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Submitted to
East Hampshire District Council

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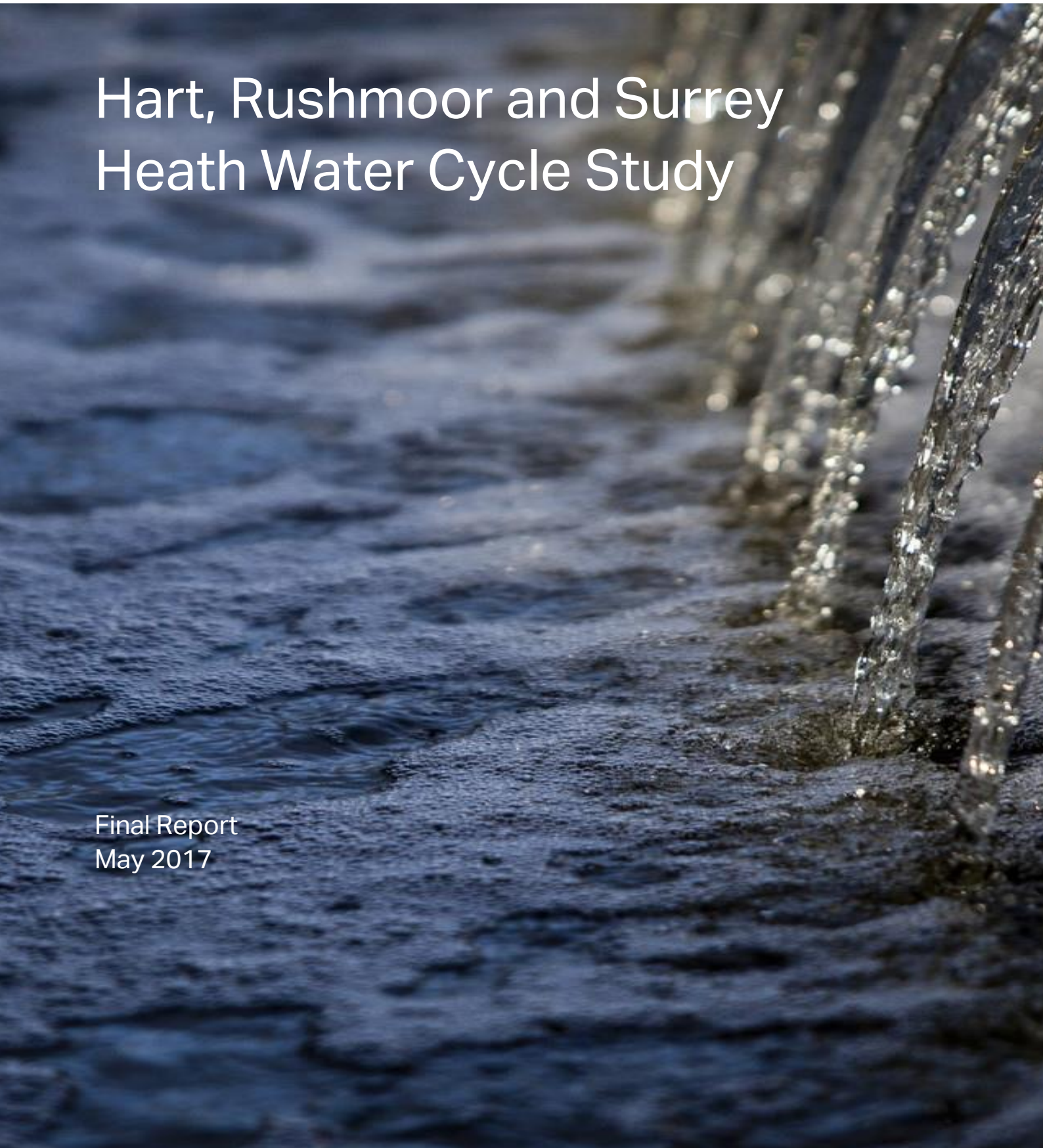

Hart, Rushmoor and Surrey Heath Water Cycle Study

Final Report
May 2017

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List of Acronyms

AMP	Asset Management Plan
AWL	Affinity Water Limited
BAP	Biodiversity Action Plan
BGS	British Geological Society
BOD	Biochemical Oxygen Demand
BREEAM	Building Research Establishment Environmental Assessment Method
CAMS	Catchment Abstraction Management Strategy
CBA	Cost Benefit Analysis
CFMP	Catchment Flood Management Plan
CIL	Community Infrastructure Levy
CIRIA	Construction Industry Research and Information Association
CLG	Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DtC	Duty to Cooperate
DWF	Dry Weather Flow
EA	Environment Agency
EFI	Environmental Flow Indicator
FEA	Functional Economic Area
GI	Green Infrastructure
GWR	Greywater Recycling
HDC	Hart District Council
HMA	Housing Market Area
IWMS	Integrated Water Management Strategy
l/h/d	Litres/head/day (a water consumption measurement)
LCT	Limits of Conventional Treatment
LDS	Local Development Scheme
LFE	Low Flow Enterprise (low flow model)
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LPA	Local Planning Authority
Ml	Megalitre (a million litres)
NE	Natural England
NPPF	National Planning Policy Framework
OAHN	Objectively Assessed Housing Need
OFWAT	The Water Services Regulation Authority (formerly the Office of Water Services)
OR	Occupancy Rate
P	Phosphorous
Q95	95 percentile (Flow exceeded 95% of the time)
RAG	Red/Amber/Green Assessment
RBC	Rushmoor Borough Council
RBMP	River Basin Management Plan
RoC	Review of Consents (under the Habitats Directive)
RQP	River Quality Planning (tool)
RWH	Rainwater Harvesting
s106	Section 106 (Town and Country Planning Act 1990)
SAC	Special Area for Conservation
SEWL	South East Water Limited
SFRA	Strategic Flood Risk Assessment
SHBC	Surrey Heath Borough Council
SHMA	Strategic Housing Market Assessment
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
STS	Severn Trent Services
SUDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
TWUL	Thames Water Utilities Limited
UKCIP02	United Kingdom Climate Impacts Programme 2002
UKCP09	United Kingdom Climate Projections 2009
UKTAG	United Kingdom Technical Advisory Group (to the WFD)
UKWIR	United Kingdom Water Industry Research group
UWWTD	Urban Wastewater Treatment Directive
WCS	Water Cycle Study
WFD	Water Framework Directive
WN	Water Neutrality
WRMP	Water Resource Management Plan
WRMU	Water Resource Management Unit (in relation to CAMS)
WRZ	Water Resource Zone (in relation to a water company's WRMP)
WSI	Water Services Infrastructure
WwTW	Wastewater Treatment Works

Non-Technical Summary

The region covering Hart, Rushmoor and Surrey Heath is expected to experience a significant increase in housing provision and economic growth over the period to 2032. This growth represents a challenge in ensuring that both the water environment and water services infrastructure has the capacity to sustain this level of growth and development proposed.

The three neighbouring local authorities of Hart District Council (HDC), Rushmoor Borough Council (RBC) and Surrey Heath Borough Council (SHBC) have chosen to partner together to commission the preparation of a Water Cycle Study (WCS) establishing a framework for co-operation. This partnership approach will encourage collaboration and enable the water cycle across the study area to be managed more effectively and holistically throughout the plan period.

The purpose of this joint partnership detailed WCS is to inform preparation of each of the local authorities Local Plan as part of the evidence base, and will seek to ensure that future development does not have a damaging effect on the water environment across the study area. The WCS has only assessed potential growth scenarios that are likely to occur on the basis of the best currently available evidence, thus helping to guide future development in terms of the most appropriate locations and appropriate timescales (with respect to water infrastructure and the water environment).

The WCS has considered four scenarios for proposed future development' that are based on an understanding of where development could come forward within the study area. The scenarios have been assessed with regards to water supply capacity, wastewater capacity and environmental capacity. Any water quality issues, associated water infrastructure upgrades that may be required and potential constraints have subsequently been identified and reported. This WCS then provides information at a level suitable to demonstrate that there are workable solutions to key constraints to deliver future development for major development sites (committed and potential allocations), including recommendations required to deliver it.

The Wastewater Strategy

The WCS identifies that in total 11 Wastewater Treatment Works (WwTW) will serve the proposed future development across the study area. The table below provides an indication of the WwTWs which have available capacity and those that are likely to require changes to environmental permits that control discharge and potentially infrastructure upgrades.

The sensitivity of the receiving watercourses in the study area has been discussed, and current water quality concerns highlighted. Despite these concerns, it has been shown that the WwTW within the study area can ultimately accept the increased wastewater generated by growth, using economically feasible, conventional treatment technologies to the standards required to prevent significant deterioration to the water environment.

WwTW	Phasing of Development
Aldershot	Flow and treatment capacity for growth under all growth scenarios with some flow capacity available for further growth.
Camberley	Limited flow capacity under all growth scenarios, therefore growth upgrades and careful development phasing will be required. Will also require treatment process upgrades using conventional and possibly non-conventional treatment technologies to meet river quality targets.
Camp Farm	Flow capacity for growth under all growth scenarios with some flow capacity available for further growth. However, treatment process upgrades will be required using conventional treatment technologies to meet river quality targets.
Chobham	Flow and treatment capacity for growth under all growth scenarios with some flow capacity available for further growth.
Crondall	Flow and treatment capacity for growth under all growth scenarios with some flow capacity available for further growth.

WwTW	Phasing of Development
Fleet	Flow capacity for growth under all growth scenarios with some flow capacity available for further growth. However, treatment process upgrades will be required using conventional treatment technologies to meet river quality targets.
Hartley Wintney	Flow capacity for growth under all growth scenarios with some flow capacity available for further growth. However, treatment process upgrades will be required using conventional treatment technologies to meet river quality targets.
Lightwater	Limited flow capacity under all growth scenarios, therefore growth upgrades and careful development phasing will be required. Treatment process upgrades will also be required using conventional treatment technologies to meet river quality targets.
Eversley	Limited flow capacity under certain growth scenarios with flow capacity for planned growth up to 2022 (based on Hart District Council Housing Trajectory), therefore growth upgrades may be required post-2022. Treatment process upgrades will be required using conventional treatment technologies to meet river quality targets.
Sandhurst	Flow and treatment capacity for growth under all growth scenarios with some flow capacity available for further growth.
Wargrave	Flow and treatment capacity for growth under all growth scenarios with some flow capacity available for further growth.

Two WwTWs (Camberley and Lightwater WwTWs) and one WwTW under specific growth scenarios (Eversley WwTW) do not have sufficient capacity to accept all future development proposed within the plan period. Therefore solutions are required in order to accommodate the growth to ensure that the increased wastewater flow discharged does not impact on the current quality of the receiving watercourses, their associated ecological sites and also to ensure that the watercourses can still meet with legislative requirements.

The detailed assessments have shown that improvements to Camp Farm, Fleet, Hartley Wintney, Lightwater and Eversley WwTWs are possible using wastewater treatment technologies currently available (conventional), demonstrating that an engineering solution is feasible and hence treatment capacity should not be seen as a barrier to growth.

Camberley WwTW may, however, require advanced treatment technologies (non-conventional) to ensure future development can be accepted without significantly compromising water quality targets in the River Blackwater. Due to the nature of advanced treatment technologies, they may potentially be expensive and unsustainable. However, the treatment performance of Camberley WwTW is already very good using currently available treatment technologies, suggesting that treatment capacity may not be a barrier to growth. The current treatment performance of Camberley WwTW should be reviewed by Thames Water Utilities Limited and the Environment Agency to determine the treatment capacity.

The phasing of developments draining to these WwTWs will need to be discussed between the respective local authority and Thames Water Utilities Limited to ensure no development occurs before the necessary upgrades are in place, and development is phased in line with the water companies asset management plans. Development may need to be phased in line with the delivery of infrastructure upgrades to serve development. Camberley and Lightwater WwTWs are shown to already be at capacity with current housing in terms of the flow the WwTWs are permitted to discharge. Thames Water Utilities Limited has stated that some treatment process upgrades are being undertaken at Camberley WwTW, however currently there are no planned upgrades to provide additional flow capacity. There are currently no planned upgrades for Lightwater WwTW.

Eversley WwTW will only reach its flow capacity limit under certain growth scenarios, and this is not expected to occur until 2022, should one of these growth scenarios come forward.

The WCS has concluded that the three local authorities, the Environment Agency, and Thames Water Utilities Limited should work together to determine if potential solutions in the study area are acceptable and hence conclude when and how much development can be accommodated across the study area in the early phases of the Local Plan delivery period.

To ensure that the planned level of development within the plan period does not result in a negative impact upon wildlife both inside and outside of designated sites, it is recommended each of the local authorities, Thames Water Utilities

Limited and Severn Trent Services use the results of this WCS to advise their Local Plans and asset management plans respectively. By working together, this will ensure that as developments come online there is sufficient capacity available locally to ensure all objectives of the Water Framework Directive (WFD) continue to be met.

Water Supply Strategy

Based on the growth assessed, the WCS has concluded that, allowing for the planned resource management of South East Water's and Affinity Water's Water Resource Zones, the study area would have adequate water supply to cater for growth over the plan period.

However, the WCS has identified that there are long term limitations on further abstraction from the raw water resources supplying the study area and that there is a drive to ensure the delivery of sustainable development for the study area as a whole. Hence there are key drivers requiring that water demand is managed in the study area for all new development in order to achieve long term sustainability in terms of water resources.

In order to reduce reliance on raw water supplies from rivers and aquifers, the WCS has set out ways in which demand for water as a result of development can be minimised without incurring excessive costs or resulting in unacceptable increases in energy use. In addition, the assessment has considered how far development in the study area can be moved towards achieving a theoretical 'water neutral' position i.e. that there is no net increase in water demand between the current use and after development across the plan period has taken place. A pathway for achieving neutrality as far as practicable has been set out, including advice on:

- what measures need to be taken technologically to deliver more water efficient development;
- what local policies need to be developed to set the framework for reduced water use through development control;
- how measures to achieve reduced water use in existing and new development can be funded; and
- where parties with a shared interest in reducing water demand need to work together to provide education and awareness initiatives to local communities to ensure that people and business in the study area understand the importance of using water wisely.

Five water neutrality scenarios have been proposed and assessed to demonstrate what is required to achieve different levels of neutrality in the study area. The assessment concluded that measures should be taken to deliver the first step on the neutrality pathway; the following initial measures are therefore suggested by the WCS:

- Ensure all housing is water efficient, with new housing development meeting the mandatory national standard as set out in the Building Regulations;
- Carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings. Aim to move towards delivery of 15% of the existing housing stock, with easy fit water saving devices; and,
- Establish a programme of water efficiency promotion and consumer education, with the aim of behavioural change with regards to water use.

Water Cycle Study Recommendations

The WCS should also set out recommendations for what is required, when, and where in order to address any emerging issues from investigating the key questions. These recommendations must take account of the likely phasing of development, potential environmental impacts, and the availability of funding and future management arrangements to ensure that adverse impact on the water environment is minimised as a result of development arising from the Local Plan process.

In order to support the further development of each of the local authorities' Local Plans with respect to water services infrastructure and the water environment; the WCS provides a site specific assessment of the potential constraints on each of the proposed major development sites.

1 Introduction

1.1 Background

The neighbouring local authorities of Hart District Council (HDC), Rushmoor Borough Council (RBC) and Surrey Heath Borough Council (SHBC) together form a Housing Market Area (HMA) and Functional Economic Area (FEA) as defined by Wessex Economics[1]. The area is expected to experience a significant increase in housing requirement and economic growth over the period to 2032.

Taking account of trends in the population, jobs, the housing stock and house prices, the latest Strategic Housing Market Assessment (SHMA) 2017[2] has indicated the need for 21,600 dwellings within the associated HMA.

Each of the local authorities are in the process of updating their evidence base to support the production of their Local Plans for the projected level of future growth within the area. This Water Cycle Study (WCS) forms an important part of the evidence base that will help to ensure that development does not have a detrimental impact on the water environment within the area. The WCS will also help to guide the development towards the most appropriate locations (with respect to water infrastructure and the water environment) to be identified in the respective local authorities' Local Plans.

The objective of the WCS is to identify any constraints on planned housing growth that may be imposed by the water cycle. The WCS then identifies how these can be resolved i.e. by ensuring that appropriate Water Services Infrastructure (WSI) can be provided to support the proposed development. Furthermore, it should provide a strategic approach to the management and use of water which ensures that the sustainability of the water environment in the area is not compromised.

Incorporating the findings of the latest SHMA, both HDC and RBC have begun the process of updating their evidence base to support their Local Plans and strategic policies to guide development until 2032. SHBC has an adopted Local Development Scheme (LDS) which indicates that work on a new Local Plan commenced in January 2017. The current Core Strategy[3] has been informed by the previous SHMA.

1.2 WCS History

Water Cycle issues relevant to the local authorities were previously reported in a Scoping Blackwater Valley WCS[4] which was completed in April 2011. The study scoped out the environmental and water services infrastructure opportunities and constraints, but its scope was not adequate to sufficiently address the key water and water quality questions. The Scoping study identified the need for a detailed WCS to acquire more up to date and detailed information from stakeholders including the Environment Agency, Thames Water Utilities Limited (TWUL), South East Water Limited (SEWL) and Natural England. This WCS has therefore been commissioned to investigate water quality and supply issues in full detail to address the key questions as outlined in Section 1.4.1.

Since the publication of the Scoping Report, key planning documents have been updated including the latest SHMA update, and as such the evidence upon which the 2011 Scoping Report conclusions and recommendations were founded have changed. An updated WCS was therefore required and is reported in this document. For reference, a list of relevant updated planning documents has been provided in Appendix A.

1.3 Study Governance

This WCS has been carried out with the guidance of the Steering Group established at the project inception meeting comprising the following organisations:

- East Hampshire District Council (EHDC) (on behalf of Hart District Council);
- Rushmoor Borough Council;
- Surrey Heath Borough Council;
- Thames Water Utilities Limited (TWUL); and

[1] Hart, Rushmoor and Surrey Heath Joint Employment Land Review, November 2016
[2] Hart, Rushmoor and Surrey Heath Strategic Housing Market Assessment 2014 -2032, Wessex Economics, November 2016
[3] Surrey Heath Core Strategy & Development Management Policies 2011- 2028, Adopted 2012
[4] Blackwater Valley Water Cycle Study Scoping Report, Halcrow, 2011

– South East Water Limited (SEWL).

The following organisations are not part of the Steering Group, but are Main Consultees for the WCS:

– Environment Agency;

– Natural England; and

– Affinity Water Limited (AWL).

1.4 WCS Study Scope

This WCS provides information at a level suitable to ensure that there are workable WSI solutions to deliver growth for the preferred development allocations, including the policy required to deliver it.

The outcome is the development of a water cycle strategy for the study area which informs the local authorities' Local Plans, sustainability appraisals and appropriate assessments specific to the water environment and WSI issues. This will need to be considered in bringing growth forward at various sites, including guidance for developers in conforming to the requirements of the strategy.

1.4.1 Key Questions

The key questions, established with the assistance and input of the Environment Agency and as set out by the local authorities in the study brief, have been listed below in Table 1-1 and have informed the key objectives of the WCS. The key questions and associated answers are referred to throughout the document under the relevant sections provided below.

Table 1-1 Key Questions

Key Question	Section of Report addressed
Can the existing sewerage network cope with the proposed options for growth?	Appendix J
Is there sufficient capacity within the sewerage network to ensure no increased risk of storm water overflows operating causing an adverse water quality impact?	
Will the options for the quantum of development compromise Water Framework Directive objectives? If so, what does the study recommend to overcome these impacts?	Section 5.2 and 5.3
Can the proposed options for growth be accommodated at the wastewater treatment works being assessed without causing deterioration in water quality?	
If major new wastewater infrastructure is needed, can it be provided and funded in time?	Section 5.4
If growth is likely to impact on water quality, can the wastewater treatment works be upgraded to prevent any deterioration from occurring, or is the water quality permit already at current limits of technology?	Section 5.2 and 5.3
Is there sufficient environmental capacity within the receiving water to cope with the proposed options for growth?	
If there is not sufficient environmental capacity within the receiving waterbodies, are there alternative discharge locations that will not compromise WFD objectives?	
Is there enough capacity in existing abstraction licenses for the proposed options for growth?	Section 6.2
If major new water supply infrastructure is needed, can it be provided and funded in time?	Section 6.6
Is there enough water to cope with the proposed options for growth?	

1.4.2 Key Objectives

The following key objectives of the WCS have been derived from the key questions as set out in Table 1-1:

- provide a strategy for wastewater treatment across the study area which determines if solutions to wastewater treatment are required and if the solutions are viable in terms of balancing environmental capacity with cost;
- describe how the wastewater treatment strategy might impact phasing of development;
- determine whether any Habitats Directive designated ecological sites have the potential to be impacted by the wastewater treatment strategy via a screening process;
- determine whether additional water resources, beyond those already planned by SEWL and AWL are required to support growth;
- determine upgrades required to water supply infrastructure relative to potential options for growth through collaboration with SEWL and AWL;
- consider whether growth can be delivered and achieve a 'neutral water use' condition;
- provide a pathway to achievement of water neutrality;
- provide detail on SuDS constraints for each growth location;
- update flood risk mitigation and environmental management measures specific to sites;
- determine impact of infrastructure and mitigation provision on housing delivery phasing; and
- provide policy recommendations.

1.5 Key Assumptions and Conditions

1.5.1 Water Company Coverage

Three water companies operate within the study area, specifically:

- South East Water Ltd (SEWL) supplies potable water to Hart, Rushmoor and western Surrey Heath (including the wards of Frimley, Frimley Green, Heatherside, Mytchett and Deepcut, Old Dean, Parkside, St Michaels, St Pauls, Camberley Town and Watchetts) as illustrated in Figure 1-1;
- Affinity Water Ltd (AWL) supplies potable water to eastern Surrey Heath (including the wards of Bagshot, Bisley, Chobham, Lightwater, West End and Windlesham) as illustrated in Figure 1-1;
- Thames Water Utilities Ltd (TWUL) is the wastewater undertaker for Hart, Surrey Heath and the majority of Rushmoor as illustrated in
- Figure 1-2; and
- Severn Trent Services (STS) is the wastewater undertaker for the site at Wellesley, near Aldershot in Rushmoor (illustrated in
- Figure 1-2), adopting the wastewater sewer network in the areas as well as operating and maintaining the Camp Farm WwTW.

Figure 1-1 Water company supply areas within the study area

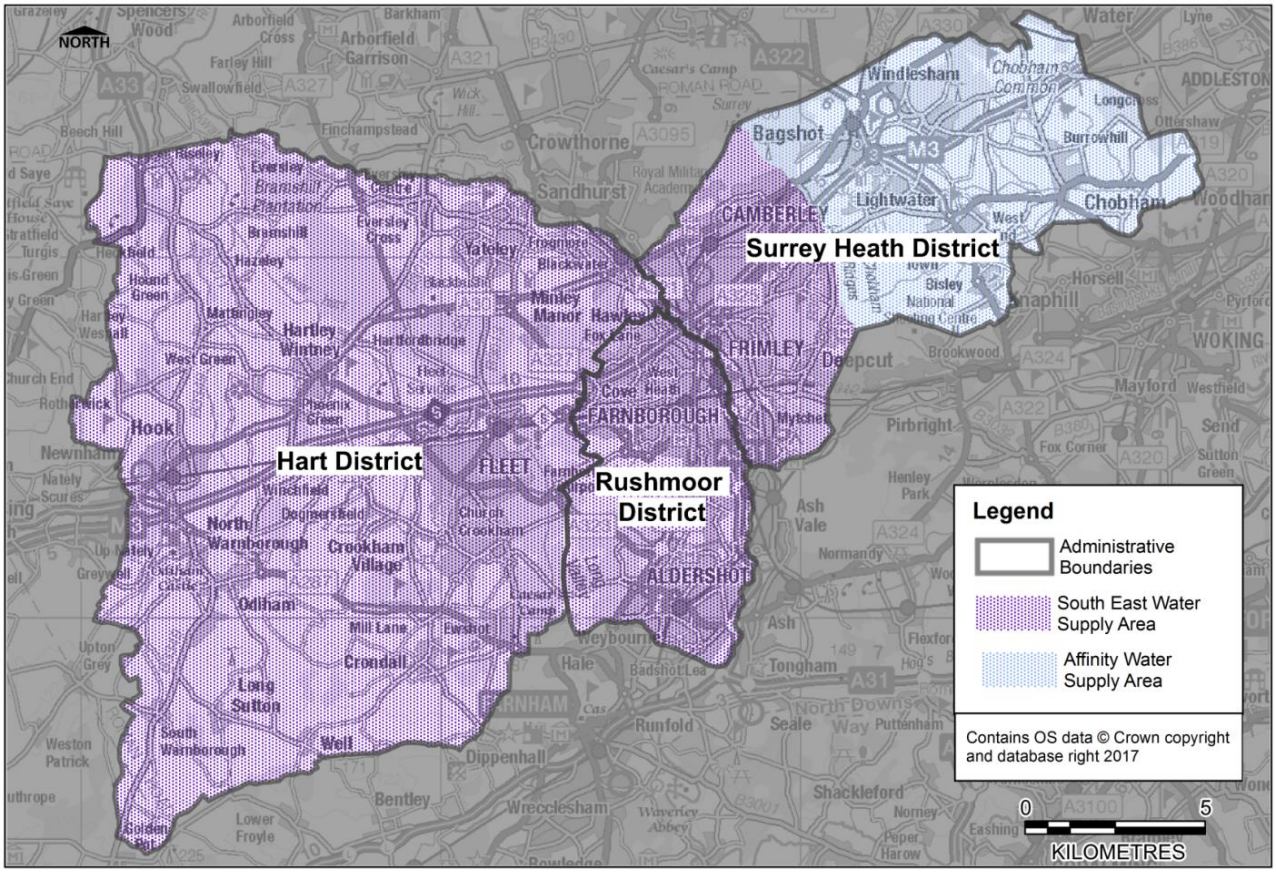
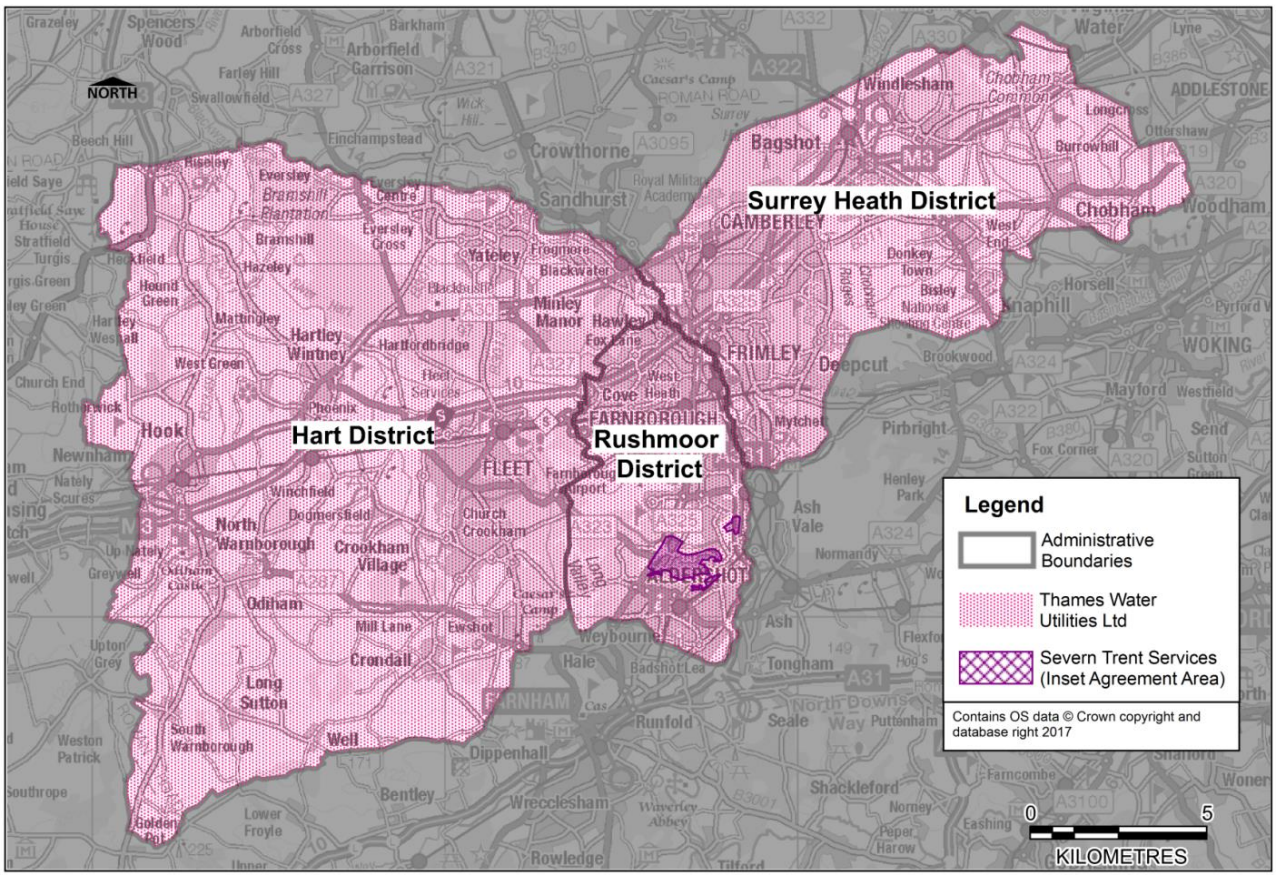


Figure 1-2 Wastewater undertakers within the study area



1.5.2 Water Use

In order to calculate the expected increase in water use as a result of growth, and to assess its impact on wastewater and water resources, the measured household consumptions for both AWL and SEWL, as published in their respective Water Resources Management Plans (WRMP), have been applied as general assumptions for water use.

