Elmbridge Outline Water Cycle Study: Phase 2- Outline Report

Elmbridge Borough Council

Project Number 60565750

FINAL

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Quality information

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List of Acronyms

AMP	Asset Management Plan
AWS	Affinity Water Services
BAP	Biodiversity Action Plan
BGS	British Geological Survey
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
CRC	Carbon Reduction Commitment
CSH	Code for Sustainable Homes
DEFRA	Department for Environment, Food and Rural Affairs
DWF	Dry Weather Flow
DYAA	Dry Year Annual Average
DYCP	Dry Year Critical Period
EA	Environment Agency
EFI	Environmental Flow Indicator
EBC	Elmbridge Borough Council
GI	Green Infrastructure
l/h/d	Litres/head/day (a water consumption measurement)
LCT	Limits of Conventional Treatment
LFE	Low Flow Enterprise (low flow model)
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LPA	Local Planning Authority
Ml	Mega Litre (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)
ONS	Office for National Statistics
OR	Occupancy Rate
P	Phosphorous
Q95	The river flow exceeded 95% of the time
RAG	Red/Amber/Green Assessment
RBMP	River Basin Management Plan
RoC	Review of Consents (under the Habitats Directive)
RoFSW	Risk of Flooding from Surface Water
RQP	River Quality Planning (tool)
S106	Section 106 (Town and Country Planning Act 1990)
SAC	Special Area for Conservation
SCC	Surrey County Council
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SUDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
TWUL	Thames Water Utilities Limited
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
STW	SewageTreatment Works
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

Executive summary

Elmbridge Borough Council is a preparing a new Local Plan that will deliver housing growth over a 15 year planning period. There is significant pressure to deliver new homes in the Borough as the need for housing has increased. This growth represents a challenge in ensuring that both the water environment and water services infrastructure has the capacity to sustain the level of growth and development proposed.

This Outline Water Cycle Study (WCS) forms an important part of the evidence base that will help Elmbridge Borough Council determine the most appropriate options for development within the Borough (with respect to water infrastructure and the water environment) to be identified in the Council's new Local Plan which will cover a 15 year period.

In addition, planned and proposed future development throughout the Borough has been assessed with regards to water supply capacity, wastewater capacity and environmental capacity. Any water quality issues, associated water infrastructure upgrades, 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 the development sites presented in the two different housing scenarios assessed, including recommendations on the policy required to deliver it.

Two housing growth scenarios have been assessed in this WCS, one which focuses on urban optimisation only and one which considers a combination of urban optimisation and partial Green Belt release.

Wastewater Strategy

Wastewater Treatment

The WCS identifies that two Sewage Treatment Works (STWs) will serve the proposed future development across the Borough: Esher STW, discharging to River Mole, and Weybridge STW, discharging to the River Wey. Both STWs would receive significant additional wastewater volumes from proposed growth. Assessment has identified that both STWs have capacity to treat the additional wastewater flows, but because of the significant volume of wastewater generated, assessment of the impact of increased pollutant load on the water quality targets of the watercourses receiving the treated flow was required. Water quality modelling was therefore undertaken.

The assessments showed that WFD objectives could be met for all proposing housing scenarios without the need for significant upgrade to treatment infrastructure. To limit deterioration to within 10% of current quality, the Environment Agency may need to consider imposing a slightly tighter permit condition for Phosphate to Esher STW, but this is a non-legislative driver and if required, could be delivered towards the end of the Local Plan period, allowing Thames Water to make provision for the investment in the 2025 Business Plan. This would mean no significant impact on phasing of proposed housing numbers assessed in this WCS. Additionally, the modelling results of discharges from Weybridge STW demonstrated that utilising the headroom would not result in risk of non-compliance with water quality objectives in the River Wey since the impact of flows from Weybridge STW on water quality in the River Wey is minor.

To ensure that the planned level of future 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 the Local Plan to ensure that these matters are addressed at a strategic level.

Water Supply Strategy

Based on the growth assessed, allowing for the planned resource management for Affinity Water's, Thames Water Utilities' and Sutton and East Surrey Water's supply areas in the Borough, the water supply companies would have adequate water supply to cater for growth over the plan period.

Nevertheless, 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 Borough 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 use across the plan period. 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 Borough 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 water efficiency in the Borough. The assessment concludes that in all cases the following measures should be taken to move towards a more water efficient position:

- Carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings.
- Aim to move towards delivery of 12% 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.

Overall impact of development

In order to support the further development of the new Local Plan with respect to water services infrastructure and the water environment, the WCS also provided a site specific assessment of the potential constraints of the housing sites (including Completed sites, sites with Planning Permission, sites Under Construction, LAA sites and Green Belt sites) identified in the two housing scenarios. No major constraints were observed in the RAG assessment, although a minority of sites will require significant investment in new network infrastructure (for either wastewater or water supply), which may pose a phasing risk for these sites.

1. Introduction

1.1 Background

1.1.1 Elmbridge Borough is situated in the north of Surrey, immediately south-west of London. The area is bordered in the north east by the River Thames and the administrative areas of Spelthorne Borough and the Royal Borough of Richmond upon Thames; to the east by the London Borough of Kingston upon Thames; to the south by Mole Valley District and Guilford Borough; and to the west by the Boroughs of Woking and Runnymede. Elmbridge covers an area of approximately 96km^2; of which approximately 58% is Green Belt and 42% is urban area.

1.1.2 Elmbridge Borough Council (EBC) is currently preparing a new Local Plan which will set out the level of development required in the Borough over the next 15 years to meet identified needs, including those for housing, employment and retail.

1.1.3 This Outline 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 Borough. 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 new Local Plan.

1.2 WCS History

1.2.1 A Scoping WCS baseline was completed in May 2018. The overall goals of this Scoping Study were to establish the required baseline data, identify gaps in knowledge and identify the appropriate organisations to inputs to the study. This study was carried out in advance of the two different housing scenarios assessed in this study and, as such, only covered specific elements set out in the Environment Agency Thames Region guidance.

1.2.2 The Scoping WCS identified that the Borough of Elmbridge is served by Esher, Hogsmill, Leatherhead, Mogden, Weybridge and Wisley Sewage Treatment Works (STWs), with the majority of Elmbridge draining to Esher (83%) and Weybridge (16%).The study concluded that only Esher and Weybridge WCS needed to be considered for further assessment.

1.2.3 In terms of water quality, the Scoping Study concluded that water Industry activities are one of the primary reasons for three of the waterbodies failing to reach required water quality and ecological standards. The increase in treated wastewater discharge from growth therefore has the potential to adversely affect the quality of the receiving watercourses, and could further prevent these surface waterbodies reaching their required condition.

1.2.4 A high level review of capacity at Esher and Weybridge STWs within the Scoping Study indicated that, both STWs were likely to have capacity to accept the calculated additional wastewater flow from proposed growth; however, it was unknown whether increasing treated flow would impact the ability of receiving watercourses to achieve water quality targets set under the requirements of the EU Water Framework Directive. Additionally, an increase in treated flow from both STWs could potentially have a detrimental impact on the ecology of locally significant or nationally significant sites due to hydrological connectivity to the STWs in the Borough. Assessment of water quality and ecological impacts of additional treated wastewater discharge was concluded as a requirement of an Outline WCS.

1.2.5 With respect to water supply, the Scoping Study concluded that the water supply companies serving the Borough had planned measures for meeting future water demand (within their statutory water resources planning process). A further detailed assessment of water resources, including the proposed growth, will be implemented for the Outline WCS.

1.3 Study Governance

1.3.1 This WCS has been carried out with the guidance of the Steering Group established at the project inception meeting, held on 14th November 2018, comprising the following organisations:

- Environment Agency; and

- Elmbridge Borough Council.

1.3.2 The study has been undertaken following discussions, and using the data provided by the following key stakeholders:

- Affinity Water Services;
- Thames Water Utilities Ltd;
- Environment Agency; and
- Elmbridge Borough Council.

1.4 Outline WCS Scope

1.4.1 This WCS provides information at a level suitable to ensure that there are solutions to deliver the two housing growth scenarios assessed, including the policy required to deliver it. The outcome is the development of a water cycle strategy for the Borough which informs the Council's new Local Plan, sustainability appraisals and appropriate assessments specific to the water environment and Water Services Infrastructure (WSI) issues.

1.4.2 The following sets out the key objectives of the Outline WCS, as informed by the Scoping WCS (2018):

- Determine the necessary permit conditions for the STWs in order to meet WFD standards in the watercourses receiving discharges;
- Confirm whether the existing permits need revising, and determine any associated treatment upgrade works to meet permit requirements and hence accommodate the projected growth in Elmbridge;
- Determine whether upgrades to the wastewater treatment process at each STW are required;
- Undertake an ecological assessment to determine whether water dependent designated sites may be impacted by the pressures of development in the catchment;
- Undertake a water efficiency assessment to support water efficiency policy in the Local Plan in relation to the water resource availability issues highlighted in the Scoping Study;
- Undertake a water supply network assessment in liaison with Thames Water Utilities Ltd (TWUL), Affinity Water Services and Sutton and East Surrey Water to identify potential infrastructure constraints that will require future investment to accommodate the proposed growth;
- Undertake a wastewater network capacity assessment, in liaison with TWUL, to identify potential infrastructure constraints that will also require future investment to accommodate the proposed growth; and;
- Further investigate (in collaboration with TWUL and Surrey County Council (SCC) in relation to locations of known sewer flooding, particularly where surface water is entering the foul sewer network, to ensure new development does not exacerbate known problems and where possible alleviates existing risk.

1.5 Key Assumptions and Conditions

Water Company Coverage

1.5.1 Affinity Water Services, Thames Water Utilities and Sutton and East Surrey Water are all potable water suppliers in the Borough of Elmbridge. Each water provider supplies approximately one third of the Borough of Elmbridge in terms of geographical coverage.

1.5.2 TWUL is the sole wastewater undertaker for the Borough.

Affinity Water Services

1.5.3 The area of the Borough which is supplied by AWS is covered by Water Resource Zone (WRZ) 6 (part of the Central Region), also known as the Wey WRZ. According to the Affinity Water Services Draft Revised Water Resources Management Plan (2019)[1], hereafter called AWS dWRMP19, the Per Capita Consumption (PCC) target is 129 l/h/d by 2025 compared to the 2016/17 average consumption of 152 l/h/d.

Thames Water Utilities

1.5.4 The area of the Borough supplied by TWUL is covered by the London WRZ. According to the Thames Water Draft Revised Water Resources Management Plan (2019)[2] hereafter called TWUL dWRMP19, the PCC for the London WRZ is identified as 147.2 l/h/d for 2016/17.

Sutton and East Surrey Water

1.5.5 The Sutton and East Surrey Revised Draft Water Resources Management Plan (2019)[3], hereafter called SES dWRMP19, identifies that the PCC for a normal year is150 l/h/d.

Water Use

1.5.6 For the water supply assessment, the PCC across AW, TWUL and SES have been averaged, which gives an value of 149.7 l/h/d. It is acknowledged that the 149.7 l/h/d assumption exceeds the current Building Regulations part G[4] requirement of 125 l/h/d for all new homes. The 125 l/h/d requirement is an aspirational target only and water companies are required under their remit to the economic regulator of the water sector (OFWAT) to plan for the expected water use.

1.5.7 For the wastewater assessment, a different assumption was made on the per capita flow values, current and forecast until 2035, for Esher and Weybridge STW and the total wastewater per capita flow was calculated as a weighted average between these two Works. In addition, to account for infiltration of surface water, groundwater and misconnections to the sewer network in the future, an additional proportion (30%[5]) was included in the calculations for 'unaccounted for' flows.

Household Occupancy Rate

1.5.8 The latest Office for National Statistics (ONS) population and household projections[6] have been used to determine the occupancy rate of each household coming forward in the plan period and have been provided in Table 1-1 Calculation of Occupancy Rate below.

Table 1-1 Calculation of Occupancy Rate

	Projection for 2035
Population	144,210

[1] Affinity Water (2019). Final Draft Water Resources Management Plan. Available at: https://www.affinitywater.co.uk/docs/Draft_Final_Water_Resources_Management_Plan_2019_Published_June_2019.pdf
[2] Thames Water Utilities (2019). Draft Revised Water Resources Management Plan. Available at: https://corporate.thameswater.co.uk/about-us/our-strategies-and-plans/water-resources
[3] Sutton and East Surrey Water (2019). Revised Draft Water Resources Management Plan. Available at: https://www.waterplc.com/pages/about/WRMP/
[4] Building Regulations Approved Document G (2016). Sanitation, hot water safety and water efficiency (2016 with 2016 amendments). Available at: https://www.planningportal.co.uk/info/200135/approved_documents/69/part_g_-_sanitation_hot_water_safety_and_water_efficiency
[5] TWUL advised an infiltration rate of maximum 30% should be applied for new development.
[6] Office of National Statistics (2016). May 2016 - Household projections for England. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland

	Projection for 2035
Number of households	60,921
Calculated Occupancy Rate (people per household)	2.37

Wastewater Treatment

1.5.9 As a wastewater treatment provider, TWUL 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 the STW permit conditions are met.

1.5.10 Through application of the best available technologies 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 1-2.

Table 1-2 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
Phosphate	0.25 mg/l annual average[9]

1.6 Report Structure

1.6.1 Section 2 of this report provides a summary of the study drivers. Section 3 of this document then 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 assessment stage of the study (reported in Section 4) assessing the current wastewater treatment facilities in regards to both capacity and compliance with legislation and environmental permits. The wider, supporting environment has also been considered, including climate change and local ecology.

1.6.2 In parallel to the wastewater assessment, Section 5 outlines the emerging update to water resource planning and discusses the water efficiency plan for Elmbridge.

1.6.3 The report includes a water cycle infrastructure assessment of proposed major development sites in Housing Scenario 1 and Housing Scenario 2 (defined as having more than 10 dwellings) in more detail (Section 6), 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 and water supply network.

1.6.4 Ultimately, recommendations have been made as part of the WCS (Section 7) in regard 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] National Asset Management Plan 6 (AMP6) trials to investigate new sewage treatment technologies to reduce Phosphate treatment were completed in 2017 and a new Technically Achievable Limit (TAL) of 0.25 mg/l for Phosphate has been agreed between water companies and the Environment Agency. This new limit is being used for current AMP7 planning work.

2. Study Drivers

2.1 Introduction

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

a. 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 Plan meets with the requirements of the National Planning Policy Framework (NPPF) with respect to water, wastewater and water quality; and

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

2.1.2 A full list of the key legislative drivers shaping the study is detailed in a summary table in Appendix A for reference.

2.1.3 Other relevant studies that have a bearing on the provision of water services infrastructure for development are provided in Appendix B and include, but are not limited to, key documents including the Water Companies' Water Resources Management Plans and the Environment Agency's latest Thames RBMP (2015).

2.2 OFWAT Price Review

2.2.1 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.

2.2.2 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]

2.3 Water Framework Directive

2.3.1 The environmental objectives of the WFD 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

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

- 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.

2.3.2 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.

Source: Environment Agency RBMPs

2.3.3 This Outline WCS is a key evidence base to demonstrate how compliance with the WFD objectives will not be compromised by the proposed growth as set out in the Borough's Local Plan.

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

3. Future Housing Growth

3.1 Future Housing Growth Options

3.1.1 The purpose of the WCS is to assess the potential impact of increased development upon the water environment and WSI across Elmbridge, including water resources, wastewater infrastructure, water quality, flood risk, surface water drainage and aquatic ecology. The minimum number of homes Elmbridge Borough Council is required to plan for has increased since the Core Strategy was adopted in 2011. According to the Elmbridge Borough Council Housing Delivery Action Plan (2019)[12] Elmbridge has a minimum requirement of 623 new homes per year[13] so over a Local Plan period of 15 years this equates to a need for 9,345 new homes.

3.1.2 Figure 3-1 illustrates EBC's administrative boundary, main towns, and watercourses within Elmbridge.

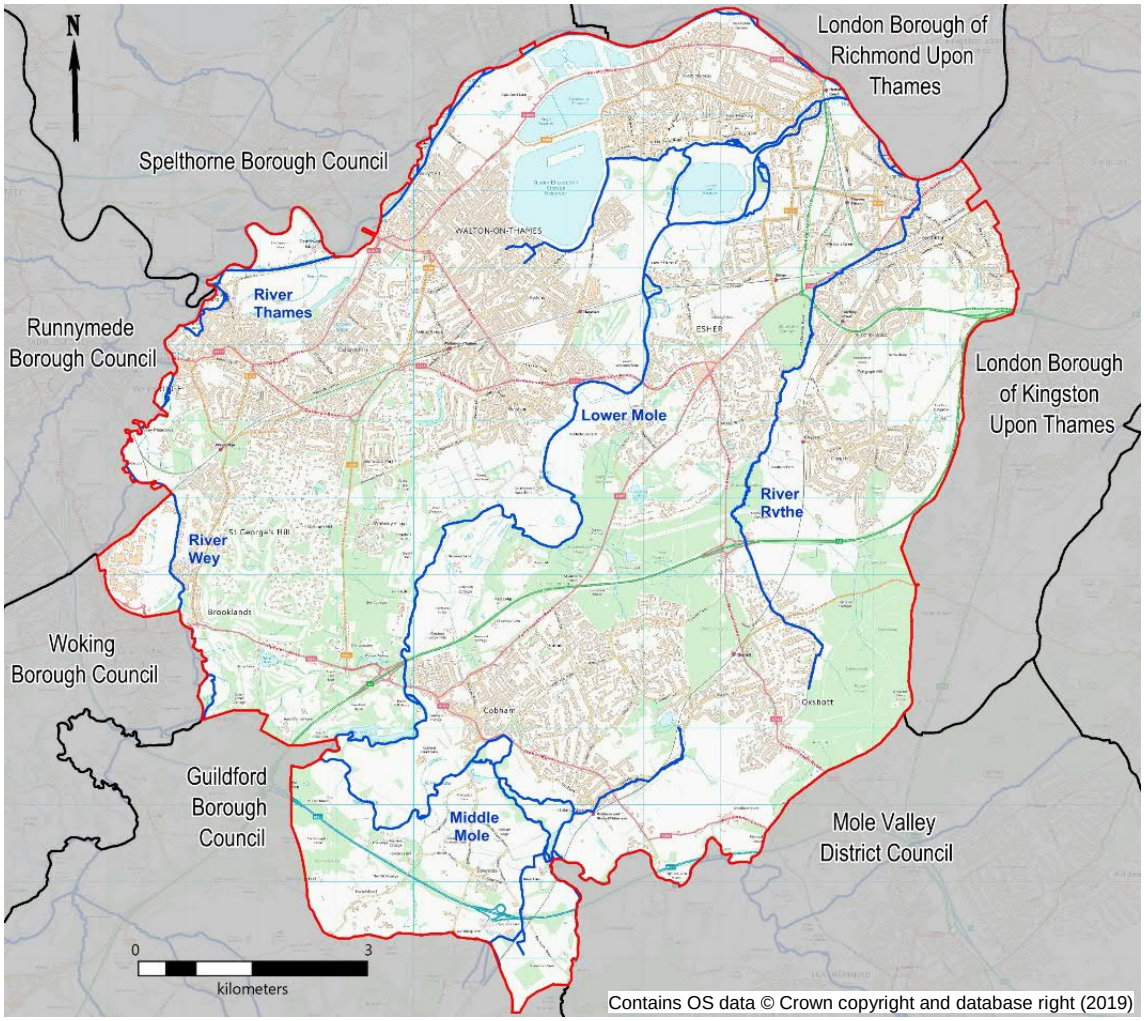


Figure 3-1 Overview of the study area

3.2 Housing

3.2.1 EBC provided two housing scenarios to be assessed.

- **Housing Scenario 1** looks at an urban optimisation strategy including; sites to be completed, sites with planning permission, sites under construction, as well as sites incorporated in the Land Availability Assessment (LAA).

[12] Elmbridge Borough Council (2019). Housing Delivery Action Plan. Available at: https://www.elmbridge.gov.uk/planning/planning-policy/monitoring-reports-action-plans-and-article-4-directions/
[13] Based on 2014 population projections

- **Housing Scenario 2** considers a combination of urban optimisation and partial Green Belt release including the abovementioned 'Scenario 1' sites, as well as sites within Green Belt areas.

3.2.2 Table 3-1 provides an overview of the number of new dwellings being considered in Housing Scenario 1 and 2 and, therefore been assessed as part of the WCS. The base year considered in the calculations presented in the subsequent Sections 4 and 5 is 2015.

Table 3-1 EBC Housing datasets

Type of Site	Net Number of Dwellings[14]
Completions	695
Sites with Planning Permission	900
Sites under construction	848
LAA sites	4,588
Totals for Scenario 1	**7,031**
Sites within greenbelt areas	12,933
Totals for Scenario 2	**19,964**

3.3 Employment Land

3.3.1 EBC has undertaken a detailed assessment as part of the LAA and the Review of Strategic Employment Land. The Local Plan evidence-based findings support a rationalisation of Strategic Employment Land designation with additional employment floor space being achieved through intensification and reconfiguration of the existing offer to meet changes in market demand. These assessments identified a figure of 1,627 additional jobs between 2014 and 2035[15].

[14] Net number of dwellings provided by Elmbridge Borough Council. The base date for the Elmbridge housing datasets is September 2018. The housing datasets do not include windfall sites nor do they include non-implemented planning permissions.
[15] The jobs growth figure resulted from the transport modelling work produced by WSP.

4. Wastewater Treatment Strategy

4.1 Wastewater in the Borough

4.1.1 A broad overview of how water and wastewater infrastructure interacts with the water cycle 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.

