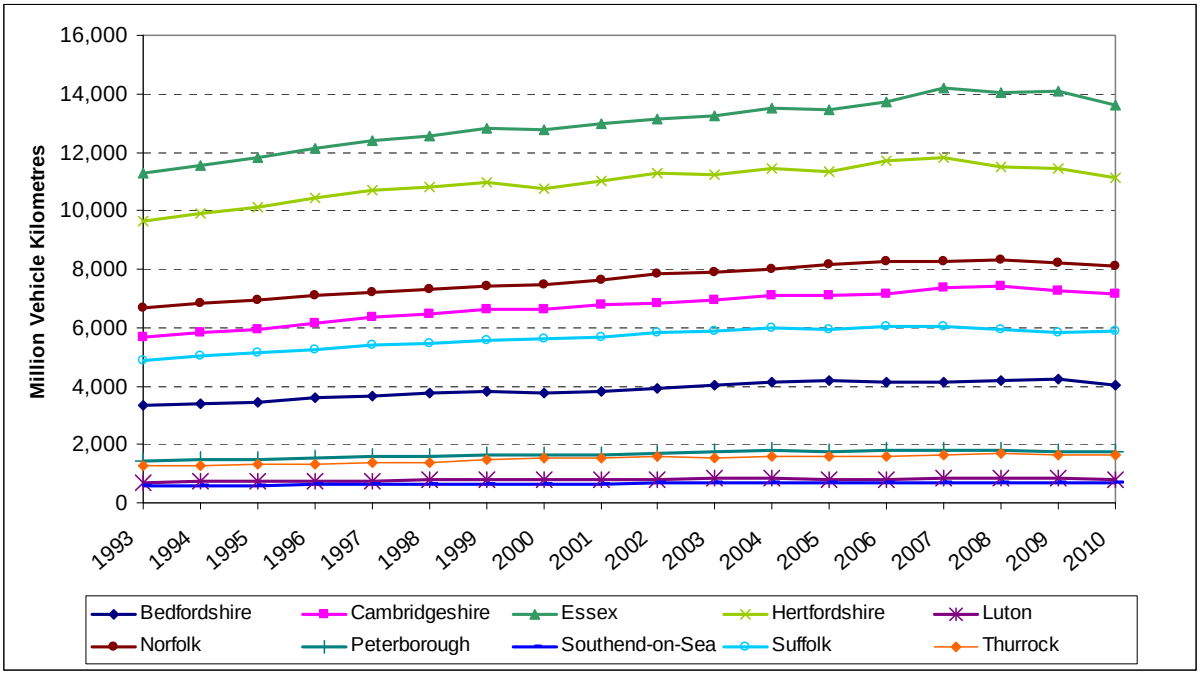
Source: Hertfordshire County Council Local Transport Plan, 2011 – 2031

Across the time period covered, the greatest proportion of respondents had a travel-to-work distance of less than 3 miles. Distances of 3 to <5 miles, 10 to <15 miles and 20 to <30 miles accounted for the majority of all respondents.

The proportion of residents travelling between 30 and 50+ miles to work can be seen to increase over the period 1990–2009 for the dates shown, with the proportion travelling less than 3 miles reducing.

10.2.3 Traffic Flow

FIGURE 45: TRAFFIC FLOWS FOR ALL VEHICLES BY LA IN THE EAST OF ENGLAND, 1993 – 2010 (IN MILLION KM)



Source: DfT, 2011

Estimated traffic flows for all motor vehicles have shown a general increase at local authority level across the entire East of England region in the last 15 years. Within Hertfordshire this has been from 9,619 to 11,136 million kilometres, with vehicle kilometres peaking at 11,819 million kilometres in 2007. However, since 2007, a number of authorities have experienced decreases in traffic flows. Hertfordshire is one such local authority.

The traffic flow for all motor vehicles in Hertfordshire has remained higher than all other areas within the East of England in the last 15 years apart from Essex.

10.3 Road Network Performance

Tackling congestion is an important part of creating an efficient transport network. Congestion is said to occur when the hourly traffic demand exceeds the maximum sustainable hourly throughput of the road. It is calculated by the Congestion Reference Flow (CRF), which is an estimate of the Annual Average Daily Traffic (AADT) flow at which the carriageway is likely to be congested at peak periods on an average day.

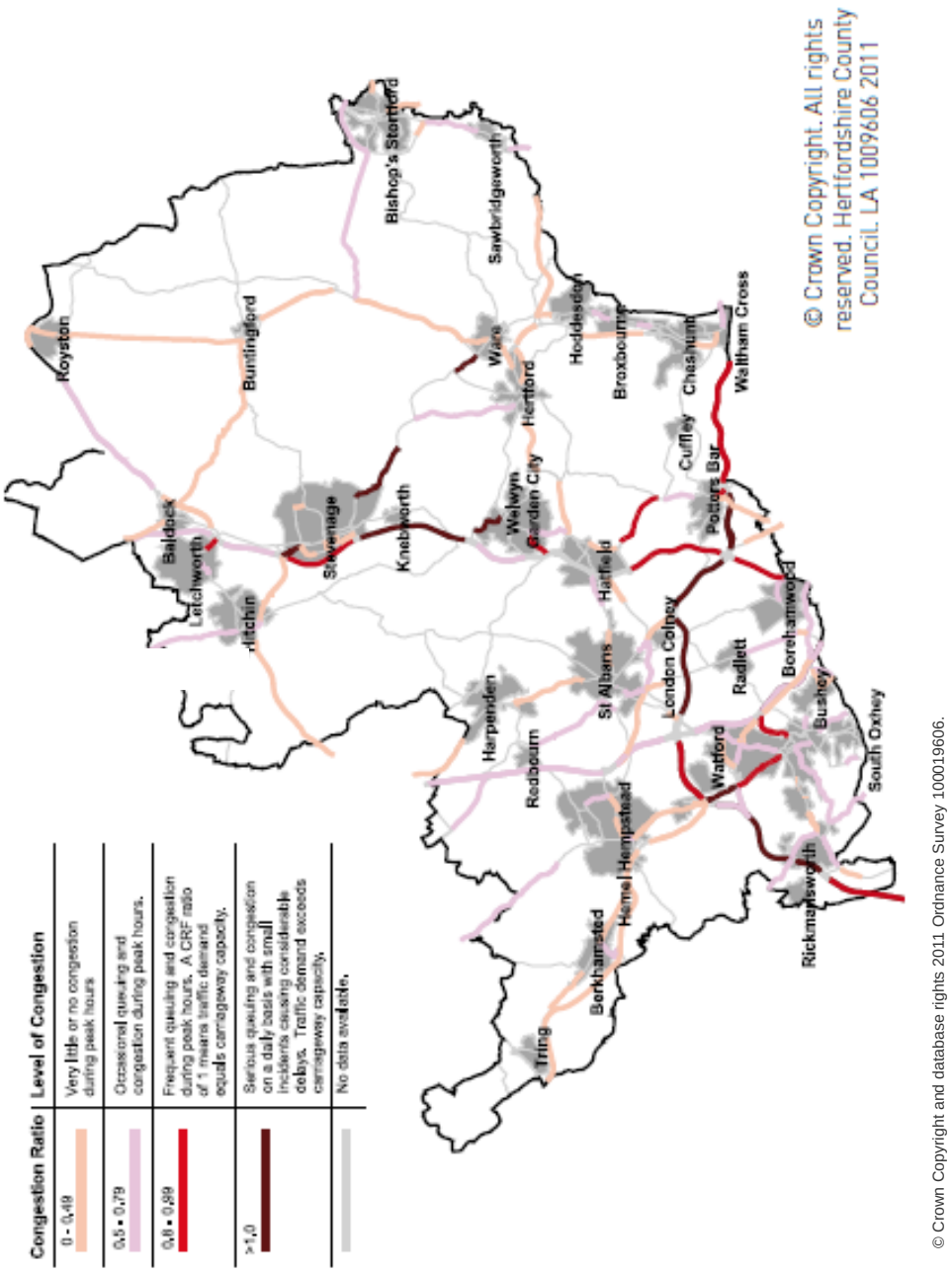
The ratio of AADT and CRF is defined as the level of 'stress' and gives an indication of the level of congestion for a particular road. Where a ratio is equal to or greater than 1 the CRF has been reached or exceeded, indicating that that particular road will encounter congestion problems.

The road network is dominated by north – south routes, the M1 and A1(M) motorways with the M11 immediately to the east of the county. The M25 provides an east-west route across the county with the A414 another east-west route towards the north. In the north of Hertfordshire, the A505 links the M11 to the A1(M) via the Baldock Bypass and then through to Hitchin and Luton.

All but the most major roads pass through rather than around urban areas leading to congestion, delays and an impact on the local environment. Traffic levels are assessed as being high, with daily flow rates on motorways and trunk roads being twice the national average whilst on A roads it has been recorded as being 80 per cent higher. On the motorways congestion can occur at any time, particularly through collisions and roadworks.

As well as considerable, largely rail-borne commuter traffic, there is much cross boundary movement between Hertfordshire and North London for retail and entertainment purposes.

FIGURE 46: ROAD NETWORK PERFORMANCE IN HERTFORDSHIRE, 2009

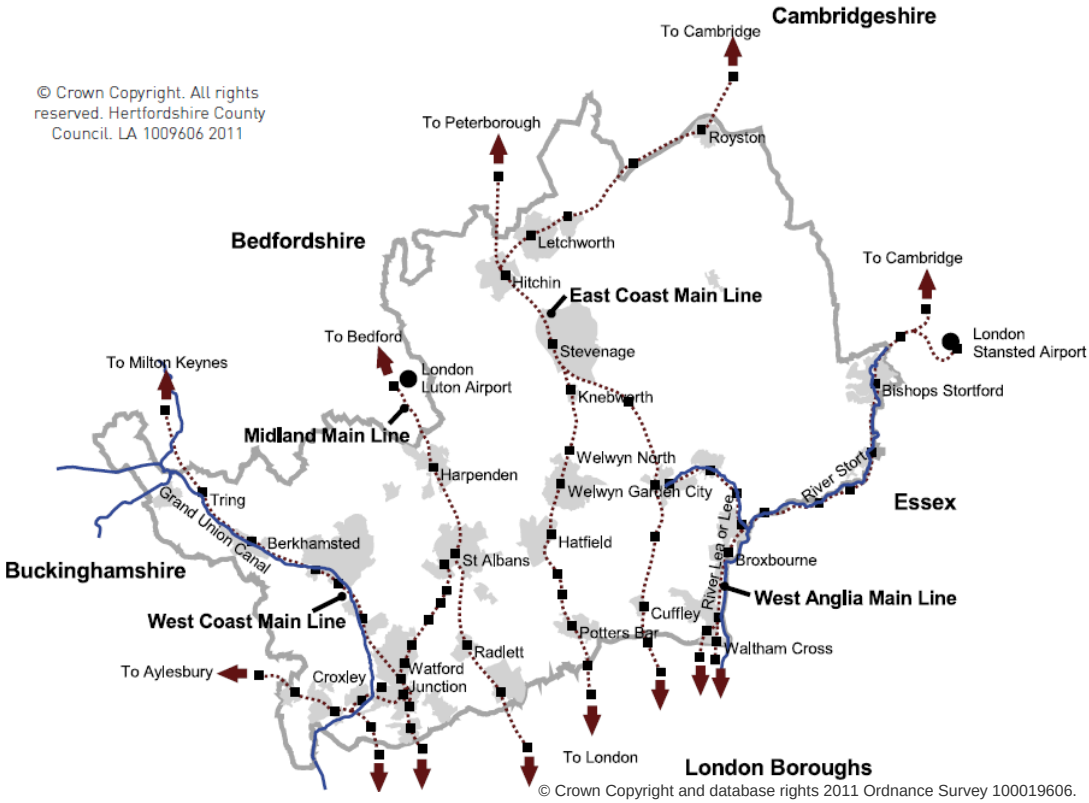


Source: Hertfordshire County Council Local Transport Plan, 2011 – 2031

The main congested routes run north to south apart from the M25. Road widening of the M25 will however help to alleviate congestion. Congestion has significant costs attached as it delays people's journeys and therefore impacts on economic competitiveness. The Transport Economic Evidence Study put Hertfordshire's expected economic losses due to congestion as £0.44bn in 2021.