As the study area covers two water companies' supply areas, two separate general assumptions of water consumption per person have been applied as follows;

- 163l/h/d (litres per head per day) assumed for new dwellings located only in AWL's supply area (as shown in Figure 1-1), and
- 150 l/h/d assumed for new dwellings located only in SEWL's supply area (as shown in Figure 1-1).

It is acknowledged that both the 163l/h/d and 150l/h/d assumptions exceed the current Building Regulations mandatory requirement of 125l/h/d for all new homes. However, in their asset planning, AWL and SEWL will continue to assume this higher water use for new homes. Analysis has shown that even when homes are built to a standard of 125l/h/d, the average household use increases over time due to various factors. The 125l/h/d mandatory requirement is an aspirational target only and AWL and SEWL are required under their remit to the industry regulator OFWAT, to plan for the expected actual use.

It is therefore important that conclusions made on infrastructure capacity within this study are consistent with AWL and SEWL planning strategies. This represents a precautionary approach and the assessments are based on a 'worst case scenario' for water consumption in the study area.

This study has also considered the effect of achieving lower average per person consumption on infrastructure capacity and the water environment to assist in developing policy that supports and helps lead to a lower per capita consumption.

1.5.3 Household Occupancy Rate

The latest Office for National Statistics (ONS) population projections[5] and household projections[6] have been used for each local authority to determine the occupancy rate of each household coming forward in the plan period, and have been provided in Table 1-2. The calculated occupancy rate has been agreed with both AWL and SEWL to calculate water consumption per person.

Table 1-2 Calculation of Occupancy Rate

Projection for 2032	
Population	**295,000**
Hart	*99,700*
Rushmoor	*101,000*
Surrey Heath	*94,300*
Number of households	**120,693**
Hart	40,367
Rushmoor	41,511
Surrey Heath	38,815
Calculated Occupancy Rate (people per household)	**2.4**

[5] 2014-based Subnational Population Projections (ONS) (May 2016). Available at https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29

[6] 2014-based Household Projections to 2039 for England (ONS) (July 2016). Available at https://www.gov.uk/government/statistical-data-sets/live-tables-on-household-projections

1.5.4 Wastewater Treatment

As a wastewater treatment provider, TWUL and STS are required to use the best available techniques (defined by the Environment Agency as the best techniques for preventing or minimising emissions and impacts on the environment) to ensure emission limit values stipulated within each Wastewater Treatment Works (WwTWs) water quality permit conditions are met.

Through application of the best available techniques in terms of wastewater treatment, the reliable limits of conventional treatment (LCT) have been determined for the key parameters of Biochemical Oxygen Demand (BOD)[7], ammonia and phosphate, and are provided in Table 1-3.

Table 1-3 Reliable limits of conventional treatment technology for wastewater

Water Quality Parameter	LCT
Ammonia	1.0 mg/l 95 percentile limit[8]
BOD	5.0 mg/l 95 percentile limit[8]
Phosphate	0.5 mg/l annual average[9]

1.6 Report Structure

The first stage of the WCS process is set out in Section 3 of this document and outlines the total proposed number of dwellings which will need to be catered for in terms of water supply and wastewater treatment. Understanding what the level of growth is and where it might be located informs the second stage of the study (reported in Section 4 and Section 5), assessing the current wastewater treatment facilities in regards to both capacity and compliance with legislation and environmental permits. The results of the assessment will identify the Wastewater Treatment Works (WwTW) which are at capacity or have remaining capacity. The wider, supporting environment has also been considered, including climate change and local ecology.

In parallel to the wastewater assessment, Section 6 outlines water resource planning targets, discusses current and proposed efficiencies within the water network and introduces the concept of water neutrality.

The report also covers the proposed major development sites (defined as having more than 100 dwellings) in more detail (Section 7), assessing each site by identifying local receptors such as watercourses, outlining current and future flood risks (inclusive of surface water and groundwater flood risks) and assessing the current wastewater network.

Ultimately, recommendations have been made as part of the WCS (Section 8) in regards to wastewater, water supply, surface water management and flood risk, ecology and stakeholder liaison.

[7] Amount of oxygen needed for the biochemical oxidation of the organic matter to carbon dioxide in 5 days. BOD is an indicator for the mass concentration of biodegradable organic compounds
[8] Considered within the water industry to be the current LCT using best available techniques
[9] Environment Agency (2015) Updated River Basin Management Plans Supporting Information: Pressure Narrative: Phosphorus and freshwater eutrophication

2 Study Drivers

There are two key overarching drivers shaping the direction of the WCS as a whole:

i. Delivering sustainable water management – ensure that provision of WSI and mitigation is sustainable and contributes to the overall delivery of sustainable growth and development and that the Local Plans meet with the requirements of the National Planning Policy Framework (NPPF) with respect to water; and

ii. Water Framework Directive (WFD) compliance – to ensure that growth, through abstraction of water for supply and discharge of treated wastewater, does not prevent waterbodies within the study area (and more widely) from achieving the standards required of them as set out in the WFD River Basin Management Plans (RBMPs).

A full list of the key legislative drivers shaping the study is detailed in a summary table in Appendix B for reference. However, it is important to note that the key legislative driver for this study is WFD compliance.

Details of other relevant studies that have a bearing on the provision of water services infrastructure for development are provided in Appendix A and include, but are not limited to, key documents including;

- Each of the local authorities respective Strategic Flood Risk Assessments (SFRAs);
- the Environment Agency's latest Thames RBMP (2015);
- SEWL's and AWL's WRMP; and
- Each of the local authorities respective Green Infrastructure Strategies/Plans.

2.1 OFWAT Price Review

The price review is a financial review process governed by the Water Services Regulatory Authority (Ofwat) - the water industry's economic regulator. Ofwat determines the limits that water companies can increase or decrease the prices charged to customers over consecutive five year periods.

Figure 2-1 summarises the timescale in the build up towards the next price review. The price limits for the next period (2020 to 2025) will be set at the end of 2019 to take effect on 1st April 2020 and is referred to as Price Review 19 (PR19). Each water company will submit a Business Plan (BP) for the next period which will be assessed by Ofwat, before being agreed. Price limit periods are referred to as AMP (Asset Management Plan) periods, with the current AMP period being referred to as AMP6.

Figure 2-1 Proposed timescales for PR19 (Water 2020) programme[10]

As the wastewater undertakers for the study area, TWUL and STS have a general duty under Section 94 of the Water Industry Act 1991 to provide effectual drainage which includes providing additional capacity as and when required to accommodate planned development. However this legal requirement must also be balanced with the price controls as set by the regulatory body Ofwat which ensure TWUL and STS have sufficient funds to finance their functions, and at the same time protect consumers' interests. The price controls affect the bills that customers pay and the sewerage services consumers receive, and ultimately ensure wastewater assets are managed and delivered efficiently.

Consequently, to avoid potential inefficient investment, TWUL and STS generally do not provide additional infrastructure to accommodate growth until there is certainty that development is due to come forward. WCS' therefore have an important role in the water company planning process by helping to identify areas for potential future investment based on long-term plans for growth and development. TWUL are urged to continue to acknowledge

[10] Water 2020: Regulatory framework for wholesale markets and the 2019 price review (December 2015)

changes in emerging and adopted local plans and use this information to inform local planning scenarios as development trajectories emerge.

2.2 Water Framework Directive (WFD)

The environmental objectives of the WFD, as published in the Environment Agency's RBMPs and relevant to this WCS are:

- to prevent deterioration of the status of surface waters and groundwater,
- to achieve objectives and standards for protected areas, and
- to aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status.

These environmental objectives are legally binding, and all public bodies should have regard to these objectives when making decisions that could affect the quality of the water environment. The Environment Agency publishes the status and objectives of each surface waterbody on the Catchment Data Explorer[11], and describes the status of each waterbody as detailed in Table 2-1.

Table 2-1 Description of status in the WFD

Status	Description
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.
Good	Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife.
Moderate	Moderate change from natural conditions as a result of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.
Poor	Major change from natural conditions as a result of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
Bad	Severe change from natural conditions as a result of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

[11] http://environment.data.gov.uk/catchment-planning/

3 Proposed Growth

3.1 Preferred Growth Strategy

The purpose of the WCS is to assess the potential impact of increased development upon the water environment and WSI across the study area, including water resources, wastewater infrastructure, water quality, flood risk, surface water drainage and ecological issues. The increased development is to accommodate the minimum housing requirement for each of the local authorities and additional housing as a result of the economic uplift experienced across the wider area. This level of projected growth has required the local authorities to revise their spatial approach of future expected development up to 2032. These growth figures therefore form the basis for the WCS.

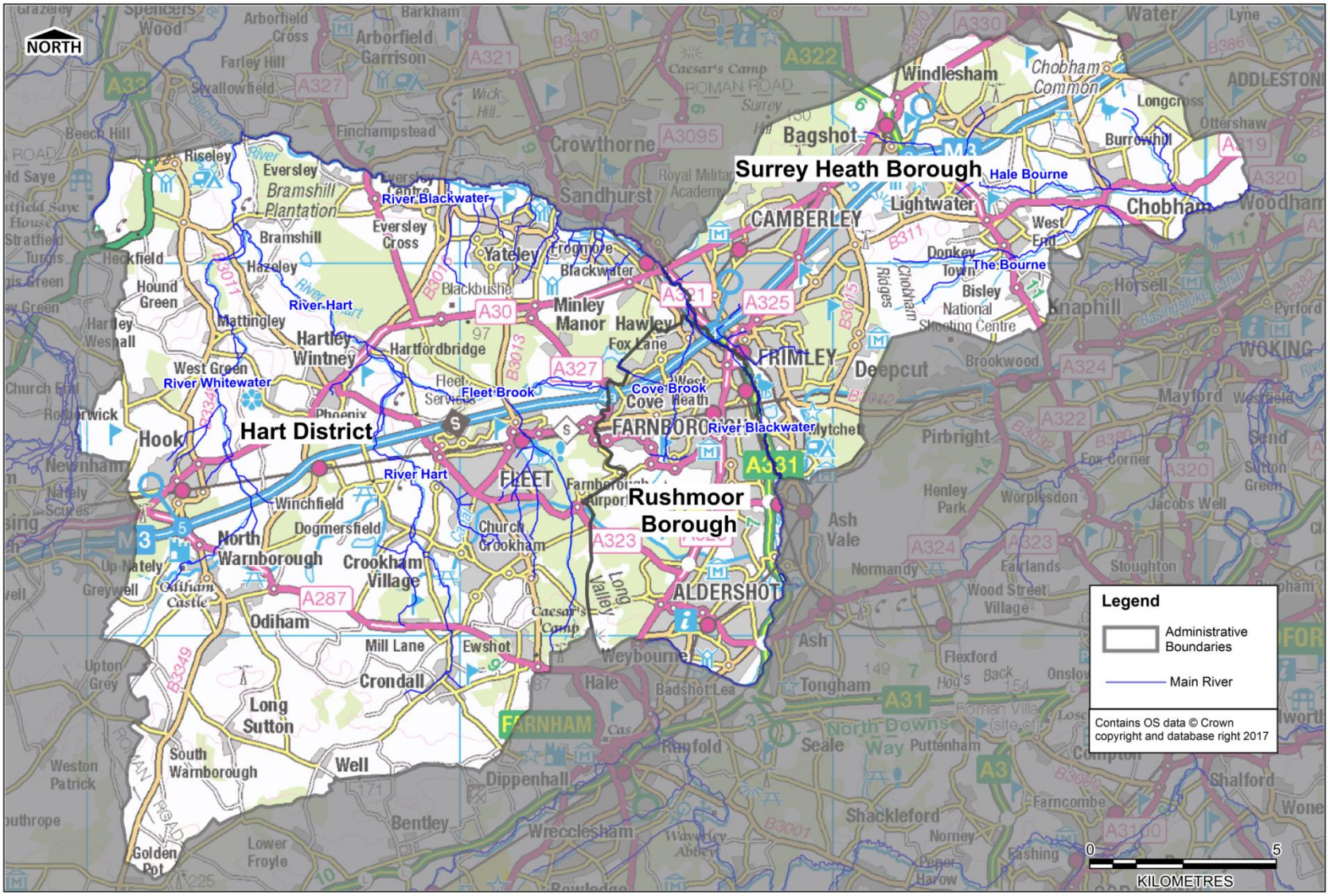
Figure 3-1 illustrates the three local authority administrative boundaries, the main urban areas, villages and watercourses within the study area.

The administrative area of Hart District Council is the largest of the three authorities and includes the Main Urban area of Fleet (including Church Crookham and Elvetham Heath), Local Service Centres including Yateley, Blackwater, Hook, Hartley Wintney and Odiham, and a number of main villages such as Crondall, Crookham Village and Dogmersfield. The River Hart, River Whitewater and Fleet Brook generally flow from the south to the north of Hart District. The River Blackwater also flows south to north creating the north and eastern border of Hart District and the Borough of Rushmoor. The River Blackwater and River Hart are part of the River Loddon catchment, ultimately flowing into the River Thames west of Wargrave (Berkshire).

The highly urbanised and densely populated Borough of Rushmoor consists of the two large settlements of Farnborough and Aldershot. The eastern boundary is bordered entirely by the River Blackwater, flowing south to north and includes the Cove Brook tributary.

The Borough of Surrey Heath is bounded by the River Blackwater in the west, with the western area containing the urbanised areas of Camberley, Frimley and the linked villages of Frimley Green, Mytchett and Deepcut. The eastern half of Surrey Heath is rural, and includes the larger villages of Bisley, Bagshot, Lightwater, Windlesham and Chobham. This part of the Borough includes the headwaters of small watercourses such as the Hale Bourne and The Bourne which form part of the River Wey catchment and ultimately flow into the River Thames at Weybridge (Surrey).

Figure 3-1 WCS Study Area (Hart District, Rushmoor Borough and Surrey Heath Borough)



3.2 Housing Growth Scenarios

The total housing target to 2032 for the study area as identified in the 2017 SHMA is 21,600 new residential dwellings; the study area is illustrated in Figure 3-1. Table 3-1 provides a breakdown of the housing requirement target per each local authority, under both an Objectively Assessed Housing Need (OAHN) scenario and a Duty to Co-operate (DtC) scenario. The three local authorities have a legal duty under the Localism Act 2011 to work together on an ongoing basis to maximise the effectiveness of Local Plan preparation in the context of strategic cross boundary matters. The DtC scenario involves RBC and SHBC delivering new housing on identified sites only in accordance with their preferred distribution, with the balance of any shortfall, relative to OAHN, being delivered within Hart.

Table 3-1 Housing Requirements per local authority

Local Authority	OAHN	DtC
Hart	6,876	9,756
Rushmoor	7,848	7,580
Surrey Heath	6,876	4,264
Total	***21,600***	***21,600***

The WCS incorporates all proposed major development sites[12] across the study area at differing stages of development, including;

- Current allocations (without planning permission),
- Proposed allocations (without planning permission),
- Committed developments (with planning permission), and
- Potential sites identified for development (alternative site options to be assessed, without planning permission).

3.2.1 Completed Developments

The WCS acknowledges that a number of dwellings which form part of the HMA housing requirement have already been built (completed). This WCS has assumed that wastewater flows from these properties are already accounted for in the measured flows at the WwTWs.

Table 3-2 provides a summary of dwellings completed between 2014 and June 2016 (i.e. prior to the commencement of the WCS) for each of the local authorities. These dwellings contribute towards the housing requirements of each local authority.

Table 3-2 Completed Dwellings (2014-16) per local authority

Local Authority	No. Dwellings
Hart	1,043
Rushmoor	472
Surrey Heath	496
Total	***1,838***

3.2.2 Growth Scenario Overview

Four growth scenarios up to 2032 have been assessed in the WCS, each scenario reflecting the different permutations of expanding existing settlements or concentrating development on new settlements, in view of either meeting the Objectively Assessed Housing Need (OAHN) or the duty to co-operate (DtC) requirements.

[12] Sites containing less than 10 dwellings are not considered major development sites and have therefore not been included for assessment as part of this WCS

Each growth scenario meets the total requirement of 21,600 dwellings across the HMA and a summary of each scenario is provided in Figure 3-2.

Figure 3-2 Summary of Growth Scenarios

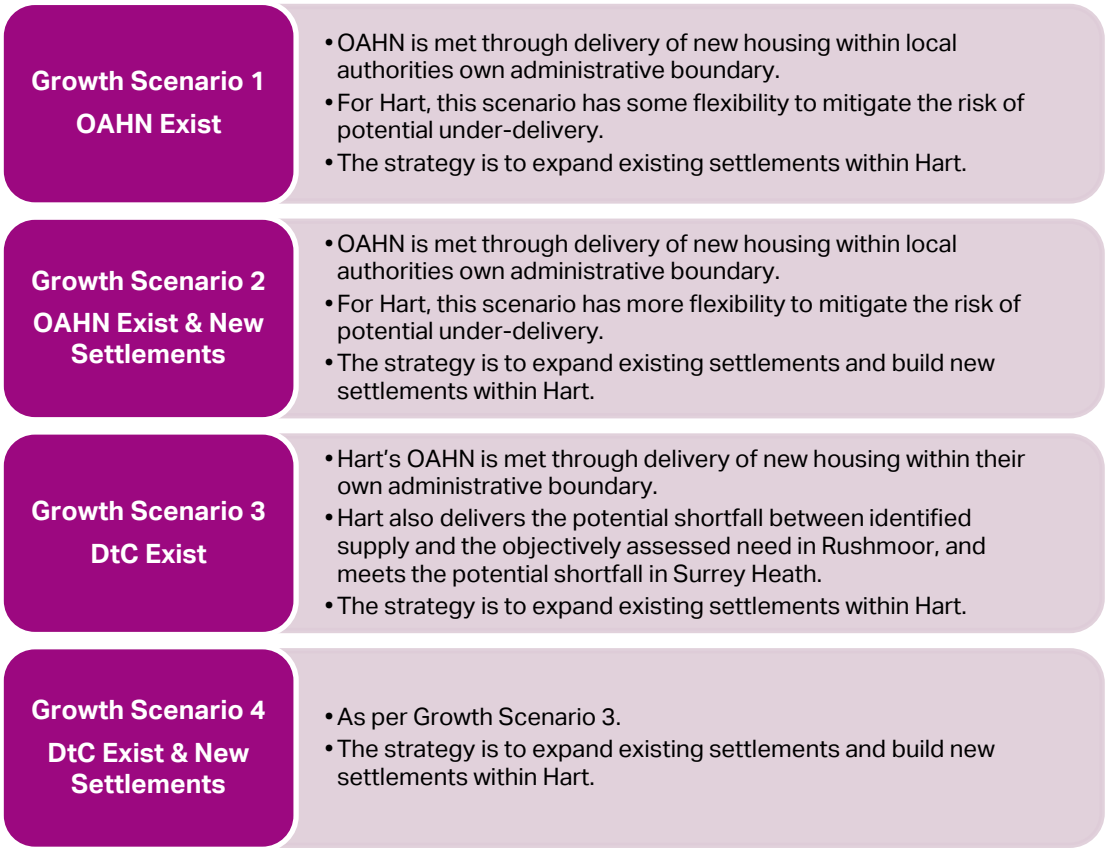


Table 3-3 provides an overview of the number of dwellings to be assessed as part of the WCS. It should be noted that the number of completed dwellings and dwellings within sites containing less than 10 dwellings, have not been included in the totals for each scenario as presented in Table 3-3, hence the total is less than total requirement of 21,600 dwellings.Table 3-3 Growth Scenarios and number of dwellings to be assessed

Local Authority	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Hart	6,547	6,751	8,936	8,364
Rushmoor	7,504	7,504	7,192	7,192
Surrey Heath	6,380	6,380	3,768	3,768
Total	***20,431***	***20,635***	***19,896***	***19,324***

3.2.3 Quantity of Development

The development site allocations have been provided by each local authority and taken from the following documents:

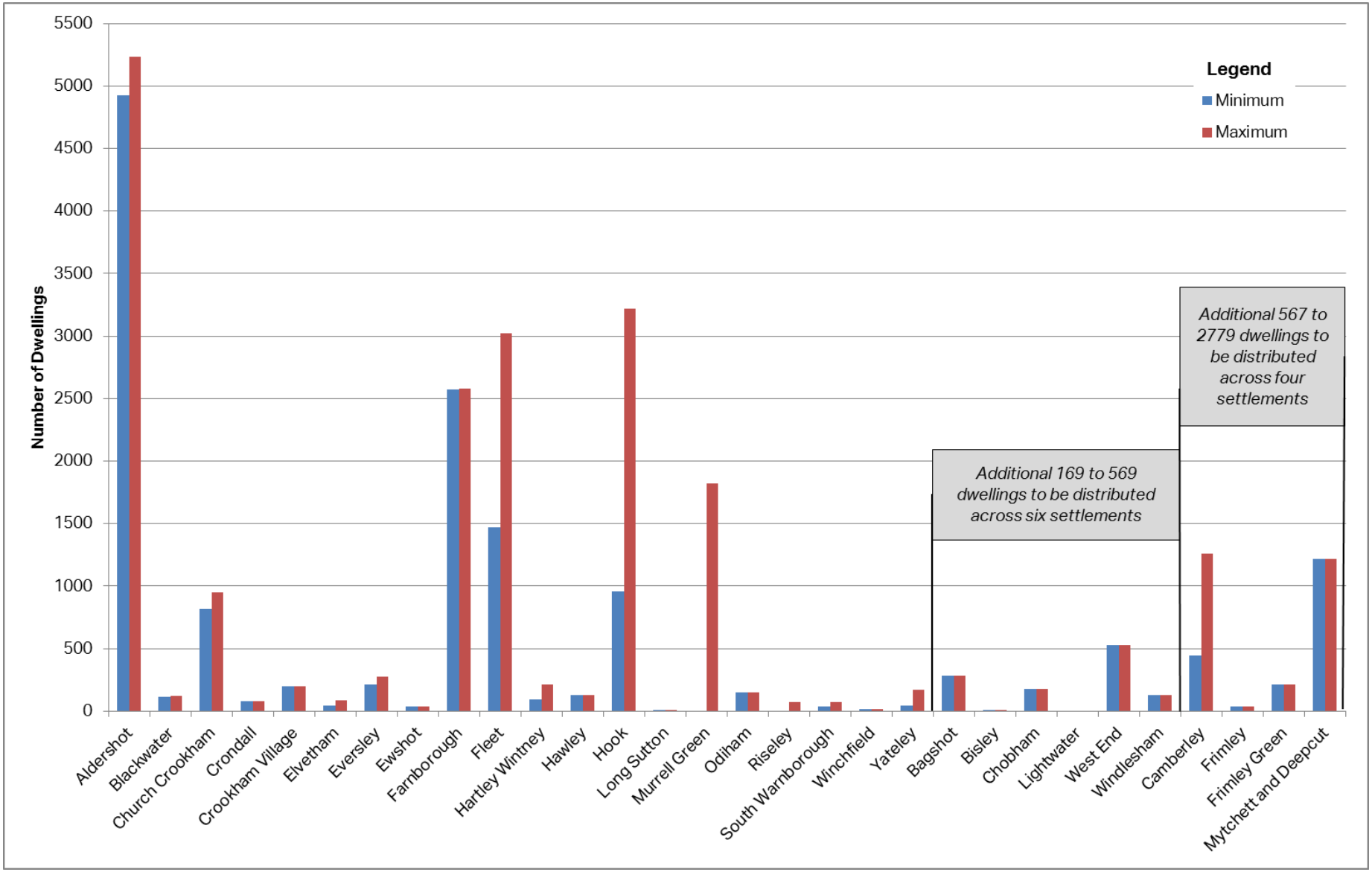
– Surrey Heath Strategic Housing Land Availability Assessment (SHLAA) 2014;

– Hart SHLAA 2016; and

– Rushmoor SHLAA 2015.

Due to the nature of the different growth scenarios, each settlement within the study area could experience a range of potential future growth. Figure 3-3 provides an overview of the maximum and minimum quantity of proposed development per settlement.

Figure 3-3 Maximum and minimum quantities of potential dwellings per settlement



3.2.4 Winchfield Garden Community

The Winchfield Garden Community development does not form part of the preferred options for the Hart District Council draft Local Plan. Therefore, whilst the development is considered as a 'reasonable alternative' for the Hart District Council draft Local Plan, it has not been included as part of the assessment undertaken in this WCS.

It is acknowledged within this WCS that a separate Integrated Water Management Strategy (IWMS) for the Winchfield Garden Community has been produced and has been reviewed by the Environment Agency and TWUL. The Environment Agency has noted that the development proposes approximately 3,000 new dwellings that could be connected to Fleet WwTW, or it is proposed that a new WwTW would serve the development which would discharge to the River Hart. Notwithstanding the IWMS, and following discussions with policy officers acting on behalf of Hart District Council, the Environment Agency is satisfied that the growth assessed within this WCS is in fact a best estimate of where housing development is likely to occur in accordance with the emerging Hart District Local Plan.

3.3 Employment

The WCS also takes account of the projected increase in employment across the study area up to 2032; a total of approximately 12,500 new jobs. Table 3-4 provides a summary of the employment figures within the study area to be assessed.

The Joint Employment Land Review (ELR)[13] suggests that the supply and demand for employment land is roughly in balance. Consequently, no new employment land has been identified with employment growth being delivered at existing employment sites.

A percentage of the projected employment growth for each local authority has been assigned to each of the respective local authority's existing employment sites, based on the size (hectare) of each site (i.e. the larger the site, the greater the proportion of full time employment jobs allocated).