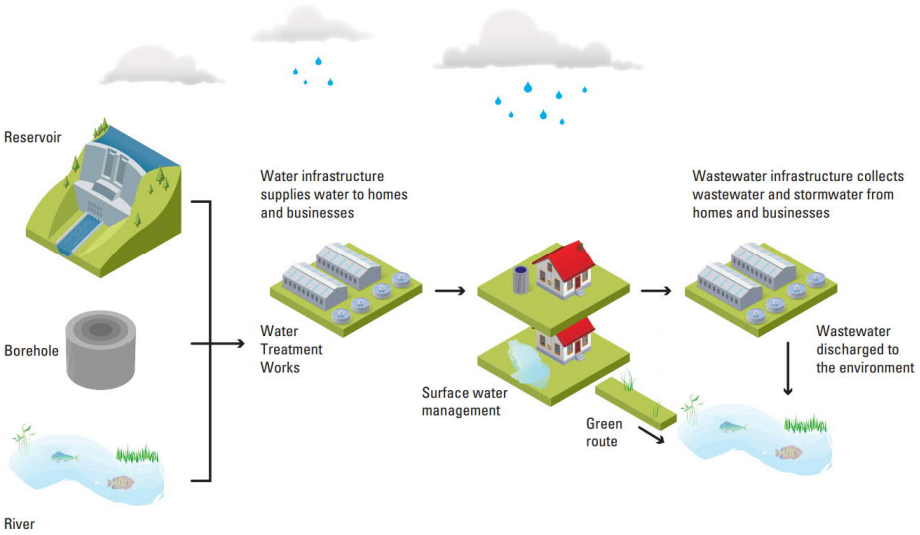


Figure 4-1 The water environment and infrastructure components[16]

4.1.2 Wastewater treatment in Elmbridge is provided via STW's operated and maintained by TWUL, ultimately discharging treated wastewater to a nearby water body. Each of the STWs is connected to development by a network of wastewater pipes (the sewerage system) which collects wastewater generated by homes and businesses to the STW; this is defined as the STWs 'catchment'.

4.1.3 Wastewater from Elmbridge is treated at 6 STW's (catchments illustrated in Figure 4-2). However as determined at Scoping stage approximately 99% of flow is treated either at Esher or Weybridge. It is therefore anticipated that these two catchments will receive additional wastewater as a result of growth in Elmbridge. The Outline WCS is focussed on assessing the impact of additional wastewater volumes at Esher STW and Weybridge STW only.

[16] Adapted from the Sustainable Urban Drainage Scottish Working Party's Water Assessment and Drainage Assessment Guide (2016)

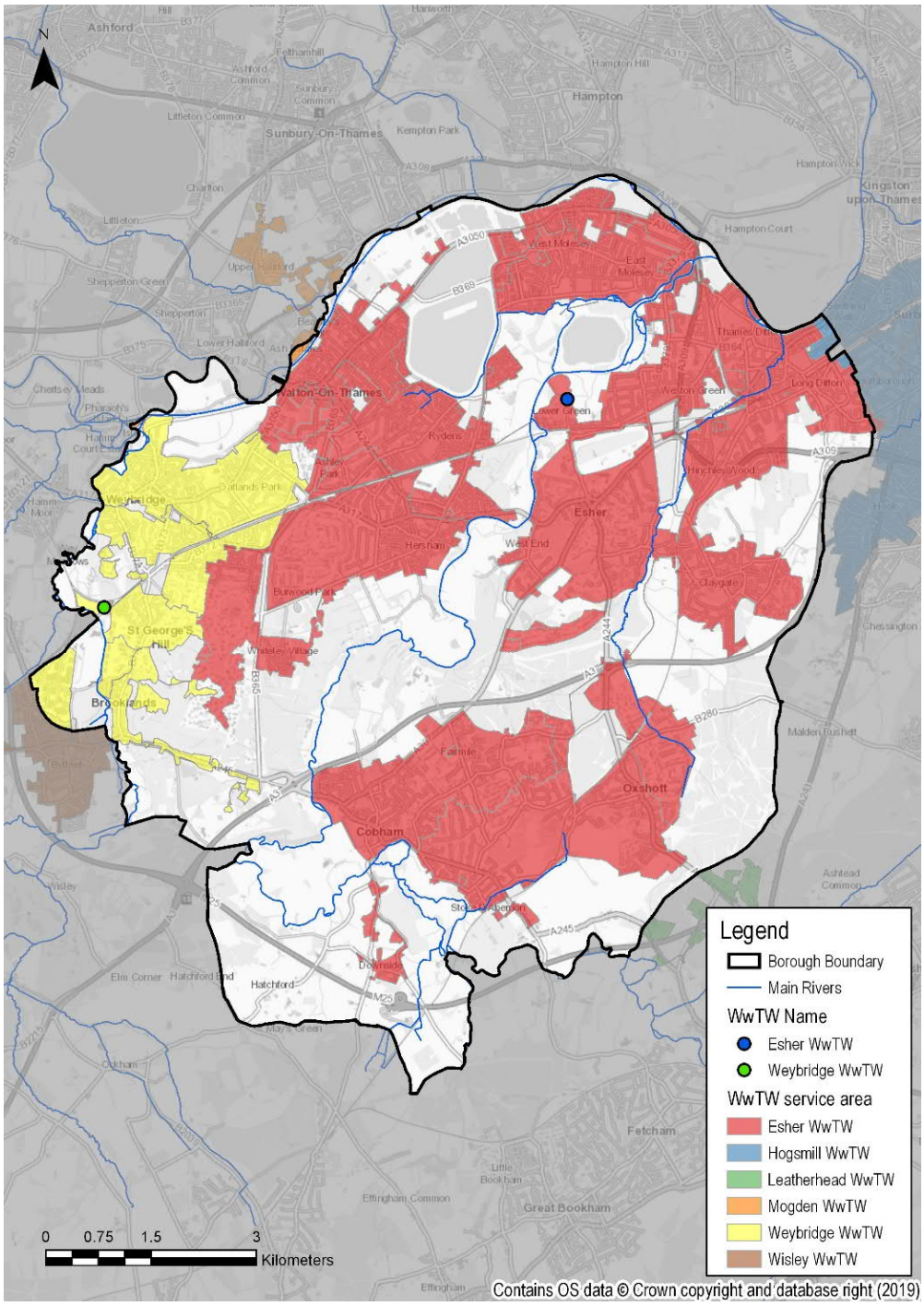


Figure 4-2 Location of STW and STW catchment areas within Elmbridge

4.2 Management of STW Discharges

4.2.1 All STWs 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. They also dictate how much wastewater each STW can accept, as well as the type of treatment processes and technology required at the STWs to achieve the quality permit limits.

4.2.2 The flow element of the discharge permit determines an approximation of the maximum number of properties that can be connected to a STW 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'. The quality conditions applied to the discharge permit are derived to ensure that the water quality of the receiving waterbody is not adversely affected, up to the maximum permitted headroom of the discharge permit.

4.2.3 The headroom determines how many additional properties can be connected to the STW catchment before TWUL would need to apply for a new or revised discharge permit (and hence how many properties can connect without significant changes to the treatment infrastructure). Additionally, for the purposes of this WCS, an analysis of additional flow received by each STW due to growth has been made to identify those STW Catchments that are receiving significant growth irrespective of the degree of available headroom. Significant growth is assumed to be a 10% or greater increase in Dry Weather Flow from the current situation and has been agreed in collaboration with the Environment Agency.

4.2.4 When a new or revised discharge permit is required, an assessment needs to be undertaken to determine what new quality conditions would need to be applied to the discharge. If the quality conditions remain unchanged, the increased flow of wastewater received at the STW would result in an increase in the pollutant load[17] of some substances 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.

4.2.5 The requirement to provide a higher standard of treatment may result in an increase in the intensity of treatment processes at a STW, which may also require improvements or upgrades to be made to the STW 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.

4.2.6 The primary legislative driver which determines the quality conditions of any new permit to discharge are the WFD and the Habitats Directive as described in the following subsections.

4.3 WFD Compliance

4.3.1 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. The following is an example of the classification hierarchy and Figure 4-3 illustrates the classifications applied within the hierarchy;

Overall water body status or potential

- Ecological or Chemical status (e.g. ecological)
  - Component (e.g. biological quality elements)
    - Element (e.g. fish)

[17] 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.

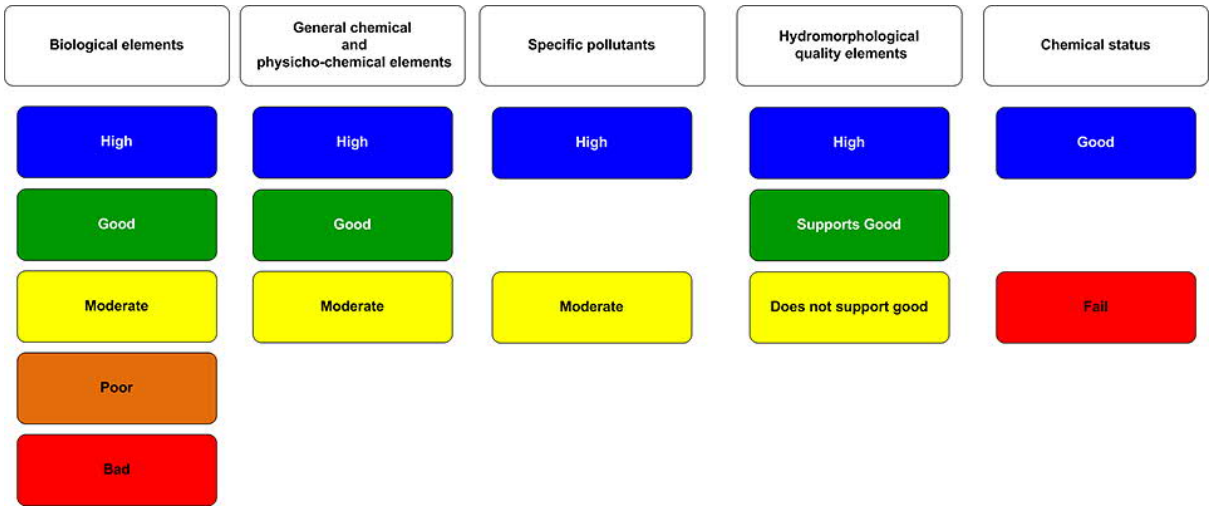


Figure 4-3 WFD status classifications used for surface water elements

4.3.2 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; and
- Development must not prevent a waterbody from achieving its Future Target Status (usually at least Good status).

4.3.3 It is not acceptable to allow 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. 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. It is also important to note that it is not acceptable to allow any deterioration in an element at Bad status according to the Wesser Ruling made by the Court of Justice of the European Union.

4.3.4 Where permitted headroom at a STW would be exceeded by proposed growth, or there is a STW that has headroom but is expected to receive a significant growth allocation, a water quality modelling assessment has been undertaken to determine the quality conditions that would need to be applied to the a new or revised discharge permit to ensure the two policy requirements of the WFD are met. The modelling process (assumptions and modelling tools) is described in detail in Appendix C.

4.4 Habitats Directive

4.4.1 The Habitats Directive and the associated UK Habitats Regulations has 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.

4.4.2 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.

4.4.3 Where discharges from an STW are predicted to significantly increase as a result of proposed levels of growth, a Habitats Regulations assessment exercise has been undertaken in this WCS to ensure that Habitats 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 such as nationally designated Sites of Special Scientific Interest (SSSI) and Local Nature Reserves (LNRs). This assessment is reported in Section 4.8 (Ecological Appraisal) of this chapter.

4.5 Wastewater Assessment Overview

Objectives

4.5.1 An increase in residential and employment growth will have a corresponding increase in the volume and flow of wastewater generated within the Borough, therefore it is essential to consider infrastructure and environmental capacity.

Infrastructure Capacity

4.5.2 Infrastructure capacity is 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 treatment facilities (STWs)?

Environmental Capacity

4.5.3 Environmental capacity is 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%? 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? Also a requirement of the WFD, which can be separated into the following two objectives:
    - Is the Future Target Status possible now assuming adoption of best available technology? To determine if it is limits in conventional treatment that would prevent the Future Target Status being achieved.
    - Is the Future Target Status technically possible after development and adoption of best available technology? To determine if it is growth that would prevent the Future Target Status being achieved.
- Could development cause an adverse impact on designated ecological sites? This question is answered in Section 4.8 of this chapter.

Methodology

4.5.4 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. The assessment steps are outlined below.

STW Headroom Assessment

4.5.5 This assessment is a scoping exercise to determine flow capacity at each STWs, as well as determine the most suitable water quality assessment tool and provide input data to the water quality assessment. The Scoping WCS already determined that water quality assessment would be required and hence the headroom assessment has been completed to inform the STW flow inputs for water quality assessment.

4.5.6 The Scoping WCS identified which STWs within the Borough will receive future growth and the Outline study has determined in detail what quantity of growth will occur in each of the two STWs catchments for both growth scenarios is in order to determine the additional wastewater flow generated. The remaining permitted flow headroom at each STW has then been calculated. A detailed explanation of this methodology is provided in Appendix C.

Water Quality Assessment

Esher STW

4.5.7 It was agreed with the Environment Agency that River Quality Planning (RQP) software (as used by the Environment Agency) is a suitable tool to undertake the required water quality modelling for determining the required discharge permit quality condition for Esher STW (results in Section 4.7). There are limitations associated with the RQP software which have been acknowledged in this WCS (Appendix C) and a stepped methodology has been developed to ensure uncertainty which may arise as a result of these limitations is minimal.

4.5.8 Statistical based water quality modelling (using RQP software) has been performed to check for compliance with the WFD objectives in terms of permit conditions for Ammonia, BOD and Phosphate.

4.5.9 The stepped methodology (provided in Appendix C) sets out modelling scenarios which have been developed in line with the water quality assessment objectives listed in 4.5.1 and was agreed with the Environment Agency (Appendix C) at the inception meeting. The modelling scenarios undertaken are detailed in Table 4-1.

Table 4-1 Water quality modelling scenarios for Esher

Scenario	Description	Objective
10% Deterioration Limit	Limiting deterioration to 10% based on the current river quality for the physico-chemical sub-element (determinand) after growth.	A test requested by the Environment Agency to determine what is required to minimise deterioration within WFD status class to protect environmental capacity for future phases of development
Status Deterioration Limit	Ensuring no deterioration from the current WFD status for the sub-element (determinand) after growth. Applied where it is not technically feasible to limit deterioration to 10%.	Aligns with the WFD policy requirement 'development must not cause a deterioration in WFD status'.
Maintain Current Quality	Maintaining the current river quality for the physico-chemical sub-element (determinand) after growth.	Where there is considered to be significant risk that a 10% deterioration could lead to a deterioration in status, this scenario is applied as a precautionary approach.
Future Target Status	Where a Future Target WFD Status has been set for the sub-element and is not currently being achieved by the waterbody.	Aligns with the WFD policy requirement 'development must not prevent a waterbody from achieving its Future Target Status'.

Weybridge WTW

4.5.10 Consultation with the Environment Agency as part of this WCS has identified the need for catchment scale modelling of the River Wey to determine the required discharge permit quality conditions for Weybridge STW. This is because there are 15 additional STW in the catchment upstream and so the impacts of additional discharges from Weybridge STW cannot be considered in isolation. The catchment scale model is required due to the location and number of STW discharges within the catchment, and in particular, their cumulative effect on ammonia and phosphate concentrations. The Environment Agency's SIMCAT model of the River Wey Catchment has therefore been used to model phosphate, ammonia and BOD effects related to discharge at Weybridge STW.

4.5.11 The catchment model takes into account the increased discharges as a result of growth within the study area from all STWs which discharge at various locations along the River Wey. 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. The model can be used to assess the impacts of additional development in the Wey catchment and of the new water quality standards for phosphate which will be implemented in 2020 and 2024 (see below).

4.5.12 The modelling scenarios undertaken are detailed in Table 4-2 below.

Table 4-2 Water quality modelling scenarios for Weybridge

Scenario	Description	Objective
Baseline Scenario	SIMCAT model showing existing water quality in the River Wey	Assessing the impact of existing effluent flows from Weybridge STW on water quality in the River Wey
2030 Scenario 0	SIMCAT model showing the impacts of additional development in the catchment upstream and new phosphate permits at STW in 2030. No development in Elmbridge	Creation of a "future baseline" against which to assess the effects of the proposed additional development in Elmbridge
2030 Scenario 1	Model run to show the impacts of additional flows at Weybridge STW in 2030 (scenario 1), taking account of additional flows and new phosphate permit limits upstream.	Assessment of impacts on future water quality in the River Wey arising from increased development in Elmbridge under Scenario 1
2030 Scenario 2	Model run to show the impacts of additional flows at Weybridge STW in 2030 (scenario 2), taking account of additional flows and new phosphate permit limits upstream.	Assessment of impacts on future water quality in the River Wey arising from increased development in Elmbridge under Scenario 2
Goal seek	Additional runs of Scenario 1 and Scenario 2 to determine future discharge consent requirements at Weybridge STW to maintain good status	Aligns with the WFD policy requirement to achieve good status in watercourses

Presentation of Results

4.5.13 The results for each STW water quality 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** – WFD objectives will not be adversely affected. Growth can be accepted with no tablesignificant changes to the STW infrastructure or permit required.
- **Amber** – in order to meet WFD objectives, changes to the discharge permit are required, and upgrades may be required to STW infrastructure which may have phasing implications;
- **Red** - in order to meet WFD objectives changes to the discharge permit are required which are beyond the limits of what can be achieved with conventional treatment. An alternative solution needs to be sought.

4.6 STW Headroom Assessment

4.6.1 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 STW catchment has been calculated and assessed against the permitted flow headroom capacity at each STW. A summary of this assessment is provided in Table 4-3.

4.6.2 The headroom assessment results reported in Table 4-3 confirm the Scoping Study finding; that both Esher and Weybridge STWs have sufficient capacity to accept additional wastewater flows for all scenarios. However, for Scenario 2 and Esher STW in particular, the additional flows generated by development are a significant increase compared to current treated flow volumes. If operated to their full permitted discharge volumes (i.e. all permitted headroom is used up by growth), the additional flow from both STWs could result in a significant deterioration in water quality and potentially deterioration in WFD status. This is particularly the case for Weybridge STW where the receiving River Wey has existing water quality compliance issues. As a result, a water quality assessment was required for both Esher and Weybridge STWs.

Table 4-3 STW headroom capacity assessment

Housing Scenarios	STW	Current DWF Permit (m^3/d)	Current Headroom Capacity		Quantity of Proposed dwellings	Increase in DWF flow after growth	Future (2035) DWF post-growth (m^3/d)	Headroom assessment after growth (2035)		Total additional flow as a % of current flow
			Current DWF (m^3/d)	Calculated Headroom (m^3/d)				Headroom capacity (m^3/d)	Approximate residual housing capacity	
Scenario 1	Esher	35,200	26,042	9,158	5,947	2,509	28,551	6,649	20,617	9.6%
	Weybridge	10,303	6,655	3,648	1,067	457	7,112	3,191	9,893	6.9%
Scenario 2	Esher	35,200	26,042	9,158	17,964	7,549	33,591	1,609	4,988	29%
	Weybridge	10,303	6,655	3,648	2,043	864	7,519	2,784	8,632	13%

4.7 Water Quality Assessment & Infrastructure Requirements

4.7.1 A summary of the water quality assessment results and proposed infrastructure upgrades required are included in the following sections for each of the STWs. More detailed model outputs are included in Appendix C

Esher STW

Environmental Baseline

4.7.2 The Mole (Hersham to R. Thames conf at East Molesey) waterbody (GB106039017622) receives treated effluent from Esher STW (see Figure 4-4) and had an overall waterbody status of 'Moderate' in 2016, with the alternative objective to maintain 'Moderate' status by 2016. The 2016 Ecological status of the Mole (Hersham to R. Thames conf at East Molesey) waterbody of the waterbody is 'Moderate' and the Chemical status is 'Good'.

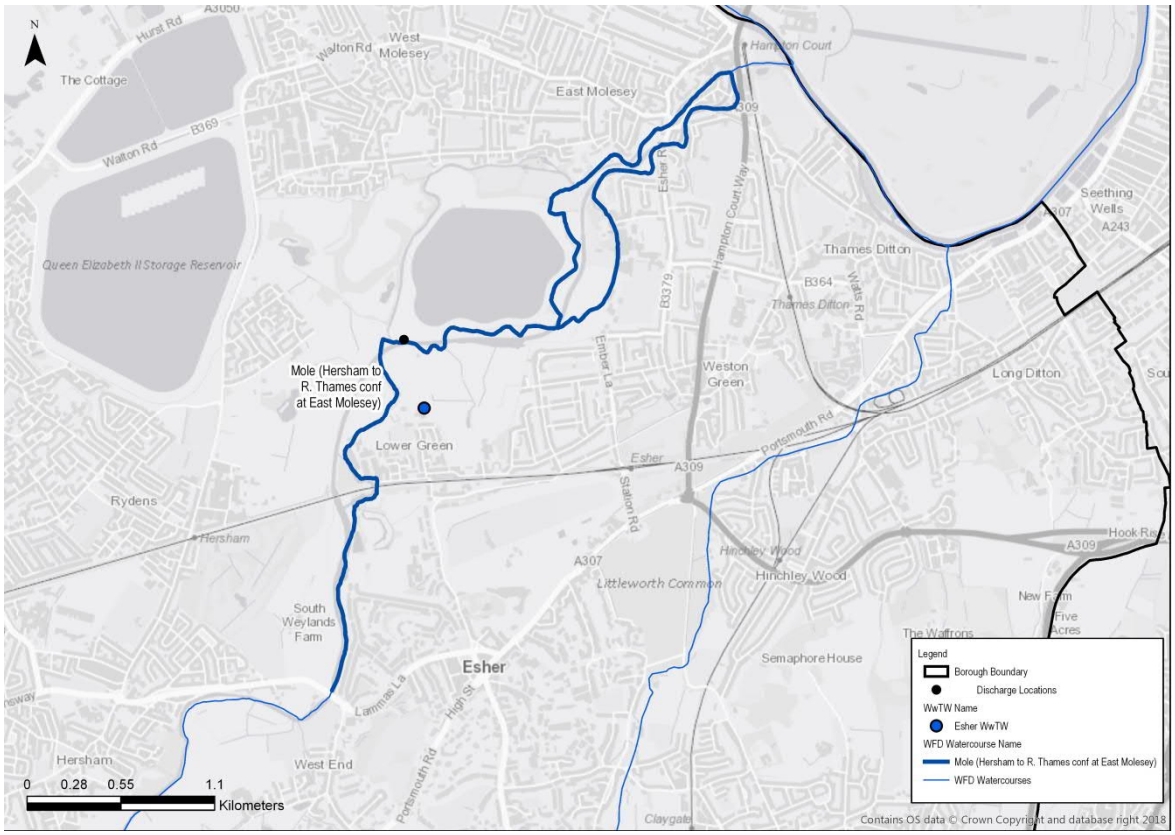


Figure 4-4 Esher WFD Watercourse location and discharge location

4.7.3 The current overall status is limited to 'Moderate' due to the less than 'Good' status classification of the elements listed in Table 4-4.