10.4 Rail Routes

FIGURE 47: RAIL ROUTES WITHIN HERTFORDSHIRE



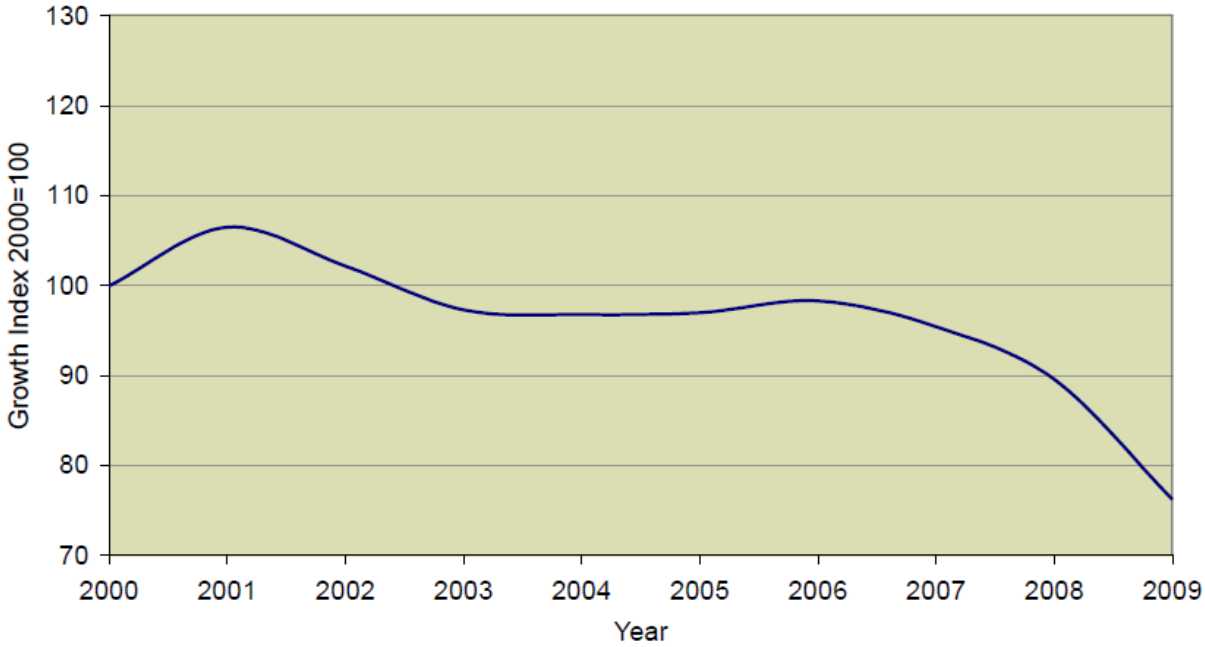
Source: Hertfordshire County Council Local Transport Plan, 2011 – 2031

The four major rail lines through Hertfordshire are the West Coast Main Line through Watford, the Midland Main Line through St Albans, the East Coast Main Line through Stevenage and the West Anglia Line through Broxbourne and Bishop's Stortford. The Midland Main Line is also part of the Thameslink system which crosses through London to the south.

Other lines include the Abbey Line, from St Albans Abbey station to Watford, and the Metropolitan Line from West Watford and Rickmansworth which is part of the London Underground system. There is no east to west rail line across the county. The majority of Hertfordshire's rail users are commuters to central London leading to capacity problems and overcrowding at peak hours. There is also considerable commuter usage in the opposite direction to the main flow and use of the long distance lines to destinations north of the county.

10.5 Freight Movements

FIGURE 48: HGV FLOWS WITHIN HERTFORDSHIRE



Source: Hertfordshire County Council Local Transport Plan, 2011 – 2031

Freight transport is an essential part of the national and local economies. In 2008, road freight accounted for two thirds of goods moved in Great Britain. Hertfordshire has both freight traffic distributing goods within the county and a large number of HGVs (heavy goods vehicles over 3.5 tonnes) passing through the county on strategic routes. Hertfordshire's motorway and trunk road networks carry two and a half times the national level of HGVs with principal A roads carrying almost double the national levels. HGV flows have however decreased since 2007.

10.6 Airports and their Impact

Immediately to the east and to the west of the county are two major civil airports, London Stansted, near Bishop's Stortford, and London Luton, north of Harpenden. Both add to traffic and rail demands in the county though the majority of airport related demand uses the rail and motorway links to London. Heathrow lies to the southwest of the county. The rail issues for Hertfordshire relate mainly to capacity in the peak periods. In addition to peak time unreliability and overcrowding, lack of capacity on the main lines limits the number of trains that can serve Hertfordshire stations and the potential for changing stopping patterns.

10.7 Summary

The road network is dominated by north to south routes, the M1 and A1(M) motorways and the M11 immediately to the east of the county. In the north of Hertfordshire, the A505 links the M11 to the A1(M) via the Baldock Bypass and then through to Hitchin and Luton. With the exception of the heavily congested M25 and A414, east to west routes are limited.

The four major rail lines through Hertfordshire are the West Coast Main Line through Watford, the Midland Main Line through St Albans, the East Coast Main Line through Stevenage and the West Anglia Line through Broxbourne and Bishop's Stortford. The

Midland Main Line is also part of the Thameslink system which crosses through London to the south.

Immediately to the east and to the west of the county are two major civil airports, London Stansted, near Bishop's Stortford, and London Luton, north of Harpenden. Both add to traffic and rail demands in the county.

Data gathered during the preparation of the Hertfordshire County Council Local Transport Plan 2011 – 2031 showed that travel by car, either as a driver or passenger, accounts for 68.9 per cent of modal share for all journeys irrespective of purpose. The next most common forms of transport are walking (13.4 per cent) and the train (7.8 per cent). An analysis of journeys taken to a place of work show a higher proportion of those driving a car (63.3 per cent) then reported across all journey purposes and a smaller proportion overall utilising a car as either a driver or passenger (66.1 per cent). At 18.8 per cent, train use is higher for journeys to work than when all journey purposes are summarised together. Journey to work modal share is an important statistic as it highlights the mode of traffic which can be expected at peak hours.

In the years 1999, 2002, 2005 and 2009, the greatest proportion of respondents to information requests issued as part of the production of the Local Transport Plan 2011 reported a travel-to-work distance of less than 3 miles. The proportion of residents travelling between 30 and 50+ miles to work can be seen to increase over the period 1999–2009, with the proportion travelling less than 3 miles reducing. This suggests that residents are driving progressively further to their places of work, meaning the potential economic implications of flooded transport infrastructure are increasing.

Hertfordshire's motorway and trunk road networks carry two and a half times the national level of Heavy Goods Vehicles (HGV), with principal A roads caring almost double the national levels. HGV flows have decreased since 2007 but again, there would still be considerably economic implications for Hertfordshire should major infrastructure routes flood for a long period of time.

11 AIR QUALITY

The SEA of the National Flood and Coastal Erosion Risk Management Strategy concluded that significant impacts on air quality as a result of the strategy were unlikely to occur and therefore it was scoped out of the assessment. Having reviewed the objectives of the LFRMS it is concluded that significant impacts on air quality as a result of the LFRMS are also unlikely to occur and therefore Air Quality is scoped out of this SEA.

12 ECONOMY

Nationally, economic policy is presented within PPS4: Planning for Sustainable Economic Growth. Here the government commits to building prosperous communities by improving the economic performance of cities, towns, regions, sub-regions and local areas, both urban and rural. The Government pledge to reduce the gap in economic growth rates between regions, promote regeneration and tackle deprivation, deliver more sustainable patterns of development in order to reduce transportation and travel, and to promote the vitality and viability of town and other centres as important places for communities. Such delivery has to respect the tenets of PPS1. This PPS again highlights the need for high and stable economic growth and employment but requires this to be facilitated alongside a prudent use of resources and effective protection of the environment. Evidently potential flood risk will be a major consideration when growing a local economy.