Table 3-4 Employment growth across the study area

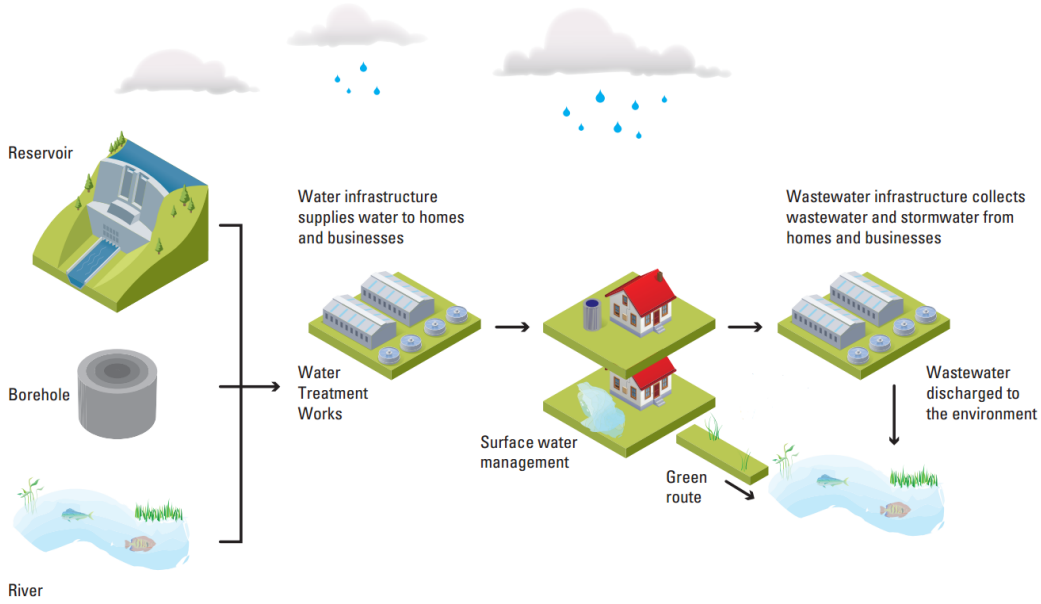
Partner Authority	Employment Growth 2014 - 2032[13] (No. Full Time Employment)	Total Employment Land Area (ha)	No. Employment sites
Hart	12,500	279	13
Rushmoor			20
Surrey Heath			11

[13] Hart, Rushmoor and Surrey Heath. Joint Employment Land Review (2016)

4 Wastewater Treatment

4.1 Wastewater in the Study Area

Figure 4-1 The water environment and infrastructure components



A broad overview of the interaction between the water environment and water and wastewater infrastructure is illustrated in Figure 4-1. Wastewater is generally produced following the use of potable water in homes, businesses, industrial processes and in certain areas can include surface water runoff.

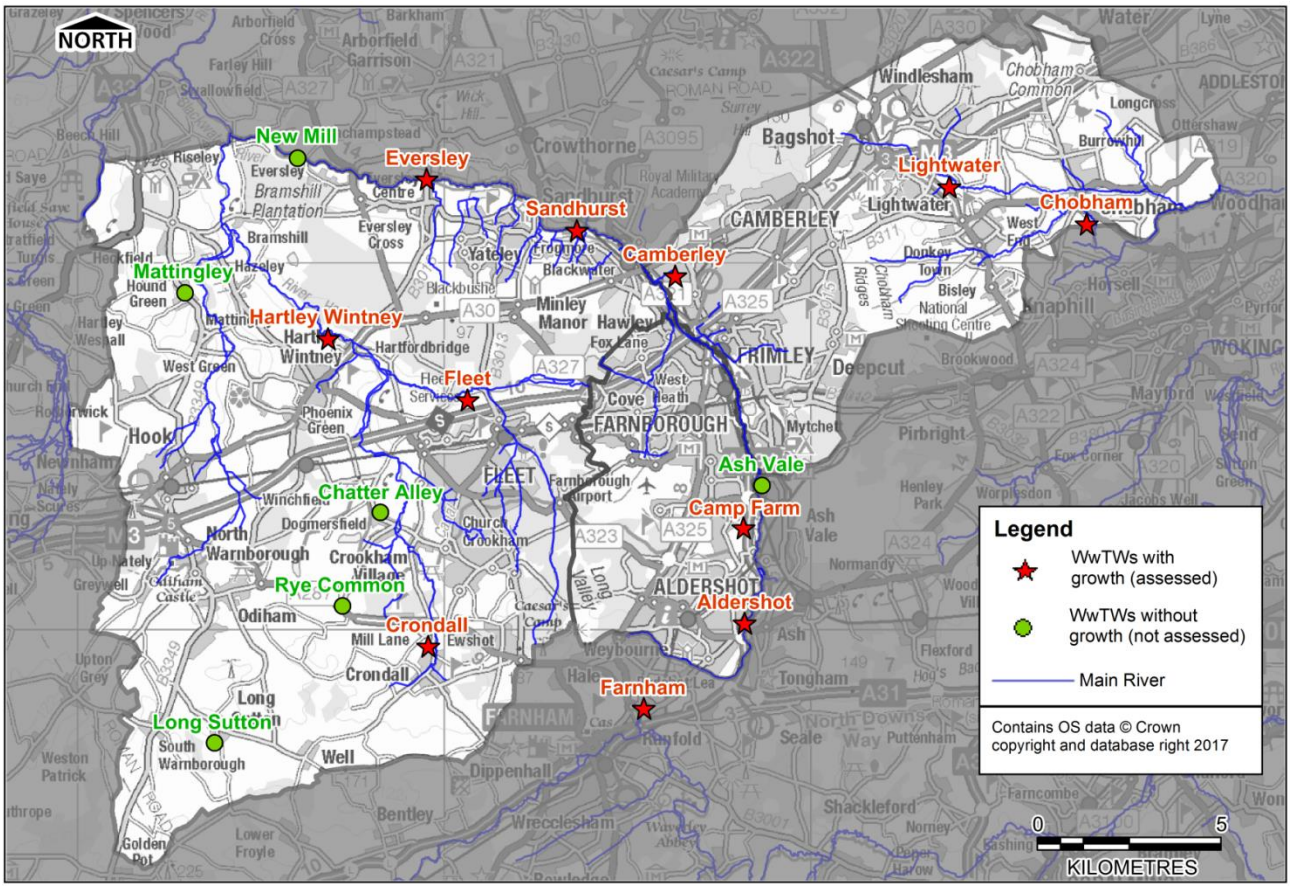
Wastewater treatment in the study area is provided via wastewater infrastructure (WwTWs) operated and maintained by TWUL, ultimately discharging treated wastewater to a nearby surface waterbody. There are a limited number of small package WwTWs which generally serve small developments, and in some cases, discharge directly to land/ground via filter systems. Each of the WwTWs is connected to a network of wastewater pipes (the sewerage system) which collects wastewater generated by homes and businesses to the WwTW; this is defined as the WwTWs 'catchment'.

Wastewater from the study area is treated at 19 WwTWs. Of the following 19 WwTWs that treat wastewater generated in the study area, 14 WwTWs (highlighted in bold in the list below) are expected to receive additional wastewater as a result of growth and have been illustrated in Figure 4-2:

- **Aldershot,**
- Ash Vale,
- **Camberley,**
- **Camp Farm,**
- Chatter Alley,
- **Chobham,**
- **Crondall,**
- Farnham,
- **Fleet,**
- Woking (located approx. 7km south east of study area).
- **Hartley Wintney,**
- **Lightwater,**
- Long Sutton[14],
- **Eversley,**
- Mattingley,
- New Mill,
- Rye Common,
- **Sandhurst,**
- **Wargrave** (located approx. 15km north of study area),

[14] Discharges to land, not a surface waterbody.

Figure 4-2 Location of WwTWs within the study area



4.1.1 Package Treatment Plants

A package treatment plant is a small WwTW which may serve a small development of a few dwellings, and are often used in areas without a wastewater network (e.g. in rural areas). There are environmental risks associated with privately owned package treatment plants, whose treatment performance is more variable than that of a larger WwTW owned and operated by a sewerage undertaker. Package treatment plants are therefore more likely to cause pollution because the discharges are less likely to meet the standards set in their environmental permit. The use of package treatment plants in unsuitable locations can lead to localised point source nutrient enrichment leading to possible eutrophication of sensitive watercourses, potentially compromising the WFD status of an entire waterbody. In particular, Natural England discourages the use of package treatment works within influential proximity to designated sites.

4.2 Management of WwTW Discharges

All WwTWs are issued with a permit to discharge by the Environment Agency, which sets out conditions on the maximum volume of treated wastewater that it can discharge and also limits on the quality of the treated discharge. These limits are set in order to protect the water quality and ecology of the receiving waterbody.

4.2.1 Flow Condition

The flow element of the discharge permit, measured as Dry Weather Flow (DWF)[15], determines an approximation of the maximum number of properties that can be connected to a WwTW catchment. When discharge permits are issued, they are generally set with a flow 'headroom', which acknowledges that allowance needs to be made for future development and the additional wastewater generated. This allowance is referred to as 'permitted headroom'.

This headroom provides an indication as to the quantity of new dwellings which can be connected to the WwTW before a new discharge permit would need to be considered.

4.2.2 Quality Conditions

The quality conditions applied to discharge permits are derived to ensure that the water quality of the receiving waterbody is not adversely affected in terms of concentration of physico-chemical elements including ammonia, Biological Oxygen Demand (BOD) and phosphate. However, currently not all WwTW discharge permits are set to equate

[15] DWF is a measure of the flow of foul water only to a WwTW (excludes additional flow as a result of excessive rainfall or groundwater infiltration entering the sewer network).

to maintaining the current WFD status of the receiving waterbody due to the discharge permits being issued prior to the implementation of the WFD. Consequently, some discharge permits, if operated to the full flow limit (i.e. all permitted headroom is used), could lead to a significant deterioration in water quality and possibly WFD status.

An assessment needs to be undertaken to determine what new quality conditions would need to be applied to the discharge under the following circumstances:

- When a new or revised discharge permit is required, or
- When a new or revised discharge permit is not required, but a significant quantity of development is proposed to connect to a WwTW.

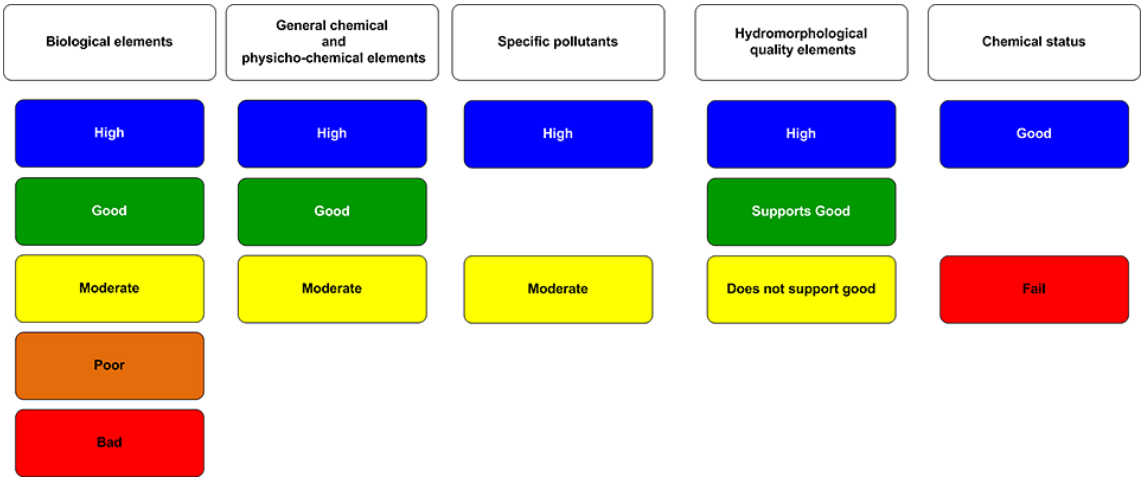
If the quality conditions remain unchanged, the increased flow of wastewater received at the WwTW would result in an increase in the quantity and load[16] of determinands being discharged to the receiving waterbody. This may have the effect of deteriorating water quality and hence in most cases, an increase in permitted discharge flow results in more stringent (or tighter) conditions on the quality of the discharge.

The requirement to provide a higher standard of treatment may result in an increase in the intensity of treatment processes at a WwTW, which may also require improvements or upgrades to be made to the WwTW to allow the new conditions to be met. In some cases, it may be possible that the quality conditions required to protect water quality and ecology are not achievable with conventional treatment processes and as a result, this WCS assumes that a new solution would be required in this situation to allow growth to proceed.

4.3 WFD Compliance

The definition of a waterbody's overall WFD 'status' is a complex assessment that combines standards for chemical quality and hydromorphology (habitat and flow conditions), with the ecological requirements of an individual waterbody catchment. A waterbody's 'overall status' is derived from the classification hierarchy made up of 'elements', and the type of waterbody will dictate what types of elements are assessed within it. Figure 4-3 illustrates the classifications applied within the hierarchy.

Figure 4-3 WFD status classifications used for surface water elements



The two key aspects of the WFD relevant to the wastewater assessment in this WCS are the policy requirements that:

- Development must not cause a deterioration in WFD status of a waterbody or waterbody sampling point; and
- Development must not prevent a waterbody from achieving its future target status (default Good status).

It is not acceptable to allow a deterioration from High status to Good status, even though the overall target of Good status as required under the WFD is still maintained, this would still represent a deterioration[17]. In addition, if a waterbody's overall status is less than Good as a result of another element, it is not acceptable to justify a deterioration in another element because the status of a waterbody is already less than Good.

[16] Concentration is a measure of the amount of a pollutant in a defined volume of water, and load is the amount of a substance discharged during a defined period of time.
[17] i.e. a reduction from High Status to Good Status as a result of a discharge would not be acceptable, even though the overall target of good status as required under the WFD is still maintained.

4.4 Habitats Directive

The Habitats Directive and the Habitats Regulations have designated some sites as areas that require protection in order to maintain or enhance the rare ecological species or habitat associated with them. A retrospective review process has been on-going since the translation of the Habitats Directive into the UK Habitats Regulations called the Review of Consents (RoC). The RoC process requires the Environment Agency to consider the impact of the abstraction licences and discharge permit it has previously issued on sites which became protected (and hence designated) under the Habitats Regulations.

If the RoC process identifies that an existing licence or permit cannot be ruled out as having an impact on a designated site, then the Environment Agency are required to either revoke or alter the licence or permit. As a result of this process, restrictions on some discharge permits have been introduced to ensure that any identified impact on downstream sites is mitigated. Although the Habitats Directive does not directly stipulate conditions on discharge, the Habitats Regulations can, by the requirement to ensure no detrimental impact on designated sites, require restrictions on discharges to (or abstractions) from water dependent habitats that could be impacted by anthropogenic manipulation of the water environment.

Where either of the circumstances as outlined in Section 4.2.2 have arisen, a Habitats Regulations assessment exercise has been undertaken in this WCS to ensure that Habitats Directive and Birds Directive sites which are hydrologically linked to watercourses receiving wastewater flows from growth would not be adversely affected. The scope of this assessment also includes non-Habitats Directive sites designated at a national Sites of Special Scientific Interest (SSSI) and Local Nature Reserves (LNRs). This assessment is reported in Section 5.6 of this chapter (Ecological Appraisal).

Whilst this WCS is not designed to undertake a full screening of likely significant effects on relevant protected sites, any development conforming to Local Plan policies must undertake project level Habitat Regulation Assessments (HRAs) and Environmental Impact Assessments (EIAs), where necessary.

4.5 Wastewater Assessment Overview

4.5.1 Objectives

An increase in residential and employment growth will have a corresponding increase in the volume and flow of wastewater generated within the study area and hence it is essential to consider:

Infrastructure Capacity
Defined in this WCS as the ability of the wastewater infrastructure to collect, transfer and treat wastewater from homes and business. The following objectives are answered in the results section:

– What new infrastructure is required to provide for the additional wastewater treatment?

– Is there sufficient treatment capacity within existing wastewater infrastructure treatment facilities (WwTWs)?

Environmental Capacity
Defined in this WCS as the water quality needed in the receiving waterbodies to maintain the aquatic environments. The following objectives are answered in the results section:

– Could development cause greater than 10% deterioration in water quality?

– Can a feasible solution be implemented to limit deterioration to 10%? This is a check to ensure that all the environmental capacity is not taken up by one phase of development and there is remaining environmental capacity for future growth beyond the plan period.

– Could development cause deterioration in WFD status of any element? This is a requirement of the WFD to prevent status deterioration.

– Could development alone prevent the receiving water from achieving its future target Status or Potential? This is also a requirement of the WFD, which can be separated into the following two assessment steps:

  - Is the future target status possible now with current technology but no growth? This step determines if it is limits in current technology that would prevent the future target status being achieved.
  - Is the future target status technically possible after development and any potential WwTW upgrades? This step determines if it is growth that would prevent the future target status being achieved.

4.5.2 Methodology

A stepped assessment approach has been developed for the WCS to determine the impact of the proposed growth on infrastructure capacity and the environmental capacity of the receiving watercourse.

To assess environmental capacity, modelling scenarios have been developed in line with the objectives listed in Section 4.5.1 and agreed with the Environment Agency (Appendix C) in order to assess infrastructure capacity, environmental capacity and ensure compliance with water quality objectives. The modelling scenarios are:

- Limiting deterioration to 10% of current river quality for each physico-chemical sub-element (where technically and economically feasible),
- Ensuring no deterioration in status for each sub-element, and
- Achieving the future target status for each sub-element.

In order to assess both infrastructure and environmental capacity for each WwTW, the following assessment techniques were developed (detailed in Appendix C);

- Development of a WwTW flow headroom calculator (reported in Section 4.6);
- Application of SIMCAT software (as used by the Environment Agency) to model river water quality at a catchment scale where multiple WwTW discharges exist within a catchment, and to assess the cumulative effect of multiple discharge and ensure their compliance with water quality standards (Section 5.2); and
- Application of River Quality Planning (RQP) software (as used by the Environment Agency) to determine the required discharge permit quality condition for an individual WwTW in a catchment (Section 5.2.4).

4.5.3 RAG Assessment

The results for each WwTW assessment are presented in a Red/Amber/Green (RAG) assessment for ease of planning reference. The RAG code refers broadly to the following categories;

- **Green**: water quality objectives will not be adversely affected. Growth can be accepted with no changes to the WwTW infrastructure or quality permit required.
- **Amber**: in order to meet the required water quality objectives, changes to the quality permit are required, and upgrades may be required to WwTW infrastructure which may have phasing implications.
- **Red**: in order to meet water quality objectives changes to the quality permit are required which are beyond the limits of what can be achieved with conventional treatment.

4.6 Headroom Assessment Results

The volume of wastewater, measured as Dry Weather Flow (DWF), which would be generated from the proposed housing and employment growth over the plan period within each WwTW catchment has been calculated and assessed against the permitted flow headroom capacity at each WwTW. The most growth scenario (i.e. worst case scenario) for each WwTW has been used in this assessment to determine headroom capacity. A summary of this assessment is provided in Table 4-1. The assessment results group WwTWs into three categories provided as the following three sub-headings, which are based on how much headroom is available and hence whether a water quality assessment is required or not.

4.6.1 Available permitted headroom

Growth in these WwTW catchments could be accepted within the current permitted headroom without deteriorating water quality and hence there is no barrier to delivering the proposed quantity of growth in these locations. No further assessment or discharge permit review is therefore required for the WwTWs of Aldershot, Chobham, Crondall, Sandhurst and Wargrave.

4.6.2 Significant growth

The calculations of flow headroom capacity found that Camp Farm, Fleet and Hartley Wintney WwTWs would theoretically have sufficient headroom once all the growth within each of the WwTW catchments is accounted for. However, the significant quantities of proposed growth within these catchments has prompted the need to assess the use of permitted headroom against the water quality objectives. Some discharge permits which are demonstrated to have sufficient flow headroom capacity, if operated to their full permitted flow (i.e. all permitted headroom is used up by growth), could potentially lead to a significant deterioration in water quality and possibly WFD status.

To ensure that the significant quantity of growth proposed within the WwTW catchments and the use of available permitted headroom does not impact on downstream water quality objectives, water quality modelling has been

undertaken to determine whether theoretically achievable quality conditions can be applied to revised discharge permits for the WwTWs of Camp Farm, Hartley Wintney and Fleet.

4.6.3 No available permitted headroom

The calculations of flow headroom capacity found that Camberley, Eversley and Lightwater WwTWs would not have sufficient headroom once all the growth within each of the WwTW catchments is accounted for. These WwTWs would exceed their maximum permitted DWF under their existing discharge permits. Additional headroom can be made available through an application by TWUL for a new or revised discharge permit from the Environment Agency.

To ensure that an increase in permitted DWF required to serve the proposed growth would not impact on downstream WFD requirements, water quality modelling has been undertaken to determine whether theoretically achievable quality conditions can be applied to revised discharge permits.

4.6.4 Summary

The WwTW headroom assessment has identified six WwTWs, as detailed in Table 4-1, which will require water quality modelling. This modelling is required to determine whether:

a) Significant growth levels could impact on water quality (and WFD) objectives through the use of available permitted headroom; or

b) Where permitted flow headroom is predicted to be exceeded, to determine whether theoretically achievable quality conditions can be applied to revised discharge permits in order to meet the WFD objectives of the receiving waterbody.

The results of the water quality modelling are provided in Section 5, with detailed results from the modelling provided in Appendix C.

Table 4-1 WwTW headroom capacity assessment

WwTW	Local Authority	Most Growth Scenario	Quantity of dwellings	Future 2032 DWF after Growth (m^3/d)	Headroom Assessment after Growth (2032)		Outcome	Water quality assessment required?
					Headroom Capacity (m^3/d)	Approx. Residual Housing Capacity[18] (no. of dwelings)		
Aldershot	Rushmoor	Any	947	9,499	1,936	5,280	**Acceptable available permitted headroom**	**No**
Chobham	Surrey Heath	3 or 4	800	2,562	10,038	25,200[19]		
Crondall	Hart	Any	50	346	324	900		
Sandhurst[20]	Hart	1 or 3	200	6,894	6,106	16,650		
Wargrave	Hart	1 or 3	50	28,415	1,585	4,300		
Camp Farm	Rushmoor	1 or 2	4,287	4,375	3,125	8,524	**Permitted headroom available – but use of headroom could affect water quality**	**Yes**
Fleet	Hart	3	2,819	11,322	1,595	4,350		
Hartley Wintney	Hart	3	3,677	5,516	1,317	3,594		
Camberley	Hart, Rushmoor & Surrey Heath	2	9,000	33,465	-3,865	-10,544	**No available headroom**	**Yes**
Lightwater[19]	Surrey Heath	1 or 2	1,000	5,905	-586	-1,471		
Eversley	Hart	1 or 3	250	291	-41	-112		

[18] Based on an Occupancy rate of 2.4 and SEWL consumption rate of 150 l/h/d
[19] Based on an Occupancy rate of 2.4 and AWL consumption rate of 163 l/h/d
[20] WwTW located outside of the study area in Bracknell Forest, Berkshire

5 Water Quality Modelling

The WwTWs identified in Section 4.6 as requiring water quality modelling are:

- Camp Farm WwTW,
- Fleet WwTW,
- Hartley Wintney WwTW,
- Camberley WwTW,
- Lightwater WwTW, and
- Eversley WwTW.

Statistical based water quality modelling is required for each WwTW to determine the discharge permit quality conditions that will be required to ensure compliance with the water quality objectives. Following consultation with the Environment Agency as part of this WCS, the modelling requirements have been agreed for each WwTW and have been outlined in the following Section.

5.1 Requirements

5.1.1 Catchment Scale Modelling

Consultation with the Environment Agency as part of this WCS has identified the need for catchment scale modelling of the River Blackwater to determine the required discharge permit quality conditions for Camp Farm WwTW, Camberley WwTW and Eversley WwTW.

The requirement for a catchment scale model has been outlined by the Environment Agency due to the location and number of WwTW discharges within the catchment, and in particular, their cumulative effect on ammonia and phosphate concentrations. The Environment Agency's SIMCAT model of the River Blackwater Catchment has therefore been used to model phosphate and ammonia effects related to discharge at Camp Farm, Camberley and Eversley WwTW.

The catchment model takes into account the increased discharges as a result of growth within the study area from all WwTWs which discharge at various locations along the River Blackwater. The model also takes into account diffuse pollution from surrounding land (including urban runoff, agricultural run-off, etc.) as well as Combined Sewer Overflows (CSOs) and storm tank discharges.

5.1.2 Discharge Modelling

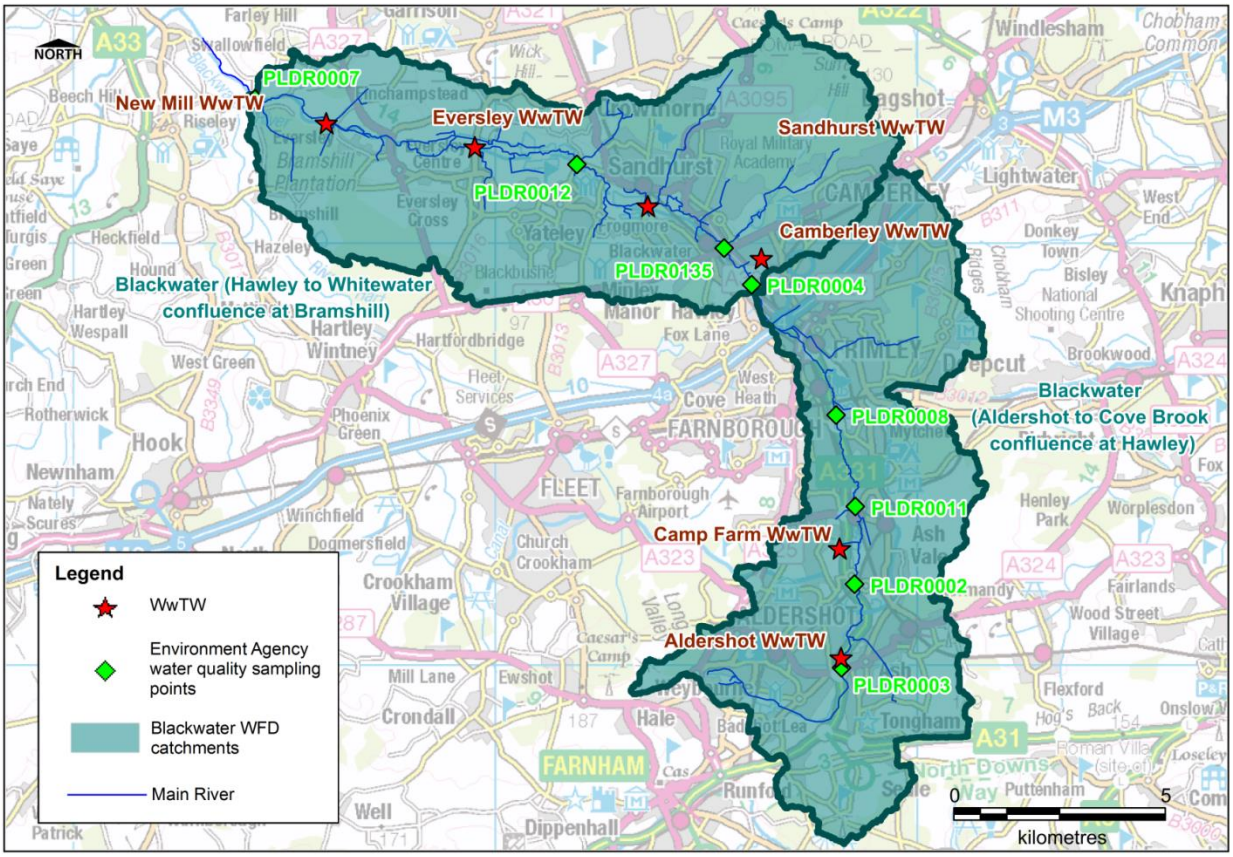
A standalone statistical based model (River Quality Planning, RQP) has been applied to Hartley Wintney WwTW, Fleet WwTW and Lightwater WwTW which also require water quality modelling for phosphate and ammonia but are located outside of the River Blackwater catchment. This approach has been agreed in consultation with the Environment Agency.

5.1.3 Load Standstill

A load standstill calculator has been used to determine the required BOD permit quality conditions in order to maintain the current quality of the discharge as flows increase. This has been applied for all six WwTWs requiring assessment. The calculator does not require river quality of discharge quality monitoring data and is considered a suitable approach given the lack of available BOD river quality monitoring data.