Table 4-4 Classification elements of less than Good status for Mole (Hersham to R. Thames confluence at East Molesey) waterbody (GB106039017622)

Classification Element	Current Status (2016)	Objective	Reason
Mitigation Measures Assessment	Moderate or less	Good by 2027	Disproportionate burdens
Ammonia	Moderate	Good by 2027	Disproportionate burdens
BoD	Moderate	Good by 2027	Disproportionate burdens

Phosphate	Poor	Poor	Unfavourable balance of costs and benefits No known technical solution is available

4.7.4 The Reasons for Not Achieving Good (RNAG), as outlined in the Thames RBMP, relevant to the Mole (Hersham to R. Thames confluence at East Molesey) waterbody have been provided in Table 4-5.

Table 4-5 Reasons for not achieving good status on the Mole (Hersham to R. Thames confluence at East Molesey) waterbody (GB106039017622)

Category	Activity	Activity Certainty	Classification Element
Water Industry	Sewage discharge (continuous)	Confirmed	Phosphate
Urban and Transport	Other	Confirmed	Mitigation Measures Assessment
Recreation	Other	Confirmed	Mitigation Measures Assessment
Local and Central Government	Other	Confirmed	Mitigation Measures Assessment
Water Industry	Incidents	Confirmed	Ammonia (Phys-Chem)
Water Industry	Sewage discharge (intermittent)	Probable	Ammonia (Phys-Chem)

Revised Permit Conditions – Modelling Results

4.7.5 Whilst the target status for Phosphate is Poor[18], it was agreed with the Environment Agency in June 2019 that modelling be carried out for the theoretical achievement of Moderate status to see whether it could be achieved with a tightened permit condition.

4.7.6 The revised discharge permit quality conditions required by the end of the plan period for each determinant (considering a moderate target for Phosphate) and for each modelled scenario are presented in Table 4-6 and a summary of result findings is provided in the following section. The results demonstrate that the current permits for Ammonia and BOD are sufficiently tight that they wold not need revising in the future to achieve target status. This is explained further in Table 4-7.

Table 4-6 Required permit quality conditions for Esher STW throughout the plan period

Housing Scenarios	Determinant	Current permit quality condition (mg/l)	Future permit quality condition required (mg/l)			
			Limit to 10% deterioration	No deterioration in WFD status	Maintain Current Quality	Achieve Future WFD Target Status
Scenario 1	Ammonia (mg/l 95%ile)	2	3.57	7.19	N/A	4.55
	BOD (mg/l 95%ile)	12	15.03	20.92	N/A	15.22
	Phosphate (mg/l annual average)	1	0.94	7.52	N/A	N/A – not achievable with or without growth
Scenario 2	Ammonia (mg/l 95%ile)	2	3.40	6.67	N/A	3.97
	BOD (mg/l 95%ile)	12	14.04	19.16	N/A	14.03
	Phosphate (mg/l annual average)	1	0.86	6.56	N/A	N/A – not achievable with or without growth

[18] due to no known technical solution

STW Assessment Summary

Table 4-7 Esher STW Assessment Summary

Assessment Criteria	Yes / No	Additional Comments
1. Is there sufficient permitted headroom to accept, treat and discharge the expected volume of wastewater as a result of growth proposed by the end of the plan period?	**Yes**	Calculated headroom capacity post-growth of 6,649 m^3/d (Scenario 1) and 1,609 m^3/d (Scenario 2).
2. Has the assessment demonstrated that utilising the headroom would risk non-compliance with water quality objectives?	**Yes**	Due to significant level of growth in catchment during plan period.
3. Has the water quality assessment demonstrated that to accept and treat all of the additional wastewater flow expected from development without impacting on water quality objectives, the quality conditions of the a new discharge permit would need to be altered compared to the current discharge permit and treatment process upgrades required?	**Yes**	
a. Can deterioration be limited to 10% based on the current river quality after growth with current conventional treatment technology?	**Yes**	No permit change required for Ammonia and BOD. Deterioration can be limited to 10% under the current permit conditions. Phosphate permit condition will need to be tightened from 1 mg/l to 0.94 mg/l (Scenario 1) and 0.86 mg/l (Scenario 2).
b. Can the WFD objective of 'no deterioration' be achieved after growth with current conventional treatment technology?	**Yes**	'No deterioration' can be achieved for Ammonia, BOD and Phosphate through the existing permit conditions.
c. Where 'no deterioration' cannot be achieved (or the test cannot be applied using RQP), can the current river quality be maintained after growth with current conventional treatment technology?	**Not assessed**	
d. Will growth prevent the future status targets from being achieved?	**No**	Ammonia- - Future Good status can be achieved with the existing permit condition. BOD - Future Good status can be achieved with the existing permit condition. Phosphate – Future Poor Status can be maintained through the existing permit condition. Modelling has demonstrated that the aspirational Moderate Phosphate status cannot be achieved within the limits of conventional treatment considering both current flow and future post-growth scenarios; therefore, growth does not prevent future moderate status being achieved.
4. Is there the potential for a cumulative impact on water quality upstream of the STW from growth proposed in the study area?	**No**	No, there is a significant distance between Esher STW and the next upstream discharge point (outside of the study area). Additionally, as there are no significant discharges upstream, a catchment-based approach was not required.
5. Are STW infrastructure upgrades required?	**Potentially**	Modelling suggests that in order to limit deterioration to 10% based on the current river quality for Phosphate, changes to the discharge permit are required and upgrades may be required to treatment processes at the STW. Whilst this scenario is not required for WFD legislative requirements, it may be permitting requirement for the Environment Agency which may have phasing implications (for both Housing Scenarios).

Weybridge STW

Environmental Baseline

4.7.7 The Wey (Shalford to River Thames confluence at Weybridge) waterbody (GB106039017630) receives treated effluent from Weybridge STW (see Figure 4-5).

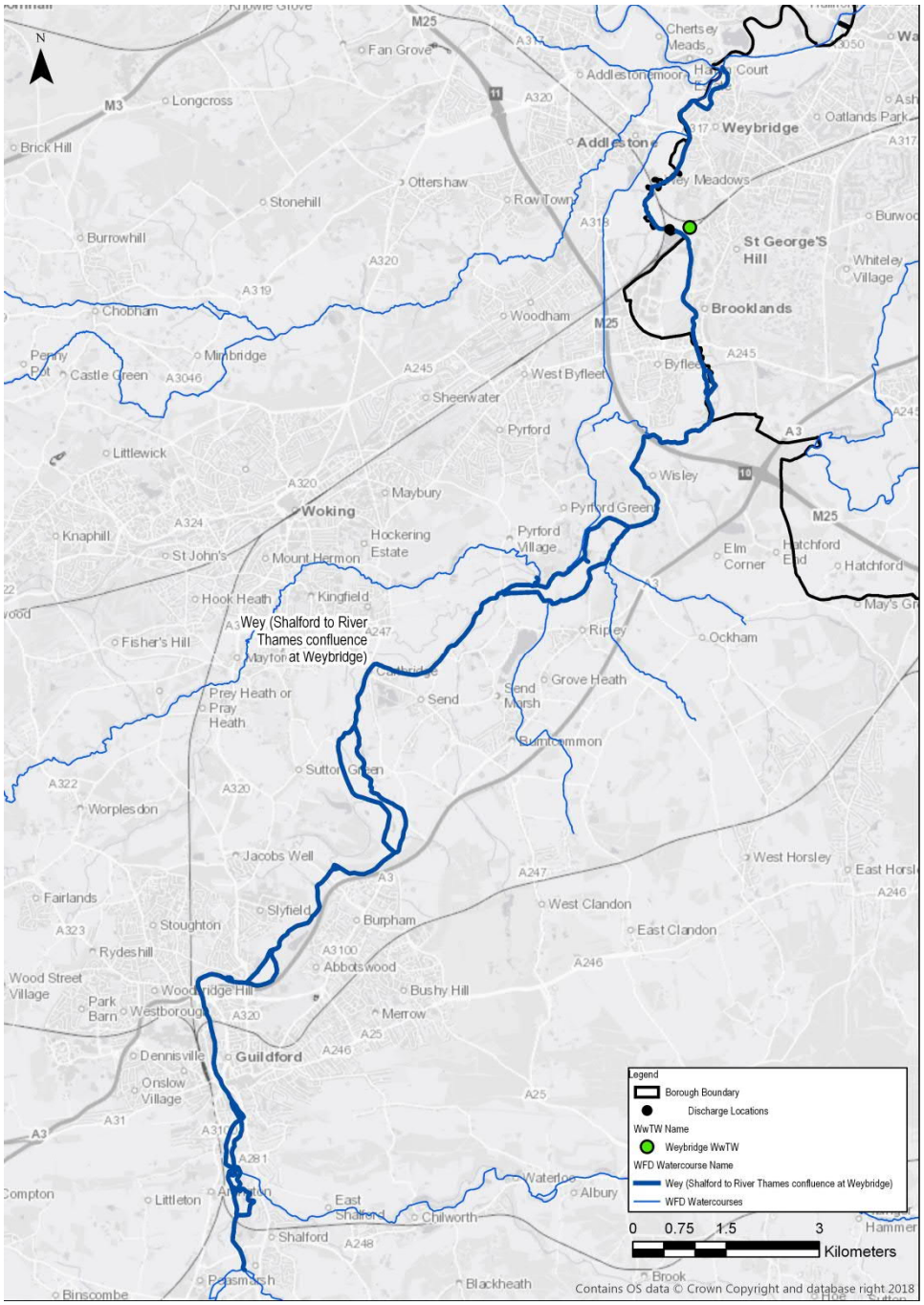


Figure 4-5 Weybridge WFD Watercourse location and discharge location

4.7.8 The River Wey (Shalford to River Thames confluence at Weybridge) had an overall waterbody status of Moderate in 2016, with the alternative objective to maintain Moderate status by 2016. The 2016 Ecological status of the Wey waterbody is 'Moderate' and the Chemical status is 'Good'.

4.7.9 The current overall status is limited to Moderate due to the less than Good status classification of the elements listed in Table 4-8.

Table 4-8 Classification elements of less than Good status for Wey (Shalford to River Thames confluence at Weybridge) (GB106039017630)

Classification Element	Current Status (2016)	Objective	Reason
Mitigation Measures Assessment	Moderate or less	Good by 2027	Disproportionate burdens
Macrophytes and Phytobenthos Combined	Moderate	Moderate by 2027	No known technical solution is available
Fish	Moderate	Good by 2027	Cause of adverse impact unknown
Phosphate	Moderate	Moderate by 2027	No known technical solution is available

4.7.10 The Reasons for Not Achieving Good (RNAG), as outlined in the Thames RBMP, relevant to the Wey (Shalford to River Thames confluence at Weybridge) waterbody have been provided in Table 4-9.

Table 4-9 Reasons for not achieving good status on the Wey (Shalford to River Thames confluence at Weybridge) waterbody (GB106039017630)

Category	Activity	Activity Certainty	Classification Element
Navigation	Other	Confirmed	Mitigation Measures Assessment
Recreation	Other	Confirmed	
Local and Central Government	Other	Confirmed	
Agriculture and rural land management	Reservoir / Impoundment - non-flow related	Suspected	Fish
Other	Barriers - ecological discontinuity	Suspected	
Navigation	Inland boating and structures	Suspected	
Urban and transport	Urbanisation - urban development	Suspected	
Water Industry	Sewage discharge (continuous)	Confirmed	Macrophytes and Phytobenthos Combined
Water Industry	Sewage discharge (continuous)	Suspected	Phosphate

4.7.11 Weybridge STW is located at the downstream end of the River Wey. Monitoring data from upstream of the STW demonstrates that it is inputs (both point source and diffuse sources) from upstream which are mainly responsible for the failure to achieve good status for phosphate for the WFD waterbody. SIMCAT modelling has shown that elevated concentrations of phosphate in the Wey are particularly impacted by the smaller STWs upstream, some of which (Bentley, Elstead, Shamley Green and Selbourne) do not currently have any limits imposed for phosphate discharges.

4.7.12 Figure 4-6 shows the modelled mean phosphate concentrations along the River Wey catchment for the baseline (current condition) scenario with the locations of the STW identified.

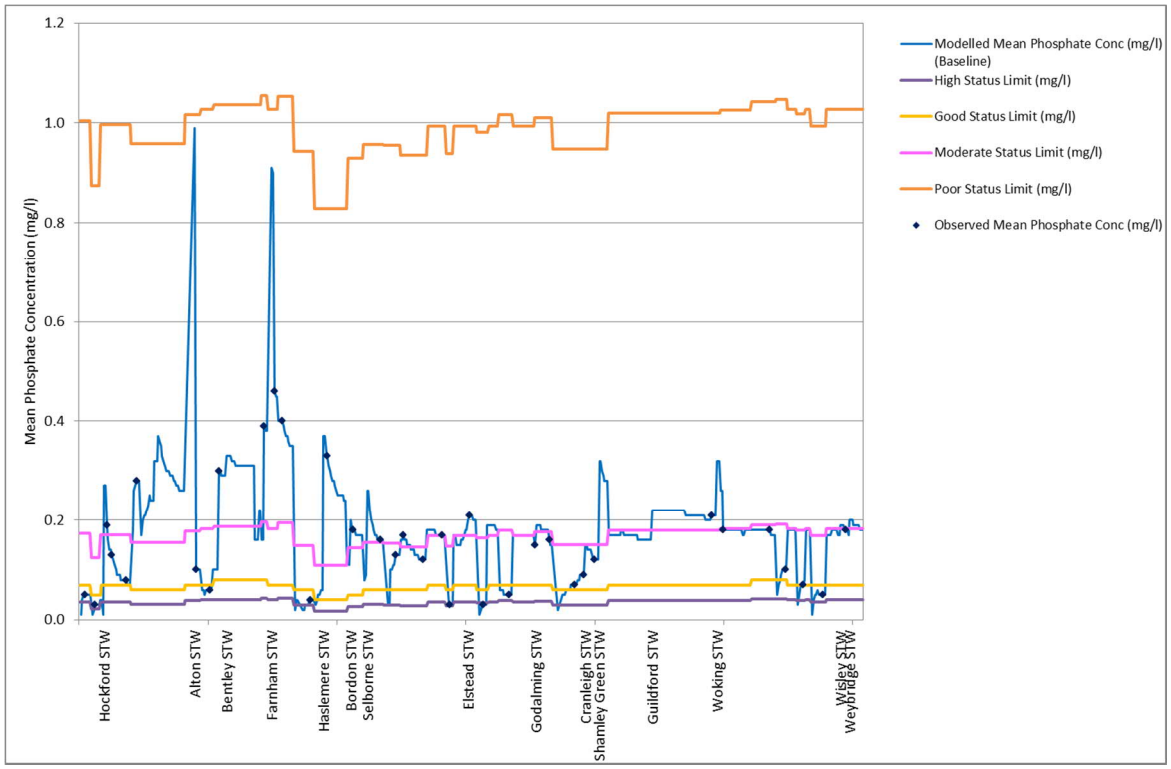


Figure 4-6 Modelled and Observed Mean Phosphate Concentrations in the River Wey Catchment (with STW locations and WFD Water Quality Standards)

4.7.13 Figure 4-6 demonstrates that the influence of Weybridge STW on overall waterbody status is relatively minor in comparison to the impacts of STWs upstream. This is part due to the larger river volumes providing dilution at Weybridge. Modelling outputs and observed data demonstrate that high phosphate concentrations result in the in much of the upper Wey catchment being considered "poor" for phosphate whilst the quality in the lower end of the catchment (including at Weybridge STW) is borderline moderate/poor under the baseline scenario. It is therefore necessary to consider the impacts of changes in upstream discharges as well the influence of Weybridge STW on the WFD waterbody as a whole.

Revised Permit Conditions – Modelling Results

4.7.14 The Environment Agency have confirmed that significant changes to the permitted limits for phosphate discharge from STW in the Wey catchment will be imposed from 2020 and 2024, as set out in Table 4-10.

Table 4-10 Future Phosphate Limits for Wey Catchment STW

STW	Current Discharge Limit (mg/l)	Discharge Limit from 2020 (mg/l)	Discharge Limit from 2024 (mg/l)
Alton	2.00	2.00	0.25
Bentley	None	None	0.90
Bordon	1.00	1.00	0.25
Weybridge	2.00	2.00	2.00
Guildford	2.00	2.00	0.25
Hockford	2.00	2.00	0.30
Cranleigh	2.00	2.00	0.40

Elstead	None	None	1.00
Farnham	2.00	2.00	0.30
Shamley Green	None	None	0.70
Haselmere	2.00	2.00	0.25
Selbourne	None	1.00	1.00
Wisley	2.00	2.00	0.25
Woking	2.00	2.00	0.25
Godalming	2.00	2.00	0.30

4.7.15 The phosphate permitted limits are significantly lower in most cases than the current limits. Of the 15 STW in the catchment, only Weybridge STW will not be subject to lower phosphate limits in future. The reduced phosphate discharges in the Wey upstream of Weybridge will improve water quality. However, the reduced concentration will be offset by increases in flow arising from the proposed new development upstream of these STW. The WCS and Water Quality Assessments for Woking Borough Council, Waverley Borough Council and Guildford Borough Council have been obtained to estimate potential future flows from the upstream STW, as set out in Table 4-11.

4.7.16 No information was available for East Hampshire area, which includes Alton, Bentley and Bordon STW. It has therefore been assumed that these STW will be operating at maximum permitted flow and load in 2030, which gives a worst-case scenario for water quality. These STW are the most upstream in the catchment and the impact of this assumption at Weybridge is expected to be minimal. Expected mean and standard deviation flows were provided for Guildford Borough sites and were used as provided. Only projected housing figures were provided for Woking Borough and these were used to calculate an expected mean and standard deviation flow following the same process as outlined above for the Elmbridge Borough STWs. It was assumed that all new development in Woking Borough would drain to Woking STW and flows from Wisely and Selbourne STW were therefore retained as existing.

4.7.17 Expected dry weather flows were provided for Waverley Borough and were converted into mean and standard deviation flows as per the SIMCAT user manual. However, this resulted in projected future mean flows for Elstead, Farnham and Shamley Green STW which were lower than existing. The existing flow conditions for these STW have therefore been retained in the 2030 models.

Table 4-11 Future Flows from Wey Catchment STW used in Modelling

STW	Current Mean Flow (Ml/d)	Current Standard Deviation (Ml/d)	2030 Projected Mean Flow (Ml/d)	2030 Projected Standard Deviation (Ml/d)
Alton	10.944	2.22	16.144	4.843
Bentley	0.917	0.626	1.120	0.336
Bordon	8.111	2.575	10.988	3.296
Guildford	25.429	8.902	29.585	9.862
Hockford	4.838	1.405	4.923	1.641
Cranleigh	4.284	1.961	5.304	1.591
Elstead	1.629	0.665	1.629	0.665
Farnham	8.832	3.621	8.832	3.621

Shamley Green	3.011	0.85	3.011	0.85
Haselmere	4.574	0.1	5.077	1.523
Selborne	0.119	0.067	0.119	0.067
Wisley	7.693	3.571	7.693	3.571
Woking	23.158	7.552	23.882	7.961
Godalming*	8.082	1.858	8.715	2.615

*projected figures calculated by combining the increased flow expected from both Guildford and Waverly Boroughs

4.7.18 The SIMCAT model was run using the above flow and concentration figures and for two scenarios for development upstream of Weybridge STW (Table 4-12).

Table 4-12 Future Flows from Weybridge STW

Scenario	Current Mean Flow (Ml/d)	Current Standard Deviation (Ml/d)	2030 Mean Flow (Ml/d)	2030 Standard Deviation (Ml/d)
1	7.524	2.008	8.891	2.964
2	7.524	2.008	9.399	3.133

4.7.19 The full results of the SIMCAT modelling are set out in Appendix C. Figure 4-7 compares the mean concentrations of phosphate along the River Wey in 2030 under the baseline scenario (blue) and under Scenario 1 (red). The reduced phosphate concentrations in the STW effluent offset the increase in flow and water quality is improved along the entire watercourse. Mean water quality at Weybridge is expected to be borderline good/moderate in 2030 compared with moderate/poor in the Baseline model.

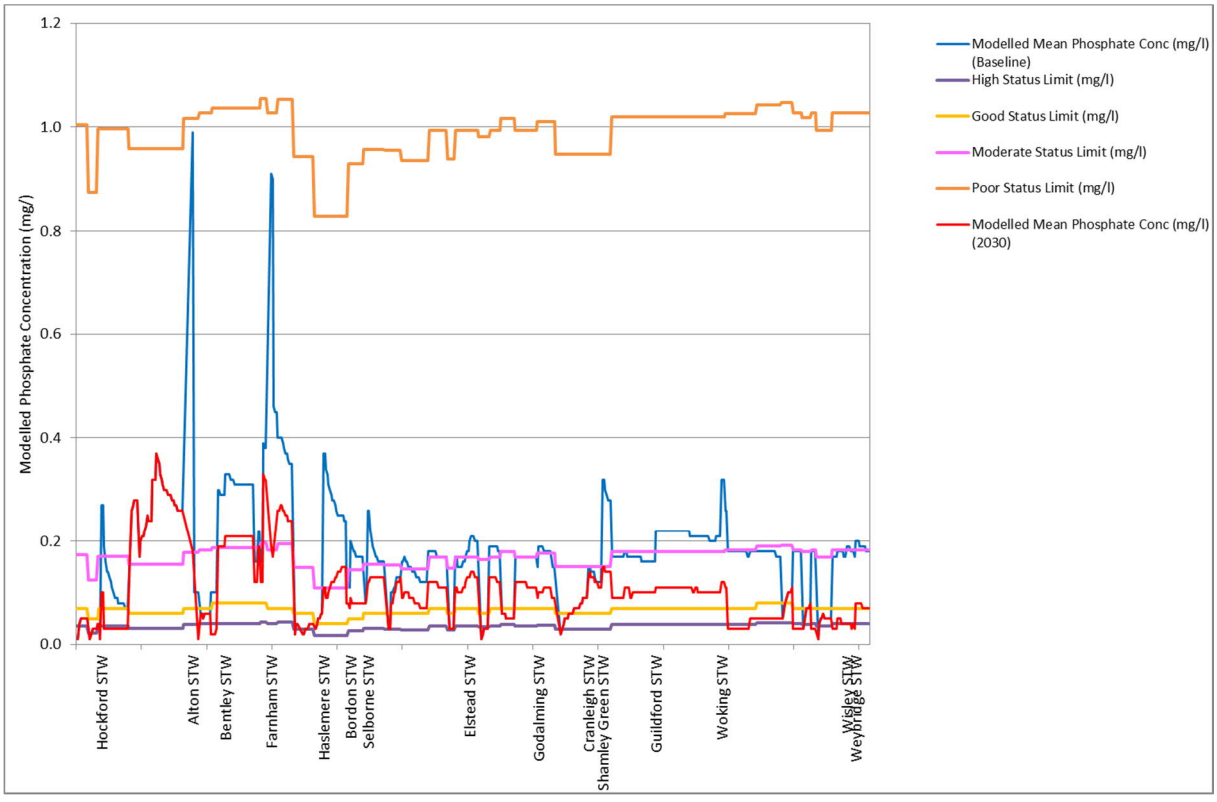


Figure 4-7 Baseline and Modelled Mean Phosphate in the River Wey Catchment (2030, Scenario 1)

4.7.20 Figure 4-8 shows the impacts of increased discharges from Weybridge STW on phosphate concentrations in the River Wey in 2030 under Scenario 1, taking into account the changes in water quality upstream.