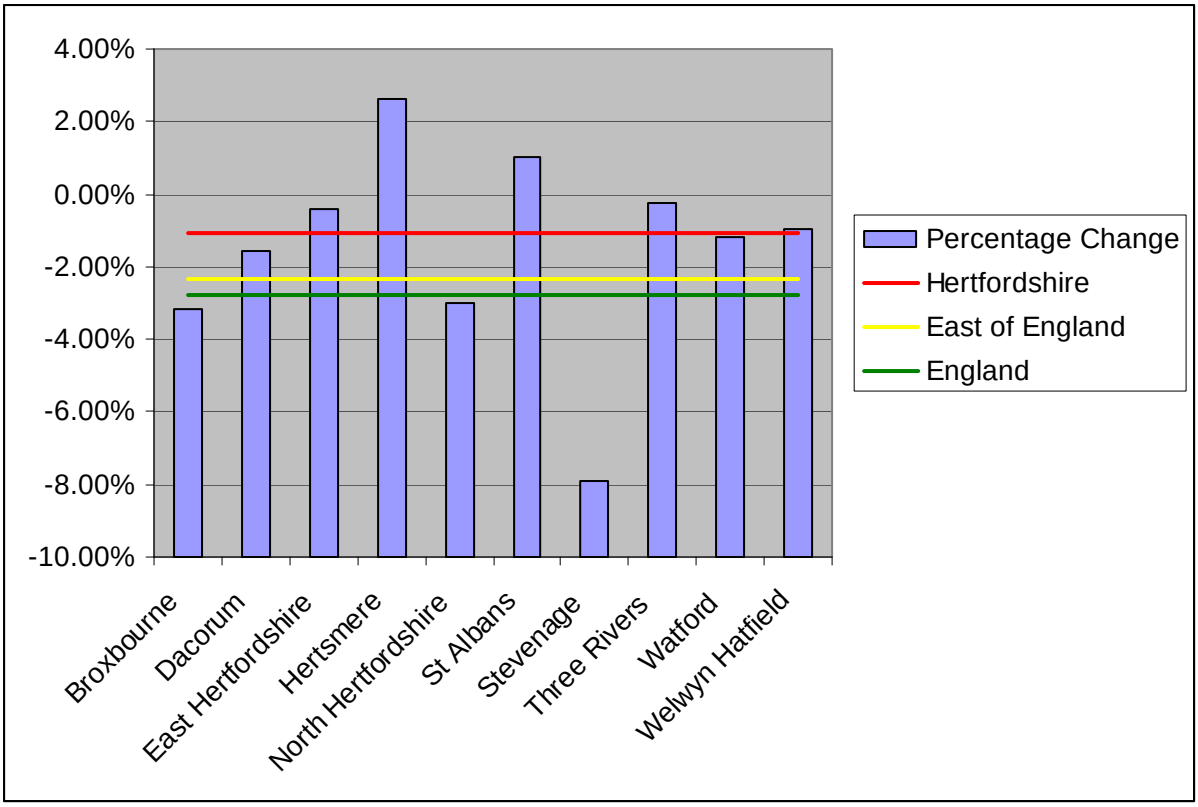
12.1 Local Unit Growth

TABLE 30: VAT AND/OR PAYE REGISTERED LOCAL UNITS, MARCH 2008 & MARCH 2010

Local Authority	March 2008	March 2010	per cent Change
Broxbourne	3,895	3,775	-3.18%
Dacorum	7,490	7,375	-1.56%
East Hertfordshire	7,690	7,660	-0.39%
Hertsmere	5,205	5,345	2.62%
North Hertfordshire	6,645	6,450	-3.02%
St Albans	7,440	7,515	1.00%
Stevenage	3,075	2,850	-7.89%
Three Rivers	4,275	4,265	-0.23%
Watford	4,215	4,165	-1.20%
Welwyn Hatfield	4,655	4,610	-0.98%
Hertfordshire	54,585	54,010	-1.06%
East of England	259,050	253,120	-2.34%
England	2,244,290	2,183,845	-2.77%

Source: ONS, 2011

FIGURE 49: PROPORTIONAL CHANGE IN THE NUMBER OF VAT AND/OR PAYE REGISTERED LOCAL UNITS BETWEEN MARCH 2008 & MARCH 2010



Source: ONS, 2011

Between March 2008 and March 2010 Hertfordshire, the East of England and England reported a proportional reduction in the number of VAT and/or PAYE registered units. At 1.06 per cent in the county, this reduction was smaller than the East of England (2.34 per cent) and England (2.77 per cent).

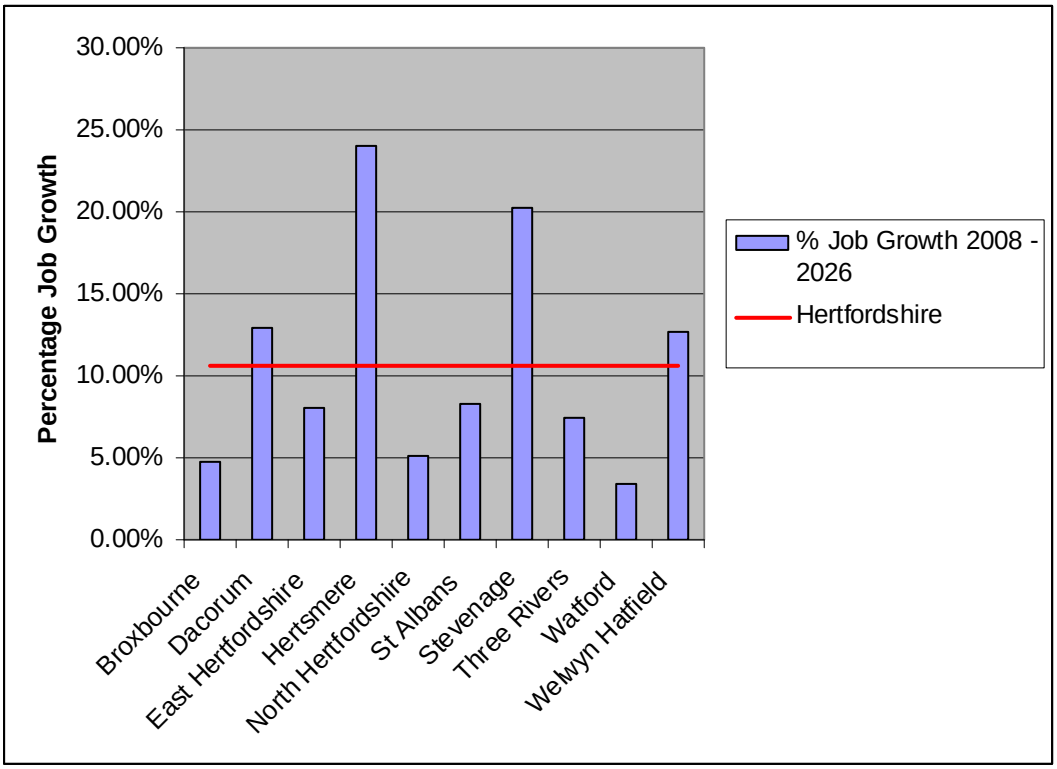
Two local authorities within Hertfordshire were able to report a growth in the number of VAT and/or PAYE registered local units. These were St Albans who reported a growth of 1 per cent and Hertsmere who reported a growth of 2.62 per cent. The remaining districts and boroughs witnessed a decrease, with the largest being in Stevenage (-7.89 per cent) and Broxbourne (-3.18 per cent)

TABLE 31: PROJECTED JOB GROWTH IN HERTFORDSHIRE, 2008 – 2026

Local Authority	Total Jobs (2008)	Projected Jobs (2026)	% Job Growth 2008 – 2026
Broxbourne	41,000	43,000	4.8%
Dacorum	70,800	79,900	12.9%
East Hertfordshire	68,900	74,500	8.1%
Hertsmere	51,400	63,800	24%
North Hertfordshire	53,600	56,300	5.1%
St Albans	79,100	85,600	8.3%
Stevenage	46,000	55,200	20.2%
Three Rivers	41,600	44,700	7.5%
Watford	57,000	59,000	3.4%
Welwyn Hatfield	75,000	84,500	12.7%
Hertfordshire	584,200	646,400	10.6%

Source: Hertfordshire Mineral and Waste Development Framework: Waste Core Strategy & Development Management Policies Pre-submission November 2010

FIGURE 50: PROJECTED JOB GROWTH IN HERTFORDSHIRE, 2008 – 2026



Source: Hertfordshire Mineral and Waste Development Framework: Waste Core Strategy & Development Management Policies Pre-submission November 2010

There is expected to be a 10.6 per cent increase in jobs within Hertfordshire by 2026 when measured from a 2008 baseline. On a local authority level there is significant variation on this figure. At 20.2 per cent Stevenage is projected to have the highest proportional job growth whilst Watford, at 3.4 per cent, is projected to have the least.

12.2 Local Unit Composition

The following table details the composition of local business units by district / borough and county.

TABLE 32: VAT AND/OR PAYE REGISTERED LOCAL UNITS BY BROAD INDUSTRIAL GROUP, MARCH 2010

	Broxbourne	Dacorum	East Herts	Hertsmere	North Herts	St Albans	Stevenage	Three Rivers	Watford	Welwyn Hatfield	Hertfordshire
All VAT and/or PAYE Based Local Units	3775	7375	7660	5345	6445	7520	2850	4265	4165	4610	54010
All Urban Units	3670	6070	5020	3975	4770	6715	2835	3845	4165	3800	44865
All Rural Units	105	1305	2640	1375	1675	800	15	425		805	9145
Agriculture, Forestry & Fishing	40	135	230	45	175	65	5	40	5	50	790
Production	265	350	470	225	470	285	145	200	240	265	2915
Construction	790	960	1075	615	730	685	430	625	420	530	6860
Motor Trades	155	195	230	150	200	145	90	115	130	145	1555
Wholesale	245	375	355	415	335	375	125	270	305	265	3065
Retail	345	675	635	480	585	660	330	315	515	425	4965
Transport & Storage	155	195	190	155	165	155	110	120	125	175	1545
Accom. & Food Services	175	355	395	255	315	365	180	195	220	230	2685
Information & Communication	165	805	540	500	580	890	285	400	380	430	4975
Finance & Insurance	85	145	280	145	130	195	65	80	125	95	1345
Property	155	225	330	300	265	245	80	190	115	180	2085
Professional, Scientific & Technical	420	1240	1280	875	1110	1700	350	805	585	735	9100
Business Admin & Support Services	360	595	695	450	520	670	240	355	400	375	4660
Public Admin & Defence	15	30	40	15	25	40	20	10	25	35	255
Education	60	180	200	100	160	195	80	85	85	110	1255
Health	125	315	250	195	250	315	135	170	190	250	2195
Arts, Entertainment, Recreation and Other Services	220	600	465	425	430	535	180	290	300	315	3760

	Broxbourne	Dacorum	East Herts	Hertsmere	North Herts	St Albans	Stevenage	Three Rivers	Watford	Welwyn Hatfield	Hertfordshire
All Urban Units	97.22	82.31	65.54	74.30	74.01	89.35	99.47	90.05	100.	82.52	83.07
All Rural Units	2.78	17.69	34.46	25.70	25.99	10.65	0.53	9.95	0.00	17.48	16.93
Agriculture, Forestry & Fishing	1.06	1.83	3.00	0.84	2.72	0.86	0.18	0.94	0.12	1.08	1.46
Production	7.02	4.75	6.14	4.21	7.29	3.79	5.09	4.69	5.76	5.75	5.40
Construction	20.93	13.02	14.03	11.51	11.33	9.11	15.09	14.65	10.08	11.50	12.70
Motor Trades	4.11	2.64	3.00	2.81	3.10	1.93	3.16	2.70	3.12	3.15	2.88
Wholesale	6.49	5.08	4.63	7.76	5.20	4.99	4.39	6.33	7.32	5.75	5.67
Retail	9.14	9.15	8.29	8.98	9.08	8.78	11.58	7.39	12.36	9.22	9.19
Transport & Storage	4.11	2.64	2.48	2.90	2.56	2.06	3.86	2.81	3.00	3.80	2.86
Accom. & Food Services	4.64	4.81	5.16	4.77	4.89	4.85	6.32	4.57	5.28	4.99	4.97
Information & Communication	4.37	10.92	7.05	9.35	9.00	11.84	10.00	9.38	9.12	9.33	9.21
Finance & Insurance	2.25	1.97	3.66	2.71	2.02	2.59	2.28	1.88	3.00	2.06	2.49
Property	4.11	3.05	4.31	5.61	4.11	3.26	2.81	4.45	2.76	3.90	3.86
Professional, Scientific & Technical	11.13	16.81	16.71	16.37	17.22	22.61	12.28	18.87	14.05	15.94	16.85
Business Admin & Support Services	9.54	8.07	9.07	8.42	8.07	8.91	8.42	8.32	9.60	8.13	8.63
Public Admin & Defence	0.40	0.41	0.52	0.28	0.39	0.53	0.70	0.23	0.60	0.76	0.47
Education	1.59	2.44	2.61	1.87	2.48	2.59	2.81	1.99	2.04	2.39	2.32
Health	3.31	4.27	3.26	3.65	3.88	4.19	4.74	3.99	4.56	5.42	4.06
Arts, Entertainment, Recreation and Other Services	5.83	8.14	6.07	7.95	6.67	7.11	6.32	6.80	7.20	6.83	6.96

Source: ONS, 2011

Across the county it can be seen that Hertfordshire's economy is largely urban based, with the county housing 83.07 per cent of its local business units in an urban setting. There is variation at the district level however, with Watford housing 100 per cent of its economy in an urban setting whilst East Hertfordshire, at 65.54 per cent, houses the least.