5.2 River Blackwater Catchment Model

Figure 5-1 River Blackwater WFD catchments, water quality sampling locations and WwTWs



The River Blackwater is separated into two WFD water body catchments (Figure 5-1), each with its own status and target; these are the 'Hawley to confluence at Bramshill' water body, and the 'Aldershot to Cove Brook confluence at Hawley' water body. The sub-elements of relevance to this model are ammonia and phosphate, however it is acknowledged that these sub-elements only make up part of the overall status classification for the River Blackwater WFD catchments, and that there are other sub-elements (e.g. Fish, Dissolved Oxygen, etc.) which are the main cause for the alternative overall waterbody target status' as set by the Environment Agency.

The modelling scenarios outlined in Section 4.5.2 have been applied against ammonia and phosphate to ensure that, if and when the other sub-elements (e.g. Fish, Dissolved Oxygen, etc.) improve in status in the future, the overall status and target status of the WFD catchments will not be limited by the status and target status' of ammonia and/or phosphate.

The Blackwater catchment water quality modelling has been reported on a catchment scale, but with reference made to the two WFD water body catchments and individual WwTW discharge permits throughout. This is necessary due to the cumulative effect of the upstream Blackwater (Aldershot to Cove Brook confluence at Hawley) which flows into the downstream Blackwater (Hawley to Whitewater confluence at Bramshill). For simplicity and readability, the WFD water body catchments will be referred to as the Upper Blackwater and Lower Blackwater respectively.

The current environmental WFD baseline against which the modelling has been applied is detailed in Table 5-1. The status of each WFD catchment is derived from the status defined at each sampling point within the catchment, as illustrated in Figure 5-1.

Details of the catchment model calibration have been provided in Appendix D.

Table 5-1 River Blackwater WFD Baseline

WFD catchment	Sampling Points	Type of status	Ammonia	Phosphate	Assessment required
Blackwater (Aldershot to Cove Brook confluence at Hawley) **'Upper Blackwater'**	PLDR0002 PLDR0003 PLDR0011 PLDR0008	Current	Moderate	Poor	No deterioration (10% and Status)
		Target	Good by 2027	Moderate by 2027	Future target status (ammonia and phosphate)
Blackwater (Hawley to Whitewater confluence at Bramshill) **'Lower Blackwater'**	PLDR0004 PLDR0135 PLDR0012 PLDR0007	Current	Moderate	Poor	No deterioration (10% and Status)
		Target	Good by 2027	None	Future target status (ammonia only)

5.2.1 Modelling Growth

5.2.1.1 Selection of Growth Scenario

The modelling of future growth has been carried out based on the quantity of development proposed under Growth Scenario 2, which represents a 'worst case scenario' in terms of growth within the River Blackwater catchment. The growth scenario has the greatest quantity of proposed growth considered cumulatively across all the WwTWs which discharge into the River Blackwater, as demonstrated in Table 5-2.

Table 5-2 Quantity of growth within the River Blackwater catchment

WwTW	Growth Scenario 1	Growth Scenario 2	Growth Scenario 3	Growth Scenario 4
Aldershot	950	950	950	950
Ash Vale	0	0	0	0
Camberley	7,480	8,980	6,760	6,760
Camp Farm	4,290	4,290	3,970	3,970
Eversley	270	120	270	120
New Mill	0	0	0	0
Sandhurst	190	150	190	150
TOTAL	**13,180**	**14,490**	**12,140**	**11,950**

5.2.1.2 Phasing of Growth

For the purposes of the modelling, the proposed growth trajectory for Growth Scenario 2 has been applied. Growth across the plan period (up to 2032) has been broken down into four 'phases' as shown in Table 5-3.

. The phases have been aligned with the AMP periods in which water companies plan for investment into infrastructure. This approach to phasing ensures that future growth is aligned with TWUL and STS investment plans.

Table 5-3 Number of new dwellings per phase of growth at WwTWs requiring review of discharge permits

WwTW	Number of new dwellings			
	AMP6 (2016 – 2020)	AMP7 (2020 – 2025)	AMP8 (2025 – 2030)	AMP9 (2030 – 2032)
Camp Farm	1,110	1,369	1,501	0
Camberley	2,145	2,352	3,029	1,454
Eversley	24	100	0	0

In addition to the increased discharges from the three WwTWs as listed in Table 5-3, four other WwTWs discharge to the river Blackwater. Two of these, Aldershot and Sandhurst WwTWs, include growth from within the study area[21]. These WwTWs did not need to be assessed directly due to the low proportion of growth within the WwTW catchments, but the increase in flow from these WwTWs is important to include for cumulative impacts related to Camp Farm, Camberley and Eversley WwTW. The quantity of growth across the plan period at Aldershot and Sandhurst WwTWs is shown in Table 5-4.

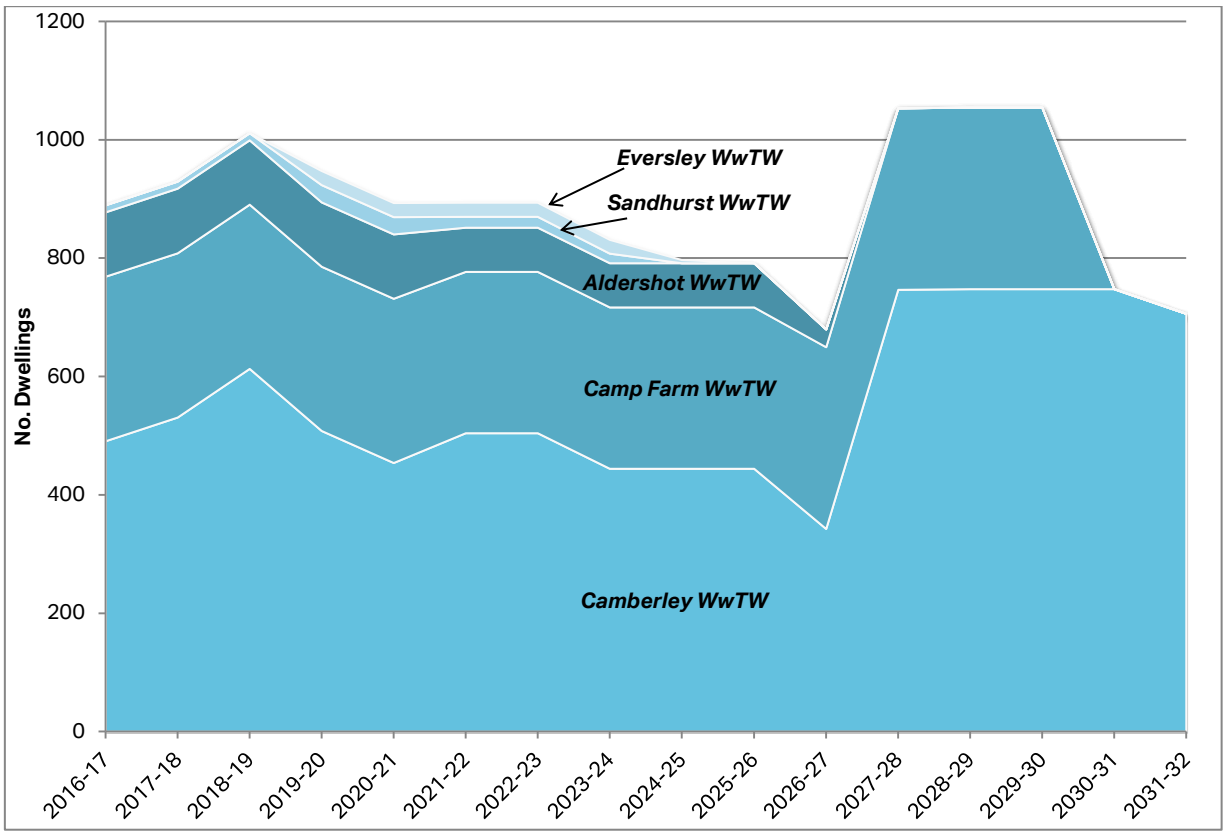
Table 5-4 Number of new dwellings per phase of growth at WwTWs which do not require review of discharge permits

WwTW	Number of dwellings			
	AMP6 (2016 – 2020)	AMP7 (2020 – 2025)	AMP8 (2025 – 2030)	AMP9 (2030 – 2032)
Aldershot	544	373	30	0
Ash Vale	No planned development within the study area			
Sandhurst	65	81	0	0
New Mill	No planned development within the study area			

The dwelling numbers provided in Table 5-3 and Table 5-4 are illustrated in Figure 5-2 as dwellings per annum to demonstrate the level of growth within the River Blackwater catchment across the plan period. This figure shows a surge in growth per annum throughout AMP6, peaking at over 1,000 proposed new dwellings by 2018-19, before declining gradually through AMP7 to approximately 800 proposed new dwellings per annum by 2024-25. Growth per annum continues to decline into the beginning of AMP8 as growth within the Aldershot WwTW catchment tails off, before a surge in growth within both the Camp Farm and Camberley WwTW catchments.

[21] Ash Vale and New Mill also discharge to the Blackwater – however, growth totals within these WwTW catchments fall outside of the study area and were not available for assessment.

Figure 5-2 Number of new dwellings per annum within WwTW catchments (Growth Scenario 2)



5.2.2 Catchment Modelling Results - Phosphate

5.2.2.1 10% Deterioration Limit

Modelling has been undertaken to take account of the increased wastewater flows from the WwTWs as a result of the proposed development throughout the Blackwater catchment whilst limiting deterioration to no more than 10% of the current downstream quality.

The aim of this assessment is to determine if it is technically feasible to limit deterioration to 10% of the current water quality downstream of Camp Farm WwTW, Camberley WwTW and Eversley WwTW, at the end of each phase of growth. For each modelling run, the discharge flows have been increased (as per phasing), but the same 10% deterioration targets apply. Consequently, the quality conditions on the discharge permits may require tightening and treatment processes may require upgrading.

Table 5-5 Required phosphate permit quality conditions for each phase of growth

WwTW	Current discharge permit quality (mean mg/l)	AMP6 (2016 – 2020)	AMP7 (2020 – 2025)	AMP8 (2025 – 2030)	AMP9 (2030 – 2032)
Camp Farm	None	2.5	2.0	2.0	2.0
Camberley	0.5 [22]	0.5	0.5	0.5	0.5
Eversley	None	Not required			

Camp Farm WwTW
The results in Table 5-5 show that a new phosphate quality condition on the discharge permit at Camp Farm WwTW would be required to ensure the 10% deterioration limit is adhered to by the end of AMP6. Subsequently tighter quality conditions will be required by the end of AMP7, AMP8 and AMP9 respectively as additional growth comes forward, but the 10% deterioration limit remains the same. The tighter phosphate quality conditions for each phase of growth can be achieved with current conventional treatment technologies (within the limits of conventional treatment) and would also ensure no deterioration in phosphate status.

[22] Phosphate permit condition of 0.5mg/l to be implemented by April 2018

This result is based on the assumption that the discharge quality at the upstream Aldershot WwTW (which is currently performing well within its discharge permit) is maintained, despite receiving additional flow from growth within the study area.

Camberley WwTW
The results in Table 5-5 show that the phosphate quality condition on the discharge permit due to be implemented by April 2018 at Camberley WwTW is sufficient to ensure the 10% deterioration limit is adhered to by the end of all phases of growth. This phosphate quality condition can be achieved with current conventional treatment technologies (within the limits of conventional treatment) and also ensures no deterioration in phosphate status.

It is important to note that the achievement of the 10% deterioration limit with the 0.5mg/l phosphate quality condition is based on the assumption that;

- A revised flow condition on the discharge permit will be implemented at Camberley WwTW, to provide the necessary headroom capacity for the proposed growth,
- The discharge quality at the upstream Ash Vale WwTW is maintained, and
- There is no additional flow from growth within the study area; though it should be noted that growth outside of the study area (and therefore not considered as part of this WCS) may connect to Ash Vale WwTW in the future (i.e. between 2020 and 2032).

Eversley WwTW
Eversley currently has no permit condition for phosphate, therefore a theoretical discharge quality of 5mg/l was modelled for each phase of growth to test whether this would cause greater than a 10% deterioration.

The results demonstrated that the current discharge quality could, in theory, worsen to at least 5mg/l without exceeding the 10% deterioration limit. It is unlikely that a worsening of this scale would occur, however, this result demonstrates that a potential phosphate quality condition could be achieved with current conventional treatment technologies (within the limits of conventional treatment) and would also ensure no deterioration in phosphate status. A new phosphate quality condition on the discharge permit at Eversley WwTW would not be required to ensure the 10% deterioration limit is adhered to.

This result is based on the new phosphate quality conditions proposed to be implemented by April 2018 at the upstream Camberley WwTW and Sandhurst WwTW.

5.2.2.2 No Deterioration in Status

As stipulated under the WFD, development must not cause a deterioration in status. The future permit quality conditions required to limit deterioration to 10% would also ensure no deterioration in status at the sampling points immediately downstream of the WwTWs.

5.2.2.3 Achieving Future Target Status

The Upper Blackwater catchment has a future target status of Moderate to achieve by 2027 (during AMP8).

A scenario was modelled to assume that the Upper Blackwater is achieving the future target status of Moderate, and calculate the quality conditions required at each WwTW to maintain the Moderate status. It should be noted that achieving Moderate status at all sampling points represents a precautionary approach as, due to the Environment Agency's method of classifying a waterbodies overall status, it is possible for some sampling points to be at a lower status but the overall waterbody still achieves its target status.

Can the Future Target Status be achieved today?
The first stage of this modelling scenario determined if a Moderate status in the Upper Blackwater catchment could be maintained today (pre-growth) with current conventional treatment.

The modelling results demonstrate that it would not be possible to achieve a Moderate status downstream of Camp Farm WwTW without improving the upstream water quality.

In order to improve upstream water quality, the upstream discharge at Aldershot WwTW would need to be improved. The results of the catchment model show that in order to achieve a Moderate status upstream of Camp Farm WwTW, a quality condition beyond the limits of conventional treatment would be required at Aldershot WwTW.

The outcomes from the assessment demonstrate that current limits in technology, rather than proposed growth, would prevent the future target status from being achieved.

5.2.3 Results – Ammonia

5.2.3.1 10% Deterioration Limit

Table 5-6 Required ammonia permit quality conditions for each phase of growth

WwTW	Current discharge permit quality (95%ile mg/l)	AMP6 (2016 – 2020)	AMP7 (2020 – 2025)	AMP8 (2025 – 2030)	AMP9 (2030 – 2032)
Camp Farm	7.0	6.0	5.0	4.5	4.5
Camberley	3.0	0.5	0.5	0.5	0.5
Eversley	None	Not required			

Camp Farm WwTW
Modelling has been undertaken to take account of the increased wastewater flows from the first phase of growth (AMP6), whilst limiting deterioration to no more than 10% of the current downstream quality. The results showed that, if the WwTW were to operate closer to its permitted quality of 7.0mg/l (currently the WwTW operates well within this permitted quality), the current ammonia quality condition would not ensure the 10% deterioration limit is adhered to. In order to achieve the 10% deterioration limit, a revised ammonia quality condition would be required by the end of AMP6 as shown in Table 5-6.

Following the second phase of growth (AMP7), another revised ammonia quality condition would be required, and a further tightening of the ammonia quality condition would be required for the third phase of growth (AMP8).

The tighter ammonia quality conditions for each phase of growth can be achieved with current conventional treatment technologies (within the limits of conventional treatment) and would also ensure no deterioration in ammonia status throughout the plan period.

It should be noted that the modelling results are based on the assumption that the discharge quality at the upstream Aldershot WwTW (which is currently performing well within its discharge permit) is maintained, despite receiving additional flow from growth within the study area.

Camberley WwTW
Modelling has been undertaken to take account of the increased wastewater flows from the first phase of growth (AMP6), whilst limiting deterioration to no more than 10% of the current downstream quality. The results showed that, if the WwTW were to operate closer to its permitted quality of 3.0mg/l (currently the WwTW operates well within this permitted quality), the current ammonia quality condition would not only result in more than a 10% deterioration, but also a deterioration in status downstream.

In order to achieve the 10% deterioration limit, a revised ammonia quality condition which cannot be achieved with current conventional treatment technologies (beyond the limits of conventional treatment) would be required by the end of AMP6, and would be required for each subsequent phase of growth, as shown in Table 5-6.

Currently, the level of ammonia treatment at Camberley WwTW (approximately 0.5 mg/l) indicates that the WwTW is capable of treating beyond what is considered achievable with conventional treatment technologies (considered to be 1.0mg/l). A revised ammonia quality condition of 0.5mg/l has therefore been modelled, assuming it is possible to maintain this level of treatment as each phase of growth comes forward.

A tighter ammonia quality condition of 0.5mg/l may require non-conventional treatment technologies (beyond the limits of conventional treatment), which may not be cost beneficial when balancing environmental capacity with the cost of treatment. Consequently, further modelling has been undertaken and reported in Section 5.2.3.2 outlining the ammonia quality conditions required at Camberley WwTW to ensure no deterioration in status after each phase of growth.

It should be noted that the modelling results are based on the same assumptions as detailed in Section 5.2.2.1.

Eversley WwTW
A new ammonia quality condition on the discharge permit at Eversley WwTW would not be required because the effect of the upstream discharge at Camberley WwTW on ammonia concentrations is greater than the effect of the discharge at Eversley WwTW.

A theoretical discharge quality of 10mg/l (approximately four times worse than the current discharge quality)has been modelled for the last phase of growth (AMP9) to test whether this would cause greater than a 10% deterioration.

The results demonstrated that the level of treatment could, in theory, worsen to 10mg/l and would only result in a 2% deterioration. Although it is unlikely that a reduction in the level of treatment of this scale would occur, this result demonstrates that the WwTW has a negligible impact on ammonia concentrations (even after all phases of growth have been taken into account), and a new quality condition could comfortably be achieved with current conventional treatment technologies (within the limits of conventional treatment) should a condition be considered necessary to ensure the 10% deterioration limit is adhered to.

5.2.3.2 No Deterioration in Status

The future permit quality conditions required at Camp Farm WwTW and Eversley WwTW to limit deterioration to 10% would also ensure no deterioration in status downstream of the WwTWs.

For Camberley WwTW, it has been concluded that limiting deterioration to 10% would require non-conventional treatment technologies (beyond the limits of conventional treatment), therefore it is necessary to demonstrate whether current conventional treatment technologies would be sufficient to ensure no deterioration in status.

A revised ammonia quality condition which can be achieved with current conventional treatment technologies (within the limits of conventional treatment) would be required by the end of AMP6, and would be required for each subsequent phase of growth, as shown in Table 5-6.

Table 5-7 Required ammonia permit quality conditions for each growth phase to ensure no deterioration in status

WwTW	Current discharge permit quality (95%ile mg/l)	AMP6 (2016 – 2020)	AMP7 (2020 – 2025)	AMP8 (2025 – 2030)	AMP9 (2030 – 2032)
Camberley	3.0	1.0	1.0	1.0	1.0

5.2.3.3 Achieving Future Target Status

The Upper and Lower Blackwater catchments each have a future target of Good ammonia status to achieve by 2027 (during AMP8). A scenario was modelled to assume that the Upper Blackwater is achieving the future target status of Good, and calculate the quality conditions required to maintain the Good status.

Can the Future Target Status be achieved today?
The first stage of this modelling scenario determined if a Good status in the Upper Blackwater catchment could be maintained today (pre-growth) with current conventional treatment. The modelling results indicated that it would not be possible to achieve a Good status downstream of Camp Farm WwTW without improving the upstream water quality.

In order to improve upstream water quality, the upstream discharge at Aldershot WwTW would need to be improved. The results showed that in order to achieve a Good status upstream of Camp Farm WwTW, a quality condition beyond the limits of conventional treatment would be required at Aldershot WwTW.

For the Lower Blackwater, it has already been demonstrated that a quality condition which would be on the limit of conventional treatment would be required to ensure no deterioration in ammonia status, therefore it can be concluded that a quality condition beyond the limit of conventional treatment would be required in order to achieve the future target status.

The outcomes from the assessment demonstrate that current limits in technology, rather than proposed growth, would prevent the future target status from being achieved.

5.2.4 Results – BOD

Load standstill calculations have been applied to the future discharge flow predicted in AMP6 and the future discharge flow predicted in AMP9 to determine the quality condition required to maintain the current BOD quality in the River Blackwater (Table 5-8).

Table 5-8 Required BOD permit quality conditions for the first and last phases of growth

WwTW	Current discharge permit quality (95%ile mg/l)	AMP6 (2016 – 2020)	AMP9 (2030 – 2032)
Camp Farm	10	8.4	5.9
Camberley	10	9.6	8.9
Eversley	30	28.1	19.7

Camp Farm WwTW
The results show that a revised (tighter) BOD quality condition (8mg/l) would be required to maintain the current quality of the discharge by the end of AMP6, and a further tightening of the BOD quality condition (6mg/l) would then be required by the end of AMP9.

Camberley WwTW
The results show that a revised (tighter) BOD quality condition (9mg/l) would be required to maintain the current quality of the discharge by the end of AMP6, and a further tightening of the BOD quality condition (8.9mg/l) would then be required by the end of AMP9.

Eversley WwTW
The results show that a revised (tighter) BOD quality condition (28mg/l) would be required to maintain the current quality of the discharge by the end of AMP6, and a further tightening of the BOD quality condition (19mg/l) would then be required by the end of AMP9.

The tighter BOD quality conditions for each of the WwTWs can be achieved with current conventional treatment technology (within limits of conventional treatment), ensuring the current BOD quality in the River Blackwater is maintained and therefore ensuring no deterioration in status.

5.3 Discharge Modelling

For WwTWs outside of the Blackwater catchment, discharge modelling using RQP has been undertaken to take account of the increased wastewater flows from the proposed development at the beginning (AMP6) and end (AMP9) of the plan period to demonstrate the need for phasing of new or revised quality conditions. The growth scenarios with the most proposed growth have been modelled for each WwTW, these are:

- Growth Scenario 3 (DtC Exist) for Fleet WwTW,
- Growth Scenario 3 (DtC Exist) for Hartley Wintney WwTW, and
- Growth Scenario 1 (OAHN Exist) for Lightwater WwTW.

The results of the required future permit quality conditions for each determinand at the beginning (AMP6) and end (AMP9) of the plan period have been presented in line with the modelling scenarios as outlined in Section 4.5.2, which include;

- Maintaining the current discharge quality,
- Limiting deterioration to 10% of current river quality,
- Ensuring no deterioration in status, and
- Achieving the future target status.

5.3.1 Fleet WwTW

The headroom assessment has demonstrated that Fleet WwTW currently has sufficient flow headroom in its existing discharge permit and can accept all proposed development without exceeding the existing discharge permit. However, there is a risk that if the WwTW were to be operated to its full permitted flow, this could potentially lead to a significant deterioration in water quality and possibly WFD status.

Additional flow headroom is therefore not required at this WwTW, however, to ensure that the significant quantity of growth proposed within the WwTW catchment does not impact on downstream water quality objectives, revised quality conditions are likely to be required before all growth is connected.The following assessment and calculated values have been based on the growth scenario which would see the greatest quantity of development within the WwTW catchment (growth scenario 3).

5.3.1.1 Environmental Baseline

The Fleet Brook receives treated effluent from Fleet WwTW and currently has an overall waterbody status of Moderate, with the alternative objective to maintain Moderate status by 2021.

Its current overall status is limited to Moderate due to the less than Good status classification of the elements as listed in Table 5-9. The current status for ammonia is Good and there is no classification for BOD.

Table 5-9. Classification elements of less than Good status for Fleet Brook

Classification Element	Current Status (2015)	Objective	Justification for alternative objective
Fish	Poor	Good by 2027	Disproportionate burdens – Disproportionately expensive
Dissolved Oxygen	Poor	Good by 2027	Cause of adverse impact unknown – Technically infeasible
Phosphate	Moderate	Moderate by 2021	No known technical solution is available – Technically infeasible

5.3.1.2 Results

The revised discharge permit quality conditions required by the end of AMP6 and AMP9 for each determinand and for each modelled scenario are presented in Table 5-10.

Table 5-10 Required discharge permit quality conditions for Fleet WwTW

Determinand	AMP Period	Current permit quality condition (mg/l)	Future permit quality condition required to…			
			Maintain current quality	Limit to 10% deterioration	Ensure no deterioration in status only	Achieve future target status
BOD (mg/l 95%ile)	AMP 6	**10**	9.7	N/A		N/A
	AMP 9		9.1			
Ammonia (mg/l 95%ile)	AMP 6	**2.5**	N/A	1.2	1.4	
	AMP 9			1.2	1.4	
Phosphate (mg/l annual average)	AMP 6	**1.0**[23]	N/A	0.9	1.0	
	AMP 9			0.9	1.0	

5.3.1.2.1 Maintain current quality (BOD)

Load standstill calculations have been applied to the future discharge flow predicted in AMP6 and the future discharge flow predicted in AMP9 to determine the quality condition required to maintain the current BOD quality in the Fleet Brook. The results show that the current BOD quality condition (10mg/l) is likely to be sufficient to maintain the current quality of the discharge up to 2020, when a revised (tighter) BOD quality condition (9mg/l) would then be required.

The tighter BOD quality condition can be achieved with current conventional treatment technology (within limits of conventional treatment), ensuring no deterioration in current BOD quality in the Fleet Brook and therefore ensuring no deterioration in status.

5.3.1.2.2 10% Deterioration Limit[24]

The modelling scenario *(10% Deterioration Limit)* has been applied to the future discharge flows (AMP6 and AMP9) to determine the quality conditions required to limit deterioration to no more than 10% of the current ammonia and phosphate quality (as measured at the nearest sampling point downstream of the WwTW) in the Fleet Brook. The results show that a revised (tighter) ammonia quality condition (1.2mg/l) would be required by the end of AMP6 to ensure the 10% deterioration limit is adhered to. This quality condition would also ensure deterioration does not exceed the 10% limit for subsequent phases of growth and therefore also ensures no deterioration in ammonia status.

The phosphate quality condition due to be implemented in April 2018 (1.0mg/l) is likely to be sufficient to ensure deterioration does not exceed the 10% limit for all phases of growth.

The tighter ammonia quality condition and incoming phosphate quality condition can both be achieved with current conventional treatment technology (within limits of conventional treatment).

5.3.1.2.3 No Deterioration in Status

In addition to the modelling scenario *(10% Deterioration Limit)*, a further modelling scenario *(No Deterioration in Status)* has been applied to the future discharge flows (AMP6 and AMP9) to determine the quality conditions required to ensure no deterioration in the ammonia and phosphate status (defined at the nearest sampling point downstream of the WwTW for 2015) for the Fleet Brook. The results show that a revised (tighter) ammonia quality condition (1.4mg/l) would be required by the end of AMP6 to ensure no deterioration in ammonia status. This quality condition would also ensure no deterioration in ammonia status for subsequent phases of growth and can both be achieved with current conventional treatment technology (within limits of conventional treatment).

The phosphate quality condition due to be implemented in April 2018 (1.0mg/l) is sufficient to ensure no deterioration in phosphate status for all phases of growth.

5.3.1.2.4 Achieving Future Target Status

The modelling scenario *(Achieving Future Target Status)*, which assesses whether growth may prevent Fleet Brook from achieving its future target statuses for BOD, ammonia or phosphate, is not applicable and the justification for this has been provided in Table 5-11.

[23] Phosphate permit condition of 1.0 mg/l due to be implemented in April 2018

[24] The 10% limit is based on the quality at the downstream sampling point which represents a more stringent and therefore precautionary approach to that applied by the Environment Agency when setting new discharge permits, whereby the 10% limit is calculated from the river quality at the point of mixing (worse quality than that measured at the downstream sampling point, where pollutant loads have reduced as a result of dilution and organic breakdown).

