Uttlesford District Council

Uttlesford District Water Cycle Study

Stage 1: Scoping and Outline Strategy

Outline Strategy Report

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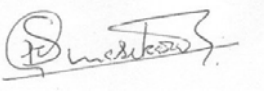
Checker	Renuka Gunasekara	
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Revisions

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1	07/05/2009	Draft	DV	RG
2	11/05/2009	Draft for Consultation	DV	RG
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5	15/06/2009	TWU and UDC changes tracked	DV	RG
6	15/06/2009	Draft addressing TWU concerns and UDC comments	DV	RG
7	22/06/2009	Draft addressing initial AWS concerns (tracked)	DV	RG
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9	10/09/2009	Final draft	NP	RG
10	16/09/2009	Final report after all comments addressed and checked	DV	RG
11	12/2009	Report to collect conclusions from additional consultation	DV	RG
12	19/01/2010	Final draft for stakeholder consideration	DV	RG
13	29/01/2010	Final Report	DV	RG

Disclaimer

The conclusions in this report, along with the information discussed at WCS steering group meetings, can be used by UDC to provide steer when progressing with their Core Strategy. However, UDC should note that as their Core Strategy is not yet finalised at the time of writing this WCS, it is impossible for this document to be classed as supporting evidence for a future Core Strategy at the Examination in Public stage.

In order for the UDC Core Strategy to be found robust, additional WCS work, based on the final development locations and trajectory decided upon, will be required to support the Core Strategy Submission.

In addition, the final versions of the most recent water company Water Resource Management Plans (WRMP) are anticipated in early 2010, which may alter the conclusions and recommendations of this report. It is suggested that any significant changes are analysed as part of any future WCS work undertaken.

In order for UDC to make an informed decision following their forthcoming Core Strategy Preferred Option consultation, they will require additional detail regarding wastewater treatment solutions from the developers promoting the potential new settlements. It is highly likely that the EA and water companies will object to a UDC Core Strategy that includes a new settlement without this detailed information being made available to all stakeholders.

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Appendices

1 Executive Summary

1.1 Introduction

The housing target set for Uttlesford District by the Regional Spatial Strategy is 8,000 homes between 2001 and 2021 with a further 2,150 homes to make sure that there is an adequate supply of housing for 15 years from the adoption of the Core Strategy. In order to achieve this target the Local Development Framework will need to allocate new sites for 3,979 homes, in addition to the 2,572 completed since 2001, the 3,302 currently allocated and the 297 predicted on smaller sites.

A Water Cycle Study (WCS) is required to ensure that the water supply, wastewater collection and wastewater treatment infrastructure in the District can accommodate the required growth levels, whilst minimising flood risk and impact on the water environment.

Four options have been tested in this WCS:

Option 1: Distribution between the three main urban areas, Great Dunmow, Saffron Walden and Stansted Mountfitchet.

Option 2: Development located around the market towns and key service centres, with around 500 dwellings at Elsenham and larger scale growth (750 dwellings) in Takeley;

Option 3: Development located around the market towns and key service centres, with around 1,450 dwellings at Elsenham; and

Option 4: A new settlement of 3,000 dwellings at Elsenham with the remaining 1,000 dwellings distributed around the existing urban areas.

Other potential locations for a new settlement are currently being proposed by developers at Boxted Wood/Andrewsfield, Chelmer Mead, Easton Park and Great Chesterford; these locations have also been tested in this WCS as alternatives to the Elsenham site in Option 4.

In addition to the housing requirements employment needs also have to be taken into account. UDC is proposing a target net gain of employment land of 25ha by 2026. Generally the proposed employment areas correlate with proposed urban extension/intensification and new settlement sites. Therefore the impact of these employment areas on the water environment will be in keeping with the impacts from the residential sites and will require mitigation accordingly.

As this WCS has tested a range of development options, UDC will be required to undertake additional work prior to submitting their Core Strategy, once they have finalised their Preferred Option, to ensure that the final development option decided upon has a robust evidence base.

UDC will be unable to make an informed decision on their Core Strategy Preferred Option until the developers promoting the potential new settlement locations have liaised with the water companies and the EA, and provided sufficient detail of the wastewater treatment/ sewerage solutions that they intend to utilise on site.

1.2 Water Resources and Supply Infrastructure

The District is partly underlain by a chalk aquifer of regional importance. However, the Environment Agency (EA) currently class the surface water and groundwater resources within the District as over-licensed or over-abstracted, meaning that there is no additional water available for supply. This highlights the importance of further developing policies to encourage the conservation of water in new and existing dwellings, and commercial properties.

Veolia Water Central (VWC) supply the District with water from a combination of groundwater and surface water abstractions, some of which are outside the District, allowing additional water to be transferred into the District to accommodate the supplied growth. However, the scale of growth proposed throughout the region, and increasing pressure on VWC from environmental constraints, means that **high levels of water efficiency** are still required. This is particularly important in existing dwellings, where reductions in consumption have the potential to offset the increased demand from new dwellings.

The VWC distribution network becomes more rural in nature (smaller in capacity) towards the east of the District. However, as the proposed growth is most likely to be located around the market towns and key service centres, VWC are confident that the potential development sites **can be supplied** without the need for major infrastructure upgrades. Option 4 however, may result in large-scale development in new rural locations, requiring extensions to the VWC trunk main network, entailing significantly higher costs.

1.3 Flood Risk

Flood risk within the District can be exacerbated by development, unless the run-off of surface water is managed appropriately. The existing national Planning Policy Statement 25 provides the framework for managing and mitigating flood risk from new development.

The Strategic Flood Risk Assessment completed for the District in 2008 contains policy guidance that should be adhered to, in order to ensure any development does not occur in areas of flood risk or increase the flood risk of downstream properties.

This WCS has identified, at a high level, the types of Sustainable Drainage Systems (SUDS) that may be appropriate at the potential growth locations, and reiterated the importance that these features have with regards to attenuating and disposing of surface water runoff.

Basins, ponds and wetlands are considered the most sustainable SUDS techniques because of their greater flood risk, water quality and wildlife benefits but the land needed and potential safety considerations may limit their use on some sites – infiltration techniques and underground storage may be suitable alternatives Source control measures should be still integrated within the SUDS management train.

In addition, consultation with the stakeholders for this WCS has revealed that the following additional policies would be beneficial:

- Use SUDS to limit surface runoff from both greenfield and brownfield development sites to the equivalent greenfield rate; and
- Ensure that surface water is always separated from foul wastewater systems, even on brownfield development sites, to minimise the impact on the sewerage network and wastewater treatment works (WwTW), and hence reduce the risk of sewer flooding and pollution of watercourses.

1.4 Wastewater Capacity

Wastewater in the District is collected and treated by Thames Water Utilities (TWU) in the southwest and Anglian Water Services (AWS) in the northeast.

Consultation with these stakeholders has revealed the following areas of concern with regards to the potential growth:

- The potential new settlement location at Elsenham would require around 3.5 km of existing sewer to be upgraded to allow connection to the network of Stansted Mountfitchet WwTW, which currently serves the village. The WwTW (which discharges to the River Stort) would need major capacity upgrades; the availability of land, and agreeing a new discharge consent, may be potential key constraints. In addition, the sewers that approach the WwTW would be restricted from being upsized by the narrow streets and existing utilities, requiring the construction of new bypass sewers around the urban areas. The possible need for a direct connection from the development site to the WwTW increase the total length of new and upgraded sewer required to at least 5.5 km.
- Similar sewerage network capacity issues to those described above are apparent at Newport, Thaxted, Saffron Walden and Stansted Mountfitchet, where the locations of the potential development sites are on the opposite periphery of the settlement to the WwTW. At Newport, the cost of the required bypass sewer (and pumping) to remedy this problem, compared to the relatively low level of development, makes this location unviable.
- The potential new settlement location at Boxted Wood/Andrewsfield is 4 km from the nearest WwTW, and the construction of a new local WwTW would be constrained by the low dilution available in the headwaters of the nearby watercourses.
- The Great Chesterford sewerage network has no capacity for additional dwellings. Any development would be best served by a direct sewer linking it to Great Chesterford WwTW, which results in sites closest to the WwTW to the north of the town being the most financially viable. Great Chesterford WwTW can accommodate the limited growth proposed under the development options, however, should a new settlement be connected, increases in treatment capacity and discharge consent would be required, subject to land availability and EA consent. However, of all the potential new settlement locations, Great Chesterford appears to have the least constraints.
- Great Dunmow WwTW currently has no capacity for additional development, and limited opportunity to expand due to land and environmental constraints. AWS are already proposing an upgrade to the WwTW at the end of AMP 5 (2014/15) to accommodate the existing allocations and the new development proposed under Option 4. Additional development on top of this, as per the other Options, will require additional process capacity, and the negotiation of an increased volumetric discharge consent.
- Large-scale development at Takeley (Option 2) could be accommodated by Bishops Stortford WwTW, which serves this area, but would require the upsizing of around 2.5 km of pumped sewer, as this is only sized for the current allocations.
- The WwTW that serve the villages of Debden and Ashdon do not currently have available capacity, or headroom against discharge consent, to accommodate any growth.

1.5 Environmental Capacity

Uttlesford District is located at the headwaters of four river catchments. As such, the dilutive capacity of the watercourses to receive increased discharges from WwTW is limited.

The development options propose large-scale growth in three of these catchments; the Rivers Stort, Cam and Chelmer.

The River Stort and Cam are listed as UK Biodiversity Action Plan priority habitats, due to their importance with regards to supporting biodiversity. In addition, a number of nationally and locally important water dependant environmental sites are located on these rivers.

As such, the River Chelmer is initially assessed as having the higher capacity to accept increased discharges. However the water quality modelling results received from the EA highlight that the new discharge consent standards (required at all the WwTW where growth is likely to cause the existing volumetric consent to be exceeded) will be **stringent** regardless of the receiving watercourse and its status or capacity. It may be possible for the water companies to meet the tighter discharge consent standards required, if they operate at Best Available Technology (BAT). However, there may be a need to go beyond this standard, which would require the use of unconventional methods, and as such will be subject to internal financial decisions and may be infeasible at the more sensitive sites. Given that the Water Framework Directive (WFD) could lead to even tighter standards being imposed to achieve good status in the future, unconventional methods may be required more often. This may lead to some solutions being regarded under the WFD as 'disproportionally expensive', which may allow for an alternative WFD objective to achieve good status by 2027 to be considered appropriate for particular watercourses. Notwithstanding this, it should be borne in mind that meeting the objectives of the WFD may impose limitations on the deliverability of the proposed development growth. If this proves to be the case, development options may have to be modified by Uttlesford District Council to ensure the most sensitive catchments are protected from adverse increases in WwTW discharge.

Additional consultation with AWS and TWU is required at the Detailed Stage of the WCS to ensure that the most sustainable wastewater strategy is developed for the District.

1.6 Conclusions and Recommendations

Whilst water resources and supply, and flood risk, remain important considerations that must be reinforced by appropriate policies throughout the LDF, the capacity limitations of the sewerage network, wastewater treatment and receiving watercourses has the highest potential to constrain development within the District.

At this stage, Option 1 appears to be most favourable option as it minimises the length of new strategic sewers required and would not result in a significant increase in discharge to the River Stort, which would be the case with large scale development at Elsenham. This option also avoids development in the potentially cost prohibitive areas of Newport and Thaxted. However, should other development pressures prevent UDC from realising Option 1, the capacity in the Takeley catchment may be able to be utilised (providing adequate upgrade are made to the sewerage system). AWS are planning to upgrade the process capacity at Great Dunmow WwTW, however the timescale for these upgrades (2014/15) means that any additional growth here (above Option 4 levels) may be delayed until 2015–2020, and will require further process upgrades and a revised discharge consent.

A new settlement, as in Option 4, creates significant challenges for water supply and wastewater collection/ treatment. However, of all the potential locations, Great Chesterford

appears to be the most favourable, as its location would make it possible for a relatively short and straightforward sewer connection into the WwTW. The existing capacity at the WwTW may allow some development to start in the short to medium term, whilst AWS investigate and construct the necessary WwTW upgrades.

It is recommended that a Detailed WCS be completed to:

- Assess the solutions, costs and phasing of the required supply and sewerage infrastructure, particularly the sewers in and around Saffron Walden and Stansted Mountfitchet;
- Liaise with the water companies to better understand the implications of achieving the water quality of additional WwTW discharges and treatment capacity upgrades required to accommodate the large scale growth once the Council's preferred development options are known;
- Recommend SUDS and biodiversity enhancement opportunities once the preferred development option is identified; and
- Discuss the responsibilities of the various stakeholders, with regards to removing the constraints that could delay the proposed growth.

2 Introduction

Uttlesford District Council (UDC) is currently in the process of preparing its Local Development Framework (LDF). The LDF will comprise statutory (and optional) documents that translate national and regional planning policy to a local level strategy.

A Water Cycle Study (WCS) is needed to ensure that water supply, water quality, sewerage and flood risk management issues can be addressed to enable the growth to 2021 and beyond, as proposed in the Regional Spatial Strategy (RSS), the East of England Plan[1], whilst preserving and enhancing the water environment. The WCS will form a key part of the evidence base for the UDC Core Strategy, which will be consulted upon early in 2010.

UDC appointed Hyder Consulting (UK) in December 2008 to complete a Stage One WCS: Scoping (Outline Strategy) for the Uttlesford District. This District wide study will provide the context for the more detailed studies which will be required for the strategic sites.

It should be noted that this WCS was commissioned at a time when UDC had not yet decided upon a final development option for their Core Strategy. Therefore, this WCS is intended to inform UDC of the possible constraints and opportunities to various development options. As such, additional work will be required once UDC have decided on a final development option following their forthcoming Preferred Options Consultation, to provide the evidence needed to fully support the Core Strategy Submission document.

It is imperative that the developers promoting the potential new settlement locations liaise with the water companies, the EA and UDC during and following the Core Strategy Preferred Options Consultation, prior to the Core Strategy Pre Submission stage. Without this information there is a risk that the stakeholders may not support the UDC Core Strategy. Figure 2-1 below illustrates the likely timeframe for the UDC Core Strategy component of the LDF, and how this relates to the additional information required.

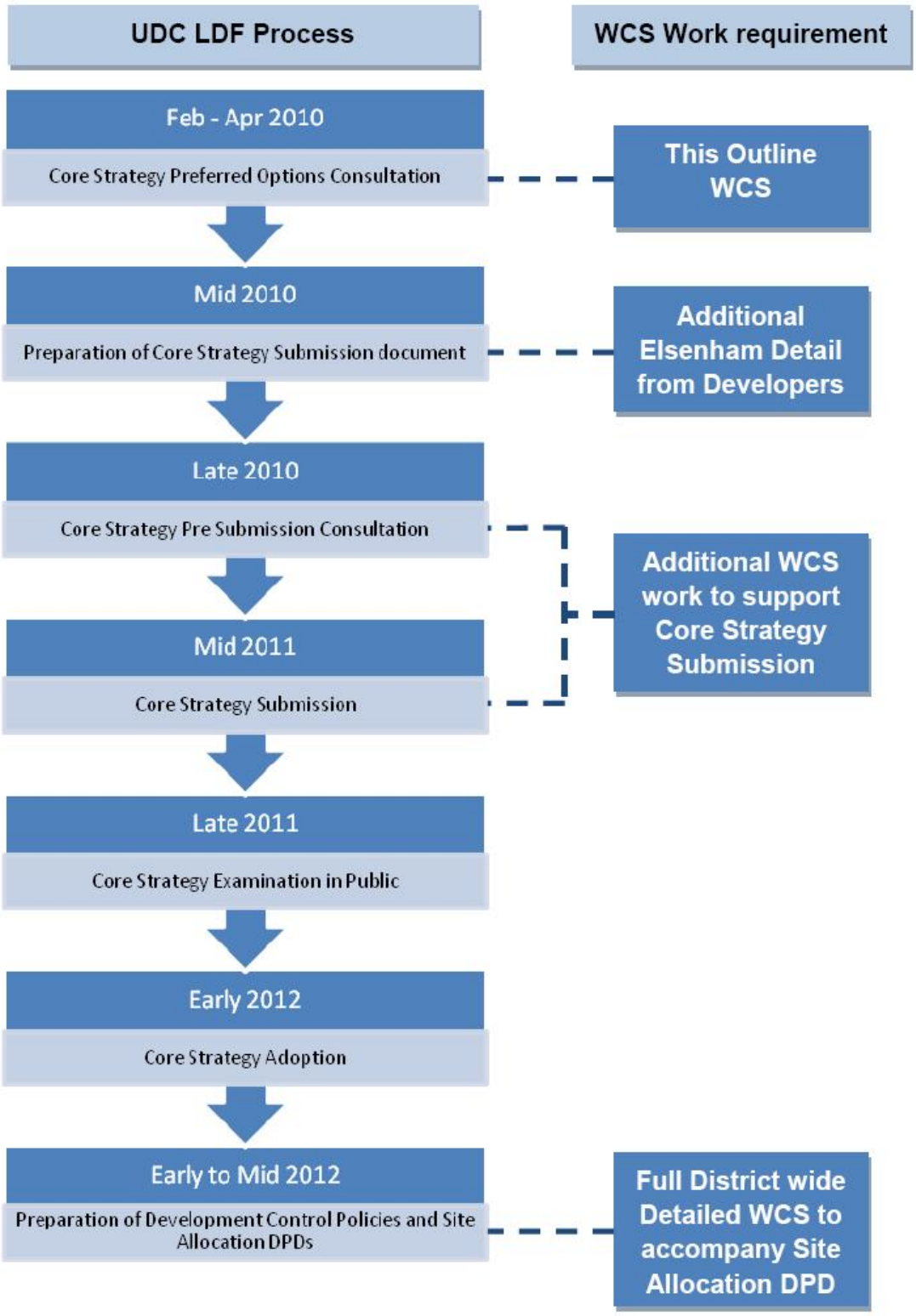

Figure 2-1 UDC LDF timetable and further work requirements

Separate WCS has already been commissioned for a number of new settlement proposals within the District, and it is imperative that these strategies are coherent with the District WCS. The outcomes from a WCS for this Elsenham settlement are not available at the time of writing this Outline Strategy Report, as the WCS has not been progressed beyond the initial scoping

stage, due to uncertainty regarding the Eco-Town proposal prior to the publication of the final PPS.

The aims of this Stage One WCS are to ensure that:

- There is a strategic and sustainable approach to the management and use of water by all stakeholders throughout the District; and
- The water infrastructure required to support the housing and employment growth planned for the Uttlesford area is identified, along with any constraints that may prevent this, so that this can be further investigated at the Detailed WCS stage.

Key objectives of this WCS will be to:

- Identify any water infrastructure services provision and usage constraints based on natural or anthropogenic changes, whilst testing the potential impact of UDC plans on the water environment;
- Develop a sustainable framework that enables the phased delivery of the key infrastructure needs and adaptation of future developments, in line with the aspirations and environmental demands of the local area, to support UDC in achieving the RSS targets;
- Inform the planning process to mitigate for any negative effects whilst maximising environmental gains through positive planning approaches;
- Promote a reduction in the risk of flooding from all sources, fluvial, surface water and groundwater etc, and incorporate within designs ideas such as Sustainable Drainage Systems (SUDS) to help reduce this threat and further manage the water cycle;
- Provide an evidence base for infrastructure requirements to inform the business plans of the water companies;
- Provide a basis to implement effective solutions to reduce the water demand within the area, helping to reduce the environmental impact of over-abstraction and ease the stress on the infrastructure demands; and
- Consider any biodiversity issues and how the water cycle impacts upon designated sites, both now and into the future, including the capacity of watercourses and ecosystems to absorb additional discharge from new developments.

The development of this WCS has involved consultation with the following stakeholders:

- Anglian Water Services (AWS);
- Environment Agency (EA);
- Natural England (NE);
- Thames Water Utilities (TWU);
- Veolia Water Central (VWC); and
- Uttlesford District Council

In addition, Essex Wildlife Trust (EWT) has contributed information.

2.1 Study area

Uttlesford District is located in the northwest of the County of Essex, in the East of England. The District is predominantly rural in nature, although it includes the market towns of Great Dunmow and Saffron Walden, and the key service centres of Elsenham, Great Chesterford, Newport, Stansted Mountfitchet, Takeley, and Thaxted. The District also contains a large number of smaller villages.

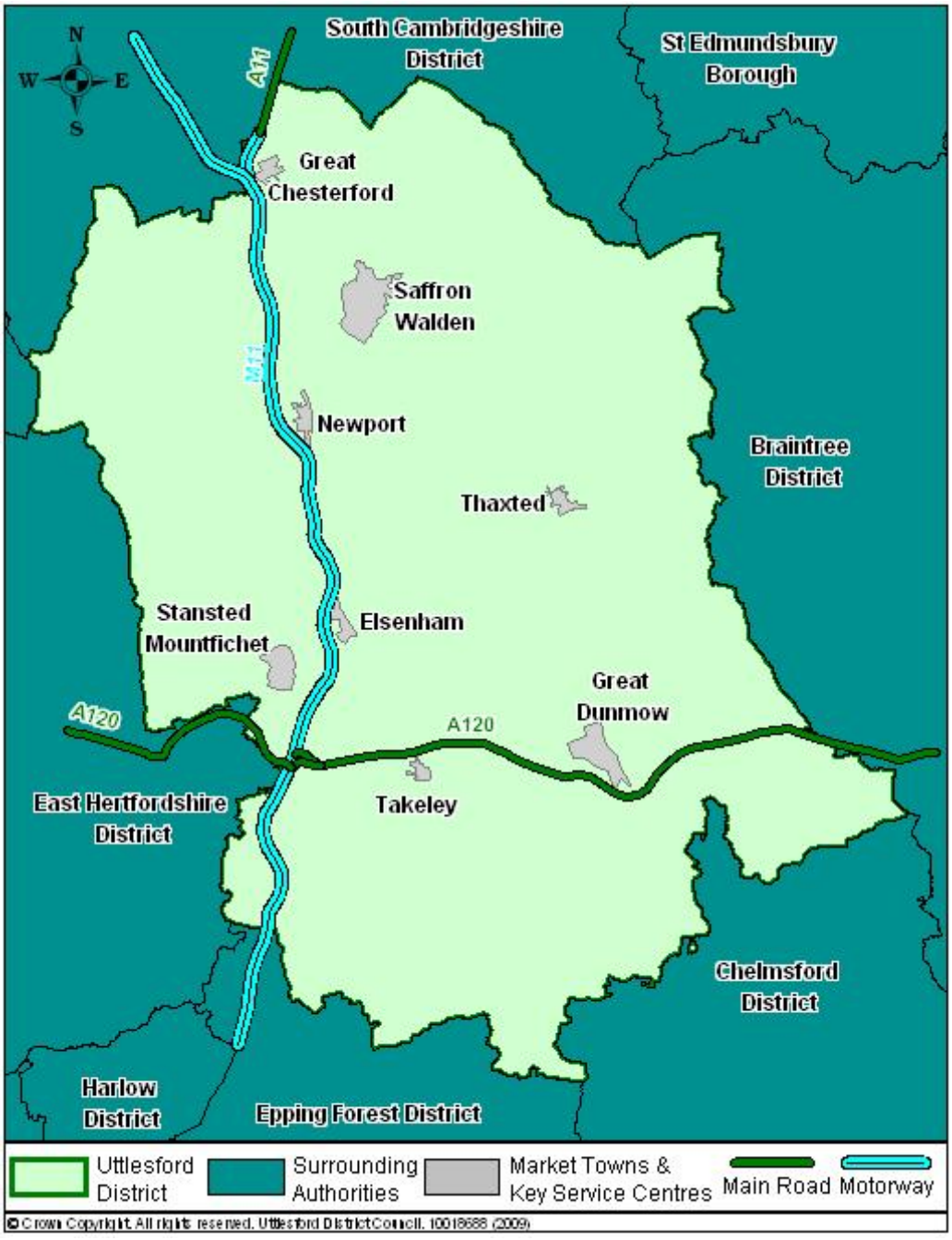

Figure 2-2 Location of Study Area

The District is under **continuous development pressure** as a consequence of the proximity to London, Stansted Airport and development of the M11 corridor.

According to the Office for National Statistics (ONS), the District population was 69,000 in 2001 and this is projected to rise to 80,300 by 2021, and 83,300 by 2026[2]. The most recent mid year estimates (2007) suggest a population of 72,500[3].

Uttlesford District is located at the headwaters of four river catchments:

- The Cam and Ely Ouse;
- The Combined Essex (Rivers Can, Chelmer, Ter and Pant, and Stebbing Brook);
- The Roding, Beam and Ingrebourne; and
- The Upper Lee (River Stort and Pincey Brook).

Figure 2-3 below illustrates the locations of the main watercourses within the catchment in relation to the larger settlements. These river catchments are described in more detail in Section 6, and illustrated in Figure 6-9.

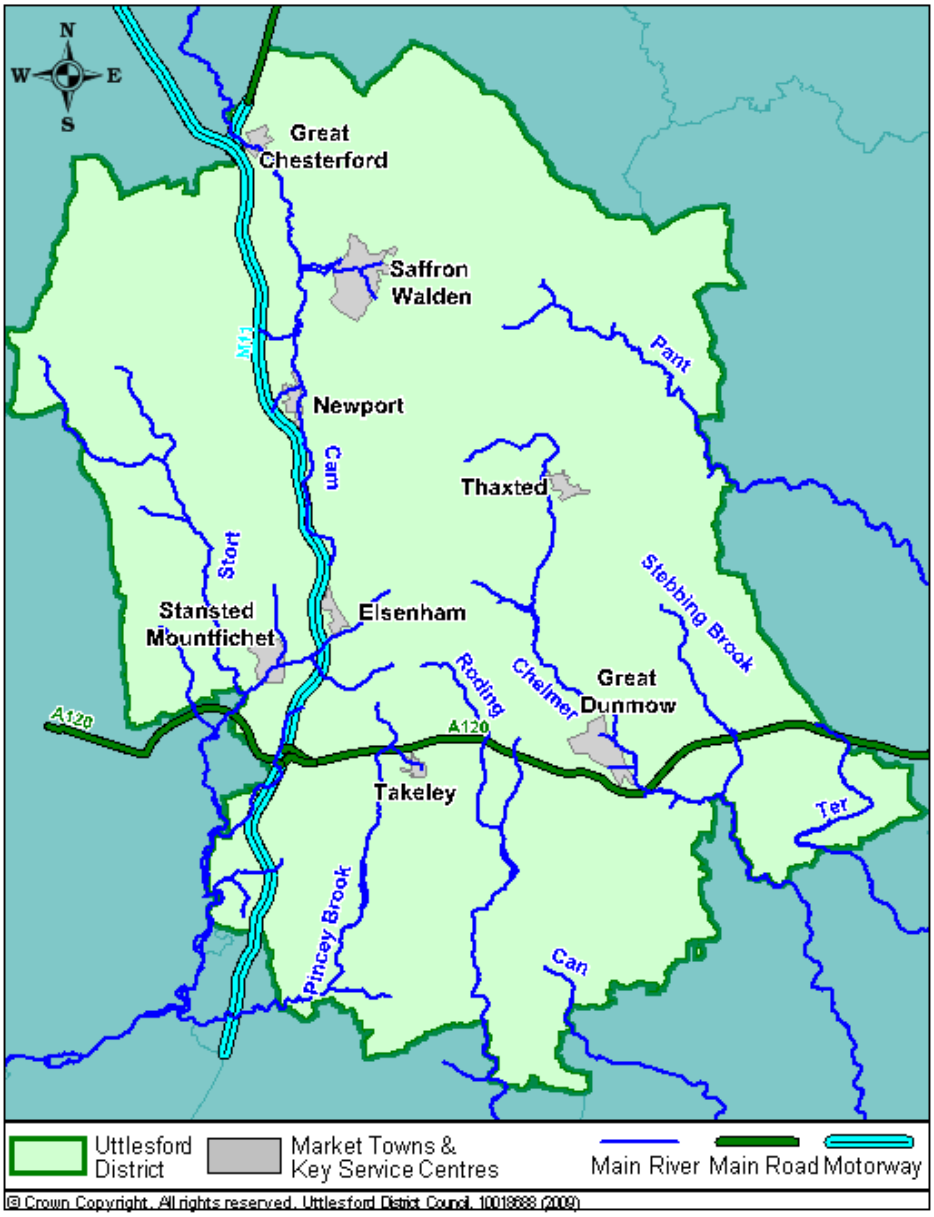

Figure 2-3 River catchments in the District

The northern half of the District is underlain by the chalk aquifer (a major store of the UK's groundwater resources). However, the majority of this chalk in the District is overlain by a layer of clay. More information regarding ground and surface water is included in Sections 6.1 and 6.2.

Potable water is supplied to the District by Veolia Water Central (VWC). Uttlesford District lies completely within VWC's Northern Water Resource Zone (WRZ). This WRZ is supplied via a number of groundwater abstractions from the underlying chalk aquifer and the import of treated water from Anglian Water Services' (AWS) Ruthamford WRZ. More information regarding potable water supply is included in Section 6.4.

The companies responsible for collecting and treating wastewater within the District are AWS and Thames Water Utilities (TWU). More information is included in Section 8.1.

Sources of flood risk within the District were identified in the Uttlesford District Strategic Flood Risk Assessment (SFRA)[4]. Key messages from this report, and other relevant flood risk policies, are highlighted and built upon in Section 7.1.

2.2 The Water Cycle

The natural water cycle is the process by which water is transported throughout a region. The process commences with some form of precipitation, be it rain, snow, sleet or hail. This is then intercepted by the ground and either travels overland through the process of surface runoff to rivers or lakes, or percolates through the surface and into underground water aquifers.

The presence of vegetation can also intercept this precipitation through the natural processes that plants carry out, such as transpiration and evapo-transpiration. The water will eventually travel through the catchment and will be evaporated back into the atmosphere along the way, or will enter the sea where a large amount will be evaporated from the surface. This evaporated water vapour then forms into clouds and falls as precipitation again to complete the cycle.

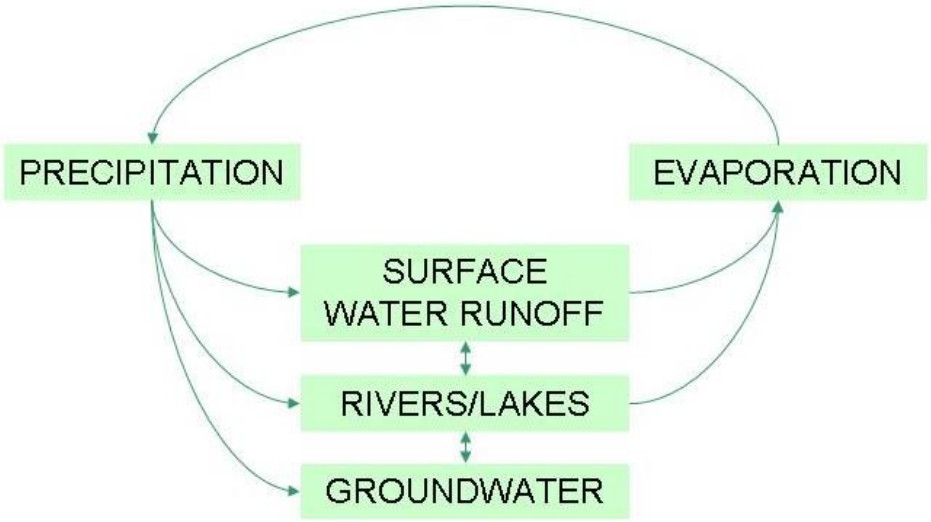

Figure 2-4 The natural Water Cycle

Urbanisation creates a number of interactions with the natural water cycle. Abstraction of water, from both surface water and groundwater sources for use by the local population, interacts with the water cycle by reducing the amount of water that is naturally held within the aquifers. Following treatment at a water treatment works (WTW) this water, now potable, is transported via trunk mains and distribution pipes to the dwellings in the area. The potable water is then used by the population within the dwellings for a number of different purposes, which creates large volumes of wastewater.

The use of tarmac and other surfaces in this development also reduces the amount of water that is able to percolate through the ground to the groundwater aquifers. This therefore increases the rate of surface water runoff, which leads to flooding and increased peak discharges in rivers.

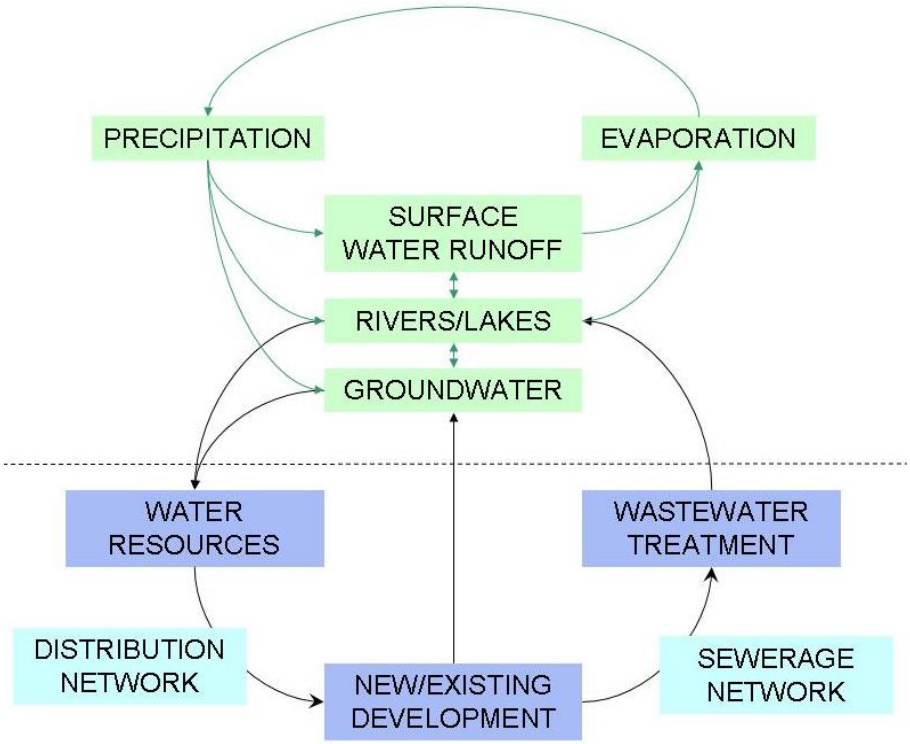

Figure 2-5 The wider Water Cycle

The wastewater from the developments is transported via the sewerage network to a wastewater treatment works (WwTW), where the water is screened, treated, and then discharged back into the rivers or groundwater.

2.3 Current funding

Water companies primarily receive funding through their customer bills. Amongst other things, Ofwat regulate how much these bills can increase, and what the funds are spent on. Asset Management Periods (AMP) are five yearly cycles that look at the improvement and upgrade works required for water company assets. The current AMP is AMP 4 (2005-2010) and the water companies are in the final process of preparing their programme and capital expenditure plan for the next period, AMP 5 (2010-2015).

Due to commercial considerations, water companies are generally reluctant to disclose their plans to external parties until the necessary financial approvals are received from Ofwat. The availability of funds, and the prices that can be set by each water company, are assessed by Ofwat during the Price Review (PR) process. PR09 is currently being finalised and, once approved by Ofwat, will set the amount that water companies can charge for water and wastewater services for AMP 5, in order to fund the operation, maintenance and upgrade of assets.

Figure 2-6 illustrates the AMP5 process to 2015 that may dictate the constraints on capital project planning and funding that could influence the phasing of the planned development. Therefore it is essential that the future infrastructure requirements are accurately factored into the water companies' AMP proposals to accommodate the proposed growth in the District.

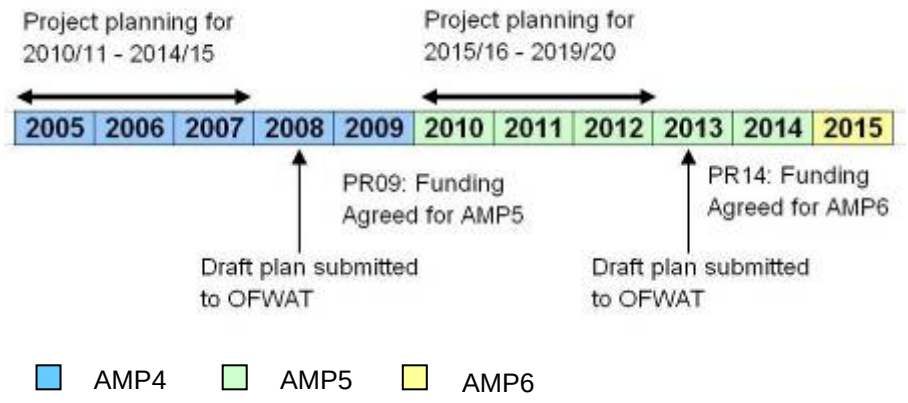

Figure 2-6 Water Company Capital Funding Cycle

Adapted from Rye Meads Water Cycle Strategy Scoping Report; EA, August 2007

Prior to each PR process, the EA publishes its National Environment Program, which is a list of environmental improvement schemes. This guides the water companies on areas where they need to undertake, or investigate, an improvement to the way in which there business interacts with an aspect of the water cycle. The EA expects that the water companies will progress with such projects, without exception, and Ofwat will therefore take these requirements into account when approving funds.

Water companies have a duty to supply potable water to customers under Section 52 of the Water Industry Act 1991, and are hence obliged to connect developments to the network once planning permission has been received.

Under Section 106 of the Water Industry Act 1991, developers have the right to connect to a nearby sewer (providing that they do not cross surface water and foul water where a separate sewerage system exists) once planning permission has been received. Currently, this law makes no allowance for the existing capacity of the sewerage network.

Where there is no existing local infrastructure in the locality of a development, or the route of such infrastructure would be required to cross land owned by a third party, the provision of water and wastewater services to new homes is subject to the requisitioning process described in sections 90 to 99 of the Water Act 2003. The difference between the costs of infrastructure upgrades (including reinforcement to the existing network to ensure adequate capacity) and the predicted revenue from the new customers can be passed onto developers from water companies using Requisitioning Agreements. The amount charged is referred to as the “relevant deficit”, and can be paid over a 12 year period, or immediately following the work, one lump sum discounted to a net present value.

This ensures that water companies do not make a loss when connecting new developments into their networks. However, the majority of the capital funding required for major strategic infrastructure will be sourced from the expenditure approved by Ofwat.

3 Policy context

The following sections introduce a number of national, regional and local policies that must be considered by UDC, water companies and developers within the District. Key extracts from these policies relating to water consumption targets and mitigating the impacts on the water environment from new development are summarised below.

3.1 National policy

3.1.1 PPS

Planning Policy Statements (PPS) and some Planning Policy Guidance Notes (PPG), which have not yet been superseded by PPS, are national planning documents that provide guidance to local authorities on planning policy. Local authorities should ensure that planning documents consider these policies, and may be able to use some of the policies contained within PPS to make decisions on individual planning applications.

The most relevant PPS to this WCS are:

- PPS1: Delivering Sustainable Development (and the 2007 Supplement entitled Planning and Climate Change);
- PPS3: Housing;
- PPS9: Biodiversity and Geological Conservation;
- PPS23: Planning and Pollution Control; and
- PPS25: Development and Flood Risk.

Relevant topics that consistently occur within the above mentioned PPS are:

- Resilience to climate change;
- Conservation / biodiversity;
- Sustainable use of resources;
- Mitigation of flood risk and the use of SUDS;
- Suitable infrastructure capacity; and
- Protection of groundwater and freshwater.

Key extracts from the above PPS are included in Appendix A.

3.1.2 Code for Sustainable Homes

The Code for Sustainable Homes (CSH) was introduced in England in April 2007. The code sets a framework, and acts as a tool, for developers to create homes to higher environmental standards than previously.

The CSH Levels require different levels of performance regarding water use, particularly per capita consumption (PCC). These are:

- Levels 1/2 – 120 l/p/d;
- Levels 3/4 – 105 l/p/d; and
- Levels 5/6 – 80 l/p/d.

It became mandatory for new homes to be assessed under the Code from May 2008; however, the achievement of a certain CSH Level is only a requirement for social housing.

As of April 2007, all housing built on English Partnerships land and from April 2008 all social housing funded through the Housing Corporation has to be built to CSH Level 3, a performance standard of **105 l/p/d**, representing current best practice in water efficiency without requiring water reuse or rainwater harvesting.

The timetable for the implementation of the CSH requires that new homes are built to Level 3 from 2010 onwards and Level 6 from 2016.[5]

3.1.3 Building Regulations

The Building Regulations prescribe the required performance of new dwellings (and alterations to existing dwellings) in England and Wales. According to Defra[6], the UK Government will amend the Building Regulation by October 2009, to require new buildings to achieve a calculated whole building performance (PCC of potable water) of **125 l/p/d**. This is equivalent to CSH Levels 1 and 2, with an additional allowance of 5 l/p/d for outside use.

This will be reinforced with amendments to the Water Supply (Fittings) Regulations 1999, which set performance levels for individual fittings.

3.1.4 Future Water

The UK Government's strategy for water in England is described in Defra's Future Water[7] document. This strategy sets out an aspirational target for average PCC, across all dwellings, of **130 l/p/d**. Defra predict this target can be achieved by 2030 through a combination of water efficiency and demand management measures, such as low consumption appliances and fittings, and changes in metering and tariffs. Defra suggest that **120 l/p/d** may also be achievable dependant on new technological developments and innovation.

3.1.5 Water for People and the Environment

In 2009 the Environment Agency published its strategy for managing water resources in England and Wales to 2050 and beyond, entitled Water for People and the Environment[8]. This strategy supports the 130 l/p/d PCC target aspired to by Defra, and shows that the average PCC for England and Wales could be reduced from around 150 l/p/d to close to 120 l/p/d by 2030. To achieve this, PCC for new dwellings would have to meet CSH Level 3 (105 l/p/d plus 5 l/p/d for outside use) and near universal metering of properties in water stressed areas would be required by 2020.

The EA strategy concludes that the above demand management approach has the potential to be cost effective when compared to the development of new resources or desalination plants.

The EA also suggest that, as metering becomes more widespread and incentives to use water efficiently increase, rainwater harvesting and grey water recycling systems will become more cost-effective and could play an increasingly important part in managing water resources in the future.

In addition, the EA strategy suggests that all planning applications for significant new housing developments should be accompanied by a water cycle strategy.

3.2 Regional policy

3.2.1 Regional Spatial Strategy

The 2008 Revision to the Regional Spatial Strategy (RSS) for the East of England, entitled the East of England Plan, is the document that provides a consistent framework to inform the preparation of Local Development Documents in the counties of Norfolk, Suffolk, Cambridgeshire, Essex, Hertfordshire and Bedfordshire.

Ambitious growth targets are set for the District, considering its predominately rural nature, by the RSS; a minimum of **8,000** new dwellings should be completed in the District between 2001—2021. In order to comply with Planning Policy Statement 3[9], the UDC Core Strategy will need to cover 15 years from adoption, currently programmed for 2011. UDC is extending the planning horizon of its Core Strategy to 2026, thus increasing the total dwelling requirement to **10,150**.

It is likely that this growth will be mainly focused on the larger market towns and key service centres with smaller scale development in some villages. The area to the north-east of Elsenham has also been considered as a location for an Eco-town to accommodate around 5,000 dwellings, by the UK Government. The final PPS on Eco-towns was published as a supplement to PPS1 in July 2009, but Elsenham is not included in the final list of locations with potential to be an Eco-town. In the Location Decision Statement, published by DCLG in July 2009, North East Elsenham is identified as one of two locations where additional funding could be made available to support further work to resolve outstanding deliverability issues. The issues identified in the report include planning and implementation of water infrastructure. The Statement identifies Elsenham as location that could have potential to meet the sustainability and deliverability requirements for successful development as an Eco-town if the outstanding issues can be resolved. The Council is opposed to the Eco-town proposal but it is continuing to test the proposal as part of its comparative assessment work, as part of the LDF process. Regarding employment, the RSS suggests a target of 56,000 net jobs to be provided in the period 2001–2021 in Essex (outside of the Haven and Thames Gateway) split between Braintree, Brentwood, Chelmsford Epping Forest, Harlow, Maldon and Uttlesford.

The RSS contains a number of polices regarding water use, water infrastructure and the wider environment:

- Policy WAT1 – States that development must be matched with a year on year reduction in **water consumption** rates;
- Policy WAT2 – States that the **water infrastructure** required to support the new development must be provided in a timely fashion (or the development phased so this can be provided), and that development should make the best use of existing infrastructure;
- Policy WAT3 – Requires partnership and cooperation between Local Authorities, the EA, water companies and others to ensure plans do not adversely affect the **water environment**; and
- Policy WAT4 – States that new development should be located away from areas of high **flood risk**, and existing properties should be protected (including through the use of SUDS).

Regional Economic Strategy

The Regional Economic Strategy[10] for the East of England sets a challenge of achieving a PCC of around **120 l/p/d** by 2030, by incorporating high, water-efficient standards into future development, reducing leakage rates, increasing the efficiency of existing buildings and behavioural change regarding the use of water in homes and businesses.

3.3 Local policy

3.3.1 Uttlesford District Core Strategy

The vision for the Core Strategy is to achieve a sustainable balance between water supplies and demand. Policies are being developed through the Core Strategy to make sure development:

- Addresses issues of water supply and sewage disposal;
- Reduces the consumption of energy and water, minimizes the production of pollution and waste and incorporates facilities for recycling water and waste; and
- Reduces flood risk – UDC will seek to allocate development beyond the floodplain. Flood risk assessments will be required for appropriate sites and management sought. Development will be directed to areas of lowest flood risk in accordance with the sequential approach in PPS25.

3.3.2 UDC Energy Efficiency SPD

In 2007 UDC adopted a Supplementary Planning Document (SPD) entitled Energy Efficiency and Renewable Energy[11]. The guidance contained within states UDC's position regarding the Code for Sustainable Homes:

The Council will negotiate to achieve a [CSH Level 3] rating on new development up to 2012. After this the Council will encourage all development to achieve a [CSH Level 4] rating up to 2016 when all development will be expected to be zero carbon with a [CSH Level 6] rating.

This builds on the guidance contained within the Essex Design Guide Urban Place Supplement[12], also adopted by UDC as an SPD in 2007, which again states that CSH Level 3 should be achieved on new builds up to 2012. This design guide supplement recommends that a Water Management Strategy is completed for every development, to specify:

- The performance of water appliances included;
- The use of rainwater harvesting; and
- The use of Sustainable Drainage Systems (SUDS).

4 Methodology

4.1 Assessment of existing situation

4.1.1 Water resources and environmental capacity

The status of water resources in and around the District has been assessed through a review of the EA Catchment Abstraction Management Strategy (CAMS) documents, for the four catchments described in Section 2.1. This gives an indication of the likelihood of any new abstraction licences for public water supply.

The capacity of the environment, most notably the capability of the receiving watercourses to receive greater discharges from WwTW, has been assessed through a review of the EA draft River Basin Management Plans (RBMP). These describe the current water quality of the watercourses, and proposed remedial actions for the future.

Additional environmental and biodiversity constraints have been assessed through the review of both UK wide and local Biodiversity Action Plans, and additional data on important sites collected from Natural England and Essex Wildlife Trust.

In addition, the EA have contributed high level water quality modelling results to determine the indicative WwTW discharge consent standards that would be required to protect the water environment given the rise in discharge rates associated with the development options. This has been based on worst case variables and assumes no drop in occupancy rates, to ensure the most conservative limits are specified. As these consent limits are indicative only, the actual consent standards will be determined at the time of consent review, which may mean that they will be different, depending on flows, river and discharge quality, and cost benefit considerations (for example what is considered to be BAT may change).

Flood risk within the District is assessed through a review of the UDC Strategic Flood Risk Assessment (SFRA) and the EA Catchment Flood Management Plans (CFMP) consultation documents, and consultation with UDC.

4.1.2 Water infrastructure

The capacity of the existing water infrastructure to accept the demands from the proposed development, including any impacts due to future climate change and tightened legislation/ environmental standards, has been assessed through consultation with the water companies in the WCS Steering Group. This allows for an understanding of the limitations of the current system, and the improvements being planned by the water companies to accommodate the proposed development, mitigate possible impacts of climate change, and maintain or improve current levels of service. High-level information was also available from the water company business plans and draft Water Resource Management Plans (WRMP).

4.2 Assessment of impact from development

The impact on water resources and infrastructure from the proposed development does not solely depend upon the number of dwellings constructed. Demographic changes, i.e. changes in population and occupancy rates, will influence the impact of each new dwelling. Behavioural changes such as changes in per capita consumption (PCC), in both new and existing dwellings, will also affect the impact that the development has on the water infrastructure.

To assess the impact of the proposed development within the District on the water infrastructure, an estimate of the predicted population and dwellings amounts, and hence occupancy rate, is required.

In the 2001 census, total occupied dwellings in the District were estimated at 27,519[13]. Completed dwellings between 2001 and 2007/08 were 2,752. Comparing these figures with the population estimates described in Section 2.1 gives the following predictions of occupancy rates.

Uttlesford District	2001–2007/08	2001–2021	2001–2026
Total Dwellings 2001	*27,519*	*27,519*	*27,519*
Completions (or RSS minimum)	*2,572*	*8,000*	*10,150*
Total Dwellings	*30,091*	*35,519*	*37,669*
Population estimate	*72,500*	*80,300*	*83,300*
Occupancy rate at end of period	*2.41*	*2.26*	*2.21*

Table 4-1 Population estimates for Uttlesford District

In order to estimate changes in occupancy rate between the above periods, for the purposes of WCS impact calculations, a linear interpolation has been applied between 2007/08 and 2020/21, and between 2020/21 and 2026/27. The results of this exercise are included in Appendix B.

It should be noted that the dwelling, population and occupancy rate figures above compare closely with those contained within a report commissioned by the East of England Regional Assembly in 2005[14]. In addition, the above figures are based on 2006 population estimates, whereas the above-mentioned report uses population projections from 2002. It is therefore assumed that the above figures provide the most up to date prediction of future population growth.

Three scenarios, dependant on PCC rate projections, were developed to assess the potential impact of the proposed development:

Scenario	PCC of Existing Dwellings	PCC of New Dwellings
Best Case	PCC reduces to DEFRA aspirational target of 130 l/p/d	CSH Level 3 present – 2016 CSH Level 6 post 2016
Business Plan Case	Reducing in line with VWC predictions	CSH Level 3 present – 2016 CSH Level 6 post 2016
Worst Case	Remains at current average PCC for VWC Northern WRZ (166 l/p/d)	PCC required by 2009 changes to Building Regulations is achieved (125 l/p/d)

Table 4-2 Development Impact Scenarios

The PCC values, which form the business plan scenario (and the starting point of the two other scenarios), are based on the VWC predicted PCC rates for metered and un-metered customers, and weighted to take account of the predicted changes in meter penetration rates, as predicted in their 2009 draft WRMP. This produces a prediction of average PCC rates for the existing population, as illustrated in Figure 4-7.