At the county level, 'Professional, scientific and technical' local units account for the greatest proportion of units at 16.85 per cent. Other strongly represented business classes proportionately are Construction (12.7 per cent) and Information and Communication (9.21 per cent). Whilst the proportions can be seen to deviate at the district / borough level, the composition of local units within each district and borough is broadly that seen at the county level.

12.3 Job Density

'Job density' is the term given to represent the number of jobs available for a single person of working age over a given area. For example, a job density of 1 would represent the fact that there is a single job available for every person of working age.

TABLE 33: JOB DENSITY ACROSS HERTFORDSHIRE BY LOCAL AUTHORITY, 2000 - 2009

Year	Broxbourne	Dacorum	East Herts	Hertsmere	North Herts	St Albans	Stevenage	Three Rivers	Watford	Welwyn Hatfield
2000	0.64	0.87	0.79	0.94	0.74	0.8	0.95	0.68	1.23	1.06
2001	0.63	0.86	0.77	1.09	0.79	0.83	0.89	0.72	1.21	1.06
2002	0.69	0.86	0.85	0.95	0.77	0.76	0.87	0.68	1.17	1.06
2003	0.76	0.85	0.81	0.91	0.79	0.8	0.97	0.72	1.08	1.01
2004	0.72	0.82	0.76	0.85	0.8	0.83	0.96	0.72	1.09	1.07
2005	0.67	0.84	0.79	0.89	0.82	0.87	0.98	0.73	1.1	1.01
2006	0.69	0.78	0.83	0.85	0.7	0.84	0.86	0.69	1.14	0.99
2007	0.68	0.79	0.78	0.82	0.7	0.85	0.93	0.7	1.1	1.03
2008	0.71	0.81	0.77	0.87	0.73	0.93	0.87	0.72	1.04	1.04
2009	0.73	0.74	0.75	0.9	0.66	0.87	0.9	0.67	1.27	1.03

Source: nomis, 2011

Watford and Welwyn have the highest job densities across the period of study, with 2009 returns showing job densities of 1.27 and 1.03 respectively. This means that there are more jobs in these local authorities than there are people of working age. The lowest job densities can be found in Three Rivers and North Hertfordshire at 0.67 and 0.66 respectively.

Of the 10 districts and boroughs in Hertfordshire; Broxbourne, St Albans and Watford witnessed an increase in job density between 2000 and 2009. The remaining seven local authorities saw decreases, with those decreases most marked in Dacorum (0.87 to 0.74) and North Hertfordshire (0.74 to 0.66).

12.4 Industrial Floorspace Composition

The following table details the industrial floorspace composition within Hertfordshire by bulk industry class in each district. An amalgamated figure is provided for the county.

TABLE 34: COMMERCIAL AND INDUSTRIAL FLOORSPACE COMPOSTION WITHIN HERTFORDSHIRE IN M^2, 2008

	Broxbourne	Dacorum	East Herts	Hertsmere	North Herts	St Albans	Stevenage	Three Rivers	Watford	Welwyn Hatfield	Hertfordshire
All Bulk Classes	849	1285	1163	791	1115	986	1039	400	1057	1341	10026
Retail Premises (%)	17.79	17.51	16.08	18.46	17.76	24.95	22.14	14.00	31.03	13.65	19.45
Commercial Offices (%)	8.36	23.89	13.24	24.27	12.38	21.20	14.63	40.75	21.10	22.82	19.10
Other Offices (%)	2.36	2.33	2.15	2.02	2.15	2.84	1.92	2.00	3.03	1.34	2.20
Factories (%)	22.73	14.40	35.17	17.70	37.04	11.56	34.26	16.00	17.60	20.66	23.31
Warehouses (%)	46.53	38.68	28.55	31.86	27.17	34.3	25.2	22.75	25.35	39.30	32.58
Other Bulk Premises (%)	2.36	3.27	4.82	5.56	3.59	5.07	1.92	4.75	1.89	2.24	3.40

ONS, 2011

Warehouses (32.58 per cent), factories (23.31 per cent) and retail premises (19.45 per cent) make up the majority of floorspace within the county. These three industry types also make up the majority of floorspace in each of the districts and boroughs although there is proportional variation. For example at 31.03 per cent and 24.95 per cent respectively, Watford and to a lesser extent St Albans have proportionately larger retail floorspace than that reported elsewhere. Three Rivers District shows the most deviation from county proportions, with 40.75 per cent of industrial floorspace being used for commercial offices. At 16 per cent the proportion of factory floor space in Three Rivers is significantly lower than that seen at the County level.

12.5 Economic Activity by Place of Residence

The following table highlights the economic situation of those of a working age who live within each district and borough within Hertfordshire.

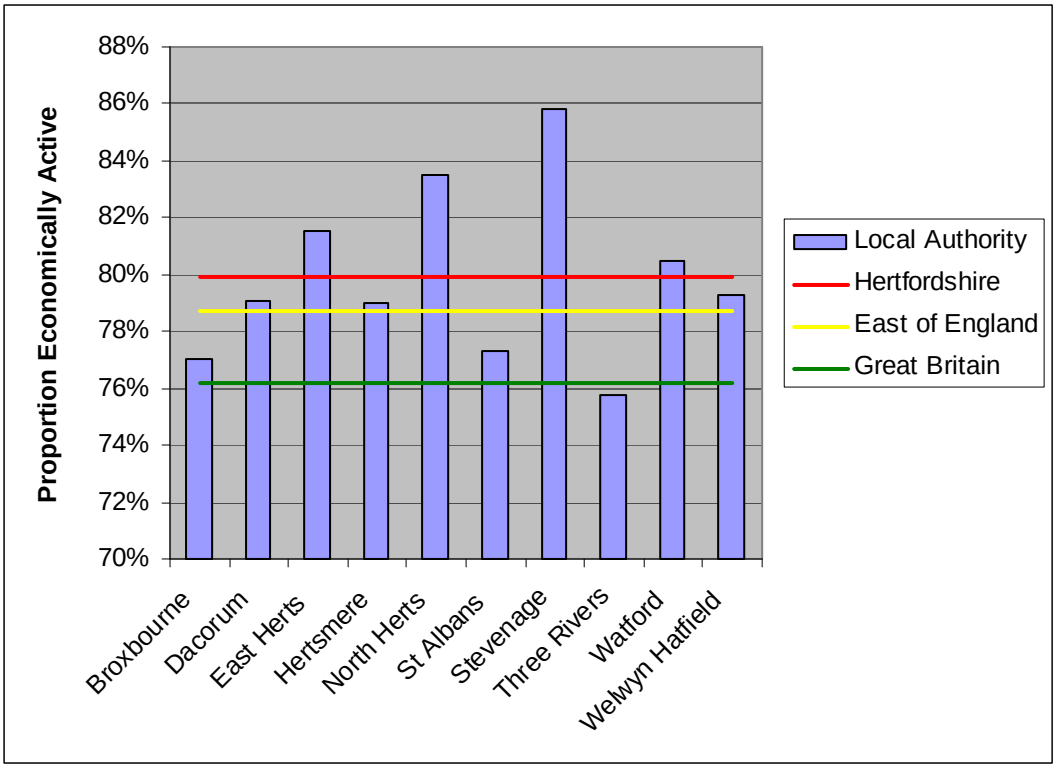
TABLE 35: ECONOMIC ACTIVITY ACROSS HERTFORDSHIRE, JANUARY – DECEMBER 2010

Area	Economically Active†		In Employment†	Employees†	Self Employed†	Unemployed†
Broxbourne	45,600	77%	70.5%	57.6%	12.1%	7.8%
Dacorum	75,700	79.1%	77.7%	68.8%	9%	5.2%
East Herts	74,800	81.5%	79.6%	70.4%	9.3%	4.2%
Hertsmere	50,000	79%	75.1%	52.1%	22.3%	5.9%
North Herts	68,100	83.5%	76.8%	68.1%	8.2%	6.1%
St Albans	69,500	77.3%	73.6%	63.9%	9.7%	4.8%
Stevenage	45,400	85.8%	80.2%	66.2%	13.2%	7.1%
Three Rivers	43,500	75.8%	71.1%	58.3%	12.8%	5.8%
Watford	46,900	80.5%	71.8%	62.3%	8.2%	7.2%
Welwyn Hatfield	61,500	79.3%	71.6%	63.4%	7.5%	6.6%
Hertfordshire (average)	581,000	79.9%	74.8%	63.1%	11.23%	6.07%
East of England		78.7%	73.4%	62.7%	10.3%	6.5%
Great Britain		76.2%	70.3%	60.8%	9.1%	7.7%

Source: nomis, 2011

Note: (†) Numbers are for those aged 16 and over, % are for those aged 16 – 64

FIGURE 51: ECONOMIC ACTIVITY ACROSS HERTFORDSHIRE, JANUARY – DECEMBER 2010



Source: nomis, 2011

Note: (†) Numbers are for those aged 16 and over, % are for those aged 16 – 64

At 79.9 per cent, the proportion of the population who are economically active in Hertfordshire is above that seen at the regional (78.7 per cent) and national (76.2 per cent) level. 74.8 per cent of the working age population in the county are employed, 67.7 per cent are employees and 11.23 per cent of the working age population are classified as self employed. These proportions are again above those seen regionally and nationally. Unemployment is currently recorded at 6.07 per cent, a figure below the regional and national statistic, given as 6.5 per cent and 7.7 per cent respectively.