Table 5-11 Justification for not assessing the future target status

Determinand	Justification
BOD	No BOD status for the Fleet Brook
Ammonia	Already at 'Good' status
Phosphate	An alternative objective has been set by the Environment Agency in place of the default objective to reach 'Good' status. The alternative objective has been set due to the need for a technically infeasible solution to resolve the less than 'Good' status of phosphate (see Appendix E for details). This target is Moderate which is the current status and hence the no deterioration assessment results apply equally to the future target status objective

5.3.2 Hartley Wintney WwTW

The headroom assessment has demonstrated that Hartley Wintney WwTW currently has sufficient flow headroom in its existing discharge permit and can accept all proposed development without exceeding the existing discharge permit. However, there is a risk that if the WwTW were to be operated to its full permitted flow, this could potentially lead to a significant deterioration in water quality and possibly WFD status.

Additional flow headroom is therefore not required at this WwTW, however, to ensure that the significant quantity of growth proposed within the WwTW catchment does not impact on downstream water quality objectives, revised quality conditions are likely to be required.The following assessment and calculated values have been based on the growth scenario which would see the greatest quantity of development within the WwTW catchment (growth scenario 3).

5.3.2.1 Environmental Baseline

The River Hart receives treated effluent from Hartley Wintney WwTW and currently has an overall waterbody status of Poor, with the alternative objective to achieve Moderate status by 2027.

Its current overall status is limited to Poor status due to the less than Good status classification of the elements as listed in Table 5-12. The current status for ammonia is Good and there is no classification for BOD.

Table 5-12 Classification elements of less than Good status for River Hart

Classification Element	Current Status (2015)	Objective	Justification for alternative objective
Fish	Poor	Good by 2027	Disproportionate burdens – Disproportionately expensive
Macrophytes and Phytobenthos Combined	Moderate	Moderate by 2021	No known technical solution is available – Technically infeasible
Dissolved Oxygen	Moderate	Good by 2027	Cause of adverse impact unknown – Technically infeasible
Phosphate	Poor	Poor by 2021	No known technical solution is available – Technically infeasible

5.3.2.2 Results

The revised discharge permit quality conditions required by the end of AMP6 and AMP9 for each determinand are presented in Table 5-13.

Table 5-13 Required discharge permit quality conditions for Hartley Wintney WwTW

Determinand	AMP Period	Current permit quality condition	Future permit quality condition required to…			
			Maintain current quality	Limit to 10% deterioration	Ensure no deterioration in status only	Achieve future target status
BOD (mg/l 95%ile)	AMP 6	**25**	23.5	N/A		N/A
	AMP 9		19.0			
Ammonia (mg/l 95%ile)	AMP 6	**2.5**	2.1	N/A	2.1	
	AMP 9		2.0		2.0	
Phosphate (mg/l annual average)	AMP 6	**1.0** [23]	0.9	N/A	1.0	
	AMP 9		0.8		1.0	

5.3.2.2.1 Maintain current quality

Load standstill calculations have been applied to the future discharge flow predicted in AMP6 and the future discharge flow predicted in AMP9 to determine the quality condition required to maintain the current BOD quality in the River Hart. The results show that a revised (tighter) BOD quality condition (23.5mg/l) would be required to maintain the current quality of the discharge by the end of AMP6, and a further tightening of the BOD quality condition (19mg/l) would then be required by the end of AMP9.

Both the tighter BOD quality conditions can be achieved with current conventional treatment technology (within limits of conventional treatment), ensuring no deterioration in current BOD quality in the River Hart and therefore ensuring no deterioration in status.

For ammonia, a modelling scenario *(Maintain Current Quality)* has been applied to the future discharge flows (AMP6 and AMP9) to determine the quality condition required to maintain the current ammonia quality (as calculated at the mixing point of the WwTW) in the River Hart. This modelling scenario replaces the 10% deterioration limit scenario because the river quality at the downstream sampling point is a higher status (High) than the status at the upstream sampling point (Good). This is a result of the downstream sampling point being located approximately 3km downstream of the discharge and the subsequent effect on dilution and organic breakdown of ammonia along the 3km reach. Consequently, this sets an unrealistic target for the WwTW discharge.

For phosphate, the same modelling scenario *(Maintain Current Quality)* has been applied to the future discharge flows (AMP6 and AMP9) to determine the quality condition required to maintain the current phosphate quality (as calculated at the mixing point of the WwTW) in the River Hart.

The targets to maintain the current river water quality at the mixing point in respect to ammonia and phosphate (i.e. 0% deterioration in current quality) represent more stringent targets than the 10% deterioration limit. This more stringent approach also reduces the risk of a cumulative effect on ammonia and phosphate concentrations in the wider river catchment as a result of the upstream Fleet WwTW discharge (which has been assessed against a 10% deterioration limit).

The results show that a revised (tighter) ammonia quality condition (2.0mg/l) would be required by the end of AMP6 to maintain the current ammonia quality at the mixing point in the River Hart. This quality condition would also ensure the current quality at the mixing point is maintained for subsequent phases of growth and therefore also ensures no deterioration in ammonia status.

The phosphate quality condition due to be implemented in April 2018 (1.0mg/l) is likely to be sufficient to maintain the current phosphate quality at the mixing point in the River Hart up to AMP9, when a revised (tighter) phosphate quality condition (0.8mg/l) may be required.

The tighter ammonia quality condition and incoming phosphate quality condition can both be achieved with current conventional treatment technology (within limits of conventional treatment).

5.3.2.2.2 No Deterioration in Status

In addition to the modelling scenario *(Maintain Current Quality)*, a further modelling scenario *(No Deterioration in Status)* has been applied to the future discharge flows (AMP6 and AMP9) to determine the quality conditions required to ensure no deterioration in the ammonia and phosphate status (defined at the nearest sampling point downstream of the WwTW for 2015) for the River Hart. The results show that a revised (tighter) ammonia quality condition (2.0mg/l) would be required by the end of AMP6 to ensure no deterioration in ammonia status. This quality condition would also ensure

no deterioration in ammonia status for subsequent phases of growth and can both be achieved with current conventional treatment technology (within limits of conventional treatment).

The phosphate quality condition due to be implemented in April 2018 (1.0mg/l) is sufficient to ensure no deterioration in phosphate status for all phases of growth.

5.3.2.2.3 Achieving Future Target Status

The modelling scenario *(Achieving Future Target Status)*, which assesses whether growth may prevent the River Hart from achieving its future target statuses for BOD, ammonia or phosphate, is not applicable and the justification for this has been provided in Table 5-14.

Table 5-14 Justification for not assessing the future target status

Determinand	Justification
BOD	No BOD status for the River Hart
Ammonia	Already at 'Good' status
Phosphate	An alternative objective has been set by the Environment Agency in place of the default objective to reach 'Good' status. The alternative objective has been set due to the need for a technically infeasible solution to resolve the less than 'Good' status of phosphate (see Appendix E for details). This target is Moderate which is the current status and hence the no deterioration assessment results apply equally to the future target status objective.

5.3.3 Lightwater WwTW

The headroom assessment has demonstrated that Lightwater WwTW does not currently have sufficient flow headroom in its existing discharge permit to accept development. In addition, according to data provided by TWUL, the WwTW is already exceeding its existing DWF permit by approximately 300m^3/d.

Therefore, until additional flow headroom can be made available at the WwTW, any development connecting to the WwTW would result in the existing DWF permit being exceeded further. The exceedance ranges from a total volume of approximately 590m^3/d (equivalent to approx. 1,470 dwellings) by the end of the plan period under growth scenarios 1 and 2, to approximately 500m^3/d (equivalent to approx. 1,250 dwellings) by the end of the plan period under growth scenarios 3 and 4. TWUL have stated that the WwTW is not subject to investment in AMP6 and there are currently no planned upgrades for the WwTW.

The following assessment and calculated values have been based on the growth scenario which would see the greatest quantity of development within the WwTW catchment (growth scenarios 1 and 2).

5.3.3.1 Environmental Baseline

The Hale Bourne receives treated effluent from Lightwater WwTW and currently has an overall waterbody status of Moderate, with the alternative objective to maintain Moderate status by 2021.

Its current overall status is limited to Moderate status due to the less than Good statuses of the classification elements as listed in Table 5-15. There is no classification for BOD.

Table 5-15 Classification elements of less than Good status for Hale Bourne

Classification Element	Current Status (2015)	Objective	Justification for alternative objective
Fish	Moderate	Good by 2027	Cause of adverse impact unknown – Technically infeasible
Ammonia	Moderate	Good by 2027	Cause of adverse impact unknown – Technically infeasible
Phosphate	Poor	Poor by 2021	No known technical solution is available – Technically infeasible

5.3.3.2 Results

The revised discharge permit quality conditions required by the end of AMP6 and AMP9 for each determinand are presented in Table 5-16.

Table 5-16 Required discharge permit quality conditions for Lightwater WwTW

Determinand	AMP Period	Current permit quality condition	Future permit quality condition required to…			
			Maintain current quality	Limit to 10% deterioration	Ensure no deterioration in status only	Achieve future target status
BOD (mg/l 95%ile)	AMP 6	10	9.4	N/A		N/A
	AMP 9		8.9			
Ammonia (mg/l 95%ile)	AMP 6	2.0	2.0	N/A	2.0	2.0
	AMP 9		2.0		2.0	2.0
Phosphate (mg/l annual average)	AMP 6	2.0	1.0	N/A	2.0	N/A
	AMP 9		0.9		2.0	

5.3.3.2.1 Maintain current quality

Load standstill calculations have been applied to the future discharge flow predicted in AMP6 and the future discharge flow predicted in AMP9 to determine the quality condition required to maintain the current BOD quality in the Hale Bourne. The results show that a revised (tighter) BOD quality condition (9.4mg/l) would be required to maintain the current quality of the discharge by the end of AMP6, and a further tightening of the BOD quality condition (8.9mg/l) would then be required by the end of AMP9.

Both the tighter BOD quality conditions can be achieved with current conventional treatment technology (within limits of conventional treatment), ensuring no deterioration in current BOD quality in the Hale Bourne and therefore ensuring no deterioration in status.

For ammonia and phosphate, a modelling scenario *(Maintain Current Quality)* has been applied to the future discharge flows (AMP6 and AMP9) to determine the quality conditions required to maintain the current ammonia and phosphate quality (as calculated at the mixing point of the WwTW) in the Hale Bourne. This modelling scenario replaces the modelling scenario *(10% Deterioration Limit)* because the river quality at the downstream sampling point is a lower status (Moderate) than the status at the mixing point (Good). This is a result of the downstream sampling point being located approximately 1km downstream of the discharge and it is likely there are other pollution sources (diffuse and point) along this reach which cause the ammonia and phosphate quality to decline. Consequently, this sets less stringent targets for the WwTW discharge.

The targets to maintain the current river water quality at the mixing point in respect to ammonia and phosphate (i.e. 0% deterioration in current quality) represent more stringent targets than the 10% deterioration limit.

The results show that the current ammonia quality condition (2mg/l) would be sufficient to maintain the current ammonia quality at the mixing point in the Hale Bourne for all phases of growth and therefore also ensures no deterioration in ammonia status.

A revised (tighter) phosphate quality condition (1.0mg/l) would be required by the end of AMP6 to maintain the current phosphate quality at the mixing point in the Hale Bourne. This quality condition is likely to ensure the current quality at the mixing point is maintained for subsequent phases of growth and therefore also ensures no deterioration in phosphate status.

The tighter ammonia and phosphate quality conditions can both be achieved with current conventional treatment technology (within limits of conventional treatment).

5.3.3.2.2 No Deterioration in Status

In addition to the modelling scenario *(Maintain Current Quality)*, a further modelling scenario *(No Deterioration in Status)* has been applied to the future discharge flows (AMP6 and AMP9) to determine the quality conditions required to ensure no deterioration in the ammonia and phosphate status (defined at the nearest sampling point downstream of the WwTW for 2015) for the Hale Bourne. The results show that current ammonia and phosphate quality conditions are sufficient to ensure no deterioration in ammonia and phosphate status for all phases of growth.

5.3.3.2.3 Achieving Future Target Status

The modelling scenario *(Achieving Future Target Status)*, which assesses whether growth may prevent the Hale Bourne from achieving its future target statuses for BOD or phosphate, is only applicable to ammonia. The test is not applicable for BOD and phosphate and the justification for this has been provided in Table 5-17.

Table 5-17 Justification for not assessing the future target status

Determinand	Justification
BOD	No BOD status for the Hale Bourne
Phosphate	An alternative objective has been set by the Environment Agency in place of the default objective to reach 'Good' status. The alternative objective has been set due to the need for a technically infeasible solution to resolve the less than 'Good' status of phosphate (see Appendix E for details). This target is Moderate which is the current status and hence the no deterioration assessment results apply equally to the future target status objective.

The modelling scenario *(Achieving Future Target Status)* has been applied to the current and future discharge flows (AMP9) to determine the quality conditions required to ensure growth does not compromise the Hale Bourne from achieving its future target ammonia status of 'Good' by 2027, which was set due to high ammonia concentrations suspected to be as a result of continuous sewerage discharge.

The results show that the current ammonia quality condition is sufficient to ensure the Hale Bourne could achieve Good status for ammonia both now (i.e. pre-growth) and by 2027 (as per objective date). Therefore, the assessed growth would not prevent future 'Good' ammonia status from being met.

5.4 WwTW Infrastructure Requirements

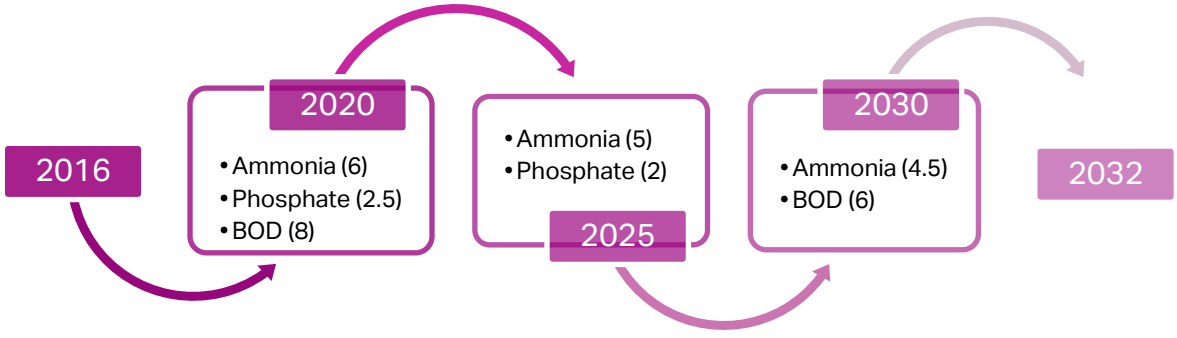
TWUL and STS are currently preparing for Asset Management Plan 7 (AMP7) and their PR19 business plan which will outline their investment programme from April 2020 to 2025. TWUL's and STS' approach to wastewater treatment asset management requires that sufficient certainty is given that the quantum of development proposed will come forward during the plan period before improvements to WwTW assets can be justified and funding sought.

Development information provided in this WCS represents the first stage in providing the most up to date plans for future development coming forward in the plan period, and can be used by TWUL and STS to inform the next investment programme (AMP7) and future programmes (AMP8 and AMP9) to ensure the provision of additional capacity is planned and development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed.

5.4.1 Camp Farm

To accept and treat all of the additional wastewater flow expected from development within each phase of growth and by the end of the plan period, BOD, ammonia and phosphate treatment process upgrades at the WwTW are likely to be required throughout the plan period as indicated in Figure 5-3, in line with revised quality conditions (given in brackets). The requirement for upgrades and the exact technical specification of upgrades should be determined by STS for each asset planning period.

Figure 5-3 Phasing of upgrades for Camp Farm WwTW



Through consultation with STS, it is understood that a study of Camp Farm WwTW has been undertaken by consultants Pick Everard to:

- assess current flows and predicted future flows;
- assess the current condition and performance of the WwTW and nearby pumping stations;
- determine asset improvement work required so that the WwTW can accommodate future flows as the Wellesley development grows; and
- assess the state of the existing sewer network to identify any faults that require repair/replacement prior to adoption.

The study findings will form the basis on which STS will develop the asset management plan for the next five, ten and fifteen years to ensure that the WwTW is able to accommodate all future flows and meet new or revised discharge permit flow and quality conditions.

5.4.2 Camberley WwTW

Information provided by TWUL confirms that the WwTW currently has no hydraulic capacity, and calculations as part of the WCS demonstrate that the WwTW may already be exceeding its permitted flow. TWUL have confirmed that the WwTW is currently subject to investment in AMP6 including upgrades to phosphate treatment processes to address the tighter phosphate quality condition due to be implemented in April 2018. However, there are currently no plans for growth upgrades to add flow headroom capacity to the WwTW or upgrades to ammonia treatment processes.

Short term (Now – 2020)

The onus is on TWUL to maintain the flow and quality conditions set within the WwTWs current environmental permit, and are responsible for completing an application to change the conditions on the environmental permit, for example, to increase the discharge flow. However, until a new or revised environmental permit is implemented, it is recommended that;

a. for each forthcoming planning application, potential developers contact TWUL as early as possible to confirm flow rates and intended connection points (via a TWUL pre-development enquiry) to demonstrate that the WwTW can accept the additional flows or viable interim treatment solutions will be implemented until a permanent solution is in place; and

b. rigorous water quality monitoring is carried out in order to ensure WFD objectives are not compromised.

It has been concluded in this WCS that a tighter ammonia quality condition would be required by the end of the current AMP6 to ensure no deterioration in WFD status, however, TWUL have not confirmed any funding for ammonia upgrades within this AMP period (up to 2020). The current treatment performance of the WwTW in terms of ammonia is well within its current ammonia quality condition, demonstrating that the WwTW is capable of achieving a much higher quality discharge. Agreement should be sought between the Environment Agency and TWUL on the ability of the WwTW to accept growth up to 2020 and maintain its current ammonia discharge quality.

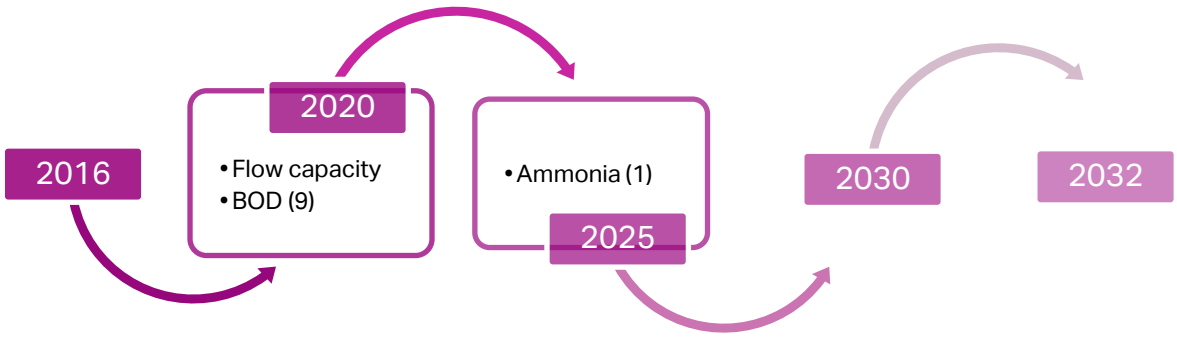
In most instances additional wastewater treatment capacity can be provided within two to three years, and infrastructure upgrades to the wastewater distribution system within 18 months to two years.

Long term (2020 – 2032)

There is no requirement for TWUL to design or plan upgrades for a WwTW for a timescale up to 2032. Upgrades will be planned and funded for within the five yearly AMP periods, with subsequent AMP periods AMP7 (2020 – 2025) and AMP8 (2025 – 2030) providing TWUL with an opportunity to review the level of proposed growth, the necessary solutions/upgrades, and the respective costs before submitting proposals and costs to OFWAT.

Agreement should be sought between TWUL, the Environment Agency and each of the local authorities on the most sustainable solution in terms of limiting ammonia levels in the River Blackwater to 10% of the current quality against the overall sustainability of future developments, to determine the technical and financial feasibility of a solution. Consideration should be given to alternative solutions, such as connecting large development sites to alternative WwTW catchments (e.g. possibility of connecting Hartland Park to Fleet WwTW) where feasible and subject to environmental and infrastructure capacity.

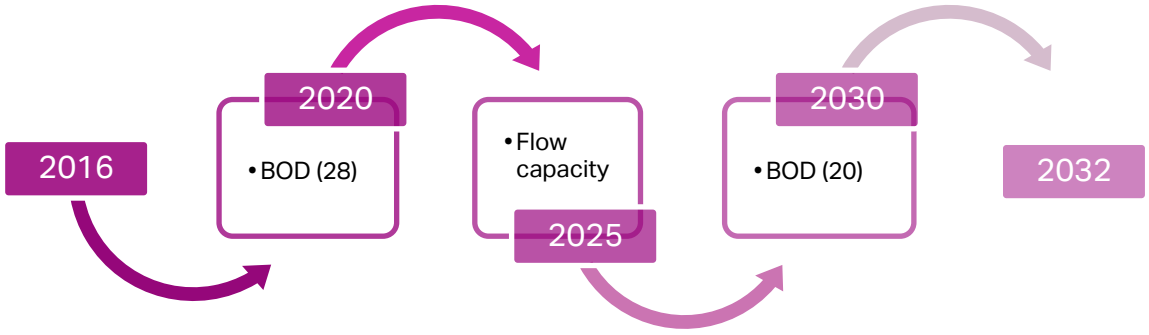
Figure 5-4 Phasing of upgrades for Camberley WwTW



5.4.3 Eversley WwTW

To accept and treat all of the additional wastewater flow expected from development within each phase of growth and by the end of the plan period, BOD treatment process and flow capacity upgrades at the WwTW are likely to be required throughout the plan period as indicated in Figure 5-5, in line with revised quality conditions (given in brackets). The requirement for upgrades and the exact technical specification of upgrades should be determined by TWUL for each asset planning period.

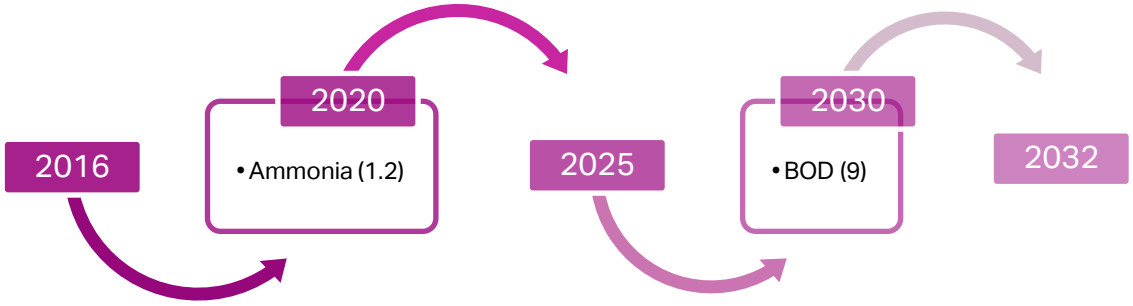
Figure 5-5 Phasing of upgrades for Eversley WwTW



5.4.4 Fleet WwTW

To accept and treat all of the additional wastewater flow expected from development within each phase of growth and by the end of the plan period, BOD and ammonia treatment process upgrades at the WwTW are likely to be required throughout the plan period as indicated in Figure 5-6, in line with revised quality conditions (given in brackets). The requirement for upgrades and the exact technical specification of upgrades should be determined by TWUL for each asset planning period.

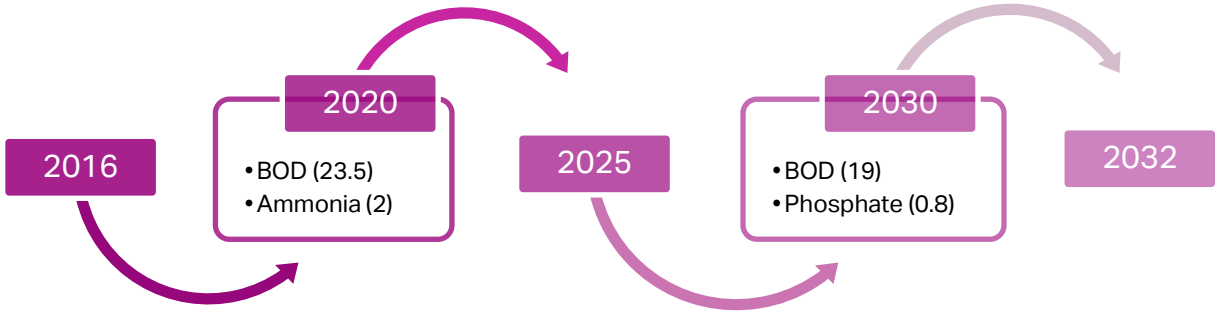
Figure 5-6 Phasing of upgrades for Fleet WwTW



5.4.5 Hartley Wintney WwTW

To accept and treat all of the additional wastewater flow expected from development within each phase of growth and by the end of the plan period, BOD, ammonia and phosphate treatment process upgrades at the WwTW are likely to be required throughout the plan period as indicated in Figure 5-7, in line with revised quality conditions (given in brackets). The requirement for upgrades and the exact technical specification of upgrades should be determined by TWUL for each asset planning period.

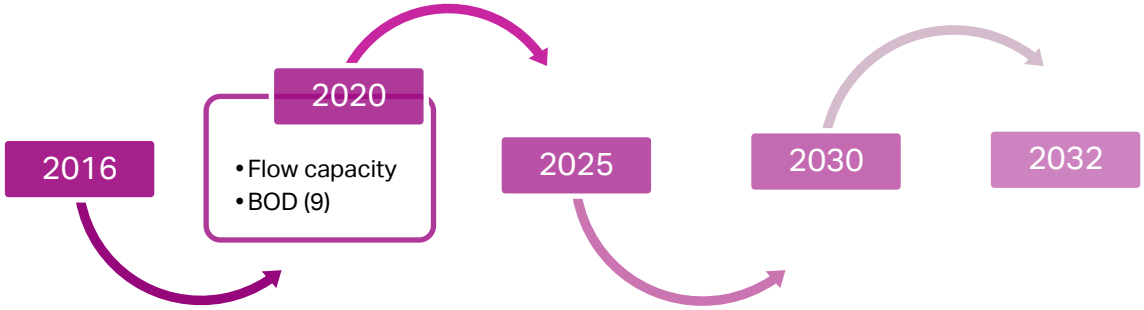
Figure 5-7 Phasing of upgrades for Hartley Wintney WwTW



5.4.6 Lightwater WwTW

Flow capacity upgrades at the WwTW and a revised flow condition on the discharge permit will be required immediately. To accept and treat all of the additional wastewater flow expected from development within each subsequent phase of growth and by the end of the plan period, BOD treatment process upgrades at the WwTW are likely to be required throughout the plan period as indicated in Figure 5-8, in line with revised quality conditions (given in brackets). The requirement for upgrades and the exact technical specification of upgrades should be determined by TWUL for each asset planning period.

Figure 5-8 Phasing of upgrades for Lightwater WwTW



5.5 Overall RAG Assessment

Table 5-18 provides a RAG assessment of the WwTWs within the study area which have been assessed and the results against the full range of water quality objectives tested.

The water quality modelling results demonstrate that, subject to the revision of discharge permits and the necessary treatment process upgrades (using conventional treatment technologies) being implemented, there is environmental capacity for the proposed options for growth to ensure the no deterioration WFD water quality objectives can be met. The results also show that, where future WFD target status of waterbodies cannot be met, it is the limitation of current technology and not the proposed growth that prevents it. Therefore, this WCS assessment has demonstrated that subject to the permit changes and potential WwTW upgrades required, growth will not impact on WFD objectives as they have currently been set.

In nearly all cases, the assessment has also shown that subject to the revision of discharge permits and the necessary treatment process upgrades (using conventional treatment technologies) being implemented, changes in water quality as a result of additional discharge can be maintained at 10% or less. The exception would be Camberley WwTW where non-conventional treatment technologies which would be required to ensure deterioration in ammonia quality does not exceed 10% within the River Blackwater. However, the critical assessment outcome is that WFD objectives can be met.