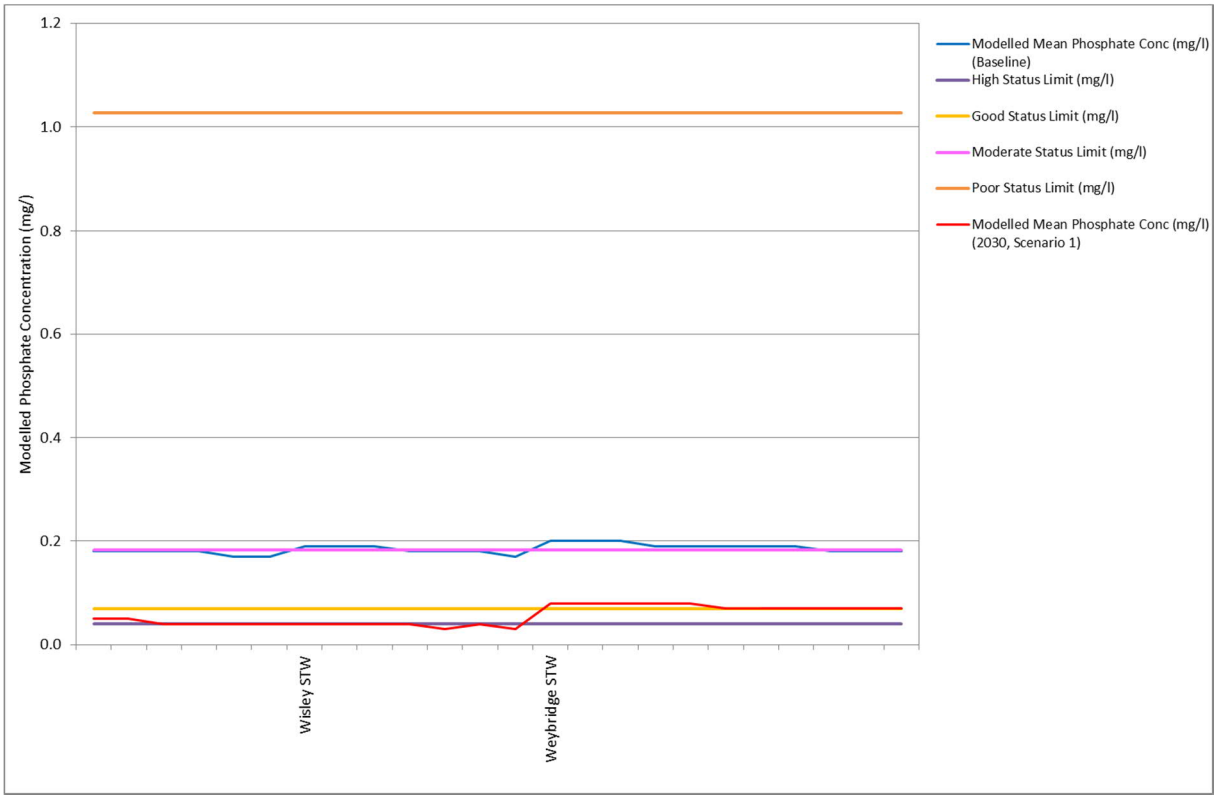


Figure 4-8 Impact of Discharges from Weybridge STW on Phosphate in the River Wey (2030, Scenario 1)

4.7.21 The model shows that concentrations of phosphate above Weybridge STW are within the "high" water quality bracket in 2030 and fall to 0.07mg/l downstream of the discharge, which is just within the "moderate" water quality bracket. Modelling of Scenario 2 shows the same result with very slightly higher phosphate concentrations (0.08mg/l) predicted downstream of Weybridge STW. Water quality downstream of Weybridge returns to good within 2km of the outfall.

4.7.22 The 2027 target for phosphate in the River Wey set out in Table 4-7 is for moderate status. This will be achieved regardless of discharges at Weybridge STW due to the greatly improved water quality upstream. However, if this target is revised to require "good" status in the Wey in future then the discharges at Weybridge will result in a localised breach of this standard. A discharge limit of **0.47mg/l** for Phosphate would be required under Scenario 1 in this case and a discharge limit of **0.45mg/l** would be required under Scenario 2.

4.7.23 The SIMCAT model has also been run to determine the impact of the additional discharges on the ammonia and BOD in the River Wey (Appendix C). The River Wey is currently achieving high status for both of these determinands, no STW are close to their discharge limits and no new, stricter limits are proposed. The results show a significant increase in river ammonia concentrations by 2030, including a reduction from high to good and good to moderate status for the upstream STW at Alton, Bentley and Farnham. Note, however, that the future flows from Alton and Bentley STW have been set at the maximum permitted flow in the absence of housing data, so this is a worst-case scenario. Downstream of these areas the forecast development is shown to increase ammonia concentration but not to the degree of causing a status reduction in the watercourse. The proposed development at Weybridge increases the modelled mean ammonia concentration by 0.06mg/l, but does not affect WFD status.

4.7.24 In terms of BOD, the main increase in BOD occurs at Alton STW and Bentley STW, which results in a reduction in status from high to moderate or good. However, the actual housing figures for these STW are unknown so the increase in BOD is uncertain. The effects of this large input of BOD are diluted downstream and, although there is a second significant increase in BOD downstream of Guildford and Woking STW, the impact is not sufficient to change the current "high" status of the Wey with regards to BOD.

Weybridge STW Assessment Summary

4.7.25 The results of the modelling of discharges from Weybridge STW have shown that there is sufficient permitted headroom to accept, treat and discharge the expected additional volume of wastewater resulting from growth in Elmbridge Borough proposed by the end of the plan period. The water quality assessment has not demonstrated that utilising the headroom would not result in non-compliance with water quality objectives since the impact of flows from Weybridge STW on water quality in the River Wey is minor. New phosphate permits to be imposed on STW upstream of Weybridge are expected to significantly improve water quality in the Wey and ensure that WFD targets for this waterbody are achieved. These new limits will offset the potential for a cumulative impact on water quality upstream of the STW from growth proposed in the wider area. No STW infrastructure upgrades are required at Weybridge STW unless the WFD targets for phosphate in the River Wey are revised from moderate to good, in which case a limit of 0.45mg/l would be required at Weybridge STW to ensure that this target is met.

4.8 Ecological Appraisal

Impacts of increased wastewater discharge on designated sites

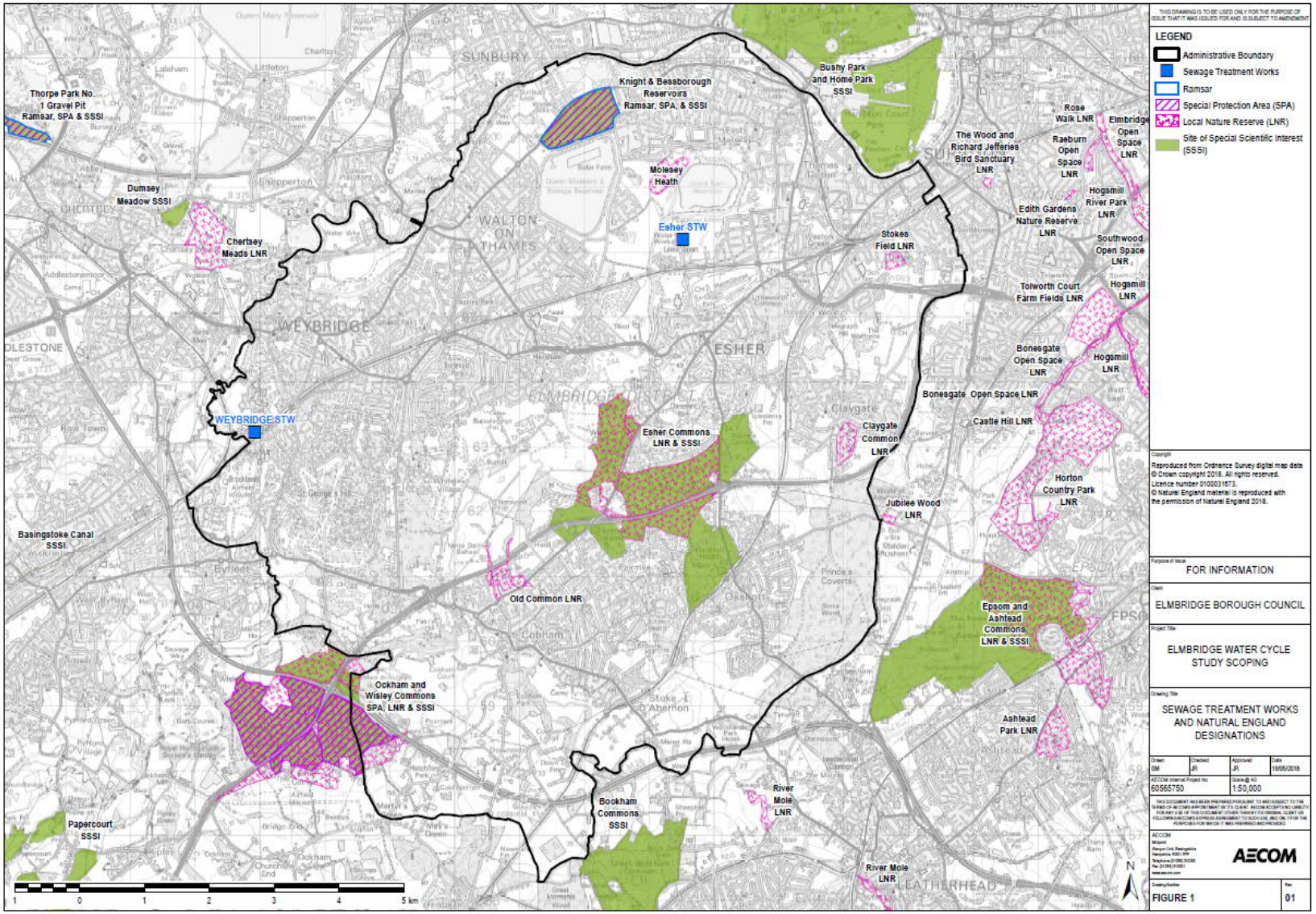
4.8.1 Two STWs have been identified as processing 99% of flows from Elmbridge Borough: Esher STW and Weybridge STW). A review has been carried out to identify any statutory designated sites which are hydrologically connected to either of the two main works.

4.8.2 The receiving watercourses for both STWs were traced downstream from each STW discharge location. Where a receiving watercourse enters, or passes adjacent to, a statutory designated wildlife site that has potential to be vulnerable to changes in hydrology (based on the available information such as citations), these are identified and discussed in the following section. The discussion relating to individual STWs includes, where required, recommendations to ensure that future development does not adversely affect statutory designated wildlife sites.

4.8.3 Where it was not possible to determine if a site was hydrologically linked to the watercourse (i.e. merely in close proximity), the site was included in the discussion of the assessment as a precaution. Following this process, one statutory designated wildlife site, Bushy Park and Home Park Site of Special Scientific Interest (SSSI), has been identified as being hydrologically connected to Weybridge STW and/or Esher STW.

4.8.4 The location of this site is illustrated in Figure 4-9. All other statutory designated sites identified within the borough are remote from watercourses into which the STWs discharge treated effluent. Bushy Park and Home Park SSSI is located approximately 9.9km downstream of the discharge point on the River Wey and approximately 3.4km downstream of the discharge point on the River Mole.

Figure 4-9 Statutory Designated sites in and around Elmbridge Borough



Impacts on ecology within Designated Sites

4.8.5 The River Thames flows past Bushy Park and Home Park SSSI 3.4 km downstream from Weybridge STW and 3.4km downstream from Esher STW. Bushy Park and Home Park SSSI comprises a mosaic of habitats which includes acidic grasslands, neutral grasslands, woodland and wetlands. The site sits on the floodplain of the River Thames. Parts of the site act as riverine floodplain, particularly those with superficial deposits of alluvium. The site is therefore hydrologically connected to the River Thames. However, the site is designated as a SSSI for its saproxylic (dead and decaying wood associated) invertebrate assemblage, population of veteran trees and acid grassland communities. None of these are dependent on inundation from the River Thames and are not within the flooded parts of the site. Therefore the nationally important interest features of this SSSI will not be affected by the treated wastewater discharges from Esher or Weybridge STW.

Ecological Opportunities Associated with Proposed Development Locations

4.8.6 To ensure that the planned level of future development within the plan period does not result in a negative impact upon wildlife both inside and outside the designated sites, it is recommended that policy is included within the EBC Local Plan 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 STWs can accommodate the increased capacity and not result in a detrimental impact upon wildlife features.

4.8.7 It is recommended that ecological risks associated with discharges from Esher and Weybridge STWs, 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.

4.9 Summary of the Wastewater Treatment Strategy

4.9.1 The headroom assessment undertaken for both housing scenarios for Esher and Weybridge STWs indicated that growth in both STW catchments could be accommodated within the current permitted headroom. However, significant increases in growth would connect to both STWs and hence water quality assessment was undertaken to determine whether upgrades to the STW would be required to minimise impact on receiving watercourses.

Esher STW

4.9.2 The RQP modelling results for Esher STW indicated that deterioration in the River Mole can be limited to 10% based on the current river quality without any permit changes for Ammonia and BOD, whereas the permit condition for Phosphate will need to be tightened. Although not a legislative requirement, if the 10% deterioration target is required by the Environment Agency, there is potential that existing processes would be adequate to meet the slightly tighter Phosphate standard required, or only limited process upgrades would be required. Any necessary upgrades could be delivered towards the end of the Local Plan period allowing time for Thames Water to plan for the investment in the 2025 Business Plan which would ensure no impact on phasing of housing delivery or the total of housing growth proposed in both housing scenarios assessed.

4.9.3 Additionally, it was shown that the no upgrades would be required because of growth to meet with legislative WFD objectives. The WFD no-deterioration target and future status targets can be achieved for all parameters without changing the permit conditions. An additional test considering an alternative of Moderate future status for phosphate in the Mole waterbody (proposed future status is currently Poor) was undertaken, and this demonstrated that it was not possible to achieve Moderate status with current discharge volumes and LCT, such that housing would not be a factor in preventing future Moderate status being achieved. Finally, the assessment has shown that no hydrological dependent statutory or non-statutory ecological sites would be impacted by the proposed growth because of changes in wastewater discharges.

4.9.4 This demonstrates that the proposed housing totals in both the housing growth scenarios assessed would not prevent WFD status being achieved and no significant treatment infrastructure upgrades would be required.

Weybridge STW

4.9.5 The SIMCAT modelling results of discharges from Weybridge STW have shown that there is sufficient permitted headroom to accept, treat and discharge the expected additional volume of wastewater resulting from growth in Elmbridge Borough proposed by the end of the plan period. The water quality assessment has demonstrated that utilising the headroom would not result in non-compliance with water quality objectives since the impact of flows from Weybridge STW on water quality in the River Wey is minor. New phosphate permits to be imposed on STW upstream of Weybridge are expected to significantly improve water quality in the Wey and ensure that WFD targets for this waterbody are achieved. These new limits will offset the potential for a cumulative impact on water quality upstream of the STW from growth proposed in the wider area. No STW infrastructure upgrades are required at Weybridge STW unless the WFD targets for phosphate in the River Wey are revised from moderate to good, in which case a limit of 0.45mg/l would be required at Weybridge STW to ensure that this target is met. The assessment has shown that no hydrological dependent statutory or non-statutory ecological sites would be impacted by the proposed growth because of changes in wastewater discharges.

4.9.6 Based on current WFD status and current planned future status, the modelling and assessment undertaken as part of the WCS demonstrate that the proposed housing totals in both housing scenarios assessed would not prevent WFD status being achieved in the River Wey and no significant treatment infrastructure upgrades would be required.

5. Water Supply Strategy

5.1 Introduction

5.1.1 Water resources within a catchment are assessed and monitored by the Environment Agency. The river catchment is split up into a number of individual units whose status is assessed through an Abstraction Licensing Strategy (ALS) as part of the Catchment Abstraction Management Strategy (CAMS) process. ALSs are strategies for the management of water resources at a local level and set out how water abstraction will be managed. They outline where water is available, and also, if relevant, where current rates of abstraction need to be reduced to allow the balance between the needs of abstractors, other water users and the aquatic environment to be protected. Elmbridge lies with the Thames CAMS area (see Figure 5-1) and is covered by the Thames, Wey, Mole and ALS published in 2014 and 2012.

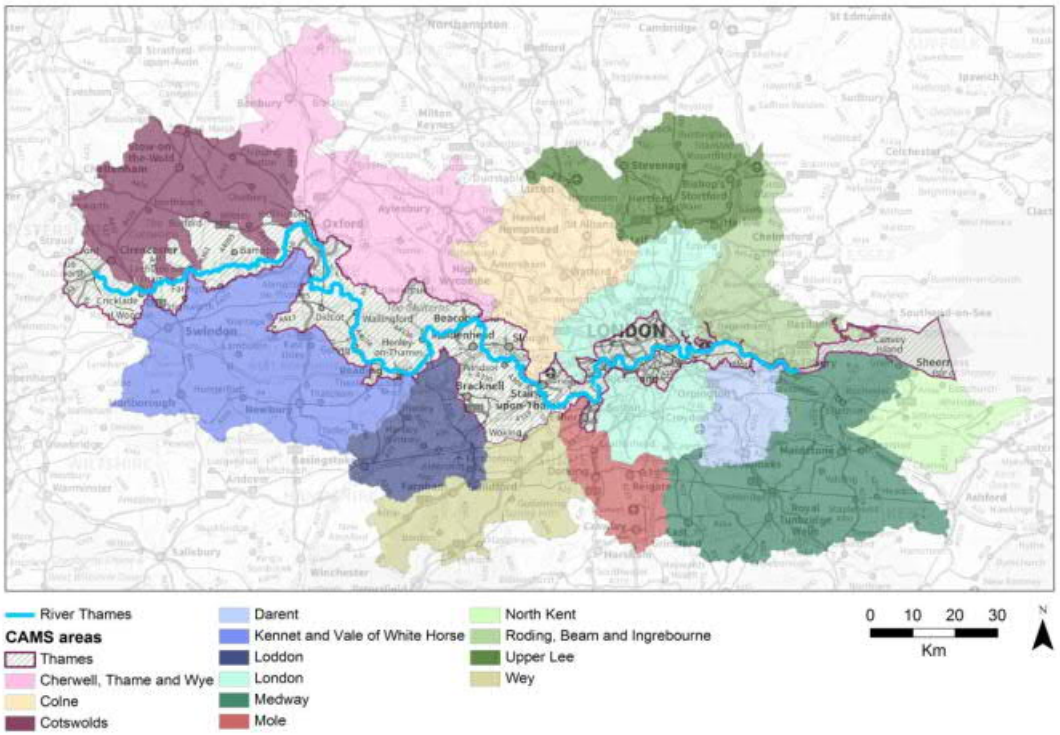


Figure 5-1 The CAMS area of the Thames and Thames Tributaries[19]

5.1.2 This study has also used the AWS dWRMP19[1], the TWUL dWRMP19[2] and the SES dWRMP19[3] to determine available water supply against predicted demand and has considered how water efficiency can be further promoted and delivered for new homes beyond that which is planned for delivery of the WRMPs.

5.2 Abstraction Licensing Strategies

5.2.1 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

[19] Environment Agency (2014) Thames catchment abstraction licensing strategy. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/321005/LIT_1855.pdf

- Areas where abstraction needs to be reduced.

5.2.2 The categories of resource availability status are shown in Table 5-1. 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 5-1 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.
Restricted water available for licencing	Full Licensed flows fall below the Environmental Flow Indictors (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: we are 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 lower River Thames is classed as water not available for licensing. Consequently all tributaries to the River Thames are protected from consumptive abstraction to ensure flows to the River Thames are maintained. A bespoke strategy for new consumptive abstractions has been produced by the Environment Agency to ensure these requirements are met.
	Thames Q50 may apply

5.2.3 The classification for each of the Water Resource Management Units (WRMU) in Elmbridge has been summarised for surface waterbodies in Table 5-2.

Table 5-2 Resource availability classification

River – WRMU	CAMS Area	Surface Water (flow exceedance scenarios)
		Q30 Q50 Q70 Q95
AP6- Kingston gauging station	Thames	
AP7- Weybridge	Wey	
AP1- Lower Mole	Mole	

5.2.4 The Thames catchment Abstraction Licensing Strategy (ALS)[20] states that there is currently no water available for abstraction at low flows throughout the Thames CAMS area. This ALS classification is significantly influenced by the flow requirements of the lower Thames downstream (at Kingston) and flow recorded at this location dictates permitted abstraction volumes throughout the Thames River Basin District (including all tributaries). A bespoke strategy for new consumptive abstractions has been produced by the Environment Agency to ensure the requirements of the Lower Thames at Kingston are met, whereby any new surface water abstractions or groundwater abstractions in direct hydraulic continuity with a river are subject to conditions when abstraction can take place. A WFD assessment must be provided for new abstractions 2Ml/d or above to show it will not cause deterioration under the WFD or prevent the waterbody achieving Good ecological status/potential. Consumptive groundwater licenses which do not have direct impact on river flows may be permitted with restrictions.