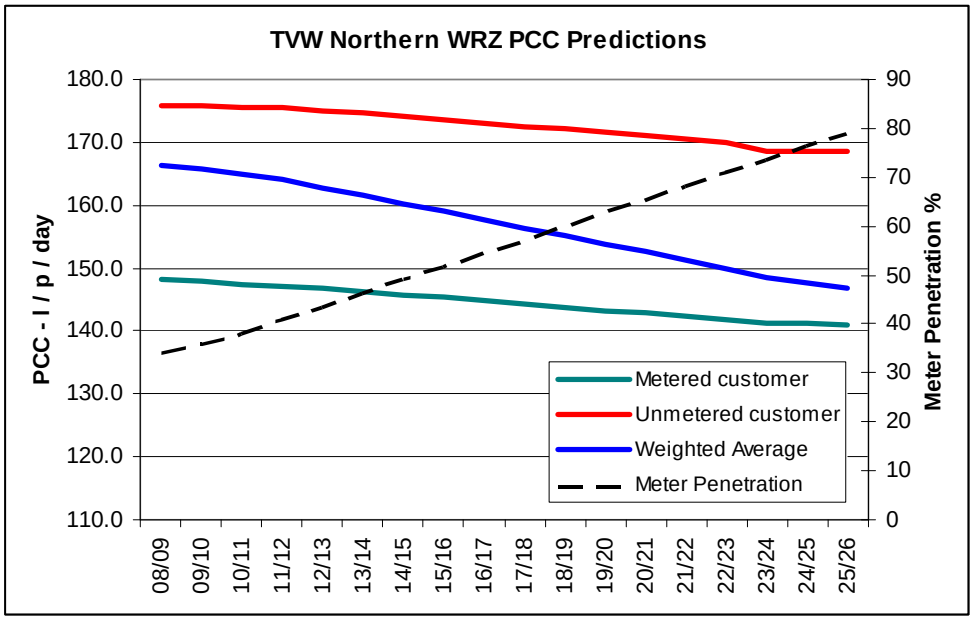

Figure 4-7 Average PCC predictions for existing population, weighted by meter penetration, as per TVW [now VWC] WRMP 2009

Using the scenarios above, the change in potable water demand (from domestic properties) due to the proposed development has been assessed using the following equation:

Total District Demand = Change in demand from existing dwellings + new dwelling demand

Where demand from new and existing dwellings is calculated from:

number of dwellings x occupancy rate x PCC

An additional allowance of 5 l/p/d has been added to the CSH PCC rates, for outside use, which makes these rates more coherent with the proposed Building Regulations recommendations.

Following discussions with water companies, it has been assumed that the demand for water and wastewater services from businesses remains constant for the foreseeable future. Intensification of existing employment areas is unlikely to result in a net increase in industrial demand, as it is predicted that companies with heavy water use will be replaced with service-orientated industry over time.

However, the development of new employment sites will obviously require modification and upgrades to the existing network. Where new sites are proposed, any likely constraints that may restrict the provision of potable water or wastewater services have been highlighted.

In addition, TWU and AWS are under no obligation to accept trade effluent to their wastewater systems. In doing so, they may require an improvement to some process streams, depending on the chemical consistency of the effluent. The capital required for this work will be a consideration that the water companies take into account when making a financial agreement with the business in question.

As the District is served by a number of WwTW, the impacts of the potential residential development must be assessed on a site-by-site basis.

Changes in Dry Weather Flow* (DWF) received by the WwTW have been assessed using the following equation:

Total DWF = Existing DWF + DWF from new dwellings

Where DWF is calculated from:

(*number of dwellings x occupancy rate x 95% of PCC) + allowance for infiltration + trade flow*

95% of the PCC rates are used to allow for an amount of water that does not re-enter the sewerage network.

The 5 l/p/d outside use allowance is also removed from the PCC rates for new dwellings, as it is assumed that this water would be collected by surface water systems, rather than the foul sewers, and should therefore not affect the capacity of the foul wastewater network or WwTW.

The allowance for infiltration, which accounts for water entering the sewerage network from incorrect or illegal connections, and through defects in the existing assets, is estimated to be an additional 25% of the DWF from dwellings, based on guidelines from water companies and previous experience undertaking neighbouring WCS.

The changes in demand for water supply (and sewerage and wastewater treatment services) that emerge from the above scenarios have been compared with water company plans, and used as a tool to aid consultation with the water companies.

4.3 Limitations

In addition to the accuracy limitations associated with predicting occupancy rates and PCC, the high-level calculations described above contain a number of inherent limitations. These include:

- Linear interpolations of changes in both the metering penetration rates and occupancy rates – these may not accurately represent future trends;
- Infiltration rates – a rough estimate based on water company experience, but will vary between individual WwTW catchment areas;
- Future climatic changes may increase the demand for water – this is factored into water company plans, but will make targets such as the CSH more difficult to achieve; and
- The link between occupancy rates and PCC – the conventional understanding within the water industry is that smaller households tend to have higher PCC rates, as there are less opportunities to ‘share’ demand for washing machines, dishwashers etc. The predicted trend of falling occupancy rates therefore may make the above PCC targets harder to achieve.

* see Technical Glossary for definition of DWF

5 Development Options

5.1 Residential development

Between 2001 and March 2008, UDC has seen the completion of **2,572** dwellings. A further **3,302** dwellings have planning permission or have been identified in capacity studies. In addition a further 297 dwellings, on small sites expected to accommodate less than six units each, have planning permission, and are expected to be completed between 2009 and 2013.

This leaves a remainder of **3,979** dwellings to be allocated to meet the 2026 RSS target.

Options for distributing these additional 3,979 dwellings for testing through the WCS are based on the four options set out in UDC's preferred options consultation for the Core Strategy (2007)[15]:

> **Option 1**: Distribution between the three main urban areas, Great Dunmow, Saffron Walden and Stansted Mountfitchet.
>
> **Option 2**: No new settlement, development located around the market towns and key service centres, with around 500 dwellings at Elsenham and larger scale growth (750 dwellings) in Takeley;
>
> **Option 3**: No new settlement, development located around the market towns and key service centres, with around 1,450 dwellings at Elsenham; and
>
> **Option 4**: A new settlement of 3,000 dwellings at Elsenham with the remaining 1,000 dwellings distributed around the existing urban areas.

In addition, this WCS will consider the impact of this new settlement being constructed at either Boxted Wood/ Andrewsfield, northeast of Great Chesterford, Easton Park or Chelmer Mead. These locations are being proposed by developers, and are not official Core Strategy Options as supported in the Core Strategy – Preferred Options Consultation (2007) document; however they will be referred to as modifications to Option 4 throughout this report.

The following table summarises the planned phasing of the remaining dwellings on the larger allocated sites, the majority of which are already under construction within the District.

Settlement	Site	Outstanding Dwellings	Phasing
Felsted/ Little Dunmow	Oakwood Park	243	143 by 2010 Further 100 by 2024
Great Dunmow	Woodlands Park	983	2009-2019
Saffron Walden	Ashdon Road	150	2010-2014
Stansted Mountfitchet	Rochford Nursery	584	2009–2014
Takeley	Priors Green (+ island sites)	574 (+ 78)	2009–2013 (2024)

Table 5-3 Phasing of remaining dwellings on current large sites

All of the above sites are currently under construction, with the exception being the Ashdon Road site, which is awaiting planning permission, with construction expected to start from 2010. A number of smaller sites, already under construction, or awaiting planning permission, also exist within the District. As these sites have previously been allocated, the water companies are aware of their existence and have made adequate plans to accommodate the development numbers.

Whilst it is important for the WCS to incorporate the dwelling numbers at these allocated sites into infrastructure impact calculations, little strategic guidance can be given as the majority of the sites are already under construction.

The additional sites that will be required, on top of those previously allocated, to meet the RSS targets, will require an assessment of possible infrastructure solutions and strategic guidance to be provided.

UDC has provided indicative phasing of this new development for all four options, to allow the assessment of likely WCS impacts and outline strategy preparation. In relation to Option 4, the Preferred Options consultation document did not specify where the balance of the housing, after the new settlement was to be provided, and only stated in general terms 750 homes in larger towns and 250 homes in villages. UDC has provided an estimate of how this development might be accommodated, but this will be the subject of further consultation and should only be considered indicative for the purposes of this study. A detailed breakdown of the potential development options, including the sites already allocated is included in the calculations in Appendix C.

A summary of the areas of development (either intensification, or extension, to the existing settlements) required to meet the RSS targets, for all four options, is included in the table below.

Settlement	Dwelling numbers (and estimated phasing)			
	Option 1	Option 2	Option 3	Option 4
Elsenham NE	N/A	N/A	950 (2018–2026)	3000 (new settlement)
Elsenham west	N/A	505 (2019–2026)	505 (2013–2020)	N/A
Great Chesterford Extension	N/A	40 (2015/16)	40 (2015/16)	N/A
Great Chesterford Intensification	N/A	30 (2013/14)	30 (2013/14)	30 (2013/14)
Great Dunmow south	300 (2013–2018)	300 (2013–2018)	300 (2013–2018)	300 (2013–2018)
Great Dunmow east	770 (2018–2026)	N/A	N/A	N/A
Great Dunmow Intensification	100 (2011–2019)	100 (2011–2019)	100 (2011–2019)	100 (2011–2019)
Great Dunmow SW	960 (2013–2026)	600 (2017–2026)	600 (2017–2026)	N/A
Newport west	N/A	100 (2018–2020)	100 (2018–2020)	50 (2018/19)
Saffron Walden NE	250 (2015–2020)	250 (2015–2020)	250 (2015–2020)	250 (2015–2020)
Saffron Walden SE	1,140 (2016–2026)	1,035 (2016–2026)	880 (2018–2026)	N/A
Stansted Mountfitchet Intensification	70 (2013–2018)	85 (2013–2018)	85 (2013–2018)	85 (2013–2018)
Stansted Mountfitchet north	400 (2018–2026)	N/A	N/A	N/A
Takeley Priors Green Extension*	N/A	750 (2013–2023)	60 (2020–2023)	40 (2020–2022)
Thaxted east	N/A	60 (2024/25)	60 (2023–2025)	30 (2023–2025)
***Total** between 2011–2026 (variation in final totals, as 3,979 target is a minimum)*	**3,990**	***3,855*** +130 in villages	***3,960*** +130 in villages	***885*** + 3,000 in new settlement + 130 in villages

Table 5-4 Summary table of phasing for new extension/ intensification sites by Option

N/A = Not Applicable, as the development option does not propose any development in this location

UDC anticipates that the completion of a new settlement at Elsenham, as required by Option 4 would take place from 2013–2026. It is anticipated that the other potential new settlement locations being proposed by developers would be constructed within a similar timeframe.

In addition, there is a requirement for the WCS to consider the impacts of the new settlement (Option 4) containing 5,000 dwellings rather than 3,000, so that the key impacts of an Eco-town being constructed in the District can be identified as part of the LDF process. This is important, as the progress of the separate Elsenham WCS has encountered more delay than originally anticipated.

* Takeley development will either be an extension to the existing Priors Green development for Option 2, or a smaller site closer to Little Canfield for Options 3 and 4.

For Options 2, 3 and 4 to meet the RSS target, 130 dwellings are anticipated to be accommodated in the small rural villages within the District between 2013–2026. The scale of this growth is likely to be limited to around 10–20 dwellings. The most sustainable form of development would be to focus this growth in those villages with some existing facilities like a school or village shop etc, and these villages are listed below:

- Ashdon;
- Barnston;
- Chrishall;
- Clavering;
- Debden;
- Felsted;
- Great Easton;
- Great Sampford;
- Hatfield Broad Oak;
- High Roding;
- Manuden;
- Quendon and Rickling;
- Radwinter;
- Stebbing; and
- Wimbish.

Any major water infrastructure, or water environment, constraints or opportunities, which may preclude or support the choice of these new settlement locations and villages, have been identified in Sections 6, 7, and 8, and are summarised in Section 9.

Figure 5-8 illustrates the potential range of development locations in relation to the existing settlements and the main rivers.

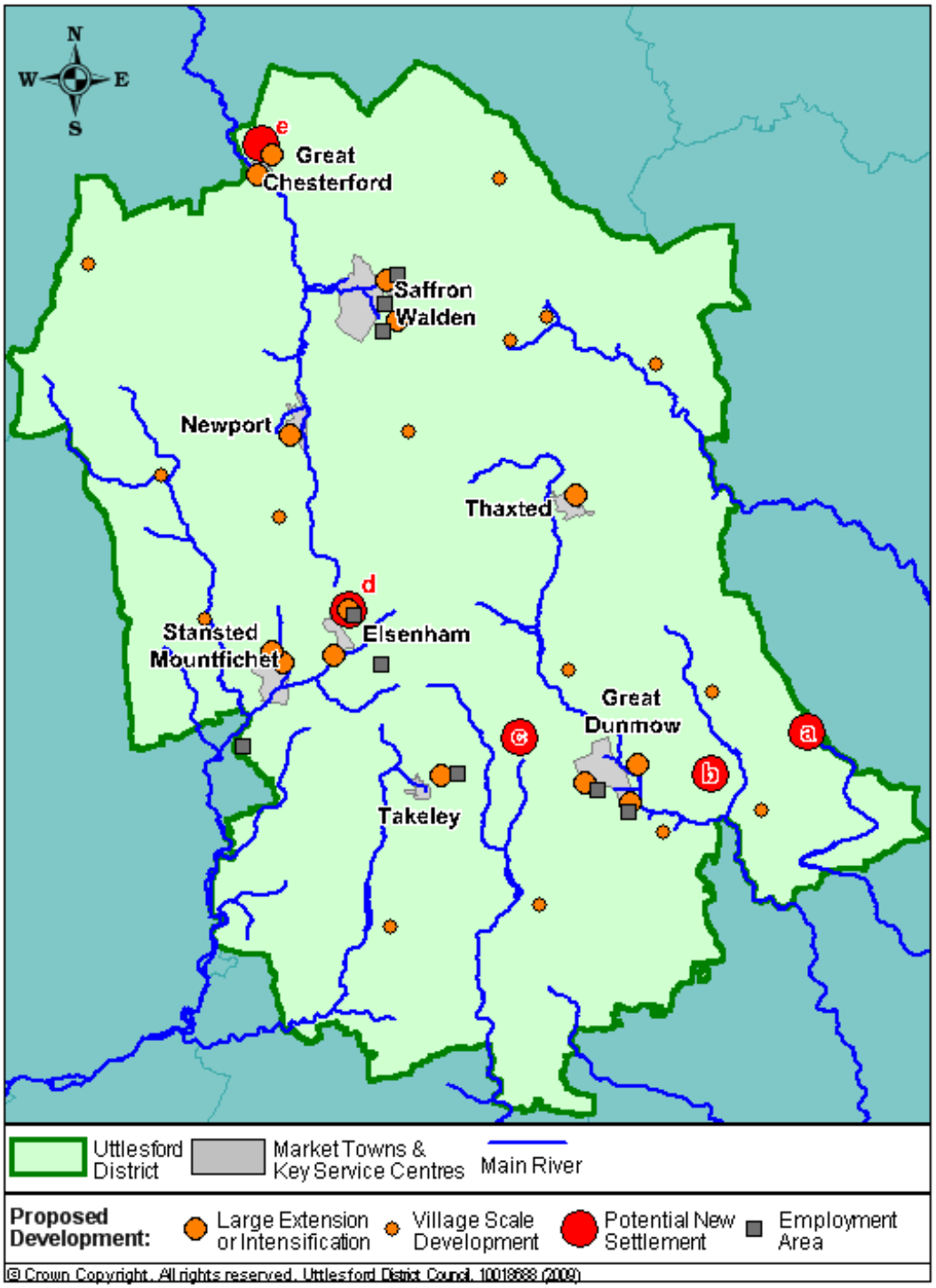

Figure 5-8 Large residential allocations, new settlements and village scale growth

New Settlements: a = Boxted Wood/ Andrewsfield, b = Chelmer Mead, c = Easton Park, d = Elsenham and e = Great Chesterford

The potential impact of these housing and employment areas on the water infrastructure and wider water environment has been identified in Sections 6.6 and 8.3.

5.2 Employment area development

The RSS requires that 56,000 net jobs are created in Essex (outside of the Thames and Haven gateways) by 2021.

Currently, RSS targets for increases in job numbers are much more difficult to apportion to a District level. The Appraisal of Employment Land Issues report[16] from 2006 predicts net demand for employment land in the District to be between 14.0 and 24.9 ha between 2001 and 2021.

UDC is proposing a target of a net gain of employment land of 25 ha by 2026. UDC has identified a number of possible employment sites across the District, on top of those sites already allocated or under construction. The extent of the development of these sites will be dependent on the final option chosen for the housing allocation.

	Net Employment Land Gain (ha)			
Potential Employment Area	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Bishops Stortford - northern edge	10	10	10	10
Elsenham Industrial Estate, Gaunts End (Extension)	-	7	7	7
Elsenham New Settlement	-	-	4	10
Great Dunmow - Land south and west (Mixed Use Scheme)	7	-	-	-
Great Dunmow south	4	4	4	4
Saffron Walden - Land west of Thaxted Road	8	8	8	8
Saffron Walden east (Mixed Use Scheme)	3.3	3.3	3.3	0
Saffron Walden northeast	6	6	6	6
Takeley - Priors Green Extension	-	2	-	-
Loss of land for housing	(14.15)	(15.04)	(15.04)	(15.04)
Total	***24.15***	***25.26***	***27.26***	***29.96***

Table 5-5 Potential employment land allocations by Option

The potential impact of these employment areas on the water infrastructure and wider water environment has been identified in Sections 6.6 and 8.3.

In addition, the WCS stakeholders believe that this WCS must refer to the impacts of the possible expansion of Stansted Airport up to 2030, on the water environment of the District. A review of the Environmental Statement[17] associated with the project reveals the following information:

Surface Water from the existing airport grounds is currently dealt with in the following fashion:

- Surface water from grassed areas to the north of the site is discharged to the Tye Green Brook (a tributary of Stansted Brook) via a series of drains and swales;
- The southern car park areas and highway interchange are drained to Pond B, which then discharges to Start Hill Brook (a tributary of Great Hallingbury Brook);
- The northern hard-standing areas are drained to Pond A, which then discharges to the Great Hallingbury Brook via an oil interceptor, with any contaminated water from de-icing process being diverted to Pond C;

- The stands, runways, and taxiways, and other southern hard standing areas, are drained via gravity to Pond C; and
- Pond C uses a Biochemical Oxygen Demand (BOD) meter to determine if the incoming water is contaminated from the airports de-icing process. Contaminated water is collected in a separate compartment and pumped to the Rye Meads WwTW for treatment. Non-contaminated water is discharged into the Pincey Brook.

The proposed 2030 expansion will include the creation of two new surface water collection ponds, one discharging to the River Roding, and one to Pincey Brook (with the less contaminated water harvested for non-potable reuse). Contaminated water will be diverted from these new ponds to Pond C, which will continue to operate as before.

The new surface water discharges to the Pincey and Great Hallingbury Brooks will be of non-contaminated water, and should therefore not adversely impact on the discharge quality required at the downstream WwTW (Hatfield Heath and Bishops Stortford respectively).

The new ponds will be designed to attenuate flows from up to a 1 in 100 year (+ 20% for climate change) storm event, and therefore should not significantly limit any increases in discharge quantities from the WwTW due to the proposed growth in the District.

Wastewater from the buildings within the airports grounds is currently collected by a series of gravity sewers and rising mains to two TWU pumping stations, which then pump the flow to Bishops Stortford WwTW for treatment and discharge to the River Stort via the Great Hallingbury Brook.

Following the proposed 2030 expansion, wastewater will continue to be collected and treated in the same fashion, with the corresponding increase in discharge at Bishops Stortford WwTW estimated to be approximately 15 l/s, with negligible effect on flows, and hence flood risk, in the Great Hallingbury Brook and River Stort. TWU have factored growth at the airport into recent upgrades to the WwTW.

Potable water (an allocation of 3 Ml/d) is currently supplied to the airport from VWC. Planned increases in efficiency and the re-use of non potable water for uses such as toilet flushing mean that this allocation is only expected to be breached in dry periods where there is less rainfall to meet the non-potable water requirements. A further 0.7 Ml/d of potable water would be supplied by VWC via the existing infrastructure (and re-provision of the supply from Takeley water tower, to be demolished as part of the expansion) during these periods.

As discussed in latter Sections of this report, the amount for water available for VWC to supply Uttlesford District is less of a constraint than the limitations of the supply network. The impact of an additional 0.7 Ml/d, during dry periods, from the airport will be negligible given the volumes of water conveyed through the VWC Northern Water Resource Zone.

Regarding the **biodiversity** and the water environment, the Environmental Statement also included details of how any losses of river habitat (due to culverting of watercourses underneath the expanded airport) will be compensated for.

6 Water resources and supply

6.1 Hydrology

As illustrated in Figure 6-9, Uttlesford District lies on the boundary between four river catchments, each covered by a separate EA Catchment Abstraction Management Strategy.

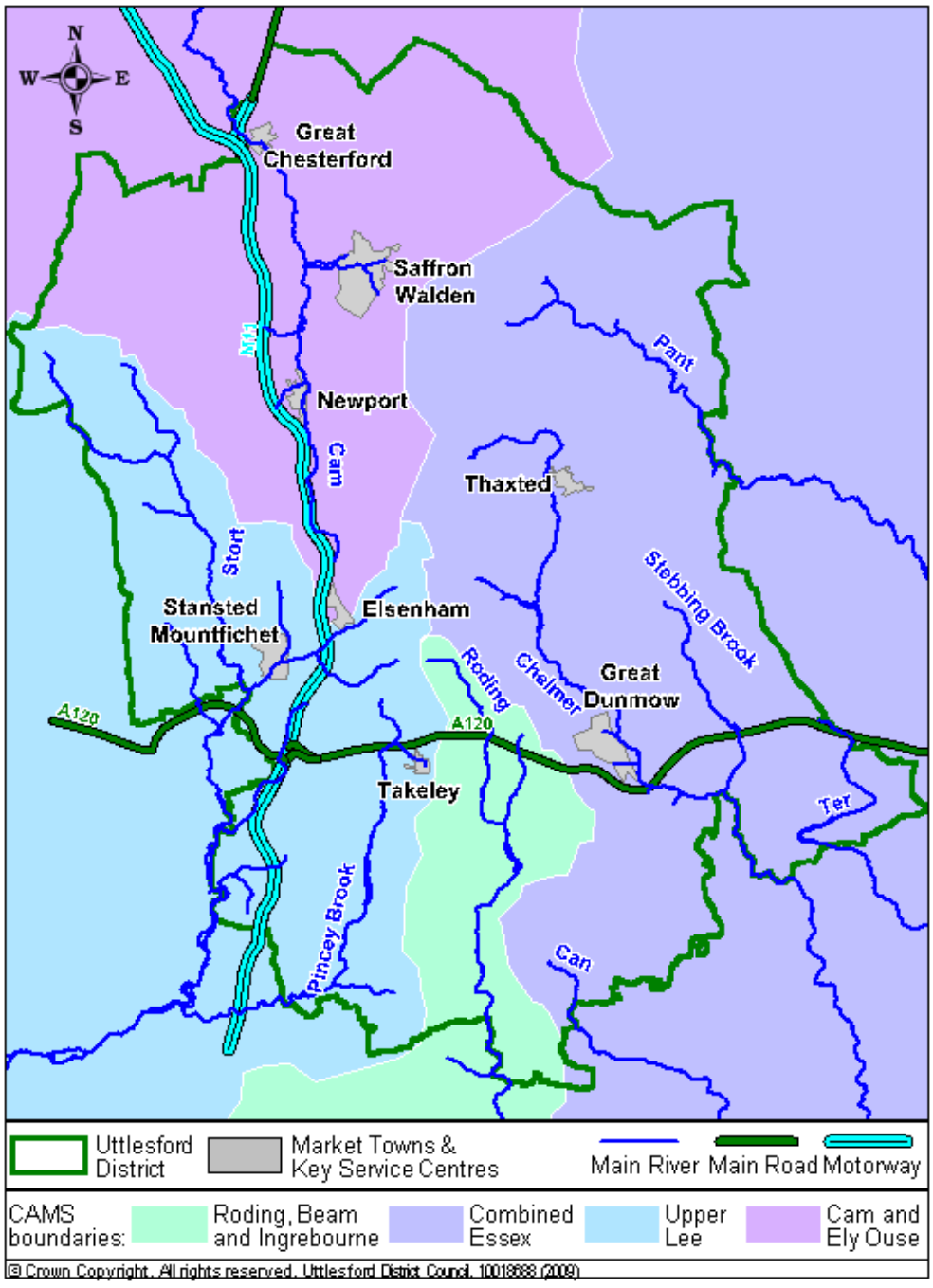

Figure 6-9 CAMS boundaries within the District

All four of the catchments are described as predominantly rural with relatively high proportions of arable land.

The Rivers **Can**, **Chelmer**, **Ter** and **Pant**, and **Stebbing Brook**, lie within the Combined Essex catchment. The following key points have been extracted from the CAMS[18] document:

- The River Chelmer responds slowly to rainfall events in the rural upper reaches of the catchment. Further downstream, run-off from the urban areas of Chelmsford and Great Dunmow into the River channel is more immediate;
- The long narrow Blackwater catchment (including River Pant) is a less flashy catchment due to the short flow paths of the contributing run-off along the whole catchment length. This process also maintains flows downstream;
- Downstream of Great Sampford STW on the River Pant, the effluent flow from the treatment works is not sufficient to sustain river flow in the summer. There is a long history of low flows and regular periods of no flow, with pooling and probable stagnation of the water occurring. There is concern that river flows are reduced due to abstraction induced leakage of water through the riverbed into the underlying Chalk; and
- The Ely Ouse to Essex Transfer Scheme (EOETS) transfers raw water from the Great Ouse to the headwaters of the Rivers Stour and Pant, although this water is primarily used to support abstraction from Abberton reservoir, outside of the District and the VWC Northern WRZ area.

The Rivers **Cam** and **Bourn**, and their associated tributaries, lie within the Cam and Ely Ouse catchment. The following key points have been extracted from the CAMS[19] document:

- The River Cam receives tributary water from both runoff, resulting directly from rainfall, and from baseflow, derived from groundwater spring flows;
- The upland rivers, with sources above the spring line, however, are dependent on rainfall, which can make them susceptible to drying-out without the baseflow to sustain them; and
- In addition to natural flows, the river flows are also regulated by effluents from WwTW.

The River **Roding** and associated tributaries lies within the Roding, Beam and Ingrebourne catchment. The following key points have been extracted from the CAMS[20] document:

- London Clay underlies the Roding, Beam and Ingrebourne surface water catchments, preventing any hydraulic interaction between surface water and groundwater in the Chalk aquifer below. Consequently, rainfall, run-off and discharges (from a number of TWU WwTW – White Roding, Leaden Roding, Abbess Roding and Willingale) – dictate flows and levels in the rivers;
- This Clay catchment typically demonstrates a flashy response to rainfall and is prone to flooding after large storm events or prolonged periods of heavy rainfall, and
- Headwaters can dry up and flows can drop significantly during prolonged dry spells

The River **Stort** and **Pincey** and **Stansted Brook**, and their associated tributaries, lie within the Upper Lee catchment. The following key points have been extracted from the CAMS[21] document:

- The Upper Stort catchment is underlain by chalk with significant base flow and spring flow contribution from Chalk groundwater, therefore the upper reaches are prone to drying during the summer;
- The Pincey Brook catchment is underlain by London clay, which gives rise to a flashier flow regime in comparison to chalk-dominated catchments; and
- Discharges form an important resource in the Upper Lee catchment, augmenting flows and supporting abstractions further downstream (particularly Takeley and Hatfield Heath WwTW, whose discharges make up a large proportion of the flow in the Pincey Brook).

More information regarding the watercourses in the District, including which CAMS catchment the smaller watercourses fall into, is included in Appendix D.

The Rivers Stort and Cam are Chalk Rivers. These particular habitats are very important in terms of biodiversity, water supply, recreation and heritage, and are a priority UK Biodiversity Action Plan (BAP) habitat, for which the Environment Agency is the national lead. Abstraction of water resources and point source discharges are recognised as resulting in significant impacts on Chalk Rivers. This topic is further discussed in Section 8.2.

6.2 Hydrogeology

The northern half of the District is underlain by the Chalk aquifer, with extensive superficial deposits of Boulder Clay. The Chalk aquifer is a major aquifer, in that it is a highly productive stratum, which is important for regional supply. The Chalk is exposed around Saffron Walden and the Stort and Cam river corridors. The southern half of the district is underlain by Sands, Gravels and Clays, again overlain by a layer of Boulder Clay. Some of these sand and gravel areas are classed as minor aquifers, in that they may be variably permeable and important for local water supplies.

The Chalk aquifer in the East of England is extensively used for water abstraction. Groundwater within the chalk feeds many of the rivers, streams and wetlands of the area. In the upper reaches of the Rivers Stort and Cam, winter rainfall percolates into the underlying chalk aquifer where it is stored. The chalk aquifer releases the stored groundwater slowly as base flow to these watercourses, attenuating the response of river flows to rainfall events.

The extent of the major and minor aquifers within the District is most clearly illustrated by mapping the EA's Groundwater Vulnerability (GWV) zones (see Figure 6-10). These zones were created based on existing soil maps and databases, and provide an indication of the vulnerability of the underlying groundwater resources to pollution from surface contaminants, as either high, intermediate or low. This EA classification of the land surface reflects the ability of contaminants to leach through the covering soils and pose a potential risk to groundwater at depth. The maps also indicate areas where the presence of low permeability drift may provide additional groundwater protection.

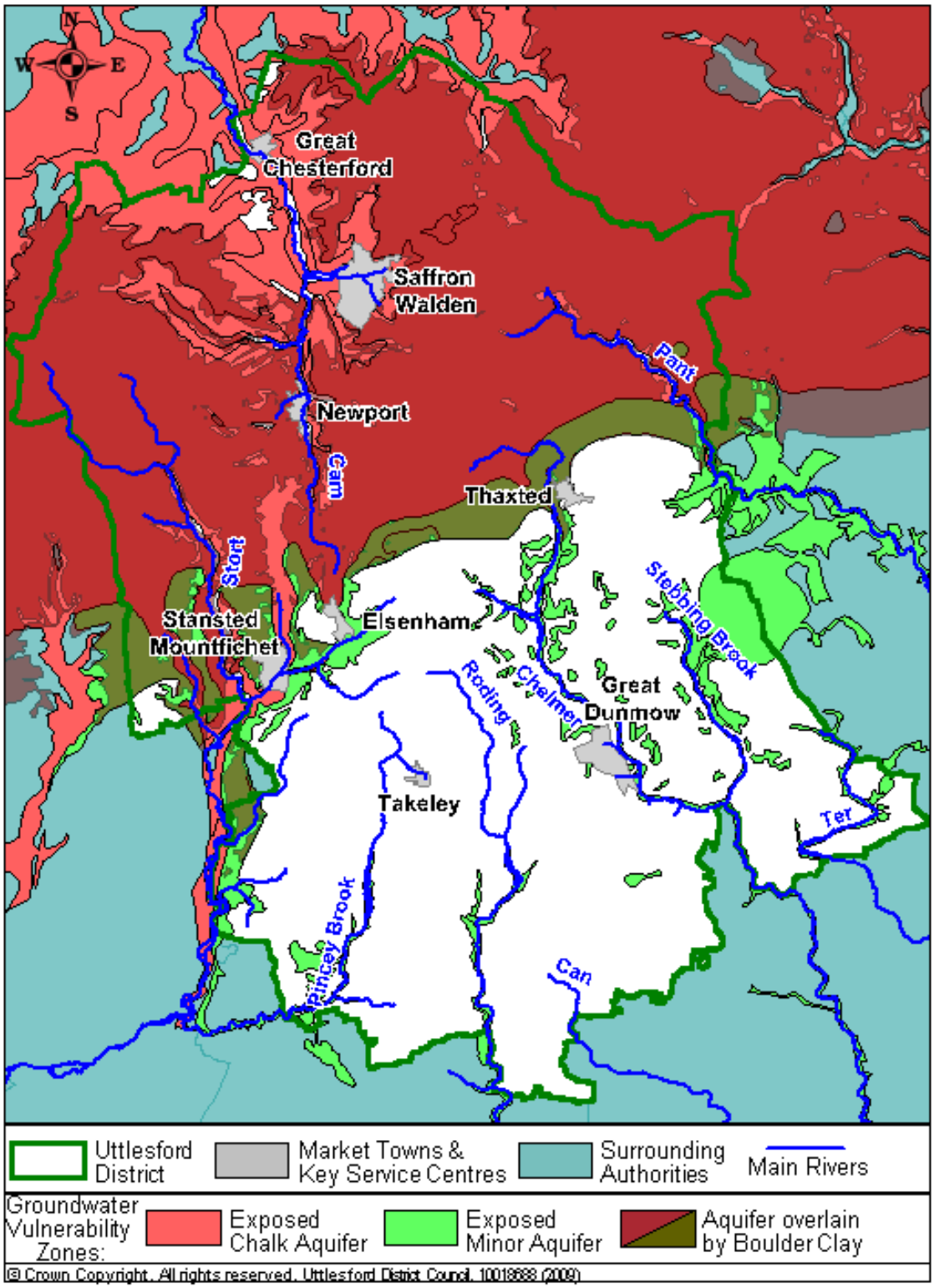

Figure 6-10 Aquifers within the District, as depicted by GWV zones

Flow rates within the chalk aquifer vary from location to location due to the large number of fissures within the rock. This presents difficulty in modelling the groundwater flow using conventional methods, and increases the risk of contamination from polluted surface water entering boreholes and wells without being percolated through the rock matrix.

The risk of contaminating the chalk aquifer with pollutants from infiltration based SUDS is a key risk that must be mitigated by local onsite tests and choice of methods. This is discussed more in Section 7.2.1.

6.3 Summary of current resources

Each CAMS uses Water Resource Management Units (WRMU) to make integrated assessments of groundwater and surface water resources. Table 6-6 shows the relevant CAMS and WRMU for the District, and highlights the availability of water for further abstraction.

CAMS catchment	WRMU reference	Uttlesford Rivers Affected	Resource Availability Status
Cam and Ely Ouse	C: (Upper River Cam, Rhee and Granta)	Cam and tributaries, Granta (River Bourn near Ashdon)	Over-licensed, (the underlying chalk aquifer is assessed as Over-abstracted)
Combined Essex	1: Pant/Blackwater, Ter, Roman/Layer, Wid, Brain, Chelmer	Pant, Ter and Chelmer	Over-abstracted
Roding, Beam and Ingrebourne	2: Upper Roding	Roding	No water available
Upper Lee	1: Rivers Lee, Mimram, Beane, Rib, Ash and Upper Stort	Stort	Over-abstracted
	2: River Stort and Pincey Brook	Stort, Pincey Brook, Stansted Brook	Over-licensed

Table 6-6 Resource Availability in the WRMU around Uttlesford

As shown in Table 6-6, none of the WRMUs in the vicinity of Uttlesford are assessed as having water available; there is no additional water available for abstraction from surface or groundwater resources at low flows. There may be an opportunity to abstract additional water at times of high flow, although this will be subject to a number of restrictions and parameters being met in accordance with EA guidance. A ‘hands off flow’ (HOF) restriction may be applied to new abstraction points. This restricts abstraction to periods when at least a minimum river flow is obtained at a nearby gauging point.

For example, a new abstraction in the Upper Cam sub-catchment in WRMU C of the Cam and Ely Ouse catchment would only be permitted to abstract water when a HOF of 94.7 Ml/d is achieved at Dernford gauging station on the River Cam downstream of Great Chesterford. The EA anticipate that these flow conditions would only occur for 144 days in an average year.

All of the other sub-catchments in the District have already licensed all available flow, even at times of high flow, except for the Lower Stort, where some water may be available only at times of very high flow. The EA state that the HOF conditions that would have to be applied to an abstraction here would mean that a reliable source of water would not be provided without the use of storage facilities if permitted.

More detailed extracts from the CAMS documents are included in Appendix D.

6.4 Current infrastructure

As stated previously, the District lies entirely within VWC's Northern WRZ.

Figure 6-11 illustrates the layout of the supply network within the District.

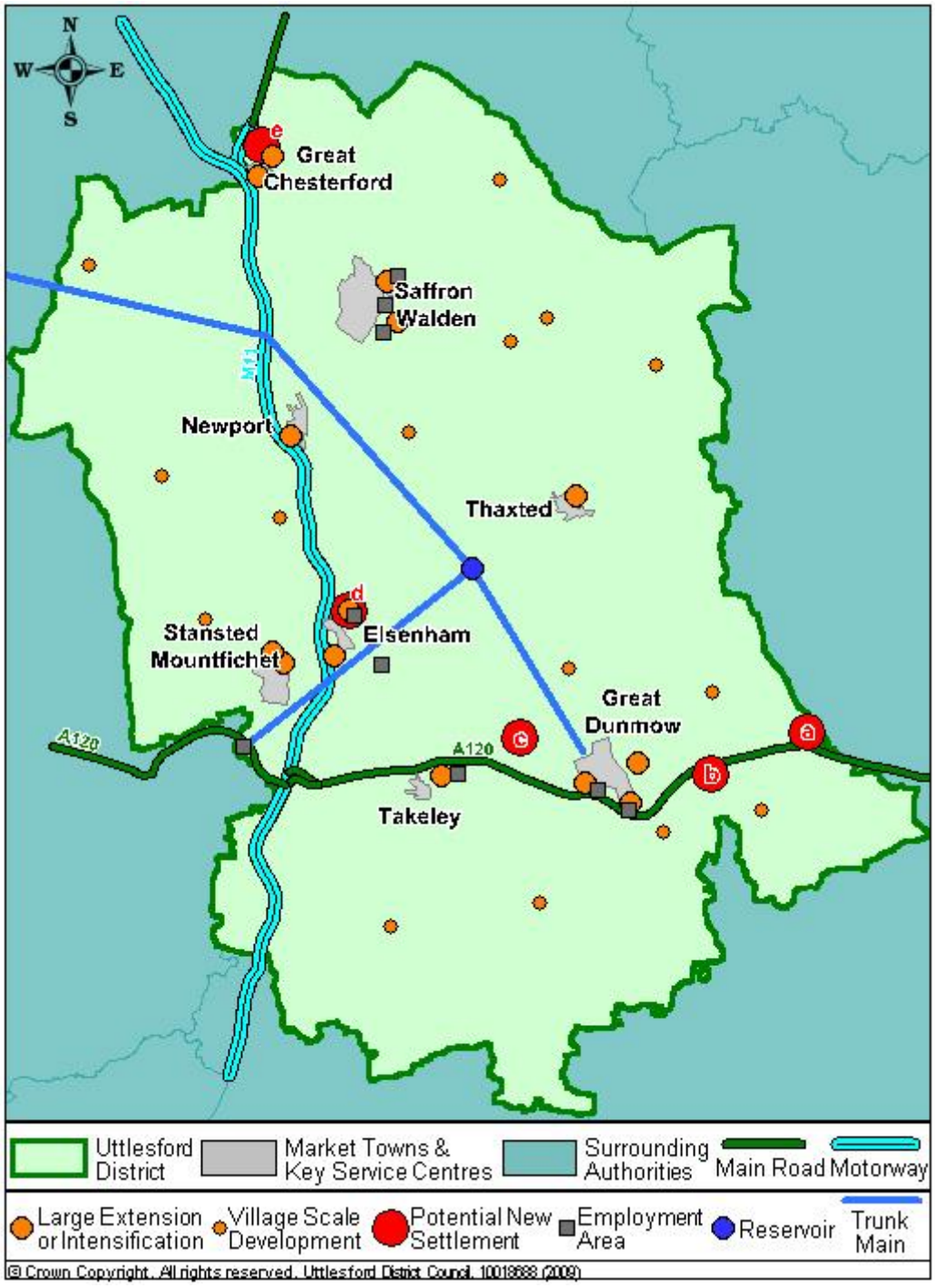

Figure 6-11 VWC Supply Schematic

New Settlements: a = Boxted Wood/ Andrewsfield, b = Chelmer Mead, c = Easton Park, d = Elsenham and e = Great Chesterford

Potable water is supplied to Uttlesford District via the VWC trunk main network, and localised groundwater abstractions. The northern trunk main enters the District to the west of Saffron Walden, and runs in a south-easterly direction towards a reservoir located around 4 km to the west of Thaxted. Two trunk mains then branch out from this location, one towards Great Dunmow, and the other towards Stansted Mountfitchet, Bishops Stortford and Elsenham.

VWC receive an import of water from the AWS Ruthamford WRZ into their Northern WRZ. A proportion of the water entering Uttlesford District via the VWC supply network will therefore be from this source.

The imported water from the Ruthamford WRZ is a treated supply arrangement governed by the Great Ouse Water Act (1961) and currently has no restrictions imposed on it relating to drought or climate change.

In order to support their PR09 submission to Ofwat, VWC have produced a draft Water Resources Management Plan[22] (WRMP), which sets out the challenges they face with supplying their customers with potable water over the next 25 years. The VWC draft WRMP assumes that the full entitlement, amounting to 91 Ml/d at average and 109 Ml/d at peak, of the allowance in the Act will be available to be imported from AWS sources in the Ruthamford supply zone. This transfer was subject to a judicial review in 1999, which concluded that VWC average and peak entitlements were not at risk.

The AWS draft WRMP states that the assessment of Water Available for Use (WAFU) is net of bulk imports and exports. Therefore, the demand management and resource development options, planned by AWS in the Ruthamford WRZ in the medium to long term (2015–2020 and beyond), will take account of this bulk export to VWC. The loss of the bulk transfer is therefore not a realistic risk to supply in Uttlesford District, according to the available information and consultation undertaken to date.

The District contains nine borehole pumping station locations. These are all groundwater sources, with treatment carried out at source before being put into supply. These abstractions generally supply their local surroundings, with any deficit within the wider area being provided using other water resources via the trunk mains. According to VWC, the local boreholes in the extreme north east of the District provide adequate supply for the planned rural levels of development, but significant development elsewhere is best placed near the trunk main, to reduce developer costs on new infrastructure and upgrades.

VWC apply significant effort into supplying the area without mixing water derived from groundwater and surface water sources. Mixing of these two sources of water can lead to taste differences, and may have implications for quality and appearance according to their customers' feedback. There are three reservoirs and seven water towers within the Uttlesford area, which enable VWC to balance the supply to meet the demand of the District.

It must be noted that the production of water company WRMPs coincides with the PR09 process and production of the Final Business Plans, and that the confirmation of the Final Business Plans will occur after November 2009, following the Final Determination from Ofwat.

As such, information from the final AWS and VWC Business Plans and WRMPs **will not** be available to inform this WCS. The information contained above may therefore be subject to amendment and revision in the future.

6.5 Future infrastructure

The VWC draft WRMP adopts a “twin track approach” to the future management of water by increasing supply as well as reducing demand. One key infrastructure related component of water demand is the amount of water lost through leakage. VWC have stressed that they will continue to make improvements in reducing the amount of water lost through both reactive and proactive leakage detection mechanisms. There will also be additional environmental pressures placed on the supply of water from more stringent legislation such as the Water Framework Directive.

From 2010 onwards, VWC are planning to continue an AMP4 study to determine the suitability of the confined chalk in northwest Essex as a groundwater resource for potable water supply. The studies will aim to demonstrate the locations and viability of available water, including the potential for artificial recharge and re-use of recovered water. The planned AMP5 study will take this information and build production boreholes and trial recharge holes for system testing, to determine the potential yield of the entire resource. This will also support further studies and programmes of work to evaluate treatment requirements for recharge water that could be used to replenish the aquifer during average demand periods.

Currently, 34% of VWC customers have water meters attached to their supply. By 2030, VWC have stated in their draft WRMP that they plan to accelerate the metering of properties to 90% of their customer base, at first metering on request and change of ownership, with the potential to move to compulsory metering in the longer term if required.. The WRMP also states that on average, once metered, customers use approximately 12.5% less water, although there is much debate within the water industry as to whether metering reduces consumption for all customers. Options such as seasonally adjustable charge rates, at times of water stress, have been deemed the fairest method of payment for water, providing vulnerable customers are appropriately protected from significant price increases. This should raise the awareness of customers, by increasing the unit price of water during times of peak demand and reducing it correspondingly at all other times. The overall objective is that it would be cost neutral over the course of a year, but will have the effect of reducing peak demand for non-essential use, such as washing vehicles, at times of greatest environmental stress. VWC began trialling such a scheme in nearby Bishops Stortford in April 2009.

The Supply-Demand balance for the Northern WRZ, as set out in the draft VWC WRMP, for both Dry Year Annual Average and Dry Year Critical Period can be seen in Figure 6-12 and Figure 6-13. Both figures show the increase in Water Available for Use (WAFU) that VWC are expecting following the completion of a number of resource refurbishment schemes (within the conditions of existing licenses) towards the end of AMP 4.

However, as stated in Section 2.3, achievement of the final planning components of demand indicated in Figure 6-12 and Figure 6-13 is subject to approval by Ofwat, and constraints on funding could influence the phasing of planned demand reductions and leakage reduction measures.

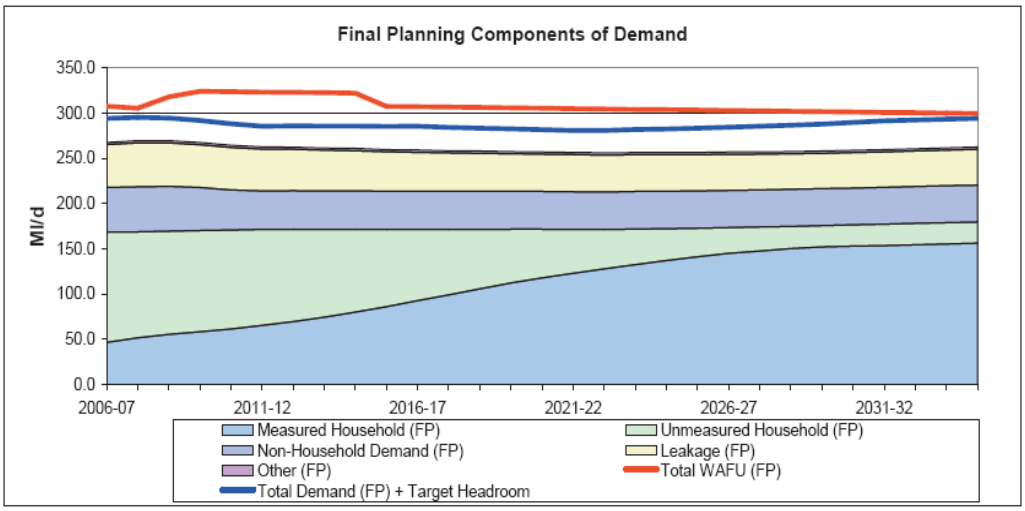

Figure 6-12 VWC Northern WRZ Dry Year Annual Average Supply-Demand Balance

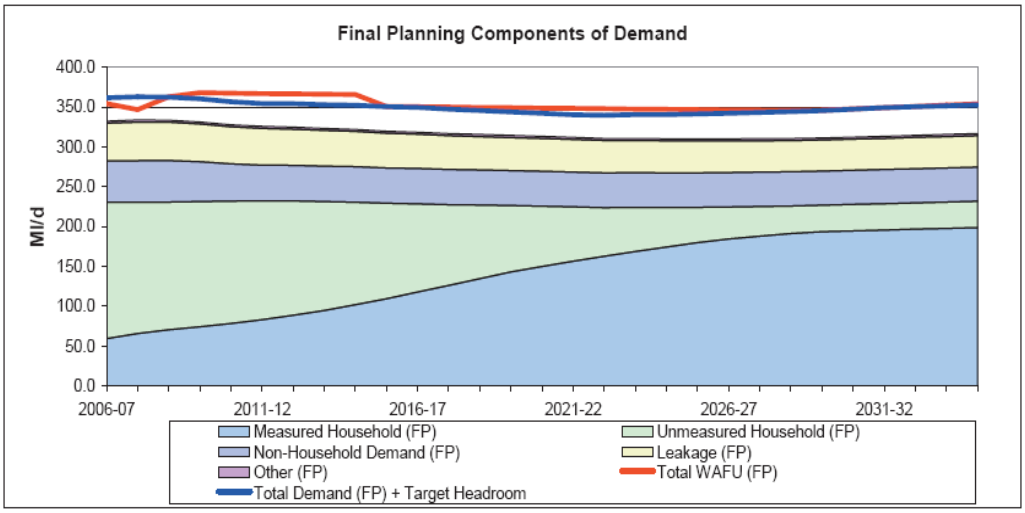

Figure 6-13 VWC Northern WRZ Dry Year Critical Period Supply-Demand Balance

(TVW [now VWC] Draft Water Resource Management Plan 2009)

Both figures show a decrease in WAFU around 2015. This 15 Ml/d decrease is due to **sustainability reductions** that the EA have recently advised (following review of the draft VWC WRMP 2008) will be required at two VWC abstraction points, to reduce the effect of these abstractions on the environment, on the Rivers Beane and Mimram (to the west of Uttlesford District). VWC are concerned that reductions in these abstractions will pass on higher costs to their customers as assets may be abandoned, and other resources may need to be developed to ensure security of supply.

Further sustainability reductions may be required in the future to support the aspirations of the WFD. Development of additional resources, or increased efficiency through demand management, would then be required to maintain the supply required for the new development. Currently, the EA are investigating the sustainability of current abstraction on the River Stort near Stansted Mountfitchet. The outcome of these studies may impact on the strategy that VWC adopts to ensure the District is adequately supplied. If existing resources cannot be further optimised, and sufficient demand management is not realised throughout the Northern WRZ, VWC may have to rely more heavily on their import from the AWS Ruthamford WRZ, especially during periods of peak demand. The increased cost of importing additional water (which is

relatively expensive and carbon intensive) in this manner may increase the cost that VWC seek to pass on to their customers in future AMP cycles.

Figure 6-12 shows that the target demand plus headroom at 2035 lies very close to the current baseline WAFU level based on annual average estimations. This further highlights the importance of UDC and VWC promoting water efficiency in both new and existing dwellings, to further reduce average PCC past that predicted by VWC in their draft WRMP, and hence increase security of supply and reduce reliance on imported water.

6.6 Development impacts

Calculations based on the three PCC scenarios (described in Section 4.2) provide the following results regarding the potable water demand from the existing domestic population within Uttlesford District.