Whilst the WCS has shown technical solutions are possible to maintain WFD objectives, it should be noted that the water bodies are not expected to be able to meet overall requirement of good status as set out in the WFD. Therefore, the assessments undertaken should be considered within the context of the lower current and future baseline quality of the water bodies assessed. As published in the latest Thames RBMP by the Environment Agency, current WwTW discharges are believed to be one of the causes for high nutrient concentrations in the River Blackwater, River Hart, Fleet Brook and the Hale Bourne, and therefore they are currently contributing to the watercourses not meeting the required Good Status under the WFD. As stated in the WwTW assessments above, the reason is because there is no technical solution currently available (i.e. beyond current limits of conventional treatment technology), and consequently alternative (lower) target WFD objectives have been set. Wastewater treatment technologies are

continuously being developed and improved, and hence capacity for additional wastewater flow from growth would need to be reconsidered in the context of achieving the future target status' up to the end of the plan period and beyond as the limits of conventional treatment are gradually improved.

Table 5-18 Wastewater treatment works RAG Assessment

WwTW	Watercourse	Is flow headroom available for proposed growth?	Is a revised discharge permit required?		Is it technically feasible to			Overall RAG
					Limit deterioration to 10%?	Achieve no deterioration in status?	Achieve future target status?	
Camp Farm	River Blackwater	Yes	BOD	Yes	Yes	Yes	N/A	Flow capacity for growth under all growth scenarios with some capacity available for further growth. However, treatment process upgrades will be required using conventional treatment technologies to meet river quality targets.
			Ammonia	Yes	Yes	Yes	No – limited by current technology	
			Phosphate	Yes	Yes	Yes	No – limited by current technology	
Camberley	River Blackwater	No - Currently no capacity	BOD	Yes	Yes	Yes	N/A	Limited flow capacity under all growth scenarios, therefore growth upgrades and careful development phasing will be required. Will also require treatment process upgrades using conventional and possibly non-conventional treatment technologies to meet river quality targets.
			Ammonia	Yes	No	Yes	No – limited by current technology	
			Phosphate	No	Yes - with current quality condition		N/A	
Eversley	River Blackwater	Limited - capacity limited up to 160 dwellings	BOD	Yes	Yes	Yes	N/A	Limited flow capacity under certain growth scenarios with capacity for planned growth up to 2022 (based on Hart District Council Housing Trajectory), therefore growth upgrades may be required post-2022. Treatment process upgrades will be required using conventional treatment technologies to meet river quality targets.
			Ammonia	No	Yes – quality condition not required		N/A	
			Phosphate	No	Yes – quality condition not required		N/A	
Fleet	Fleet Brook	Yes	BOD	Yes	Yes	Yes	N/A	Flow capacity for growth under all growth scenarios with some capacity available for further growth. However, treatment process upgrades will be required using conventional treatment technologies to meet river quality targets.
			Ammonia	Yes	Yes	Yes	N/A	
			Phosphate	No	Yes - with current quality condition		N/A	
Hartley Wintney	River Hart	Yes	BOD	Yes	Yes	Yes	N/A	Flow capacity for growth under all growth scenarios with some capacity available for further growth. However, treatment process upgrades will be required using conventional treatment technologies to meet river quality targets.
			Ammonia	Yes	Yes	Yes	N/A	
			Phosphate	Yes	Yes	Yes - with current quality condition	N/A	

WwTW	Watercourse	Is flow headroom available for proposed growth?	Is a revised discharge permit required?		Is it technically feasible to			Overall RAG
					Limit deterioration to 10%?	Achieve no deterioration in status?	Achieve future target status?	
Lightwater	Hale Bourne	No - Currently no capacity	BOD	Yes	Yes	Yes	N/A	Limited flow capacity under all growth scenarios, therefore growth upgrades and careful development phasing will be required. Treatment process upgrades will also be required using conventional treatment technologies to meet river quality targets.
			Ammonia	No	Yes - with current quality condition			
			Phosphate	Yes	Yes	Yes - with current quality condition	N/A	

5.6 Ecological Appraisal

The Headroom Assessment identified that growth in five WwTW catchments could be accommodated within the current permitted headroom hence there is no barrier to delivering the proposed quantity of growth in these catchments. These WwTWs are Aldershot WwTW, Chobham WwTW, Crondall WwTW, Sandhurst WwTW and Wargrave WwTW and as such these are not discussed further within this Section in relation to ecological impacts.

As detailed in Section 5, Camp Farm WwTW, Fleet WwTW and Hartley Wintney WwTW would theoretically have sufficient headroom to accommodate planned future growth. However, the significant quantities of growth proposed within these WwTW catchments has prompted the need to assess the use of permitted headroom against water quality objectives. In addition, the Headroom Assessment identified that Camberley WwTW and Lightwater WwTW would not have sufficient headroom to accommodate future growth under their existing discharge permits. As such water quality modelling was undertaken for:

- Camp Farm WwTW;
- Fleet WwTW;
- Hartley Wintney WwTW;
- Camberley WwTW;
- Lightwater WwTW; and,
- Eversley WwTW.

5.6.1 Impact on Wildlife Sites

Four statutory and 28 non-statutory designated sites have been identified as potentially being hydrologically connected to the six WwTWs which have undergone water quality modelling. The designated sites located in Hart District include:

- Alder Copse SINC;
- Blackwater Valley SSSI;
- Blackwater Valley, Frimley Bridge SINC;
- Crabtree Copse Complex SINC;
- Darby Green Lakes SINC;
- Darby Green Meadows SINC;
- Eversley Bridge Meadow SINC;
- Eversley Lakes SINC;
- Fleethill Farm Meadow SINC;
- Grants Moor. Hatch Moor/ Frimley Bridge Lake SINC;
- Hatchgate Farm Meadows SINC;
- Hulford's Pond SINC;
- Meadow North of M3 Junction 4 SINC;
- Old Chapel Farm Meadows SINC;
- Peatmoor Copse SINC;
- Purdies Farm SINC;
- River Hart SINC;
- River Whitewater SINC;
- Thames Basin Heaths SPA/ Hazeley Heath SSSI;
- Upper Meadow and Pond SINC;
- Vinall's Copse SINC;
- Yateley Bridge Lake and Copse SINC; and
- Yateley Lakes SINC.

The designated sites located in Rushmoor Borough include:

- Hollybush Hill Country Park SINC;
- Meadow North of M3 Junction 4 SINC;
- Prior's Meadow SINC; and
- Ramillies Park/ North Camp Lakes SINC.

The designated sites located in Surrey Heath Borough include:

- Bourne Fields and Young Stroat Meadows' SINC;
- Chobham Meadow South of the Mill Bourne SINC; and
- Coleford Bridge SINC.

Other designated site located outside of the study area, but considered hydrologically connected to a WwTW discharge within the study area include:

- Lavell's Lake (Dinton Pastures) LNR in Wokingham Borough; and
- Lodge Wood and Sandford Mill SSSI in Wokingham Borough.

All other designated sites identified within the study area are either remote from watercourses into which WwTWs discharge treated effluent, or are downstream of WwTWs which did not require water quality modelling as part of this WCS. The ecological background to the statutory designated sites, including the details of the interest features and relevant condition assessments are provided in Appendix F.

The six WwTW which have undergone water quality modelling in Section 5 therefore potentially pose implications for downstream water quality (and thus ecology). Table 5-19 details the designated wildlife sites that potentially contain linking pathways to each relevant WwTW.

Table 5-19: Designated wildlife sites with pathways linking to WwTWs

WwTW	Wildlife Site	Comments
Camp Farm (discharges into a drain and then into the Blackwater River within 315m of the discharge point; flows into Long Water, Blackwater River, River Loddon and into the River Thames after 45.2km)	Hollybush Hill Country Park SINC	65m downstream on a ditch
	Ramillies Park/ North Camp Lakes SINC	863m downstream on the Blackwater River
	Coleford Bridge SINC	3.9km downstream on the Blackwater River
	Blackwater Valley, Frimley Bridge SINC; and Grants Moor. Hatch Moor/ Frimley bridge Lake SINC	4.4km downstream on the Blackwater River
	Meadow North of M3 Junction 4 SINC	7.2km downstream on the Blackwater River
	Prior's Meadow SINC	7.5km downstream on the Blackwater River
	Upper Meadow and Pond SINC	8.6km downstream on the Blackwater River
	Blackwater Valley SSSI	9.6km downstream on the Blackwater River
	Darby Green Meadows SINC	11.5km downstream on the Blackwater River
	Darby Green Lakes SINC	12.0km downstream on the Blackwater River
	Yateley Bridge Lake and Copse SINC	13.2km downstream on the Blackwater River
	Yateley Lakes SINC	13.5km downstream on the Blackwater River
	Eversley Lakes SINC	15.0km downstream on the Blackwater River
	Fleethill Farm Meadow SINC	18.5km downstream on the Long Water
	Eversley Bridge Meadow SINC	19.6km downstream on the Long Water
	Old Chapel Farm Meadows SINC	22.0km downstream on the Long Water
	Lavell's Lake LNR	38.2km downstream on the River Loddon
	Lodge Wood and Sandford Mill SSSI	38.8km downstream on the River Loddon
Camberley (discharges into a	Upper Meadow and Pond SINC	230m downstream on the Blackwater River
	Blackwater Valley SSSI	1.0km downstream on the Blackwater River

WwTW	Wildlife Site	Comments
drain and then into the Blackwater River within 230m of the discharge point; flows into Long Water, Blackwater River, River Loddon and into the River Thames after 36.8km)	Darby Green Meadows SINC	3.1km downstream on the Blackwater River
	Darby Green Lakes SINC	3.6km downstream on the Blackwater River
	Yateley Bridge Lake and Copse SINC	4.8km downstream on the Blackwater River
	Yateley Lakes SINC	5.1km downstream on the Blackwater River
	Eversley Lakes SINC	6.6km downstream on the Blackwater River
	Fleethill Farm Meadow SINC	10.1km downstream on the Long Water
	Eversley Bridge Meadow SINC	11.2km downstream on the Long Water
	Old Chapel Farm Meadows SINC	13.6km downstream on the Long Water
	Lavell's Lake LNR	29.8km downstream on the River Loddon
	Lodge Wood and Sandford Mill SSSI	30.4km downstream on the River Loddon
Eversley (discharges into the Long Water; flows into the Blackwater River, River Loddon and into the River Thames after 27.8km)	Fleethill Farm Meadow SINC	1.1km downstream on the Long Water
	Eversley Bridge Meadow SINC	2.2km downstream on the Long Water
	Old Chapel Farm Meadows SINC	4.6km downstream on the Long Water
	Lavell's Lake LNR	20.8km downstream on the River Loddon
	Lodge Wood and Sandford Mill SSSI	21.4km downstream on the River Loddon
Lightwater (discharges into Hale Bourne; flows into Mill Bourne, The Bourne and then into the River Thames after 11.98km)	Chobham Meadow South of the Mill Bourne SINC	4.8km downstream on Mill Bourne
	Bourne Fields and Young Stroat Meadows' SINC	7.3km downstream on Mill Bourne
Fleet (discharges into Fleet Brook, Flows into the River Hart, River Whitewater, River Blackwater, River Loddon and into the River Thames after 34.6 km)	River Hart SINC	2.4km downstream on the River Hart
	Alder Copse SINC	3.4km downstream on the River Hart
	Thames Basin Heaths SPA/ Hazeley Heath SSSI	5.5 km downstream on the River Hart
	Purdies Farm SINC	5.6 km downstream on the River Hart
	Hulford's Pond SINC	6.3km downstream on the River Hart
	Crabtree Copse Complex SINC	6.7km downstream on the River Hart
	Peatmoor Copse SINC	8.3 km downstream on the River Hart
	Vinall's Copse SINC	9.7 km downstream on the River Hart
	Hatchgate Farm Meadows SINC	10.1 km downstream on the River Hart
	River Whitewater SINC	10.5 km downstream on the River Whitewater
Hartley Wintney (discharges into the River Hart, flows into the River Whitewater, River Blackwater, River Loddon and into the River Thames after 29.7 km)	Thames Basin Heaths SPA/ Hazeley Heath SSSI	0.5 km downstream on the River Hart
	Purdies Farm SINC	0.6 km downstream on the River Hart
	Hulford's Pond SINC	1.3km downstream on the River Hart
	Crabtree Copse Complex SINC	1.7km downstream on the River Hart
	Peatmoor Copse SINC	5.3 km downstream on the River Hart
	Vinall's Copse SINC	4.7 km downstream on the River Hart
	Hatchgate Farm Meadows SINC	5.1 km downstream on the River Hart
	River Whitewater SINC	5.5 km downstream on the River Whitewater

Thames Basin Heaths SPA is identified in Table 5-19 as being located in proximity to a waterbody that receives discharge from one of the six WwTWs modelled. The only other internationally important wildlife site that is geographically close to the study area is Thursley, Ash, and Pirbright & Chobham SAC. This internationally designated site does not receives surface water from the watercourses detailed in Table 5-19, and its features for designation are not sensitive to changes in water quality that could be associated with the six WwTWs modelled. As a result, there is no

impact pathway present and therefore this internationally designated site is not considered further. Thames Basin Heaths SPA is discussed further in the below section relating to Fleet and Hartley Wintney WwTW.

Each relevant WwTW is discussed further below. Camp Farm WwTW, Camberley WwTW and Eversley WwTWs are discussed at the catchment level in Section 5.6.3.

5.6.2 Effects of Nutrient Inputs upon Ecological Receptors

Designated wildlife sites identified in Table 5-19 are in general either freshwater aquatic habitats, terrestrial habitats that are influenced by inundations from freshwater riverine environments, or it cannot be confirmed that they are not influenced by discharged flood waters. This section discusses the potential impacts of modelled determinands (BOD, ammonia and phosphate) on freshwater aquatic habitats, terrestrial habitats influenced by riverine conditions and their associated flora and fauna.

Biochemical Oxygen Demand (BOD)
Elevated Biochemical Oxygen Demand (BOD) in freshwater habitats can result in lower oxygen levels in watercourses that can in turn result in death to plants and animals. BOD is not relevant to terrestrial habitats.

Ammonia
Ammonia is directly toxic to aquatic organisms in freshwater environments. Low levels of exposure to ammonia may result in reduced growth rates, fecundity and fertility, increase stress and susceptibility to bacterial infections and diseases in fish. Higher levels of exposure can cause fish to increase respiratory activity thus increasing oxygen uptake and increased heart rate. It can also lead to tissue damage, lethargy, convulsions, coma and death. Ammonia itself does not interact with terrestrial habitats.

Nitrification of ammonia results in increased nitrogen in freshwater environments. Nitrogen is a growth-limiting nutrient in terrestrial environments. Elevated levels of nitrogen can result in increased plant growth of those plant species that can readily take advantage of increased levels of nitrogen, outcompeting less competitive plant species, thus potentially altering the species composition of a site.

Phosphate
In freshwater environments phosphates are growth-limiting nutrients. Increases in phosphate levels in freshwater environments can result in the death of aquatic plants and animals via the process of eutrophication.

The subsequent sections discuss the impacts of changes in water quality on designated wildlife sites per WwTW. Section 5.6.3 discusses Camp Farm WwTW, Camberley WwTW and Eversley WwTW at a catchment level along the River Blackwater.

5.6.3 River Blackwater: Catchment Modelling

The Environment Agency confirmed that SIMCAT modelling was required to determine if cumulative ammonia and phosphate concentrations along the River Blackwater catchments could be limited to a 'no more than 10%' deterioration criterion as a result of planned future growth. This was on the basis that a deterioration of less than 10%, which is still a net deterioration, is considered sufficiently small as to be acceptable where 'no deterioration' or a net improvement are not achievable within the limits of conventional technology. Both the Upper Blackwater and Lower Blackwater are included within the SIMCAT modelling. SIMCAT modelling for the River Blackwater modelled discharges from Camp Farm WwTW, Camberley WwTW and Eversley WwTW collectively.

Phosphate
Modelling identified that whilst planned future growth would not result in an exceedance of existing headroom, due to the significant quantum of proposed growth within the Camp Farm WwTW catchment there was a need to assess the use of permitted headroom against water quality objectives. Modelling determined that planned future growth could be delivered without resulting in a more than 10% deterioration. However, it was noted that substantially tighter quality conditions would be required by AMP7, AMP8, and AMP9 as growth occurs in order to ensure that this quality condition remains achievable. These tighter quality controls can be achieved using current technologies. During all AMP periods, the planned future growth will result in a decrease in water quality, but will be less than 10% deterioration.

The Headroom Assessment identified that Camberley WwTW and Eversley WwTW will exceed available flow headroom as a result of planned future growth within their catchments. Whilst Eversley WwTW does not have a current phosphate quality condition (modelling demonstrated that a phosphate quality condition would not be required) SIMCAT modelling for both Camberley and Eversley WwTW identified that planned future growth within these catchments would not prevent the 'less than 10% deterioration' water quality target being achieved within current conventional technology limits. It should be noted that for Camberley WwTW, a tighter phosphate quality condition on the discharge permit will be implemented by April 2018. The SIMCAT modelling illustrates that a revised flow permit will result in the phosphate discharge quality from Camberley WwTW, and the downstream river quality, to be of better phosphate quality, despite growth.

As previously detailed, in freshwater environments phosphates are growth-limiting nutrients. Increases in phosphate levels in freshwater environments can result in the death of aquatic plants and animals via the process of eutrophication. As such, whilst it is acknowledged that planned future growth will not result in more than a 10% deterioration in water quality, for the Blackwater catchment upstream of Camberley WwTW, water quality will still deteriorate to a small extent. As such there is potential for this to have a minor negative effect designated wildlife sites and associated flora and fauna. However, for the River Blackwater catchment at, and downstream of, Camberley WwTW, the new phosphate quality condition will ensure that phosphate levels will be better than existing levels. Clearly this will not adversely affect designated wildlife sites.

In all cases the planned future growth will not prevent future WFD status being achieved, However the WFD status for the Upper Blackwater is limited to 'Moderate' by 2027 due to pre-existing high phosphate levels.

Ammonia
Whilst Camp Farm WwTW operates well within its existing permitted quality, to ensure no more than 10% deterioration in ammonia at Camp Farm WwTW, new quality conditions (which could be achieved within the limits of conventional technologies) would be required by the end of AMP6, AMP7, AMP8 and AMP9.

The current quality condition for ammonia at Camberley WwTW is 3.0mg/l. Currently the WwTW ammonia discharge quality is well within its existing permitted quality and below what is considered achievable with current conventional treatment technology. As such this WwTW is considered to be over-performing in terms of its ammonia treatment. Consequently, if this WwTW were to operate closer to its existing 3mg/l quality condition, there would be deterioration in water quality downstream of more than 10%. As such, a tighter quality condition will be required by the end of AMP6. Two modelling scenarios were undertaken with a revised ammonia quality condition of 1mg/l and 0.5m/l. The setting of a revised quality condition of 1.0mg/l would ensure no deterioration in WFD status that is achievable within current technology limits. The setting of a revised quality condition of 0.5mg/l would result in less than a 10% deterioration, however, a quality condition of this nature is not considered achievable with currently available treatment technology and therefore limiting deterioration to 10% cannot be guaranteed.

Eversley WwTW would not require a quality condition for ammonia as the effect of ammonia discharge from the upstream Camberley WwTW is greater than the ammonia discharge from Eversley WwTW. Modelling demonstrated that an ammonia quality condition would not be required.

At a catchment level, planned development will result in an increase in ammonia levels both in the Upper and Lower Blackwater catchment and as such there is potential to impact upon designated wildlife sites and associated flora and fauna that interact with the water of the River Blackwater.

In the absence of designation detail for all SINC sites[25] located on the River Blackwater identified in Table 5-19, it is assumed that due to their location adjacent to the river, the SINC sites will be influenced by the River Blackwater. As such it is also likely that they will be designated for a range of features, including freshwater habitats, wetlands, and terrestrial habitats that interact with flood water from the River Blackwater. Lavell's Lake LNR is the only designated site located along the Upper and Lower River Blackwater for which designated features have been identified (see Appendix F.2). Lavell's Lake is located on the River Loddon downstream of the River Blackwater catchment and as such the SIMCAT modelling undertaken for the River Blackwater does not provide sufficient detail of this waterbody. Further due to the distances involved (i.e. more than 13 km downstream from the Hart District Council Boundary), it is unlikely that nutrient inputs from increased growth in Hart, Rushmoor and Surrey Heath will affect this LNR.

Modelling has identified that the River Blackwater will be subject to increased ammonia inputs that will not prevent WFD status from being achieved, but may result in greater than 10% deterioration. In contrast, deterioration of phosphate can be limited to less than 10% at each of the WwTW, within conventional treatment limits.

5.6.4 Fleet WwTW

Calculations (Section 5.3.1) identify that existing levels of BOD (despite additional flows from growth) can be maintained by tightening the BOD quality condition and with conventional treatment technology, and therefore BOD will not change in Fleet Brook. As there will be no change to existing BOD, no further ecological assessment is required of this quality parameter.

The current WFD status for ammonia is 'Good'. Planned development within Fleet WwTW catchment will require a permit revision of the ammonia quality condition to ensure that the ammonia quality in Fleet Brook does not deteriorate by more than 10%. This can be achieved with conventional treatment technology. As a result, planned development within Fleet WwTW catchment will result in a small increase in ammonia levels, but this will not prevent the future WFD target of 'Good' from being achieved.

The Environment Agency has recently issued a new phosphate quality condition for Fleet WwTW that will be implemented in April 2018. Modelling has shown that this new quality condition will be sufficient to ensure phosphate

[25] The designation details for some SINC sites have been provided in Appendix F.

quality in the Fleet Brook will not deteriorate more than 10% and this can be achieved with conventional treatment technology. However, as previously noted the WFD status for Fleet Brook is limited to 'Moderate' by 2021 due to existing phosphate levels that are not capable of being treated to a 'Good' standard within a known technical solution.

The nearest designated wildlife site to Fleet WwTW discharge point is River Hart SINC located 2.4km downstream, and it has been assumed that the designated features will be aquatic in nature. Whilst both ammonia and phosphate deterioration can be limited to no more than 10% this is still a small increase in ammonia and phosphate levels. As previously noted increased level of ammonia can be toxic to aquatic fauna and flora and can result in changes in plant communities (both terrestrial and aquatic) from increased inputs of nitrogen (from nitrification of ammonia). In addition increased levels of phosphate in freshwater environments can limit growth, and result in the death of aquatic plants and animals via the process of eutrophication which in turn can in turn result in an increased BOD.

Alder Copse SINC is located 3.4km downstream of the discharge point and is likely to be designated for wet woodland potentially hydrologically linked to the River Hart. As such elevated levels of nitrogen (from nitrified ammonia), have some theoretical potential to alter plant communities within the terrestrial habitats. Thames Basin Heaths SPA and Hazeley Heath SSSI are 5.5km downstream from the discharge point. Whilst these sites support important heathland habitats that in turn support internationally important bird populations, it is very unlikely that the wet heath within these sites is maintained by riverine inundation, and is more likely to be reliant on perched groundwater levels or surface runoff. Within the SPA and SSSI the riparian habitat adjacent to the River Hart is broadleaved woodland, but this is not a designated feature of either the SPA or SSSI. As such, the features of these designated sites would not be affected by changes in water quality within the River Hart resulting from the planned future growth. This does not disqualify any inundation from the river impacting upon woodland habitats elsewhere along the river (see discussion regarding Alder Copse SINC).

Table 5-19 identifies that further downstream within Hart, Rushmoor and Surrey Heath authorities are seven SINC sites likely to be designated for their riverine and terrestrial habitats that are connected to the river and thus potentially affected by discharge from Fleet WwTW. These are located between 5.6 km and 10.5km downstream of the discharge point. Whilst these are located at a considerable distance from the discharge point and concentrations of discharged nutrients from the WwTW are likely to have been considerably diluted, there is potential for some impact upon these habitats and associated fauna similarly to the discussion over River Hart SINC and Alder Copse SINC in the above paragraphs.

Whilst future planned growth will not prevent the achievement of future WFD status, it will lead to a slight deterioration in ammonia and phosphate quality but it will remain within the 'less than 10% deterioration' criterion set by the Environment Agency. Although the future target WFD status for phosphate is only 'Moderate', this is due to existing phosphate conditions. As previously mentioned 'Good' WFD status cannot be achieved as it is technically infeasible. As discussed above, there is the potential for some water quality effect on downstream designated local wildlife sites, but the effect is likely to be small.

5.6.5 Hartley Wintney WwTW

Calculations (Section 5.3.2) identify that existing levels of BOD (despite additional flows from growth) can be maintained by tightening the BOD quality condition and with conventional treatment technology, and therefore BOD will not change in the River Hart. As there will be no change to existing BOD, no further ecological assessment is required of this quality parameter.

The current WFD status for ammonia is 'Good'. Planned development within Hartley Wintney WwTW catchment will require a permit revision of the ammonia quality condition to ensure the current ammonia quality in the River Hart is maintained (i.e. 0% deterioration in quality) for all phases of future growth. '0% deterioration' has been modelled as a precautionary approach in order to reduce the risk of a cumulative effect on ammonia concentrations in the wider river catchment as a result of the upstream Fleet WwTW discharge. The 0% deterioration can be achieved with conventional treatment technology. It is likely that a tighter quality condition will be required after AMP6 to ensure continued 0% deterioration in ammonia river quality. As there will be 0% deterioration in ammonia quality, no ecological features will be affected and further ecological assessment is not required.

The Environment Agency has recently issued a new phosphate quality condition for Hartley Wintney WwTW that will be implemented in April 2018. Modelling has shown that this new quality condition will be sufficient to ensure phosphate quality in the River Hart will be maintained (i.e. 0% deterioration) up to 2030 (AMP9) when a tighter quality condition may be required. This will also ensure no deterioration in phosphate status. The 0% deterioration can be achieved with conventional treatment technology. Similar to ammonia, 'no deterioration' has been modelled as a precautionary approach in order to reduce the risk a cumulative effect on phosphate concentrations in the wider river catchment as a result of the upstream Fleet WwTW discharge. As there will be no deterioration in phosphate quality, no ecological features will be affected and further ecological assessment is not required.

5.6.6 Lightwater WwTW

Calculations (Section 5.3.3) identify that existing levels of BOD (despite additional flows from growth) can be maintained by tightening the BOD quality condition and with conventional treatment technology, and therefore BOD will not change in the Hale Bourne. As there will be no change to existing BOD, no further ecological assessment is required of this quality parameter.

The current WFD status for ammonia is 'Moderate'. The current ammonia quality condition on the discharge permit is sufficient (no revised permit needed) to ensure the current ammonia quality in the Hale Bourne will be maintained (i.e. 0% deterioration) for all phases of growth. '0% deterioration' has been modelled as a precautionary approach because other inputs into the watercourse appear to cause the quality to be worse downstream than at the discharge of the WwTW thus maintaining quality discharge from this WwTW will reduce the risk of further deterioration further downstream. The current ammonia quality condition on the discharge permit is also sufficient to ensure growth does not prevent the Hale Bourne from achieving its future target of 'Good' status by 2027. As there will be no deterioration in ammonia quality, no ecological features will be affected and further ecological assessment is not required.

A revised (tighter) permit is required by AMP6 to ensure that the current phosphate quality in the Hale Bourne will be maintained (i.e. 0% deterioration) for all phases of growth (up to AMP9). As with ammonia, 0% has been modelled as a precautionary approach because other inputs into the watercourse appear to cause the quality to be worse downstream than at the discharge of the WwTW, thus maintaining quality discharge from this WwTW will reduce the risk of further deterioration further downstream. This will also ensure no deterioration in phosphate status. The 0% deterioration can be achieved with conventional treatment technology. As there will be no deterioration in phosphate quality, no ecological features will be affected and further ecological assessment is not required.

5.6.7 Impacts on Ecology outside Designated Sites

Whilst the above assessment is primarily focused on the impact on ecologically designated sites, the following section discusses ecology outside of designated sites. The limitations of a WCS make it impossible for such a discussion to be exhaustive or spatially specific.