[20] Environment Agency (2014). Thames catchment abstraction licensing strategy. Available at: https://www.gov.uk/government/publications/thames-catchment-abstraction-licensing-strategy

5.2.5 According to the Mole ALS[21], the Lower Mole is defined as having restricted water available for licencing during periods of low flow (Q70-Q95) in parts of its river basin. Both the River Wey (as determined in the Wey Catchment Abstraction Licensing Strategy[22]) and the Lower Mole sites have some availability of water during higher flow. This analysis indicates that there is potential for local abstractions at all the sites during periods of high flow, there may be water available for abstraction at average to low flows. This may be beneficial to supplying water resources locally.

5.3 Water Resource Planning in the Borough

5.3.1 Water companies have a statutory duty to undertake medium to long term planning of water resources in order to demonstrate that there is a long-term plan for delivering sustainable water supply within its operational area to meet existing and future demand. This is reported via WRMPs on a 5 yearly cycle.

5.3.2 WRMPs are a key document for a WCS as they set out how future demand for water from growth within a water company's supply area will 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.

5.3.3 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 it is freely available; but also share the same risk of supply when water is not as freely available during dry periods (i.e. deficit of supply). For current WRMPs, Water companies have undertaken 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.

5.4 Water Supply

5.4.1 AWS, TWUL and SES supply water to the Borough. Each water provider supplies approximately one third of the Borough in terms of geographical coverage. It has been assumed that the water provider companies have taken the planned growth into account into their WRMPs.

Affinity Water Services

5.4.2 The area of the Borough which is supplied by AWS is covered by Water Resource Zone (WRZ) 6 (part of the Central Region), also known as the Wey WRZ. The water resources in AWS's Central region are largely groundwater (60%), with the remainder (40%) from surface water sources and imports from neighbouring companies[12]. In the Wey WRZ water imports are provided by TWUL, with export available to South East Water.

5.4.3 Figure 5-2 show the baseline supply demand balances at the Dry year Annual Average (DYAA) and Dry year Critical Period (DYCP) for the Central region. The water available for supply is reduced by 33.7 Ml/d by 2024/25 as a result of sustainability reductions; this is off-set by use of AWS's full statutory entitlement of Grafham Water from 2024/25 following installation of conditioning treatment at Sundon. The water available for Affinity Water falls through the planning period due to the impact of climate change.

5.4.4 Demand initially falls under average and peak conditions as a result of AWS Water Saving Programme. It then rises from 2027/28, due to population growth, estimated to be 12% by 2025, 27% by 2045 and 50% by 2080, equivalent to 1.6million more people living in the Central region.

5.4.5 The baseline supply-demand balance shows that by 2045 there is a shortfall of water of 100.7 Ml/d under peak conditions and 107.9 Ml/d under average conditions if no additional measures are planned for. This shortfall increases by 2080 to 279.5 Ml/d and 255.7 Ml/d under average conditions.

[21] Environment Agency (2013). Mole Abstraction Licensing Strategy. Available at: https://www.gov.uk/government/publications/mole-catchment-abstraction-licensing-strategy
[22] Environment Agency (2019). Wey Catchment Abstraction Licensing Strategy, a strategy to manage water resource sustainably. Available at: https://www.gov.uk/government/publications/wey-catchment-abstraction-licensing-strategy

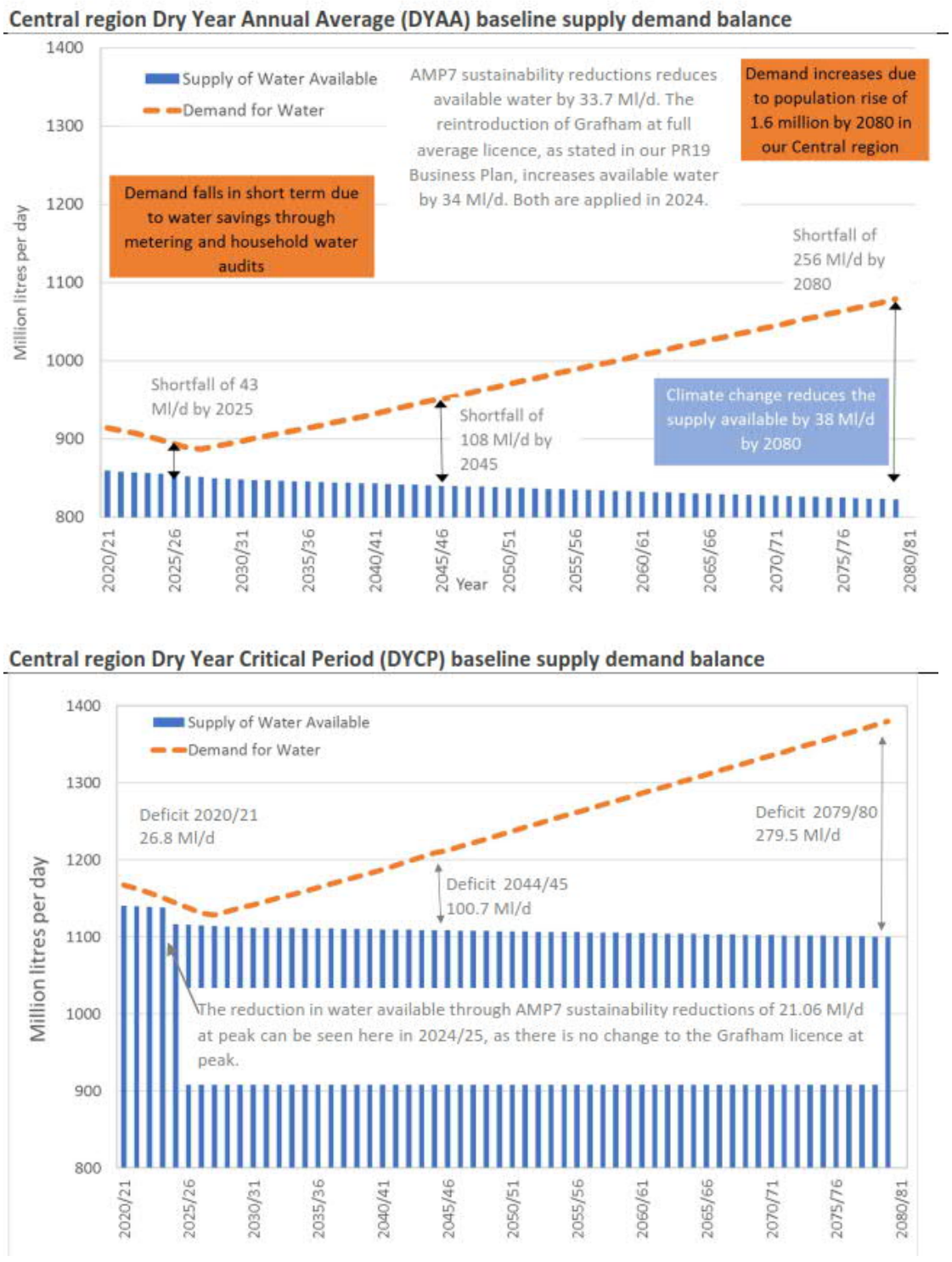


Figure 5-2 Central region baseline supply/demand water balance under average (DYAA) and peak (DYCP) conditions[1]

5.4.6 AWS's best value Plan for the Central region is an adaptive Plan delivering a 'twin-track approach' that combines ambitious demand management activities with the appropriate and timely development of supply-side schemes in order to address the supply demand-deficit. This comprises:

- A demand management strategy, which includes:
  - Reduction of PCC of household customers;
  - Reduction of non-household demand; and
- Reduction of leakage.

- A demand management strategy, which includes:
  - Provision of smaller additional sources within the region;
  - Maintaining and improving operational flexibilities via inter-WRZ transfers to enhance flexibility;
  - Provision of strategic supply schemes from outside the region; and
  - Intra-WRZ transfers to accommodate local losses.

5.4.7 AWS have developed final plan supply demand balances taking into account the measures listed above for both the DYAA and DYCP which are shown in Figure 5-3.

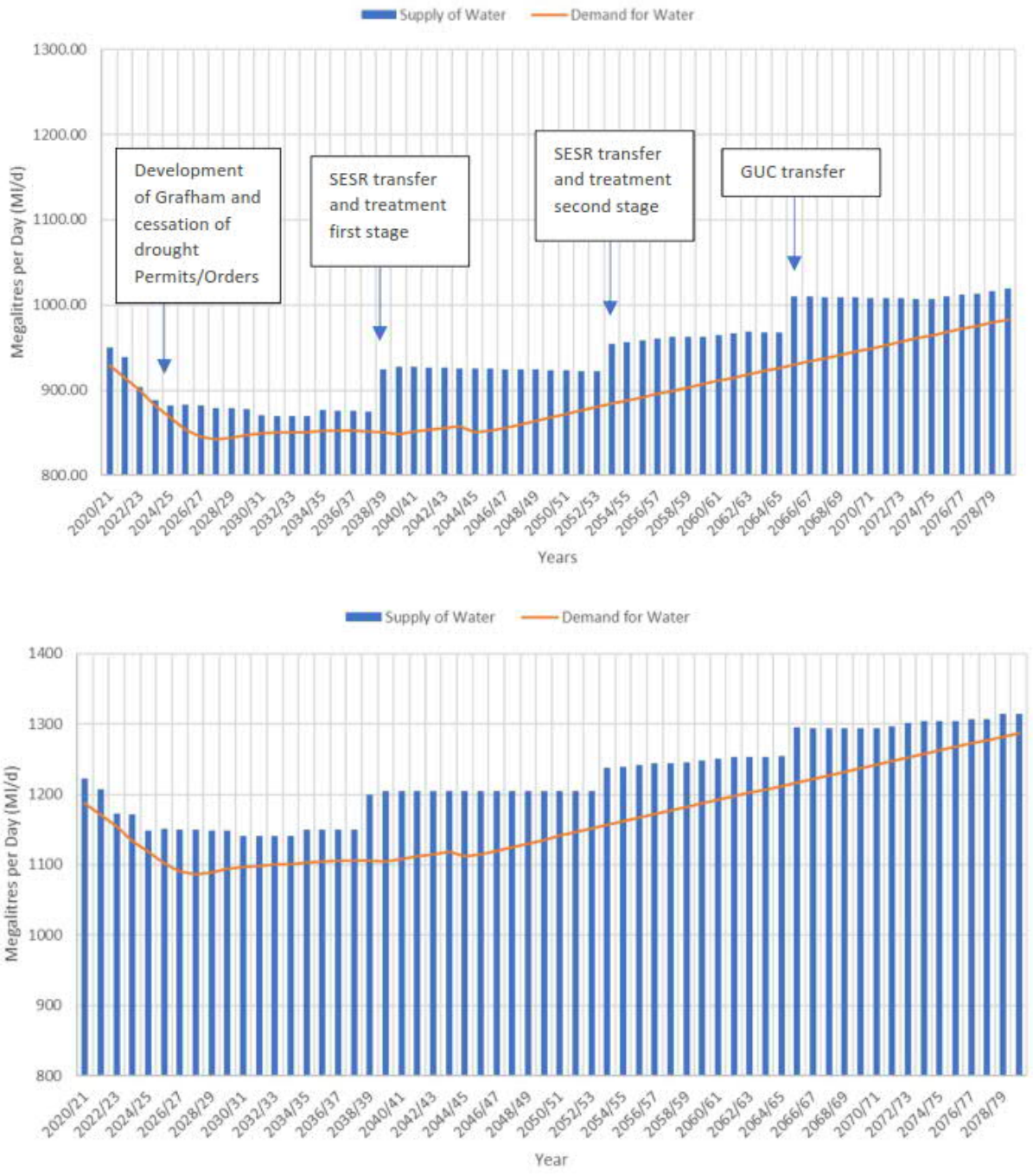


Figure 5-3 Central region final supply/demand water balance under average (DYAA) and peak(DYCP) conditions[1]

5.4.8 As shown in Figure 5-3, there is a slight surplus available when strategic schemes are built. This is reflective of the risk management inherently contained in the adaptive strategy and demonstrates the resilience within AWS's dWRMP19 to future uncertainties.

Thames Water Utilities

5.4.9 The area of the Borough supplied by TWUL is covered by the London WRZ. The Thames basin is one of the most intensively used water resource systems in the world, with approximately 55% of effective rainfall being licensed for abstraction, 82% of which is being used for public water supply. Approximately 80% of the water supplied within this region is derived from surface water sources (largely from bunded storage reservoirs) and 20% from groundwater, with the potential to also abstract and treat brackish estuarine water at the desalination plant in Beckton.

5.4.10 Figure 5-4 highlights a significant supply demand deficit under dry year annual average conditions in the period 2016-2100. According to the TWUL dWRMP19, growth in demand due to population growth outstrips any water demand management activity. Climate change, changes to bulk supplies (the end of an agreement with Essex and Suffolk Water to reduce TWUL's bulk supply to Essex and Suffolk Water) and increase third party abstraction from the River Thames, have an adverse impact on the amount of water available to supply.

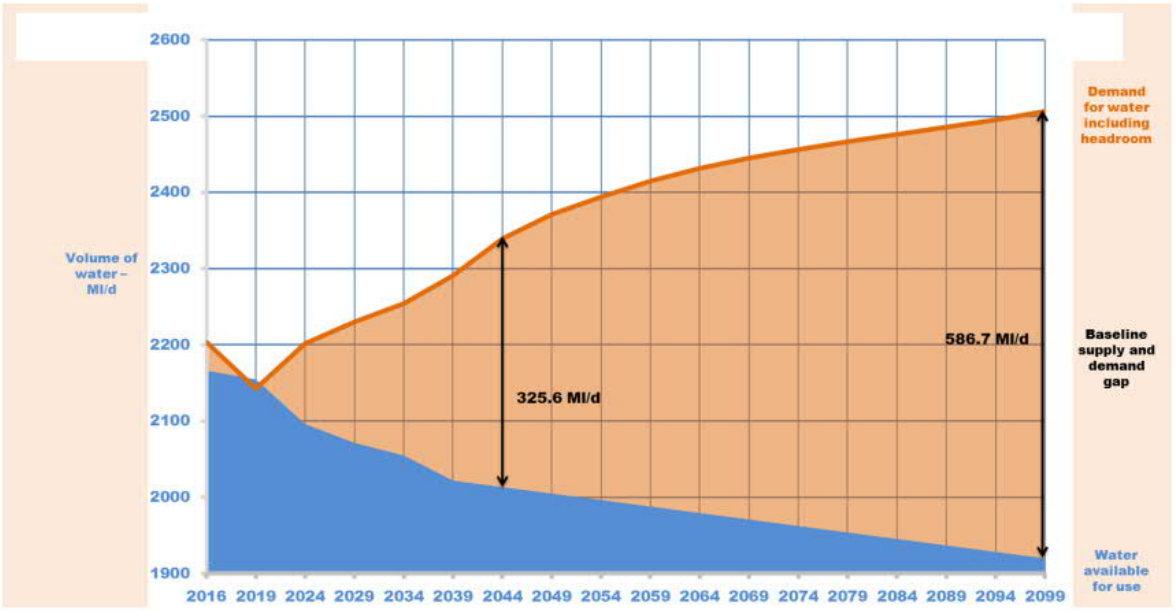


Figure 5-4 Baseline London WRZ supply demand (dry year)[2]

5.4.11 It is identified that a DYAA deficit of 326 Ml/d and 587 Ml/d will occur in 2044/45 and 2099/2100, respectively. Without corrective action, these deficits will result in a supply for London WRZ that is not secure; hence, demand management and resource option to close this gap have been addressed through TWUL's economic analysis process.

5.4.12 The preferred plan for London WRZ ensures that security of supply will be maintained through the 80-year TWUL planning period and removes the supply-demand deficit in the baseline forecast, as this is shown in Figure 5-4. The diagram in Table 5-3 and Table 5-4 illustrates how the interventions from both the demand management programme and resource schemes have been combined to remove the deficit.

Table 5-3 London preferred plan – Overall plan (DYAA) for demand management

	London	Delivery date and ongoing supply demand benefit (Ml/d)							
		AMP7	AMP8	AMP9	AMP10	AMP11	AMP12	AMP13	AMP14-AMP22
		2020-2024	2025-2029	2030-2034	2035-2039	2040-2044	2045-2049	2050-2054	2055-2100
Total benefit from DMP		**177.2**	**93.7**	**49.4**	**84.8**	**29.8**	**15.0**	**7.5**	**Benefits maintained**
Leakage reduction	**Total leakage reduction**	**122.4**	**46.8**	**29.4**	**40.8**	**24.8**	**10.0**	**7.5**	**Benefits maintained**
	AMP6 Leakage reduction carry over	31.6							
	Household metering customer side leakage (CSL)	22.7	9.7						
	Bulk metering CSL								
	AMP7: 36,001 meters	3.0							
	AMP8: 122,081 meters		15.4						
	AMP9: 0 meters			0.0					
	AMP10: 87,505 meters				6.0				
	Replacement metering CSL	3.5	3.5	3.5					
	Mains replacement	6.1	0.9	21.1	30.0	20.0	10.0	7.5	
	Pressure management	6.2							
	Innovation			4.8	4.8	4.8			
	DMA enhancement	26.0	17.3						
	AMP6 activity deferral	23.3							
Usage reduction	**Total usage reduction**	**54.8**	**46.9**	**20.0**	**44.0**	**5.0**	**5.0**	**Benefits maintained**	
	Household metering								
	AMP7: 365,007 meters	28.7							
	AMP8: 319,793 meters		28.1						
	AMP9: 0 meters			2.4					
	Water efficiency	24.8	18.1	16.9	5.0	5.0	5.0		
	Incentive scheme	0.8	0.2	0.2	0.2				
	Non-potable water	0.5	0.5	0.5	0.5				

Table 5-4 London preferred plan – Overall plan (DYAA) for resource management

London	Delivery date and ongoing supply demand benefit (Ml/d)												
	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12	AMP13	AMP14	AMP15	AMP19	AMP20	AMP21	AMP22
	2020-2024	2025-2029	2030-2034	2035-2039	2040-2044	2045-2049	2050-2054	2055-2059	2060-2064	2080-2084	2085-2089	2090-2094	2095-2099
Groundwater schemes													
Network constraint removal New River Head	3	3	3	3	3	3	3	3	3	3	3	3	3
Aquifer storage and recovery – Horton Kirby	5	5	5	5	5	5	5	5	5	5	5	5	5
Groundwater Southfleet/ Greenhithe	8	8	8	8	8	8	8	8	8	8	8	8	8
Groundwater Addington			1	1	1	1	1	1	1	1	1	1	1
Groundwater Merton			2	2	2	2	2	2	2	2	2	2	2
Network constraint removal Epsom			2	2	2	2	2	2	2	2	2	2	2
Artificial recharge – Kidbrooke (SLARS1)			7	7	7	7	7	7	7	7	7	7	7
Artificial recharge – Merton (SLARS3)			5	5	5	5	5	5	5	5	5	5	5
Aquifer storage and recovery – South East London (Addington)			3	3	3	3	3	3	3	3	3	3	3
Raw water purchase schemes													
RWE Didcot	18												
Oxford Canal			11	11	11	11	11	11	11	11	11	11	11
Reduced raw water export													
Chingford				20	20	20	20	20					
Indirect potable reuse													

London	Delivery date and ongoing supply demand benefit (Ml/d)												
	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12	AMP13	AMP14	AMP15	AMP19	AMP20	AMP21	AMP22
	2020-2024	2025-2029	2030-2034	2035-2039	2040-2044	2045-2049	2050-2054	2055-2059	2060-2064	2080-2084	2085-2089	2090-2094	2095-2099
Deephams reuse			45	45	45	45	45	45	45	45	45	45	45
Strategic Options													
SESRO 150Mm³ transfer from SWOX to London						22.2	46.6	75.3	119.8	194	194	194	194
Severn Thames Transfer										4.2	22.4	51.9	60.3
Total additional water resource	**34**	**16**	**92**	**112**	**112.0**	**134.1**	**158.6**	**187.2**	**211.9**	**290.2**	**308.4**	**337.9**	**346.3**
Baseline deficit	-142.6	-195.2	-236.2	-305.8	-362.3	-403.2	-434.7	-463.4	-489.0	-530.6	-567.3	-604.0	-623.4
Additional reduction in DO													
1:200 drought resilience			-140	-140	-140	-140	-140	-140	-140	-140	-140	-140	-140
Vulnerable chalk stream reductions (Waddon and North Orpington)				-15.97	-15.97	-15.97	-15.97	-15.97	-15.97	-15.97	-15.97	-15.97	-15.97
Raw water transfer to WRSE[4]				-100	-100	-100	-100	-100	-100	-100	-100	-100	-100

5.4.13 By the implementation of TWUL preferred plan, the supply-demand deficit will be removed in AMP7 and the supply-demand for water will remain in balance throughout the remainder of the TWUL planning period, as shown in Figure 5-5 below.

Figure 5-5 London WRZ supply-demand balance (DYAA) over 80-year planning period

Sutton and East Surrey Water

5.4.14 SES supplies 160 million litres per day with 85% raw water being extracted from groundwater resources and 15% from Bough Beech Reservoir, supplied by a pumped river abstraction from the River Eden in Kent.

5.4.15 The results of the supply/demand balance under the Worst Drought on Historic Record (WDHR) are presented in Figure 5-6 below, which shows that for the DYAA scenario, there is a surplus until 2048/49. By the end of the 2099 the deficit has increased to 22.7 Ml/d. The point at which demand plus headroom exceeds supply is in the year 2047/48. The deficit by 2080 is calculated to be 20.2 Ml/d. The Annual Average is the more challenging of the two scenarios and it has been used as the basis of the options analysis.