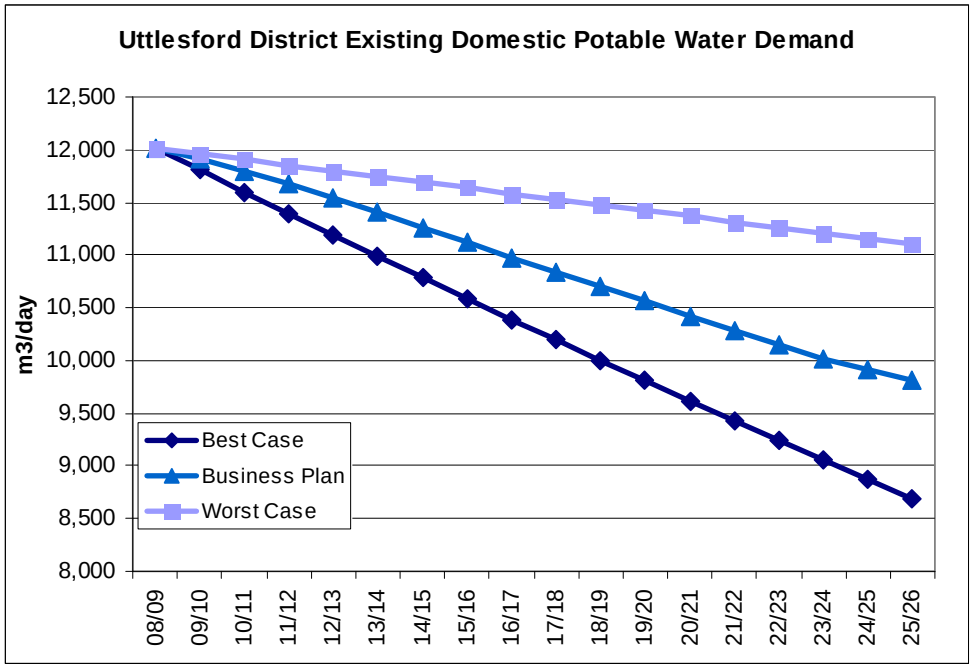

Figure 6-14 Potable water demand from existing properties

As expected, the combinations of reducing occupancy and PCC rates in the existing dwellings all result in a reduction in overall demand.

The predicted demand from the new developments is shown below in Figure 6-15, for all four development options discussed in Section 5.1. Note that the Best Case and Business Plan scenarios both predict the same demand due to new developments, so only Best Case is displayed for simplicity and clarity. This lack of variation is because the PCC values specified in UDC policies are in keeping with the CSH implementation targets that make up the Best Case and Business Plan Case Scenario.

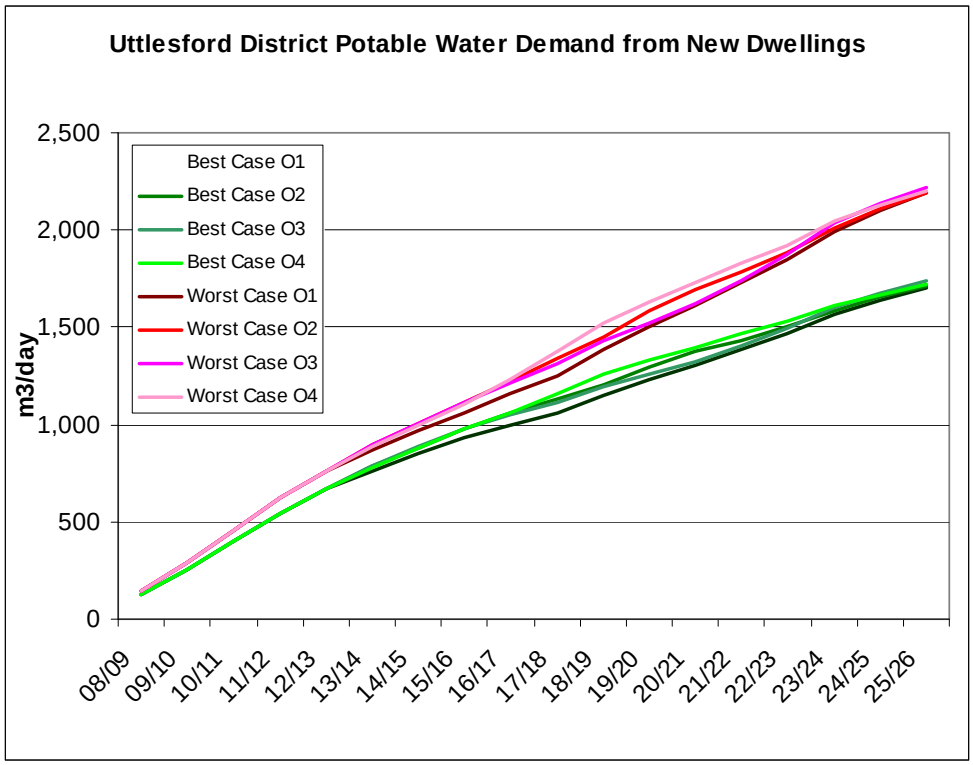

Figure 6-15 Potable water demand for new dwellings

VWC incorporate updated Source Reliable Output and Demand figures for the forecasting of water demand and resource availability at a Water Resource Zone level. These figures are continually updated to incorporate developments that may arise (including RSS targets) and are required to be published and consulted upon every five years as part of the AMP process. The VWC draft WRMP indicates, that for the VWC Northern Water Resource Zone (with the current baseline water metering and water efficiency), there is likely to be **sufficient water to meet demand**. The implementation of further demand reductions or resource development options should not be required over the water company planning period (2010 – 2035), although there are clear benefits associated with aspiring towards water neutrality within the District, as discussed in Section 6.7.

The proximity of the potential new settlement sites to the trunk main network, and their capacity in this location, will determine the ease with which the site can be supplied by VWC, and hence have a significant impact on the cost.

6.7 Water neutrality

The concept of offsetting the potable water demand from new development by increased water efficiency and reduced demand in existing buildings is referred to as water neutrality. This concept allows the new development to be served without impacting on water resources (and in some cases the supply network), and therefore minimises the risks to supply from future climate change.

Water neutrality allows water to remain in the environment for ecological and leisure purposes and negates the need for the development of new resources such as reservoirs. As the amount of water in the supply system is not increased, there are no increases in the energy (and hence carbon footprint) required to supply the water. Water neutrality also benefits sewerage and wastewater treatment, as the hydraulic assets involved in these processes do not have to deal

with increased flows from new development in the long term. However, as the proliferation of water efficient fittings reduces the volumes of water released into the sewerage network, there will be an increased risk of settlement and blockages in areas of shallow gradient. In addition, WwTW process will have to deal with more concentrated wastewater, which could have implications on the treatment methods and operational costs required in order to meet environmental standards. As this is an issue affecting all water companies, and driven by national policy, it is outside of the scope of the WCS.

Achieving the required reductions in PCC to move towards water neutrality will require multiple stakeholder engagement. The consumer awareness required, particularly to encourage the installation of water efficient fittings into existing dwellings and adoption of water saving practices, will need to be generated by TWU and UDC working in cooperation with the local community. Particular emphasis will also need to be placed on encouraging occupants of new dwellings to retain their water efficient fittings, as there is a risk that occupants may revert back to higher usage fittings due to consumer preference.

Combining the demand predictions from existing and new dwellings produces an estimation of total domestic demand within the District. Figure 6-16 below shows the total domestic demand predictions for the three scenarios, with results from all four development options displayed. The 2008/09 demand is also shown as a constant throughout the study timeframe, to assess if water neutrality for the residential developments can be achieved.

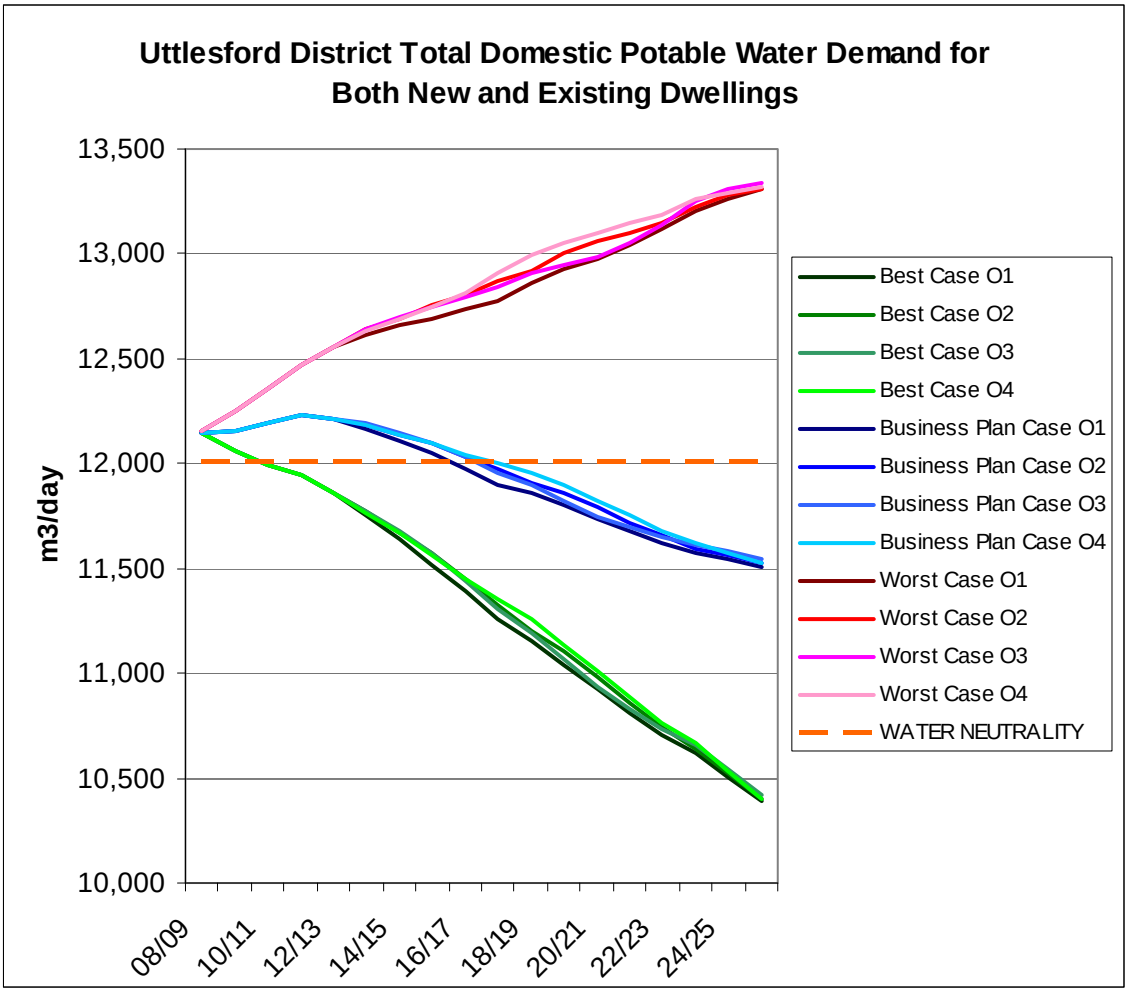

Figure 6-16 Prediction of Total Demand from all Dwellings, by Scenario and Option

As Figure 6-16 demonstrates, if PCC rates in new dwellings follow the implementation targets for the CSH (which UDC are proposing to require of developers) and the average PCC of the existing dwellings falls in line with VWC predictions, then **water neutrality can be achieved** for domestic development across the District by approximately 2017/18 (dependant on development Option). At its peak, in this Business Plan Case, total domestic demand across the District is predicted to increase on 2008/09 levels by approximately 1.8%, before the reducing demand from the large proportion of existing properties results in total demand to decreasing.

This reinforces the message from VWC in the above Section; that sufficient potable water can be supplied to accommodate the proposed development. The only major constraint to the potential development sites, regarding the supply of potable water, will therefore be from capacity limitations in the localised supply network assuming that the planned efficiency measure can be met.

If UDC were also able to reduce the PCC of the population in the estimated 2,880 council (or housing association) managed properties from the VWC estimated average to the Defra aspirational target of 130 l/p/d, then the reduction in demand would be enough to supply around 950* new dwellings at CSH Level 3. It may be possible to achieve this, possibly in cooperation

* It must be noted that this is an estimation based on 2008/09 average occupancy rates and PCC.

with VWC, through the retrofitting of water efficient fittings, increased consumer education, financial incentives and the provision of consumption reducing devices, such as shower timers and aerating tap inserts.

The above results rely on the predicted decreases in occupancy rates and PCC both being realised. Figure 6-17 below illustrates the sensitivity of these predictions to changes in occupancy rate. In this figure, occupancy rates across the District remain at the 2008/09 level for the study timeframe.

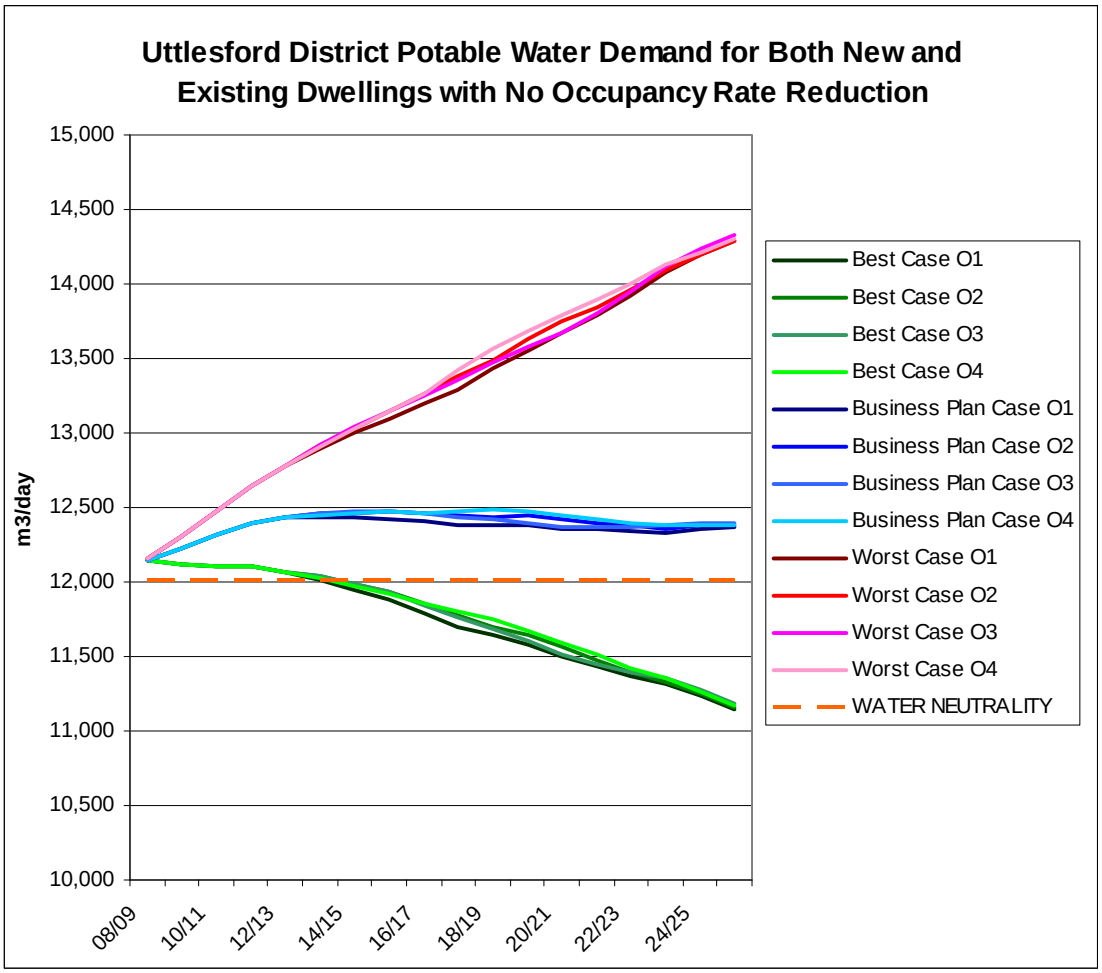

Figure 6-17 Prediction of Total Demand from all Dwellings with no decrease in Occupancy

If occupancy rates did not decrease as predicted, and remained at 2008/09 levels, the population of the District, following the achievement of the RSS development targets, would be approximately 7% higher than the initial ONS predictions. As Figure 6-17 illustrates, this would result in water neutrality not being achieved in the Business Plan Scenario (in contrast to Figure 6-16), and total domestic demand peaking at an approximate **4% increase** on 2008/09 levels.

Both figures highlight the importance of achieving the PCC values estimated by VWC and specified for new dwellings by UDC. Rigorous specification through the planning process, and monitoring of the water usage of new developments post construction, will be required to ensure these targets are achieved. If average PCC in existing dwellings remains constant from 2008/09, and new dwellings only achieve 125 l/p/d, total domestic demand by 2026 could increase by 11%, or even 19%, on 2008/09 levels, dependant on whether occupancy rates decrease or not. An increase in demand such as this, when coupled with the risk of decreasing summer river flows due to climate change, and possible sustainability reductions that may be

applied to VWC abstractions in the future, would significantly increase the requirement to source and import more expensive supplies of water from further afield to supply the District.

Table 6-7 below highlights the reductions in PCC that would be required by the residents in the existing dwellings in the District to work towards various percentage levels of water neutrality to accommodate the proposed growth.

PCC Reduction Required in Existing Dwellings (l/p/day)

% towards Water Neutrality	Business Plan Case	Worst Case
25%	6	8
50%	12	15
75%	18	23
100%	24	31

Table 6-7 Reductions required in existing dwelling PCC to achieve water neutrality

It must be noted that this assumes PCC in the new dwellings will remain at the levels agreed at the design stage. Any reversion to higher levels of PCC by the occupants of these new dwellings will make the target of water neutrality harder to achieve for the District.

6.8 Constraints and costs

As the majority of the extension/ intensification sites needed to meet the RSS targets are in the market towns or key service centres, VWC predict **no major constraints** to supplying these sites with potable water, providing the EA do not enforce further sustainability reductions in the Northern WRZ. Similar to the village scale development, any upgrades to the existing supply network required in these locations are likely to be funded from the usual water company investment process and developer requisitions, as described in Section 2.3.

On a localised level, whilst the existing network can be adapted (with some reinforcement) to transfer water from the trunk mains to supply the village scale development in the more rural locations, it would be preferable for these locations to continue to be served primarily by boreholes, for the customer preference reason described previously. This means that any of the potential new large settlements will require to be served by direct extensions to the trunk network, as there is unlikely to be adequate network capacity or water resources in the rural locations to accommodate this scale of development.

For this reason, whilst VWC will be able to supply new settlements at Boxted Wood/ Andrewsfield and Great Chesterford with potable water via extensions to the trunk main network, these sites will necessitate the creation of significantly more extensive, and costly, infrastructure than the other potential locations. The associated costs, in terms of both capital investment, disruption during construction, lead time and operating costs, will be higher. Table 6-8 below highlights the major constraints to the construction of such infrastructure, indicating that Easton Park and Elsenham locations will be the least constrained by water supply considerations.

Potential New Settlement	Linear Distance from VWC Network	Main road crossing	River Crossing
Boxted Wood/ Andrewsfield	8 km around Great Dunmow, or 13 km from reservoir	N/A	Chelmer, Stebbing Brook
Chelmer Mead	5 km around Great Dunmow, or 11 km from reservoir	A120	Chelmer
Easton Park	1.5 km	N/A	N/A
Elsenham	1.5 km	N/A	Stansted Brook
Great Chesterford	6.5 km	M11	Cam

Table 6-8 High-level summary of water supply constraints for the new settlement locations

The potential new settlements at Boxted Wood/ Andrewsfield and Great Chesterford are relatively close to the potable water operational boundary between AWS and VWC, and Cambridge Water and VWC. It may therefore be possible for these settlements to be supplied with potable water by other water companies. This would be subject to the negotiations between the water companies, UDC and developers, and depend upon available resources and capacity of existing infrastructure. Further investigation of this issue should be investigated in the WCS that accompany the new settlement proposals.

6.9 Issues for next stage

The following issues should be considered as part of a Detailed WCS:

- Approximate costs and timing (including site phasing if applicable) associated with the key supply network upgrades for the new settlement options or other development option preferred by UDC;
- Typical costs for implementing water efficiency measures; and
- Development control and enforcement guidance for UDC and the water companies.

7 Flood risk management

7.1 Existing situation

The sources of flood risk within Uttlesford District have been identified as:

- Fluvial flooding – due to watercourses spilling over their banks into the floodplain;
- Surface water flooding – due to the pooling and flow of surface runoff during storm events;
- Groundwater flooding – due to the level of the groundwater in an aquifer exceeding ground level; and
- Sewer flooding – backing up and surcharging of wastewater in the sewerage network due to either maintenance issues or capacity being exceeded.

The District contains no formal flood defences (i.e. a flood defence maintained and operated by the EA). There are a number of weirs, sluices and embankments maintained by private landowners, which contribute to the management of water levels and may serve as flood defences. However, these structures can sometimes have negative implications on local flood risk and biodiversity if not managed sympathetically.

The responsibility of managing channel sides (both natural and modified), bridges and culverts is spread within the District between the EA, UDC and private riparian landowners. The designated main rivers (see Figure 2-3) are the responsibility of the riparian owners, although the EA have powers that allow them to carry out maintenance work in these locations.

The other ordinary watercourses are the responsibility of UDC and other riparian landowners. UDC has powers as the operating authority to require maintenance be carried out on ordinary watercourses belonging to other riparian landowners.

7.1.1 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMP) have been developed by the EA to understand flood risk within a river catchment, and recommended the best way of managing this risk over the next 50 to 100 years.

Uttlesford District falls within three CFMP areas:

- North Essex;
- Thames; and
- Great Ouse.

The CFMPs underwent a period of consultation in 2006/07, and the final results of this process are yet to be published. However, the EA have indicated that the resulting policies and message, whilst still subject to change, are likely to be similar to those contained within the consultation documents.

A review of the CFMP consultation documents highlights that the following flood risk management strategies will be adopted by the EA in the Uttlesford District:

- Maintain and upgrade existing flood defences;
- Maintain and improve flood warning system; and

- Create wetlands, as natural flood storage areas, wherever feasible.

More information regarding the CFMP consultation documents is included in Appendix E.

7.1.2 The Pitt Review

Following the floods of summer 2007, an independent comprehensive review was published by Sir Michael Pitt, entitled 'Learning Lessons from the 2007 Floods.' This review contained 92 recommendations to the Government, Local Authorities and others. In December 2008, Defra published the UK Governments response[23] to the Pitt review.

Within this response, it is proposed that Local Authorities such as UDC or Essex County Council will be taking on a local leadership role, including responsibility for local flood risk management including surface water risk.

Local Authorities will be required to co-ordinate and lead local flood management activity, they will know where all local flood risk and drainage assets are and who owns them, and they will be able to assess the needs and desires of local communities in the area. There will be clear local responsibilities and people will know to approach the Council for advice if there are problems. This will be within the context of the additional Strategic Overview role provided by the EA, which will also retain its responsibility for flooding from main rivers and the sea.

The Government intends that Local Authorities should be responsible for adopting and maintaining new and redeveloped sustainable drainage systems on highways and the public realm, so as to increase their uptake and effectiveness.

Full implementation will require appropriate resource and legislative backing from the Floods and Water Bill, the draft of which is presently open for consultation.

Flood risk management activity by Local Authorities is supported by the Revenue Support Grant. The need to spend more in this area was foreseen by the Government, and additional funding was provided in the local government settlement for 2008–09 to 2010–11. Further Defra funding may be made available in response to the Pitt review.

7.1.3 Strategic Flood Risk Assessment

When planning and designing new development, UDC must ensure that the development will not add to and should, where practicable, reduce flood risk. PPS25 should be adhered to in order that new development is steered to Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, decision-makers identifying locations for development and infrastructure, allocating land in spatial plans or determining applications for development at any particular location should consider sites in Flood Zone 2. This decision should take into account the flood risk vulnerability of land uses and apply the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3, again taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

In 2008 UDC completed a Strategic Flood Risk Assessment[24] (SFRA) for the District, to be used as a planning tool to aid in the location of future development away from areas of high flood risk, therefore allowing UDC to comply with PPS25 (see Appendix A). The following key issues are discussed within the SFRA:

- The District is prone to localised flooding (mainly from fluvial and surface water sources) within Great Dunmow, Saffron Walden, Stansted Mountfitchet, Great Hallingbury, Great

Canfield, Ashdon, Berden, Manuden, Great Chesterford, Newport and Hatfield Broad Oak;

- A fluvial flood event in June 2007 in Ashdon (UDC have since confirmed that a similar fluvial flood event took place here as recently as February 2009);
- The actual depth of the water table compared to the ground surface, and the clay that overlays the majority of the underlying chalk aquifer (see Section 6.2), results in a relatively low risk of groundwater flooding, although this has occurred historically at Hatfield Broad Oak and Debden;
- Sewer flooding has affected properties within the District on six occasions in the last ten years: There are four sewer flooding records in the Saffron Walden area, one in the Bishops Stortford area and one in the Manuden area (based on Postcode);
- Concerns have been raised over the condition of culverts in Saffron Walden, deterioration of the structures can decrease capacity and increase flood risk;
- WwTW at Little Hallingbury (FZ3b)*, Felsted (FZ3b), Great Dunmow (FZ3b), Saffron Walden (FZ3a) and Clavering (FZ3a), and the terminal pumping station at Bishops Stortford WwTW are at risk of flooding, and Newport WwTW has previously been affected;
- It should be possible to direct all future development in the three major urban settlements into areas of FZ1; and
- The geological conditions will impede shallow infiltration based SUDS techniques in the majority of the District, although localised infiltration tests would be advised, as there are areas of freely draining soil around the river corridors.

A list of historical flood events within the District is contained within the SFRA.

The SFRA also contains surface water modelling results for the settlements of Great Dunmow, Saffron Walden and Stansted Mountfitchet. This has been modelled for a 100 year event, minus the capacity of the piped drainage system, estimated at a 10 year event, to find surface water flow routes and areas where water may pool. The SFRA recommends that any development across an area where surface water flows or ponds have been identified should have a Drainage Impact Assessment undertaken through the normal planning process.

Following review of the SFRA, any major constraints to the proposed development have been identified in Section 7.3.

7.2 Strategic objectives

UDC should continue to refer to their 2008 SFRA and other strategies such as this WCS when shaping development policies and documents, and when determining planning permissions.

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* Definition of Flood Zones (FZ) –

FZ1: Less than a 1 in 1000 annual probability of flooding in any year

FZ2: Between a 1 in 1000 and 1 in 100 annual probability of flooding in any year

FZ3a: 1 in 100 or greater annual probability of flooding in any year

FZ3b: Functional Floodplain, equivalent to a 1 in 20 annual probability of flooding in any year

Following review of the above policies and reports, the following strategic objectives can be highlighted with regards to flood risk management in the District:

- UDC should require developers to build resilience into a sites design (e.g. flood-proofing, raised floor levels) where applicable;
- Suitable Sustainable Drainage (see next Section) should be included on all new developments of appropriate size and ground condition;
- Surface water run-off rate post development should be managed (through the use of SUDS) to be the same, or less, as the corresponding greenfield run-off rate prior to development;
- Foul water should be separated from surface water runoff for both greenfield development and brownfield development/ refurbishment to reduce storm flows in foul sewers;
- The potential increase in flood risk, due to increased effluent discharges from expanded WwTW, should be assessed and managed accordingly by the EA and AWS/ TWU;
- Existing undeveloped river corridors, particularly the Greenfield functional floodplain, should be preserved from further development to help attenuate flood waters;
- New developments should be designed to preserve and improve the conveyance and storage of fluvial and surface floodwater;
- UDC and developers should work in partnership with the EA to look at opportunities for river restoration/ enhancement as part of developments, and to make space for water to accommodate climate change impacts; and
- A Surface Water Management Plan should be undertaken for the settlements within Uttlesford, as the District is prone to localised flooding and is experiencing increased flood risk due to the deterioration of existing structures in some locations.

7.2.1 Sustainable Drainage Systems (SUDS)

New development can affect the quantity and quality of the receiving water cycle in several ways by:

- Altering the natural surface water runoff rate and quality;
- Passing more wastewater to the treatment works and hence discharging more treated effluent to receiving watercourses, and perhaps more untreated effluent during storm conditions;
- Discharging un-attenuated or poorly attenuated storm water runoff into storm sewers or receiving watercourses; and
- Discharging storm flows into existing network with the associated risk of Combined Sewer Overflows (CSOs) on existing sewers.

The sustainable management of surface water will therefore ensure that:

- The risk of surface water flooding is reduced through the attenuation or infiltration of surface water;
- The quality of the runoff is improved, to lessen the effect of poor quality surface water draining to watercourses; and
- The environmental biodiversity of the development is increased through the allocation of more green areas and techniques such as reed beds and wetlands.

Fully developed SUDS schemes should ensure that all three of these elements are considered thoroughly during the early stages of design.

The EA currently suggest that the SUDS hierarchy is adopted when considering SUDS techniques for new development, showing the preferred order in which different SUDS techniques should be considered for a site. SUDS techniques at the top of the hierarchy are preferable for their potential ecological and water quality benefits, as illustrated by Figure 7-18.

	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
Most Sustainable	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	✓		

Figure 7-18 SUDS Hierarchy[25]

It is the responsibility of Local Authorities to promote the use of SUDS for the management of surface water runoff. The successful implementation of SUDS requires the early consideration of a wide range of issues surrounding their management, long term adoption and maintenance. The designers and stakeholders should take every available chance to discuss SUDS early in the development phase. It is essential that responsibility for future adoption, management and maintenance is established in the use of any SUDS in any development in order to ensure that it is successful and worthwhile. This must be an early consideration in the planning process for each potential development site.

The common method of developing SUDS schemes is through the concept of a 'management train'. A conceptualisation of this can be seen in Figure 7-19. It shows that a combination of individual SUDS elements is required to contribute to the overall effectiveness of the SUDS scheme. Single elements such as a soak away or infiltration basin may not be suitable in a number of circumstances due to, for example, the potential to contaminate groundwater sources.

The Interim Code of Practice[26] for SUDS, which was published by CIRIA in 2004, sets out the management and adoption of SUDS elements within the context of urban planning policy. CIRIA have also produced three model agreements[27] that have been designed as a binding agreement between the organisation involved in developing the SUDS scheme, the local authority and the Water Company. Defra have recently carried out a consultation on the future management of surface water as a follow on leading to the publication of Future Water in 2008.

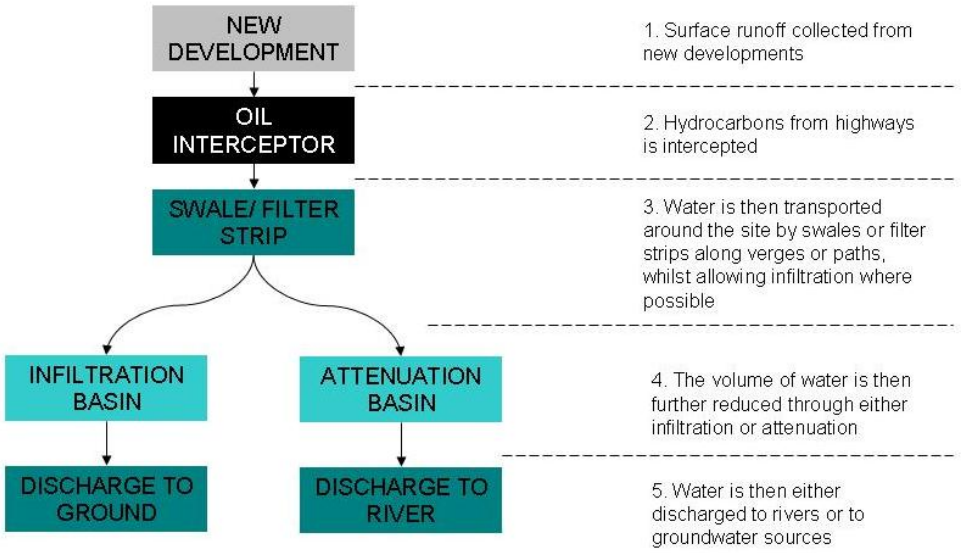

Figure 7-19 Example of SUDS management train

SUDS elements can also be retrofitted to existing developments or to the current urban fabric. An example is the use of rainwater harvesting techniques such as a simple garden water butt. A water butt collects a proportion of the rainwater that falls onto the roof of a property, which subsequently can be used, for example, to water the garden. Although legislation cannot oblige residents to fit rainwater harvesting solutions to their property, the promotion of these elements through guidance by UDC and the water companies is vital to increase the uptake within the community.

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. UDC should encourage developers to incorporate SUDS from the higher levels of the SUDS hierarchy (Figure 7-18) into development sites wherever possible.

7.3 Constraints, solutions and costs

7.3.1 Constraints

Following a review of the SFRA, the following key constraints to the potential large development sites have been identified. Localised sewer flooding is not included, as the postcode area scale resolution of the SFRA results does not provide the detail required to assess individual sites in a meaningful way. However, the possible impact of the development on the sewerage network, which in turn may affect the risk of sewer flooding, is discussed further in Section 8.3.

Development Location	Flood Risk Constraint
Great Dunmow: Woodlands Park (existing allocation)	Fluvial: Great Dunmow WwTW is in FZ3b Surface Water: Surface water flow paths of up to 0.2 m depth are predicted within site. A ponding depth of more than 0.6 m is predicted in the northern area of the site.
Great Dunmow: south of town (new extension)	Fluvial: Great Dunmow WwTW is in FZ3b Surface Water: Main areas of surface water flow are around Ash Grove tributary (River Chelmer), with depths mostly less than 0.6 m.
Saffron Walden: northeast	Fluvial: Saffron Walden WwTW is in FZ3a. Surface Water: Predicted flow paths coincide with Kings Slade tributaries, with depths of over 0.6 m in places. Blockage of the Kings Slade culvert could cause the extremities of the site to flood.
Saffron Walden: East of Thaxted Road (new extension)	Fluvial: Saffron Walden WwTW is in FZ3a. Surface Water: Predicted flow paths coincide with Thaxted Road Slade tributaries, with depths of over up to 0.5 m in places. Blockage of the Thaxted Road Slade culvert could cause the extremities of the site to flood.
Saffron Walden: Other sites	Allocated site at Jossaumes may need the Exception Test to justify its location including the application of the Sequential Test locally within the site boundary, as it is in FZ2/ 3a
Stansted Mountfitchet: Rochford Nurseries (existing allocation)	Surface Water: Predicted flow paths along Manor and Stoney Common Road, from the high school to Stansted Brook, with depths of more than 0.6 m in places. Small areas of ponding and flow with depths of up to 0.1 m exist throughout the site.
Takeley/Little Canfield (new extension)	Fluvial: Bishops Stortford WwTW (serves Priors Green and Canfield End) Terminal wastewater pumping station may be at risk of flooding.
Newport (new extension)	Fluvial: Terminal wastewater pumping station is in FZ3b
Elsenham (new extension/ settlement)	Fluvial: Historic flooding recorded on Old Mead Road from a tributary of the River Cam Surface Water: Risk of Stansted Brook culvert blockage under railway
Great Chesterford: New NE Settlement	Fluvial: An area of FZ3b around 70 m wide runs through the south of the site. Development within the floodplain should be avoided in accordance with PPS25
Chelmer Mead (new settlement)	Fluvial: Felsted WwTW is in FZ3b

Table 7-9 SFRA constraints relevant to potential UDC development in terms of direct flood risk to sites, or related WwTW infrastructure

All new development in the smaller rural areas should be located in FZ1 according to PPS25 guidance, by fully applying the Sequential Test whilst considering all forms of flooding. UDC should utilise the mapping contained within the SFRA to assess the flood risk of any development sites that come forwards through site allocations processes, or development

elsewhere. In addition, UDC should take account of the historic flooding events listed within the SFRA, as some of the previous events appear to have been in areas now listed as FZ1.

Surface water management is also a key consideration for all new developments, and may significantly constrain the viability and design of some of these sites. Further investigation through site specific Flood Risk Assessments will be required. Section 7.3.2 provides some guidance on the use of SUDS within Uttlesford District.

Any development that causes a WwTW to require an increased volumetric discharge consent, may subsequently increase fluvial flood risk on the watercourse downstream of the WwTW discharge point. This is discussed further in Section 8.3.3.

7.3.2 Suitability of SUDS

Following the requirements of PPS25, and best practice advocated by the WCS Steering Group, it is recommended that the surface water runoff from new and refurbished sites be controlled to be equal to the greenfield runoff rate prior to development. Attenuation facilities will be required to store the critical storm on site. For sites 1 ha and over, discussions with the local EA office are recommended, to ensure that they are designed to the correct criteria, unless another drainage body has jurisdiction.

As indicated in Figure 7-18, basins, ponds and wetlands are considered the most sustainable SUDS techniques (aside from living roofs), due to their inherent wildlife benefits. Wetland habitat can play an important role in mitigating the effects of climate change, including the management of floodwater and the adverse effects of low rainfall. Every opportunity should be taken by UDC and developers to incorporate techniques such as these into the potential development sites. However, the size of land needed, and in some cases safety considerations, can preclude such techniques on some sites.

Where the use of the more sustainable SUDS is constrained, underground storage and infiltration techniques may be the only option available to developers, although it must be noted that “tanked” systems are regarded as the least sustainable option.

Figure 7-20 illustrates the EA Source Protection Zones* (SPZ) in the District. When coupled with the GWV zones identified earlier in the report, and the soil permeability figures in the Uttlesford SFRA, a high-level strategic overview of the suitability, or not, of the development locations to utilise certain infiltration based SUDS techniques can be formed.

* See Technical Glossary for explanation of SPZ

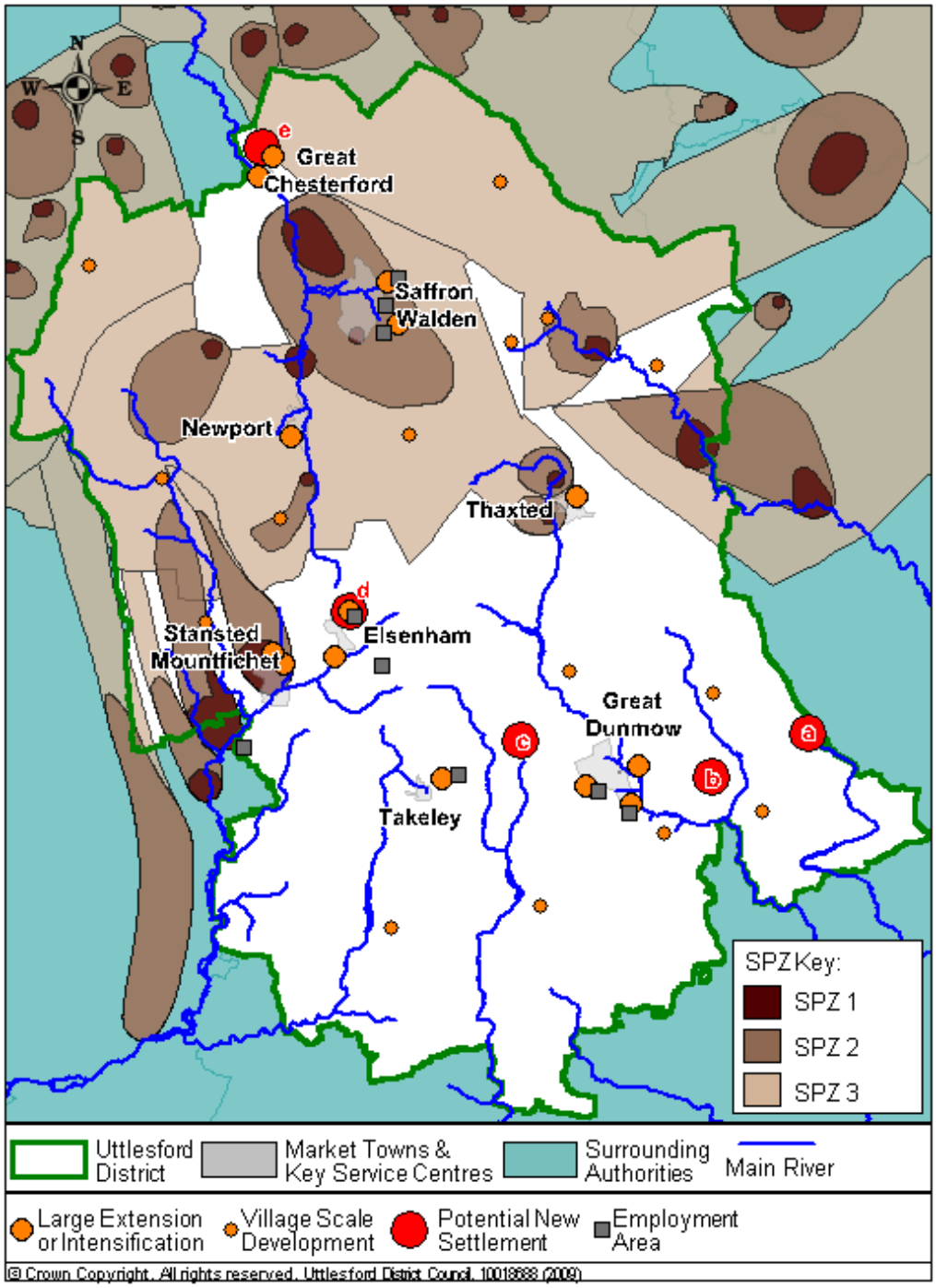

Figure 7-20 SPZ to show where certain infiltration based SUDS may not be appropriate without further investigation

New Settlements: a = Boxted Wood/ Andrewsfield, b = Chelmer Mead, c = Easton Park, d = Elsenham and e = Great Chesterford

The low permeability of the Boulder Clay, which overlies the majority of the District, may preclude the use of shallow infiltration SUDS techniques. However, should localised tests suggest that there is suitable permeability for a given technique, developers and UDC should consult the EA to ensure that any SUDS design takes account of any SPZ and other areas where the aquifers may be vulnerable, and ensure that the risk of pollution is adequately controlled.

Table 7-10 below describes how these factors may constrain the choice of infiltration SUDS at the development sites. It must be noted that there is still a need to undertake localised infiltration tests and ground investigations to confirm these constraints. All new development sites of appropriate size should aim to employ SUDS techniques according to the SUDS hierarchy and SUDS management train, as detailed in Figure 7-18 and Figure 7-19 respectively.

Note that not all of the sites are shown, as there is some overlap between the new settlement, extension/ intensification and employment area locations.

	Development Site	Soil Permeability*	SPZ	GWV – aquifer type (vulnerability according to EA) *see Section 6.2*
New Settlement	Boxted Wood/ Andrewsfield	Slowly Permeable	N/A	Minor (high)
	Chelmer Mead	Well Drained	N/A	N/A
	Easton Park	Slowly Permeable	N/A	Minor (intermediate)
	Elsenham	Slowly Permeable	N/A	Major and Minor (intermediate)
	Great Chesterford	Well Drained	N/A	Major (high/ intermediate)
Market Town	Great Dunmow	Well Drained	N/A	Minor (intermediate)
	Saffron Walden (sites to the east)	Slowly Permeable	SPZ 2	Major (high)
Key Service Centre	Stansted Mountfitchet (sites to the north)	Slowly Permeable	SPZ 1	Minor (high/ intermediate)
	Newport	Well Drained	SPZ 3	Major (intermediate)
	Takeley	Slowly Permeable	N/A	N/A
	Thaxted (sites to the east)	Slowly Permeable	N/A	N/A
Village	Ashdon	Well Drained	SPZ 3	Major (intermediate)
	Barnston	Well Drained	N/A	N/A
	Chrishall	Slowly Permeable	SPZ 3	Major (intermediate)
	Clavering	Slowly Permeable	SPZ 3	Major (intermediate)
	Debden	Slowly Permeable	SPZ 3	Major (intermediate)
	Felsted	Slowly Permeable	N/A	N/A
	Great Easton	Well Drained	N/A	N/A
	Great Sampford	Slowly Permeable	N/A	Major (intermediate)
	Hatfield Broad Oak	Well Drained	N/A	N/A
	High Roding	Well Drained	N/A	N/A
	Manuden	Well Drained	SPZ 2	Major (intermediate)
	Quendon and Rickling	Well Drained	SPZ 2	Major (intermediate)
	Radwinter	Well Drained	SPZ 3	Major (intermediate)
	Stebbing	Slowly Permeable	N/A	N/A
	Wimbish	Slowly Permeable	N/A	Major (intermediate)
	Employment Area			
	Bishops Stortford northern edge	Well Drained	N/A	Minor (intermediate)
	Elsenham Gaunts End	Well Drained	N/A	N/A

Table 7-10 Constraints to infiltrations SUDS

* Based on Figure 5, Uttlesford District SFRA, 2008

The table shows that, should wetlands and basins not be feasible, (for example due to cost, safety or space constraints), SUDS based on infiltration techniques would be most suitable at the following locations, as there are no obvious constraints to such techniques:

- Barnston;
- Chelmer Mead;
- Great Easton;
- Hatfield Broad Oak;
- High Roding; and
- The extension to the Elsenham Industrial Park at Gaunts End.

Development sites in the other potential locations may only be suitable for the less sustainable solutions from the SUDS EA hierarchy, unless localised tests can provide evidence to the contrary.

The above results are based on an assessment of mapping which if at a district wide scale. As such, localised testing, and discussions with the EA regarding the suitability of SUDS techniques, is recommended for every site, in conjunction with a Flood Risk Assessment where required by PPS25.

7.4 Issues for next stages

Achieving the most sustainable attenuation, treatment and discharge technique for each of the potential development sites requires detailed knowledge of the site location, and a prediction of site layout and phasing. At this stage in UDC's LDF process, uncertainty over the final direction of the Core Strategy prevents this data being readily available for the development of the WCS.

A Detailed WCS, completed alongside the development of the Core Strategy Final Submission, and other Development Plan Documents, such as Site Allocation DPDs and Supplementary Planning Policy Documents should aim to identify flood risk management solutions that not only align with the themes contained within PPS25, but also promote and enhance biodiversity. The results of such a study may aid UDC in deciding upon the financial contributions required from developers, either though the emerging Community Infrastructure Levy, or the existing Section 106 regulations.

However, detailed design of site-specific flood risk management solutions should form part of the Flood Risk Assessments (required for PPS25) for the potential sites, through the normal planning application process.

Further investigation will be required to consider the viability of strategic flood risk mitigation measures to address any increases in flood risk due to increased effluent discharge from WwTW due to the proposed development, following the confirmation of UDC's preferred development option (based on this Outline WCS and other elements of the LDF evidence base).

8 Wastewater treatment and sewerage network

8.1 Existing situation

As illustrated in Figure 8-21, there are 27 Wastewater Treatment Works (WwTW) in the District, 18 operated by AWS and nine by TWU.

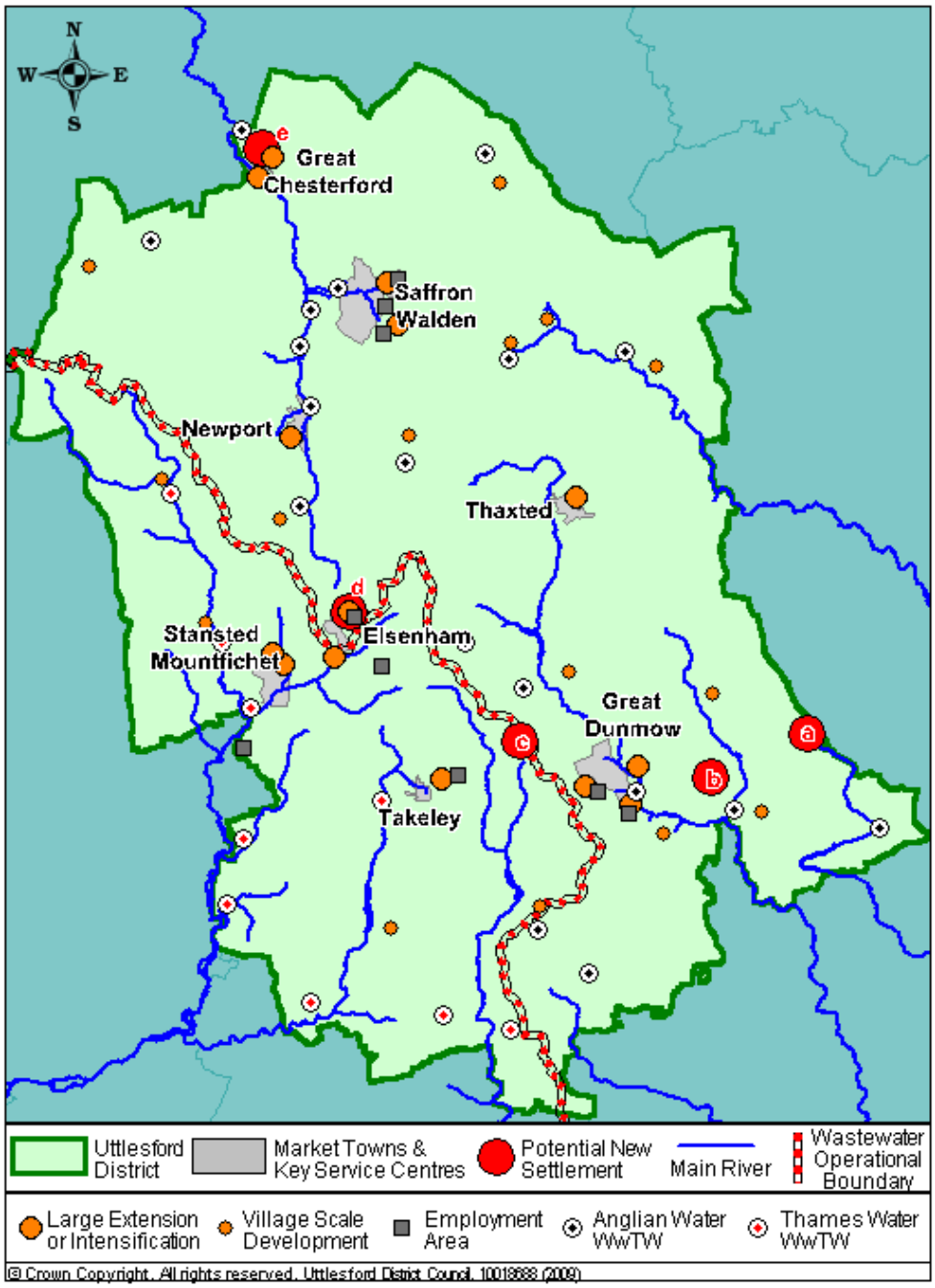

Figure 8-21 WwTW in the District

New Settlements: a = Boxted Wood/ Andrewsfield, b = Chelmer Mead, c = Easton Park, d = Elsenham and e = Great Chesterford

Appendix F shows which WwTW catchment areas the potential development locations fall under, and to which watercourses the treated effluent is discharged.

To reduce the risk of storm flows causing surcharging in sewers and overloading at WwTW, some combined sewer systems incorporate a CSO, which discharges untreated (usually screened) storm sewage into a watercourse during storm events. Whilst this spilled sewage is heavily diluted by excess storm water it can still be detrimental to the water quality and flood risk of the receiving watercourse.