In addition to impacts on designated sites, a range of other UK or Hampshire and Surrey BAP species or otherwise protected/notable species that are found in the study area can be affected by wastewater discharge. These include:

- Water vole (protected through Wildlife & Countryside Act 1981 and a UK/ Hampshire/ Surrey BAP species),
- Grass snake (partially protected through Wildlife & Countryside Act 1981),
- Common toad (UK BAP species),
- Great crested newt (legally protected through Conservation of Habitats & Species Regulations 2010, Wildlife & Countryside Act 1981 and a UK/ Hampshire/ Surrey BAP species),
- Birds such as bittern, kingfisher (protected through Wildlife & Countryside Act 1981 and a UK BAP species), lapwing and snipe (Hampshire/ Surrey BAP species),
- Fish (UK BAP),
- Invertebrates such as white clawed crayfish (protected through Wildlife & Countryside Act 1981 and a UK/ Hampshire/ Surrey BAP species), and
- Otter (legally protected through Conservation of Habitats & Species Regulations 2010, Wildlife & Countryside Act 1981 and a UK/ Hampshire/ Surrey BAP species).

Similarly important habitats (all listed in the Hampshire and/ or Surrey BAP) include:

- Ancient semi-natural woodlands,
- Lowland wet grassland,
- Heathland,
- acid grassland,
- bog,
- Standing open water,
- Chalk stream,
- Rivers and streams,
- Canals,
- Wet woodland,
- Lowland fen,

- Reedbeds, and
- Floodplain grazing marsh.

All of these habitats and species are present (or possibly present) in the study area.

It is not possible within the scope of this commission to undertake a detailed investigation and evaluation of the impacts of the changes in water quality/flow and infrastructure to be delivered under the water cycle study on wildlife generally, since it would be necessary to undertake detailed species surveys of each watercourse and utilise detailed flow and quality data/modelling which has not been available for this commission for most watercourses.

Assessments identified that in no instances would planned future development prevent future WFD status from being achieved. In the case of phosphate on the Lower Blackwater catchment, planned future development could potentially result in an improvement in phosphate quality levels (acknowledging an alternative WFD status of 'Moderate' was provided due to pre-existing high phosphate levels). Whilst deterioration levels can be limited to no more than 10% (with the exception of ammonia quality in the River Blackwater downstream of Camberley WwTW which may result in more than 10% deterioration, but would remain within current WFD status), planned future development will result in water quality deterioration and as such could result in adverse effects on wildlife of the receiving freshwater habitats, watercourses and terrestrial habitats that interact with receiving watercourses downstream.

5.6.8 Ecological Opportunities Associated with Proposed Development Locations

To ensure that the planned level of development within the plan period does not result in a negative impact upon wildlife both inside and outside of designated sites, it is recommended that policy is included within each of the local authorities Local Plans to ensure that these matters are addressed at a strategic level and water quality at these locations will be improved to suitable WFD levels and permit levels. This may include the requirement for new infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure to ensure that the WwTWs can accommodate the increased capacity and not result in a detrimental impact upon wildlife features.

It is recommended that ecological risks associated with discharges from Camp Farm, Camberley, Eversley, Fleet, Hartley Wintney and Lightwater WwTWs, as well as the risks to the potential habitats and species that may be affected by development in the study area, should be taken into account by developers, with regard to their proposals to manage flood risks and surface water drainage on development sites. Proposals to reduce the identified risks can be incorporated into the detailed design of the developments and local green infrastructure strategies.

6 Water Supply and Demand Strategy

6.1 Introduction

Water supply for Hart, Rushmoor and the western area of Surrey Heath (includes Camberley and Frimley) is provided by SEWL, with the remainder of eastern Surrey Heath provided by AWL. Both water companies have therefore both been consulted as part of the WCS.

To determine the availability of water resources in both water company supply zones, the Water Resource Management Plans (WRMPs) for SEWL and AWL, as well as the Environment Agency Thames Catchment Abstraction Licencing Strategy (CAMS), published in May 2014, have been reviewed.

This will determine whether both water companies can accommodate the demand from the proposed new growth and consider how water efficiency can be further promoted and delivered for new homes in the housing market area.

6.2 Abstraction Licensing Strategies

An assessment of the existing environmental baseline with respect to locally available resources in the aquifers and the main river systems has been completed based on the Environment Agency's abstraction licensing strategies. The study area falls within the Thames and the Loddon abstraction licensing strategies.

The Environment Agency manages water resources at the local level through the use of abstraction licensing strategies. Within the abstraction licensing strategies, the Environment Agency's assessment of the availability of water resources is based on a classification system that gives a resource availability status which indicates:

- The relative balance between the environmental requirements for water and how much is licensed for abstraction;
- Whether water is available for further abstraction; and
- Areas where abstraction needs to be reduced.

The categories of resource availability status are shown in Table 6-1. The classification is based on an assessment of a river system's ecological sensitivity to abstraction-related flow reduction. This classification can then be used to assess the potential for additional water resource abstractions.

Table 6-1 Water resource availability status categories

Indicative Resource Availability Status	License Availability
Water available for licensing	There is more water than required to meet the needs of the environment. New licences can be considered depending on local and downstream impacts.
Water not available for licensing, due to Thames Q50	The downstream lower River Thames is classed as not having water available and consequently low flows within the Loddon waterbodies (tributaries of the Thames) are protected from consumptive abstraction to account for the flow requirements of the River Thames. A bespoke strategy for new consumptive abstractions has been produced by the Environment Agency to ensure these requirements are met.
Restricted water available for licencing	Full Licensed flows fall below the Environmental Flow Indicators (EFIs). If all licensed water is abstracted there will not be enough water left for the needs of the environment. No new consumptive licences would be granted. It may also be appropriate to investigate the possibilities for reducing fully licensed risks. Water may be available if you can 'buy' (known as licence trading) the entitlement to abstract water from an existing licence holder.
No water available for licencing	Recent actual flows are below the EFI. This scenario highlights water bodies where flows are below the indicative flow requirement to help support Good Ecological Status (as required by the Water Framework Directive (Note: the Environment Agency is currently investigating water bodies that are not supporting GES / GEP). No further consumptive licences will be granted. Water may be available if you can buy (known as licence trading) the amount equivalent to recently abstracted from an existing licence holder.

The classification for each of the Water Resource Management Units (WRMU) in the study area has been summarised in Table 6-2 for both the Loddon and Thames abstraction licensing strategies. The Loddon abstraction licensing strategy covers the majority of the study area, with the Thames abstraction licensing strategy covering the east of Surrey Heath.

The Environment Agency aims to protect the annual flow variability in rivers, from low to high flow conditions through the application of flow statistics derived from flow data collected at river gauging stations. Flow statistics are expressed as the percentage of time that flow is exceeded. Resource availability is calculated by the Environment Agency at four different flow scenarios:

- Q95 (lowest),
- Q70,
- Q50, and
- Q30 (highest).

Q_{95} is the flow exceeded for 95% of the time, and is used as a low flow indicator. Q_{30} is the flow exceeded for 30% of the time, this is considered to be a high flow. Figure 6-1 below illustrates an example gauged daily flow across a period of time and the calculated flow percentiles associated to the flow measured in the river.

Figure 6-1 Example of gauged daily flow and calculated flow statistics

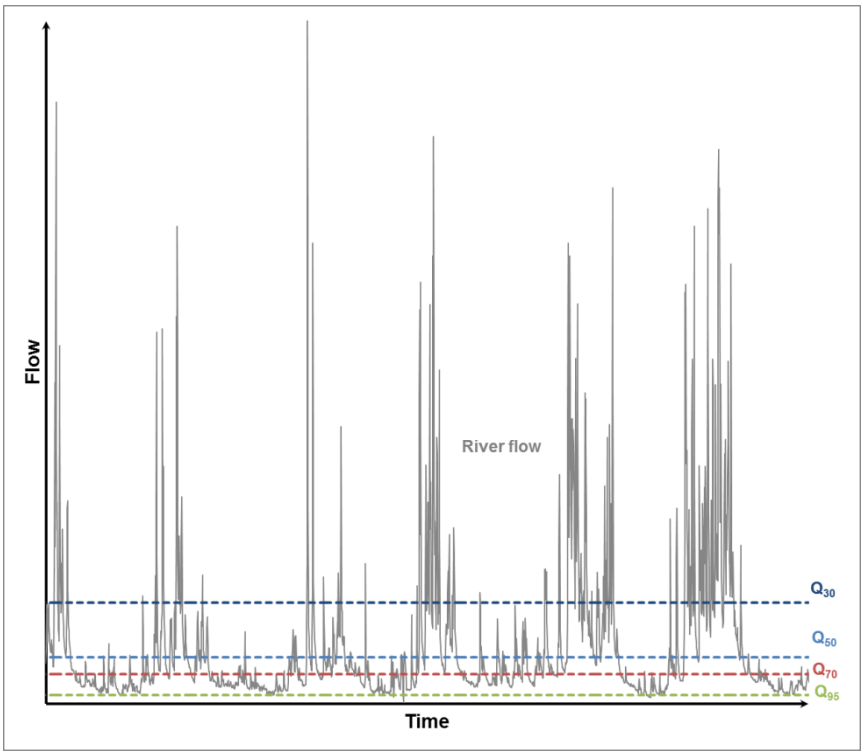


Table 6-2 Resource availability classification

River – WRMU	Surface Water (flow exceedance scenarios)				Licence restriction
	Q_{30}	Q_{50}	Q_{70}	Q_{95}	
Loddon abstraction licensing strategy					
AP5 Whitewater					• Water available for licencing during high flows. • New abstractions will be subject to HOF at Q_{64} on the Loddon and the Thames Q_{50} Hands Off Flow (HOF). • Groundwater licences which do not have a direct and immediate impact on river flow may be permitted all year.
AP6 Hart					• Water available for licencing during high flows. • New abstractions will be subject to the Thames Q_{50} HOF. • Groundwater licences which do not have a direct and immediate impact on river flow may be permitted all year.
AP7 Blackwater					
Thames abstraction licensing strategy					
AP5 Windsor Gauging Station					• Bespoke licensing strategy applies, restricted water available to abstractions less than 2Ml/d at high flows. • No water available to abstractions greater than 2Ml/d at any flow. • New abstractions will be subject to the Thames Q_{50} HOF. • Groundwater licences which do not have a direct and immediate impact on river flow may be permitted all year.

The majority of rivers in the Loddon catchment are defined as locally having water available for licencing under all flow scenarios (green), with the exception of the River Whitewater which has no water available for licensing at very low flows. The downstream lower River Thames (outside of the study area) is classed as not having water available and consequently medium to low flows within tributaries feeding the Thames (including the Loddon waterbodies) are protected from consumptive abstraction to account for the flow requirements of the River Thames.

This analysis indicates that there is limited potential for local abstractions in the Loddon catchment, whereby new abstractions will only be allowed at high flows from rivers in the Loddon catchment due to the overriding requirement of the downstream lower River Thames. Abstractions in the Thames catchment is also limited and new groundwater abstractions should demonstrate they will have no impact on river flows. Therefore, reliance on strategic water resource management and movement of water into the study area is required to sustain growth and demand for potable water.

6.3 Water Resource Planning

Water companies have historically undertaken medium to long term planning of water resources in order to demonstrate that a there is a long-term plan for delivering sustainable water supply within its operational area to meet existing and future demand.

WRMPs are a key document for a WCS as they set out how demand for water from growth within a water company's supply area can be met, taking into account the need to for the environment to be protected. As part of the statutory approval process, the plans must be approved by both the Environment Agency and Natural England (as well as other regulators) and hence the outcomes of the plans can be used directly to inform whether growth levels being assessed within a WCS can be supplied with a sustainable source of water supply.

Water companies manage available water resources within key zones, called Water Resource Zones (WRZ). These zones share the same raw resources for supply and are interconnected by supply pipes, treatment works and pumping stations. As such the customers within these zones share the same available 'surplus of supply' of water when there is more available water than demand; but also share the same risk of supply when demand for water is greater than the available supply (i.e. deficit of supply). Water companies undertake resource modelling to calculate if there is likely to

be a surplus of available water or a deficit in each WRZ by 2040, once additional demand from growth and other factors such as climate change are taken into account.

6.4 Water Resource Planning in the Study Area

The latest AWL WRMP and SEWL WRMP were published in 2014 and the information within these WRMP's has been used to inform the WCS. In reviewing both WRMP's and through liaison with AWL and SEWL it has been established that the growth figures assessed for this WCS study are catered for in the 2040 prediction of supply and demand deficits in the relevant WRZs under average conditions. Therefore, conclusions on available water supply from both WRMP's can be used directly in this study to inform and support each local authority's Local Plan.

6.5 Demand for Water

Likely increases in demand in the study area have been calculated using five different water demand projections based on different rates of water use for new homes that could be implemented through potential future policy.

The projections were derived as follows:

- **Projection 1** – Average metered consumption – New homes in Hart and Rushmoor would use 165l/h/d, this reflects the planning consumption used by SEWL to maintain security of supply, and new homes in Surrey Heath would use 175l/h/d which reflects an average of the planning consumption between SEWL and AWL;
- **Projection 2** – Low Scenario (Building Regulations) – New homes would conform to (and not use more than) Part G of the Building Regulations requirement of 125 l/h/d;
- **Projection 3** – Medium Scenario (Building Regulations Optional Requirement) – Only applies where a condition that the new home should meet the optional requirement is imposed as part of the process of granting planning permission. Where it applies, new homes would conform to (and not use more than) Part G of the Building Regulations optional requirement of 110 l/h/d;
- **Projection 4** – High Efficiency Scenario – New homes would achieve 80 l/h/d (to reflect the now superseded Code for Sustainable Homes Level of 5 or 6); and,
- **Projection 5** – Very High Efficiency Scenario – New homes would include both greywater recycling and rainwater harvesting reducing water use to a minimum of 62 l/h/d.

Using these projections, the increase in demand for water has been calculated for both housing scenarios (OAHN and DtC), and for each local authority. The results have been provided in Appendix H.

6.6 Planned Water Availability Summary

6.6.1 Water Resource Zone 6 (AWL)

AWL supplies the eastern wards of Surrey Heath, equivalent to approximately 34% of Surrey Heath's current housing stock[26]. AWL's WRZ6 covers this area and forms part of AWL's Central supply region. The Central region abstracts 60% of its water supply from groundwater sources with boreholes abstracting from chalk and gravel aquifers, with the remaining 40% abstracted from either surface water sources (WRZ6 includes three intakes on the River Thames) and bulk imports of treated water from TWUL.

Supply-Demand Strategy
AWL's assessment of available water identifies that WRZ6 does not have sufficient water for the whole of the 25 year planning period to meet its customers' need. The baseline supply and demand assessment demonstrates that WRZ6 will be in deficit from 2015/16 (-6.75Ml/d) through to 2031/32 (-15.45Ml/d).

AWL has therefore identified a number of schemes that will benefit the WRZ. This strategy ensures that AWL maintains a headroom surplus throughout the planning period. The measures include:

- Reduction of leakage through active leakage control between 2015 and 2020,
- Increase import from Thames Water (2036),
- Recommission local sources (2039), and
- Source Optimisation near Guildford (2039).

[26] Based on ONS 2011 Census data for the number of households per ward in Surrey Heath

6.6.2 Water Resource Zone 4 (SEWL)

SEWL supplies the majority of the study area, including the western wards of Surrey Heath, equivalent to approximately 66% of Surrey Heath's current housing stock. SEWL's WRZ4 covers this area, with 65% of the water supplied by 12 groundwater sources with boreholes abstracting from Chalk, Greensand and Hythe aquifers. Surface water abstractions account for 20% and the remaining 15% from bulk imports of treated water from Southern Water and AWL.

Supply-Demand Strategy
SEWL's assessment of available water identifies that WRZ4 is in surplus from 2015/16 (+21.64 Ml/d) through to 2031/32 (+6.77 Ml/d).

SEWL has identified a number of schemes that will benefit the WRZ. The measures which are proposed by SEWL to maintain the supply-demand balance show that the available supplies will be sufficient to meet expected demand. The measures include:

- Reinforce pumped delivery mains at Cookham and Boxalls,
- Leakage reductions (2015-2020),
- Ensure water efficiency (2015-2040),
- Complete Boxall's Lane groundwater scheme (2015-2020),
- Improvements to existing treatment works (2030-2040), and
- Windsor to Surrey Hills regional transfer scheme (2030-2040).

6.7 Water Efficiency Plan

In order to ensure water efficiency in the future, SEWL and AWL have both proposed plans to reduce water consumption through a series of demand management measures as agreed with the Environment Agency. It is hoped that by reducing the long term demand for water, the supply of water can be controlled to aid in ensuring that water is available in the future.

Since development within the study area is not proposed to exceed that for which both SEWL and AWL are planning, it is not necessary to evaluate the impacts of water supply in the study area independently of the WRMPs and their assessments.

However, there are several key drivers for ensuring that water use in the development plan period is minimised as far as possible. This WCS therefore includes an assessment of the feasibility of achieving a 'water neutral' position after growth across the study area.

6.8 Drivers and Justification for Water Efficiency

The study area is an area of moderate water stress[27]. Any growth and increase in population will further exacerbate this issue. In order to ensure surplus raw water supply for growth in the study area, SEWL's and AWL's WRMP's over the next 25 years are reliant on more efficient use of existing resources and demand reduction from customers. The proposals and opportunities for abstraction from existing river systems and aquifers in the supply area are limited, mainly due to the limitation on available new resources locally. Therefore looking beyond the next 25 years, further new resources would potentially need to be transferred into the area to cater for further increases in population and hence water demand. This creates a very strong driver for new homes in the next 25 years to be made as efficient as economically possible to safeguard the future resources to be made available by SEWL and AWL in the study area.

SEWL and AWL have to consider new measures to address supply and demand deficits within their respective WRZ's serving the study area. Therefore, measures should be taken to reduce demand from new property as far as possible.

6.8.1 Managing Climate Change and Availability of Water

It is predicted that climate change will further reduce the available water resources in the study area. Rainfall patterns are predicted to change to less frequent, but more extreme, rainfall events.

AWL has recognised the risk climate change poses to the three crucial areas of their business, abstraction, treatment and distribution of water. The impact of climate change on groundwater poses the most significant risks to long term supply/demand balance due to reductions in rainfall, particularly during consecutive seasons, reducing the amount of

[27] As classified by the Environment Agency
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244333/water-stressed-classification-2013.pdf

groundwater recharge that occurs. SEWL have also acknowledged the impact that climate change may have on the supply of water in their adaptation to Climate Change report (2011)[28] and the WRMP.

Customers expect AWL and SEWL to provide a continuous supply of water, but the resilience of the supply systems have the potential to be affected by the impact of climate change with severe weather-related events, such as flooding.

In planning for future water resources availability, both AWL and SEWL have accounted for the impacts of climate change within their supply-demand forecasts.

6.8.1.1 Impact on Supplies

Both water companies are required to calculate the likely impact of climate change on their water sources. AWL have calculated that climate change is likely to reduce the amount of available groundwater by up to 9.1Ml/d during peak times within AWL's WRZ6, however, AWL state that their Central region is considered to be at low vulnerability to climate change.

Climate change assessment results for SEWL's WRZ4 have indicated a reduction in the baseline of water available for use (WAFU), with the biggest reduction taking place in 2015-2020. The loss of the Greywell Pumping Station is also likely to have contributed to the decrease in baseline supplies from 2020-2040.

6.8.1.2 Impact on Demand

The main impact of climate change on demand is related to periods of extremely hot and dry weather that will increase the peak demand for water. Both AWL and SEWL have accounted for the impact on the peak demand and the longer duration effect of a dry year through forecasting the increased demand of water and accounting for it in their plans.

Although they have planned for the anticipated impacts of climate change, the view of both AWL, SEWL and other water companies is that, in order to manage the effects of climate change effectively, the single most cost effective step in water resources climate change resilience is to manage demand downwards. The reduction in demand will also help to reduce carbon emissions which aids in reducing impacts of climate change.

6.8.2 Sustainability Reductions

The AWL 2014 WRMP indicates that groundwater levels are the most significant risk to water supply. The WRMP explains that a reduction of 70Ml/d has been agreed with the Environment Agency. The potential for further sustainability reductions from 'uncertain' classification sources is also being explored.

The SEWL WRMP has identified that Greywell Pumping Station (supplies groundwater in WRZ4) is not a sustainable source for groundwater abstractions. SEWL have planned to stop abstractions at Greywell during 2020-2025 as it is having an adverse impact of Greywell Fen SSSI. Sustainability reductions for Greywell have been classified as 'certain' by the Environment Agency and a reduction of 6.8Ml/d is likely to be implemented before 2020. Abstraction from the River Thames is already constrained to 45Ml/d if the flow falls below 1,110 Ml/d.

Whilst these reductions in licenced abstraction have been considered within the WRMP, they indicate the pressure on existing sources and the limits to which they can be managed further.

6.9 Water Neutrality

Water neutrality is a concept whereby the total demand for water within a planning area after development has taken place is the same (or less) than it was before development took place[29]. If this can be achieved, the overall balance for water demand is 'neutral', and there is considered to be no net increase in demand as a result of development. In order to achieve this, new development needs to be subject to planning policy which aims to ensure that where possible, houses and businesses are built to high standards of water efficiency through the use of water efficient fixtures and fittings, and in some cases rainwater harvesting and greywater recycling.

It is theoretically possible that neutrality can be achieved within a new development area, through the complete management of the water cycle within that development area. In addition to water demand being limited to a minimum, it requires:

- all wastewater to be treated and re-used for potable consumption rather than discharged to the environment;
- maximisation of rainwater harvesting (in some cases complete capture of rainfall falling within the development) for use in the home; and
- abstraction of local groundwater or river flow storage for treatment and potable supply.

[28] http://www.southeastwater.co.uk/media/109036/ClimateChange_Adaptation_Report_Final.pdf
[29] Water Neutrality is defined more fully in the Environment Agency report 'Towards water neutrality in the Thames Gateway' (2007)

Achieving 'total' water neutrality within a development remains an aspirational concept due to the requirement for specific catchment conditions to supply raw water for treatment and significant capital expenditure. It also requires specialist operational input to maintain the systems such as wastewater re-use on a community scale.

For the majority of new development, in order for the water neutrality concept to work, the additional demand created by new development needs to be offset in part by reducing the demand from existing population and employment. Therefore, a 'planning area' needs to be considered where measures are taken to reduce existing or current water demand from the current housing and employment stock. The planning area in this case is considered to be the study area as a whole.

6.9.1 Twin-Track Approach

Attainment of water neutrality requires a 'twin track' approach whereby water demand in new development is minimised as far as possible, whilst at the same time taking measures, such as retrofitting of water efficient devices on existing homes and business to reduce water use in existing development.

In order to reduce water consumption and manage demand for the limited water resources within the study area, a number of measures and devices are available[30]. Generally, these measures fall into two categories due to cost and space constraints, as those that should be installed in new developments and those which could be retrofitted. Appendix G provides more detail on the different types of device or system along with the range of efficiency savings they could lead to.

6.9.2 Achieving Total Neutrality – is it feasible?

When considering neutrality within an existing planning area, it is recognised by the Environment Agency[31] that achievement of total water neutrality (100%) for new development is often not possible, as the levels of water savings required in the existing housing stock may not be possible for the level of growth proposed. A lower percentage of neutrality may therefore be a realistic target.

This WCS therefore considers four water neutrality targets and sets out a 'pathway' for how the most likely target (or level of neutrality) can be achieved. Appendix H discusses the pathway concept in more detail, and highlights the importance of developing local planning policy and other local policies that are not land-use related (for example, initiatives that local authorities might launch to help residents and businesses become more sustainable) for delivering aspirations like water neutrality as well as understanding the additional steps required beyond 'business as usual' required to achieve it.

6.9.3 Metering Assumptions

Installing water meters within existing residential properties is an important element of both water companies WRMPs to manage their customers' demand for water. Each of the water companies metering programmes as described in Section 6.9.3.1 and 6.9.3.2 has been applied to the four water neutrality scenarios (outlined in Section 6.9.4) and details the level of additional metering that could be undertaken.

6.9.3.1 South East Water

Water supply in Hart, Rushmoor and a western proportion of Surrey Heath[32] is managed and provided by SEWL.

The existing level of metering within the SEWL WRZ4 is 66%. SEWL's future target for meter penetration on domestic water supplies is 91% by 2032. As stated in the SEWL WRMP, meter installation will continue to a target of 92% of domestic water supplies to be metered by 2040. Therefore, the water neutrality scenarios could, in line with SEWL's WRMP, assume that 92% is achieved earlier than 2040 and instead by the end of the plan period allowing a further possible 1% meter penetration within the existing housing stock by 2032.

6.9.3.2 Affinity Water

Water supply to the eastern area of Surrey Heath[33] is managed and provided by AWL.

The existing level of metering within the AWL WRZ is 48%. AWL's future target for meter penetration on domestic water supplies is 96% by 2025 and to remain at this level up to 2032. As stated in the AWL final WRMP, meter installation will continue to the target of 96% of domestic water supplies to be metered by 2040.

6.9.4 Water Neutrality Scenarios

To achieve any level of neutrality, a series of policies, partnership approaches and funding sources would need to be developed. Further detail and examples of partnership approaches and funding sources have been provided in

[30] Source: Water Efficiency in the South East of England, Environment Agency, April 2007.
[31] Environment Agency (2009) Water Neutrality, an improved and expanded water management definition
[32] Approximately 66% of homes in the west of Surrey Heath are supplied by SEWL
[33] Approximately 34% of homes in the east of Surrey Heath are supplied by AWL

Appendix G. The preferred strategy for delivering water neutrality specific to each of the local authorities has also been provided in Appendix H.

For additional general advice, Waterwise in conjunction with the EA, DEFRA, OFWAT and the Department of Communities and Local Government published a best practice guide to water efficiency and retrofitting in 2009. This guide provides case studies and advice on how water companies, local authorities and housing providers can manage retrofitting strategies under different scenarios[34].Many different organisations and individuals have a role in water efficiency, from government departments such as Defra, DCLG and DECC to water companies, local government, building control, manufacturers, retailers, plumbers, builders, and universities, to individual businesses and households. Each organisation has a role to play within the wider context of reducing water consumption, but at present there is little or no co-ordination.

6.9.4.1 Very High Scenario

This scenario has been developed as a context to demonstrate what is required to achieve the full aspiration of water neutrality. In reality, achieving 100% meter penetration across the study area is unlikely, due to a proportion of existing properties which either have complicated plumbing or whose water is supplied by bulk (i.e. flats), making it difficult for meter installation.

The key assumptions for this scenario are that water neutrality is achieved; however it is considered as aspirational only as it is unlikely to be feasible based on:

- Existing research into financial viability of such high levels of water efficiency measures in new homes; and
- Uptake of retrofitting water efficiency measures considered to be at the maximum achievable (35%) in the study area.

It would require:

- Meter installation into all existing residential properties (100% meter penetration);
- A significant funding pool and a specific joint partnership 'delivery plan' to deliver the extremely high percentage of retrofitting measures required;
- Strong local policy within the Local Plans on restriction of water use in new homes on a local authority scale which is currently unprecedented in the UK; and
- All new development to include water recycling facilities across the study area which is currently limited to small scale development in the UK.

6.9.4.2 High Scenario

The key assumptions for this scenario are that a high water neutrality percentage[35] is achieved but requires significant funding and partnership working, and adoption of new local policy which is currently unprecedented in the UK.

It would require:

- Meter installation up to the maximum planned (up to 2040) as per SEWL and AWL WRMPs by 2032 (92% and 72% meter penetration respectively);
- Uptake of retrofitting water efficiency measures to be high (25%) in relation to studies undertaken across the UK; and
- A significant funding pool and a specific joint partnership 'delivery plan' to deliver the high percentage of retrofitting measures required.

It is considered that, despite being at the upper scale of percentage uptake of retrofitting measures, it is technically and politically feasible to obtain this level of neutrality if a fully funded joint partnership approach could be developed.