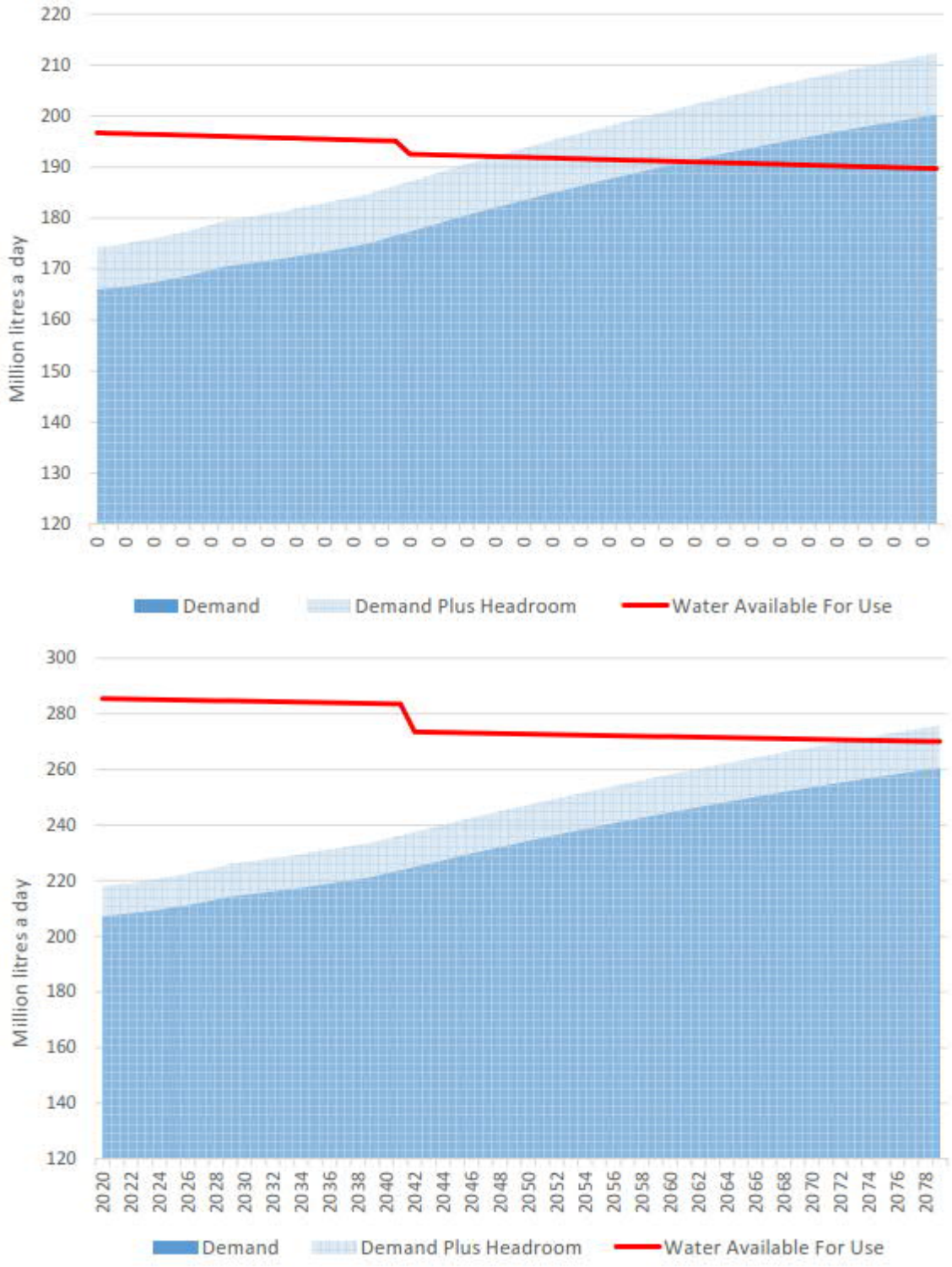
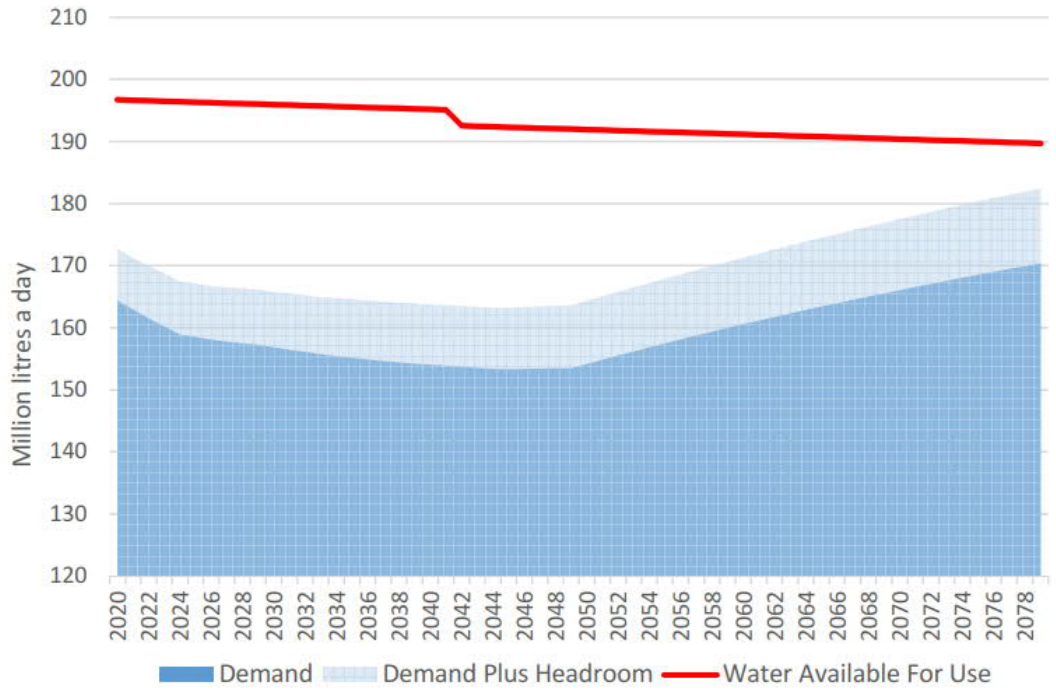


Figure 5-6 Water Available to Use (DYAA-above and DYCP-below)[3]

5.4.16 The revised plan is shown in Figure 5-7 with the Preferred plan Options listed in Table 5-5. The effect of the demand management options is to reduce demand below current levels, with a surplus at the end of the planning period of 7.4 Ml/d for the average scenario and a surplus of 24.2 Ml/d for the critical scenario.

Table 5-5 Preferred Plan Selected Options (WDHR Scenario)

Option	Delivery Year	Is Option Utilised?
SESW-LEA-900: Leakage Strategy (Bundle 1)	2020	Yes
SESW-WEF-700b-ph1: Water Efficiency Option 1b (phase 1)	2020	Yes
SESW-MET-600: Compulsory metering AMI - enhanced higher meter penetration	2020	Yes
SESW-TAR-800b: Tariffs (scenario b)	2045	Yes
SESW-WEF-700b-ph2: Water Efficiency Option 1b (phase 2)	2045	Yes



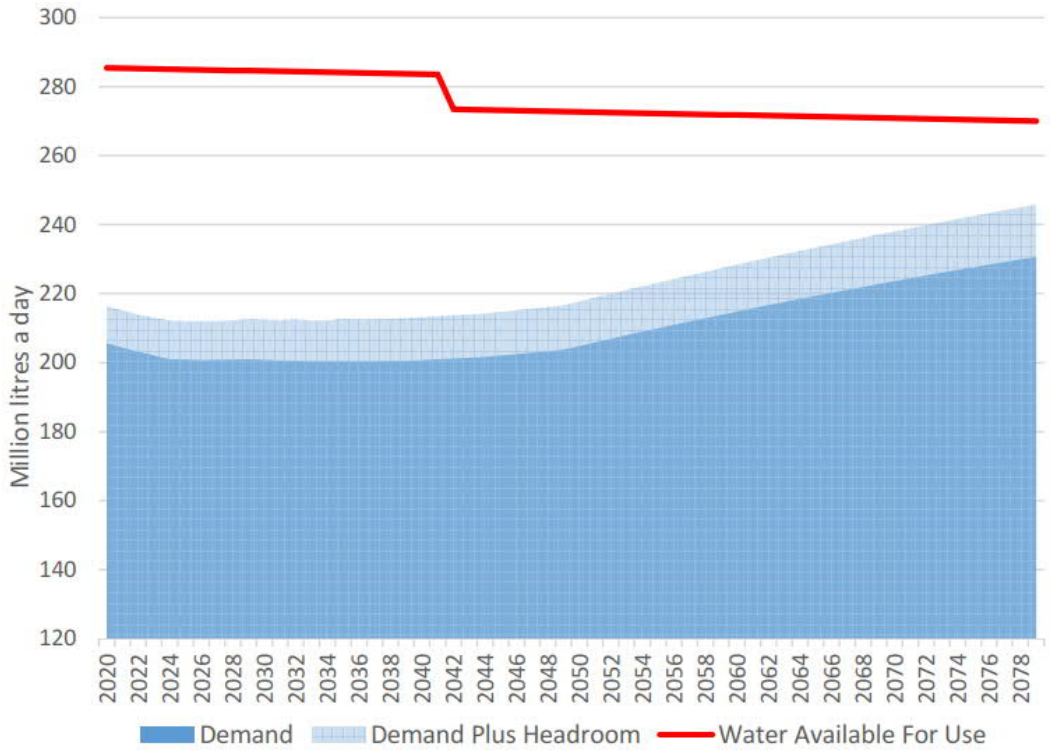


Figure 5-7 Final Plan Supply Demand Balance (DYAA-above and DYCP-below, WDHR scenario)

5.5 Water Efficiency Plan

5.5.1 As well as providing additional supply resource, it is important to ensure that the existing resources are used as efficiently as possible to reduce demand. AWS, TWUL and SES are planning a series of demand management measures and a number of improvements to existing infrastructure and resources. Lowering water consumption levels is considered to be a priority in offsetting resource development.

5.5.2 Proposed demand management measures across the WRZs include:

- Completing water efficiency audits;
- Water metering; and,
- Leakage reduction.

5.5.3 There are several key drivers for ensuring that water use in the development plan period is minimised as far as possible through the adoption of water efficiency policy. This WCS therefore includes an assessment of the feasibility of achieving a 'water neutral' position after growth across Elmbridge.

Drivers and Justification for Water Efficiency

5.5.4 In 2013, the AWS, TWUL and SES supply areas were classified by the Environment Agency as an 'Area of serious water stress' based on a 'Water Exploitation Index' as derived by the European Environment Agency[23]. Part of this classification is based on climate change effects as well as increases in demand driven by Local Plan growth targets. This creates a very strong driver for new homes in the next 20 years to be made as efficient as economically possible to safeguard the future resources to be made available by AWS and TWUL in Elmbridge.

[23] Environment Agency (2013). Water stressed areas – final classification. Available at: https://www.gov.uk/government/publications/water-stressed-areas-2013-classification

5.5.5 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. AWS, TWUL and SES have recognised the risk climate change poses to the three crucial areas of their business, abstraction, treatment and distribution of water. Customers expect AWS, TWUL and SES 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.

5.5.6 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. AWS, TWUL and SES 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.

5.5.7 Although AWS, TWUL and SES have planned for the anticipated impacts of climate change, the view of AWS, TWUL, SES 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. Planning policy has a significant role to play in helping to achieve this.

Water Neutrality

5.5.8 As stated in 0, the TWUL and AWS supply areas are classified as being under “Serious” water stress. 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[24]. 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.

5.5.9 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.

5.5.10 Achieving ‘total’ water neutrality within a development remains an aspirational concept and is usually only considered for an eco-town or eco-village type development, 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.

5.5.11 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 Borough as a whole.

Twin-Track Approach

5.5.12 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.

[24] Water Neutrality is defined more fully in the Environment Agency report ‘Towards water neutrality in the Thames Gateway’ (2007)

5.5.13 In order to reduce water consumption and manage demand for the limited water resources within the Borough, a number of measures and devices are available[25]. 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 D provides more detail on the different types of device or system along with the range of efficiency savings they could lead to.

Achieving Total Neutrality – is it feasible?

5.5.14 When considering neutrality within an existing planning area, it is recognised by the Environment Agency[26] that achievement of total water neutrality (100%) for new development is often not possible, as the levels of water savings required in existing stock may not be possible for the level of growth proposed. A lower percentage of neutrality may therefore be a realistic target, for example 50% neutrality.

5.5.15 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 D discusses the pathway concept in more detail and highlights the importance of developing local policy in the study area for delivering aspirations like water neutrality as well as understanding the additional steps required beyond 'business as usual' required to achieve it.

Metering Assumptions

5.5.16 Installing water meters within existing residential properties is an important element of WRMPs to manage their customers' demand for water. Affinity Water's metering programme as described in the WRMP has been applied to the water neutrality scenarios (outlined in Section 5.5) and details the level of additional metering that could be undertaken.

5.5.17 AWS's dWRMP19 identifies that the meter penetration (the percentage of properties that are metered) will increase from 59.2% in 2020 to over 90% in 2045. By linearly interpolating, it was found that meter penetration in 2035 would reach 88%.

5.5.18 TWUL's dWRMP19 identifies that the meter penetration in the London WRZ in 2016/17 was 33.42%. Within the same study, it has been assumed that a 5% reduction of measured household consumption will be applied with the introduction of tariffs in 2035. This is anticipated to take place when meter penetration will reach at least 65% to ensure fairness to customers,

5.5.19 Finally, SES's dWRMP19 states that the proportion of metered customers will increase from around 60% in 2020 to 70% by 2025 and 93% by the end of the period. For the purpose of our calculations, it was assumed (by linearly interpolating) that meter penetration in 2015 was reaching approximately 50%.

Water Neutrality Scenarios

Theoretical Scenario (Water Neutrality)

5.5.20 The scenario has been developed as a context to demonstrate what is required to achieve a neutral position in the Borough. In practice achieving 100% neutrality across the study area is unrealistic for two main reasons:

- Developers would be required to voluntarily provide homes where water use is reduced below Building Regulation Part G Optional Requirements, through incorporation of water re-use technologies in all major development to meet non-potable demands. Local Authorities are currently limited to setting policies with specific water efficiency targets which link to existing technical standards and without a policy to drive higher specification homes, developers are unlikely to deliver homes with lower water use designed in.
- A significant proportion of existing homes would need to be retrofitted with efficient fixtures and fittings which would require a significant funding pool and a specific project management resource to ensure the retrofitting programme is implemented.

5.5.21 They key assumptions for this scenario are:

[25] Source: Water Efficiency in the South East of England, Environment Agency, April 2007.
[26] Environment Agency (2009) Water Neutrality, an improved and expanded water management definition

- Meter installation should be undertaken into all existing residential properties where metering is technically feasible.
- All new homes would be built to deliver a water use of 62 litres per person per day, based on high specification fixtures and fittings, as well as rainwater harvesting and/or greywater recycling to meet non-potable demands generated by toilet flushing and washing machine use.
- Uptake of retrofitting water efficiency measures considered to be at the maximum achievable (12% for Housing Scenario 1 and 51% for Housing Scenario 2) in the Borough.

5.5.22 To deliver, it would require:

- 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 Plan to encourage restriction of water use in new homes beyond Building regulations; and
- All new development to include water recycling facilities across the Borough.

Optional requirements Scenario plus retrofit

5.5.23 This scenario considers the savings which could be made including a policy within the Local Plan to require developers to build houses to meet the optional standard for water efficiency (Building Regulation Part G Optional Requirements) in addition to a modest programme of additional retrofitting.

5.5.24 The key assumptions for this scenario are:

- All new homes would be built to deliver a water use of 110 litres per person per day (Building Regulation Part G Optional); and
- 5% of existing homes would be retrofitted with low flush cisterns, as well as aerated taps and shower heads.

5.5.25 The scenario has primarily been developed to demonstrate (and provide an evidence based for) the added benefit of adopting policy based on Building Regulation Part G Optional as well as undertaking a joint programme of retrofit.

Mandatory requirement Scenario plus retrofit

5.5.26 This scenario considers a more realistic scenario, and considers the savings which could be made based on developers building houses to meet the minimum expected technical requirements for water use (Building Regulation Part G Mandatory Requirements) in addition to a modest programme of additional retrofitting.

5.5.27 The key assumptions for this scenario are:

- All new homes would be built to deliver a water use of 125 litres per person per day (Building Regulation Part G Mandatory); and
- 5% of existing homes would be retrofitted with low flush cisterns, as well as aerated taps and shower heads.

Neutrality Scenario Assessment Results

5.5.28 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 in the Borough was calculated to be 20.06 Ml/d.

5.5.29 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[27], 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 C). The results are provided in Table 5-6 and Table 5-7 , which also include the effect of just implementing Building Regulation Optional and Mandatory policy control without retrofit for context.

[27] UKWIR – The United Kingdom Water Industry Research group, attended and part funded by all major UK water companies

Table 5-6 Results of the Neutrality Scenario Assessments for Housing Scenario 1

Neutrality Scenario	New homes consumption rate (l/h/d)	% of existing properties to be retrofitted	Demand from Growth (Ml/d)	Total demand post growth* (Ml/d)	Total demand after metering (Ml/d)	Total demand after metering & retrofitting (Ml/d)	Percentage of neutrality
Business As Usual	***149.7***	*0*	*2.59*	*22.65*	***22.26***	***22.26***	***15%***
Mandatory requirements	**125**	0	2.17	22.22	**21.84**	**21.84**	**31%**
Optional requirements	**110**	0	1.91	21.97	**21.58**	**21.58**	**41%**
Mandatory requirements plus retrofit	**125**	5	2.17	22.22	**21.84**	**21.62**	**40%**
Optional requirements plus retrofit	**110**	5	1.91	21.97	**21.58**	**21.35**	**50%**
Theoretical Water Neutrality	**62**	12	1.09	21.14	**20.60**	**20.06**	**100%**

Table 5-7 Results of the Neutrality Scenario Assessments for Housing Scenario 2

Neutrality Scenario	New homes consumption rate (l/h/d)	% of existing properties to be retrofitted	Demand from Growth (Ml/d)	Total demand post growth* (Ml/d)	Total demand after metering (Ml/d)	Total demand after metering & retrofitting (Ml/d)	Percentage of neutrality
Business As Usual	***149.7***	*0*	*6.72*	*26.78*	***26.45***	***26.45***	***5%***
Mandatory requirements	**125**	0	5.62	25.67	**25.34**	**25.34**	**21%**
Optional requirements	**110**	0	4.95	25.00	**24.67**	**24.67**	**31%**
Mandatory requirements plus retrofit	**125**	5	5.62	25.67	**25.34**	**25.16**	**24%**
Optional requirements plus retrofit	**110**	5	4.95	25.00	**24.67**	**24.44**	**35%**
Theoretical Water Neutrality	**62**	12	2.80	22.86	**22.36**	**20.06**	**100%**

5.5.30 Table 5-6 and Table 5-7 indicate that to achieve water neutrality would require the implementation of unrealistic measures: all new development to minimise water demand through the use of extensive and expensive recycling technologies and all water companies to meet maximum water meter penetration in existing housing stock. Therefore, two more realistic water demand management scenarios have been tested.

- Mandatory requirements scenario plus retrofit
- Optional requirements scenario plus retrofit

5.5.31 The water neutrality analysis demonstrated that both the mandatory and optional requirement scenarios would reduce post development demand in 2035.

5.5.32 The mandatory requirements scenario plus 5% retrofit would potentially deliver a post development demand reduction of 0.64 Ml/d for Housing Scenario 1 and 1.29 Ml/d for Housing Scenario 2 (compared to the Business As Usual demand, which is 22.26 ML/d and 26.45 Ml/d for Scenarios 1 and 2 respectively) whilst the optional requirement plus 5% retrofit would deliver a potential reduction of 0.61 Ml/d and 2.01 Ml/d for Housing Scenarios 1 and 2 respectively (compared to the Business As Usual demand).

5.5.33 The Optional requirements scenario plus 5% retrofit, which would achieve 50% (Scenario 1) and 35% (Scenario 2) neutrality, would require new homes to be designed to use water at rate of 110 l/h/d. However, as the neutrality proportion is still not very high, it would be advisable to extend meter penetration or to increase the number of retrofitting properties.

Financial Cost Considerations

5.5.34 There are detailed financial and sustainability issues to consider in deciding on a policy for water neutrality. Whilst being water efficient is a key consideration of this study, reaching neutrality should not be at the expense of increasing energy use and potential increasing the carbon footprint of development.

5.5.35 Using the information compiled, the financial costs per neutrality scenario has been calculated and are included in Table 5-8 and Table 5-9. It should be noted that these are only estimated costs based on strategic level research into water efficiency implementation and cost.

5.5.36 The costs in Table 5-8 and Table 5-9 are calculated using the financial considerations presented in Appendix D4. It is illustrated that for Housing Scenario 1, for example, the total cost when implementing the Optional requirements plus retrofit, instead of the Mandatory requirements is approximately 1.2% higher.

Table 5-8 Estimated Cost of Neutrality Scenarios for Housing Scenario 1

Neutrality Scenario	New Homes		Existing Properties				Costs Summary		
	No.	Efficiency cost (£)	Metering cost (£)	Population Retrofit	No. to retrofit	Retrofit cost (£)	Developer (£)	Non developer (£)	Total (£)
Mandatory requirements plus retrofit	7,047	-	4,671,307	5%	2,694	511,803	-	5,183,110	5,183,110
Optional requirements plus retrofit	7,047	63,423	4,671,307	5%	2,694	511,803	63,423	5,183,110	5,246,533
Theoretical Water Neutrality	7,047	28,871,559	4,671,307	12.04%	6,485	1,232,124	28,871,559	5,903,431	34,774,990

Table 5-9 Estimated Cost of Neutrality Scenarios for Housing Scenario 2

Neutrality Scenario	New Homes		Existing Properties				Costs Summary		
	No.	Efficiency cost (£)	Metering cost (£)	Population Retrofit	No. to retrofit	Retrofit cost (£)	Developer (£)	Non developer (£)	Total (£)
Mandatory requirements plus retrofit	20,040	-	4,671,307	5%	2,694	511,803	-	5,183,110	5,183,110
Optional requirements plus retrofit	20,040	180,360	4,671,307	5%	2,694	511,803	180,360	5,183,110	5,363,470
Theoretical Water Neutrality	20,040	82,103,880	4,671,307	51.01%	27,479	5,221,018	82,103,880	9,892,325	91,996,205

Preferred Strategy – Delivery Pathway

5.5.37 In order to set out a feasible route for how the proposed scenarios could be delivered, this study has considered delivery requirements for the 'optional requirement plus retrofit scenario'. This has been undertaken to allow EBC to consider the potential costs and benefits of developing a water use policy to require developers to build new homes to meet the Building Regulation Part G Optional water standards, and to consider working with water companies to develop further options for retrofitting existing properties with efficiency fixtures and fittings.