The data sets and comments provided by AWS and TWU suggests that the majority of the networks in the study area are separate systems for wastewater and storm water; however there are CSOs in Saffron Walden, Great Easton, Newport and Thaxted. New development that connects into combined sewers can decrease the available network capacity and also increase the risk of overflows occurring during storm events. Where the potential growth represents a significant increase (more than 10%) in the population served by a sewerage network and CSO, a detailed assessment will be required to be undertaken by AWS in conjunction with the EA. In this respect, it is likely that such as assessment would be required for Saffron Walden.

Assessing the likely impact of the development options on the CSOs is prohibited by the uncertainty inherent within this stage of the WCS in terms of final preferred development locations, model availability and time and budget constraints. Detailed models of the sewerage networks, where they are available, would need to be interrogated by AWS to identify, and propose solutions to, any problems such as this. A model currently exists for the Saffron Walden sewerage network, and may be of use in the next Stage of the WCS, once development options are more certain, following assessment of the available evidence base by UDC.

8.2 Environmental capacity

8.2.1 Water Framework Directive

Water quality has always been an important consideration; however, more stringent standards on surface and groundwater quality (and hence discharges into rivers from WwTW) than present are likely to be applied by the EA, as the Water Framework Directive (WFD) is gradually implemented at regional and local levels.

The WFD sets out a strategy for **protecting and enhancing** the quality of groundwater, rivers, lakes, estuaries and coasts. It introduces the integrated approach to river basin management that the EA is currently applying to the 11 River Basin Districts in England and Wales; identifying and characterising the water bodies and protected areas in each district, and the pressures and risks upon them.

The main objective of the WFD is to bring all water bodies up to ‘good status’ by 2015. The actual parameters for the assessment of a river have been set by the UK Technical Advisory Group (UK TAG)[28]. A requirement of the WFD is that a **no deterioration** policy is adopted for the WFD parameters, which could have potential implications for future developments.

A number of the watercourses in the District have initially been classified as being Heavily Modified under the WFD. This means that the channel has undergone significant morphological changes. The requirement for Heavily Modified Water Bodies (HMWB) is to reach good ecological potential (GEP) as opposed to ‘good status’.

River Basin Management Plans (RBMP) have been developed by the various regional offices of the Environment Agency and were consulted on from December 2008 until June 2009, and final plans submitted to the Secretary of State for approval in September 2009 ahead of publication

in December 2009. The RBMPs set out a strategy, including a Programme of Measures, for each catchment to comply with the requirements of the WFD. An assessment of the current status of the rivers has be made, showing the rivers and lakes that currently fall below the 'good' status required to meet the WFD. The documents then set out those rivers that should be at 'good' status by 2015 with the remainder being at 'good' status by 2027. As with the CAMS designations, Uttlesford District falls within the Thames and Anglian RBMP areas. Further information on the WFD, the current status, and future targets, of the District's watercourses, and any proposed studies regarding WwTW discharges, is included in Appendix G.

Reviewing the RBMPs reveals that, with the exception of Stebbing Brook, and Wicken Brook (a tributary of the River Cam), all of the main watercourses within the District **cannot currently achieve 'good' status** (or GEP). According to the RBMPs[29], throughout the District the main barriers to achieving 'good' status are:

- Excessive Phosphate concentrations;
- Low Dissolved Oxygen concentrations;
- Low Fish and Invertebrate population levels;
- Unfavourable ratios between nutrient sensitive and nutrient tolerant species of Phytobenthos (microscopic plant life residing on the river bed) ; and
- Failure to adequately mitigate the impacts of modification (which is preventing the majority of the HMWB in the District achieving GEP).

Discharges from WwTW and industry, and surface water runoff (in particular from agricultural areas) can lead to nutrient enrichment, or eutrophication, of the receiving watercourses. High levels of nutrients such as phosphorous or nitrates can encourage excessive algal growth. This can adversely affect the biodiversity of the watercourse, particularly as it decreases the oxygen levels in the water that other life forms depend upon.

The EA recognise that phosphorous removal at all WwTW* is not cost effective and may not be immediately achievable. For this reason WwTW that are negatively impacting conservation sites, or causing watercourses to become evidently eutrophic, will be prioritised for detailed investigation in the period to 2015.

TWU are planning to implement phosphorous removal at Stansted Mountfitchet and Bishops Stortford in AMP 5.

Whilst the EA is the 'competent body' tasked with implementing the WFD in England and Wales, other stakeholders will have an important part to play. The Programmes of Measures included in the RBMPs (currently out for consultation) will contain integrated solutions requiring input and action from Natural England, the water companies, UDC and developers.

Liaison panels have been setup within each of the River Basin areas, and include representatives from water companies, agriculture and industry, and non-government organisations amongst others.

* WwTW that serve a PE of more than 10,000 are required to employ phosphorous removal processes under the Urban Wastewater Treatment Directive

8.2.2 Diffuse pollution

Of particular importance will be dealing with pollution of watercourses other than WwTW discharges. Policies and practices must also be developed to deal with diffuse pollution from urban and rural surface runoff. Ensuring that all new development includes features such as SUDS to attenuate (and possibly treat) such runoff can help to improve water quality by preventing pollutants being transported from highways, hard standing and farmland into rivers.

With regard to new urban developments this source of pollution is not hugely relevant, but the high levels of agricultural activity within the District may result in point source pollution from farmyard runoff, and diffuse pollution following the application of slurry or other fertilizers to land. By being aware of this it may be possible to incorporate possible solutions into UDC's plans and policies. Reducing diffuse pollution from agriculture is being promoted by Defra through the Catchment Sensitive Farming Initiative[30]. Defra is already delivering guidance to 50 priority catchments, and will be imposing regulation in the future. This includes:

- Managing the use of fertilisers, manures and pesticides;
- Promoting good soil structure and rain infiltration to avoid run-off and erosion;
- Protecting watercourses from faecal contamination, sedimentation and pesticides;
- Reducing stocking density;
- Managing stock on farms to avoid compaction and poaching of land; and
- Separating clean and dirty water on farms.

The Upper Roding catchment is listed as one of these 50 priority catchments. A £5 M/year Capital Grant Scheme (launched in April 2007) is available to farmers in the priority catchments for capital items which address water pollution issues within the catchment.

In areas that are not priority catchments there is much that still can be achieved to address diffuse water pollution from agriculture; guidance on management options and good practice are available from Defra.

Integrated Constructed Wetlands (ICW) can be used to manage diffuse pollution from agriculture. ICW are comprised of a series of shallow lagoons or ponds, with suitable wetland vegetation, which can be used to mix, dilute and balance flows from various sources. Nutrients and other pollutants are removed via natural physical, chemical and biological processes.

ICW can form an important link in any future "green" infrastructure proposals by UDC, and can promote and enhance biodiversity in addition to improving water quality and reducing flood risk. UDC should therefore explore the possibility of constructing ICW on the fringes of urban development areas, to intercept, attenuate and treat runoff from both the urban area and surrounding agricultural land through wider initiatives and strategies.

8.2.3 Sites of environmental importance

The majority of water dependant sites of environmental importance, which may be affected by the potential development, are situated along the **Rivers Cam** and **Stort**. Figure 8-22 and Figure 8-23 below illustrate the Sites of Special Scientific Interest (SSSI), Local Wildlife Sites (LoWS) and UK Biodiversity Action Plan (UKBAP) priority habitats on these rivers that may be influenced by the potential development.

Further information regarding these sites is included in the sections below.

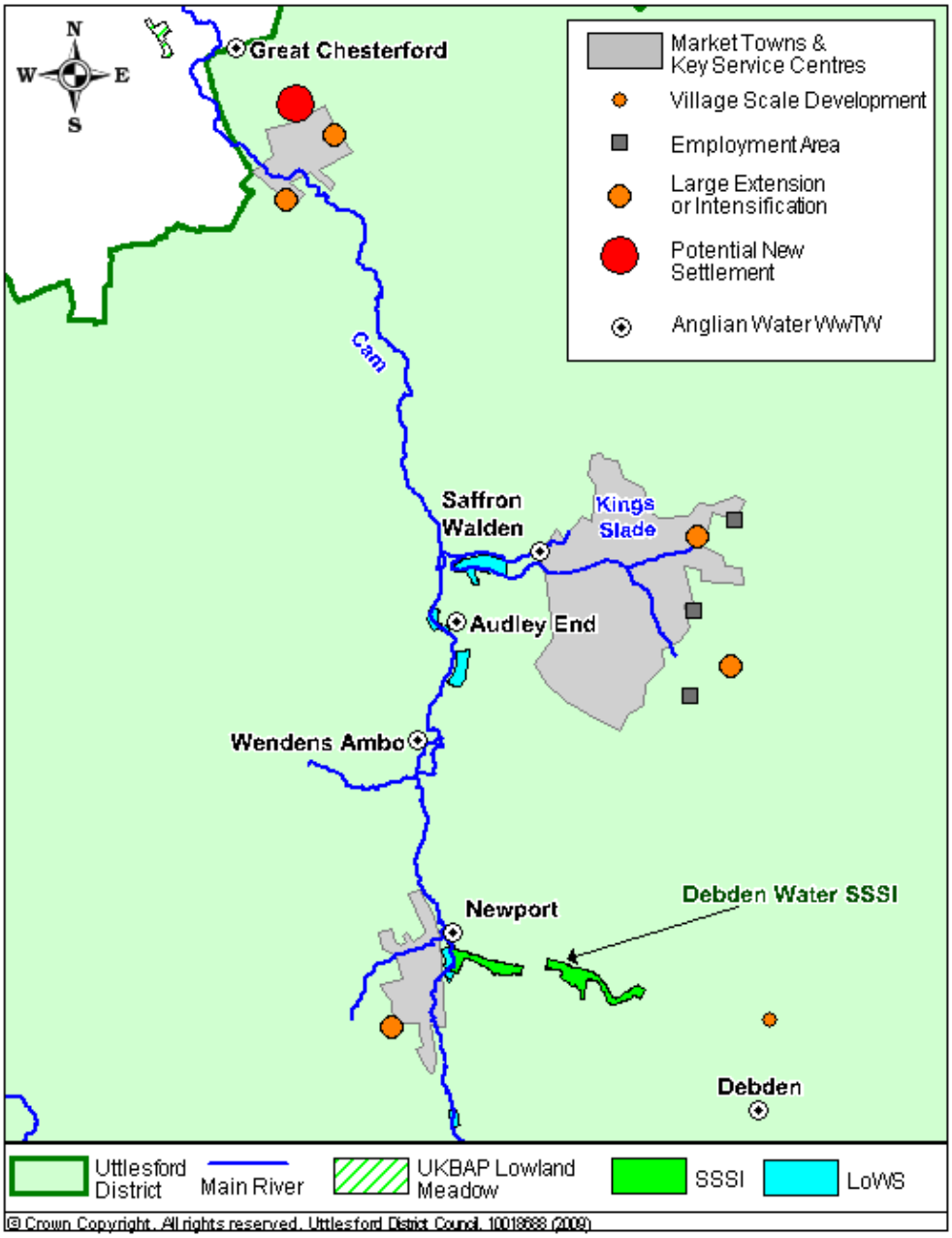

Figure 8-22 Environmentally important sites on the River Cam

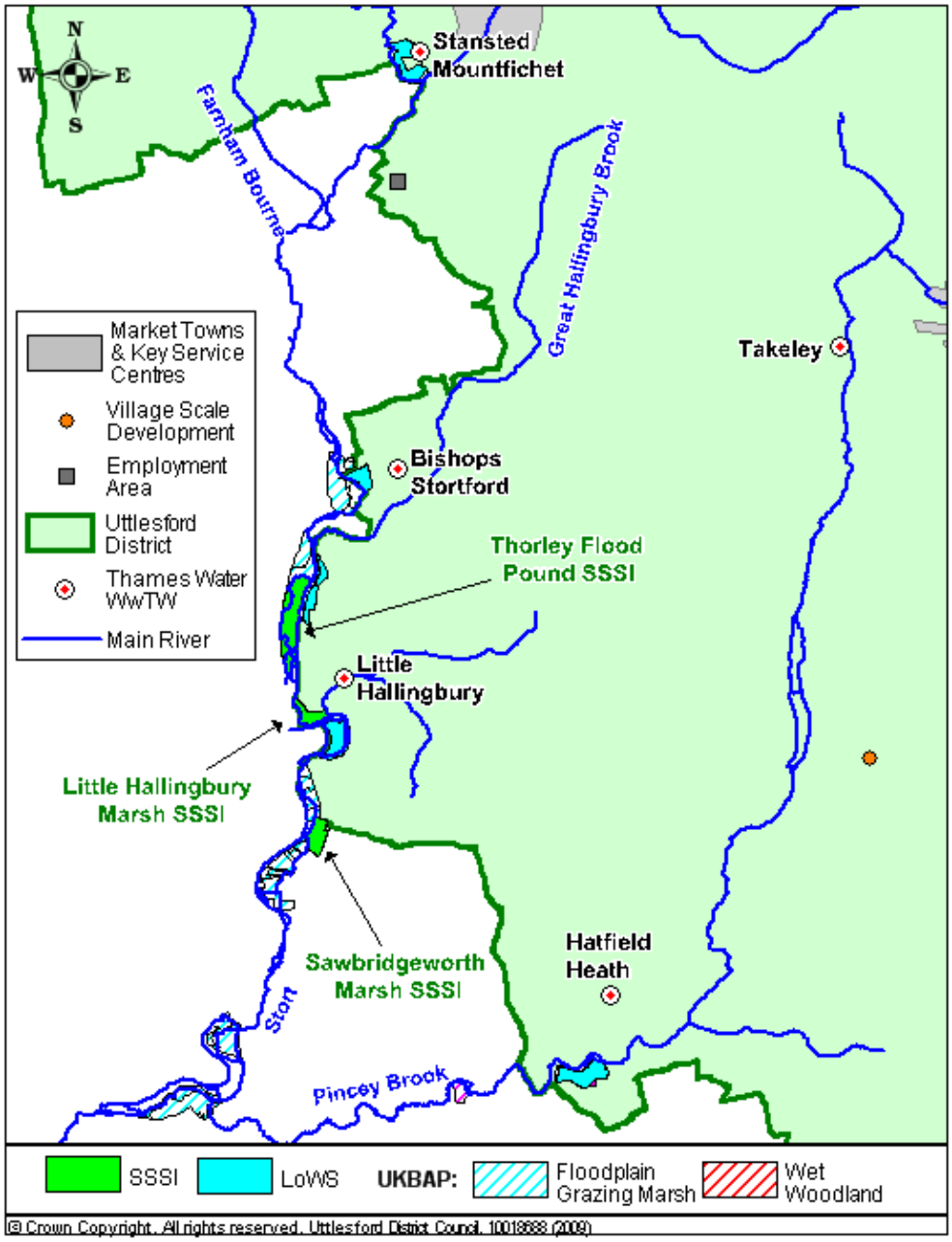

Figure 8-23 Environmentally important sites on the River Stort

Sites of Special Scientific Interest

The condition of any Sites of Special Scientific Interest (SSSI) within the District that are 'water dependant' has been assessed, by reviewing the latest data published by Natural England (NE).

Ashdon Meadows SSSI, upstream of Ashdon village on a tributary of the River Bourn, was in an unfavourable and declining condition in 2001 due to eutrophic groundwater. However, this site is not downstream of any WwTW so is unlikely to be affected by the potential development. It is likely that the water quality issues here are caused by agricultural runoff.

None of the other water dependant SSSI in the District, or those outside the District but immediately downstream of WwTW in the District, are listed by NE as having problems with water quality. However, changes in volumetric discharges from WwTW, coupled with possible

reductions in river flow due to climate change, have the potential to alter the concentration of determinands* in the watercourses, and hence negatively impact upon the SSSI. Variations in river flows, again from changes to WwTW discharges, and the runoff of surface water from new developments, may also be of detriment to the sites. As illustrated in Figure 8-22 and Figure 8-23, the water dependant SSSI where this risk must be mitigated are:

- Debden Water;
- Little Hallingbury Marsh;
- Sawbridgeworth Marsh; and
- Thorley Flood Pound.

Biodiversity Action Plan**

According to the UK Biodiversity Action Plan (UKBAP) Steering Group for Chalk Rivers[31], chalk rivers such as the Rivers Stort and Cam are a precious resource. All chalk rivers are fed from groundwater aquifers, producing clear waters and a generally stable flow and temperature regime. These conditions support a **rich diversity** of invertebrate life and important game fisheries. Also, chalk rivers tend to be associated with a high water table on the floodplain throughout the year and hence the floodplains support a wide diversity of BAP habitats and species. Phosphate pollution, turbidity and protection of water resources from unsustainable abstraction are particular concerns in relation to chalk rivers, and therefore require attention through the WCS development process.

The principle objectives of the UKBAP for chalk rivers, which may influence UDC's planning process, are to:

- Maintain and enhance the characteristic habitats, plants and animals of chalk rivers, including winterbourne stretches; and
- Restore water quality, flows and habitat diversity.

Increases of discharges from WwTW, to either the Rivers Stort or Cam, may be less likely to be permitted by the EA because of the potential conflict with the above objectives.

The UKBAP Steering Group recommends the following actions for chalk stream catchments:

- Identify solutions to unsustainable abstractions;
- More efficient use of water in chalk river catchments including demand management and promotion of efficient practices; and
- Reduce rapid runoff and peak flows, enhance aquifer recharge and restore the natural function of the floodplain.

The other water related UKBAP priority habitats within, and bordering, the District are described in Table 8-11 below.

* See Discharge Consent in Technical Glossary for description of determinands

** See Technical Glossary for explanation of UK BAP

UKBAP Priority Habitat	Location	Reason for Priority	Threats
Wet Woodland	Throughout District	Found on floodplains, hillsides and plateaus, these woodlands support a large number of species of flora and fauna.	Unlikely that development will affect water quality or flow, as these woodlands tend to be upstream of WwTW or main channel of receiving watercourses. However, Pincey Brook does run through two sites downstream of the Hatfield Heath WwTW discharge (see Figure 8-23)
Floodplain Grazing Marsh	River Cam, downstream of Great Chesterford. River Stort, downstream of Bishops Stortford. Pincey Brook	These areas of periodically flooded pasture are rich in plants and invertebrates. They may also support a variety of wading birds. A significant area of Flood Plain Grazing Marsh has just been created on the Pincey Brook upstream of Hatfield Broad Oak (downstream of Takeley)	Any changes in water levels or quality, due to changes in flood management or WwTW discharge variations, may adversely affect these habitats.
Fen	As above	Fens are peatlands which receive water and nutrients from the soil, rock and ground water as well as from rainfall. Fen habitats support a diversity of plant and animal communities.	Variations in groundwater quality, due to the interaction between the chalk streams (which receive WwTW discharges) and the underlying aquifer, may be detrimental to these habitats.
Lowland Meadows	Debden Water, and River Cam Tributary at Ickleton.	These seasonably flooded grasslands support many scarce and declining plant species. Lowland meadows and pastures are important habitats for skylark and a number of other farmland birds	Any changes in water levels or quality, due to changes in flood management or WwTW discharge variations, may adversely affect these habitats.

Table 8-11 UKBAP priority habitats within Uttlesford District

Local Biodiversity Action Plans (LBAP) have also been developed for Hertfordshire and Essex, to identify the presences of UK priority habitats and species and inform relevant policies.

The Essex BAP[32] states that, historically (1996/97), there were **otters** present on the Rivers Blackwater, Lower Chelmer, Stort and Cam. More recently (2000–2002) otters were still known to be present on the River Cam, and the EA advise that they are known to be currently present on the Rivers Stort, Roding and Pincey Brook. This UKBAP priority species is impacted by water quality, which affects its food supply, and low flows. Addressing these issues are objectives for the Essex BAP, and it is important that the wetland habitats that otters require are protected from any negative impacts due to development.

A 1997 survey for the Essex BAP found that **water voles** were present on most of the main rivers within Essex, although population numbers were thought to have declined at some sites. The Hertfordshire BAP[33] also noted the presence of water voles on the River Stort and Pincey Brook, downstream of Uttlesford District near Sawbridgeworth. Water voles are afforded full protection under the Wildlife and Countryside Act 1981 (as amended). Water level changes can severely impact this UKBAP priority species by damaging its habitat. Water quality may also be

an issue, although there are records of water voles thriving on polluted watercourses. Better management of water levels is needed to protect this species; it is important that areas where water voles are found are protected and enhanced where possible.

Another UKBAP priority species, the **Desmoulin's whorl snail**, is currently found along the River Stort at Sawbridgeworth Marsh SSSI, Little Hallingbury Marsh and Thorley Flood Pound. This species is sensitive to habitat disturbance. UDC, the EA, NE and developers need to ensure water level management plans and flood defence schemes take account of this species.

White clawed crayfish are present on the River Pant/ Blackwater, and Stebbing Brook. This UKBAP priority species is sensitive to changes in water quality. A scheme is in place to trap the non-native Signal crayfish (which are a threat to this species) at Wixoe, to prevent transfer to the River Pant via the EOETS.

Local Wildlife Sites

Local Wildlife Sites (LoWS), previously named as either County Wildlife Sites or Sites of Importance for Nature Conservation, are areas of land with **significant wildlife value** that complement and support the network of SSSI and other sites of European and national importance. Many of the sites contain species or habitats listed as a priority in either the UKBAP or LBAPs.

Therefore, LoWS should be a material consideration in the determination of planning applications, and any sites that are dependant on the water environment should be protected wherever possible. Uttlesford District contains around 300 LoWS. Aside from the obvious risk of encroachment and disturbance from development, any LoWS dependant on the water environment may be adversely affected by changes in water quality and flow levels due to increases in WwTW discharges and changes in surface water management.

Table 8-12 highlights the LoWS that have been identified as significant to this WCS as they are areas of marsh, meadow, fen or wet woodland that are periodically flooded by the watercourses, and are downstream of the WwTW that may experience an increase in flows due to the proposed growth. It is important to recognise that the periodic flooding of such sites with relatively nutrient rich water will be one of the factors that creates such a rich habitat. However, changes in water quality and flow levels can encourage the growth of other plant species, which may displace the BAP priority plants, and may eradicate the food supply and/or the habitat of BAP priority wildlife.

Local Wildlife Site	River	WwTW	Distance downstream (km) from WwTW
Stansted Marsh	Stort	Stansted Mountfitchet	At discharge
Rushy Mead	Stort	Stansted Mountfitchet	5.8
Twyfordbury Gravel Pit	Stort	Stansted Mountfitchet	6.0
Wallbury Plantation and Marsh	Stort	Bishops Stortford	1.5
Hallingbury Mill Pastures	Stort	Bishops Stortford	3.8
Downhall Wood	Pincey Brook	Hatfield Heath	0.5
		Takeley	9
Heathen Wood Marsh	Pincey Brook	Hatfield Heath	2.5
		Takeley	11
Marsh Lane Wood	Pincey Brook	Hatfield Heath	5.5
Felsted Fen	Chelmer	Felsted	0.7
		Great Dunmow	4.3
Kiora Pasture	Cam	Quendon	1.8
Water Lane Plantation	Cam	Quendon	3.6
		Debden	4.5
River Cam Wet Woods	Cam	Newport	3.5
		Wendens Ambo	1
		Quendon	7
		Debden	8
Audley Park Pastures	Madgate Slade	Saffron Walden	0.4

Table 8-12 Water dependant LoWS that may be at risk from the potential development

In addition, consultation with Essex Wildlife Trust (EWT) reveals that flows levels are managed at Rushy Mead by a sluice gate, and that the reedbeds and alder carr woodland that make up this site would be adversely impacted by any decreases in water quality due to changes in discharges at Stansted Mountfitchet WwTW, and other WwTW further upstream on the River Stort.

The presence of LoWS downstream of a WwTW discharge point will not necessarily constrain development being connected to this WwTW. However it is important that their presence is considered along with SSSI and BAP habitats and species, so that UDC can develop policies that mitigate the impact of the development on the water environment.

Achieving the indicative discharge consents proposed by the EA should ensure that water quality does not have a major affect on these sites, although the EA suggest that their ecological monitoring network on the Upper River Stort, Pincey Brook and River Roding and their tributaries is currently limited. Any requirement to mitigate against adverse changes in water levels or increased flood risk at a specific site due to increased discharge will need to be discussed with the EA following modelling at the Detailed Stage of the WCS.

European Sites

Special Areas of Conservation (SAC) and Special Protection Areas (SPA) are sites of European importance for biodiversity. Under Regulation 48(1) of the Habitats Directive, an Appropriate Assessment needs to be undertaken in respect of any plan or project which:

- Either alone or in combination with other plans or projects would be likely to have a significant effect on a European Site; and
- Is not directly connected with the management of the site for nature conservation.

In 2007 UDC undertook an Appropriate Assessment of their Core Strategy Preferred Options document. The resulting report[34] determined that only one European site could potentially be impacted by development within the UDC Preferred Option (Option 4), when the cumulative impacts (on water abstraction and effluent discharge) of the development in other Districts within Essex were also considered. This site is the Blackwater Estuary SPA/Ramsar site on the River Chelmer, approximately 35 km downstream of Felsted.

The 2007 Appropriate Assessment concluded that, due to the local environmental controls, such as discharge consents and abstraction licenses, "*the Core Strategy policies in combination with other plans will not have a detrimental impact on the integrity of the Blackwater Estuary SPA/Ramsar site for reasons of water supply and wastewater treatment."*

This is reinforced by the recently published Habitats Regulation Assessment for the East of England Implementation Plan[35] (2009) which states that "*implementation of the policies within the East of England RSS will not result in any likely significant effects on* [SAC/SPA] *sites or Ramsar sites, either individually or in-combination."*

However, neither of these studies took account of the potential new settlement within the Uttlesford District discharging into the River Chelmer via Felsted or Great Dunmow WwTW. Whilst the requirements of the WFD are likely to protect the interest of any downstream SPA/ SAC, such as the Blackwater Estuary, final dwelling numbers for the new settlement in Uttlesford may be as high as 10,000 (beyond the timeframe of this WCS). It is therefore recommended that an updated assessment be carried out at a regional level, once RSS and LDF documents are finalised, and more development locations are confirmed within Uttlesford and the other Districts in Essex.

8.3 Development Impact

8.3.1 Infrastructure capacity

It is assumed that WwTW where there are only current allocations are not of concern to this WCS, as the water companies will already be aware of these relatively small-scale plans and therefore no new strategic solutions will be required, as any upgrades will already be planned or completed.

Where large scale growth through extensions, intensification or new settlements, is required to meet the RSS targets, the current volumetric flow consent figures, measured or calculated DWF figures, and estimated population equivalent (PE) have been assessed. The capacity of each WwTW to receive wastewater flows from additional development has then been estimated through high-level assessment and consultation with TWU and AWS. These WwTW include:

- Bishops Stortford;
- Felsted (if flows from a new settlement, or parts of Great Dunmow, are connected);

- Great Chesterford;
- Great Dunmow;
- Great Easton;
- Newport;
- Saffron Walden; and
- Stansted Mountfitchet.

Any noticeable capacity issues associated with the above WwTWs and the existing sewerage network have also been identified through qualitative assessment and discussion with the water company representatives.

The capacity of the WwTW and sewerage networks where only village scale growth is proposed is best assessed through a qualitative discussion with water company representatives, as models do not exist for many of these locations. The results of this exercise are presented in Section 9.

At some WwTW, AWS are already proposing increases in DWF consents, to allow the upgrades needed to alleviate current capacity issues and accommodate any currently allocated development sites and seasonal variations in DWF. These WwTW are:

- Ashdon;
- Debden;
- Great Easton;
- Great Sampford;
- High Roding; and
- Newport.

The increased DWF consents are designed to maintain at least a 10% buffer between actual DWF and consented DWF in accordance with the standard requirements of the EA. If growth to meet the RSS targets is also likely to occur within these catchments (e.g. Great Easton and Newport), the consents will have to be further negotiated with the EA, subject to overcoming any environmental constraints, to ensure the 10% buffer remains.

After assessing the current (or proposed) capacity of the WwTW, and consulting AWS and TWU regarding capacity within the sewerage networks, the following infrastructure constraints and possible solutions have been identified. Water quality, environmental capacity and flood risk constraints are discussed in Sections 8.3.2 and 8.3.3.

Larger urban extensions

Elsenham lies on the operational boundary between TWU and AWS. The majority of the existing village's wastewater is collected via AWS sewers, and then pumped over the boundary into the TWU network, where it then flows by gravity through an outfall sewer to the Stansted Mountfitchet network, for treatment at the WwTW.

TWU estimate that the outfall sewer currently has the capacity to accept flows from a maximum of 500 new dwellings (this would need to be confirmed at the Detailed Stage), although the existing network capacity in the village may be less than this (around 20–30 dwellings max.), due to limitations in the pumping network.

Any potential extension to the west of the existing Elsenham village (Options 2 and 3) would be in close proximity to the existing outfall sewer, avoiding the need for upgrades to the existing

network of sewers and pumping stations in the village. However, with the significant scale of potential growth, e.g. 500 dwellings, at this site, the outfall sewer to Stansted Mountfitchet (which is in excess of 2 km long and crosses the M11) may not require upsizing along the majority of its length, subject to further investigation by TWU. It is also likely that some upsizing to the existing network in Stansted Mountfitchet, where the outfall sewer discharges to the existing sewerage network, would be required. TWU have indicated that the space in which to accommodate these upsized sewers will not be available, due to the narrow streets within Stansted Mountfitchet. Additional sewerage capacity may therefore have to be provided through new sewers bypassing the existing network.

If connected into the Stansted Mountfitchet sewerage network, development to the northeast of Elsenham, either the new settlement under Option 4, or a lesser scale of development such as the 950 dwellings possible under Option 3, would require the upsizing of the outfall sewer to Stansted Mountfitchet, and would further compound the above problem. The existing sewerage network through the village would either have to be upgraded (unlikely due to space constraints), or bypassed with a new strategic sewer linking the new development to the existing (or upsized) outfall sewer, or even directly to the WwTW.

Other possible solutions to the Elsenham sewerage issues are discussed later in the new settlements section.

Regarding flows received by the WwTW, TWU are concerned that the process capacity at Stansted Mountfitchet WwTW may still require substantial upgrading to accommodate the additional loading from the increased population, regardless of the final development option preferred by UDC. TWU predict that the process capacity of the WwTW will be reached once the Rochford Nurseries site (the existing allocation) is completed, with additional capacity for 200 dwellings. Therefore, any additional wastewater flows from Elsenham, or the growth proposed under Option 1, are likely to require the upgrading of some of the WwTW processes and potentially provision of an additional disc filter. TWU advise that the new settlement option will require conversion of the current filter works into an activated sludge plant in order to consistently meet the required physio-chemical consent standards (see 8.3.2). This would be problematic given the need to construct the new processes whilst continuing to treat wastewater at the site, given the available land.

Predictions based on the worst-case PCC scenario, shown in Figure 8-24[*], suggest that all of the growth options will cause flows to the WwTW to exceed the existing treatment capacity by 2012/13. Upgrades to the existing process facilities, or the provision of additional process, will therefore be required.

[*] It must be noted that all graphs in this Section refer to the existing volumetric consent, and actual hydraulic capacity at the WwTW may be less..

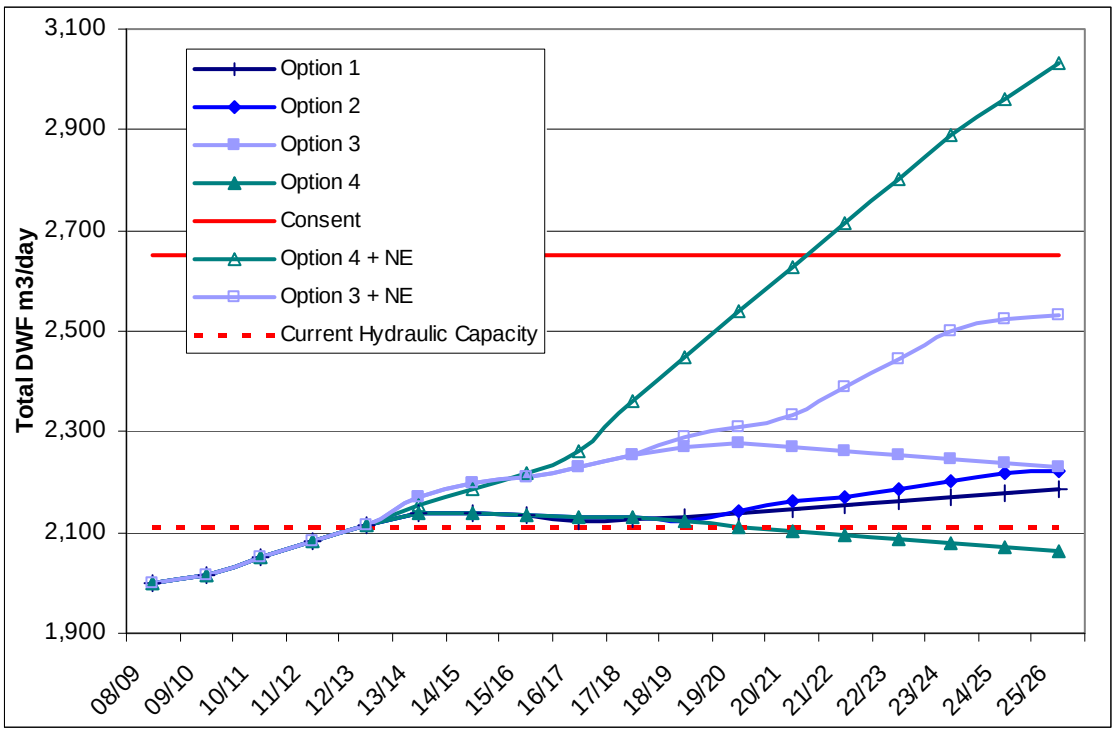

Figure 8-24 Worst Case Scenario Total DWF predictions for Stansted Mountfitchet WwTW by Option, with and without northeast Elsenham (NE)

The current capacity of the works is an estimation based on the dwelling capacity, as indicated by TWU, using 08/09 variables for consumption and occupancy rates in new dwellings.

The above figure clearly highlights that flows received at the works would not exceed the volumetric discharge consent by 2026, if the development from Option 3 (including 950 dwellings northeast of Elsenham) is connected. By approximately 2021 the existing DWF volumetric discharge consent will only be exceeded if a new settlement (Option 4) is connected to the WwTW.

In addition, sensitivity analysis of this data, as shown in Figure 8-25 below, reveals that if occupancy rates remain at 2008/09 levels, the flow from the Option 3 dwellings, plus the 950 dwellings to the northeast of the village, are predicted to exceed current capacity by 2011/12. This would cause the volumetric discharge consent to be exceeded by approximately 2% by 2026.

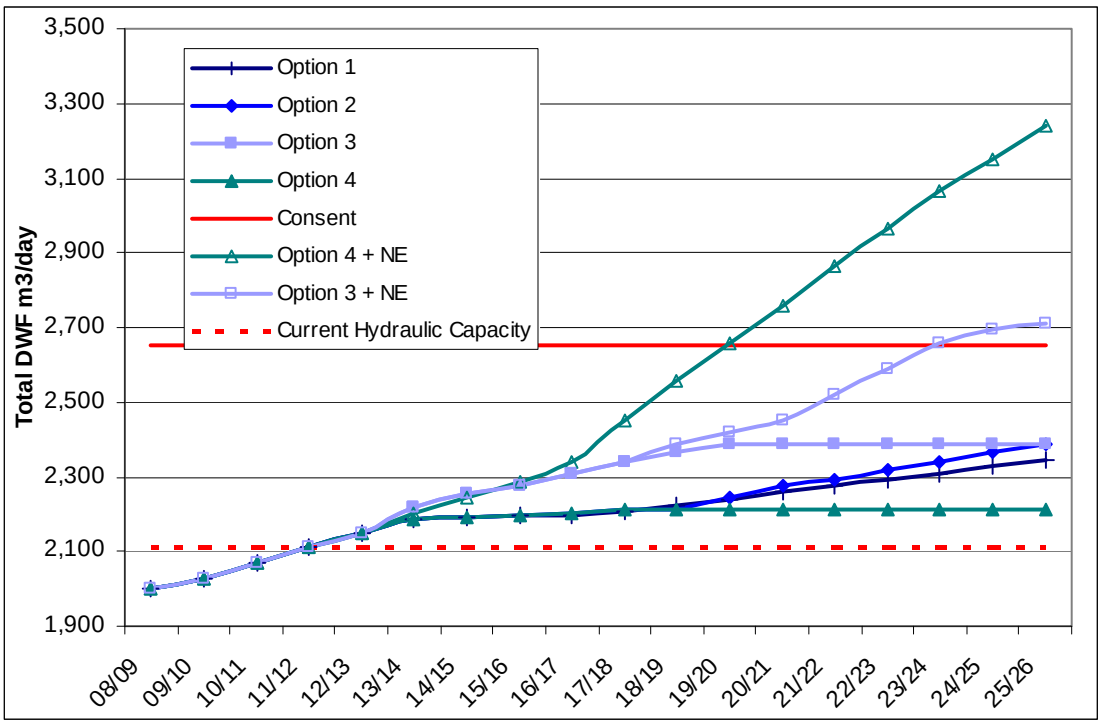

Figure 8-25 Worst Case Scenario (with constant occupancy rates) Total DWF predictions for Stansted Mountfitchet WwTW by Option, with and without northeast Elsenham (NE)

Great Chesterford is served primarily by a small diameter gravity sewerage system (less than 225mm dia. except one outfall sewer), with wastewater collecting at a pumping station to the north of the village, and then pumped 0.8 km to Great Chesterford WwTW. AWS have indicated that there is currently **no capacity** in the network for additional dwellings. AWS have also indicated that any new development will require a direct connection to the existing WwTW and prefer that such a development site is located so that the length of this new sewer is minimised. Otherwise, for the small scale development associated with Options 2, 3 and 4 (without the 3,000 dwelling new settlement) the cost to enable the construction of a long length of new sewer, through the developer requisitions process, would become prohibitive

However, given that the scale of the potential extension/ intensification sites under Options 2, 3 and 4 (excluding a new settlement) is small in relation to the existing dwellings (an approximate 3% rise in dwelling numbers), the development will have a negligible affect on flows at the WwTW. It is predicted that reductions in flow due to the projected decreases in occupancy will actually decrease the DWF arriving at the WwTW, even in the worst case scenario (see Figure 8-26 below).

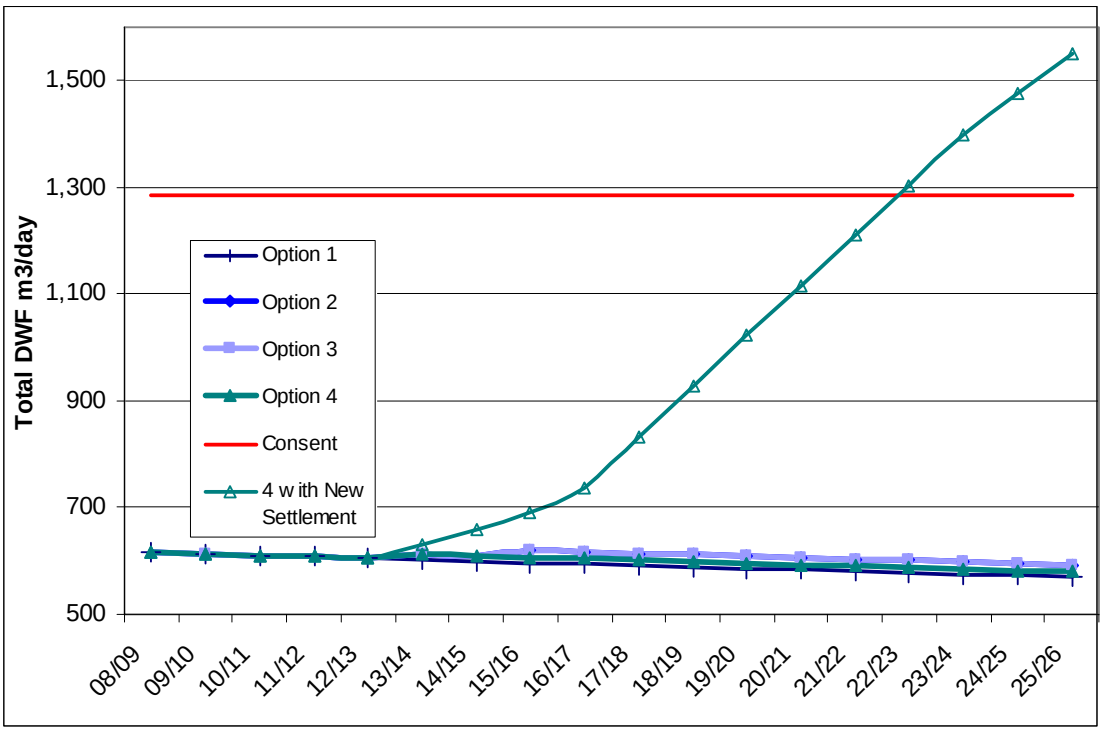

Figure 8-26 Worst Case Scenario Total DWF predictions for Great Chesterford WwTW by Option

AWS estimate that the current process capacity of Great Chesterford WwTW can accommodate the flows from 800 additional dwellings. This is adequate capacity for all development options, except for the possible new settlement located at Great Chesterford (under Option 4), which would require rebuilding of the WwTW before approximately 2020, as the PE would be more than doubled.

Great Dunmow is currently served by separate surface water and foul water sewerage systems, with the foul water being primarily conveyed to Great Dunmow WwTW via gravity sewers. AWS estimate that the existing network contains adequate capacity to accommodate the existing allocations.

However, the scale of the growth proposed to meet the RSS targets will either require upgrades to the existing network, or new strategic sewers to link the potential sites directly to the WwTW. In this respect, proximity of the potential large-scale growth sites (e.g. Great Dunmow south) to the WwTW will influence the costs associated with this infrastructure. Whilst primarily a gravity sewerage system, there are pumping facilities in the southwest and northeast of the existing town. Any significant development here may also require the upgrading of these facilities.

The capacity of the WwTW is a key constraint in Great Dunmow. AWS predict that the completion of the existing allocations (at Woodlands Park) will exceed the current process capacity, and also require a new volumetric discharge consent to be negotiated with the EA.

In order to address this, AWS are planning to upgrade the process capacity at Great Dunmow WwTW at the end of AMP 5 (2014/15), to accommodate a DWF of 2,200 m3/day; a 46% increase on the existing DWF consent. This will provide adequate process capacity, and headroom within DWF consent (recently negotiated with the EA), to accommodate the flows from the current allocations and the development projected in Option 4 (excluding a new settlement). However, all the other growth Options (including Option 4 where the new settlement is within the Great Dunmow catchment) will exceed the capacity that AWS are currently planning to install.

Therefore at present there is no capacity at the WwTW for the connection of additional flows from the potential extension sites, however the required process capacity should be in place by 2016. Additional WwTW capacity, along with a revised volumetric discharge consent, will be required to accommodate the flows from Options 1, 2, 3 (and 4 should the new settlement be located within this catchment). AWS advise that this does not result in the higher growth levels being unachievable, but that there will be an additional delay in providing the required WwTW capacity and negotiating a new flow consent with the EA, over and above what has recently been agreed for AMP 5. In addition, there is a risk that flows in excess of those agreed will require tighter physio-chemical standards in subsequent RBMP periods, particularly for the new settlement option (see Appendix I). Any such consent changes would come under the requirements of the Water Framework Directive, to prevent deterioration of water quality or achieve 'good status', which could have implications for the long term deliverability of the proposed growth.

Newport is served primarily by a gravity sewerage system, with wastewater collecting at a pumping station to the northeast of the village, and then pumped across the River Cam to Newport WwTW.

The potential development to the west of the development would be on the opposite side of the village to the WwTW. AWS have indicated that the existing network has limited capacity and it will be difficult to accept the additional flows from the potential 50, or 100, dwellings to the south west of the village without substantial network upgrades. In particular, development here would be located approximately 1.5 to 2 km distance away from the existing WwTW, on the opposite side of the village. The scale of development compared to the extent of the infrastructure upgrade required means that the development at the southwest of the village would be cost prohibitive to fund through the normal developer requisitions process for this type of development. A possible option to overcome this issue could be to relocate this development to the north or east of the village.

AWS have indicated that, due to seasonal variations in existing DWF received at Newport WwTW, there is no capacity within the existing (or proposed higher) DWF consent, or the process capacity of the WwTW, to accommodate the flows from any new dwellings. Any increase in dwellings at Newport will require that the negotiation of a new increased DWF consent with the EA, and this may lead to tightening of the quality levels required in this discharge.

Figure 8-27 below illustrates how the potential development will increase the Newport discharge to within 10% of the higher DWF consent proposed from 2010 onwards; seasonal variations in DWF would be more likely to breach the higher proposed consent. This problem would be further compounded if occupancy rate reductions do not occur as predicted,

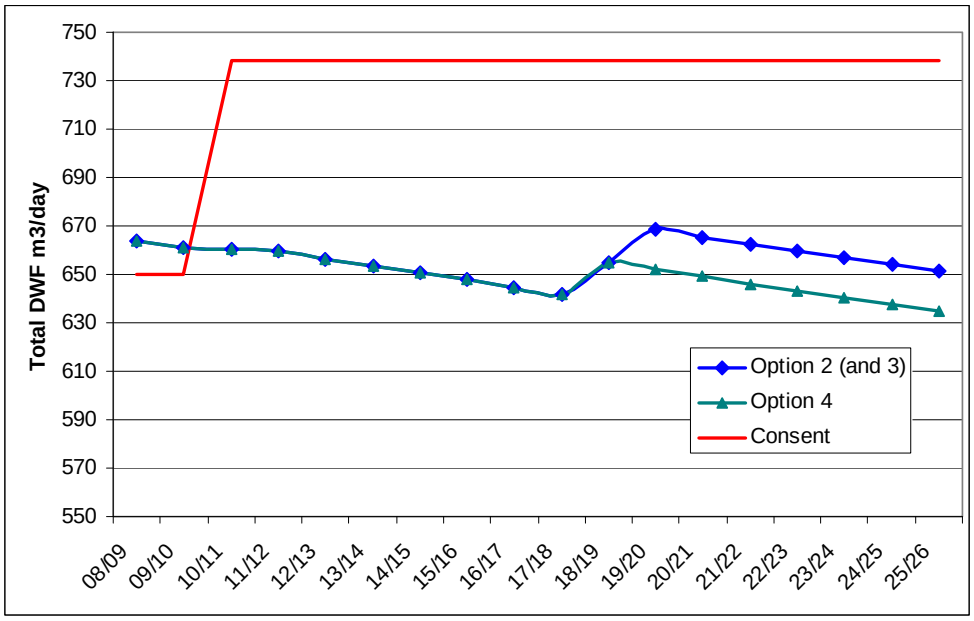

Figure 8-27 Worst Case Scenario Total DWF predictions for Newport WwTW by Option

It is therefore concluded that discharge consent and WwTW capacity severely constrain the potential development within the Newport catchment, in addition to the sewerage network constraints identified above.

Saffron Walden is predominantly served by a separate surface water and foul water sewerage system. The foul water sewerage system operates primarily by gravity, conveying wastewater to the WwTW to the northwest of the town. The Uttlesford District SFRA notes several sewer flooding incidents within Saffron Walden.

UDC have indicated that capacity for expansion/ intensification in Saffron Walden is limited mainly to the south and east of the town - the opposite side of the town to the WwTW. Consultation with AWS suggests that the existing sewerage network within the town is near capacity, and that the potential development sites would therefore require extensive upgrades to the network through the town, which would likely be highly disruptive. Due to the relatively narrow streets, it may be unfeasible to upsize the sewers through the town, which would result in the only viable sewerage solution being the creation of new strategic sewers linked directly from the development sites to the WwTW. This is an issue for the detailed strategy as the potential development sites are located primarily towards the east of the town away from the existing WwTW, requiring some network modelling to fully understand the constraints. It is worth noting that AWS have an up to date strategic sewer model for the Saffron Walden catchment, which can be used for any future investigations.

Figure 8-28 below illustrates that the predicted total DWF received by the Saffron Walden WwTW will not exceed its volumetric discharge consent, even for the worst-case scenario. However, AWS may wish to apply for a new consent at some, as the flows from the growth in Options 1, 2 and 3 may compromise the 10% headroom between actual and consented DWF by 2020 onwards. According to AWS, the existing WwTW should be able to accommodate the increased flows from the new developments for these options, in line with their phasing and actual build rates, and providing that the flows remain within the current discharge consent limit. Figure 8-27 highlights that this would be the case for the development options considered by UDC.

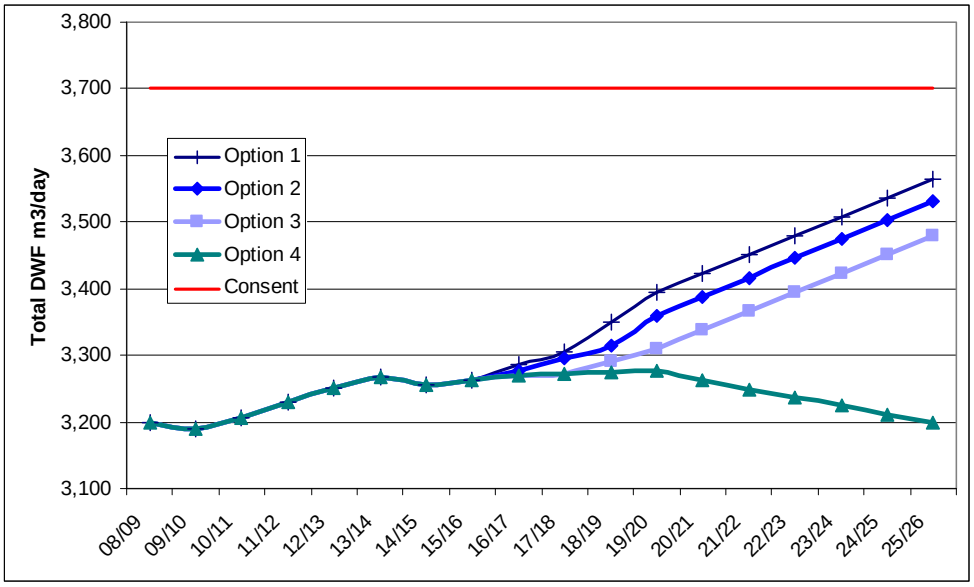

Figure 8-28 Worst Case Scenario Total DWF predictions for Saffron Walden WwTW by Option

However, Figure 8-29 below illustrates the impact on predicted flows at the WwTW if occupancy rates remain at 2008/09 levels. This shows that Option 4 is the only development Option that does not risk exceeding the volumetric discharge consent at the WwTW, although will still compromise the 10% headroom between actual and consented DWF, requiring the negotiation of an increased consent.