6.9.4.3 Medium Scenario

The key assumptions for this scenario are that the water neutrality percentage[36] achieved is at least 50% of the total neutrality target and would require funding and partnership working, and adoption of new local policy which has only been adopted in a minimal number of Local Plans in the UK.

It would require:

- Meter installation as per SEWL and AWL WRMPs by 2032 (91% and 65% meter penetration respectively);

[34] Water Efficiency Retrofitting: A Best Practice Guide. Waterwise 2009. Available at: http://www.waterwise.org.uk/resources.php/30/water-efficiency-retrofitting-a-best-practice-guide

[35] WN percentage refers to the percentage of water use savings made by various measures against the total new demand if the business as usual demand were to continue

[36] WN percentage refers to the percentage of water use savings made by various measures against the total new demand if the business as usual demand were to continue

- Uptake of retrofitting water efficiency measures to be reasonably high (20%) in the study area; and
- A significant funding pool and a specific joint partnership 'delivery plan' to deliver the high percentage of retrofitting measures required.

It is considered that it is technically and politically feasible to obtain this level with a relatively modest funded joint partnership approach and with new developers contributing relatively standard, but high specification water efficient homes.

6.9.4.4 Low Scenario

The key assumptions for this scenario are that the water neutrality percentage[37] achieved is low but would require small scale level of funding and partnership working, and adoption of new local policy which is likely to be easily justified and straightforward for developers to implement.

It would require:

- Meter installation as per SEWL and AWL WRMPs by 2032 (91% and 65% meter penetration respectively);
- Uptake of retrofitting water efficiency measures to be fairly low (10%); and
- A relatively small funding pool and a partnership working not moving too far beyond 'business as usual' for stakeholders.

It is considered that it is technically and politically straightforward to obtain this level with a small funded joint partnership approach and with new developers contributing standard, but water efficient homes with a relative low capital expenditure.

6.9.5 Neutrality Scenario Assessment Results

To achieve total water neutrality, the demand post growth must be the same as, or less than existing demand. Based on estimates of population size, current demand within each of the local authorities has been calculated and presented separately in Appendix H.

For each neutrality option and neutrality scenario, an outline of the required water efficiency specification was developed for new houses, combined with an estimate of the savings that could be achieved through metering and further savings that could be achieved via retrofitting of water efficient fixtures and fittings in existing property. This has been undertaken utilising research undertaken by groups and organisations such as Waterwise, UKWIR[38], the Environment Agency and OFWAT to determine realistic and feasible efficiency savings as part of developer design of properties, and standards for non-residential properties (Appendix G).

For each neutrality scenario, total demand was calculated at three separate stages for housing under both the OAHN and DtC growth scenario's as follows:

- Stage 1 – total demand post growth (OAHN and DtC) without any assumed water efficiency retrofitting for the differing levels of water efficiency in new homes;
- Stage 2 – total demand post growth (OAHN and DtC) with effect of metering applied for the differing levels of water efficiency in new homes; and,
- Stage 3 – total demand post growth (OAHN and DtC) with metering and water efficient retrofitting applied to existing homes for the differing levels of water efficiency in new homes.

The results for each local authority's OAHN and DtC growth scenarios are provided in Appendix H. The assessment of water neutrality demonstrates whether moving towards neutrality is feasible and what the technological implications might be to get as close to neutrality as possible.

6.9.6 Delivery Recommendations – Policy

In order to meet the specific water neutrality target scenario as set out for each local authority in Appendix H, specific planning policy will be required and recommendations are presented in Section 8.

When considering planning applications for new development (regardless of size), the planning authority and statutory consultees should consider whether the proposed design of the development has incorporated water efficiency measures, including (but not necessarily limited to) garden water butts, low flush toilets, low volume baths, aerated taps, and water efficient appliances.

Undertaking retrofitting and water audits must work in parallel with the promotion and education programme. Further recommendations on how to achieve it are included in Section 6.9.7 including recommended funding mechanisms.

[37] WN percentage refers to the percentage of water use savings made by various measures against the total new demand if the business as usual demand were to continue
[38] UKWIR – The United Kingdom Water Industry Research group, attended and part funded by all major UK water companies

6.9.7 Delivery Recommendations – Partnership Approaches

Housing association partners should be targeted with a programme of retrofitting water efficient devices, to showcase the policy and promote the benefits. This should be a collaborative scheme between the three councils, AWL, SEWL, and Waterwise. In addition, rainwater harvesting (RWH) and greywater recycling (GWR) schemes could be implemented into larger council owned and maintained buildings, such as schools or community centres. RWH could be introduced to public toilets. The retrofitting scheme should then be extended to non-Council owned properties, via a promotion and education programme.

A programme of water audits should be carried out in existing domestic and non-domestic buildings, again showcased by Council owned properties, to establish water usage and to make recommendations for improving water efficiency measures. The water audits should be followed up by retrofitting water efficient measures in these buildings, as discussed above. In private non-domestic buildings water audits and retrofitting should be funded by the asset owner, the cost of this could be offset by the financial savings resulting from the implementation of water efficient measures. Funding options for domestic properties are discussed above.

In order to ensure the uptake of retrofitting water efficient devices for non-council properties, the councils could implement an awareness and education campaign, which could include the following:

- working with AWL and SEWL to help with its water efficiency initiative, which has seen leaflets distributed directly to customers and at events across the region each year;
- a media campaign, with adverts/articles in local papers and features on a local news programme;
- a media campaign could be supplemented by promotional material, ranging from those that directly affect water use e.g. free cistern displacement devices, to products which will raise awareness e.g. fridge magnets with a water saving message;
- encouraging developers to provide new residents with 'welcome packs', explaining the importance of water efficiency and the steps that they can take to reduce water use;
- working with retailers to promote water efficient products;
- carrying out educational visits to schools and colleges, to raise awareness of water efficiency amongst children and young adults;
- working with neighbourhood trusts, community groups and local interest groups to raise awareness of water efficiency; and,
- carrying out home visits to householders to explain the benefits of saving water, this may not be possible for the general population of the study area, but rather should be used to support a targeted scheme aimed at a specific residential group.

6.9.7.1 Responsibility

The recommendations above are targeted at the three local authorities, AWL and SEWL, as these are the major stakeholders, although the Environment Agency and other statutory consultees can also influence future development to ensure the water neutrality target is achieved.

It is therefore suggested that responsibility for implementing water efficiency policies be shared as detailed in Table 6-3.

Table 6-3 Responsibility for implementing water efficiency

Responsibility	Responsible stakeholder
Ensure planning applications are compliant with the recommended policies	HDC, RBC and SHBC
Fitting water efficient devices in accordance with policy	Developers
Provide guidance and if necessary enforce the installation of water efficient devices through the planning application process	HDC, RBC and SHBC
Ensure continuing increases in the level of water meter penetration	AWL and SEWL
Retrofit devices within housing association, private social housing and (where present) council owned housing stock.	HDC, RBC and SHBC
Retrofit devices within privately owned housing stock (via section 106 agreements)	Developers

Responsibility	Responsible stakeholder
Promote water audits and set targets for the number of businesses that have water audits carried out. Develop approaches to liaise with the community including households (council and privately owned) and businesses where water efficient devices are to be retrofitted, to ensure the occupants of the affected properties understand the need and mechanisms for water efficiency.	HDC, RBC and SHBC
Educate and raise awareness of water efficiency	HDC, RBC, SHBC, SEWL and AWL

A major aim of the education and awareness programme, as outlined by Policy Recommendation WS5, is to change peoples' attitude to water use and water saving and to make the general population understand that it is everybody's responsibility to reduce water use. Studies[39] have shown that the water efficiencies in existing housing stock achieved by behavioural changes, such as turning off the tap while brushing teeth or reducing shower time are important and need to be considered in balance with the installation of water efficient devices.

6.9.7.2 Retrofitting funding options

In addition to possible resistance from existing householders, the biggest obstacle to retrofitting is the funding mechanism.

Water companies are embarking on retrofit as part of their response to meeting OFWAT's mandatory water efficiency targets. These programmes are funded out of operational expenditure. If a company has, or is forecasting, a supply-demand deficit over the planning period, water efficiency programmes can form part of a preferred option(s) set to overcome the deficit. However, these options are identified as part of the company's water resource management plans and will have to undergo a cost-benefit analysis.

The local authorities could consider developer contributions to the Community Infrastructure Levy (CIL) or through S106 agreements. Part 11 of the Planning Act 2008[40] (c. 29) ("the Act") provides for the imposition of a charge to be known CIL. This is a local levy that authorities can choose to introduce to help fund infrastructure in their area. CIL will help pay for the infrastructure required to serve new development, and although CIL should not be used to remedy pre-existing deficiencies, if the new development makes the deficiency more severe than the use of CIL is appropriate.

Section 106 (S106) of the Town and Country Planning Act 1990[41] allows a local planning authority (LPA) to enter into a legally-binding agreement or planning obligation with a landowner in association with the granting of planning permission, known as a Section 106 Agreement. These agreements are a way of delivering or addressing matters that are necessary to make a development acceptable in planning terms. They are increasingly used to support the provision of services and infrastructure, such as highways, recreational facilities, education, health and affordable housing.

However, there are considerable existing demands on developer contributions and it is unlikely that all of the retrofitting required in the study area could be funded through these mechanisms; they therefore need to look beyond developer contributions, possibly to the water companies, for further funding sources. Some councils offer council tax rebates to residents who install energy efficient measures (rebates jointly funded by the Council and Energy Company)[42]. The local authorities should consider a similar scheme, although this would require the agreement of AWL and SEWL.

6.9.7.3 Retrofitting monitoring

During delivery stage, it will be important to ensure sufficient monitoring is in place to track the effects of retrofitting on reducing demand form existing housing stock. The latest research shows that retrofitting can have a significant beneficial effect and can be a cost effective way of managing the water supply-demand balance[43]. However, it is acknowledged that savings from retrofitting measures do diminish with time. This means that a long-term communication strategy is also needed to accompany any retrofit programme taken forward. This needs to be supported by monitoring, so that messages can be targeted and water savings maintained in the longer-term. The communication and monitoring message also applies to new builds to maintain continued use of water efficient fixtures and fittings.

[39] Understanding household water behaviours and testing water efficiency messages. Available at: http://randd.defra.gov.uk/Document.aspx?Document=11538_IcaroConsultingReport-FINAL010813.pdf
[40] http://www.legislation.gov.uk/ukpga/2008/29/contents
[41] http://www.legislation.gov.uk/ukpga/1990/8/contents
[42] Cambridge (and surrounding major growth areas) WCS Phase 2, Halcrow, 2010
[43] Waterwise (2011): Evidence base for large-scale water efficiency, Phase II Final report

7 Major Development Site Assessment

7.1 Introduction

Following the assessment of wastewater treatment capacity and water resources, this section of the WCS addresses infrastructure capacity issues, flood risk, surface water management and SuDS suitability for each of the major development sites (sites containing more than 100 dwellings). The results are presented for each of the major development sites in Appendix I.

Due to the nature of the different growth scenarios, a range of potential future growth options at each settlement was used to provide a high level assessment.

7.2 Assessment Methodologies

7.2.1 Wastewater Network

The wastewater strategy to cater for growth requires an assessment of the capacity of the wastewater network (sewer system) to accept and transmit wastewater flows from new development to the WwTW for treatment.

The capacity of the existing sewer network is an important consideration for growth, as in some cases the existing system is already at, or over its design capacity. Further additions of wastewater from growth can result in sewer flooding in the system (affecting property or infrastructure) or can increase the frequency with which overflows to river systems occur, resulting in ecological impact and deterioration in water quality.

As the wastewater undertaker for the study area, TWUL has a general duty under Section 94 of the Water Industry Act 1991 to provide effectual drainage which includes providing additional capacity as and when required to accommodate planned development. However this legal requirement must also be balanced with the price controls as set by the regulatory body OFWAT which ensure TWUL has sufficient funds to finance its functions, and at the same time protect consumers' interests. The price controls affect the bills that customers pay and the sewerage services consumers receive, and ultimately ensure wastewater assets are managed and delivered efficiently.

Consequently, to avoid potential inefficient investment TWUL generally do not provide additional capacity until there is certainty that the development is due to commence. Where development proposals are likely to require additional capacity upgrades to accommodate new development flows, it is highly recommended that potential developers contact TWUL as early as possible to confirm flow rates and intended connection points. This will ensure the provision of additional capacity is planned into TWUL's investment programme to ensure development is not delayed and will also identify whether new infrastructure can be requisitioned by the developer.

TWUL have undertaken an internal assessment of the capacity of the network system using local operational knowledge (Appendix J).

The results are presented for each settlement within the study area in Appendix I. A RAG assessment has been undertaken; a key indicating the coding applied to each assessment is provided in

Table 7-1.

Table 7-1 Key for wastewater network RAG assessment

There are no known network constraints downstream of this site. Development is likely to be possible without upgrades.	Pumping station or pipe size may restrict growth; a pre-development enquiry is recommended before planning permission is granted, and network modelling may be required to assess the scope of any capacity improvements.	There is limited capacity in the network; network modelling will be required to assess the scope of any capacity improvements to determine an appropriate solution required to prevent further CSO discharges or sewer flooding.

7.2.2 Water Supply

In addition to available water resources, there is a requirement to consider whether there is the infrastructure capacity to move water to where the demand will increase. From a water supply perspective there is no strategic limitation on growth as water companies have the duty to supply water regardless of the level of growth. However, the key

importance from the water supply perspective is ensuring the precise location of growth is captured in the next Water Resources Management Plan for AMP7. This will ensure potential deficits in the supply-demand balance are foreseen and options can be identified to mitigate future challenges.

AWL and SEWL have undertaken an assessment of the capacity of the water supply system using local operational knowledge (Appendix A). A RAG assessment has been undertaken; a key indicating the coding applied to each assessment is provided in Table 7-2.

Table 7-2 Key for water supply network RAG assessment

Capacity available to serve the proposed growth	Infrastructure and/or treatment upgrades required to serve proposed growth or diversion of assets may be required	Major constraints to the provision of infrastructure and/or treatment to serve proposed growth

7.2.3 Flood Risk

7.2.3.1 Fluvial

The flood risk to each of the large development sites has been considered using the Environment Agency Flood Maps. The percentage of development site area within each Flood Zone has been provided. The Strategic Flood Risk Assessment's (SFRA) for each of the partner authorities have also been used to help identify the risk of fluvial flooding at each development site.

7.2.3.2 Surface Water Flood Risk

Surface water flooding has been reviewed for each of the large development sites using the Risk of Flooding from Surface Water (RoFSW)[44] mapping produced by the Environment Agency.

7.2.4 Surface Water Management

Surface water drainage methods that take account of run-off rates, water quality, pollution control, biodiversity and amenity issues are collectively referred to as Sustainable Drainage Systems (SuDS). Sustainable surface water management takes account of long term environmental and social factors in designing a surface water drainage system that avoids the problems of flooding, pollution or damage to the environment that may occur with conventional surface water management systems. SuDS can therefore offer multiple benefits including enhancing local biodiversity, creating wildlife links for species movement, providing groundwater recharge and affording climate change adaptation.

The National Planning Policy Framework (NPPF) sets out that proposed development should ensure runoff rates from the development are no greater than pre-development rates and for developments requiring a flood risk assessment, discharge should be reduced to mitigate against the impacts of climate change.

The government published a ministerial statement (HCWS161)[45] on sustainable drainage systems on 18th December 2014 whereby decisions on planning applications relating to major development must ensure that sustainable drainage systems for the management of runoff are put in place, unless demonstrated to be inappropriate. Additionally, applicants must demonstrate that the proposed minimum standards of operation are appropriate and that there are clear arrangements in place for ongoing maintenance.

7.2.5 SuDS and Groundwater Protection

When considering infiltration SuDS, developers should consider the following with respect to protection of groundwater quality in the study area. Groundwater Source Protection Zones (SPZs) 1, 2 and 3 are located in the south of the Hart District, whilst Rushmoor and Surrey Heath contain no SPZ's, as identified in the Environment Agency's Groundwater Map[46]. With respect to growth in the south of the Hart District, groundwater is potentially vulnerable and there is an increased potential for pollution from inappropriately located and/or designed infiltration SuDS.

The Environment Agency support the use of SuDS for new discharges and state that where infiltration SuDS are to be used for surface run-off from roads, car parking and public or amenity areas, a suitable series of treatment steps should be provided to prevent the pollution of groundwater[47]. Where infiltration SuDS are proposed for anything other than

[44] Previously referred to as the updated Flood Map for Surface Water (uFMfSW)
[45] http://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2014-12-18/HCWS161/
[46] http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683&y=355134&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=groundwater
[47] Environment Agency (2013) Groundwater protection: Principles and practice (GP3)

clean roof drainage in a SPZ1 the Environment Agency will require a risk assessment to demonstrate that pollution of groundwater would not occur.

SPZ's within the study area should therefore be taken into account when planning SuDS as part of developments. The following considerations should be taken into account with respect to infiltration SuDS:

- Soakaways and other infiltration SuDS must not be constructed in contaminated ground. The use of infiltration drainage would only be acceptable if a phased site investigation (in line with CLR11, 'Model Procedures for the Management of Land Contamination') showed the presence of no significant contamination. The use of non-infiltration SUDS may be acceptable subject to agreement with the Environment Agency. More information on SuDS is available in the SuDS Manual produced by CIRIA48.
- The Environment Agency considers that deep boreholes and other deep soakaways systems are not appropriate in areas where groundwater constitutes a significant resource. Deep soakaways increase the risk of groundwater pollution.

7.2.6 Main Rivers

Under the Water Resources Act, the Environment Agency is the permitting Authority for main rivers, and any works in, over, under or near a main river or a flood defence will need a flood risk activity permit. A main river is a watercourse that is shown on a main river map and includes any structure or appliance for controlling or regulating the flow of water into, in or out of the channel.

Developers need to obtain an Environmental Permit to ensure that their activities do not cause or make existing flood risk worse, interfere with Environment Agency work, and do not adversely affect the local environment, fisheries or wildlife.

This assessment considers the impact of future development on the water environment at a site-specific scale, in addition to the wastewater assessment in Section 4.5 which has been undertaken at regional scale. The following site specific considerations should be taken into account when reviewing planning applications of future development sites:

- The culverting and straightening of watercourses should be avoided as these activities impact on the ecology and geomorphology of a watercourse and therefore risk compromising WFD objectives;
- Where watercourses have in the past been culverted or straightened, the opportunity to reinstate a more natural landscape should be explored where new developments contain a watercourse or are situated alongside a watercourse which may help to achieve a future WFD objective; and
- Each development should aim to enhance the quality of the local watercourse, for example, through the provision of new ecological habitat or the incorporation of SuDS within the development to improve the quality of surface water runoff entering the watercourse.

7.2.7 Odour Assessment

Where new development increases proximity of the urban area to existing WwTWs, odour may become a cause for nuisance and complaints from residents. Managing odour at WwTWs can add considerable capital and operational costs, particularly when retro-fit to existing WwTWs.

National Planning Policy Guidance recommends that plan-makers considering whether new development is appropriate near to sites used for water and wastewater infrastructure, in particular due to the risk of odour impacting on residents and requiring additional investment to address.

A RAG assessment has been undertaken and a key indicating the coding applied to each assessment is provided in Table 7-3.

Table 7-3 Key for water supply network RAG assessment

Site is located more than 800m from a WwTWs and therefore unlikely to be impacted by odour	Site is located within 800m of a WwTWs, but does not encroach closer than existing urbanised area. An odour impact assessment may be required.	Site is located within 800m of a WwTWs and encroaches closer than the surrounding existing urbanised area. There may also be confirmed odour issues. An odour impact assessment will be required.

[48] The SuDS Manual (C753) (2015). Available at http://www.ciria.org/ItemDetail?iProductCode=C753&Category=BOOK&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91

8 Water Cycle Study Recommendations

Based on the findings of the various WCS assessments, this section of the WCS sets out recommendations for ongoing and future updates to the Council's Local Plans. These recommendations have been provided to ensure that adverse impact on the water environment is minimised as a result of development arising from the Local Plan process.

Implementation of the recommendations would also aid in creating an evidence base that demonstrates the water, wastewater and water quality requirements of the NPPF have been met in the Local Plan process. Each Council will need to take a balanced, locally relevant, pragmatic approach when integrating the findings of this WCS into the formulation of Local Plan updates.

8.1 Wastewater

Development in the Camberley WwTW catchment
It is recommended that the Council's consider embedding a development control policy within their respective Local Plans to require that developers provide evidence to them that they have consulted with TWUL regarding wastewater treatment capacity, and the outcome of this consultation, prior to development approval. The Councils should consider the response from TWUL when deciding if the expected timeframe for the development site in question is appropriate.

It is recommended that any planning permission for Major Development proposed to drain to Camberley WwTW up to 2020, is subject to consultation with and discharge of any conditions imposed by the Environment Agency and TWUL. Prior to development, both organisations should be satisfied that the development can be accommodated either within the limits of capacity at the WwTW or by sufficient additional capacity being made available, and that the water quality requirements of the WFD will not be compromised.

If necessary, a Grampian condition could be imposed by the respective local authority, prohibiting development authorised by the planning permission or other aspects linked to the planning permission (e.g. occupation of dwellings) until the provision of the necessary infrastructure to accept the additional flows.

Development in the Lightwater WwTW catchment
It is recommended that Surrey Heath Borough Council consider embedding a development control policy within their Local Plan to require that developers provide evidence to them that they have consulted with TWUL regarding wastewater treatment capacity, and the outcome of this consultation, prior to development approval. The Council should consider the response from TWUL when deciding if the expected timeframe for the development site in question is appropriate.

It is recommended that any planning permission for Major Development proposed to drain to Lightwater WwTW up to 2020, is subject to consultation with and discharge of any conditions imposed by the Environment Agency and TWUL. Prior to development, both organisations should be satisfied that the development can be accommodated either within the limits of capacity at the WwTW or by sufficient additional capacity being made available, and that the water quality requirements of the WFD will not be compromised.

If necessary, a Grampian condition could be imposed by Surrey Heath Borough Council, prohibiting development authorised by the planning permission or other aspects linked to the planning permission (e.g. occupation of dwellings) until the provision of the necessary infrastructure to accept the additional flows.

Treatment Capacity Review
It is recommended that each Council continues to update both TWUL and STS on future development phasing and changes to growth allocations to ensure that plans for WwTW upgrades in response to permit change requirements or flow capacity constraints take account of the most up to date planning position. All Major Development at sites which are located within the catchments of the WwTWs assessed within this WCS, should be subject to a pre-development enquiry[49] with TWUL at an early stage, and if possible before submitting a planning application, to determine process capacity at the WwTW prior to planning permission being granted.

Development and the Sewerage Network
It is recommended that Major Development sites assessed by TWUL as part of the WCS as having medium to very high wastewater network constraints should be subject to a pre-development enquiry[49] with TWUL at an early stage, and if

[49] Pre-development enquiries to TWUL can be made via the Thames Water website: https://developers.thameswater.co.uk/developing-a-large-site/planning-your-development/wastewater

possible before submitting a planning application, to inform the asset management plans prior to planning permission being granted. Assessments made within this WCS consider each site in isolation and network capacity will change depending on when and where sites come forward.

Development Outside of the Study Area
Communication with neighbouring local authorities, as part of the Councils duty to co-operate, should be pursued, to ensure that future WCS assessments closely represent the future growth scenarios at WwTWs which receive growth from within and outside the study area, and therefore more accurately assesses available environmental capacity.

8.2 Water Supply

Water Efficiency in new homes and buildings
The Council's should consider embedding a development control policy within their respective Local Plans', requiring developers to show how, through the installation of certain components and fittings, water use per person per day for new homes meets the specific water use standard of 110 l/h/d in line with the Building Regulations Optional Requirement (the Regulations already require developers to submit such evidence before a completion certificate can be granted) in order to reduce demand from new property as far as possible. Non-domestic building should as a minimum reach 'Good' BREEAM status.

Water Efficiency Retrofitting
In order to move towards a more 'water neutral position' throughout the study area, each Council should seek to advocate the achievement of further water efficiency savings through their planning policies and development control. It is recommended that each Council adopts a facilitating role of encouraging private landlords, owner-occupiers and businesses to retrofit existing dwellings and non-domestic buildings.

Water Supply Demand Balance
It is recommended that each Council continues to update both SEWL and AWL on future development phasing and changes to growth allocations to ensure the future supply-demand balance can be appropriately captured in the next asset planning period (AMP7).

8.3 Surface Water Management and Flood Risk

Sewer Separation
Developers should ensure foul and surface water from new development and redevelopment are kept separate where possible. Surface water should be discharged as high up the following hierarchy of drainage options as reasonably practicable, before a connection to the foul network is considered:

- into the ground (infiltration);
- to a surface waterbody;
- to a surface water sewer or another drainage system[50];
- to a combined sewer.

Where there are sites which are currently connected to combined sewers are redeveloped, the opportunity to disconnect surface water and highway drainage from combined sewers must be taken. This approach will also aid in improving capacity constraints at WwTWs.

SuDS and Green Infrastructure
Developers should ensure linkage of SuDS to green infrastructure to provide environmental enhancement and amenity, social and recreational value as well as improvements in quality of discharge. SuDS design should maximise opportunities to create amenity, enhance biodiversity, and contribute to a network of green (and blue) open space. The Defra funded Local Action Toolkit[51] can be applied to urbanised/urbanising environments to identify how SuDS and Green Infrastructure can be most effectively applied in a constrained urban setting, while also considering the benefits of biodiversity and natural capital.

With climate change the region can anticipate increases in temperature but also increases in the intensity, frequency and duration of storm events. SuDS can play a role in helping to offset some of these changes, for example through evaporative cooling lost as a result of urbanisation, as well as reducing the surface water runoff during storm events, helping to offset flood risk and improve water quality downstream. Further information on Climate Change Adaptation is

[50] Hampshire County Council does not accept surface water discharge from development into the highway drainage system.
[51] Available at: http://urbanwater-eco.services/

available from Natural England[52]. The councils may wish to commission an assessment to explore potential expansion of SuDS within the region, including greater retrofitting and the potential impacts on flood risk and water quality.

SuDS and Water Efficiency
Developers should ensure linkage of SuDS to water efficiency measures where possible, including rainwater harvesting.

Linkages to SWMP and SFRA
Developers should ensure the design and long term maintenance of SuDS supports the findings and recommendations of the Rushmoor Surface Water Management Plan (SWMP) and the appropriate Council's SFRA.

Water Quality Improvements
Developers should ensure, where possible, that discharges of surface water are designed to deliver water quality improvements in the receiving watercourse or aquifer where possible to help meet the objectives of the Water Framework Directive.

8.4 Ecology

Biodiversity Enhancement
It is recommended that the Council's consider embedding a development control policy within their respective Local Plans' which commits to seeking and securing (through planning permissions, etc.) enhancements to aquatic biodiversity within their administrative areas through the implementation of SuDS as a part of general Green Infrastructure principles. Types of SuDS could include rain gardens, green roofs, retention ponds and wetlands (subject to appropriate project-level studies to confirm feasibility including environmental risk and agreement with relevant authorities). These opportunities can be incorporated into the detailed design of developments and local green infrastructure plans.

8.5 Further Recommendations

Stakeholder Liaison
It is recommended that key partners involved in the development of the WCS maintain regular consultation with each other as development proposals progress. It is also recommended that STS are considered in future development consultations.

WCS Review
Development phasing and new sites should be monitored by the Councils when future development plans evolve, to enable continued assessment on water supply and wastewater treatment. Where growth is expected to be significant, the Councils should consider carrying out an update to the WCS to account for additional growth. In any future updates to the WCS, note should be taken of changes to the various studies and plans that support it; including:

- Five yearly reviews of AWL's and SEWL's WRMP (the next full review is due in 2019, although interim reviews are undertaken annually); and
- Periodic review 2019 (PR19) (TWUL's business plan for AMP7 – 2020 to 2025).

[52] Natural England. June 2014. Climate Change Adaptation Manual - Evidence to support nature conservation in a changing climate (NE546). Available at: http://publications.naturalengland.org.uk/publication/5629923804839936

About AECOM

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