At 80.2 per cent and 79.6 per cent, Stevenage and East Hertfordshire have the highest proportion of their economically active population in employment whilst Hertsmere has the highest proportion of people being self-employed. At 7.8 per cent and 7.2 per cent respectively, Broxbourne and Watford are the only district or boroughs with an unemployment rate above the national average. Welwyn is the only other borough with an unemployment rate above the regional value.

12.6 Gross Weekly Pay by Residence

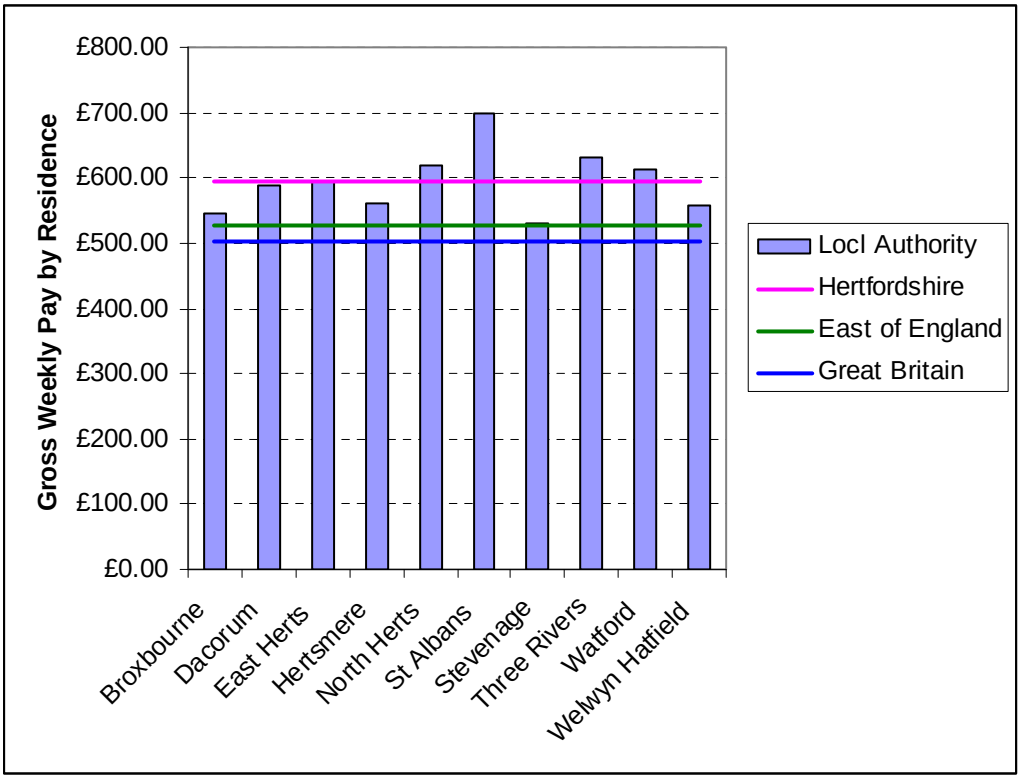
The following table analyses the average wage of people who reside within each district in Hertfordshire, the Eastern Region and Great Britain, irrespective of where they are employed.

TABLE 36: COMPARISON OF AVERAGE WEEKLY WAGES ACROSS HERTFORDSHIRE BY RESIDENCE, 2011

Area	Gross Weekly Pay by Residence	Area	Gross Weekly Pay by Residence
Broxbourne	£544.70	Three Rivers	£632.60
Dacorum	£589.10	Watford	£611.50
East Herts	£595.30	Welwyn Hatfield	£558.50
Hertsmere	£560.60	Hertfordshire	£594.20
North Herts	£619.40	East of England	£528.50
St Albans	£698.50	Great Britain	£503.10
Stevenage	£531.20		

Source: nomis, 2012

FIGURE 52: COMPARISON OF AVERAGE WEEKLY WAGES ACROSS HERTFORDSHIRE BY RESIDENCE, 2010



Source: nomis, 2011

Average weekly wages received by people living within Hertfordshire, at £594.20, are above the average paid across the East of England (£528.50) and Great Britain (£503.10). The highest average weekly wages are on offer in St Albans (£698.50) with the lowest in Stevenage (£531.20).

12.7 Summary

Between March 2008 and March 2010 Hertfordshire, the East of England and England reported a proportional reduction in the number of VAT and/or PAYE

registered business units in their administrative areas. At 1.06 per cent in the county, this reduction was smaller than the East of England (2.34 per cent) and England (2.77 per cent). Two local authorities within Hertfordshire were able to report a growth in the number of VAT and/or PAYE registered local units. These were St Albans which reported a growth of 1 per cent and Hertsmere who reported a growth of 2.62 per cent. The largest decrease was in Stevenage at 7.89 per cent.

There is expected to be a 10.6 per cent increase in jobs within Hertfordshire by 2026 when measured from a 2008 baseline. On a local authority level there is significant variation on this figure. At 20.2 per cent, Stevenage is projected to have the highest proportional job growth whilst Watford, at 3.4 per cent, is projected to have the least.

Across the county it can be seen that Hertfordshire's economy is largely urban based, with the county housing 83.07 per cent of its local business units in an urban setting. There is variation at the district level however, with Watford housing 100 per cent of its economy in an urban setting whilst East Hertfordshire, at 65.54 per cent, houses the least in an urban setting.

At the county level in 2010, 'Professional, scientific and technical' local units account for the greatest proportion of VAT and/or PAYE units at 16.85 per cent. Other strongly represented business classes proportionately are Construction (12.7 per cent) and Information and Communication (9.21 per cent). Whilst the proportions can be seen to deviate at the district / borough level, the composition of local units within each district and borough is broadly that seen at the county level.

Job density' is the term given to represent the number of jobs available for a single person of working age over a given area. In 2009, the boroughs of Watford and Welwyn Hatfield had the highest job densities across the period of study, with 2009 returns showing job densities of 1.27 and 1.03 respectively. This means that there were more jobs in these local authorities than there are people of working age. The lowest job densities in 2009 were found in Three Rivers and North Hertfordshire at 0.67 and 0.66 respectively. Of the 10 districts and boroughs in Hertfordshire; Broxbourne, St Albans and Watford witnessed an increase in job density between 2000 and 2009. The remaining 7 local authorities saw decreases,

In 2008, warehouses (32.58 per cent), factories (23.31 per cent) and retail premises (19.45 per cent) made up the majority of floorspace within the county. These three industry types made up the majority of floorspace in each of the districts and boroughs although there is proportional variation.

At 79.9 per cent in 2010, the proportion of the population who were economically active in Hertfordshire was above that seen at the regional (78.7 per cent) and national (76.2 per cent) level. 74.8 per cent of the working age population in the county were employed, 67.7 per cent were employees and 11.23 per cent of the working age population were classified as self employed. Unemployment was recorded at 6.07 per cent.

Average weekly wages received by people living within Hertfordshire, at £594.20, are above the average paid across the East of England (£528.50) and Great Britain (£503.10). The highest average weekly wages are on offer in St Albans (£698.50) with the lowest in Stevenage (£531.20).

13 HEALTH

The environment in which we live is a major determinant of health and well-being. Concerns about levels of physical activity, obesity, asthma and increasing environmental inequality have put health firmly on the planning agenda.

13.1 Health Profile 2011

The Association of Public Health Observatories publishes annual health profiles for districts, counties and regions throughout the UK. The headline results for Hertfordshire in the 2011 report were as follows:

- The health of people in Hertfordshire is generally better than the England average. Deprivation is lower than average although 32,415 children live in poverty. Life expectancy for both men and women is higher than the England average.
- Life expectancy is 7.4 years lower for men and 5.4 years lower for women in the most deprived areas of Hertfordshire than in the least deprived areas (based on the Slope Index of Inequality published on 5th January 2011).
- Over the last 10 years, all cause mortality rates have fallen. The early death rates from cancer and from heart disease and stroke have fallen and are better than the England average.
- About 17 per cent of Year 6 children are classified as obese. A lower percentage than average of pupils spend at least three hours each week on school sport.
- 75.0 per cent of mothers initiate breast feeding and 11.1 per cent of expectant mothers smoke during pregnancy. An estimated 19.5 per cent of adults smoke and 21.4 per cent are obese. There were 15,850 hospital stays for alcohol related harm in 2009/10 and there are 1,500 deaths from smoking each year.
- Priorities in Hertfordshire include physical activity and obesity, particularly among younger people, helping the growing older population to maintain their health and continuing to reduce levels of smoking.

13.2 Life Expectancy

Table 37 shows the life expectancy at birth for males and females born within the different geographical hierarchies

TABLE 37: LIFE EXPECTANCY AT BIRTH, JAN 2007 – JAN 2009

Local Authority	Males	Females	Local Authority	Males	Females
Broxbourne	79.8	83.8	Three Rivers	80.6	84.5
Dacorum	80.5	83.4	Watford	78.1	81.7
East Hertfordshire	80	83.5	Welwyn Hatfield	79.3	83.1
Hertsmere	78.9	82.8	Hertfordshire	79.5	83.1
North Hertfordshire	79.4	82.3	East of England	79.3	83
St Albans	80.9	83.5	England	78.3	82.3
Stevenage	77.4	82.4			

Source: ONS, October 2009

Residents of Hertfordshire collectively have a life expectancy above the national and regional averages for both genders. The highest male life expectancy at birth within the county is in St Albans at 80.9 years whilst the lowest is in Stevenage at 77.4 years, a figure below the national and regional average. The highest female life expectancy at birth within the county is in Three Rivers at 84.5 years whilst the lowest is in North Hertfordshire at 82.3 years, a figure above the national average and equal to the regional.

13.3 Participation in Sport

Physical activity can help reduce obesity as well as contributing to well-being and general good health. Studies have shown that people who are physically active reduce their risk of developing major chronic diseases – such as coronary heart disease and strokes.

The following results have been taken from the Active People Survey 3 carried out by Sport England between October 2008 and October 2009. The definition of 'participation' in this instance is a measure of the percentage of the adult population who participate in at least 30 minutes of sport and active recreation of at least moderate intensity at least three days a week. Walking and cycling are included in this measure.

TABLE 38: PARTICIPATION IN SPORT IN HERTFORDSHIRE, OCTOBER 2007 – OCTOBER 2010

Local Authority	APS 2 (October 2007-2008)	APS 3 (October 2008-2009)	APS 4 (October 2009-2010)
Broxbourne	17.3%	17.4%	15.9%
Dacorum	16.9%	17.8%	17%
East Hertfordshire	18.9%	18.3%	19.6%
Hertsmere	17.6%	15.4%	15.1%
North Hertfordshire	16.3%	16.1%	14.3%
St Albans	19.2%	15%	18%
Stevenage	18.1%	16.6%	15.4%
Three Rivers	18.6%	20.7%	14%
Watford	13.8%	16.1%	17.5%
Welwyn Hatfield	19.5%	16.9%	21.5%
Hertfordshire	17.7%	17%	17%
East	15.1%	16.2%	15.8%
England	15.5%	16.4%	16.6%

Source: Active People Survey 4, Sport England, 2011

Participation in sport within Hertfordshire was higher than the regional and national average across the period analysed in the above table.