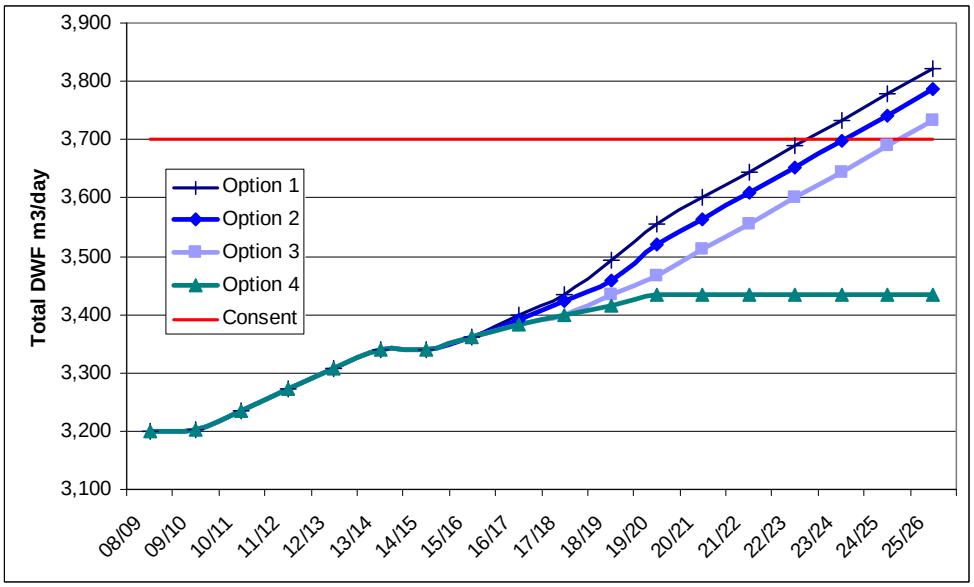

Figure 8-29 Worst Case Scenario (with constant occupancy rates) Total DWF predictions for Saffron Walden WwTW by Option

Stansted Mountfitchet is served by a combination of gravity and pumped sewers. The 70–85 dwellings suggested as intensification in the existing town (for all options) should be able to connect to the existing sewerage network with minimal localised upgrades, funded through developer requisitions. Due to Green belt constraints to the south of the town any potential expansion under Option 1 would be likely to be limited to the north of the town. However, the potential 400 dwelling extension to the north of the town (Option 1) would require extensive

upgrades to the existing network (unlikely due to space constraints described previously), or a new strategic sewer, approximately 1.75 km in length, linking the site to the WwTW. Wastewater in this new strategic sewer would require pumping to the Bentfield Green area, from where the flow could gravitate south to the WwTW.

Regarding WwTW capacity, as stated above, TWU estimate that there is only sufficient treatment capacity at the WwTW to accommodate the allocations at Rochford Nurseries and an additional 200 dwellings. Therefore, the potential development to the north of the town (Option 1) would require additional process capacity to be provided at the WwTW, similar to if development to the west of Elsenham is connected. Regarding volumetric discharge consent, as shown in Figure 8-24, in the worst case scenario, the increase in DWF from the new developments will only cause the WwTW to exceed its DWF consent if flows from the dwellings to the northeast of Elsenham are included.

Takeley (Priors Green) currently has wastewater collected by a gravity sewer system to a pumping station at Canfield End. Wastewater from here is then pumped to a location near Stansted Airport, before joining a gravity sewer, which conveys the flows to Bishops Stortford WwTW. The rising main was designed to accommodate flows from the existing Priors Green allocation, of which 574 dwellings have yet to be completed. TWU estimate that the wet well at the pumping station can accommodate flows from an additional 1,000 dwellings in addition to this 574, and that the gravity sewer from the Airport to Bishops Stortford WwTW has adequate capacity for such growth. However, the rising main (with an approximate length of 2.5 km), would require upsizing, as it was originally sized for the existing Priors Green allocations only.

The capacity of Bishops Stortford WwTW has recently been upgraded by TWU to accommodate the proposed growth in East Hertfordshire, the M11 corridor and at Stansted Airport. The original allocations at Priors Green were factored into these decisions. The effects of an additional extension, even at the highest level (750 dwellings; as suggested in Option 2), will be negligible compared to the size of the WwTW.

Thaxted is currently served by a network of rising mains and gravity sewers that convey wastewater southwards through the village to join a 225mm diameter gravity outfall sewer, which flows parallel to the River Chelmer for nearly 6 km, to Great Easton WwTW.

AWS estimate that there is no additional capacity within the existing sewerage network or the gravity outfall sewer to accommodate the potential growth required to meet the RSS targets. However, at this stage it is not clear if the entire length of outfall sewer would need upsizing, or certain sections would require reinforcement, depending on the actual capacity (pipe size and gradient) and ground cover. If the entire length of outfall sewer requires replacement, then it is very likely that a medium scale development involving a maximum of 60 dwellings would make the costs of undertaking the necessary infrastructure upgrades prohibitive. Alternatively, it may be possible that local upgrades to the existing network in Thaxted could be undertaken to increase capacity as well as attenuation storage, prior to discharge to the main outfall sewer. Possible measures may include the construction of large diameter sewers, up rating the existing pumping station to the north of the village and providing an adequately sized wet well to provide the required attenuation storage.

AWS are aware of current process capacity issues at Great Easton WwTW, and are proposing a new volumetric discharge consent from 2010 onwards to ensure the 10% buffer between actual and consented DWF is maintained.

Figure 8-30 below illustrates that, even for the worst case PCC scenario, the increased discharge consent will provide adequate capacity between actual and consented DWF to accommodate all four development options. However, AWS advise that seasonal variations in flow regimes at this WwTW are the driver behind the requirement to increase the existing DWF

consent. These seasonal flow variations mean that any new development connected to Great Easton WwTW will cause the existing capacity, and the proposed higher DWF consent, to be exceeded. Therefore, for Great Easton WwTW to accommodate any growth, a new consent will be required from the EA, in addition to the currently proposed increase. In addition, if any upgrades to the WwTW require additional land, the extension of the works will be restricted to the north, east and south by the surrounding roads and watercourses.

Figure 8-30 also illustrates the significant impact that a new settlement (Option 4) connected to Great Easton WwTW would have on the flow through the WwTW. This would require rebuilding of the existing works, subject to land negotiations, planning agreement and the negotiation of an increased DWF consent, and would arise if the potential new settlement at Easton Park was connected to this WwTW.

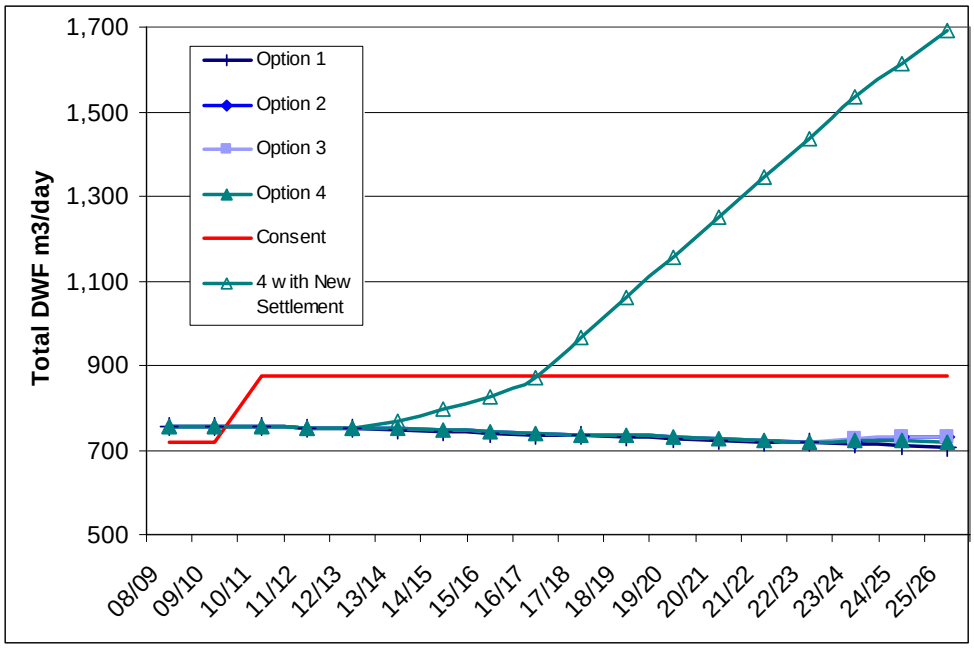

Figure 8-30 Worst Case Scenario Total DWF predictions for Great Easton WwTW by Option

The capacity of all the potentially impacted WwTW and sewerage networks to accept flows from the new settlements (Option 4) are discussed in the following Section.

New settlements

The treatment of wastewater from the potential new settlement locations would have to be accommodated at an existing WwTW, following potential upgrades to hydraulic and treatment capacity and the successful application for an increased volumetric discharge consent. The feasibility of this is discussed below, by referring to UDC's Development Option 4, which involves a new settlement to the northeast of Elsenham and the alternative new settlement locations put forward by the development industry at:

- Boxted Wood/ Andrewsfield;
- Chelmer Mead;
- Easton Park; and
- Great Chesterford.

The alternative would be treatment on site with a new WwTW discharging to a nearby watercourse, or the possible on site reuse of treated effluent for water supply. This is discussed further in Section 8.4.

Boxted Wood/ Andrewsfield would be approximately 4 km away from all three closest AWS WwTW; Felsted, Willows Green, or Rayne. Whilst the number of new dwellings in Uttlesford District will be 3,000, the proposed settlement will comprise an additional 1,500 homes within the Braintree District. It is therefore likely that the wastewater infrastructure solution will have to accommodate flows from all 4,500 dwellings up to 2021-2024, with the potential for this to expand to 10,000 dwellings at a later date.

A WCS for Braintree District[36] suggested that there is limited capacity for Rayne WwTW to accept major growth, as it is already operating at BATNEEC*, and constrained by treatment capacity and the dilutive capacity, and existing quality, of the receiving watercourse.

Willows Green WwTW, within Uttlesford District on the River Ter, is a small WwTW, which currently treats wastewater from a PE of less than 100. It is likely that a new works, with a lead in time of approximately 10 years, would be required at Willows Green to treat the large scale of development proposed, again subject to overcoming environmental constraints including water quality and flood risk. The EA has advised that the River Ter has the best freshwater invertebrate assemblage in Essex, and provides the habitat for a number of nationally important freshwater fish species, both of which would be severely impacted by any discharge from the potential settlement. In addition, the route of a sewer connecting Boxted Wood/ Andrewsfield to Willows Green would cross the A120 and River Ter, entailing additional costs.

Felsted WwTW is the largest existing WwTW in proximity to the proposed site. AWS anticipate that the WwTW has adequate treatment and hydraulic capacity, and headroom within its volumetric and chemical consent limits, to accommodate the current allocations at Oakwood Park, of which 243 dwellings remain to be built. The only other growth proposed in the Felsted WwTW catchment would be any village scale growth at Barnston, Felsted village and Stebbing, dependant on the UDC development Option that is favoured. Figure 8-31 below illustrates the impact of the development options (ignoring any transfer of flows from Great Dunmow) on the total DWF received by Felsted WwTW.

* Best Available Technology Not Entailing Excessive Cost – see Technical Glossary

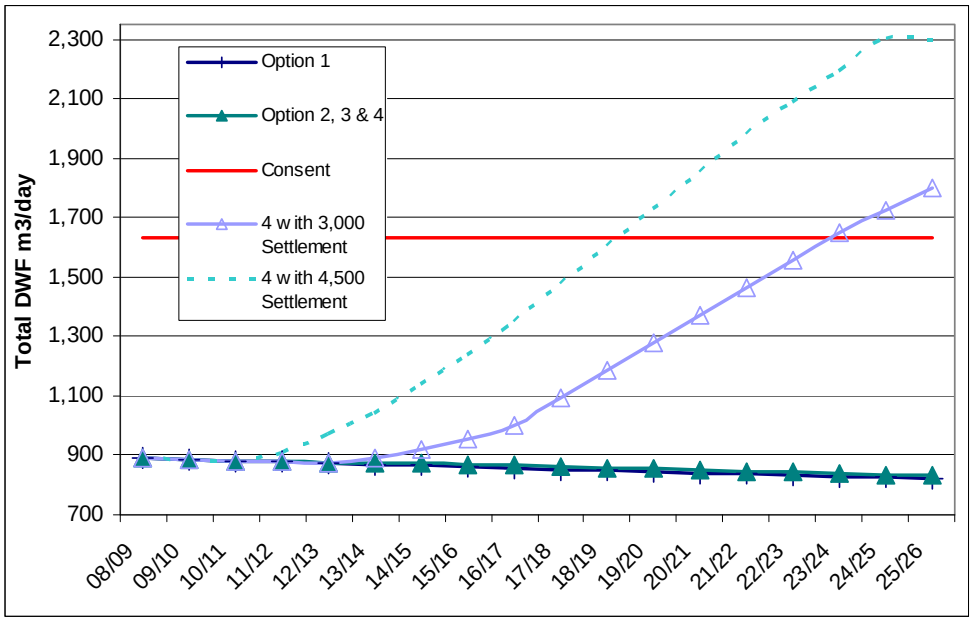

Figure 8-31 Worst Case Scenario Total DWF predictions for Felsted WwTW by Option

The above Figure suggests that Felsted WwTW does not have the headroom available within its current volumetric flow consent to accommodate the proposed new settlement at Boxted Wood/Andrewsfield (either the 3,000 dwellings within Uttlesford District, or the total 4,500 for the Boxted Wood proposal). Also, AWS analysis suggests that the biological filter treatment process is currently near capacity. A large-scale upgrade of the majority of the processes within the WwTW would be required to accommodate such growth.

AWS are concerned that, dependant on the size of upgrade required at Felsted WwTW, there may not be adequate land available within the site boundary. The location of Felsted WwTW results in any extension to the north or west being constrained by Station Road and the Stebbing Brook (and associated flood plain). Also, any extension to the east or west would be restricted by AWS's requirement to maintain a 400 m distance between development and the WwTW, or 'cordon sanitaire', which has already been compromised by part of the Oakwood Park development.

AWS have indicated that the earliest that Felsted WwTW could be upgraded, or relocated if necessary, to accommodate a new settlement would be in the AMP7 period after 2020, significantly delaying and constraining the development commencement and subsequent phasing. Less intensive network and WwTW upgrades to the existing Felsted WwTW, to accommodate the additional growth at Great Dunmow, may be achievable in a shorter timeframe (AMP5 investigation:AMP6 construction), dependant on AWS strategy.

Chelmer Mead is faced with similar issues as above, although in this case, the only WwTW within proximity to the site are Felsted and Great Dunmow, at a distance of approximately 1.5 km and 2.6 km respectively. As described previously, treatment and hydraulic capacity at Great Dunmow WwTW is already a concern for AWS and accommodating further increased flows from this settlement will require additional treatment capacity to be provided, and a new consent negotiated, over and above that which has been agreed for AMP 5.

A new outfall sewer from Chelmer Mead could possible connect straight to Felsted WwTW, somewhere along the outfall sewer from Stebbing to Felsted, requiring a crossing of the Stebbing Brook, or into a new WwTW. The route of a sewer from Chelmer Mead to Great

Dunmow WwTW would cross the A120 and River Chelmer, entailing additional costs. However, the commencement of this new extension, or new WwTW, may be constrained until the AMP7 period, as described above for Boxted Wood/ Andrewsfield.

Local treatment options, as described in Section 8.4, may offer a feasible solution for treating wastewater onsite. The uptake of such solutions will be dependent on the willingness of developers to accept the costs associated with such technologies, and will be subject to negotiations between the developers, the water companies and the EA.

It should also be noted that, due to the likely importance of the Chelmer/Stebbing Brook for invertebrates and White Clawed Crayfish, the EA believe that the Chelmer Mead development may have negative impacts on the catchment which would lead to the need for mitigation or avoidance of the area altogether. Discussions will be required between UDC, developers, the EA and AWS to resolve this issue.

Easton Park would be situated approximately 1.5 km south of Great Easton WwTW. AWS have indicated that there is no capacity at this WwTW. Should UDC development Options 2, 3 or 4 be preferred, additional capacity will be required at Great Easton WwTW for the potential growth at Thaxted, and some village scale growth in Great Easton itself. Possible extension to the WwTW will be partially constrained by the surrounding watercourses and road; however there may be scope to extend the WwTW to the west, dependant on land negotiations and planning conditions. The connection of Easton Park to Great Easton WwTW may constrain the levels of development available elsewhere in the Great Easton catchment, however AWS indicate that the proposal of such a new settlement here may aid them in securing funding through Ofwat for the upgrades required at the WwTW.

Figure 8-30 above illustrates the predicted worst case increase in DWF at Great Easton WwTW should a new settlement of 3,000 dwellings be connected. This would require a new discharge consent subject to agreement by the EA. The extensive WwTW upgrades required would mean that the development still may be constrained until the AMP7 period unless a local treatment option with developer funding mechanisms can be agreed upon.

If local treatment solutions are not economically viable, and the environmental capacity of the tributary of the River Chelmer at Great Easton prevents an increase in discharge at this location, a possible solution would be the construction of a costly new trunk sewer, around 5 km in length, connecting the site to Great Dunmow WwTW, (although again the capacity of the WwTW and watercourse here is an issue). Alternatively, flows from Easton Park could be connected into TWU's network near Takeley, around 3 km away, to be pumped towards Stansted Airport and ultimately treated at Bishops Stortford WwTW. This latter option would also require extensive upgrades to the TWU network in this area because, as stated in the previous Section, the Takeley/Priors Green pump and rising main setup only has capacity for approximately an additional 1,500 dwellings. The route of the new sewer required, from Easton Park to this area of the TWU network, would also require a crossing of the A120 and River Roding, again entailing significant additional costs.

A new settlement to the northeast of **Elsenham** would require extensive upgrades to the AWS network in the existing village, or a new strategic sewer bypassing the village, as described in the previous Section. This network pumps wastewater from the village over the water company operational boundary, where it is then transported by a TWU gravity outfall sewer to Stansted Mountfitchet WwTW. The large-scale growth proposed would also require the upsizing of around 2.5 km of the TWU outfall sewer and sewerage network in Stansted Mountfitchet, although given the previously mentioned space constraints, new bypass sewers may be required. According to TWU, a near doubling of the size of the existing WwTW, leading to the rebuilding of the works, will be required due to the limitations of the existing process capacity (as illustrated above in Figure 8-24). Such a change in capacity would require the treatment

process to be changed from biological filters to activated sludge. As described in Section 8.4, this may allow the required high discharge quality standards to be met (providing of course that flow and water quality of the River Stort could accommodate such a discharge without increasing flood risk and causing environmental damage), but will entail relatively high capital and operational costs, and a lead in time of 10 years. TWU are also concerned that adequate land will not be available at the WwTW to accommodate the required process upgrades whilst continuing to treat the wastewater received by the WwTW.

Other possible solutions would be the treatment of wastewater from the new settlement at either Quendon or Broxted WwTW, both operated by AWS, and over 4 km from the site. Both solutions would effectively require a new WwTW to be built at the sites, and may be severely constrained by the environmental capacity of the receiving watercourses. A sewer connecting the new settlement to Quendon WwTW would be required to cross the M11 and River Cam, adding to the capital costs of providing such infrastructure.

The only possible solution, utilising existing WwTW, which would not be severely constrained by existing WwTW process capacity, and the environmental capacity of the receiving watercourse, would be to sewer the flows from a new settlement at Elsenham to Bishops Stortford WwTW. However, this would require close to 10 km of new sewer (with a significant proportion of this length perhaps requiring pumping), incurring substantial capital and operational costs.

More detailed information should be available to UDC following the completion of the Elsenham WCS, although there is some doubt that such information will be available in sufficient time to inform the detailed stage of this WCS.

Great Chesterford WwTW treats the wastewater from Great Chesterford, Hinxton and Ickleton, There are several rising mains leading to the works but the existing sewerage system in Great Chesterford is primarily a gravity system with a network of small diameter pipes, which have no spare capacity. A new settlement to the north of the existing Great Chesterford village boundary would be in close proximity (less than 1 km) to the WwTW, allowing the direct connection of a new sewer into the WwTW itself. This new connection would be required to cross the M11/ A11 interchange slip roads, potentially entailing additional capital cost and disruption.

There appears to be some existing hydraulic headroom against volumetric discharge consent, although, as illustrated in Figure 8-26, a larger consent would be required to accommodate the flows from the proposed new settlement, which would be an increase of more than double the existing flows, by approximately 2022. AWS have indicated that the WwTW has process capacity for around 800 dwellings; it is estimated that if the new settlement were constructed from 2013 onwards, process capacity would be reached by approximately 2018. It is likely that the WwTW would require extensive upgrades to accommodate the more than doubled flows, delaying the commencement of the development until the AMP7 period, after 2020, unless the upgrades can be phased in tandem with the growth. Such an extension, and corresponding increase in discharged effluent, would be subject to land availability, planning conditions and EA consent. Great Chesterford WwTW is partially restricted from expanding to the west by the watercourse, flood plain and cordon, and to the east by the M11 slip road. AWS have advised that this location has the least sewerage constraints when compared to the other potential new settlement locations, and that the indicative consent standards supplied by the EA (Appendix I) would likely be achievable in the future.

Village scale growth

TWU and AWS have provided an indication of the available additional capacity within the village WwTW and sewerage networks, where the nominal village scale growth may be proposed. A summary is included in the following table based on consultations with the water companies to date, although it should be noted that it is not a definitive guide of the headroom available at these affected WwTW but only indicates whether the potential level of growth identified by UDC may be a constraint or not.

Village	WwTW connected to (operated by)	Available Extra Capacity* for Village (dwellings)	Constraints and Opportunities
Ashdon	Ashdon (AWS)	0	No headroom available within the volumetric discharge consent at this WwTW
Barnston	Felsted (AWS)	Up to 10	There appears to be adequate headroom within the volumetric discharge consent at this WwTW, although the connection of a new settlement would eradicate this and require process capacity upgrades.
Chrishall	Elmdon (AWS)	Up to 10	There appears to be adequate headroom within the volumetric discharge consent at this WwTW
Clavering	Clavering (TWU)	Up to 20	TWU indicate that is preferable for development to be located along Stortford Road, as any other locations within the village will require pumping of the wastewater, and the current pump network is at capacity. There appears to be adequate headroom within the volumetric discharge consent at this WwTW
Debden	Debden (AWS)	0	No headroom available within the volumetric discharge consent at this WwTW
Felsted	Felsted (AWS)	Up to 10	There appears to be adequate headroom within the volumetric discharge consent at this WwTW, although the connection of a new settlement would eradicate this and require process capacity upgrades.
Great Easton	Great Easton (AWS)	Up to 10	There appears to be adequate headroom within the volumetric discharge consent at this WwTW, although the connection of a new settlement would eradicate this and require process capacity upgrades
Great Sampford	Great Sampford (AWS)	Up to 10	There appears to be inadequate headroom within the volumetric discharge consent at this WwTW, although AWS are proposing increased consents, which would likely be sufficient for this level of growth.
Hatfield Broad Oak	Hatfield Heath (TWU)	Up to 30	Wastewater is pumped from Hatfield Broad Oak to Hatfield Heath. Dwelling capacity is dictated by the capacity of this pumping system. There appears to be adequate headroom within the volumetric discharge consent at this WwTW
High Roding	High Roding (AWS)	Up to 10	There appears to be inadequate headroom within the volumetric discharge consent at this WwTW, although AWS are proposing increased consents, which would likely be sufficient for this level of growth.
Manuden	Manuden (TWU)	Up to 10	Sewers are heavily influenced by storm flows, additional development will increase the risk of spilling untreated wastewater to the River Stort. There

			appears to be adequate headroom within the volumetric discharge consent at this WwTW.
Quendon and Rickling	Quendon (AWS)	Up to 10	There appears to be adequate headroom within the volumetric discharge consent at this WwTW
Radwinter	Great Sampford (AWS)	Up to 10	There appears to be adequate headroom within the volumetric discharge consent at this WwTW
Stebbing	Felsted (AWS)	Up to 10	There appears to be adequate headroom within the volumetric discharge consent at this WwTW, although the connection of a new settlement would eradicate this and require process capacity upgrades.
Wimbish	Wimbish (AWS)	Up to 10	Consent details still to be provided by AWS.

Table 8-13 WwTW and sewerage network constraints and opportunities for villages

* AWS have estimated capacity for development at the village WwTW based on the existing DWF and consented DWF. As such, the scale of development may cause capacity issues for some processes within the WwTW, which AWS will have to resolve as they become apparent.

Employment areas

Following a review of the available network data, and consultations with the water companies, the following wastewater treatment and sewerage network constraints have been identified for the potential employment areas.

Employment Area	WwTW connected to (operated by)	Constraints and Opportunities
Bishops Stortford - northern edge	Bishops Stortford (TWU)	Capacity at the WwTW has recently been upgraded by TWU to accommodate development in East Hertfordshire District and along the Airport/ M11 corridor.
Elsenham Industrial Estate, Gaunts End (Extension)	Stansted Mountfitchet (or other Elsenham solution) (TWU)	The available capacity in the Elsenham to Stansted Mountfitchet outfall sewer, and the WwTW, will be taken up by the dwellings in all four development Options. Additional capacity will need to be provided to accommodate additional trade flow.
Elsenham New Settlement	Stansted Mountfitchet (or other Elsenham solution)	As above, unless a different treatment solution for the new settlement is proposed.
Great Dunmow - Land south and west (Mixed Use Scheme)	Great Dunmow (or Felsted solution) (AWS)	Great Dunmow WwTW process stream/facility is currently at capacity.
Great Dunmow south	Great Dunmow (or Felsted solution) (AWS)	Great Dunmow WwTW process stream/facility is currently at capacity.
Saffron Walden - Land west of Thaxted Road	Saffron Walden (AWS)	All sites are located on the opposite side of the town to the WwTW. However, upgrades to the existing network, or new strategic sewers, will be needed for the housing sites. There will be scope to include the additional capacity for trade flows if identified early.
Saffron Walden east (Mixed Use Scheme)	Saffron Walden (AWS)	
Saffron Walden northeast	Saffron Walden (AWS)	WwTW upgrades may be needed, and higher discharge consent may be required, dependant on trade flow volumes.
Takeley - Priors Green Extension	Bishops Stortford (TWU)	Capacity at the WwTW has recently been upgraded by TWU to accommodate development in East Hertfordshire District and along the Airport/ M11 corridor. There is a finite limit on the current capacity of the sewerage network that transfers wastewater to Bishops Stortford. Increases in trade flow will decrease the capacity available for dwellings.

Table 8-14 WwTW and sewerage network constraints and opportunities for employment areas

Should any of the above areas include businesses with a high water usage, AWS/ TWU would be likely to conduct a detailed assessment (at the stage when planning applications are made) to ascertain the volumes and quality of the trade effluent from these businesses. The acceptance of this effluent by the sewage undertakes would be subject to the necessary financial arrangements being made with the businesses in question.

8.3.2 Water Quality and Environmental Capacity

The major impact of the potential development sites on the water environment will be the variations in water **quality** and **quantity** discharged to receiving watercourses from the WwTW that serve the sites.

Where discharges from WwTW will increase, it is likely that the chemical constraints included within these consents will be tightened by the EA, to ensure that the water quality of the receiving watercourses does not deteriorate. When assessing possible consent changes the EA will take account of any sensitive sites and species downstream of the discharge, as well as the current dilution available from the river flow, and the possible benefits of increased flows.

In some cases the chemical limits required for some of the WwTW discharges may be tightened, to meet the WFD requirements, to limits that require the water companies to operate at Best Available Technology* (BAT), or beyond in the future. As water companies primarily obtain funding from the public through Ofwat, it may not be economically feasible for them to build and operate WwTW processes at this level, due to the increased costs (in both financial and energy/ carbon terms). Instead, it may be more feasible for water companies to plan to operate at Best Available Technology Not Entailing Excessive Cost* (BATNEEC), as there are less risks associated with releasing funds for achieving this. However, this will still require discussion and agreement with both the EA and Ofwat.

As described in Section 8.2.1, the majority of receiving watercourses already exhibit high levels of phosphate, which cause them to be classed as not achieving good ecological status (or GEP) under the WFD. This is a key concern throughout the majority of the East of England, and will require ongoing cooperation between water companies, the EA and other parties such as Defra to overcome this issue.

It has been assessed that certain development options under the worst case scenario will cause the existing volumetric discharge consent to be exceeded at the following WwTW:

- Felsted (if a new settlement or Great Dunmow connected);
- Great Chesterford (if a new settlement connected);
- Great Dunmow;
- Great Easton;
- Newport;
- Quendon;
- Rayne (if a new settlement connected);
- Stansted Mountfitchet; and
- Willows Green (if a new settlement connected).

The EA have used the worst-case increases in DWF calculated in this report to undertake initial water quality modelling, and therefore determine the indicative consent standards that would be required to ensure achieve the required quality under the WFD (or where upstream water quality is better than this, ensure that there is no deterioration in quality standards)

The results of this exercise are tabulated in Appendix I, and key outcomes are included in the following sections. However, it must be noted that the modelling exercise is based on the

* See Technical Glossary for definition of BAT and BATNEEC

current information and guidance that the EA have access to, and therefore results will be subject to change should additional guidance and information emerge during the implementation of the WFD.

The EA have previously indicated that they would not require P concentrations more stringent than BAT for consent revisions in the first period of the WFD (to 2015), however there is a risk that future iterations of the RBMPs may require more stringent standards, dependent on the water quality improvements realised to 2015.

Larger urban extensions/ intensification

The potential development sites that may be particularly constrained by the capacity of the water environment are those that are connected to WwTW that discharge to the Rivers Stort and Cam i.e. Elsenham, Great Chesterford, Newport, Saffron Walden, Stansted Mountfitchet and Takeley (Priors Green via Bishops Stortford). The ecological sensitivity and importance to biodiversity of these chalk rivers means that any increase in flows through increased WwTW discharges will result in consent standards tighter than BATNEEC, and in some cases BAT, (see Appendix I).

If it is economically feasible for the water companies to decrease the levels of determinands in the discharges to meet the requirements of the WFD, then development in these catchments may be preferable. The increased flows from the WwTW have the potential to supplement the low flows known to be impacting these rivers, subject to overcoming other flood risk and environmental constraints.

In addition, the requirement to improve the quality of the River Chelmer in keeping with the WFD also results in the requirement of tighter consent standards (see Appendix I) should development go ahead here.

New settlements

As described in previous sections, a number of possible solutions to the treatment of wastewater from the proposed new settlements require further investigation during the Detailed WCS. The EA have assessed that the connection of 3,000 (or 5,000) dwellings at Elsenham to the Stansted Mountfitchet WwTW would require discharge consents tighter than BAT for Phosphorus (P)*, and BATNEEC for Ammoniacal Nitrogen (Amm. N)* and Biochemical Oxygen Demand (BOD)*, to ensure that the ecological interest of the River Stort, and associated SSSI and UKBAP species and habitats, is protected. Availability of land on the WwTW site to accommodate the required process upgrades may also be a constraint, as will the lack of space to accommodate larger sewers in the narrow streets through the town. For these reasons, whether a designated Eco-Town or not, any new settlement at Elsenham should aspire to the strictest environmental standards, similar to those required of an official Eco-Town.

Similarly, a new settlement at Great Chesterford would increase the discharge of treated effluent to the River Cam. The EA have assessed that the consent standards required for an increase in flow such as this will be tighter than BATNEEC for BOD, approach BATNEEC for Amm. N, and BAT for P (although the quality requirements of the river may technically require a tighter P consent). In addition, should this new settlement be connected at the 5,000 dwelling level in the future, consent standards would have to be even more stringent.

* See Technical Glossary for explanation of these determinands, note that the EA have stated that they would not impose a consent tighter than BAT in the first BRMP round (to 2015)

The potential new settlement at Boxted Wood/ Andrewsfield would require all consent standards to be tighter than BATNEEC if the effluent was treated and discharged from either Rayne or Willows Green WwTW. Appendix I shows that with regards to discharge consents, the wastewater from Boxted Wood/ Andrewsfield would have the least environmental impact if treated and discharged at either Great Dunmow or Felsted WwTW (unless a more sustainable onsite solution is proposed by developers).

Local on site WwTW options for Elsenham, Easton Park and Boxted Wood/ Andrewsfield new settlements, described in Section 8.4, may be constrained due to both technical and economic viability considerations, because of the limited environmental capacity of the small local watercourses.

Given the sensitivity of the Rivers Stort and Cam, especially with respect to dissolved oxygen concentrations, it may be that the Stebbing Brook and River Chelmer can better accommodate the increased discharges from a new settlement without an unacceptable deterioration in water quality and environmental considerations.

However, it must be noted that according to the results in Appendix H, the required consent standards for Amm. N and P would be more stringent than BATNEEC and BAT respectively for such a treatment solution.

Village scale growth

The water quality of the receiving watercourses for the WwTW that treat wastewater from all of the potential villages would currently fail to meet good status (or GEP in the case of HMWB) under the WFD, due to high concentrations of phosphate.

As described above, the Rivers Stort and Cam are both chalk rivers, and hence UKBAP priority habitats. It would therefore be advisable to steer any significant development that risks increasing WwTW discharges away from the villages of Clavering, Chrishall, Debden, Quendon and even Hatfield Broad Oak (as the Pincey Brook is a tributary of the River Stort).

The prevalence of water dependant SSSI and LoWS, and other UKBAP priority habitats and species (as described in Section 8.2.3) on the River Stort and Cam also means that development at the above mentioned villages may not be advisable, unless there can be an assurance that water quality throughout these sites will not be at risk of deterioration.

Employment areas

The potential employment areas correlate with the proposed urban extension/ intensification, and new settlement, sites. Therefore, the impact of these employment areas on the water environment will be in keeping with the impacts from the residential sites and will require mitigation accordingly.

8.3.3 Flood risk

The connection of new sites to the existing sewerage network and WwTW can increase the risk of flooding in two ways:

- New development connected to the existing sewerage network may exceed the capacity of certain network capacity bottlenecks, causing surcharging of sewers, and the risk of properties being flooded with wastewater. This risk will be increased during storm events, as increased infiltration of surface water from the existing catchment area will also add to the flows in addition to any direct storm flows in combined systems; and

- DWF at WwTW will be increased following the connection of new dwellings to the network. Whilst some flows may be stored on site during peak flows, an increase to the volumetric flow rate of the discharge is likely. This may be within the existing volumetric discharge consent, as stipulated by the EA. However, discharges in excess of this, which will require an updated consent, may increase the fluvial flood risk to properties on the watercourse downstream of the discharge point.

Both of these risks will be more likely for the new settlement and larger extension/ intensification proposals, due to the larger flow increases associated with these sites.

Regarding sewerage network capacity and sewer flooding, priority sites for further assessment will be:

- Elsenham northeast and Elsenham west;
- Great Dunmow east;
- Saffron Walden (both the northeast and southeast sites);
- Takeley (extensions to Priors Green);
- Stansted Mountfitchet north; and
- Newport west.

These potential sites are located at the opposite periphery of the sewerage networks to their respective WwTW, and will require further assessment to ensure that network capacity, and hence sewer flooding, does not become a constraint to development (unless new sewers are used to bypass the existing networks). Thaxted east will also need investigation due to the capacity issues and long length of the outfall sewer involved, as described in previous Sections.

Ongoing discussions between UDC and AWS/ TWU, throughout the LDF process, will be required to ensure that adequate sewerage network upgrades can be implemented prior to the commencement of the development sites. Additional network models may become available to the water companies to allow this risk to be better quantified in the Detailed WCS.

8.4 Alternative options

For the new settlements, either at 3,000 or 5,000 dwellings, the treatment of wastewater on site must be considered as an alternative to connection to the existing sewerage network and WwTW.

The UK Government states that Eco-towns should aim for a minimum dwelling target of 5,000 homes[37]. This size is necessary to support the new local services and infrastructure required, and provide some economies of scale for the advanced technologies needed to make the development carbon neutral.

As such, a new local WwTW for a settlement of 3,000 dwellings in any location other than Chelmer Mead or Great Chesterford may not be economically feasible, particularly given the tight discharge standards that would be required before a discharge to the surrounding watercourses was consented to.

An alternative option for the Elsenham Eco-town would be a local WwTW to pre-treat effluent to a sufficient quality and then discharge to an upgraded Stansted Mountfitchet WwTW for final treatment, although this will require further investigation. As an official Eco-town, the new settlement would be expected to achieve PCC rates for potable water in line with CSH Level 5/6. UDC will also require that a new settlement of 3,000 dwellings achieves these PCC targets.

As stated previously, any consumption targets less than CSH Level 3 (105 l/p/d) require the use of rainwater harvesting or grey water re-use to supplement potable supply.

Given that the discharge of treated effluent may be constricted by the relatively small flow rates, and ecological sensitivity, of the receiving watercourses, there may be an opportunity to treat and re-use wastewater on site. This treated wastewater could then contribute to a grey water supply network, for uses such as flushing toilets.

Appendix H displays a range of wastewater treatment options, the size of population they are best suited to, and their advantages and disadvantages.

Whilst reed bed treatment of wastewater can offer biodiversity advantages, by increasing area of wetland habitat, the significant land required, and maintenance concerns, is unlikely to make it suitable for full treatment for a 5,000+ dwelling settlement. However, dependant on land availability and cost, reed beds may be utilised in combination with other technologies, to provide tertiary treatment for some of the wastewater, and perhaps contribute to the attenuation and treatment of surface water runoff.

This means that the treatment option required would be either a multitude of membrane bioreactors or biological aerated filtration units, installed as the phasing of the development dictates, or a new trickling filter or activated sludge plant (utilising advanced aeration techniques). Trickling filters may be preferable due to their lower energy requirements, however the potential for further expansion of the settlement in future RSS periods may warrant the construction of an activated sludge plant.

It may be that the detailed design of the infrastructure for a new settlement or Eco-town may specify that additional technologies are incorporated into the wastewater treatment system. For example, a development intended for 5,000+ inhabitants in Freiburg, Germany[38] utilises a vacuum toilet and sewer system for a pilot area of around 400 dwellings, to extract solids from the wastewater, which are then combined with organic household waste and anaerobically digested to produce biogas for cooking. The remaining liquid continues though the sewerage system to be biologically and chemically treated at a WwTW.

The decision of a developer to utilise such a system will be based on the economic feasibility of installing the technology, and must consider the economic gains that can be achieved from reduced dependency on potable water and energy supply.

It must also be noted that the current EA stance is against the proliferation of small scale WwTW. If such systems are required to the constraints discussed above, then the EA would prefer that they were adopted by AWS/ TWU to minimise the risk to the environment.

The optimum wastewater collection and treatment system will vary by site, dependant on available land and total dwelling numbers proposed. Whether or not such a system is built or adopted by AWS/ TWU will depend on negotiations between the developer and the water companies. Therefore, it is imperative that developers begin work now with UDC and the water companies to identify technical solutions to the constraints described in this WCS, prior to the UDC Core Strategy being finalised.

8.5 Issues for next stages

The further work required to be undertaken in a Detailed WCS includes:

- Obtaining the outstanding information regarding WwTW and sewerage network capacity for the locations highlighted in Section 8.3.1, such as Saffron Walden and other smaller villages;

- Consulting with the EA and water companies to assess the likelihood of obtaining increased volumetric discharge consents for the affected WwTW, considering water quality, environmental constraints and flood risk issues;
- Confirming the necessary key strategic sewerage and WwTW upgrades (or new WwTW), including the production of intervention charts and approximate costs in collaboration with the water companies, following confirmation of the preferred development option through the LDF process.

9 Constraints, Solutions and Opportunities summary

The following summary tables illustrate how the issues and solutions identified in Section 6, 7 and 8 may constrain or facilitate the proposed development. However, this will require confirmation and investigation through further consultation with the key stakeholders during the detailed WCS strategy production.

As an indicative guide, the issues are displayed and discussed using the following convention:

	Major constraint to development, requiring extensive infrastructure improvements to allow development (possible showstopper at this stage but may be reclassified following further investigation).
	Major constraint to development, requiring extensive infrastructure improvements to allow development (Not considered as a showstopper at this but requires further investigation to confirm).
	Major or possible constraint to development, although infrastructure solutions and mitigation techniques are identified and/ or judged feasible to allow development.
	No constraint to development, or minor localised improvements required to allow development

Table 9-15 Key for constraints summary tables

The sections below discuss constraints, solutions and opportunities in the following order:

- Larger urban intensification and extensions;
- New settlements; and
- Village growth.

Larger urban intensification and extensions

Regarding the supply of potable water, as the extension/ intensification sites required to meet the RSS targets are centred on the existing market towns and key service centres, VWC are confident that adequate supply can be provided through the existing network and local boreholes. There is however a risk that future sustainability reductions imposed by the EA on VWC abstractions may require VWC to alter the strategy they adopt in their Northern WRZ, which may pass on higher costs to their customers.

For the majority of locations, the connection of a site to the potable network will probably require the reinforcement of certain areas of the localised network. It is assumed that this need will be addressed by VWC through the normal developer requisition process.

An exception to this rule may be the extension to Priors Green site and surrounding area, in Takeley. If development Option 2 becomes reality, the provision of an additional 750 homes, on top of the 717 still outstanding, may require some upsizing of the trunk main between Bishops Stortford and Great Dunmow. VWC have advised that they could contribute high level modelling of this issue for the Detailed WCS.

Additional constraints to the potential sites are summarised in Table 9-16 below.

Settlement	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Wider Environment
Elsenham NE	See above text	If connected to Stansted Mountfitchet WwTW, parts of the existing sewerage network will need upgrading to reduce the risk of sewer flooding. Increased flood risk from additional effluent will need assessment and mitigation as required.	Stansted Mountfitchet WwTW has capacity for current allocations (plus 200 infill) only. Significant additional process capacity will be required for this level of development, and availability of land may be an issue.	Existing 2.5 km outfall sewer to Stansted Mountfitchet has capacity for approximately 100 dwellings. Upsizing will be required if these sites connected. Upgrade or preferably bypass of existing village network will be required.	Rivers Cam and Stort are UKBAP priority habitats, with a number of important habitats and species identified downstream, and are currently failing to comply with WFD due to phosphate and dissolved oxygen levels. Increased discharges from either Stansted Mountfitchet or Quendon WwTW would require tight chemical consents.
Elsenham west	See above text				
Great Chesterford Extension	See above text	No significant issues	Great Chesterford WwTW discharge consent will not be exceeded by the increase in flows. AWS estimate that the WwTW currently has capacity to accommodate the flows from an additional 800 dwellings.	No spare network capacity and require direct connection to WWTW.	Volume of flows from this scale of development will not require an increased discharge consent, however, River Cam is a UKBAP priority habitat, with a number of important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate and dissolved oxygen levels. There is a risk that tighter consents may be required in future cycles of the RBMP (post 2015)
Great Chesterford Intensification	See above text	No significant issues, providing sites do not encroach upon River Cam floodplain		No spare network capacity and require direct connection to WWTW.	
Great Dunmow south	See above text	WwTW is in FZ3b, required upgrades may be constrained. Eastern sites should take account of historic flooding at Churchend. Sites to the southwest should take account of surface water flows and possible ponding – see SFRA. Increased flood risk from additional effluent will need assessment and mitigation as	WwTW capacity and consent will be exceeded by current allocations. Additional process capacity and an increased DWF consent is planned for the end of AMP 5, which should be able to accommodate the existing allocations and the additional growth proposed under Option 4 (excluding a new settlement in this catchment)	Localised upgrades, or bypass, of existing village network will be required.	AWS have negotiated revised discharge consent standards with the EA to accommodate the increased flows in AMP 5. However, any new growth in excess of Option 4 will require additional capacity and a new consent, which may entail significantly tighter physio-chemical standards, particularly as it is likely this would occur in future cycles of the RBMP (post 2015)
Great Dunmow east	See above text			Development near Churchend is furthest from WwTW, and may require extensive network upgrades or new strategic sewer approximately 1.5 km in length.	

Settlement	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Wider Environment
Great Dunmow Intensification	See above text	required.		Localised upgrades, or bypass, of existing village network will be required.	
Great Dunmow SW	See above text			Localised upgrades, or bypass, of existing village network will be required.	
Newport west	See above text	No significant issues	The DWF consent increase proposed by AWS will maintain the required headroom for existing seasonal variations in DWF. However, additional process capacity, and an increased consent will be required to accommodate any growth.	Development is 1.5 km to 2.0 km away from WwTW, and may require extensive network upgrades through the town or a new strategic sewer. This may be cost prohibitive given the relatively small quantum of development.	River Cam is a UKBAP priority habitat, with important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate levels. AWS proposed discharge consent will not be breached, but it may be beneficial to water quality to limit the development to 50 dwellings (Option 4). There is a risk that tighter consents may be required in future cycles of the RBMP (post 2015)
Saffron Walden northeast			Saffron Walden WwTW discharge consent will not be exceeded by the increase in flows. Process capacity is unlikely to be an issue.	Both potential sites are the opposite side of the town to the WwTW. The existing sewerage network is at capacity. Extensive upgrades, or new direct sewers to the WwTW may be required. Linear distance is approximately 2 km, new sewer may be considerably longer dependant on route.	River Cam is a UKBAP priority habitat, with important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate and dissolved oxygen levels. It may be beneficial to water quality to limit development here (Option 4). There is a risk that tighter consents may be required in future cycles of the RBMP (post 2015)
Saffron Walden SE					
Stansted Mountfitchet Intensification	See above text	No significant issues	WwTW has adequate capacity and headroom within discharge consent.	Scale of development can be accommodated within existing network. With minor upgrades as required.	Volume of flows from this level of development can be accommodated within the existing WwTW discharge consent. However (see below)

Settlement	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Wider Environment
Stansted Mountfitchet northeast	See above text	Level of growth may increase risk of sewer flooding	TWU estimate process capacity at Stansted Mountfitchet WwTW will be reached with 200 additional dwellings. Upgrades will be required, and availability of land may be an issue, however there may be adequate headroom within the existing discharge consent.	Upgrade, or more likely a pumped bypass (due to the lack of space for upsized sewers in the narrow town streets) of existing village network (around 1.75 km), will be required.	River Stort is a UKBAP priority habitat, with a number of important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate levels.
Takeley Priors Green Extension	See above text	Increased discharge, and hence downstream flood risk, at Bishops Stortford WwTW would be negligible.	Bishops Stortford WwTW has adequate capacity and headroom within discharge consent	Size of pumping station can accommodate flows from an additional 1,500 dwellings but pump size and rising main (to Stansted Airport, approximately 2.5 km) would need upsizing.	River Stort is a UKBAP priority habitat, with a number of important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate and dissolved oxygen levels. However, increase in flows from this development will have a relatively small impact on overall WwTW discharge.
Thaxted east	See above text	No significant issues	Current capacity issues at Great Easton WwTW will need to be overcome before proposed growth can be accommodated.	The network in the village and gravity outfall sewer has no spare capacity. A new outfall sewer (approximately 6 km) or sections of the sewer may need upgrading unless local storage options and pumping station up rating is feasible.	The River Chelmer is currently impacted by poor phosphate and dissolved oxygen levels.

Table 9-16 Summary of constraints to large-scale extensions/ intensification

New settlements

The identified key constraints, solutions and opportunities are summarised in Table 9-16 below.

Location	Potable Supply	WwTW Capacity and Sewerage Network Capacity	Flood Risk	Wider Environment
Boxted Wood/ Andrewsfield	Site could possibly be supplied via a new trunk main linked to the reservoir.	New local WwTW or rebuilding of existing WwTW at the same site would be required. Site is 4 km from nearest WwTW.	Downstream flood-risk would be exacerbated by the increased discharges from any of the nearby WwTW, or a new WwTW, as watercourses are small. If connected to Felsted WwTW, the increased risk of flooding on the Stebbing Brook and River Chelmer would have to be assessed.	All three possible receiving watercourses are currently known to be impacted by poor quality, particularly high phosphate levels. Connection to Felsted WwTW would be likely have the least impact, due to higher dilution available and a lesser number of notably important habitats downstream. Chemical consent limits may still have to be tightened to protect the water quality of the River Chelmer
Chelmer Mead	Site could possibly be supplied via extension to Great Dunmow Trunk network, or a new link to the reservoir.	Direct connection to Felsted WwTW would be feasible, although the WwTW will require rebuilding of existing WwTW at the same site which may take up to 10 years.	If connected to Felsted WwTW, the increased risk of flooding on the Stebbing Brook and River Chelmer would have to be assessed.	If connected to Felsted WwTW, chemical consent limits may still have to be tightened to protect the water quality of the River Chelmer. Catchment solution may not be realised until post 2020.
Easton Park	Site could possibly be supplied via VWC trunk main between Bishops Stortford and Great Dunmow.	Direct connection to Great Easton WwTW would be feasible, although the WwTW will require rebuilding. It may be possible to link into the Takeley – Bishops Stortford sewerage network, although this would require at least 4 km of new infrastructure, and use a significant proportion of available WwTW capacity.	Downstream flood-risk would be exacerbated by the increased discharges from a new WwTW on the River Roding, or connection to Great Easton WwTW (on the River Chelmer). If connected to Takeley – Bishops Stortford sewerage network, increase in downstream flood risk on the River Stort from WwTW works will be negligible as flows will still be within consent.	It is likely that the chemical consent would be tightest on the River Roding, due to the low dilution available. Connection to Bishops Stortford may have the least environmental impact, as the WwTW will still be operating within its consent.

Location	Potable Supply	WwTW Capacity and Sewerage Network Capacity	Flood Risk	Wider Environment
NE Elsenham	Site can be feasibly supplied via VWC trunk main system.	Connection of site to TWU network to Stansted Mountfitchet would require extensive network upgrades and the rebuilding of the WwTW.	If connected to Stansted Mountfitchet, Broxted or Quendon WwTW, the increased size of discharge would need to be further assessed and mitigated.	Rivers Cam and Stort are UKBAP priority habitats, with a number of important habitats and species identified downstream, and are currently failing to comply with WFD due to phosphate and dissolved oxygen levels.. Increased discharges from either Stansted Mountfitchet or Quendon WwTW would require tight chemical consents.
Great Chesterford	Site could possibly be supplied via a new trunk main linked to the reservoir.	Direct connection to Great Chesterford WwTW would be feasible, although the WwTW will require extensive upgrades.	Proposed site contains areas of functional floodplain. Development would have to avoid, or provide compensation for any floodplain lost. The impact of the increased WwTW discharge on the flood risk of the River Cam would have to be assessed.	River Cam is a UKBAP priority habitat, with a number of important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate and dissolved oxygen levels. The flows from this development would require an increased volumetric discharge consent. There is a risk that tighter consents may also be required in future cycles of the RBMP (post 2015).