5.5.38 Table 5-10 summarises the delivery requirement and includes a high level assessment of the likely ease with which each element could be pursued and delivered, along with recommendations on the likely responsible organisation that could take each option forward.

Table 5-10 Water efficiency and retrofit measures and recommended responsible organisations

Delivery requirements	Ease of adoption and delivery	Responsible stakeholder
Ensure planning applications for Major Development are compliant with the recommended policies on water use requirements	High Some officer training may be required, but policing of policy compliance would be a reasonably straightforward procedure. Examples for water efficiency policy guidance are available.[28]	EBC (LPA – Planning team)
Fitting water efficient devices in accordance with policy	High A significant library of information base is available on available water efficiency measures to meet a range of standards including online water calculators.	Developers and LPA (Building Control)
Provide guidance on the installation of water efficient devices through the planning application process	High Pre-application advice could be provided specific to water efficiency options and specific information made available on each LPA's website or on KCC's website.	EBC (LPA)
Ensure continuing increases in the level of water meter penetration where the maximum possible is not already achieved	Medium This initiative should reflect commitments in current and future WRMPs.	TWUL and AWR
• Retrofit devices within council owned housing stock; and, • Retrofit devices within privately owned housing stock	Low to Medium A significant funding pool and staff resource requirement would need to be identified to deliver feasibility studies and retrofit implementation. 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. These options are identified as part of the companies' WRMPs and will have to undergo a cost-benefit analysis but further analysis subsequent to this study could inform a greater investment in retrofitting measures as a means to offset demand from new property, particularly where funding could be supplemented through developer contributions (although this is considered unlikely).	TWUL and AWS in partnership with EBC's LPA – TWUL and AWS would need to fund this, but TWUL and AWS LPA could consider providing a programme lead to identify suitable properties and manage the programme delivery
Promote water audits and set targets for the number of businesses that have water audits carried out.	Medium Allocate a specific individual or team within each of the local authorities to be responsible for promoting and undertaking water audits (a relatively low cost option) and ensuring the targets are met. The same team or individual could also act as a community liaison for 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.	EBC (LPA)

[28] https://www.eastcambs.gov.uk/sites/default/files/FD.EVR23%20-%20Final.pdf

Delivery requirements	Ease of adoption and delivery	Responsible stakeholder
Educate and raise awareness of water efficiency[29]	High All stakeholders could use existing tools such as website information, pre-development application responses and public events to increase awareness and education regards the importance of water efficiency in Kent	All stakeholders

[29] A major aim of an education and awareness programme, 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 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, can be as important as the installation of water efficient devices

6. Major Development Site Assessments

6.1 Introduction

6.1.1 This section of the WCS addresses local infrastructure capacity issues, flood risk, surface water management and SuDS suitability for each of the proposed opportunity sites for major development (sites containing more than 10 dwellings). A brief methodology is outlined below. Summary tables detailing the outcome of the site assessments are set out in Section 6.3.

6.2 Assessment Methodologies

Wastewater Network

6.2.1 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 the new development to the STW for treatment.

6.2.2 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.

6.2.3 As the wastewater undertaker for the Borough, 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, but 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.

6.2.4 TWUL have undertaken an internal assessment of the capacity of the network system using local operational knowledge. A RAG assessment has been undertaken; a key indicating the coding applied to each assessment is provided in Table 6-1.

6.2.5 TWUL has advised that for the Esher catchment:

- Standalone development of less than 100 units are unlikely to require upgrades (Reference: ESHER-1).
- Cluster developments and standalone developments of more than 100 units may require upgrades. The scale of those upgrades will be determined by exactly where, when and at what rate those developments occur (Reference: ESHER-2).
- Cluster developments and standalone development of more than 300 units may require solutions of a more strategic nature (Reference: ESHER-3).

6.2.6 TWUL has also advised that for the Weybridge catchment:

- Standalone development of less than 40 units are unlikely to require upgrades (Reference: WEY-1).
- Cluster developments and standalone developments of more than 40 units may require upgrades. The scale of those upgrades will be determined by exactly where when and at what rate those developments occur (Reference: WEY-2).
- Cluster developments and standalone development of more than 300 units may require solutions of a more strategic nature (Reference: WEY-3).

6.2.7 TWUL has advised that the sites included in the 'red' group may require a longer time for their infrastructure to be delivered.

Table 6-1 Key for wastewater network RAG assessment

Development is likely to be possible without upgrades (Reference in Table 6-3 and Table 6-4: ESHER-1, WEY-1).	**No significant infrastructure likely to be required. However, local network reinforcements may be required (Reference in Table 6-3 and Table 6-4: ESHER-2, WEY-2).**	**Major local network reinforcements will be required to support this development and to ensure no reduction in service to existing services in the area (Reference in Table 6-3 and Table 6-4: ESHER-3, WEY-3).**

Water supply network capacity

6.2.8 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.

6.2.9 AWS and TWUL have undertaken an assessment of the capacity of the water supply system using local operational knowledge. A RAG assessment has been undertaken; a key indicating the coding applied to each assessment is provided in Table 6-2.

6.2.10 According to TWUL, the coding is as follows:

- DS-W5: The water network capacity in this area may be unable to support the demand anticipated from this development. Local upgrades to the existing water network infrastructure may be required to ensure sufficient capacity is brought forward ahead of the development. The developer is encouraged to work with Thames Water early on in the planning process to understand what infrastructure is required, where, when and how it will be delivered.
- DS-W7: On the information available to date TWUL does not envisage infrastructure concerns regarding Water Supply capability in relation to this site.
- DS-W8: The site falls outside TWUL's water supply boundary.

6.2.11 Additionally, AWS has assessed the network performance under two different scenarios; current demand (to establish baseline) and future demand. According to the simulation results:

- The demand increase due to the Elmbridge sites in the LAA development sites and Greenbelt sites will be 1.37 ML/d and 1.42 ML/d respectively;
- The pressures at the critical points in the network due to the new development are such that major reinforcements in the network in the Elmbridge area will be required (Reference: AWS in Table 6-3 and Table 6-4). This normally means new pipelines, although in some new pumping stations, will be required. There is sufficient water supply in the region.

6.2.12 AWS has also informed AECOM that all the proposed reinforcements will aim to recover the current level of service and the loss of capacity in the network due to the additional load imposed by projected development. Infrastructure will be available for the new housing growth, but current capacity in the network may be used to absorb some initial phases of growth. The overall scheme design and construction programme will depend on the location and phasing of development and any early information concerning this will help planning.

Table 6-2 Key for water supply network RAG assessment

Capacity available to serve the proposed growth (Reference in Table 6-3 and Table 6-4: DS-W7)	**Infrastructure upgrades required to serve proposed growth (Reference in Table 6-3 and Table 6-4: DS-W5)**	**Major constraints to the provision of infrastructure to serve proposed growth (Reference in Table 6-3 and Table 6-4: AWS)**

Flood Risk

6.2.13 The flood risk to each of the major development sites has been considered using the Flood Maps for Planning mapping produced by the Environment Agency. The Elmbridge Level 1 SFRA[30] has also been used to help identify the risk of flooding at each development site.

6.2.14 Surface water flooding has been reviewed for each of the major development sites using the Risk of Flooding from Surface Water (RoFSW)[31] mapping produced by the Environment Agency.

6.3 Site Assessment tables

6.3.1 The following section contains the detail of the assessment of each of the proposed major development LAA and Green Belt sites in Table 6-3 and Table 6-4 It should be noted that the sites shown in those two tables have been classified by TWUL as sites where solutions of a more strategic nature may be required due to solely the site's size. It should also be noted that some Green Belt sites are classified as 'Red' implying that due to the absence of current water supply infrastructure, major infrastructure upgrades would be required before significant development could progress.

[30] AECOM (2019). Elmbridge Borough Council Level 1 Strategic Flood Risk Assessment
[31] Previously referred to as the updated Flood Map for Surface Water (uFMfSW)

Table 6-3 Sites assessment summary table for LAA sites

Site details				Wastewater and Water Supply			Flood Risk					
Site reference	Site Name	Total Dwellings	STW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
US106	BT Telephone Exchange, Heath Road	17	WEYBRIDGE STW	WEY-1	DS-W8		100%	0%	0%	0%	0%	2%
US108	Weybridge Library, Church Street, Weybridge	12	WEYBRIDGE STW	WEY-1	DS-W7		100%	0%	0%	0%	0%	0%
US110	The Heights, Weybridge	9000-1000sqm B1	WEYBRIDGE STW	WEY-3		AWS	45%	16%	39%	2%	5%	17%
US111	Warling Dean 33 New Road, Esher	12	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	0%	5%
US115	18 Springfield Lane, Weybridge	21	WEYBRIDGE STW	WEY-1	DS-W8		100%	0%	0%	0%	1%	7%
US116	Molesey FC Walton Road	38	ESHER STW	ESHER-1			100%	0%	0%	0%	3%	15%
US127	30 Copsem Lane, Esher, KT10 9HE	33	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	0%
US134	Hanover Cottage 6 Claremont Lane Esher KT10 9DW	10	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	0%	0%
US135	12-16 High Street, Walton-on-Thames, KT12 1DA	40	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	1%
US136	Bevendean Cottage, Warren Lane, Oxshott, KT22 0SU	11	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	0%
US138	Land adjacent to Walton Road, West Molesey, KT8 2AU	13	ESHER STW	ESHER-1	DS-W7		56%	44%	0%	0%	2%	32%
US140	4-10 Webster Close, 45-55 Waverley Road and 1-11 Lyfield	11	ESHER STW	ESHER-1			0%	100%	0%	5%	33%	53%
US142	19-23 Church Road, East Molesey KT8 9DW	11	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	0%	0%
US145	28-30 Sugden Road, Hinchley Wood, KT7 0AE	12	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	100%	40%
US147	Thamesview House Felix Road Walton-On-Thames KT12 2SL	33	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	3%	15%
US156	Garages, Foxwarren	15	ESHER STW	ESHER-1			100%	0%	0%	0%	2%	11%
US157	101-153 Farm Road, Esher, KT10 8AX	13	ESHER STW	ESHER-1	DS-W7		1%	99%	0%	0%	0%	0%
US164	Garages off Tartar Road	11	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	0%
US169	Claygate Station Car Park, The Parade	15	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	0%	0%
US175	Claygate Centre, Elm Road	14	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	0%
US177	Claygate Lawn Tennis Club	24	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	6%	21%
US178	Sainsbury's car park, Bridge Way, Cobham, KT11 1HW	58	ESHER STW	ESHER-1	DS-W7		98%	2%	0%	0%	5%	23%
US183	BMW Cobham, 18-22 Portsmouth Road, Cobham	27	ESHER STW	ESHER-1	DS-W8		41%	59%	0%	0%	7%	19%
US188	Ford Garage, 97 Portsmouth Road, Cobham, KT11 1JJ	21	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	0%
US190	Shell Fairmile, 270 Portsmouth Road, Cobham KT11 1HU	10	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	3%

Site details				Wastewater and Water Supply			Flood Risk					
Site reference	Site Name	Total Dwellings	STW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
US191	73 Between Streets, Cobham, KT11 1AA	20	ESHER STW	ESHER-1	DS-W8		6%	94%	0%	0%	3%	9%
US194	Protech House, Copse Road, Cobham KT11 2TW	28	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	1%	38%
US195	Cobham Village Hall and Centre for the Community, Lushington Drive, Cobham, KT11 2LU	37	ESHER STW	ESHER-1			100%	0%	0%	0%	4%	26%
US20	Land north of Leaf Close, Thames Ditton	20	ESHER STW	ESHER-1			0%	100%	0%	0%	0%	21%
US201	Tiltwood Care Home, Hogshill Lane, Cobham, KT11 2AQ	17	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	1%	7%
US208	Cobham RFC - Fairmile Lane, Cobham KT11 2BU	83	ESHER STW	ESHER-1			100%	0%	0%	4%	9%	25%
US210	Eaton Farm, Miles Lane, Cobham, KT11 2ED	27	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	2%	10%
US212	50 Station Road, Stoke D'Abernon, KT11 3BN	30	ESHER STW	ESHER-1	DS-W7		1%	4%	95%	55%	96%	90%
US214	Waitrose, 16-18 Between Streets, Cobham KT11 1AF	20	ESHER STW	ESHER-1	DS-W7		80%	20%	0%	1%	14%	32%
US218	Holden Place and 12-18 Anyards Road, Cobham	20	ESHER STW	ESHER-1			60%	40%	0%	14%	0%	3%
US218	Coveham House, Downside Bridge Road and The Royal British Legion, Hollyhedge Road, Cobham	14	ESHER STW	ESHER-1	DS-W8		60%	40%	0%	14%	0%	3%
US220	Cobham Gate, Anyards Road	17	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	4%	37%
US226	Sandpiper, Newlands Avenue, Thames Ditton, KT7 0HF	22	ESHER STW	ESHER-1	DS-W8		83%	17%	0%	0%	0%	9%
US227	Rythe Centre, Willow Bank, Claygate Lane, Thames Ditton, KT7 0LE	19	ESHER STW	ESHER-1	DS-W8		1%	71%	28%	1%	2%	39%
US232	Nuffield Health off Simpson Way, Long Ditton	16	HOGSMILL STW		DS-W8		100%	0%	0%	0%	0%	2%
US233	Nuffield Health car park Off Simpson Way, Long Ditton	10	HOGSMILL STW		DS-W8		100%	0%	0%	0%	0%	0%
US237	Ashly Road Car Park and Back Land to the west of High Street, Thames Ditton	14	ESHER STW	ESHER-1	DS-W8		16%	84%	0%	5%	19%	56%
US24	Garages to the rear of Longmead Road	21	ESHER STW	ESHER-1	DS-W7		50%	50%	0%	0%	0%	0%
US240	Thames Ditton Lawn Tennis Club, Weston Green Road, Thames Ditton, KT7 0HX	37	ESHER STW	ESHER-1	DS-W8		95%	5%	0%	0%	0%	0%

Site details				Wastewater and Water Supply			Flood Risk					
Site reference	Site Name	Total Dwellings	STW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
US248	School Bungalow, Mercer Close, Thames Ditton, KT7 0BS	10	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	0%
US25	BT Telephone Exchange, Portsmouth Road, Thames Ditton	20	ESHER STW	ESHER-1	DS-W8		83%	17%	0%	0%	0%	0%
US250	Community centres at the junction of Mercer Close and Watts Road, Thames Ditton	29	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	5%
US251	Old Pauline Sports Ground Car Park	35	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	5%
US254	4-6 Manor Road South and 4 Greenways, Hinchley Wood	33	ESHER STW	ESHER-1			100%	0%	0%	0%	1%	39%
US261	Land at Cockcrow Hill, Long Ditton	15	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	0%	0%
US269	Unit 1-3 Hampton Court Estate, Summer Road, Thames Ditton	93	ESHER STW	ESHER-1			0%	100%	0%	0%	0%	5%
US272	Industrial units at 67 Summer Road East Molesey KT8 9LX	12	ESHER STW	ESHER-1	DS-W7		0%	100%	0%	0%	1%	19%
US274	Two Furlongs and Wren House, Portsmouth Road, Esher, KT10 9AA	10	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	0%
US277	61-63 More Lane, Esher	15	ESHER STW	ESHER-1	DS-W7		0%	100%	0%	0%	0%	0%
US278	45 More Lane, Esher, KT10 8AP	40 C2	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	0%
US279	Esher Place, 30 Esher Place Avenue, Esher, KT10 8PZ	50	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	1%	1%
US280	St Andrews and Hillbrow House, Portsmouth Road, Esher, KT10 9SA	30	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	4%	21%
US282	42 New Road Esher KT10 9NU	12	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	0%
US282	Land to the north east of Heathside School, Brooklands Lane, Weybridge	17	WEYBRIDGE STW	WEY-1	DS-W7		100%	0%	0%	0%	0%	0%
US283	1-5 Millbourne Lane, Esher, KT10 9DU	37	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	23%
US283	The Old Warehouse, 37A Church Street, Weybridge KT13 8DG	37	WEYBRIDGE STW	WEY-1			100%	0%	0%	0%	0%	23%
US284	NHS North West, 58 Church Street, Weybridge KT13 8DP	19	WEYBRIDGE STW	WEY-1	DS-W7		100%	0%	0%	0%	0%	0%
US286	Idis House, Churchfield Rd, Weybridge KT13 8DB	12	WEYBRIDGE STW	WEY-1			100%	0%	0%	0%	0%	20%
US287	Land to the west of Fenner House, Queens Road, Hersham	24	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	5%
US287	15 Clare Hill Esher KT10 9NB	56	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	0%	5%
US288	Hawkshill Place Portsmouth Road Esher KT10 9HY	12	ESHER STW	ESHER-1			100%	0%	0%	0%	5%	16%

Site details				Wastewater and Water Supply			Flood Risk					
Site reference	Site Name	Total Dwellings	STW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
US291	Woodlawn, Hanger Hill and 2 Churchfields Avenue	12	WEYBRIDGE STW	WEY-1	DS-W7		100%	0%	0%	0%	0%	4%
US291	Green space between Grenside Road and Thames Street Weybridge	10	WEYBRIDGE STW	WEY-1			100%	0%	0%	0%	0%	4%
US293	Amenity space at Southdown Road, Hersham	10	ESHER STW	ESHER-1			0%	100%	0%	2%	100%	9%
US294	2-8 Princes Road Weybridge KT13 9BQ	10	WEYBRIDGE STW	WEY-1	DS-W7		100%	0%	0%	0%	0%	0%
US296	5 Matham Road East Molesey KT8 0SX	23	ESHER STW	ESHER-1	DS-W7		44%	54%	2%	0%	0%	0%
US297	Foxholes, Weybridge KT13 0BN	78	WEYBRIDGE STW	WEY-2		AWS	100%	0%	0%	2%	6%	26%
US298	118 Ashley Road Walton-On-Thames KT12 1HN	50	WEYBRIDGE STW	WEY-2	DS-W7	AWS	100%	0%	0%	0%	0%	13%
US299	East Molesey Car Park, Walton Road, East Molesey	23	ESHER STW	ESHER-1			1%	99%	0%	0%	0%	53%
US300	Vine Hall 39-41 Vine Road East Molesey KT8 9LF	11	ESHER STW	ESHER-1			0%	100%	0%	0%	6%	45%
US302	43 Palace Road East Molesey KT8 9DN	18	ESHER STW	ESHER-1	DS-W7		0%	89%	11%	0%	0%	0%
US302	Weybridge Business Centre, 66-70 York Road Weybridge KT13 9DY	19	WEYBRIDGE STW	WEY-1	DS-W7		0%	89%	11%	0%	0%	0%
US303	Land to the south of Woodley Manor Granville Road Weybridge KT13 0QJ	29	WEYBRIDGE STW	WEY-1	DS-W7		100%	0%	0%	0%	0%	2%
US304	Land to the rear of 1-2 Segrave Close Weybridge KT13 0TD	12	WEYBRIDGE STW	WEY-1			100%	0%	0%	0%	0%	0%
US306	Molesey Clinic and library, Walton Road, West Molesey, KT8 2HZ	10	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	8%	22%
US307	Amenity space between Walton Road and The Forum, East Molesey	14	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	0%
US308	Cobham Free School, 357 Hurst Road, Molesey	29	ESHER STW	ESHER-1	DS-W7		96%	3%	0%	0%	0%	7%
US309	35-47 Monument Hill, Weybridge KT13 8RN	25	WEYBRIDGE STW	WEY-1	DS-W7		100%	0%	0%	2%	6%	11%
US311	181 Oatlands Drive, Weybridge KT13 9DJ	12	WEYBRIDGE STW	WEY-1	DS-W8		26%	74%	1%	0%	0%	3%
US311	Ray Road Allotments, West Molesey	29	ESHER STW	ESHER-1	DS-W8		26%	74%	1%	0%	0%	3%
US312	Youth Centre Ray Road West Molesey KT8 2LG	13	ESHER STW	ESHER-1	DS-W8		4%	96%	0%	0%	16%	58%
US314	Weybridge Bowling Club 19 Springfield Lane Weybridge KT13 8AW	11	WEYBRIDGE STW	WEY-1	DS-W8		100%	0%	0%	0%	0%	0%
US317	Tesco Metro parking south of Walton Road, East Molesey	11	ESHER STW	ESHER-1	DS-W8		0%	100%	0%	0%	63%	99%

Site details				Wastewater and Water Supply			Flood Risk					
Site reference	Site Name	Total Dwellings	STW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
US32	Windsor Houses 34-40 High Street	29	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	0%
US321	Case House 85-89 High Street Walton On Thames KT12 1DZ	28	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	2%	19%
US324	Manor Road Car Park, Manor Road, Walton-on-Thames, KT12 2QN	31	ESHER STW	ESHER-1			100%	0%	0%	0%	6%	9%
US325	Station Car Park next to PGS House	60	ESHER STW	ESHER-1	DS-W8	AWS	100%	0%	0%	0%	5%	43%
US326	13-19 High Street, Walton-on-Thames	30	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	5%
US327	Bridge Motor Works New Zealand Avenue and Playhouse Hurst Grove Walton-On-Thames KT12 1AU	55	ESHER STW	ESHER-1	DS-W8	AWS	100%	0%	0%	4%	8%	23%
US328	Walton Lodge, Bridge Street, Walton-on-Thames KT12 1BT	18	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	3%
US33	River Mole Business Park, Mill Road, Esher	200	ESHER STW	ESHER-2			98%	2%	0%	1%	3%	17%
US333	Site A Public open space to the north of St Johns Drive, Walton-on-Thames	10	ESHER STW	ESHER-1	DS-W8		99%	1%	0%	0%	1%	74%
US334	Site B Public open space to the south of St Johns Drive, Walton-on-Thames	15	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	3%	32%
US337	Severn Drive Green, Walton-on-Thames	15	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	4%
US341	Area of green space between Colne Drive and Lindley Road, Walton-on-Thames	11	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	0%
US348	Cornerstone Church, Station Avenue, Walton- On-Thames	18	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	7%
US350	Leylands House, Dometto House and petrol station, Molesey Road, Walton-on-Thames	14	ESHER STW	ESHER-1	DS-W8		24%	76%	0%	0%	0%	0%
US351	Land at Mellor Close	11	ESHER STW	ESHER-1			30%	70%	0%	0%	0%	1%
US352	Fire/Ambulance station Hersham Road Walton-On-Thames KT12 1RZ	21	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	4%	36%
US353	Fernleigh Day Service Fernleigh Close Walton-On-Thames KT12 1RD	19	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	22%
US354	KIA Motors / P G S Court, Halfway Green, Walton-on-Thames, KT12 1FJ	23	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	0%
US355	Walton Audi 1 Station Avenue Walton-On-Thames KT12 1PD	16	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	2%
US356	Station Avenue Car Park, Station Avenue, Walton-on-Thames	30	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	3%	9%	21%