The district with the highest percentage of participation in sport and active recreation within Hertfordshire between October 2009 and October 2010 was Welwyn Hatfield with 21.5 per cent. The lowest percentage was Three Rivers at 14 per cent

Six local authorities in Hertfordshire experienced a decrease in sport and active recreation participation between October 2007-08 and October 2009-10. Hertfordshire saw a drop overall from 17.7 per cent to 17 per cent whilst the East of England and England reported increases over this time period, although only England reported a year-on-year increase.

13.4 Accessible Natural Greenspace

Accessible local greenspace is an important contributor to good health. It not only provides a daily experience of wildlife but contact with nature boosts people's physical and mental health. Exercise in the outdoors reduces obesity and is shown to reduce heart disease, blood pressure and diabetes – among England's most common medical problems.

Natural England has devised the Accessible Natural Greenspace Standard (ANGSt), which sets out the minimum amount of accessible natural greenspace that any household should be within reach of. The criteria to be satisfied are as follows:

- an accessible natural greenspace of at least 2 hectares in size, no more than 300 metres (5 minutes walk) from home;
- at least one accessible 20 hectare site within two kilometres of home;

- one accessible 100 hectare site within five kilometres of home; and
- one accessible 500 hectare site within ten kilometres of home.

13.4.1 Hertfordshire Performance under ANGSt

In Hertfordshire there is 8,264ha of accessible natural greenspace, representing 9 per cent of the county's total area. 6.7 per cent of Hertfordshire households have all of their ANGSt requirements met while 6.4 per cent of households have none of their ANGSt requirements met. These figures compare favourably with surrounding counties. For example within Essex 7 per cent of households have all their ANGSt criteria met whilst 14 per cent have none.

TABLE 39: PERCENTAGE OF HOUSEHOLDS IN HERTFORDSHIRE ACCORDING WITH ANGST CRITERIA

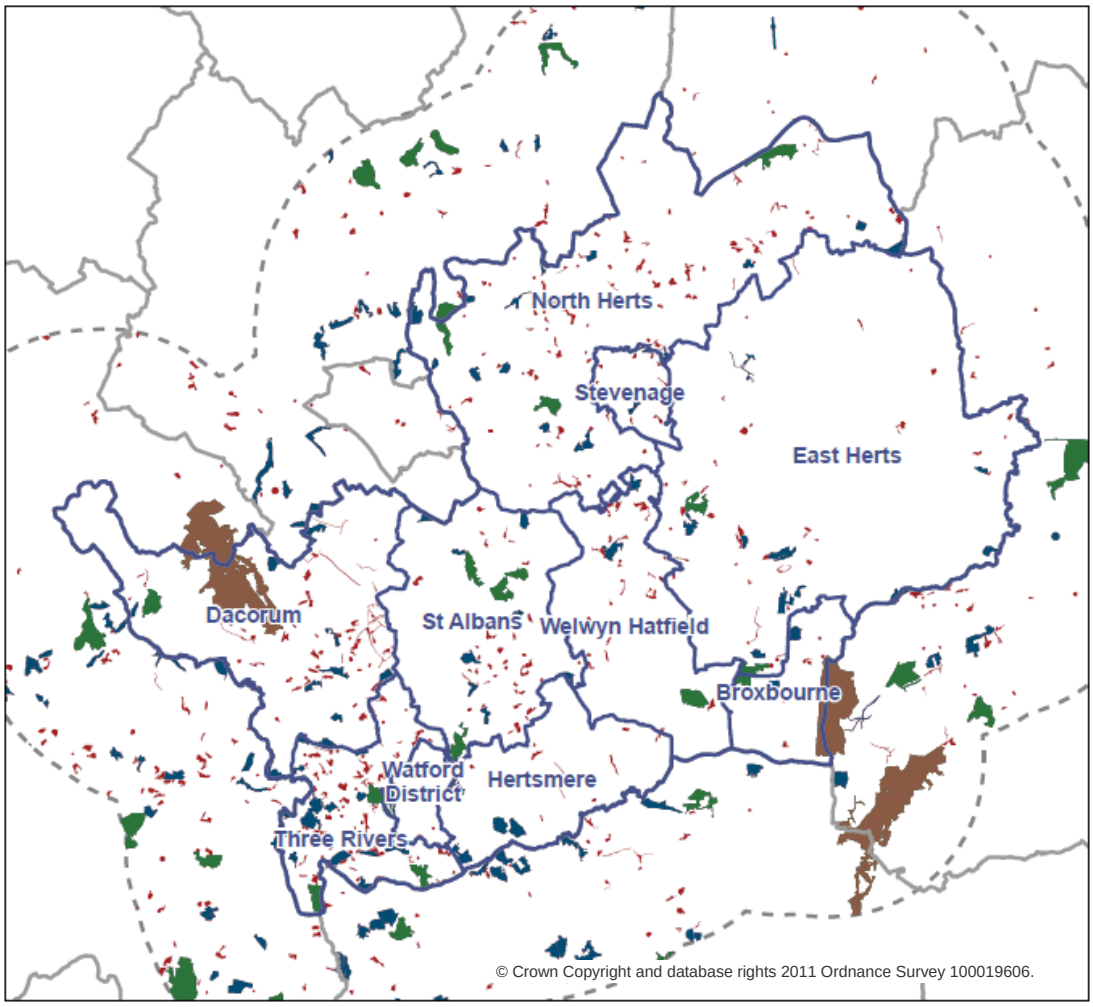
		Percentage of Households					
Local Authority	Number of Households*	within 300m of a 2ha+ site	within 2km of a 20ha+ site	within 5km of a 100ha+ site	within 10km of a 500ha+ site	meeting all the ANGSt (%)	meeting none of the ANGSt (%)
Broxbourne	40,452	19.2%	84.8%	100.0%	100.0%	19.1%	0.0%
Dacorum	63,305	63.3%	89.2%	62.7%	100.0%	39.8%	0.0%
East Herts	60,631	25.7%	76.6%	54.6%	44.9%	3.8%	14.1%
Hertsmere	43,354	12.6%	47.8%	60.7%	2.7%	0.0%	15.2%
North Herts	57,390	52.3%	70.7%	39.9%	0.0%	0.0%	8.7%
St Albans	60,272	52.1%	80.5%	97.8%	4.0%	0.0%	0.6%
Stevenage	36,309	33.7%	86.7%	37.7%	0.0%	0.0%	0.0%
Three Rivers	37,247	60.5%	87.9%	99.6%	7.0%	3.6%	0.0%
Watford	38,249	8.7%	86.8%	100.0%	0.0%	0.0%	0.0%
Welwyn Hatfield	47,078	33.9%	42.8%	44.4%	5.9%	0.8%	25.6%
Hertfordshire Average	484,287	36.2%	75.4%	69.7%	26.5%	6.7%	6.4%

*Estimate from 2005 AddressPoint data checked against 2001 Census data

Source: Analysis of Accessible Greenspace Provision for Hertfordshire, June 2010

The districts of Dacorum and Broxbourne had the highest proportions of households meeting all ANGSt criteria at 39.8 per cent and 19.1 per cent respectively. Five districts reported 0 per cent of households fulfilling all criteria. Welwyn Hatfield and Hertsmere reported the highest proportion of households meeting none of the ANGSt criteria at 25.6 per cent and 15.2 per cent respectively. 5 districts were able to report that 0 per cent of households failed to meet a single ANGSt criteria.

FIGURE 53: ALL ACCESSIBLE NATURAL GREENSPACE DIVIDED INTO ANGST SIZE CLASSES

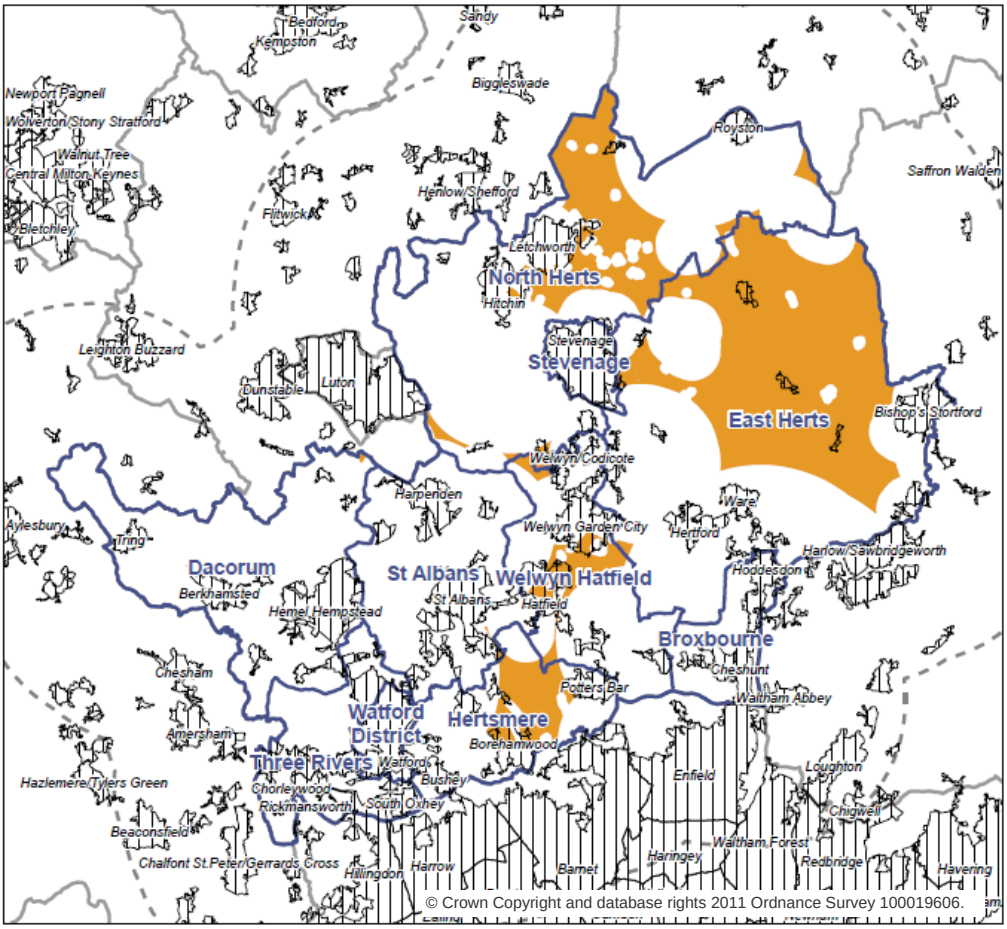


Key

- Local authority boundaries
- County & Unitary boundaries
- 2ha+ ANG
- 20ha+ ANG
- 100ha+ ANG
- 500ha+ ANG
- Study boundary

Source: Analysis of Accessible Greenspace Provision for Hertfordshire, 2010

FIGURE 54: AREAS WITH NO ACCESSIBLE GREENSPACE PROVISION AT ALL LEVELS OF ANGST ANALYSIS



Source: Analysis of Accessible Greenspace Provision for Hertfordshire, 2010

13.5 Summary

The health of people in Hertfordshire is generally better than the England average. Deprivation is lower than average although 32,415 children live in poverty.