Table 9-17 Summary of new settlement constraints

Employment areas

Location	Potable Supply	WwTW and Sewerage Network Capacity	Flood Risk	Wider Environment
Bishops Stortford - northern edge	Site can be feasibly supplied via VWC trunk main system.	WwTW should have adequate capacity for this development, localised network upgrades may be required	New flows will not cause WwTW to exceed volumetric discharge consent, therefore downstream fluvial flood risk will not significantly increase	New flows will not cause WwTW to exceed volumetric discharge consent, environmental capacity will be a key constraint
Elsenham Industrial Estate, Gaunts End (Extension)	Site can be feasibly supplied via VWC trunk main system.	Additional loading on the Stansted Mountfitchet WwTW and Elsenham sewerage network will need to be mitigated by TWU	Increased risk of fluvial flooding downstream of WwTW, and sewer flooding, will need to be mitigated	See concerns in Table 9-16 for Stansted Mountfitchet
Elsenham (or other locations as part of a New Settlement)	Site can be feasibly supplied via VWC trunk main system.	Extensive upgrades to receiving WwTW and sewerage network required.	Increased risk of fluvial flooding downstream of WwTW, and sewer flooding, will need to be mitigated	See concerns in Table 9-17 for new settlements
Great Dunmow - Land south and west (Mixed Use Scheme)	Site can be feasibly supplied via VWC trunk main system.	Localised improvements to the sewerage network may be required. The WwTW is currently at capacity but AWS are proposing to increase this in AMP 5.	Increased risk of fluvial flooding downstream of WwTW, and sewer flooding, will need to be mitigated	See concerns in Table 9-16 for Great Dunmow
Great Dunmow south	Site can be feasibly supplied via VWC trunk main system.			
Saffron Walden - Land west of Thaxted Road	Site can be feasibly supplied via VWC trunk main system.	Similar to concerns for Saffron Walden residential sites listed in Table 9-16	Increased risk of fluvial flooding downstream of WwTW	See concerns in Table 9-16 for Saffron Walden
Saffron Walden east (Mixed Use Scheme)	Site can be feasibly supplied via VWC trunk main system.			
Saffron Walden northeast	Site can be feasibly supplied via VWC trunk main system.			

Location	Potable Supply	WwTW and Sewerage Network Capacity	Flood Risk	Wider Environment
Takeley - Priors Green Extension	Dependant on dwelling completions, this site may contribute to the requirement of upgrades to the trunk main between Bishops Stortford–Great Dunmow	Size of pumps and rising main to Stansted Airport needs increasing for the residential development in Option 2. The addition of trade flows will require the installation of larger infrastructure, and the upsizing of the pumping station wet well.	New flows will not cause WwTW to exceed volumetric discharge consent, therefore downstream fluvial flood risk will not significantly increase	See concerns in Table 9-16 for Takeley

Table 9-18 Summary of employment area constraints

Village scale growth

The small scale of the potential growth anticipated in the villages results in VWC being confident that **potable water supply will not be a constraint** to development. However, the following constraints, from other aspects of the water cycle, should be considered:

Village	Flood Risk	WwTW and Sewerage Network Capacity	Wider Environment
Ashdon	Serious fluvial flooding issues around village. Ensure development is located in FZ1	No headroom within existing or proposed DWF discharge consent	Poor phosphate levels in watercourse.
Barnston	WwTW in FZ3b – upgrades must be avoided in this		Poor phosphate levels in
Chrishall			
Clavering			
Debden		No headroom within existing or proposed DWF discharge consent.	
Felsted	WwTW in FZ3b – upgrades must be avoided in this area	No major concerns are expected to accommodate up to 10 new dwellings.	Poor phosphate levels in watercourse.
Great Easton	No issues – ensure development is located in FZ1	No major concerns are expected to accommodate up to 10 new dwellings.	Poor phosphate levels in watercourse.
Great Sampford	No issues – ensure development is located in FZ1	No major concerns are expected to accommodate up to 10 new dwellings.	UKBAP priority species previously identified downstream of WwTW. Poor phosphate levels in watercourse, although additional discharge would aid known low flow issues in headwaters.

Village	Flood Risk	WwTW and Sewerage Network Capacity	Wider Environment
Hatfield Broad Oak	Historic groundwater flooding event should be considered	The capacity of pumps and rising main to Hatfield Heath will limit development to 30 dwellings max.	UKBAP priority habitats located downstream of WwTW discharge. Pincey Brook is a tributary of a chalk stream.
High Roding	No issues – ensure development is located in FZ1	No major concerns are expected to accommodate up to 10 new dwellings.	Moderate phosphate levels in watercourse, although additional discharge would aid known low flow issues in headwaters.
Manuden	WwTW in FZ2 - adequate pollution control must be in place	There is adequate headroom at WwTW, although network capacity will limit development to less than 20 dwellings. Currently, there are issues with spillages during storm events.	SSSI and UKBAP priority habitats and species located downstream of WwTW discharge.
Quendon and Rickling	No issues – ensure development is located in FZ1	No major concerns are expected to accommodate up to 10 new dwellings.	SSSI and UKBAP priority habitats and species located downstream of WwTW discharge.
Radwinter	No issues – ensure development is located in FZ1	No major concerns are expected to accommodate up to 10 new dwellings.	UKBAP priority species previously identified downstream of WwTW. Poor phosphate levels in watercourse, although additional discharge would aid known low flow issues in headwaters.
Stebbing	WwTW in FZ3b - upgrades must be avoided in this area	No major concerns are expected to accommodate up to 10 new dwellings.	Poor phosphate levels in watercourse.
Wimbish	No issues – ensure development is located in FZ1	No major concerns are expected to accommodate up to 10 new dwellings.	UKBAP priority species previously identified downstream of WwTW. Poor phosphate levels in watercourse, although additional discharge would aid known low flow issues in headwaters.

Table 9-19 Summary of constraints to village scale growth

10 Outline strategy Conclusions and Recommendations

10.1 Major infrastructure requirements

Table 10-20 highlights the significant infrastructure requirements that will be required to accommodate the future development options for the District. Note that Option 4 is further subdivided, based on the location of the proposed new settlement, as follows:

- 4a – Boxted Wood/ Andrewsfield;
- 4b – Chelmer Mead;
- 4c – Easton Park;
- 4d – Elsenham; and
- 4e – Great Chesterford.

✔ = Infrastructure required – = Infrastructure not required

( ) = Infrastructure may be required dependant on water company/developer strategy

Infrastructure Requirement	Development Option							
WwTW Infrastructure	**1**	**2**	**3**	**4a**	**4b**	**4c**	**4d**	**4e**
New process capacity and increased discharge consent at Stansted Mountfitchet WwTW - (process change required for option 4d)	✔	✔	✔	–	–	–	( )	–
New process capacity and increased discharge consent at Great Dunmow WwTW, beyond current AMP 5 proposal	✔	✔	✔	( )	( )	( )	–	–
New process capacity and increased discharge consent at Great Chesterford WwTW	–	–	–	–	–	–	–	✔
New process capacity and increased discharge consent at Felsted WwTW	–	–	–	( )	( )	–	–	–
New process capacity and increased discharge consent at Great Easton WwTW	–	✔	✔	✔	✔	✔	✔	✔
New process capacity and increased discharge consent at Newport WwTW	–	✔	✔	✔	✔	✔	✔	✔
New local WwTW on new settlement site	–	–	–	( )	( )	( )	( )	( )
Strategic Sewerage Infrastructure								
Upgrade outfall sewer or new sewer from Elsenham to Stansted Mountfitchet WwTW	–	–	✔	–	–	–	( )	–
Upgrade Rising Main and Pumps from Canfield End to Stansted Airport	–	✔	–	–	–	( )	–	–
New strategic sewer to connect Newport west to Newport WwTW	–	✔	✔	✔	✔	✔	✔	✔
Upgrade existing sewers through Saffron Walden, or construct new sewers, to connect new development to the east of the town to Saffron Walden WwTW	✔	✔	✔	( )	( )	( )	( )	( )
Upgrade existing outfall sewer, or construct new strategic sewer, from Stansted Mountfitchet north to Stansted Mountfitchet WwTW	✔	–	–	–	–	–	–	–
Upgrade outfall sewer from Thaxted to Great Easton WwTW (or local network upgrades)	–	✔	✔	✔	✔	✔	✔	✔
New sewers from Boxted Wood/ Andrewsfield and Easton Park new settlements to the nearest existing WwTW	–	–	–	( )	–	( )	–	–
Potable Supply Infrastructure								
Extensive upgrades to VWC trunk main network to serve Great Chesterford	–	–	–	–	–	–	–	✔
Extensive upgrades to VWC trunk main network to serve new settlements east of Great Dunmow	–	–	–	✔	✔	–	–	–
Possible upgrades to trunk main between Bishops Stortford–Great Dunmow	–	✔	–	–	–	✔	–	–

Table 10-20 Major Infrastructure Requirements by Development Option

10.2 Implementation - constraints and solutions

It is anticipated that major extensions to the strategic potable water supply or sewerage network, such as those listed above, will take around five years to plan and complete. Any localised network upgrades can be commenced by water companies once planning permission for the development has been approved, and the developer requisition received. Therefore, development phasing and planned development trajectories to meet RSS targets should clearly allow for the lead in time involved in investigating, planning and constructing the required key infrastructure needs.

Indicative guidance from the water companies suggests the following planning and construction timeframes for wastewater infrastructure:

- Network improvements – up to three years;
- Significant new network, and upgraded processes capability at WwTW – up to five years; and
- Major upgrade of WwTW, or construction of new WwTW – up to ten years.

It should also be noted that the majority of speculative future RSS growth sites assessed in this WCS for UDC development options are unlikely to be factored into the current business plans prepared by the water companies as part of PR09, other than for general water resource and demand management purposes. This is further compounded due to the current general economic down turn and uncertainty on timing for any noticeable recovery. Therefore, securing funds for undertaking any major capital schemes would be another key constraint where such funds are unlikely to be forthcoming through the alternative process of developer requisitions. However, the EA have suggested that some of the wastewater treatment upgrades may be able to be added to subsequent National Environment Programmes to ensure that the water companies and Ofwat consider these schemes when determining future funding, although this would now be delayed until PR14. The EA have commented that they would want assurances that adequate funding for any wastewater treatment solutions and network improvements is in place prior to large scale development commencing, particularly in Stansted Mountfitchet, Takeley and Elsenham.

All four UDC development options currently require that additional development (in addition to that already allocated) begins at **Great Dunmow** from 2011 to meet RSS targets, however there is some flexibility, as the phasing information provided to date is not definitive. As described in previous sections, Great Dunmow WwTW is at capacity and will require upgrades, currently planned for 2014/15.

Whilst TWU predict that the existing sewerage network and WwTW at **Stansted Mountfitchet** can accommodate the flows from the sites within the town itself (Option 2, 3 and 4), any development at Elsenham (which would be required under these options) will require the provision of additional WwTW capacity and significant network upgrades. This essentially means that infrastructure upgrades will be required regardless of the final development option adopted, unless Option 4 goes ahead with the new settlement in a location other than at Elsenham. As discussed previously, the availability of land at the WwTW to accommodate the require process upgrades may limit the treatment capacity that TWU can provide. Narrow streets through the town, already congested with utilities, have little capacity to accept upsized sewers, and hence new costly bypass sewers may be required. Option 1 is likely to require the least amount of infrastructure upgrades to the network around Stansted Mountfitchet, as it involves a shorter length of new sewers or upgrade of existing sewers, compared to all other options. Also, the predicted start date (post 2018) of this development site in Option 1 would

allow the necessary timeframe for the upgrades to be put in place, including the additional process capacity required at the WwTW. The potential development site at Elsenham west, in Option 2, also shares this benefit (as it is predicted to occur between 2019 and 2026), however would require significantly more network infrastructure upgrades. Option 1 is therefore considered to be favourable over the other options, in relation to the impact on Stansted Mountfitchet catchment, and associated new infrastructure needs. Therefore, this option has the best potential to accommodate the required development in this catchment within the anticipated timescale, entailing the least infrastructure cost.

The potential development to the west of **Elsenham** is most likely to be connected to Stansted Mountfitchet WwTW, and is therefore dependant on the provision of adequate treatment capacity, along with the upgrade of the existing outfall sewer or possibly construction of a new outfall sewer. Development here would therefore be delayed until later part of 2015-2020, dependant on the scale of upgrades required. To upgrade the WwTW to accept the least development from Elsenham west (Option 2) and associated sewerage upgrades may take until 2015 at the earliest, subject to developer requisitions and the necessary funds, and land, being made available. However, under Option 2 this development is predicted to begin from 2019, so there will be an adequate timeframe available to TWU in which to upgrade both the sewerage network and WwTW, prior to commencement of construction. Option 3, which requires development here to start in 2013, and may require the connection of a nearly 1,000 additional dwellings from northeast of Elsenham after 2018, is very likely to be constrained as the WwTW will need extensive upgrades to accommodate these additional flows. Development at Elsenham could be realised earlier than the above dates if developers are able to propose technologically (and economically) feasible wastewater treatment solutions to the satisfaction of the EA, water companies and UDC

Regarding **Takeley**, Option 2 proposes that the additional development to meet RSS targets begins here from 2013/14. The necessary upgrade to the rising main and pumps that serve Canfield End/ Priors Green may take up to five years; therefore the planning of this infrastructure solution will need to begin as soon as possible, should this Option be pursued by UDC.

All four development options do not require additional development sites to commence in **Saffron Walden** prior to 2015. It is likely that any required increases in treatment capacity at the WwTW, and network improvements such as new sewers bypassing the existing network, could be provided in this timeframe subject to developer requisitions. The existing discharge consent is unlikely to be exceeded by any of these options and AWS have indicated that process capacity is not an issue if development can be accommodated within the current consent. Therefore, development is unlikely to be significantly constrained. However, the higher levels of development suggested here in Options 1 and 2 may necessitate more extensive sewerage upgrades, and require longer timeframes for the completion of the required infrastructure. The possibility of sewerage network upgrades causing major disruption to traffic, due to the narrow streets within the town, is a key risk. This risk should be further assessed in consultation with AWS and UDC in the Detailed WCS.

Regarding **Great Chesterford**, Options 2, 3 and 4 (excluding a new settlement option here) are unlikely to require upgrades to the WwTW, but may require local sewerage upgrades or new sewers direct to the existing WwTW. The economic viability of such upgrades, compared to the scale of development proposed for these options, may constrain such development at these locations to some extent. This risk should be further investigated in the Detailed WCS. Option 1 does not have this risk as it excludes development in the town.

The previous sections also highlighted that there are significant sewerage needs associated with other development locations such as **Newport west** and **Thaxted east,** causing some doubt over their viability compared to the scale of development proposed.

Any of the Option 4 **new settlement** locations are likely to result in entire replacement of the existing WwTW process with a more advanced process. Therefore, it is likely that the required treatment capacity will not be able to be provided until at least 2020, or even later depending on the speed of undertaking the relevant investigations and overcoming any planning issues. This would significantly constrain the UDC aspiration to begin development at a new settlement from 2013/14 as currently envisaged, unless upgrades at the receiving WwTW can be phased in line with the development.

However, if the new settlements are judged to be of sufficient size to make on site treatment, and re-use of treated effluent economically feasible, as described in Section 8.4, this timeframe may be able to be accelerated, particularly if developers fund and build such infrastructure on land they already own. As discussed previously, whether or not this becomes economically feasible will depend on emerging technologies, land availability, the predicted overall numbers and phasing of development, and the willingness of developers to fund the required treatment technology. This WCS has also highlighted that such local WwTW options are unlikely to become viable due to the extremely limited environmental capacity involved with the small receiving watercourses, in particular for Elsenham and Boxted Wood/ Andrewsfield, as they are located at the headwaters of main rivers.

All of the above statements assume that adequate water quality standards can be achieved in the WwTW discharges, and any new discharge consents, which will be the case for all new settlement options, can be agreed with the EA and the water companies. However, there is a risk that the EA may require tighter consent standards to be applied in the future in order to comply with the WFD, and protect the interest of downstream environmental sites. Therefore, further consultation is needed with the EA and TWU/ AWS in a Detailed WCS, to assess where this issue poses the greatest risk to development.

10.3 Proposed Strategy

Amongst the development options 1, 2 and 3 (those excluding the need for a new settlement) it appears that Option 1 is preferable, as it is likely to cause the least impact on the Stansted Mountfitchet WwTW catchment, whilst providing sufficient time to undertake the required upgrades (providing TWU can make sufficient land available). This option also excludes development at other problematic (and potentially cost prohibitive) locations such as Newport west, Thaxted east and Elsenham. However, should other planning constraints rule this Option out, there is some flexibility offered by the existing capacity in the Takeley area (given the available capacity at Bishops Stortford WwTW), which UDC may be able to utilise, although this will be dependent on creating adequate capacity in the rising mains and pumps in this catchment. A disadvantage of Option 1 is that the majority of the additional development in Great Dunmow (on top of the existing allocations) will have to be delayed until at least 2015, once AWS upgrade the WwTW capacity, and begin to investigate the additional process upgrades and revised consent required to fully accommodate the flows from the Option 1 development. However, this would be the case for all of the options suggested by UDC.

Amongst the potential new settlements locations considered, AWS advise that Great Chesterford is best located to provide the necessary water services infrastructure in the most cost advantageous way, given the relatively short length of new sewers that would be required compared to the other settlement locations (including Elsenham), and the availability of land

adjacent to the existing WwTW. AWS advise that the indicative consent standards provided by the EA are achievable, once adequate process upgrades are in place at the WwTW. The available capacity at the WwTW also allows for some development to begin in the short to medium term, whilst AWS plan and construct the required process upgrades to serve the full 3,000 dwellings.

The viability of the new settlements, particularly with regards to the cost of wastewater infrastructure, depends upon the aspirations and financial commitment of the developers. Until more information is available from the developers of these sites, regarding potential onsite treatment options, the feasibility of a new settlement, including the original UDC Option 4 (Elsenham), cannot accurately be assessed.

However, as shown in Appendix I, the discharge consent standards required for all of the above solutions will be tight; more stringent than BATNEEC, and in some cases BAT. At this stage in the WCS, this cannot be considered a complete constraint to development, and further assessment will required by the water companies and EA to determine the optimum treatment solution for the District once UDC have finalised development locations and quantum in their Core Strategy.

Therefore, it is strongly recommended that the developers promoting the new settlement locations liaise with the water companies, the EA and UDC during and following the UDC Core Strategy Preferred Options stage, to ensure that UDC have the necessary information to finalise their Core Strategy. Once this final option is decided upon, UDC will be required to undertake further WCS work in order to fully support their final Core Strategy. A Detailed WCS could then be completed for the District, following the finalisation and submission of the Core Strategy, to support the Site Allocations DPDs.

10.4 The need for a Detailed WCS

This Outline WCS provides UDC with an indication of where water and wastewater infrastructure, and the wider water environment, will constrain development. The key infrastructure requirements associated with each development Option have been identified.

However, at present the range of development options available to UDC prevents the assessment of detailed site-specific infrastructure requirements.

A Detailed WCS should be completed alongside finalisation of the UDC Core Strategy Final Submission Site Allocation Development Plan Documents, and will be required to:

- Liaise with ongoing WCS undertaken by the developers proposing the new settlement locations, to ensure that the emerging strategy for the District is coherent;
- Collate any ongoing assessments undertaken by the EA or water companies with regards to the indicative consents included in this Outline WCS;
- Ensure an assessment is made, with cooperation from AWS and the EA, of the impact of the potential development at Saffron Walden on the town's sewerage system and CSOs;
- Confirm with the water companies the scale and phasing of the other required WwTW upgrades to accommodate the final development Option UDC decide upon, whilst protecting the water environment;
- Confirm with the water companies the scale and phasing of the sewerage and potable network upgrades required to allow the connection of the large extension/ intensification in the market towns and key service centres;

- Identify how the above infrastructure constraints can be overcome, the further action required to achieve this, and which of the stakeholders will be responsible for these actions;
- Work with UDC, the EA and Natural England (and perhaps developers) to determine the most sustainable options for the attenuation, treatment and discharge of surface water at a strategic level, once a development Option is decided upon;
- Inform the WCS stakeholders of the indicative costs of the required water infrastructure and provide advice on financial contributions required from developers to fund strategic improvements; and
- If possible, assess how emerging regulations on the Community Infrastructure Levy can influence the funding of the key water and wastewater infrastructure.

10.5 Guidance for UDC and developers

Developers will continue to be required to comply with emerging UDC and regional policies, in addition to statutory national policies such as PPS25.

UDC should look to include the availability of water and wastewater infrastructure as a planning condition, so that planning permission is not granted until developers have consulted with VWC and TWU/ AWS regarding network capacity and possible strategic solutions. Contributions towards the costs of such infrastructure may be collected through the forthcoming Community Infrastructure Levy, although this will depend on local implementation guidelines.

The following checklist (Table 10-21) should be used to guide policy development by UDC, and is also provided as outline guidance for developers, to enable developments to be planned whilst taking account of best practice, and conforming to the strategy and aspirations discussed throughout this WCS. This guidance will need further development in line with the detailed WCS findings in next stage.

Meeting the “actively encouraged” requirements will minimise the negative impacts of any development on the water infrastructure within the study area, and the wider water environment.

Topic	Strategic Requirement/ Aspiration	Minimum Requirement	Actively Encouraged
Flood Risk	*Has the development been approved following an assessment under PPS25, utilising the sequential and exception tests, a FRA and District SFRA 2008 where appropriate?*	ⓘ	
	Does the FRA for the development site propose measures to reduce downstream flood risk, particularly from surface water runoff following WCS guidance?		✔
SUDS	*Has the developer provided details of how surface water runoff will be separated from foul drainage systems and limited to the rate prior to development (the equivalent greenfield rate for brownfield sites), in line with EA guidance, CFMP and SFRA?*	ⓘ	
	Can the developer demonstrate that any planned SUDS are appropriate for the site geology, taking into account Groundwater Vulnerability and SPZ, as detailed in this WCS. Previous land use should be considered, and localised permeability tests will also be required, potentially as part of the site FRA?	ⓘ	
	Has the developer consulted with UDC regarding who will be responsible for maintenance of any SUDS features, and how this will be funded?	ⓘ	
	Is the developer proposing to integrate biodiversity features such as wetlands and green corridors into any proposed SUDS, as recommended in this WCS?		✔
Demand Management	*Has the developer provided evidence of how calculated whole building performance will be 105 l/p/d or less, as required by UDC policy and recommended in this WCS?*	ⓘ	
	Has the developer provided details of any rainwater harvesting/ grey water reuse systems to achieve PCC between 80-105 l/p/d?		✔
	Has the developer provided details of any schemes/ measures to raise the occupiers'/ community's awareness of the importance of water efficiency?		✔
Potable Supply	*Has the developer liaised with VWC to ascertain if supply can be provided, and agreed appropriate funding mechanisms?*	ⓘ	
	Is the development part of a strategic site within close proximity to VWC assets, in keeping with Section 9 of this WCS?		✔
Sewerage	*Has the developer provided evidence (following liaison with AWS/ TWU) that network capacity can be provided, the receiving WwTW has adequate capacity to receive the flows, and that appropriate funding mechanisms are in place?*	ⓘ	
	Is the development location and phasing in keeping with the strategy recommended in this WCS		✔
Conservation	*Has the developer completed all relevant ecological surveys and impact assessments, and complied with all relevant planning conditions, as directed by UK/ EC law, PPS9 and the latest UDC policies?*	ⓘ	

Topic	Strategic Requirement/ Aspiration	Minimum Requirement	Actively Encouraged
	Has the developer provided details of integrated site specific solutions to enhance biodiversity in the water environment?		✔

Table 10-21 Developer checklist

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[34] UDC, Appropriate Assessment of Core Strategy - Preferred Options, 2007

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[38] Vauban District, Freiburg, Germany [http://www.vauban.de/info/abstract4.html accessed 30th April 2009]

Glossary of Terms

Acronym	Term
Amm. N	Ammoniacal Nitrogen (re Discharge Consent)
AMP	Asset Management Period
AMR	Annual Monitoring Report
AWS	Anglian Water Services
BAP/ (L)BAP	(Local) Biodiversity Action Plan
BAT	Best Available Technology
BATNEEC	Best Available Technology Not Entailing Excessive Cost
BOD	Biochemical Oxygen Demand
CAMS	Catchment Abstraction Management Strategies
CFMP	Catchment Flood Management Plans
CSH	Code for Sustainable Homes
CSO	Combined Sewer Overflow
DEFRA	Department for Environment, Food and Rural Affairs
DPD	Development Plan Documents
DWF	Dry Weather Flow
DYCP	Dry Year Critical Period
EA	Environment Agency
EWT	Essex Wildlife Trust
GEP	Good Ecological Potential
GWV	Groundwater Vulnerability
HMWB	Heavily Modified Water Body
HOF	Hands Off Flow
LDD	Local Development Documents
LDF	Local Development Framework
LDS	Local Development Scheme
NE	Natural England
OFWAT	The Water Services Regulation Authority
ONS	The Office for National Statistics
P	Phosphorous (re Discharge Consent)
PCC	Per Capita Consumption
PE	Population Equivalent
PPS	Planning Policy Statement
PR09/ 14	Price Review 2009/ 2014
RBMP	River Basement Management Plan
RSS	Regional Spatial Strategy
SFRA	Strategic Flood Risk Assessment
SPD	Supplementary Planning Document
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TVW	Three Valleys Water
TWU	Thames Water Utilities
UDC	Uttlesford District Council
UKTAG	United Kingdom Technical Advisory Group
UWWTD	Urban Waste Water Treatment Directive
WAFU	Water Available for Use
WFD	Water Framework Directive
WRZ	Water Resource Zone
WwTW	Wastewater Treatment Works

Technical Glossary

- **Asset Management Period (AMP)** - A period of five years in which water companies implement planned upgrades and improvements to their asset base. For example, AMP4 is 2005-2010 and AMP5 is 2010-2015.
- **Aquifer** – a layer of permeable rock, which acts as a store of groundwater. Water is stored within fissures, or within the rock matrix itself.
- **Best Available Technology (BAT) –** in this context refers to the most advanced methods (that have been proven in the industry) that a water company can utilise to obtain the best result from a process.
- **Best Available Technology Not Entailing Excessive Cost (BATNEEC) –** similar to the above, but taking account of the whole life cycle costs. BATNEEC is often applied by water companies because they pass on costs to customers through the Price Review process, and this funding regime requires that the optimum balance between benefits and costs is therefore achieved.
- **Biochemical Oxygen Demand –** a measure of the oxygen demand that results from bacteria breaking down organic carbon compounds in water. High levels of BOD can use up oxygen in a watercourse, to the detriment of the ecology.
- **Catchment Abstraction Management Strategies (CAMS)** - the production of a strategy by the EA to assess and improve the amount of water that is available on a catchment scale. The first cycle of CAMS have recently been produced and are currently being reviewed. An interim update of the CAMS process can be viewed at http://publications.environment-agency.gov.uk/pdf/GEH00508BOAH-e-e.pdf?lang=_e. *Additional CAMS information, specific to the study area, is included in Appendix B.*
- **Code for Sustainable Homes (CSH)** - released in 2007 and aims to make newly built homes more efficient in the future. The code gives a star rating (between 1 and 6) for a home based on nine different categories including water, waste and energy. In May 2008 the government announced a timetable to ensure the implementation of the CSH through the tightening up of building regulations. At present all new homes are required to be assessed for a CSH star rating. Details and technical guidance for the CSH can be found at; http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/englandwales/codesustainable/.
- **Combined Sewer Overflow (CSO) –** a point on the sewerage network where untreated wastewater is discharged during storm events to relieve pressure on the network and prevent sewer flooding. Sewerage systems that are not influenced by storm water should not require a CSO.
- **Deployable Output –** the amount of water that can be abstracted from a source (or bulk supply) as constrained by environment, license, pumping plant and well/aquifer properties, raw water mains, transfer, treatment and water quality.
- **Discharge Consent –** a consent issued and reviewed by the EA which permits an organisation or individual to discharge sewage or trade effluent into surface water, groundwater or the sea. Volume and quality levels are set to protect water quality, the environment and human health. Regarding water quality, the detrimands controlled under a discharge consent are:
  - Suspended Solids;
  - Biochemical Oxygen Demand; and
  - Ammoniacal Nitrogen (Amm. N) and Phosphorous (P), where the UWWTD conditions apply.
- **Draft Water Resource Management Plan (WRMP)** - Currently in their draft stages awaiting approval by OFWAT later this year, the Water Resource Management Plans are studies undertaken by every water company in England to determine the availability of water resources for the next 25 years. WRMPs can be found on most water company websites.
- **Drainage Impact Assessment** – a study that sets out the principles of how a development site will be drained, and predicts the impact on the existing drainage system, and associated flood risk.
- **Dry Weather Flow (DWF)** – an estimation of the flow of wastewater to a WwTW during a period of dry weather. This is based on the 20th percentile of daily flow through the works over a rolling three year period.

- **Dry Year Critical Period (DYCP) –** the period of time during which the customer experiences the greatest risk of loss of potable water supply, during a year of rainfall below long-term average (characterised with high summer temperatures and high demand).
- **Eutrophication –** higher than natural levels of nutrients in a watercourse, which may lead to the excessive build up of plant life (especially algae). Excessive algal blooms remove valuable oxygen from the watercourse, block filters at water treatment works, affect the taste and smell of water, and can be toxic to other wildlife.
- **Fluvial** – term referring to rivers or streams.
- **Hands Off Flow (HOF)** – the minimum river flow that must be achieved at a monitoring point to allow abstraction to take place at any associated abstraction points.
- **Local Development Framework (LDF)** – A folder of development documents outlining the spatial planning strategy for each local authority. The LDF will contain a number of statutory Local Development Documents (LDDs), such as a Statement of Community Involvement, Annual Monitoring Reports, Core Strategy, Local Development Scheme as well as a number of optional Supplementary Planning Documents. More information can be found at: http://www.planningportal.gov.uk/uploads/ldf/ldfguide.html.
- **National Nature Reserve (NNR) –** are areas of national importance, protected because they are amongst the best examples of a particular habitat in the country. Details of NNR can be found at http://www.natureonthemap.org.uk/.
- **Per Capita Consumption (PCC) –** the volume of water used by one person over a day, expressed in units of litres per person per day (l/p/d).
- **Planning Policy Statement (PPS)** - set out the Government's national policies on different aspect of planning. The policies in these statements apply throughout England and focus on procedural policy and the process of preparing local development documents. One of the Statements, PPS 25, deals with the impacts of Flood Risk on development. More information can be found at http://www.planningportal.gov.uk/england/professionals/en/1020432881271.html.
- **Population Equivalent –** a method of measuring the loading on a WwTW, and is based on a notional population comprising; resident population, a percentage of transient population, cessed liquor input expressed in population, and trade effluent expressed in population.
- **Potable Water –** water that is fit for drinking, being free of harmful chemicals and pathogens. Raw water can be potable in some instances, although it usually requires treatment of some kind to bring it up to this level.
- **Price Review –** the process with which Ofwat reviews water company business plans and subsequently sets limits on the prices the companies can charge their customers for the following AMP. The business plan submissions are often referred to as the Price Review submission, e.g. business plan submitted in 2009 for AMP5 (2010–2015) is referred to as the PR09 submission.
- **Raw Water -** water taken from the environment, which is subsequently treated or purified to produce potable water.
- **Regional Spatial Strategy (RSS)** - a broad development strategy for a region for a 15 to 20 year period prepared by the Regional Planning Body. The Regional Spatial Strategy for the East of England is currently under review. Once issued, it will establish the broad development strategy for the region, and provide a framework within which local development documents and local transport plans can be prepared for the period to 2021. The Government Office has submitted representations on the draft Plan on behalf of Ministers.
- **Riparian Landowner** – the owner of land adjacent to a watercourse.
- **River Basin Management Plans (RBMP)** – documents being produced for consultation by each of the EA regions to catalogue the water quality of all watercourses and set out actions to ensure they achieve the ecological targets stipulated in the WFD.
- **Site of Special Scientific Interest (SSSI) -** an area of special interest by reason of any of its flora, fauna, geological or physiographical features (basically, plants, animals, and natural features relating to the Earth's structure). A map showing all SSSI sites can be found at http://www.natureonthemap.org.uk/**.**

- **Source Protection Zones (SPZ)** - zones designated around public drinking water abstractions and sensitive receptors which detail risk to the groundwater zone they protect:
  - **SPZ1** – Inner Protection Zone: This zone represents the area within which a pollutant would take up to 50 days to travel to the abstraction point, plus a 50 m exclusion zone around abstraction point;
  - **SPZ2** – Outer Protection Zone: This zone represents the area within which a pollutant would take up to 400 days to arrive at the abstraction point, or 25% of the total catchment, whichever is greater; and
  - **SPZ3** – Total Catchment: The total area needed to support abstraction at this point.
- **Strategic Flood Risk Assessment (SFRA)** – document required by PPS25 that informs the planning process of flood risk and provides information on future risk over a wide spatial area. It is also used as a planning tool to examine the sustainability of the proposed development allocations.
- **Surface Water Management Plans (SWMP)** –assist in the assessment of flood risk to ensure that increased levels of development, and climate change, do not have an adverse impact on flooding from surface water sources within the catchment. SWMP were introduced following he severe flooding in 2007, as means for Local Authorities to take the lead in reducing flood risk.
- **Sustainable Drainage Systems (SUDS)** – a combination of physical structures and management techniques designed to drain, attenuate, and in some cases treat, runoff from urban (and in some cases rural) areas.
- **Target Headroom -** the threshold of minimum acceptable headroom, which would trigger the need for water management options to increase water available for use or decrease demand.
- **UK Biodiversity Action Plan (BAP) –** is the Government's response to the Convention on Biological Diversity 1992. It describes the UK's biological resources, both species and habitats, and details a plan to protect them. UK BAP habitats are often encompassed within the other sites listed above, however smaller pockets of UK BAP habitat may also exist outside these sites. More information can be found at http://www.ukbap.org.uk/.
- **Water Available for Use (WAFU) –** the amount of water remaining after allowable outages and planning allowances are deducted from deployable output in a WRZ.
- **Water Framework Directive (WFD) 2000** - A European Union directive (2000/60/EC) which commits member states to make all water bodies of good qualitative and quantitative status by 2015. The WFD could have significant implications on water quality and abstraction. Important dates for the WFD are:
  - 2008 Draft River Basin Management Plans for each river basin district completed;
  - 2009 Final River Basin Management Plans completed;
  - 2012 Programs of measures for improvements to be fully operational; and
  - 2015 Achieve the first set of water body objectives.
- **Water Neutrality –** the concept of offsetting demand from new developments by making existing homes and buildings more water efficient.
- **Water Resource Zone (WRZ) –** are areas based on the existing potable water supply network and represent the largest area in which water resources can be shared.
- **Wastewater -** is any water that has been adversely affected in quality by anthropogenic influence. It comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture.
- **Water Treatment Works (WTW)** – facility which treats abstracted raw water to bring it up to potable standards.
- **Wastewater Treatment Works (WwTW)** – facility which treats wastewater through a combination of physical, biological and chemical processes.
- **Winterbourne –** describes a river or stream which only flows during the winter season, when groundwater levels are high enough

Appendix A

Planning Policy Context

National Policy

National policy for development and planning is set by the Government. The planning system has changed significantly in recent years due to the Governments planning reform. This reform has included the introduction of the 'Planning for a Sustainable Future: White Paper' and the 'Planning and Compulsory Purchase Act' which has lead to the need for local authorities to develop unified Local Development Frameworks. The planning reform has also lead to the revision of a number of planning policy documents. Extracts from the most relevant Planning Policy Statement (PPS) documents is set out below. This is not and exhaustive list but include the key areas where Local Authorities are required to contribute to the protection of the water environment.

Planning Policy Statement (PPS)

PPS 1: Delivering Sustainable Development[1]

PPS1 sets out the overarching planning policies on the delivery of sustainable development through the planning system. Regional planning authorities and local authorities should promote… *the sustainable use of water resources; and the use of sustainable drainage systems in the management of run-off.*

Development plan policies should take account of environmental issues such as:

- the protection of groundwater from contamination;
- the conservation and enhancement of wildlife species and habitats and the promotion of biodiversity; and
- the potential impact of the environment on proposed developments.

The Government is committed to promoting a strong, stable, and productive economy that aims to bring jobs and prosperity for all. Planning authorities should…ensure that infrastructure and services are provided to support new and existing economic development and housing.

In preparing development plans, planning authorities should seek to…*address, on the basis of sound science, the causes and impacts of climate change, the management of pollution and natural hazards, the safeguarding of natural resources, and the minimisation of impacts from the management and use of resources.*

PPS Planning and Climate Change: Supplement to PPS1[2]

This PPS on climate change supplements PPS1 by setting out how planning should contribute to reducing emissions and stabilising climate change and take into account the unavoidable consequences. In deciding which areas and sites are suitable, and for what type and intensity of development, planning authorities should assess their consistency with the policies in this PPS. In doing so, planning authorities should take into account:

- the capacity of existing and potential infrastructure (including for water supply, sewage and sewerage, waste management and community infrastructure such as schools and

[1] Planning Policy Statement 1: Delivering Sustainable Development, Office of the Deputy Prime Minister. 2005

[2] Planning Policy Statement: Planning and Climate Change. Supplement to Planning Policy Statement 1, Office of the Deputy Prime Minister. December 2007

hospitals) to service the site or area in ways consistent with cutting carbon dioxide emissions and successfully adapting to likely changes in the local climate;

- the effect of development on biodiversity and its capacity to adapt to likely changes in the climate;
- the contribution to be made from existing and new opportunities for open space and green infrastructure to urban cooling, sustainable drainage systems, and conserving and enhancing biodiversity; and
- known physical and environmental constraints on the development of land such as sea level rises, flood risk and stability, and take a precautionary approach to increases in risk that could arise as a result of likely changes to the climate.

In their consideration of the environmental performance of proposed development, taking particular account of the climate the development is likely to experience over its expected lifetime, planning authorities should expect new development to…*give priority to the use of sustainable drainage systems, paying attention to the potential contribution to be gained from water harvesting from impermeable surfaces, and encourage layouts that accommodate waste water recycling.*

PPS 3: Housing[3]

PPS3 sets out the national planning policy framework for delivering the Government's housing objectives. Local Planning Authorities should encourage applicants to bring forward sustainable and environmentally friendly new housing developments, including affordable housing developments, and in doing so should reflect the approach set out in the forthcoming PPS on climate change, including on the Code for Sustainable Homes.

PPS 9: Biodiversity and Geological Conservation[4]

PPS9 sets out planning policies on protection of biodiversity and geological conservation through the planning system. Regional planning bodies and local planning authorities should adhere to the following key principles to ensure that the potential impacts of planning decisions on biodiversity and geological conservation are fully considered.

Development plan policies and planning decisions should be based upon up-to-date information about the environmental characteristics of their areas. These characteristics should include the relevant biodiversity and geological resources of the area. In reviewing environmental characteristics local authorities should assess the potential to sustain and enhance those resources.

Plan policies and planning decisions should aim to maintain, and enhance, restore or add to biodiversity and geological conservation interests. In taking decisions, local planning authorities should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; and to biodiversity and geological interests within the wider environment.

Plan policies on the form and location of development should take a strategic approach to the conservation, enhancement and restoration of biodiversity and geology, and recognise the

[3] Planning Policy Statement 3: Housing, Office of the Deputy Prime Minister. November 2006

[4] Planning Policy Statement 9: Biodiversity and Geological Conservation, Office of the Deputy Prime Minister. August 2005

contributions that sites, areas and features, both individually and in combination, make to conserving these resources.

Plan policies should promote opportunities for the incorporation of beneficial biodiversity and geological features within the design of development.

Development proposals where the principal objective is to conserve or enhance biodiversity and geological conservation interests should be permitted.

The aim of planning decisions should be to prevent harm to biodiversity and geological conservation interests. Where granting planning permission would result in significant harm to those interests, local planning authorities will need to be satisfied that the development cannot reasonably be located on any alternative sites that would result in less or no harm. In the absence of any such alternatives, local planning authorities should ensure that, before planning permission is granted, adequate mitigation measures are put in place. Where a planning decision would result in significant harm to biodiversity and geological interests which cannot be prevented or adequately mitigated against, appropriate compensation measures should be sought. If that significant harm cannot be prevented, adequately mitigated against, or compensated for, then planning permission should be refused.

Local development frameworks should indicate the location of designated sites of importance for biodiversity and geodiversity, making clear distinctions between the hierarchy of international, national, regional and locally designated sites. They should also identify any areas or sites for the restoration or creation of new priority habitats, which contribute to regional targets, and support this restoration or creation through appropriate policies.

PPS 12: Local Spatial Planning[5]

PPS 12 sets out government policy on local development frameworks. The core strategy should be supported by evidence of what physical, social and green infrastructure is needed to enable the amount of development proposed for the area, taking account of its type and distribution. This evidence should cover who will provide the infrastructure and when it will be provided. The core strategy should draw on and in parallel influence any strategies and investment plans of the local authority and other organisations.

Good infrastructure planning considers the infrastructure required to support development, costs, sources of funding, timescales for delivery and gaps in funding. This allows for the identified infrastructure to be prioritised in discussions with key local partners. This has been a major theme highlighted and considered via HM Treasury's CSR07 Policy Review on Supporting Housing Growth. The infrastructure planning process should identify, as far as possible:

- infrastructure needs and costs;
- phasing of development;
- funding sources; and
- responsibilities for delivery.

The need for infrastructure to support housing growth and the associated need for an infrastructure delivery planning process has been highlighted further in the Government's recent Housing Green Paper. The outcome of the infrastructure planning process should inform the core strategy and should be part of a robust evidence base. It will greatly assist the overall

[5] Planning Policy Statement 12: Local Spatial Planning, Office of the Deputy Prime Minister. 2008

planning process for all participants if the agencies responsible for infrastructure delivery and the local authority producing the core strategy were to align their planning processes. Local authorities should undertake timely, effective and conclusive discussion with key infrastructure providers when preparing a core strategy. Key infrastructure stakeholders are encouraged to engage in such discussions and to reflect the core strategy within their own future planning. However the Government recognises that the budgeting processes of different agencies may mean that less information may be available when the core strategy is being prepared than would be ideal. It is important therefore that the core strategy makes proper provision for such uncertainty and does not place undue reliance on critical elements of infrastructure whose funding is unknown. The test should be whether there is a reasonable prospect of provision. Contingency planning – showing how the objectives will be achieved under different scenarios – may be necessary in circumstances where provision is uncertain.

PPS 23: Planning and Pollution Control[6]

The following matters (not in any order of importance) should be considered in the preparation of development plan documents and may also be material in the consideration of individual planning applications where pollution considerations arise:

- the potential sensitivity of the area to adverse effects from pollution, in particular reflected in landscape, the quality of soil, air, and ground and surface waters, nature conservation (including Sites of Special Scientific Interest (SSSIs), National Parks, Areas of Outstanding Natural Beauty (AONBs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs),Wetland of International Importance (RAMSAR sites), agricultural land quality, water supply (Source Protection Zones), archaeological designations and the need to protect natural resources;
- the possible adverse impacts on water quality and the impact of any possible discharge of effluent or leachates which may pose a threat to surface or underground water resources directly or indirectly through surrounding soils;
- the need to make suitable provision for the drainage of surface water; and
- the provision of sewerage and sewage treatment and the availability of existing sewage infrastructure.

PPS 25: Development and Flood Risk[7]

RPBs and LPAs should adhere to the following principles in preparing planning strategies:

- LPAs should prepare Local Development Documents (LDDs) that set out policies for the allocation of sites and the control of development which avoid flood risk to people and property where possible and manage it elsewhere, reflecting the approach to managing flood risk in this PPS and in the RSS for their region;
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, LPAs should consider whether there are opportunities in the preparation of LDDs to facilitate the relocation of development, including housing to more sustainable locations at less risk from flooding;

In addition, LPAs should in determining planning applications:

[6] Planning Policy Statement 23: Pollution Control, Office of the Deputy Prime Minister. 2004

[7] Planning Policy Statement 25: Development and Flood Risk, CLG, 2006

- give priority to the use of SUDS; and
- ensure that all new development in flood risk areas is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed.

Appendix B

Occupancy Rate Projections

Occupancy Rate Projections

Occupied Houses 2001	27,519
Completions 2001-2007/08	*2,572*
Houses 07/08	30,091
Population 2007	72,500
07/08 occupancy rate	**2.41**
2021 total houses	35,519
2021 Population estimate	80,300
2021 occupancy rate	**2.26**
2026 total houses	37,669
2026 population estimate	83,300
2026 occupancy rate	**2.21**
Linear Interpolation of Occupancy Rates	
2007/2008	**2.41**
2008/2009	2.40
2009/2010	2.39
2010/2011	2.38
2011/2012	2.37
2012/2013	2.36
2013/2014	2.35
2014/2015	2.34
2015/2016	2.32
2016/2017	2.31
2017/2018	2.30
2018/2019	2.29
2019/2020	2.28
2020/2021	2.27
2021/2022	**2.26**
2022/2023	2.25
2023/2024	2.24
2024/2025	2.23
2025/2026	2.22
2026/2027	**2.21**

Appendix C

Development Trajectory

Predicted Yearly Dwelling Completions by Development Option

Option 1	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	***Total***
Great Dunmow Identified Sites	125	121	152	157	80	70	169	82	82	50	50	0	0	0	0	0	0	0	*1138*
Great Dunmow New Sites	0	0	0	10	30	95	120	130	135	110	180	170	170	220	220	200	200	140	*2130*
Saffron Walden Identified Sites	0	12	90	112	100	94	0	12	13	0	0	0	0	0	0	0	0	0	*433*
Saffron Walden New Sites	0	0	0	0	0	0	0	50	100	100	180	180	130	130	130	130	130	130	*1390*
Stansted Mountfitchet Identified Sites	73	75	127	118	123	86	7	0	0	0	0	0	0	0	0	0	0	0	*609*
Stansted Mountfitchet New Sites	0	0	0	0	0	15	15	10	0	30	50	50	50	50	50	50	50	50	*470*
Rural Areas Commitments	275	247	165	166	108	5	11	5	5	5	5	5	5	5	5	105	0	0	*1122*
Total UDC trajectory	473	455	534	563	441	365	322	289	335	295	465	405	355	405	405	485	380	320	***7292***
Option 2																			
Great Dunmow Identified Sites	125	121	152	157	80	70	169	82	82	50	50	0	0	0	0	0	0	0	*1138*
Great Dunmow New Sites	0	0	0	10	30	60	60	85	85	95	70	45	50	50	90	90	90	90	*1000*
Saffron Walden Identified Sites	0	12	90	112	100	94	0	12	13	0	0	0	0	0	0	0	0	0	*433*
Saffron Walden New Sites	0	0	0	0	0	0	0	50	75	100	100	180	130	130	130	130	130	130	*1285*
Stansted Mountfitchet Identified Sites	73	75	127	118	123	86	7	0	0	0	0	0	0	0	0	0	0	0	*609*
Stansted Mountfitchet New Sites	0	0	0	0	0	15	15	15	10	30	0	0	0	0	0	0	0	0	*85*
Rural Areas Commitments	275	247	165	166	108	5	11	5	5	5	5	5	5	5	5	105	0	0	*1122*
Rural Areas New sites	0	0	0	0	0	120	90	130	90	90	140	230	180	120	135	85	145	60	*1615*
Total UDC trajectory	473	455	534	563	441	450	352	379	360	370	365	460	365	305	360	410	365	280	***7287***
Option 3																			
Great Dunmow Identified Sites	125	121	152	157	80	70	169	82	82	50	50	0	0	0	0	0	0	0	*1138*
Great Dunmow New Sites	0	0	0	10	30	60	60	85	85	95	70	45	50	50	90	90	90	90	*1000*
Saffron Walden Identified Sites	0	12	90	112	100	94	0	12	13	0	0	0	0	0	0	0	0	0	*433*
Saffron Walden New Sites	0	0	0	0	0	0	0	50	50	50	100	100	130	130	130	130	130	130	*1130*
Stansted Mountfitchet Identified Sites	73	75	127	118	123	86	7	0	0	0	0	0	0	0	0	0	0	0	*609*
Stansted Mountfitchet New Sites	0	0	0	0	0	15	15	15	10	30	0	0	0	0	0	0	0	0	*85*
Rural Areas Commitments	275	247	165	166	108	5	11	5	5	5	5	5	5	5	5	105	0	0	*1122*
Rural Areas New sites	0	0	0	0	0	130	100	100	85	85	185	160	130	230	230	240	140	60	*1875*
Total UDC trajectory	473	455	534	563	441	460	362	349	330	315	410	310	315	415	455	565	360	280	***7392***
Option 4																			
Great Dunmow Identified Sites	125	121	152	157	80	70	169	82	82	50	50	0	0	0	0	0	0	0	*1138*
Great Dunmow New Sites	0	0	0	10	30	60	60	85	85	60	10	0	0	0	0	0	0	0	*400*
Saffron Walden Identified Sites	0	12	90	112	100	94	0	12	13	0	0	0	0	0	0	0	0	0	*433*
Saffron Walden New Sites	0	0	0	0	0	0	0	50	50	50	50	50	0	0	0	0	0	0	*250*
Stansted Mountfitchet Identified Sites	73	75	127	118	123	86	7	0	0	0	0	0	0	0	0	0	0	0	*609*
Stansted Mountfitchet New Sites	0	0	0	0	0	15	15	15	10	30	0	0	0	0	0	0	0	0	*85*
Rural Areas Commitments	275	247	165	166	108	5	11	5	5	5	5	5	5	5	5	105	0	0	*1122*
Rural Areas New sites	0	0	0	0	0	40	10	10	10	10	60	10	30	30	10	25	25	10	*280*
Elsenham (New Settlement)	0	0	0	0	0	50	100	100	150	300	300	300	300	300	300	300	250	250	*3000*
Total UDC trajectory	473	455	534	563	441	420	372	359	405	505	475	365	335	335	315	430	275	260	***7317***

Appendix D

Catchment Abstraction Management Strategies

Catchment Abstraction Management Strategies (CAMS)

CAMS are EA strategies for the management of water resources. They provide information on water resources and licensing practice and allow the balance between the needs of abstractors, other water users and the aquatic environment to be considered in consultation with the local community. This study crosses a number of four river catchment boundaries:

- Anglian Region - Cam and Ely Ouse;
- Anglian Region - Combined Essex;
- Thames Region - Roding, Beam and Ingrebourne; and
- Thames Region - Upper Lee.

Each co dependant area of river catchment and groundwater is designated as a Water Resource Management Unit (WRMU), and assigned a Resource Availability Status (RAS).

This "resource availability status" indicates the relative balance between committed and available resources and the relationship with the environmental requirements for the water. The status category shows whether licences are likely to be available and highlighting areas where abstraction needs to be reduced. There are four categories of resource availability status, as shown in Table D-1.

Indicative Resource Availability Status	Definition
Water available	Water likely to be available at all flows including low flows. Restrictions may apply
No water available	No water available for further licensing at low flows although water may be available at higher flows with appropriate restrictions.
Over-licensed	Current actual abstraction is resulting in no water available at low flows. If existing licenses were used to their full allocation they would have the potential to cause unacceptable environmental impact at low flows. Water may be available at high flows with appropriate restrictions.
Over-abstracted	Existing abstraction is causing unacceptable environmental impact at low flows. Water may still be available at high flows with appropriate restrictions

Table D-1 Definition of CAMS availability status

The resonant issue throughout all of the CAMS documents is that the majority of the rivers and groundwater sources within the region are identified as being over–abstracted and over–licensed.

More information contained within the CAMS documents relevant to this WCS is included below.

Cam and Ely Ouse

The Cam and Ely Ouse CAMS area is characterised by the East Anglian Chalklands in the south, and Brecklands in the north of the area. Land use is predominantly arable agriculture and there is a strong rural feel to much of the CAMS area.

There are over 1,500 consented discharges in the CAMS area. The most significant of these are related to WwTW, with the largest being associated with Cambridge, Bury St. Edmunds and the other larger urban areas. Approximately a third of discharges are small agricultural consents. The remaining consented discharges relate predominantly to small quantities of treated sewage/final effluent of private consents.

Public water supply and water transfers together account for just over 70% of all water abstraction. 77% of all water authorised for abstraction in the CAMS area is sourced from the groundwater

The Water Resource Management Unit (WRMU) C contains the Upper River Cam, Rhee and Granta.

The Upper Cam, the Rhee and the Granta have been assessed as Over-licensed resource availability status (RAS) at low flows, as shown in Table 12. The target status for this WRMU in 2013 is to remain at Over-licensed for all three surface water units.

This WRMU incorporates the Upper Cam Chalk, the Rhee Chalk and the Granta Chalk. The resource availability status of all three Groundwater Management Units s is Over-abstracted. They are included in this WRMU because the surface and groundwater are interconnected. The groundwater will be managed by the EA under the same strategy defined for the surface water, described below:

- There is no water available at low flows for consumptive purposes, although the EA may consider applications for non consumptive use;
- There is no water available for new groundwater abstractions;
- Limited surface water may be available during periods of high flow and will have HOF conditions;

Combined Essex

The Rivers Chelmer, Ter, and Pant (Blackwater) fall into the Combined Essex catchment. The impact of run-off on flow in rivers is greater in the lower, more urban half of the catchment compared to the rural, upper catchment where rainfall is more likely to be intercepted and taken up by vegetation.

Key issues within the CAMS area include:

- The Ely-Ouse to Essex Transfer Scheme (EOETS), which transfers water from the Great Ouse to the headwaters of the Rivers Stour and Pant, providing resources for public water supply and agricultural abstraction in Essex;
- Ecological features dependent on groundwater from the Chalk north of the Eocene boundary have been identified as being at ‘probable significant risk’ from groundwater abstraction; and
- There is little recharge of the main confined Chalk aquifer and possible unsustainable groundwater abstraction;

Volumetrically the largest groundwater and surface water abstractions are for public water supply. The majority of the remaining licences are for winter storage and subsequent spray irrigation.

The catchment has a fairly flashy signature due to the relatively low permeability of the near-surface geology (e.g. Glacial Till in the headwaters, London Clay in outcrop in the southern areas).

There are low flow issues on the River Chelmer resulting in weed clogging at Broomfield. The headwaters of the River Chelmer are vulnerable to drying out which affects the fish populations in the upper stretches.

The water resource availability status of this WRMU is Over-abstracted at low flows. The RAS of the River Brain, River Wid and River Ter have been overridden due to the more critical status of the River Blackwater and River Chelmer. The target status for this WRMU in 2012 is to remain at Over-abstracted but to seek to improve the situation with regard to the balance of abstraction, available resources and flow to estuaries. It should be noted that for this WRMU it is not appropriate or feasible to move towards a status of Over-licensed by 2012 due to the amount of resource recovery necessary. It is hoped that measures such as improved water efficiency and/or reviewing Hands Off Flow constraints will go some way to ameliorating the environmental impacts currently experienced in the unit.

The Blackwater fisheries, whilst still recovering from a Tributyltin pollution incident (in 2002), are known to support brown trout in upper reaches of the river.

The Chelmer system (including the River Wid, River Can and River Ter) and Chelmer & Blackwater Canal have good mixed coarse fish populations including carp (Cyprinus carpio) in the canal where the high nutrient load suits cyprinid fish, and brown trout in the Upper Chelmer and Ter.

The EOETS results in fluctuating water levels. These fluctuating water levels have impacts on water vole populations, as they need steady water levels in the channel to make their tunnel entrances secure.

The upper reaches of the River Pant (downstream of Great Sampford STW) dry out during summer months. Effluent flow from the WwTW is not sufficient to sustain the river flow. There is a long history of low flows and regular periods of no flow, with pooling and probable stagnation of the water occurring.

This is compounded by the eutrophic nature of the watercourse, high volume of aquatic plant growth, and low dilution of effluent from Great Sampford WwTW.

In 2004 concern was raised by EA fisheries staff over loss of fish during dry periods. Angling matches have been cancelled due to low flows. Attempts were made to provide refuges against additional flow from EOETS using barriers in the river. However these were quickly destroyed by the volume of water, and spawning suffered accordingly. Some species such as dace and gudgeon have reduced in their numbers, whilst strong fish such as chub and trout have thrived.

Roding, Beam and Ingrebourne

The predominant land use in the upper half and far south-eastern corner of the catchment is agriculture. The vast majority of surface water abstraction licenses are concentrated in these areas and are for irrigation purposes. The nature of the catchment and the general presumption against issuing licences for consumptive summer abstraction has meant that farmers commonly build their own water storage facilities. These are mainly reservoirs that can be filled during the winter months to provide a reliable supply of water for subsequent summer irrigation. Other surface water abstraction licences in the catchment include use for golf course irrigation, industrial process water, topping up of fishing lakes and mineral washing.

The rivers Roding and Ingrebourne flow over a clay base and generally provide good habitat for coarse fish. The upper reaches of the Roding and the Cripsey Brook have many riffle and pool

sequences that support good fish species richness with healthy numbers of minor species (which are not of interest to anglers). This habitat also provides favourable spawning sites for Dace in spring and Chub in summer.

The Upper Roding WRMU takes in the River Roding from its source at Molehill Green down to High Ongar gauging station, which is the Assessment Point, located just before the confluence with the Cripsey Brook. Very similar to the Cripsey Brook, this is a headwater catchment and the underlying Chalk aquifer is completely confined by Clay. The Upper Roding is therefore a rainfall/run-off dominated catchment that demonstrates variable flow rates, a quick response to rainfall events and is prone to very low flows during prolonged dry periods. There is no interaction between the groundwater and flow in the rivers. The river network comprises numerous small tributaries feeding into the main channel along its length.

There are 19 licensed surface water abstractions in this management unit. The total licensed volume of these abstractions is 1100.3 Ml/year. All but one of these licences are for agricultural purposes, including filling storage reservoirs over the winter for subsequent spray irrigation during the summer. The other is used to maintain water levels in a lake.

Discharges from a number of small Thames Water sewage treatment works – White Roding, Leaden Roding, Abbess Roding and Willingale – can make up a significant proportion of the flow under low flow conditions.

This water resource management unit has a resource availability status of 'no water available'. Through the sustainability appraisal process it was decided that the target resource availability status (i.e. what the EA is aiming to achieve at the end of this CAMS cycle) should be to remain at 'no water available'. This was considered to be the most sustainable option.

The majority of abstraction licences in this catchment are licences of right and cannot be revoked or reviewed under current legislation. The significant available resource in the Upper Roding is at high flows. The fact that the volumes of water available, even at high flows, are relatively small means that much of this resource has already been licensed away and many existing licences have high flow constraints. To prevent derogation, any new licences would have to be issued with very restrictive flow constraints only allowing abstraction for around 9% of the time in an average year. It is therefore felt that abstraction in this WRMU has reached the sustainable limit, at high flows as well as low flows and the catchment will be closed to any further consumptive abstraction. Applications for non-consumptive abstraction purposes or those with a net benefit to the environment may be granted licences irrespective of the resource availability status. Such licences will normally be time-limited to expire with a common end date of 2016 with a normal renewal period of 12 years.

Upper Lee

The hydrology is primarily influenced by unconfined chalk, which, to the south east of the catchment, is overlain by London Clay and Reading Beds. In the unconfined chalk area, winter rainfall recharges the groundwater where it is released slowly into the chalk streams. This provides a relatively high base flow with a much smaller proportion of flow coming from runoff. Many of the chalk streams have winterbourne sections that are prone to drying up. Where an impervious layer of clay covers the chalk, rainfall cannot percolate into the ground and, instead, runs off directly to the surface water system. This is a much faster response to rainfall and makes the clay catchments such as the Stort and Ash relatively flashy.

WRMU1 covers an area of 802km2 and includes the Rivers Lee, Mimram, Beane, Rib, Ash and Upper Stort and the associated unconfined Chalk aquifer. These rivers are chalk based and dependent on groundwater for flow.

Of the 200 licensed abstractions in the unit, 80% are from groundwater. Almost 90%of the volume abstracted is for public water supply, however there are also many licences for small volume, high-loss agricultural use.

The low flow resource availability status of WRMU1 is Over-abstracted. Through the sustainability appraisal process a target of moving to 'less Over-abstracted' within the next six years (1 CAMS cycle) was set. It was considered unachievable to recover sufficient resources to move to Over-licensed given the size of the resource deficit. The aim for this CAMS cycle is to recover in the region of 5Ml/d (see Section 5.2.7) for the Upper Lee CAMS area by:

- Implementing the CAMS licensing policy alongside the existing policy;
- Carrying out investigations under AMP/RSAp schemes;
- Investigating the use of new powers granted under the Water Act 2003 for revoking unused licences; and
- Promoting water efficiency.

WRMU2 comprises the middle and lower reaches of the River Stort and the Pincey Brook. London Clay partially confines the chalk in this area, limiting the hydraulic interactions between surface and groundwater.

There are 74 licensed abstractions, split almost equally between surface and groundwater, though 90% of the volume is taken from groundwater. Public water supply accounts for 9% of the licences but 90% of the volume. The remaining licences are for small quantities for agricultural use. WwTWs in the WRMU include Little Hallingbury, Stansted Mountfitchet and Hatfield Heath, which provide significant flows during dry conditions.

This area includes the water-dependent SSSIs of Hunsden Mead, Sawbridgeworth Marsh, Little Hallingbury Marsh and Thorley Flood Pound, all of which are important locations for otters, wetland vegetation and over wintering birds such as snipe and water rail.

The low flow water resource availability status of WRMU2 is Over-licensed.

Flows in the upper reaches of the Stort are influenced more by the underlying Chalk and interaction with groundwater than the lower reaches which are clay and urban in character. The drift geology of the area however is predominantly Boulder Clay and there can be a greater influence of run-off than might be expected for a chalk catchment. There is little abstraction within the surface water catchment, however flows from the Stort Springs are known to be influenced by public water supply abstractions in Stansted Mountfitchet. The upper reaches of the Stort are winterbourne and the location of the source ranges from the top of the catchment to just upstream of the assessment point. This section of the Stort has suitable water quality and habitat diversity to support native Salmonid species, however, because of its winterbourne nature it is of limited fisheries value. In the past a swallow hole has been observed at Clavering, and at times there has been flow upstream of this point, although the channel has been dry for a few kilometres downstream of the swallow hole. More recently the swallow hole has become less obvious, although the same pattern of flows has been observed. There is little abstraction within the surface water; however flows from Stort Springs are known to be influenced by public water supply abstractions in Stansted Mountfitchet.

Appendix E

Catchment Flood Management Plans

Catchment Flood Management Plan

Extracts from the relevant EA Catchment Flood Management Plans (CFMP) are included below.

CFMPs present what is considered to be the most sustainable direction for managing fluvial flood risk within a region for the next 50 to 100 years. The CFMP is based on extensive research into the catchment characteristics of the region and the options available for managing the risk to people, properties and the environment. It takes into account the likely impacts of climate change and the plans for future development.

The CFMPs underwent a period of consultation in 2006/07, the results of which are not yet published.

North Essex[8]

This catchment includes the Rivers Chelmer, Ter and Pant (Blackwater).

The proposed policy in the Pant (Blackwater) catchment is to:

- Improve flood warning system
- Upgrade defences where necessary as defined in strategy
- Create wetlands if feasible
- Improve co-ordination of emergency response systems
- Promote use of SuDS

The proposed policy in the Chelmer and Ter catchments is to as above, but includes additional policies for the rural areas, to:

- Maintain flood warning system; and
- Continue maintenance of existing assets.

Thames[9]

The River Stort and Pincey Brook are contained within this catchment, and the CFMP classes them as areas of 'narrow flood plains and mixed land use'.

According to the CFMP consultation document, areas such as this should adopt the following main message:

PPS25 provides the policy framework to make sure that flood risk is considered in new developments. There does not need to be a radical change in the way the EA manage the risk in these areas. They will continue to maintain watercourses, increase flood awareness and provide appropriate flood warnings.

Great Ouse[10]

In summary, the EA objectives for the Great Ouse catchment are to:

[8] EA, North Essex CFMP, Summary of Draft Plan 2006

[9] EA, Thames CFMP, Summary Document 2007

[10] EA, Great Ouse CFMP, Summary Document 2007

- Minimise flood damage to people and property;
- Manage flood risk to achieve development and regeneration objectives at Regional and Local Government level without increasing flooding elsewhere;
- Ensure that prospective mineral abstraction possibilities are retained;
- Optimise joint use of the floodplain and river corridor for flood risk management, nature conservation and recreation functions;
- Protect and enhance where possible the nature conservation value within the catchment;
- Maintain water quality standards and improve where feasible; and
- Preserve heritage to protect and enhance cultural heritage and landscape character.

The Rivers Cam and Granta fall into Southern Rivers policy unit of this CFMP, where the proposed policy is to:

- Use areas as active floodplain where opportunities exist - take action to increase the frequency of flooding to achieve benefits locally or elsewhere (which may lead to an overall reduction in flood risk). An example of this would be the creation of wetlands or washlands upstream of a risk area, which in addition to delivering environmental benefits could reduce the frequency of flooding threatening people and property;
- Take further action to reduce flood risk (now and/or in the future), where current flood risk measures are insufficient for both current and future flood;
- Continue existing and alternative actions to manage flood risk at the current level in areas where flood risk is small and sustainable (accepting that flood risk will increase over time from this baseline); and
- Reduce existing flood risk management actions where possible (accepting that flood risk will increase with time);

Appendix F

Demand Impact Calculations

Domestic Potable Supply Variables

	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26
Occupancy rate	2.40	2.39	2.38	2.37	2.36	2.35	2.34	2.32	2.31	2.30	2.29	2.28	2.27	2.26	2.25	2.24	2.23	2.22
PCC l/p/d																		
Best Case																		
Existing Properties(1)	166.38	164.24	162.10	159.96	157.82	155.68	153.54	151.40	149.26	147.12	144.98	142.84	140.70	138.56	136.42	134.28	132.14	130.00
New Properties(2)	110	110	110	110	110	110	110	110	85	85	85	85	85	85	85	85	85	85
Business Plan Case																		
Existing Properties(3)	175.80	175.70	175.60	175.50	175.10	174.60	174.10	173.60	173.10	172.60	172.10	171.60	171.00	170.40	169.90	168.70	168.70	168.70
New Properties(2)	110	110	110	110	110	110	110	110	85	85	85	85	85	85	85	85	85	85
Worst Case																		
Existing Properties(4)	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38	166.38
New Properties(5)	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125

1 Reduces from current TVW average to 130 l/p/d (Defra aspiration from Future Water)
2 CSH (+ 5 l/p/d outside use) Level 3 to 2016, Level 6 afterwards
3 TVW business plan predicted average PCC for Northern WRZ
4 Stays at current TVW average
5 Whole building use proposed in 2009 Building Regulation Amendments (includes 5 l/p/d for outside use)

Domestic Wastewater Variables (2)

	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26
Occupancy rate	2.40	2.39	2.38	2.37	2.36	2.35	2.34	2.32	2.31	2.30	2.29	2.28	2.27	2.26	2.25	2.24	2.23	2.22
95 % of PCC l/p/d																		
Best Case																		
Existing Properties	158.06	156.03	154.00	151.96	149.93	147.90	145.86	143.83	141.80	139.76	137.73	135.70	133.67	131.63	129.60	127.57	125.53	123.50
New Properties (1)	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75
Business Plan Case																		
Existing Properties	158.06	157.37	156.68	155.77	154.70	153.45	152.24	151.02	149.81	148.60	147.39	146.18	144.94	143.70	142.43	141.04	140.26	139.46
New Properties (1)	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75	99.75
Worst Case																		
Existing Properties	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06	158.06
New Properties (1)	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114

1 PCC - 5 l/p/d outside use, as this is not connected to foul sewers

2 Assumes efficiencies beyond CHS Level 3 utilise rainwater harvesting or grey water reuse, so flows to sewers will not further decrease

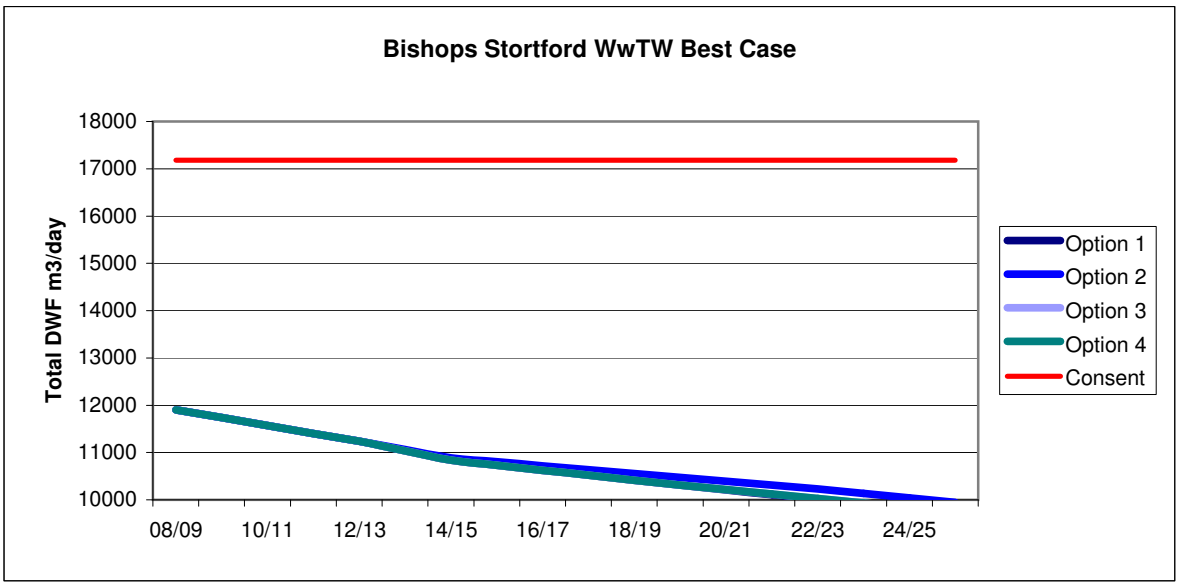
Domestic Potable Supply Calculations

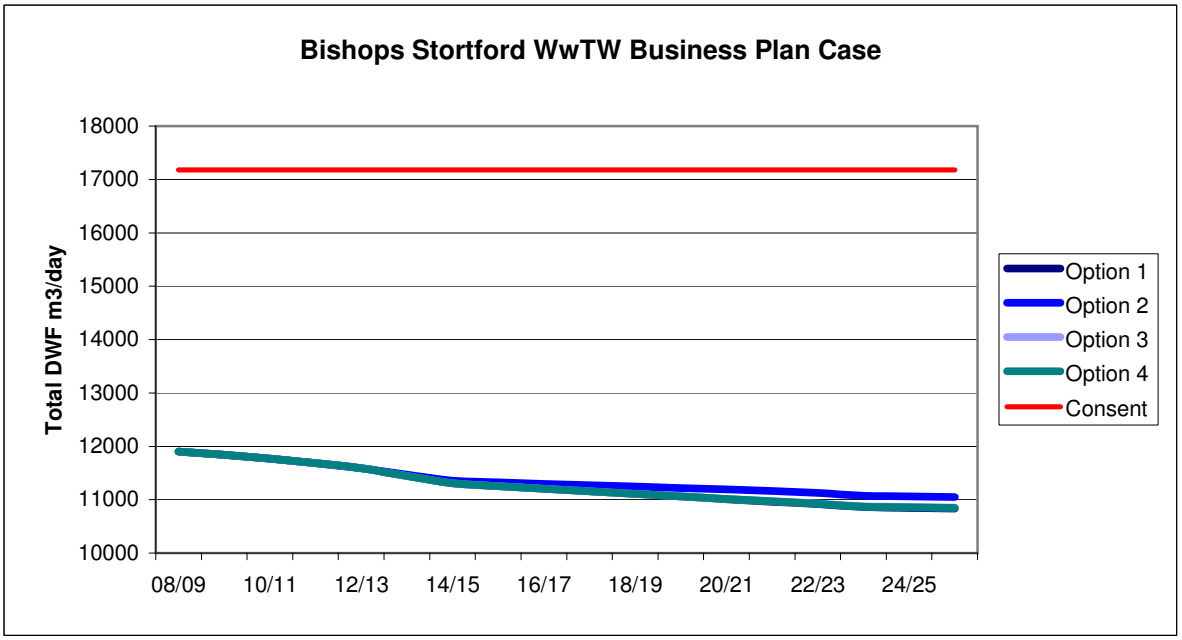
Numbers may not sum with those in report due to rounding

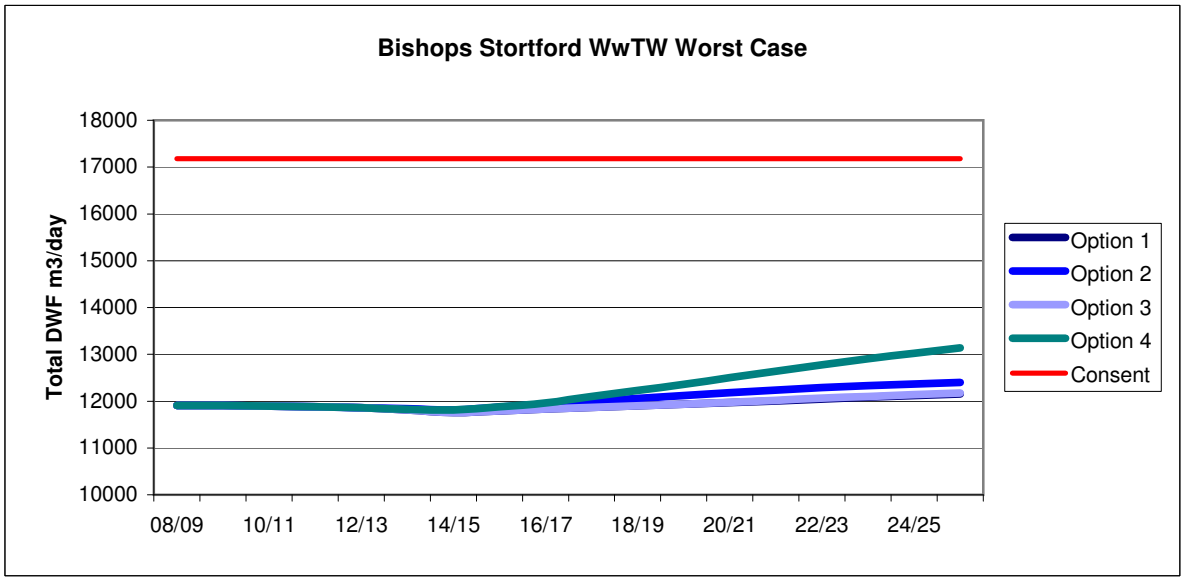
			08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26		
08/09 Dwellings		**30,091**																				Overall
Best Case	Population of existing dwellings		72,197	71,875	71,552	71,230	70,907	70,585	70,262	69,940	69,618	69,295	68,973	68,650	68,328	68,006	67,705	67,404	67,103	66,802	Existing Change	net
	Existing population usage (m3/day)		*12,012*	*11,805*	*11,599*	*11,394*	*11,191*	*10,989*	*10,788*	*10,589*	*10,391*	*10,195*	*10,000*	*9,806*	*9,614*	*9,423*	*9,236*	*9,051*	*8,867*	*8,684*	***-3,328***	increase m3/day
																					Total Increase	
Option 1	New dwellings		490	472	551	580	458	382	339	306	352	312	482	422	372	422	422	502	397	337	**7,589**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	895	790	710	813	717	1,104	962	844	953	948	1,123	884	747	**17,550**	
	New dwelling usage (m3/day)		*129*	*124*	*144*	*151*	*119*	*98*	*87*	*78*	*69*	*61*	*94*	*82*	*72*	*81*	*81*	*95*	*75*	*63*	***1,703***	*-1,625*
	Cumulative Increase from new dwellings (m3/day)		129	253	397	548	667	765	852	930	999	1,060	1,154	1,236	1,307	1,388	1,469	1,564	1,640	1,703		
	Total Demand (m3/day)		**12,141**	**12,058**	**11,996**	**11,942**	**11,857**	**11,754**	**11,640**	**11,519**	**11,390**	**11,255**	**11,154**	**11,042**	**10,921**	**10,811**	**10,705**	**10,615**	**10,507**	**10,387**		
Option 2	New dwellings		490	472	551	580	458	467	369	396	377	387	382	477	382	322	377	427	382	297	**7,584**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	1,094	860	919	871	890	874	1,087	866	727	847	955	851	658	**17,560**	
	New dwelling usage (m3/day)		*129*	*124*	*144*	*151*	*119*	*120*	*95*	*101*	*74*	*76*	*74*	*92*	*74*	*62*	*72*	*81*	*72*	*56*	***1,716***	*-1,612*
	Cumulative Increase from new dwellings (m3/day)		129	253	397	548	667	787	882	983	1,057	1,132	1,207	1,299	1,373	1,435	1,507	1,588	1,660	1,716		
	Total Demand (m3/day)		**12,141**	**12,058**	**11,996**	**11,942**	**11,857**	**11,776**	**11,670**	**11,572**	**11,448**	**11,327**	**11,206**	**11,105**	**10,987**	**10,857**	**10,743**	**10,639**	**10,527**	**10,400**		
Option 3	New dwellings		490	472	551	580	458	477	379	366	347	332	427	327	332	432	472	582	377	297	**7,689**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	1,118	884	850	802	763	978	745	753	975	1,061	1,303	840	658	**17,787**	
	New dwelling usage (m3/day)		*129*	*124*	*144*	*151*	*119*	*123*	*97*	*93*	*68*	*65*	*83*	*63*	*64*	*83*	*90*	*111*	*71*	*56*	***1,735***	*-1,593*
	Cumulative Increase from new dwellings (m3/day)		129	253	397	548	667	789	887	980	1,048	1,113	1,196	1,260	1,324	1,406	1,497	1,607	1,679	1,735		
	Total Demand (m3/day)		**12,141**	**12,058**	**11,996**	**11,942**	**11,857**	**11,778**	**11,675**	**11,569**	**11,439**	**11,308**	**11,196**	**11,066**	**10,937**	**10,829**	**10,733**	**10,658**	**10,546**	**10,419**		
Option 4	New dwellings		490	472	551	580	458	437	389	376	422	522	492	382	352	352	332	447	292	277	**7,614**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	1,024	907	873	975	1,201	1,127	870	798	794	746	1,000	650	614	**17,639**	
	New dwelling usage (m3/day)		*129*	*124*	*144*	*151*	*119*	*113*	*100*	*96*	*83*	*102*	*96*	*74*	*68*	*68*	*63*	*85*	*55*	*52*	***1,721***	*-1,607*
	Cumulative Increase from new dwellings (m3/day)		129	253	397	548	667	779	879	975	1,058	1,160	1,256	1,330	1,398	1,465	1,528	1,613	1,669	1,721		
	Total Demand (m3/day)		**12,141**	**12,058**	**11,996**	**11,942**	**11,857**	**11,768**	**11,667**	**11,564**	**11,449**	**11,355**	**11,255**	**11,136**	**11,011**	**10,888**	**10,765**	**10,664**	**10,536**	**10,405**		
Business Plan Case																					Existing Change	
	Population of existing dwellings		72,197	71,875	71,552	71,230	70,907	70,585	70,262	69,940	69,618	69,295	68,973	68,650	68,328	68,006	67,705	67,404	67,103	66,802		
	Existing population usage (m3/day)		*12,012*	*11,906*	*11,801*	*11,680*	*11,547*	*11,401*	*11,259*	*11,119*	*10,979*	*10,839*	*10,701*	*10,564*	*10,425*	*10,287*	*10,150*	*10,007*	*9,907*	*9,807*	***-2,206***	
																					Total Increase	
Option 1	New dwellings		490	472	551	580	458	382	339	306	352	312	482	422	372	422	422	502	397	337	**7,589**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	895	790	710	813	717	1,104	962	844	953	948	1,123	884	747	**17,550**	
	New dwelling usage (m3/day)		*129*	*124*	*144*	*151*	*119*	*98*	*87*	*78*	*69*	*61*	*94*	*82*	*72*	*81*	*81*	*95*	*75*	*63*	***1,703***	*-502*
	Cumulative Increase from new dwellings (m3/day)		129	253	397	548	667	765	852	930	999	1,060	1,154	1,236	1,307	1,388	1,469	1,564	1,640	1,703		
	Total Demand (m3/day)		**12,141**	**12,160**	**12,198**	**12,228**	**12,213**	**12,166**	**12,111**	**12,049**	**11,978**	**11,900**	**11,855**	**11,799**	**11,732**	**11,675**	**11,619**	**11,572**	**11,546**	**11,510**		
Option 2	New dwellings		490	472	551	580	458	467	369	396	377	387	382	477	382	322	377	427	382	297	**7,584**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	1,094	860	919	871	890	874	1,087	866	727	847	955	851	658	**17,560**	
	New dwelling usage (m3/day)		*129*	*124*	*144*	*151*	*119*	*120*	*95*	*101*	*74*	*76*	*74*	*92*	*74*	*62*	*72*	*81*	*72*	*56*	***1,716***	*-490*
	Cumulative Increase from new dwellings (m3/day)		129	253	397	548	667	787	882	983	1,057	1,132	1,207	1,299	1,373	1,435	1,507	1,588	1,660	1,716		
	Total Demand (m3/day)		**12,141**	**12,160**	**12,198**	**12,228**	**12,213**	**12,188**	**12,141**	**12,101**	**12,035**	**11,972**	**11,908**	**11,863**	**11,797**	**11,721**	**11,657**	**11,595**	**11,567**	**11,523**		
Option 3	New dwellings		490	472	551	580	458	477	379	366	347	332	427	327	332	432	472	582	377	297	**7,689**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	1,118	884	850	802	763	978	745	753	975	1,061	1,303	840	658	**17,787**	
	New dwelling usage (m3/day)		*129*	*124*	*144*	*151*	*119*	*123*	*97*	*93*	*68*	*65*	*83*	*63*	*64*	*83*	*90*	*111*	*71*	*56*	***1,735***	*-471*
	Cumulative Increase from new dwellings (m3/day)		129	253	397	548	667	789	887	980	1,048	1,113	1,196	1,260	1,324	1,406	1,497	1,607	1,679	1,735		
	Total Demand (m3/day)		**12,141**	**12,160**	**12,198**	**12,228**	**12,213**	**12,191**	**12,146**	**12,099**	**12,027**	**11,953**	**11,897**	**11,823**	**11,748**	**11,693**	**11,647**	**11,615**	**11,586**	**11,541**		
Option 4	New dwellings		490	472	551	580	458	437	389	376	422	522	492	382	352	352	332	447	292	277	**7,614**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	1,024	907	873	975	1,201	1,127	870	798	794	746	1,000	650	614	**17,639**	
	New dwelling usage (m3/day)		*129*	*124*	*144*	*151*	*119*	*113*	*100*	*96*	*83*	*102*	*96*	*74*	*68*	*68*	*63*	*85*	*55*	*52*	***1,721***	*-485*
	Cumulative Increase from new dwellings (m3/day)		129	253	397	548	667	779	879	975	1,058	1,160	1,256	1,330	1,398	1,465	1,528	1,613	1,669	1,721		
	Total Demand (m3/day)		**12,141**	**12,160**	**12,198**	**12,228**	**12,213**	**12,180**	**12,138**	**12,094**	**12,036**	**11,999**	**11,957**	**11,893**	**11,822**	**11,752**	**11,679**	**11,621**	**11,576**	**11,528**		
Worst Case																					Existing Change	
	Population of existing dwellings		72,197	71,875	71,552	71,230	70,907	70,585	70,262	69,940	69,618	69,295	68,973	68,650	68,328	68,006	67,705	67,404	67,103	66,802		
	Existing population usage (m3/day)		*12,012*	*11,958*	*11,905*	*11,851*	*11,798*	*11,744*	*11,690*	*11,637*	*11,583*	*11,529*	*11,476*	*11,422*	*11,368*	*11,315*	*11,265*	*11,215*	*11,165*	*11,115*	***-898***	
																					Total Increase	
Option 1	New dwellings		490	472	551	580	458	382	339	306	352	312	482	422	372	422	422	502	397	337	**7,589**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	895	790	710	813	717	1,104	962	844	953	948	1,123	884	747	**17,550**	
	New dwelling usage (m3/day)		*147*	*141*	*164*	*171*	*135*	*112*	*99*	*89*	*102*	*90*	*138*	*120*	*105*	*119*	*119*	*140*	*111*	*93*	***2,194***	*-12*
	Cumulative Increase from new dwellings (m3/day)		147	288	451	623	757	869	968	1,057	1,159	1,248	1,386	1,506	1,612	1,731	1,849	1,990	2,100	2,194		
	Total Demand (m3/day)		**12,159**	**12,246**	**12,356**	**12,474**	**12,555**	**12,613**	**12,658**	**12,693**	**12,741**	**12,778**	**12,862**	**12,928**	**12,980**	**13,046**	**13,114**	**13,204**	**13,265**	**13,308**		
Option 2	New dwellings		490	472	551	580	458	467	369	396	377	387	382	477	382	322	377	427	382	297	**7,584**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	1,094	860	919	871	890	874	1,087	866	727	847	955	851	658	**17,560**	
	New dwelling usage (m3/day)		*147*	*141*	*164*	*171*	*135*	*137*	*108*	*115*	*109*	*111*	*109*	*136*	*108*	*91*	*106*	*119*	*106*	*82*	***2,195***	*-11*
	Cumulative Increase from new dwellings (m3/day)		147	288	451	623	757	894	1,002	1,117	1,226	1,337	1,446	1,582	1,690	1,781	1,887	2,006	2,113	2,195		
	Total Demand (m3/day)		**12,159**	**12,246**	**12,356**	**12,474**	**12,555**	**12,638**	**12,692**	**12,753**	**12,809**	**12,866**	**12,922**	**13,004**	**13,059**	**13,096**	**13,152**	**13,221**	**13,277**	**13,310**		
Option 3	New dwellings		490	472	551	580	458	477	379	366	347	332	427	327	332	432	472	582	377	297	**7,689**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	1,118	884	850	802	763	978	745	753	975	1,061	1,303	840	658	**17,787**	
	New dwelling usage (m3/day)		*147*	*141*	*164*	*171*	*135*	*140*	*110*	*106*	*100*	*95*	*122*	*93*	*94*	*122*	*133*	*163*	*105*	*82*	***2,223***	*18*
	Cumulative Increase from new dwellings (m3/day)		147	288	451	623	757	897	1,008	1,114	1,214	1,309	1,432	1,525	1,619	1,741	1,873	2,036	2,141	2,223		
	Total Demand (m3/day)		**12,159**	**12,246**	**12,356**	**12,474**	**12,555**	**12,641**	**12,698**	**12,750**	**12,797**	**12,839**	**12,907**	**12,947**	**12,987**	**13,056**	**13,138**	**13,251**	**13,306**	**13,338**		
Option 4	New dwellings		490	472	551	580	458	437	389	376	422	522	492	382	352	352	332	447	292	277	**7,614**	
	New dwelling population		1,174	1,126	1,309	1,372	1,078	1,024	907	873	975	1,201	1,127	870	798	794	746	1,000	650	614	**17,639**	
	New dwelling usage (m3/day)		*147*	*141*	*164*	*171*	*135*	*128*	*113*	*109*	*122*	*150*	*141*	*109*	*100*	*99*	*93*	*125*	*81*	*77*	***2,205***	*-1*
	Cumulative Increase from new dwellings (m3/day)		147	288	451	623	757	885	999	1,108	1,230	1,380	1,521	1,630	1,729	1,829	1,922	2,047	2,128	2,205		
	Total Demand (m3/day)		**12,159**	**12,246**	**12,356**	**12,474**	**12,555**	**12,629**	**12,689**	**12,745**	**12,813**	**12,909**	**12,996**	**13,052**	**13,098**	**13,143**	**13,187**	**13,262**	**13,293**	**13,319**		

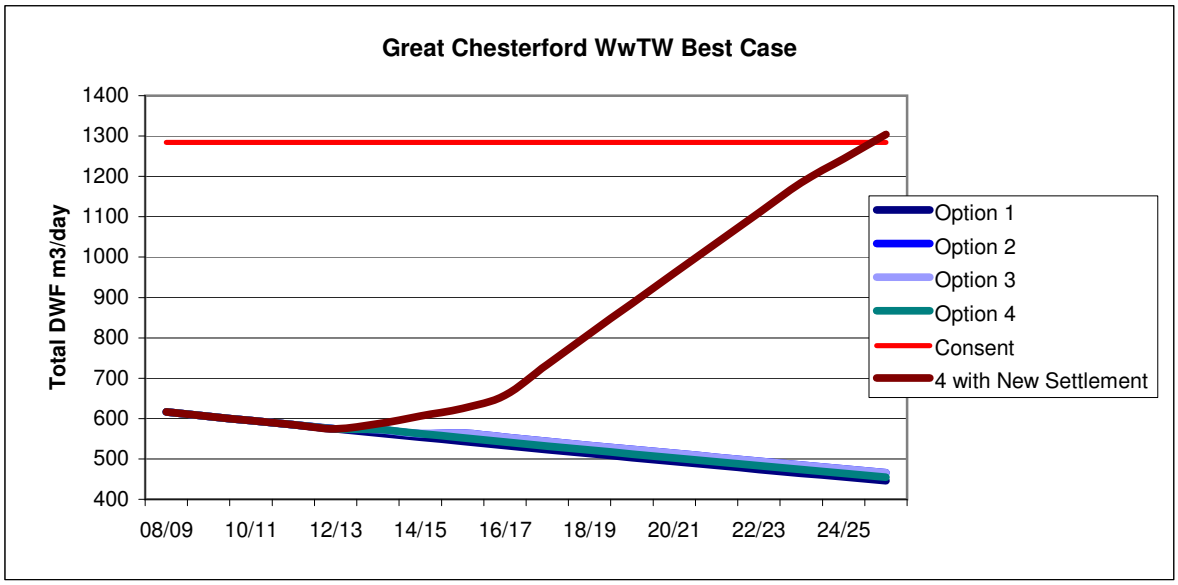
	WwTW	Growth area served	Receiving Watercourse
TWU	Bishops Stortford	B Stortford, Birchanger, Takeley (Priors Green and Canfield End)	Great Hallingbury Brook - River Stort
	Clavering	Clavering	River Stort
	Hatfield Heath	Hatfield Heath, Hatfield Broad Oak	Pincey Brook
	Leaden Roding	Leaden Roding	River Roding
	Manuden	Manuden	River Stort
	Stansted Mountfitchet	Stansted Mountfitchet, Elsenham, Birchanger	River Stort
	Takeley	Takeley Village	Pincey Brook
AWS	Ashdon	Ashdon	River Bourn - River Granta
	Debden	Debden	Debden Water - River Cam
	Elmdon	Chrishall	River Cam tributary
	Felsted	Felsted, Stebbing, Barnston	Stebbing Brook - River Chelmer
	Great Chesterford	Gt Chesterford	River Cam
	Great Dunmow	Gt Dunmow	River Chelmer
	Great Easton	Gt Easton, Thaxted, Easton Park?	River Chelmer
	Great Sampford	Gt Sampford, Radwinter	River Pant
	High Roding	High Roding	High Roding Brook - River Can
	Newport	Newport	River Cam
	Quendon	Quendon and Rickling, Ugley	River Cam
	Saffron Walden	Saffron Walden	River Slade - River Cam
	Wendens Ambo	Wendens Ambo	River Cam
	Wimbish	Wimbish	River Pant

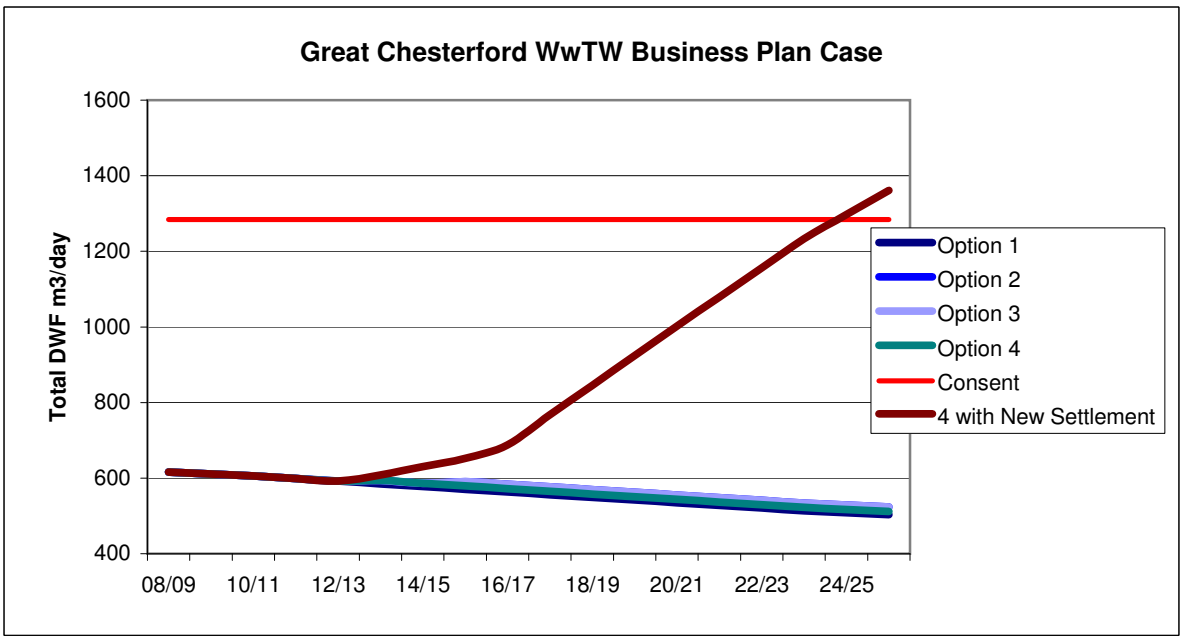
	Current Allocations + Large future RSS growth
	Large future RSS growth
	Current Allocations + Village scale future RSS growth
	Village scale RSS growth only
	Current Allocations only

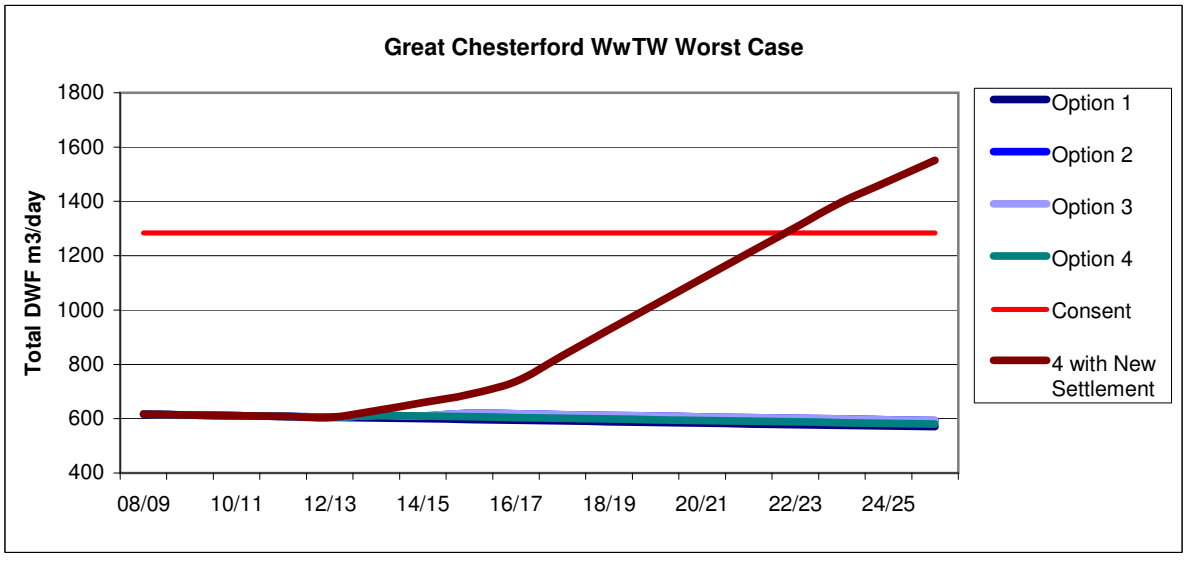

Bishops Stortford WwTW Best Case
Total DWF m3/day
18000
17000
16000
15000
14000
13000
12000
11000
10000
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent


Bishops Stortford WwTW Business Plan Case
Total DWF m3/day
18000
17000
16000
15000
14000
13000
12000
11000
10000
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent

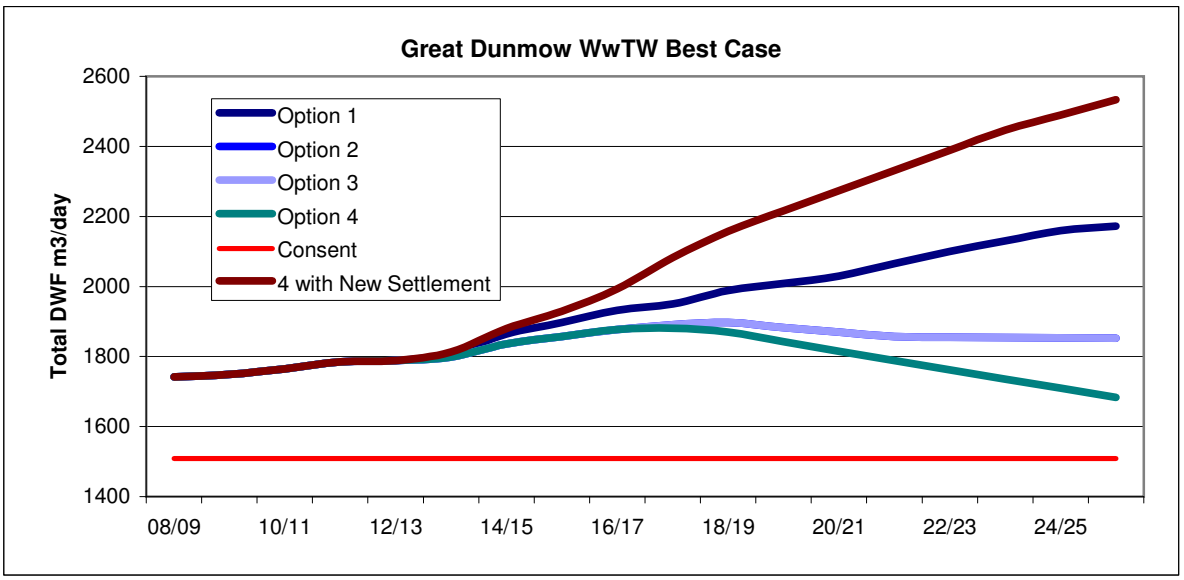

Bishops Stortford WwTW Worst Case
Total DWF m3/day
18000
17000
16000
15000
14000
13000
12000
11000
10000
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent

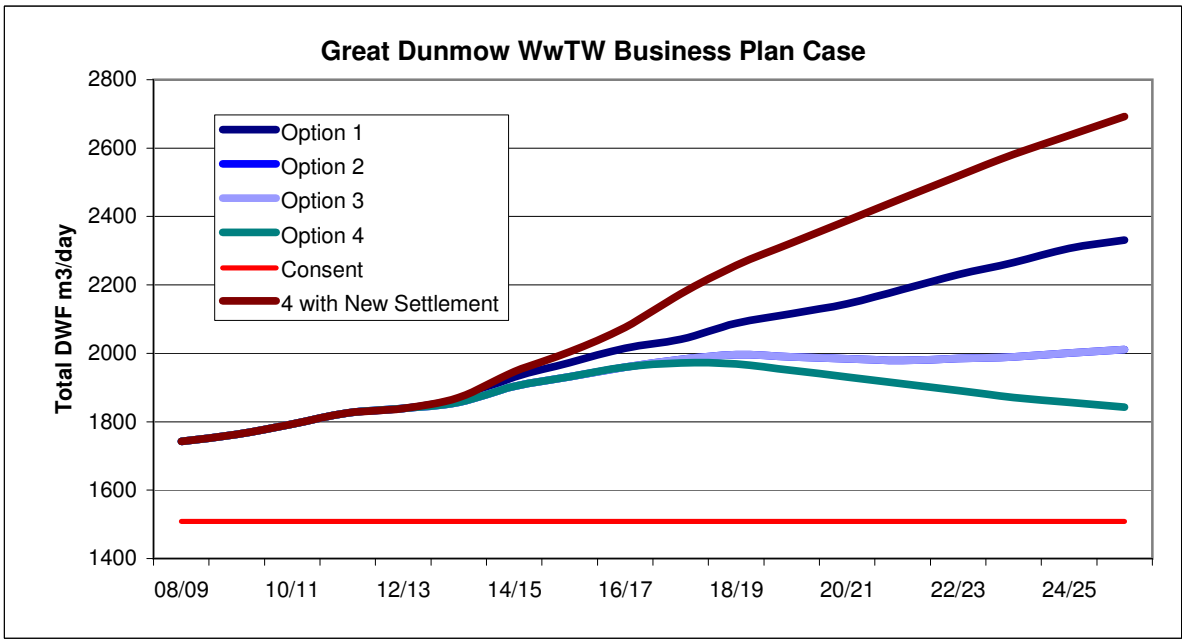

Great Chesterford WwTW Best Case
Total DWF m3/day
1400
1300
1200
1100
1000
900
800
700
600
500
400
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent
4 with New Settlement