Residents of Hertfordshire collectively have a life expectancy above the national and regional averages for both genders. The highest male life expectancy at birth within the county is in St Albans at 80.9 years whilst the lowest is in Stevenage at 77.4 years, a figure below the national and regional average. The highest female life expectancy at birth within the county is in Three Rivers at 84.5 years whilst the lowest is in North Hertfordshire at 82.3 years, a figure above the national average and equal to the regional.

Participation in sport within Hertfordshire was higher than the regional and national average between October 2007 and October 2010 although six local authorities in Hertfordshire experienced a decrease in sport and active recreation participation over

this period. Overall, Hertfordshire saw a drop from 17.7 per cent to 17 per cent between these dates whilst the East of England and England reported increases, although only England has reported a year-on-year increase across this period.

Accessible local greenspace is an important contributor to good health. It not only provides a daily experience of wildlife but contact with nature boosts people's physical and mental health. Natural England has devised the Accessible Natural Greenspace Standard (ANGSt), which sets out the minimum amount of accessible natural greenspace that any household should be within reach of. For more information relating to the ANGSt criteria themselves, please see the preceding section.

In Hertfordshire there is 8,264ha of accessible natural greenspace, representing 9 per cent of the county's total area. The districts of Dacorum and Broxbourne had the highest proportions of households meeting all ANGSt criteria at 39.8 per cent and 19.1 per cent respectively. 5 districts reported 0 per cent of households fulfilling all criteria. Welwyn Hatfield and Hertsmere reported the highest proportion of households meeting none of the ANGSt criteria at 25.6 per cent and 15.2 per cent respectively. 5 districts were able to report that 0 per cent of households failed to meet a single ANGSt criteria.

14 LANDSCAPE

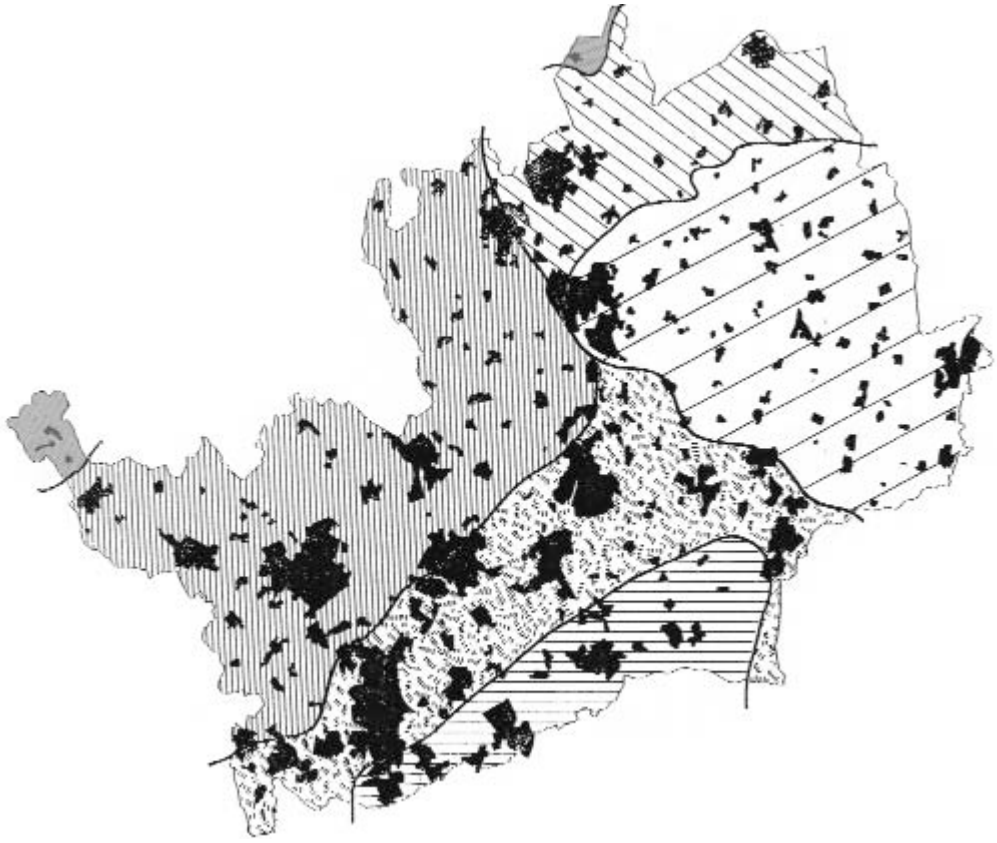
Since the end of the last Ice Age, natural processes and successive human use have shaped the Hertfordshire landscape into its present form. The result is a combination of physical components such as landform, visible spatial components and non visible spatial components which can incorporate sound and cultural associations. It is the particular combination of these aspects that determines an areas distinctive character, which can then be classified into wider character areas, or remain as distinct unique areas. Within the Hertfordshire landscape there are many areas of special interest which have been designated and protected from inappropriate development.

14.1 Landscape Character Areas

The classification of areas for their landscape value dates back to the creation of Areas of Outstanding Natural Beauty in the 1940s. Landscape character is defined as a distinct, recognisable and consistent pattern of elements in the landscape that makes landscapes different from another. Landscape character assessment is a useful tool as the understanding of what makes places different can ensure that development is well situated, sensitive to its location, and contributes to environmental, social and economic objectives.

In 1997 Hertfordshire County Council produced the Hertfordshire Landscape Strategy Volume 1 which was adopted as Supplementary Planning Guidance. The strategy identified six landscape character regions for the County, as shown in Figure 55 below:

FIGURE 55: LANDSCAPE CHARACTER AREAS IN HERTFORDSHIRE



Region 1: The Northern Vale Salients.
A transition zone between the Chilterns scarp face and the adjacent open plains (Oxfordshire and Bedfordshire).

Region 2: The Chilterns.

Region 3: The East Anglian Chalk (North Hertfordshire Ridge). A sub-section of the Chilterns.

Region 4: The East Hertfordshire Plateau.
(The South Suffolk and North Essex Clay Lands).

Region 5: The Central River Valleys.
A sub-section of the Northern Thames Basin.

Region 6: The South Hertfordshire Plateau.
A sub-section of the Northern Thames Basin.

Source: Hertfordshire Landscape Strategy Volume 1, 1997

Within these broad categories there are physical and cultural features that serve to distinguish sub-divisions within each area. Some of these divisions are not immediately obvious and require analysis of the basic landscape components and their relationship to each other.

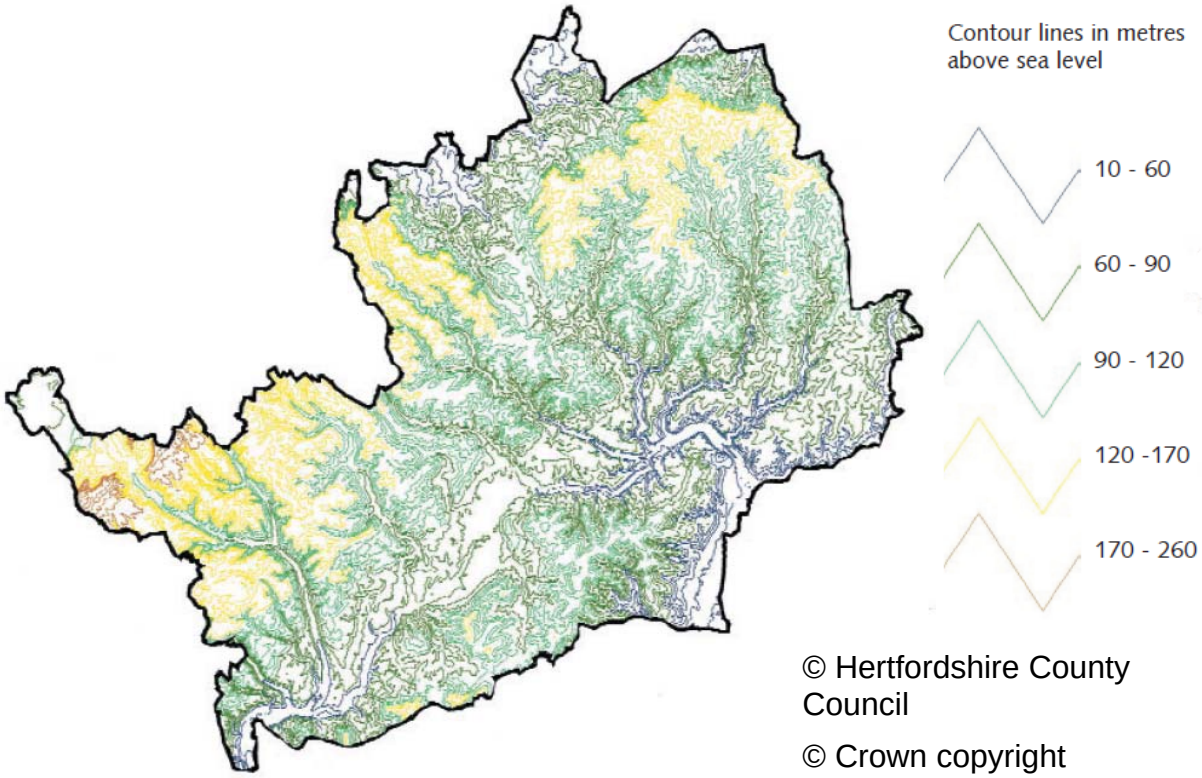
A number of district wide Landscape Character Assessments have also been produced, including Dacorum (2004), North Hertfordshire and Stevenage (2004) and East Hertfordshire (2007). These provide significantly more detail regarding individual areas and will be the primary source for understanding landscape based issues. Repetition of their findings is however considered to be outside the scope of this primarily county level baseline.

14.2 Topography

Hertfordshire contains three upland areas: the southern upland area of London clay, the north-east upland area of boulder clay, and the western chalk / clay-with-flint uplands. The latter of these three areas falls within Dacorum Borough and represents the maximum elevations within the county on the Chiltern Hills.

The central river valleys including the Lee are generally shallow whilst to the west within Dacorum Borough the Gade and Bulbourne river valleys are more pronounced. On the boulder clay of the north east the rivers are deeply incised, often with very narrow valleys of no great length.

FIGURE 56: TOPOGRAPHY OF HERTFORDSHIRE



Source: Dacorum Landscape Character Assessment, 2004

14.3 Area of Outstanding Natural Beauty

Areas of Outstanding Natural Beauty (AONBs) are described by Natural England as areas of high scenic quality that have statutory protection in order to conserve and enhance the natural beauty of their landscapes.

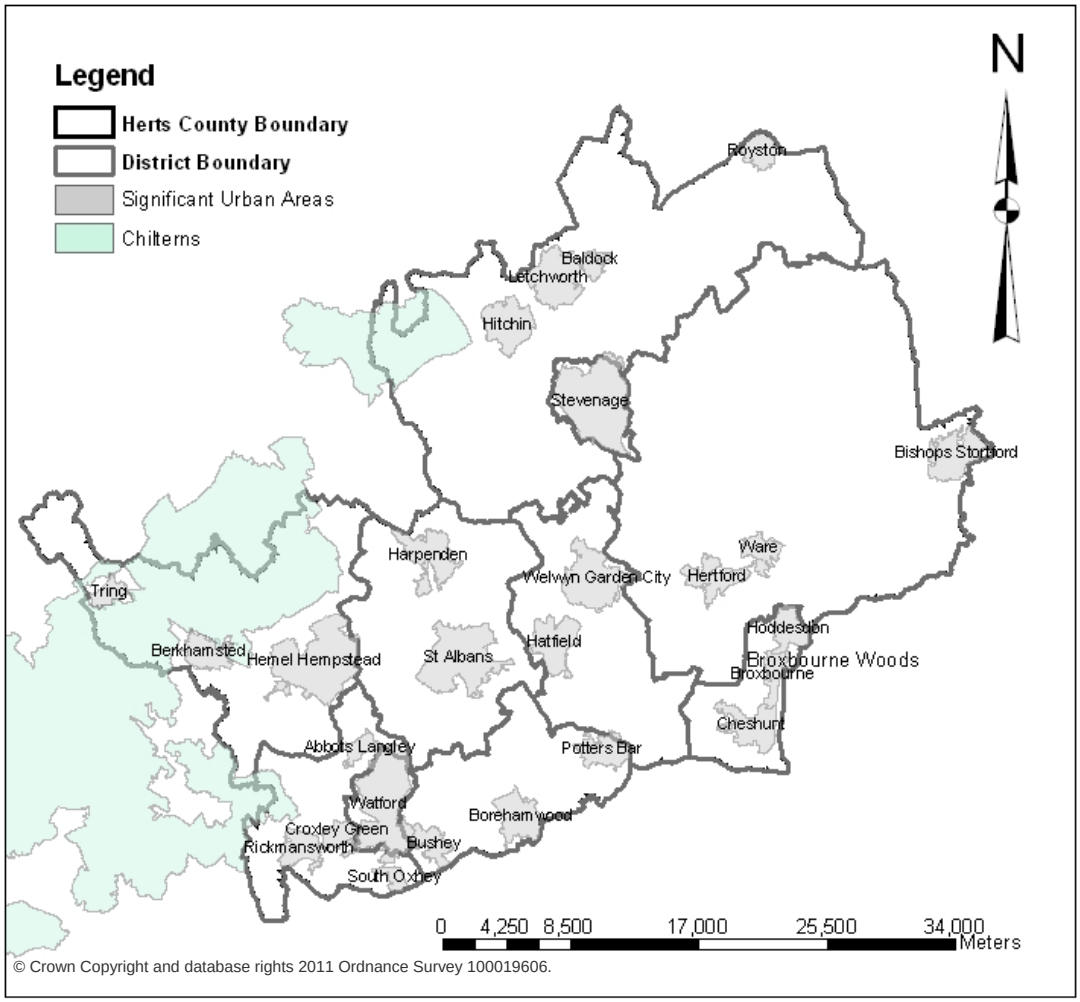
There are 36 AONBs in England covering approximately 15 per cent of the country, which have designated protection under the Countryside and Rights of Way Act 2000. In Hertfordshire there is one AONB, the Chilterns, which lies within North Hertfordshire and Dacorum. Its features include:

- a steep chalk escarpment with concentrations of wildlife-rich downland,
- extensive ancient woodland, including internationally important beech woods,
- rich mosaic of farmland habitats including arable plants communities, ancient hedgerows, ponds and orchards,

- river valleys with chalk rivers,
- a globally scarce habitat which is home to some of the UK's most threatened species,
- remnants of heath, acid grassland and wood pasture – often associated with common land.

It's spatial extant is shown in Figure 57 below:

FIGURE 57: AREA OF OUTSTANDING NATURAL BEAUTY



Source: Hertfordshire County Council, 2010

14.4 Green Belt

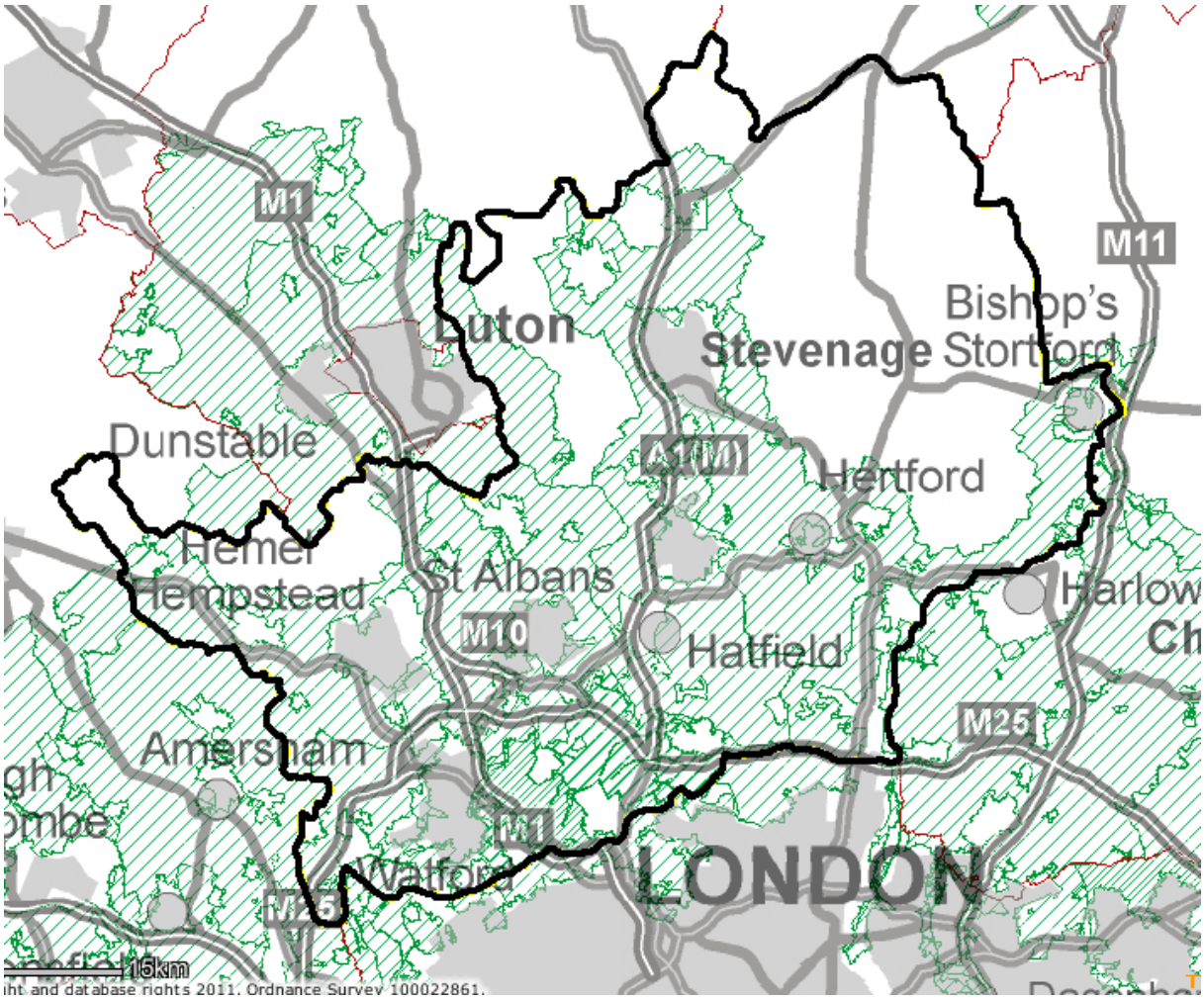
The largest green belt within the UK is the Metropolitan Green Belt around London which includes a large area of land in Hertfordshire. It is protected by planning policies within Local Plans which enforce restrictions on certain development within the designated area. There are five purposes of including land in Green Belts as set out in Planning Policy Guidance 2: Green Belts. They are:

- to check the unrestricted sprawl of large built-up areas;
- to prevent neighbouring towns from merging into one another;
- to assist in safeguarding the countryside from encroachment;
- to preserve the setting and special character of historic towns; and

- to assist in urban regeneration, by encouraging the recycling of derelict and other urban land.

Figure 58 shows the coverage of Green Belt in Hertfordshire.

FIGURE 58: METROPOLITAN GREEN BELT COVERAGE IN HERTFORDSHIRE



Source: http://magic.defra.gov.uk/

14.5 Summary

In 1997 Hertfordshire County Council produced the Hertfordshire Landscape Strategy Volume 1 which was adopted as Supplementary Planning Guidance. The strategy identified six landscape character regions for the county. Within these broad categories there are physical and cultural features that serve to distinguish sub-divisions within each area. Some of these divisions are not immediately obvious and require analysis of the basic landscape components and their relationship to each other. Landscape types in Hertfordshire include The Chilterns, The East Hertfordshire Plateau and the Central River Valleys.

Hertfordshire contains three upland areas: the southern upland area of London clay, the north-east upland area of boulder clay, and the western chalk / clay-with-flint uplands. The latter of these three areas falls within Dacorum Borough and represents the maximum elevations within the county on the Chiltern Hills.

The central river valleys including the Lee are generally shallow while to the west within Dacorum Borough the Gade and Bulbourne river valleys are more

pronounced. On the boulder clay of the north east the rivers are deeply incised, often with very narrow valleys of no great length.

Areas of Outstanding Natural Beauty (AONBs) are described by Natural England as areas of high scenic quality that have statutory protection in order to conserve and enhance the natural beauty of their landscapes. Part of a single AONB, the Chiltern Hills, lies within North Hertfordshire and Dacorum with a small part also found in Three Rivers.

The largest green belt within the UK is the Metropolitan Green Belt around London which includes a large area of land in Hertfordshire. It is protected by planning policies within Local Plans which enforce restrictions on certain development within the designated area.