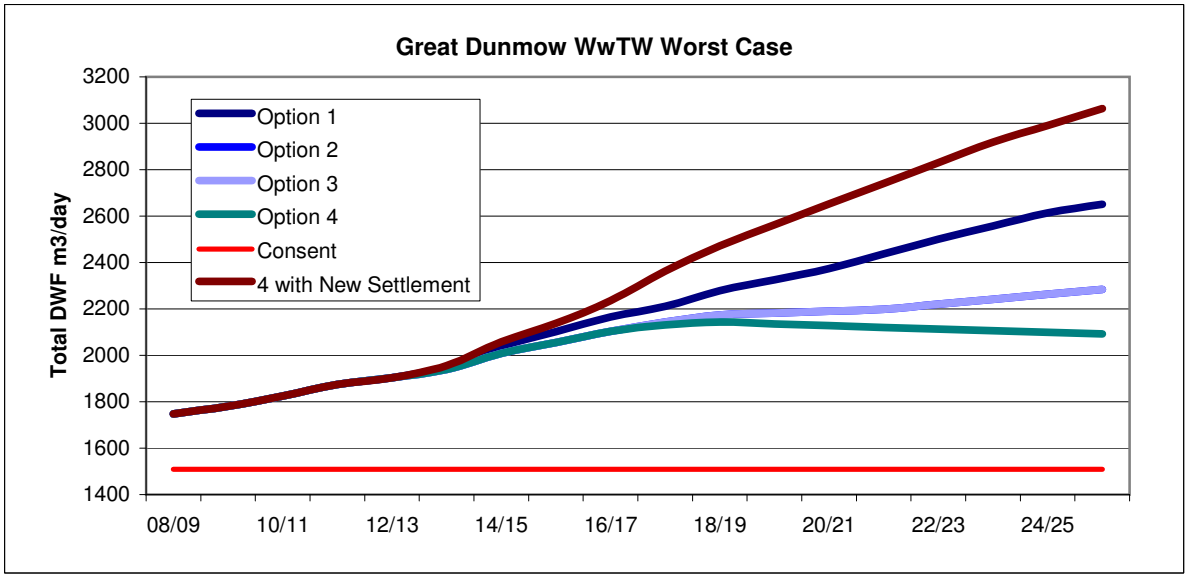

Great Chesterford WwTW Business Plan Case
Total DWF m3/day
1600
1400
1200
1000
800
600
400
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent
4 with New Settlement

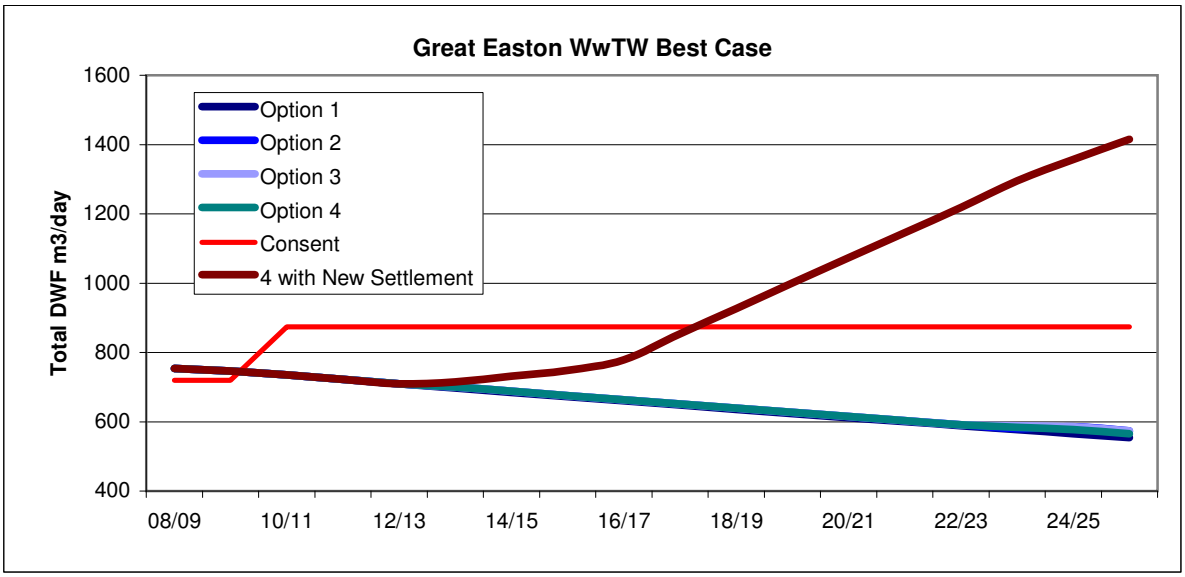

Great Chesterford WwTW Worst Case
Total DWF m3/day
1800
1600
1400
1200
1000
800
600
400
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent
4 with New Settlement

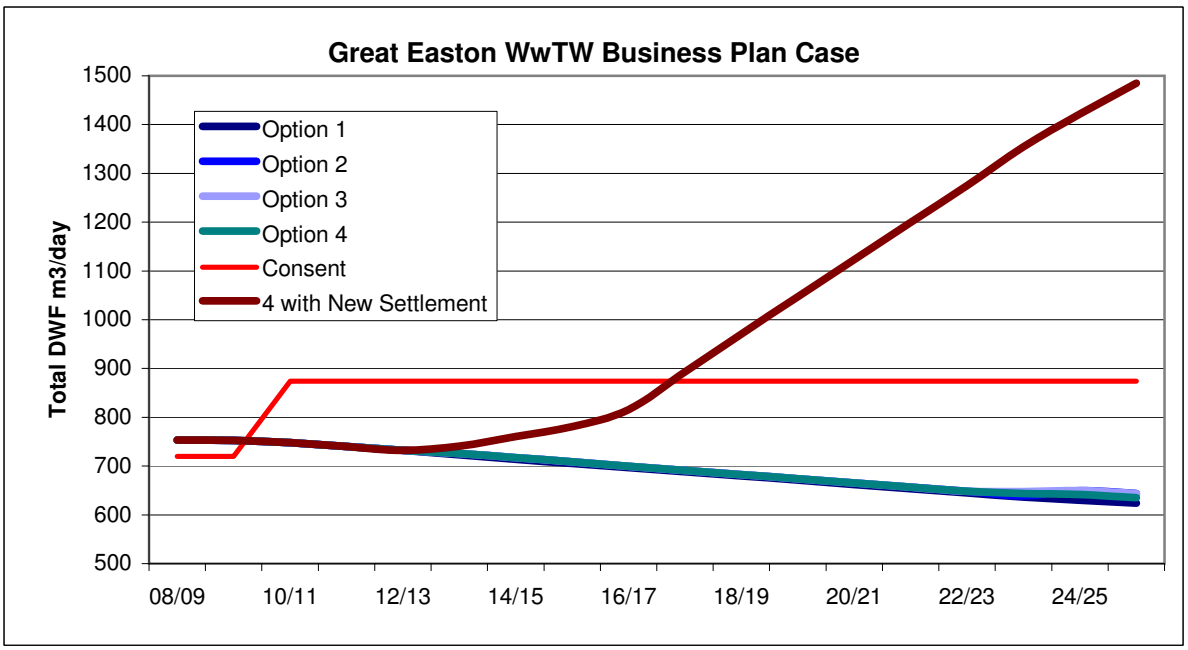
Note that Great Dunmow graphs do not show proposed consent increase as discussed in report text

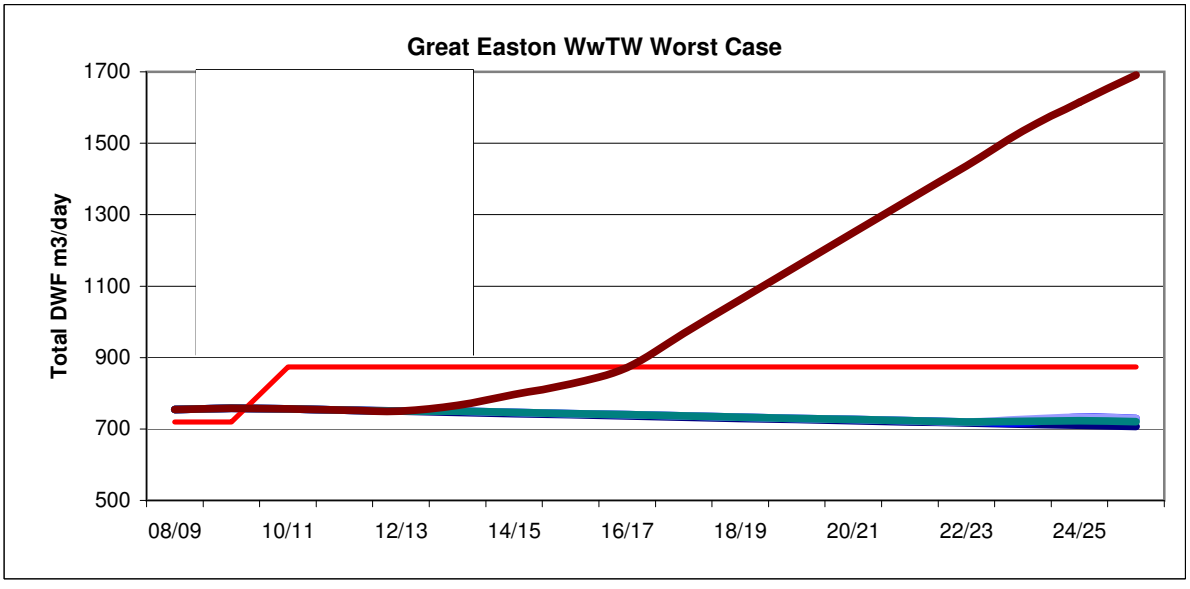


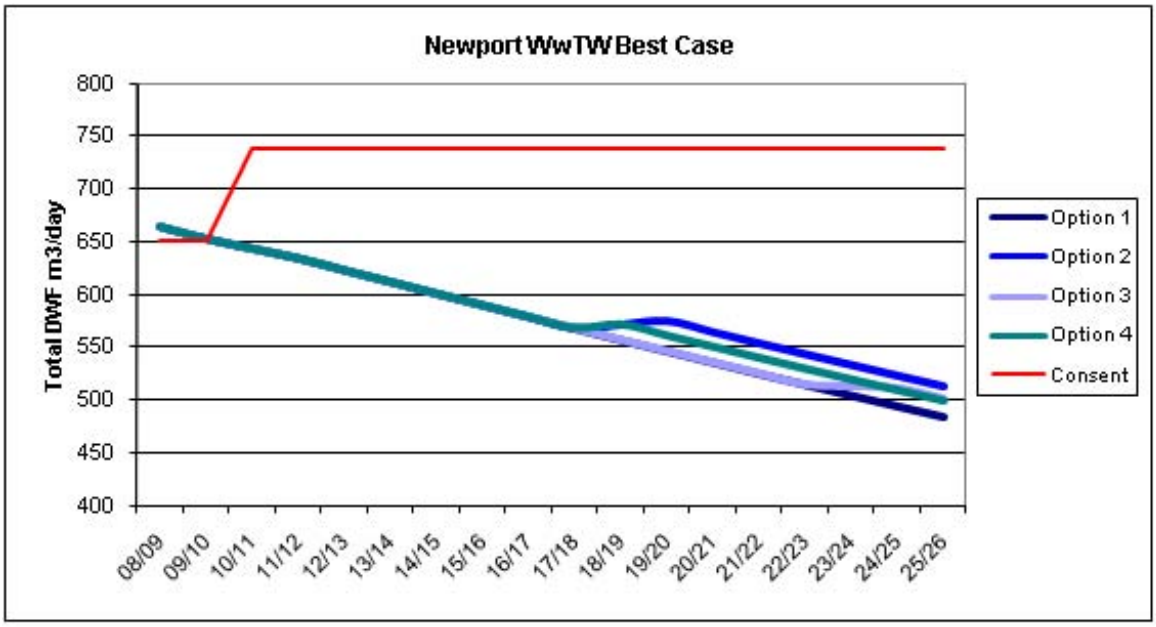


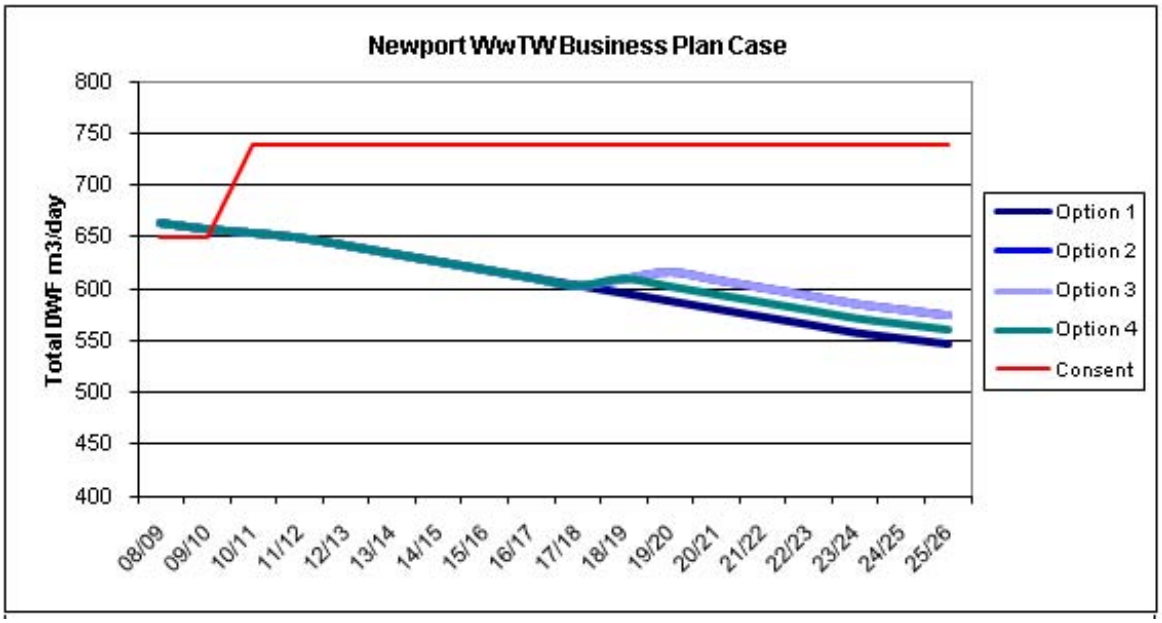


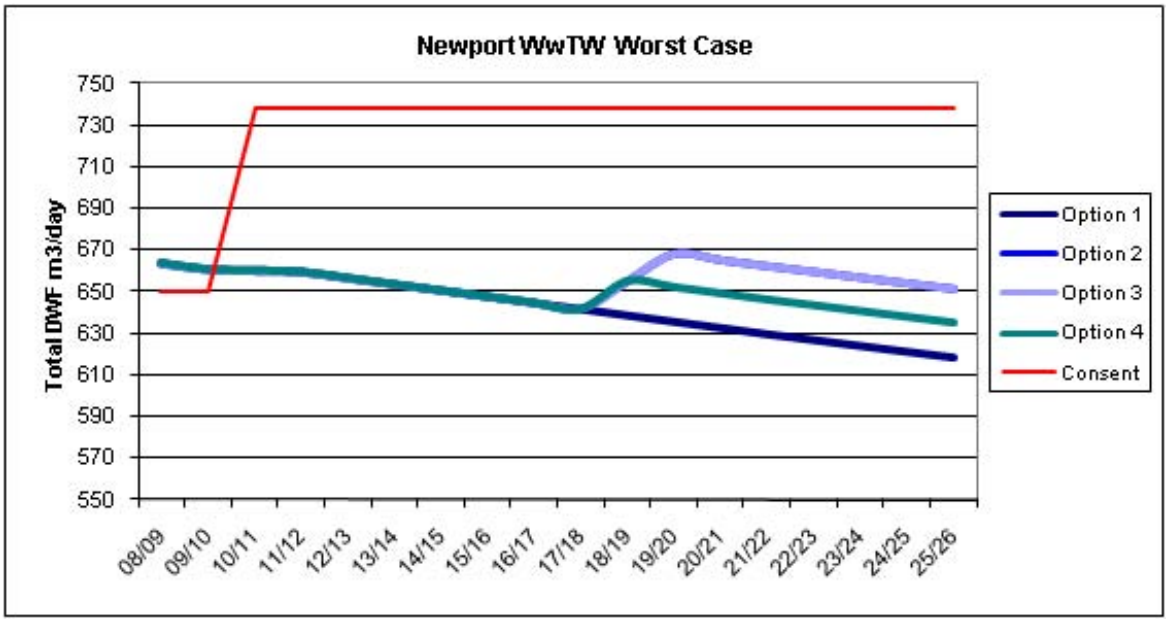

Great Easton WwTW Best Case
Total DWF m3/day
1600
1400
1200
1000
800
600
400
Option 1
Option 2
Option 3
Option 4
Consent
4 with New Settlement
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25

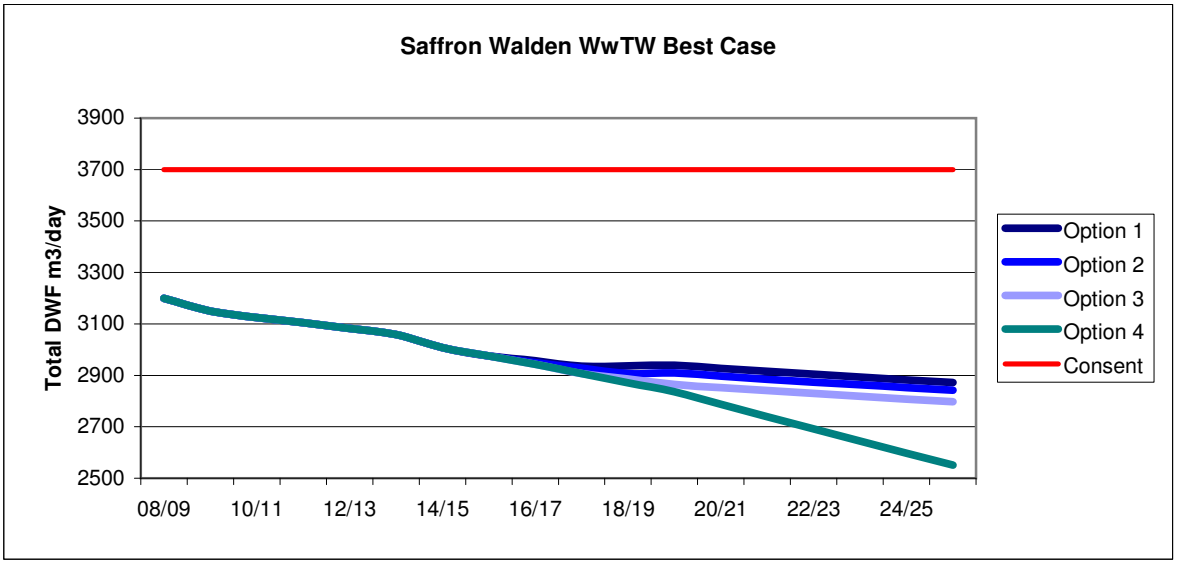

Great Easton WwTW Business Plan Case
Total DWF m3/day
1500
1400
1300
1200
1100
1000
900
800
700
600
500
Option 1
Option 2
Option 3
Option 4
Consent
4 with New Settlement
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25

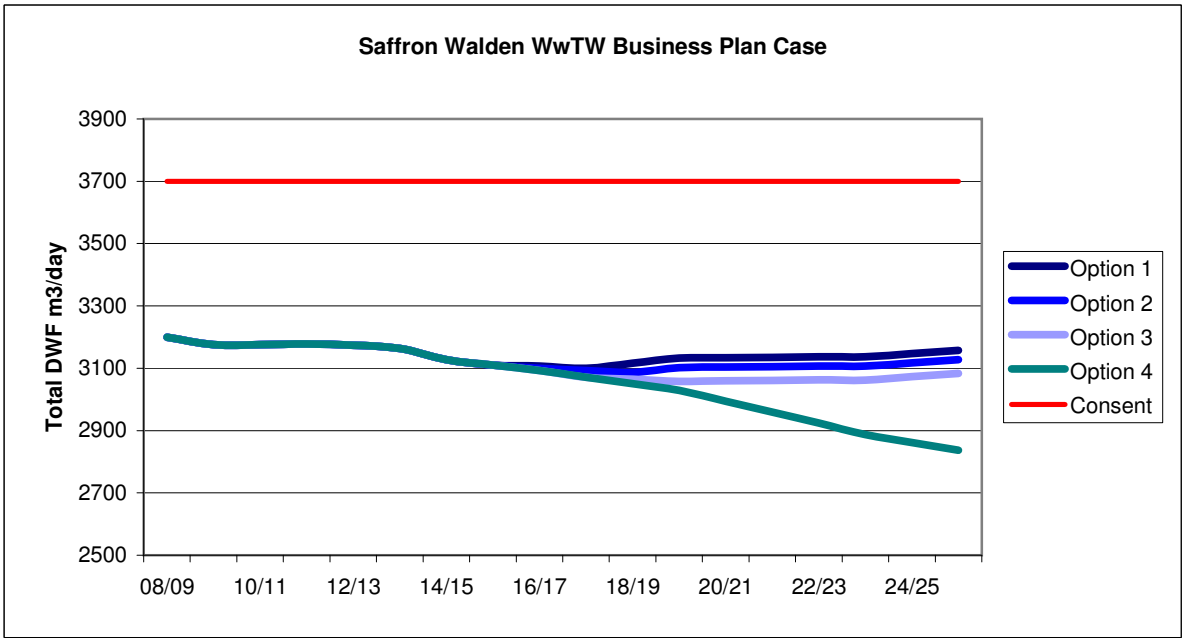

Great Easton WwTW Worst Case
Total DWF m3/day
1700
1500
1300
1100
900
700
500
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25

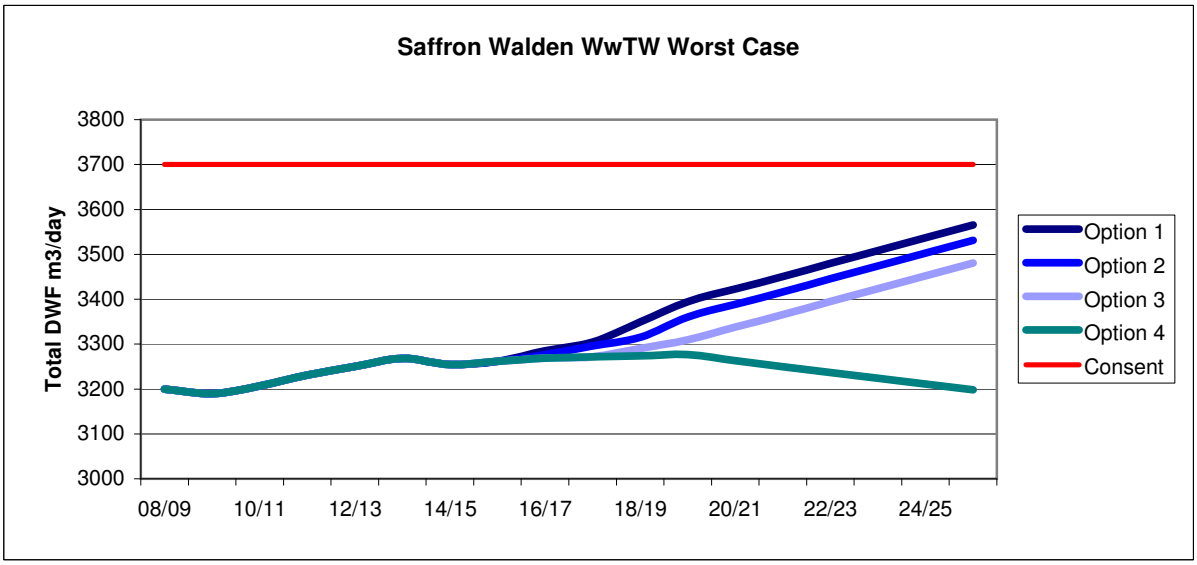

Newport WwTW Best Case
Total DWF m3/day
800
750
700
650
600
550
500
450
400
08/09
09/10
10/11
11/12
12/13
13/14
14/15
15/16
16/17
17/18
18/19
19/20
20/21
21/22
22/23
23/24
24/25
25/26
Option 1
Option 2
Option 3
Option 4
Consent

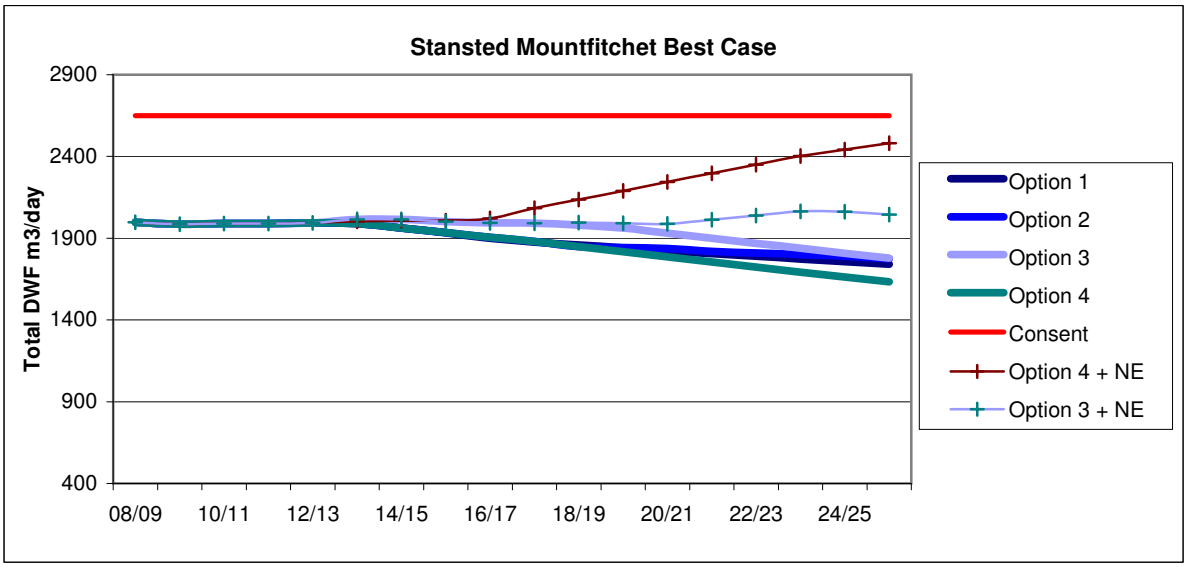

Newport WwTW Business Plan Case
Total DWF m3/day
800
750
700
650
600
550
500
450
400
08/09
09/10
10/11
11/12
12/13
13/14
14/15
15/16
16/17
17/18
18/19
19/20
20/21
21/22
22/23
23/24
24/25
25/26
Option 1
Option 2
Option 3
Option 4
Consent

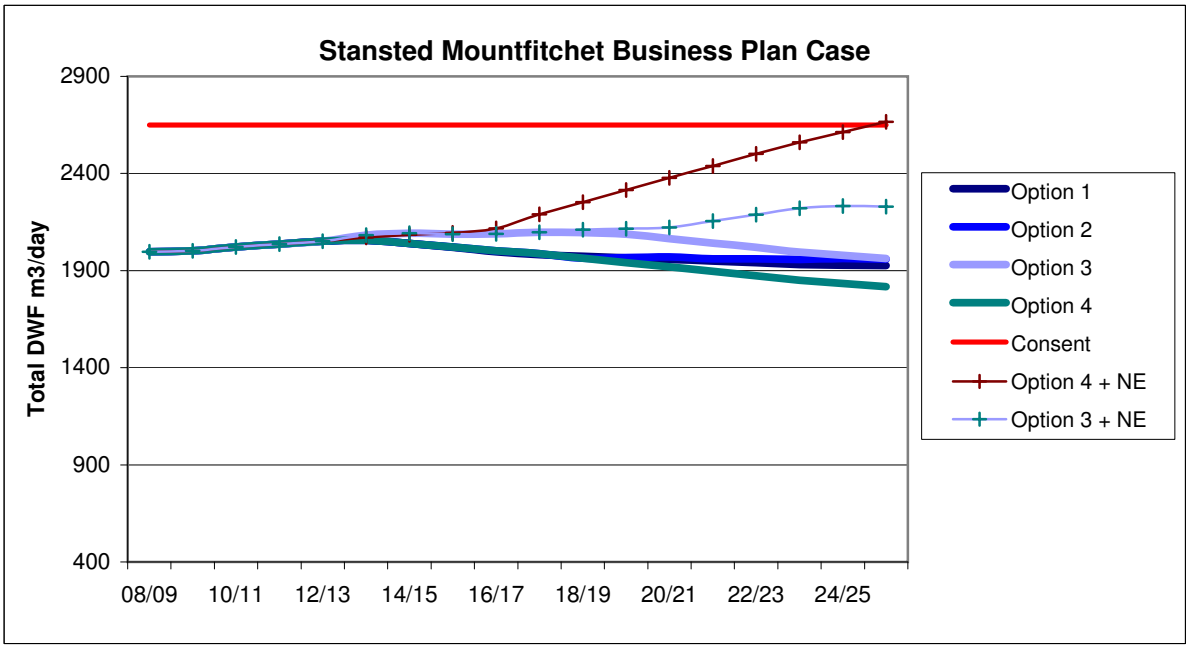

Newport WwTW Worst Case
Total DWF m3/day
750
730
710
690
670
650
630
610
590
570
550
08/09
09/10
10/11
11/12
12/13
13/14
14/15
15/16
16/17
17/18
18/19
19/20
20/21
21/22
22/23
23/24
24/25
25/26
Option 1
Option 2
Option 3
Option 4
Consent

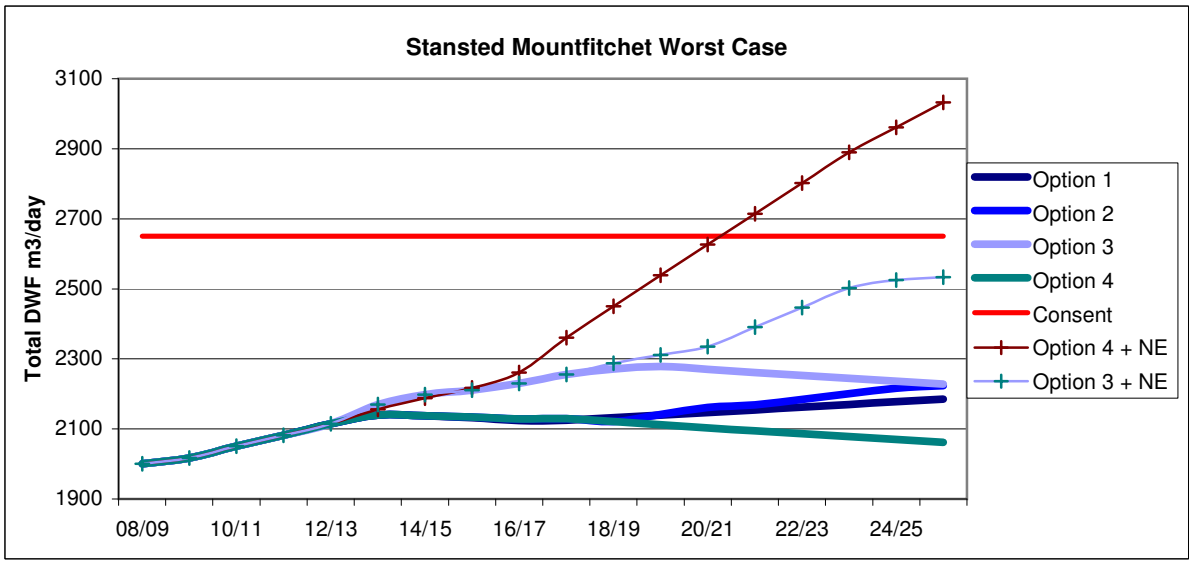

Saffron Walden WwTW Best Case
Total DWF m3/day
3900
3700
3500
3300
3100
2900
2700
2500
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent


Saffron Walden WwTW Business Plan Case
Total DWF m3/day
3900
3700
3500
3300
3100
2900
2700
2500
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent


Saffron Walden WwTW Worst Case
Total DWF m3/day
3800
3700
3600
3500
3400
3300
3200
3100
3000
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent


Stansted Mountfitchet Best Case
Total DWF m3/day
2900
2400
1900
1400
900
400
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent
Option 4 + NE
Option 3 + NE


Stansted Mountfitchet Business Plan Case
Total DWF m3/day
2900
2400
1900
1400
900
400
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent
Option 4 + NE
Option 3 + NE

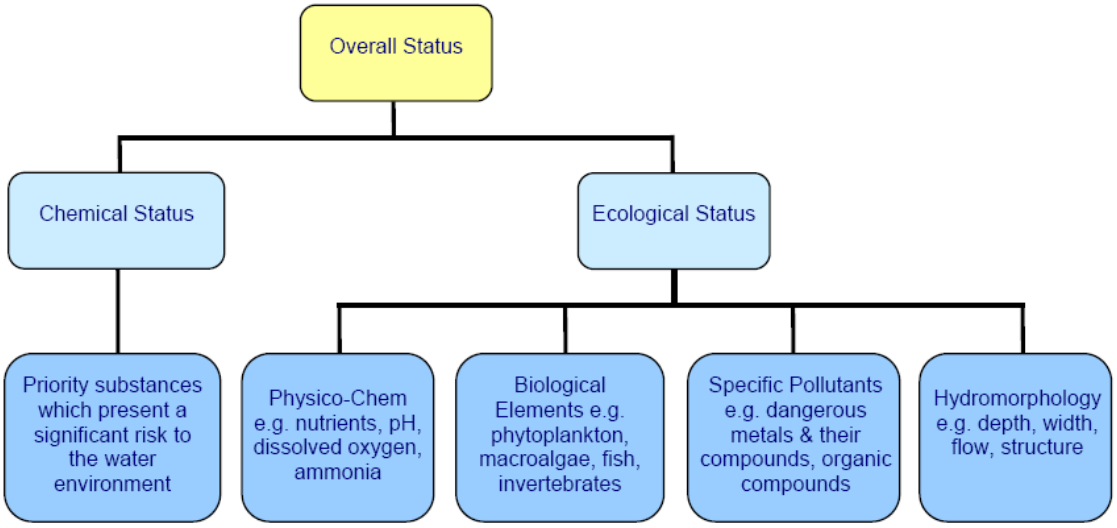

Stansted Mountfitchet Worst Case
Total DWF m3/day
3100
2900
2700
2500
2300
2100
1900
08/09
10/11
12/13
14/15
16/17
18/19
20/21
22/23
24/25
Option 1
Option 2
Option 3
Option 4
Consent
Option 4 + NE
Option 3 + NE

Appendix G

Water Framework Directive

Water Framework Directive

The new methodology of assessing the status of a watercourse, and contributing factors, is shown in the Figure below.



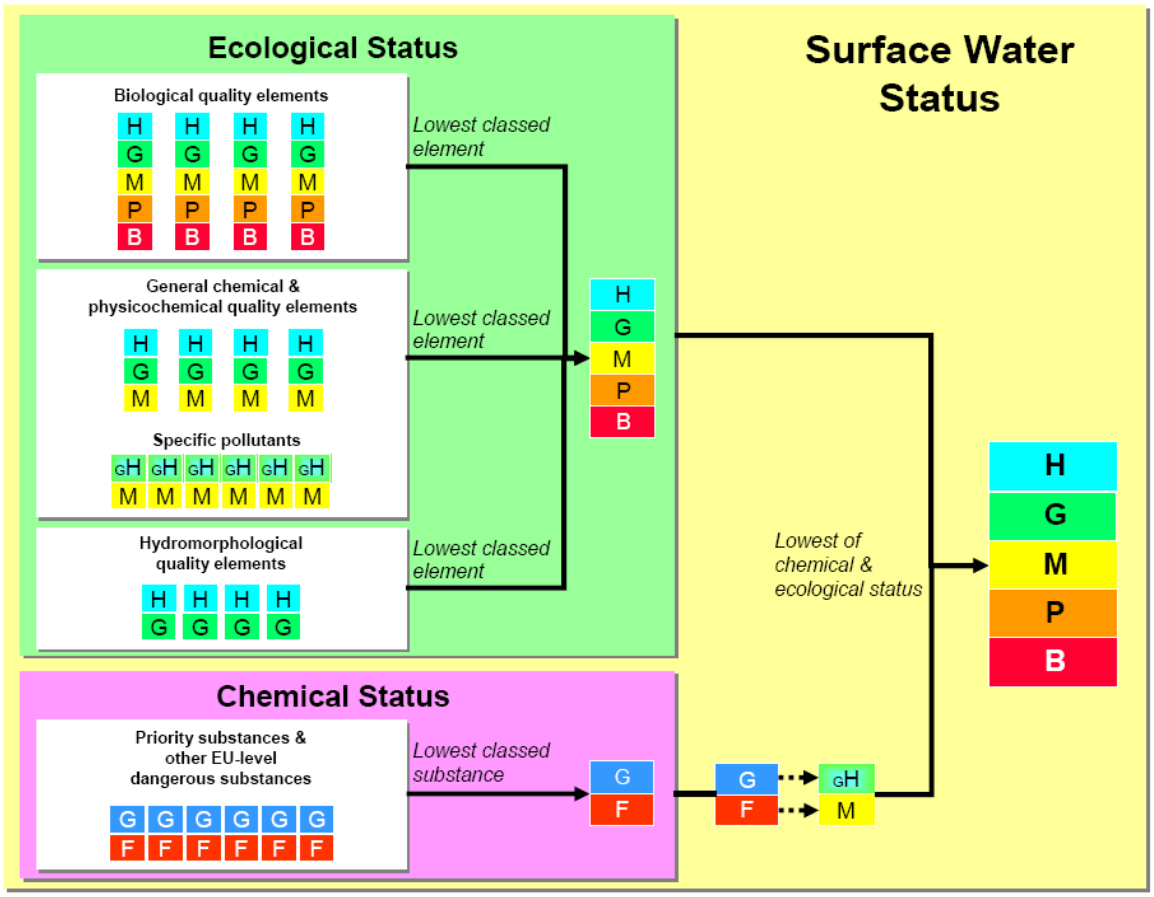
Components of WFD surface water status

Environment Agency Draft River Basin Management Plan, Thames River Basin District December 2008

Surface water status, and ecological status, is assessed on a scale from high to bad, shown in the Table below. Concentrations of individual priority substances and other chemicals deemed dangerous by the EU are classed as either good, or failing to meet good.

Ecological Status	Chemical Status Grades
High	Good
Good	
Moderate	Fail
Poor	
Bad	

Details of the classification components that make up surface water status under the WFD are displayed below.



WFD classification

UKTAG Recommendations on Surface Water Classification Schemes for the purposes of the Water Framework Directive, 2007

Key dates for the implementation of the WFD and RBMPs are:

- 2008: Draft River Basin Management Plans for each river basin district completed;
- 2009: Final River Basin Management Plans completed following consultation;
- 2012: Programs of measures for improvements to be fully operational;
- 2015: Achieve the first set of water body objectives, publish second RBMP;
- 2021: Achieve the second set of water body objectives, publish third RBMP;
- 2027: Achieve the third set of water body objectives, final deadline for achieving objectives.

However, if it is determined that the solutions required to bring a watercourse up to good status by 2015 are either technically infeasible or disproportionately costly, lower objectives can be set for the short term, with 2027 being the latest date at which the objectives should be met. Under the WFD, there is also a provision for good status to not be met for reasons of overriding public interest.

Further details on the WFD are available from the EA RBMPs, Defra and http://www.wfduk.org/.

Extracts from the RBMPs relevant to the watercourses and WwTW in Uttlesford District are included in the tables below, although it must be noted that the RBMPs are consultation documents that will be subject to amendments and corrections in the future, and as such any information may already be out of date.

River Basin District: Anglian

Catchment: Cam and Ely Ouse including South Level

River	Reach (with unique reference code)	Current Ecological Status (or EP in the case of HMWB)	Current Chemical Status	Barriers to Good status (or GEP for HMWB)	Proposed Date for Achieving Good status (or GEP)
Cam or Granta	Source…Newport GB105033037480	Good	Not required		2015
Cam	Newport…Wendens Ambo GB105033037520 (HMWB flood protection)	Poor	Not required	Phosphate: Bad Invertebrates: Moderate Phytobenthos: Poor HMWB mitigation: Moderate	2027
Cam	Wendens Ambo…Saffron Walden GB105033037550 (HMWB wider environment)	Poor	Not required	Invertebrates: Moderate Phytobenthos: Poor	2027
Cam	Saffron Walden…Great Shelford GB105033037590 (HMWB flood protection)	Poor	Good	Phosphate: Poor Phytobenthos: Poor Fish: Moderate Dissolved Oxygen: Moderate HMWB mitigation: Moderate	2027 Chemical Status to meet High by 2015
Debden Water	Source…River Cam at Newport GB105033037490 (HMWB water regulation and wider environment)	Moderate	Not required	HMWB mitigation: Moderate	2027
Wicken Water	Source…River Cam at Newport GB105033037540	Good	Not required		2015
Wendon Brook	Source…River Cam at Wendens Ambo GB105033037560 (HMWB land drainage)	Moderate	Good	Invertebrates: Moderate Quantity and dynamics of flow will not support good status before 2015	2027 Chemical Status to meet High by 2015
Cam tributary	Chrishall…River Cam at Ickleton GB105033037570 (HMWB land drainage)	Moderate	Not required	HMWB mitigation: Moderate	2027 Flows to support good by 2015

Cam tributary (The Slade)	Sources…River Cam at Saffron Walden GB105033037580 (HMWB land drainage)	Moderate	Not required	Phosphate: Poor Dissolved Oxygen: Moderate HMWB mitigation: Moderate	2027
Granta	Sources…River Cam at Great Shelford GB105033037810	Poor	Good	Phosphate: Poor Dissolved Oxygen: Moderate Fish: Poor Quantity and dynamics of flow will not support good status before 2015	2027 Chemical Status to meet High by 2015

Catchment: Combined Essex

River	Reach (with unique reference code)	Current Ecological Status (or EP in the case of HMWB)	Current Chemical Status	Barriers to Good status (or GEP for HMWB)	Proposed Date for Achieving Good status (or GEP)
Pant	Source…Great Bardfield GB105037041180 (HMWB flood protection and water regulation)	Moderate	Not required	Phosphate: Poor Dissolved Oxygen: Bad Invertebrates: Moderate Phytobenthos: Moderate HMWB mitigation: Moderate	2027
Chelmer	Sources…Duton Hill GB105037041220	Moderate	Not required	Phosphate: Moderate Dissolved Oxygen: Moderate Quantity and dynamics of flow will not support good status before 2015	2027
Chelmer tributary	Sources (at Broxted, Chickney and Cherry Green)…River Chelmer at Duton Hill GB105037041200 (HMWB land drainage)	Moderate	Not required	Phosphate: Moderate HMWB mitigation: Moderate	2027
Stebbing Brook	Source…River Chelmer at Felsted GB105037041190	Good	Not required		2015
Chelmer	Duton Hill…Chelmsford GB105037033950 (HMWB flood protection)	Moderate	Not required	Phosphate: Poor Dissolved Oxygen: Moderate HMWB mitigation: Moderate	2027
Ter	Source…River Chelmer GB105037033940	Moderate	Not required	Phosphate: Poor	2027
Can	Source (nr High Roding)…Chelmsford GB105037033840	Moderate	Not required	Phosphate: Moderate	2027

River Basin District: Thames

Catchment: Roding, Beam and Ingrebourne

River	Reach (with unique reference code)	Current Ecological Status (or EP in the case of HMWB)	Current Chemical Status	Barriers to Good status (or GEP for HMWB)	Proposed Date for Achieving Good status (or GEP)
Roding	Upper Roding…Norton Ditch GB106037033500 (HMWB Urbanisation, Land Drainage, Flood Protection, Wider Environment)	Moderate	Not required	Fish: Moderate Invertebrates: Moderate Phytobenthos: Moderate Phosphate: Moderate HMWB mitigation: Moderate	2027

Catchment: Upper Lee

River	Reach (with unique reference code)	Current Ecological Status (or EP in the case of HMWB)	Current Chemical Status	Barriers to Good status (or GEP for HMWB)	Proposed Date for Achieving Good status (or GEP)
Pincey Brook	Source (nr Stansted Airport…River Stort GB106038033380	Poor	Not required	Phytobenthos: Poor Phosphate: Poor	2027
Stort	Clavering…confluence with Stanstead/ Tye Green Brook GB106038040130	Poor	Not required	Phosphate: Poor Phytobenthos: Poor	2027
Stort	Confluence with Stanstead Brook…confluence with Bourne/ Farnham Brook GB106038033340	Poor	Not required	Phosphate: Poor Phytobenthos: Poor Quantity and dynamics of flow will not support good status	2027 Flows to support good by 2015
Bourne/ Farnham Brook	Near Farnham…River Stort at Bishops Stortford GB106038033430	Moderate	Not required	Dissolved oxygen: moderate Phosphate: Poor Quantity and dynamics of flow will not support good status before 2015	2027
Great Hallingbury Brook	Source nr Stansted Airport…River Stort at Latchmore Bank GB106038033330	Poor	Not required	Phosphate: Moderate Phytobenthos: Poor Invertebrates: Poor	2027
Stort (Navigation)	Through Bishops Stortford…confluence with Great Hallingbury Brook GB106038033320 (HMWB Urbanisation, Flood Protection, Navigation)	Poor	Not required	Phosphate: Poor Phytobenthos: Poor Dissolved oxygen: Moderate Quantity and dynamics of flow will not support good status by 2015 HMWB mitigation: Moderate	2027
Stort (Navigation)	Bishops Stortford…River Lee GB106038033280 (HMWB Water Storage)	Poor	Not Good	Phytobenthos: Poor Tributyltin Compounds: Moderate Phosphate: Poor	2027 GEP by 2015, Chemical Status to meet High by 2027

Little Hallingbury and Woodside Green Brooks	Little Hallingbury…River Stort at Gaston Green GB106038033250	Moderate	Not required	Phosphate: Poor	2027

The table below illustrates the improvements, and associated timescale, proposed in the RBMPs (or advised by stakeholders during the WCS consultation) for the WwTW within Uttlesford District.

WwTW	Proposed Improvement	Timeframe	Organisation	Driver
Stansted Mountfitchet	Imposition of an annual average P consent of 2 mg/l, an Fe limit of 3 mg/l and an Al limit of 1 mg/l	By 2015	TWU	National Environment Programme
Bishops Stortford	Imposition of an annual average P consent of 2 mg/l, an Fe limit of 2.5 mg/l and an Al limit of 1mg/l	By 2012	TWU	National Environment Programme
Hatfield Heath	Investigation into components of discharge	By 2011	TWU	WFD
High Roding	Control of organic pollutants through PR09/ AMP5	By 2015	AWS	WFD
Felsted	Investigation into the possible improvement of nutrient levels in discharge concluded that P removal not beneficial	Completed 2008	AWS	SSSI (Hanningfield reservoir)
Great Sampford	Investigation into intermittent groundwater discharges regarding Groundwater Hazardous Substances,	By 2012	AWS	Groundwater Directive
Quendon	Investigation into groundwater discharges regarding Groundwater Hazardous Substances,	By 2012	AWS	Groundwater Directive
Saffron Walden	P removal (to 2mg/l) implemented as River Cam is candidate Sensitive Area (Eutrophication)	Completed 2008	AWS	UWWTD

Appendix H

Wastewater Treatment Options

Wastewater Treatment Options

The following table displays current wastewater treatment options that may be utilised for residential developments. Advantages and disadvantages are shown, along with an estimation of the maximum population equivalent (PE) that can be served.

Treatment Process	Description	Issues	Advantages
Reed beds	Screened wastewater flows through the root system of a bed of reeds PE <50 for wastewater treatment, PE <2000 for tertiary treatment	Significant land required Constant loading required Winter die-back	Low capital investment required Can be used for tertiary treatment of effluents
Rotating Biological Contactor	Small scale treatment method where organic matter is aerobically digested on the surface of paddles PE = 100-2000	High maintenance required Only works within specified flow ranges	Multiple units can be used in parallel for phased upgrades
Aerated Lagoons	Oxygen provided to large ponds of screened wastewater to treat effluent PE ~<2000	Significant land required Reduced efficiency rates in winter Odour Issues	Can be wind powered to reduce operating costs Little sludge produced Lower capital costs
Membrane Bio Reactor	Physical permeable barrier used to trap solids and nutrients PE = 50+ (can be upgraded in stages)	High operating costs High capital cost	High quality of effluent achievable Low tank volume required
Trickling Filter	Screened wastewater passed through filter media with biological film to digest organic matter PE = small-medium sized communities	Additional treatment may be required Risk of clogging Affected by cold weather Difficulty in achieving low ammonia loads	Simple, reliable biological process Low power requirements Relatively small land requirements
Biological Aerated Filtration	Similar to trickling filter, but self contained within one tank. Oxygen introduced to encourage the digestion of organic material by the aerobic bacteria within the biological film. PE = 15-200 per unit	Tanks require regular de-sludging. May be affected by cold weather.	As above, plus Low Operating costs Self contained units can be installed as development requires
Activated Sludge Plant	Provides oxygen to bacteria that feed on organic matter within wastewater PE ~ medium-large communities	Large quantities of sludge produced Constant monitoring required High power costs	High quality treatment available Well established technology

Advanced Aeration	Liquids and solids treated in tandem through microbiological process and aeration; bubbles created in a partial vacuum, to have a higher surface area, which increases the performance of the aerobic bacteria PE = full range of applications and sizes	Power requirement may still be higher than other methods e.g. trickling filter	High quality treatment available Low odour Low sludge production Significant reduction in energy consumption compared to traditional ASP

Appendix I

EA Indicative Consent Modelling Results

Results of EA 'River Needs Consent' Modelling

WwTW	Existing Consent mg/l BOD	AmmN	P	Development Scenario	Predicted Consent mg/l BOD	AmmN	P
Felsted	20	10	-	Including flows from Gt. Dunmow Option 1	12	1	0.05
				Including flows from Gt. Dunmow Option 4	14	2	0.05
				Including flows from Great Dunmow Option 4 plus 3000 dwellings in a new settlment	11	1	0.05
				Including flows from Great Dunmow Option 4 plus 5000 dwellings in a new settlment	10	1	0.05
Great Chesterford	9	5	-	Including flows from 3000 dwellings in a new settlment (Option 4)	6#	3#	1
				Including flows from 5000 dwellings in a new settlment (Option 4)	4#	2.5#	1
Great Dunmow	13	5	-	Option 1	13	2	0.3
				Option 4	13	2	0.4
				Option 4 plus 3000 dwellings in a new settlment	13	1	0.3
				Option 4 plus 5000 dwellings in a new settlement	13	1	0.3
Great Easton	20	6	-	Option 2/3 including flows from Thaxted	20	2	0.6
				Including flows from 3000 dwellings in a new settlment (Option 4)	20	2	0.3
				Including flows from 5000 dwellings in a new settlment (Option 4)	18	1	0.3
Newport	20	10	-	Option 2/3	19#	8	1
Quendon	20	-	-	Including flows from 3000 dwellings in a new settlment (Option 4)	15	3	0.28
				Including flows from 5000 dwellings in a new settlment (Option 4)	12	2	0.23
Rayne	10	3	-	Including flows from 4500 dwellings at Boxted Wood (Option 4)	9	1	0.2
Stansted Mountfitchet	10	3	-	Option 3	9	3	0.2
				Including flows from 3000 dwellings in a new settlment (Option 4)	8	2.7	0.2
				Including flows from 5000 dwellings in a new settlment (Option 4)	7	2.5	0.2
Willows Green	-	-	-	Including flows from 4500 dwellings at Boxted Wood (Option 4)	8	0.03	0.18

Consent limits are more stringent than BATNEEC

Consent limits are more stringent than BAT

\# No Deterioration' policy applies. Consent limits based on maintenance of load

EA assumptions	mg/l BOD	AmmN	P
BATNEEC	10	3	N/A
BAT	5	1	1