Site details				Wastewater and Water Supply			Flood Risk					
Site reference	Site Name	Total Dwellings	STW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
US359	6-8 Hersham Road Walton-On-Thames KT12 1JZ	15	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	19%	55%
US360	Walton Comrades Club 7 Franklyn Road Walton-On-Thames KT12 2LF	16	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	0%
US374	Hersham Library Molesey Road Hersham	13	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	68%
US375	Volkswagen Ltd Esher Road Hersham KT12 4JY	27	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	3%	10%
US376	Trinity Hall and 63-67 Molesey Road, Hersham	47	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	6%
US379	Waitrose car park, New Berry Lane, Hersham	17	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	0%
US38	Units C and D, Sandown Industrial Park, Mill Road, Esher	60	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	0%
US382	Vauxmead Playing Fields Faulkners Road Hersham KT12 5JB	45	ESHER STW	ESHER-1			100%	0%	0%	2%	2%	5%
US383	Land to the west of 4 Hutton Close Hersham KT12 5EF	10	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	38%
US39	Unit A & B Sandown Industrial Park, Esher	40	ESHER STW	ESHER-1			98%	1%	0%	0%	0%	0%
US4	BT Telephone Exhange, Hare Lane	60	ESHER STW	ESHER-1			100%	0%	0%	5%	18%	31%
US40	Hersham Day Centre and Village Hal	15	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	5%
US50	Royal Cambridge Home	60	ESHER STW	ESHER-1	DS-W7		59%	40%	1%	0%	0%	1%
US53	Mole Hall, 2 Bishop Fox Way, West Molesey	10	ESHER STW	ESHER-1	DS-W8		15%	34%	51%	0%	3%	31%
US56	Joseph Palmer Centre, 319a Walton Road	20	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	7%
US6	Crown House	12	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	8%
US61	Land adjacent to 151 Rydens Road	14	ESHER STW	ESHER-1			49%	36%	15%	0%	0%	10%
US66	7-9 Ashley Road, Walton-on-Thames, KT12 1HY	15	ESHER STW	ESHER-1			100%	0%	0%	0%	0%	6%
US72	Courtlands & 1-5 Terrace Road	78	ESHER STW	ESHER-1	DS-W8	AWS	100%	0%	0%	0%	0%	3%
US81	Walton Court, Station Avenue, Walton	375	ESHER STW	ESHER-3	DS-W8	AWS	100%	0%	0%	0%	2%	19%
US83	Homebase, New Zealand Avenue, Walton-on-Thames, KT12 1XA	69	ESHER STW	ESHER-1	DS-W8	AWS	100%	0%	0%	0%	0%	0%
US84	Elm Grove Hall, 1 Hersham Road, Walton-on-Thames, KT12 1LH	70	ESHER STW	ESHER-1	DS-W8	AWS	100%	0%	0%	9%	16%	31%
US85	16 Vickers Drive South	COU B8 to A1	WEYBRIDGE STW	WEY-1			0%	5%	95%	3%	9%	28%

Site details				Wastewater and Water Supply			Flood Risk					
Site reference	Site Name	Total Dwellings	STW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
US9	BT Telephone Exchange, 6-10 Church Street, Cobham	15	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	18%
US92	GlaxoSmithKline, St. Georges Avenue	100	WEYBRIDGE STW	WEY-2	DS-W8	AWS	100%	0%	0%	2%	6%	21%
US93	Horizon Business Village	6000 sqm B1	WEYBRIDGE STW	WEY-2		AWS	0%	12%	88%	15%	20%	30%
US94	Locke King House, 2 Balfour Road, Weybridge	10	WEYBRIDGE STW	WEY-1	DS-W8		100%	0%	0%	0%	0%	0%

Table 6-4 Sites assessment summary table for Green Belt sites

Site Details				Wastewater and Water supply			Flood Risk					
Site reference	Site name	Total Dwellings	WWTW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
GB1	SA- 89	400	ESHER STW	ESHER-3	DS-W8		100%	0%	0%	0%	1%	6%
GB10	Manor Farm, Woodlands Lane	615	ESHER STW	ESHER-3	DS-W7		100%	0%	0%	3%	11%	29%
GB11	Land south east of Queen Elizabeth II Reservoir	180	ESHER STW	ESHER-2	DS-W8	AWS	0%	23%	76%	1%	1%	26%
GB12	Land at Rydens Road	70	ESHER STW	ESHER-1	DS-W8	AWS	0%	20%	79%	0%	0%	62%
GB13	Thames Water Site A - Land west of Walton Road	30	ESHER STW	ESHER-1	DS-W8		73%	19%	7%	1%	2%	7%
GB14	Corbie Wood, Seven Hills Road	120	ESHER STW	ESHER-2	DS-W8	AWS	100%	0%	0%	4%	14%	36%
GB15	Land at Byfleet Road	50	WEYBRIDGE STW	WEY-2	DS-W7	AWS	100%	0%	0%	0%	0%	0%
GB17	SA- 32	50	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	1%
GB18	SA-88	120	ESHER STW	ESHER-2	DS-W8		5%	87%	8%	0%	0%	7%
GB19	SA- 14	100	ESHER STW	ESHER-2	DS-W8		100%	0%	0%	0%	0%	0%
GB2	SA-35	10	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	0%
GB20	SA- 28	45	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	9%	17%	30%
GB21	LA- 70	45	ESHER STW	ESHER-1	DS-W8		25%	71%	3%	0%	1%	11%
GB22	Fieldcommon (Drake Park)	707	ESHER STW	ESHER-3	DS-W8	AWS	89%	11%	0%	0%	0%	2%
GB23	SA-85	225	ESHER STW	ESHER-2	DS-W8		76%	24%	0%	0%	1%	7%
GB24	SA- 75	200	ESHER STW	ESHER-2	DS-W7		49%	51%	0%	0%	2%	18%
GB25	LA-58	900	ESHER STW	ESHER-3	DS-W8		100%	0%	0%	3%	63%	11%
GB26	SA-25	50	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	11%	20%	45%
GB27	SA-58	60	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	6%	17%	23%
GB28	Land south of Ruxley Crescent	40	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	1%	3%
GB29	SA-53 Slough Farm, Claygate	80	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	39%	55%	79%
GB3	LA-18	25			DS-W8		78%	2%	20%	6%	8%	13%
GB30	Land east of Littleworth Road	250	ESHER STW	ESHER-2	DS-W8		32%	41%	27%	12%	21%	37%
GB31	SA-45 Land between 75 & 79 Pleasant Place, Hersham	45	ESHER STW	ESHER-1	DS-W5		93%	7%	0%	0%	0%	0%
GB32	Land east of Oaken Lane	50	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	0%	0%
GB33	SA-65	40	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	0%	0%	0%
GB34	Land at Horringdon Farm (East)	80	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	3%	9%	20%
GB35	SA- 59 Land east of Claygate House	60	ESHER STW	ESHER-1	DS-W7		60%	20%	20%	10%	17%	40%
GB36	Land at Chilbrook Road	10	ESHER STW	ESHER-1	DS-W5		100%	0%	0%	0%	0%	7%
GB37	Land at Burwood Road	85	ESHER STW	ESHER-1	DS-W8	AWS	100%	0%	0%	4%	10%	23%

Site Details				Wastewater and Water supply			Flood Risk					
Site reference	Site name	Total Dwellings	WWTW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
GB38	Winterdown, Portsmouth Road, Esher	20			DS-W7		100%	0%	0%	2%	2%	4%
GB4	SA-9	30	ESHER STW	ESHER-1	DS-W8		18%	74%	8%	18%	20%	27%
GB40	Land between Blundel Lane and M25	2000	ESHER STW	ESHER-3	DS-W7		97%	0%	3%	3%	6%	12%
GB41	SA-87	100	ESHER STW	ESHER-2	DS-W8	AWS	100%	0%	0%	0%	0%	1%
GB42	SA-16	100	ESHER STW	ESHER-2	DS-W8	AWS	21%	46%	33%	0%	0%	5%
GB43	Bramley Hedge Farm	200			DS-W8		100%	0%	0%	0%	0%	2%
GB44	Land North of Fieldcommon Lane	200	ESHER STW	ESHER-2	DS-W8	AWS	59%	41%	0%	0%	0%	2%
GB45	The Kennels, Turners Lane	180	ESHER STW	ESHER-2	DS-W8	AWS	100%	0%	0%	1%	3%	10%
GB46	SA-11	180	ESHER STW	ESHER-2	DS-W8		57%	43%	0%	0%	1%	7%
GB48	SA- 6	50	ESHER STW	ESHER-1	DS-W8		16%	26%	58%	14%	25%	37%
GB49	SA-54	75	ESHER STW	ESHER-1	DS-W8		88%	12%	0%	4%	8%	17%
GB5	SA-73	150	ESHER STW	ESHER-2	DS-W8		34%	40%	26%	0%	4%	18%
GB50	SA-74	150	ESHER STW	ESHER-2	DS-W8		40%	60%	0%	0%	2%	8%
GB51	Hersham Golf Club	500	ESHER STW	ESHER-3	DS-W8	AWS	67%	33%	0%	0%	0%	3%
GB52	Norwood Farm	80			DS-W8		75%	25%	0%	0%	0%	7%
GB53	Cobham Saw Mill	45	ESHER STW	ESHER-1	DS-W7		100%	0%	0%	5%	5%	9%
GB54	Land South West of Heathside, Hinchley Wood, Dittons	100	ESHER STW	ESHER-2	DS-W5		37%	63%	0%	0%	3%	19%
GB55	Sandown Park Racecourse	300	ESHER STW	ESHER-3	DS-W8		82%	18%	0%	1%	2%	7%
GB56	Brooklands College, Heath Road	360	WEYBRIDGE STW	WEY-3	DS-W8	AWS	100%	0%	0%	1%	21%	6%
GB57	Esher Rugby Club	200	ESHER STW	ESHER-2	DS-W8	AWS	52%	29%	19%	0%	2%	14%
GB58	SA-29	200	ESHER STW	ESHER-2	DS-W5		100%	0%	0%	7%	11%	27%
GB59	Land adjacent to Mole Bridge House, Esher Road	20	ESHER STW	ESHER-1	DS-W5		0%	37%	63%	6%	11%	16%
GB6	Land to the east of Octagon Road	60	ESHER STW	ESHER-1	DS-W8	AWS	100%	0%	0%	0%	0%	0%
GB60	Land north of Grove Way	790	ESHER STW	ESHER-3	DS-W8		30%	70%	0%	0%	1%	4%
GB61	N-2	30	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	0%	0%	1%
GB62	SA-47	35	ESHER STW	ESHER-1	DS-W8		67%	33%	0%	0%	0%	1%
GB63	SA-41	150	ESHER STW	ESHER-2	DS-W8		100%	0%	0%	0%	0%	1%
GB64	SA-50	300	ESHER STW	ESHER-3	DS-W8		100%	0%	0%	0%	1%	2%
GB65	LA-20	500	ESHER STW	ESHER-3	DS-W8		100%	0%	0%	1%	2%	9%
GB66	The Broom Painshill	250	ESHER STW	ESHER-2	DS-W5	AWS	100%	0%	0%	1%	3%	10%

Site Details				Wastewater and Water supply			Flood Risk					
Site reference	Site name	Total Dwellings	WWTW	Wastewater Network Constraints	Water Supply Network Constraints (TWUL data)	Water Supply Network Constraints (AWS data)	Flood Zone 1	Flood Zone 2	Flood Zone 3	High SW Flood Risk (1 in 30yr)	Medium SW Flood Risk (1 in 100yr)	Low SW Flood Risk (1 in 1000yr)
GB67	LA-14	250	ESHER STW	ESHER-2	DS-W5		95%	4%	0%	3%	6%	16%
GB7	SA-36	35	ESHER STW	ESHER-1	DS-W8		100%	0%	0%	5%	7%	16%
GB8	Hunters Lodge, Horsley Road, Cobham	270	ESHER STW	ESHER-2	DS-W8		100%	0%	0%	1%	3%	8%
GB9	Land at Stoke Road	330	ESHER STW	ESHER-3	DS-W8		100%	0%	0%	0%	0%	4%

7. WCS Outcomes, Recommendations and Policy

7.1 Water Cycle Study Main Outcomes

7.1.1 Wastewater treatment for proposed housing growth will be provided at two main STWs: Esher and Weybridge. The wastewater assessment has identified that growth in both STW catchments could be accommodated within the current permitted headroom.

7.1.2 Water quality modelling was undertaken to test the impact of utilising this headroom on compliance with water quality standards in addition to an assessment of impact on designated ecological sites. The assessments demonstrated that WFD objectives could be met for all proposing housing scenarios without the need for significant upgrade to treatment infrastructure. To limit deterioration to within 10% of current quality, the Environment Agency may need to consider imposing a slightly tighter permit condition for Phosphate to Esher STW, but this is a non-legislative driver and if required, could be delivered towards the end of the Local Plan period, allowing Thames Water to make provision for the investment in the 2025 Business Plan. This would mean no significant impact on phasing of proposed housing numbers assessed in this WCS.

7.1.3 Regarding the Borough's Water Supply Strategy, it has been assumed that the water companies have made adequate provisions within their plans for the proposed growth and they should deliver demand management and water supply options to accommodate this growth. The WCS indicated that in order to minimise future demand for water the 'optional requirement plus retrofit scenario' for water efficiency should be considered. This has been undertaken to allow EBC to consider the potential costs and benefits of developing a water use policy to require developers to build new homes to meet the Building Regulation Part G Optional water standards, and to consider working with water companies to develop further options for retrofitting existing properties with efficiency fixtures and fittings.

7.1.4 The WCS also provided a site specific assessment of the potential constraints on each of the proposed major development sites in the two housing scenarios. No major constraints were observed in the RAG assessment, although a minority of sites, indicated in Table 7-1 and Table 7-2, will or may require significant investment in new network infrastructure (for either wastewater or water supply), which may pose a phasing risk for these sites.

Table 7-1 Sites of clustered development and standalone development of more than 300 units that may require wastewater solutions of a more strategic nature

Site reference	Site Name	Total Dwellings	STW
US110	The Heights, Weybridge	9000-1000sqm B1	WEYBRIDGE STW
US81	Walton Court, Station Avenue, Walton	375	ESHER STW
GB1	SA- 89	400	ESHER STW
GB10	Manor Farm, Woodlands Lane	615	ESHER STW
GB22	Fieldcommon (Drake Park)	707	ESHER STW
GB25	LA-58	900	ESHER STW
GB40	Land between Blundel Lane and M25	2000	ESHER STW
GB51	Hersham Golf Club	500	ESHER STW
GB55	Sandown Park Racecourse	300	ESHER STW
GB56	Brooklands College, Heath Road	360	WEYBRIDGE STW
GB60	Land north of Grove Way	790	ESHER STW
GB64	SA-50	300	ESHER STW

Site reference	Site Name	Total Dwellings	STW
GB65	LA-20	500	ESHER STW
GB9	Land at Stoke Road	330	ESHER STW

7.1.5 It should be noted that the sites shown in Table 7-1 have been classified by TWUL as sites where solutions of a more strategic nature may be required due to solely the site's size.

Table 7-2 Sites where major reinforcements in the water supply network will be required to due pressures at critical points in the network

Site reference	Site Name	Total Dwellings	STW
US110	The Heights, Weybridge	9000-1000sqm B1	WEYBRIDGE STW
US297	Foxholes, Weybridge KT13 0BN	78	WEYBRIDGE STW
US298	118 Ashley Road Walton-On-Thames KT12 1HN	50	WEYBRIDGE STW
US325	Station Car Park next to PGS House	60	ESHER STW
US327	Bridge Motor Works New Zealand Avenue and Playhouse Hurst Grove Walton-On-Thames KT12 1AU	55	ESHER STW
US72	Courtlands & 1-5 Terrace Road	78	ESHER STW
US81	Walton Court, Station Avenue, Walton	375	ESHER STW
US83	Homebase, New Zealand Avenue, Walton-on-Thames, KT12 1XA	69	ESHER STW
US84	Elm Grove Hall, 1 Hersham Road, Walton-on-Thames, KT12 1LH	70	ESHER STW
US92	GlaxoSmithKline, St. Georges Avenue	100	WEYBRIDGE STW
US93	Horizon Business Village	6000 sqm B1	WEYBRIDGE STW

7.1.6 The sites that EBC should ensure that policy is included within the Local Plan and necessary actions are taken to address these matters providing advice to developers to hold pre-development discussions with the water companies to ensure upgrades can be delivered as required

7.2 Policy Recommendations Overview

7.2.1 The following policy recommendations are made and should be considered by EBC to ensure that the Local Plan considers potential limitations (and opportunities) presented by the water environment and water infrastructure on growth, as well as phasing of growth.

Wastewater

WW1 – Development and the Sewerage Network

7.2.2 It is recommended that Major Development sites assessed by TWUL as part of the WCS as having limited foul sewerage network capacity (Amber or Red) should be subject to a pre-planning enquiry[32] with Thames Water at an early stage, and if possible before submitting a planning application, to inform developers of the scale of any contribution required to strategic infrastructure, as well as TWUL's 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.

WW2 – Treatment Capacity Review

[32] Pre-planning enquiries to Thames Water can be made via the Thames Water's website: https://developers.thameswater.co.uk/Developing-a-large-site/Planning-your-development

7.2.3 It is recommended that EBC continues to update TWUL on future development phasing and changes to growth allocations to ensure that plans for STW upgrades in response to permit change requirements or flow capacity constraints take account of the most up to date planning position, to ensure capacity has not been used up by other developments within a STW catchment.

WW3 – Development outside the Borough

7.2.4 It is recommended that communication with neighbouring local authorities, as part of the EBC duty to co-operate, should continue to be pursued, to ensure that future WCS assessments closely represent the future growth scenarios at STWs which receive growth from within and outside the Borough.

Water Supply

WS1 -Water Efficiency in new home and buildings

7.2.5 In order to move towards a more 'water neutral position' and to enhance sustainability of development coming forward, a policy should be developed that ensures all housing is as water efficient as possible, and that new housing development should go beyond mandatory Building Regulations requirements, ideally to 110 l/h/d optional Building Regulations requirements. Non-domestic buildings should as a minimum reach 'Good' BREEAM status.

WS2 - Water Efficiency Retrofitting

7.2.6 In order to move towards a more 'water neutral position' throughout the Borough, the Council should seek to advocate the achievement of further water efficiency savings through their planning policies and development management. This could be considered further through the preparation of the Local Plan. It is recommended that the Council adopts a facilitating role of encouraging private landlords, owner-occupiers and businesses to retrofit existing dwellings and non-domestic buildings with water efficient devices, where sufficient resources are available.

WS3 – Water Efficiency Promotion

7.2.7 It is recommended that a policy be developed to establish a programme of water efficiency promotion and consumer education, with the aim of behavioural change with regards to water use to move towards the higher water neutrality scenarios.

Surface water Management and Flood Risk

SWM1 – Sewer Separation

7.2.8 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, highway drain, or another drainage system;
- to a combined sewer.

7.2.9 Where 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.

SWM2 – SuDS and Green Infrastructure

7.2.10 Developers should ensure linkage of SuDS to green infrastructure to provide environmental enhancement and amenity, social and recreational value. SuDS design should maximise opportunities to create amenity, enhance biodiversity, and contribute to a network of green (and blue) open space.

SWM3 – Water Quality Improvements

7.2.11 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.

Ecology

ECO1 – Biodiversity Enhancement

7.2.12 It is recommended that EBC include a policy within its Local Plan which commits to seeking and securing (through planning permissions etc.) enhancements to aquatic biodiversity in the Borough through the use of SuDS (subject to appropriate project-level studies to confirm feasibility including environmental risk and discussion with relevant authorities).

7.3 Further Recommendations

Stakeholder Liaison

7.3.1 It is recommended that key partners in the WCS maintain regular consultation with each other as development proposals progress.

WCS Review

7.3.2 Development phasing and new sites should continue to be monitored by EBC when future development plans evolve via the Council's Authority Monitoring Reports, to enable continued assessment on Water supply and wastewater treatment. Where growth is expected to be significant, the Council 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.

Appendix A Policy and Legislative Drivers Shaping the WCS

Directive/Legislation/Guidance	Description
Birds Directive 2009/147/EC	Provides for the designation of Special Protection Areas.
Eel Regulations 2009	Provides protection to the European eel during certain periods to prevent fishing and other detrimental impacts.
Environmental Protection Act 1990	Integrated Pollution Control (IPC) system for emissions to air, land and water.
Flood & Water Management Act 2010	The Flood and Water Management Act 2010 is the outcome of a thorough review of the responsibilities of regulators, local authorities, water companies and other stakeholders in the management of flood risk and the water industry in the UK. The Pitt Review of the 2007 flood was a major driver in the forming of the legislation. Its key features relevant to this WCS are: • To give the Environment Agency an overview of all flood and coastal erosion risk management and unitary and county councils the lead in managing the risk of all local floods. • To encourage the uptake of sustainable drainage systems by removing the automatic right to connect to sewers. (NB this part of the Act – Schedule 3 is yet to be enacted) • To widen the list of uses of water that water companies can control during periods of water shortage, and enable Government to add to and remove uses from the list. • To enable water and sewerage companies to operate concessionary schemes for community groups on surface water drainage charges. • To make it easier for water and sewerage companies to develop and implement social tariffs where companies consider there is a good cause to do so, and in light of guidance issued by the Secretary of State.
Floods Directive 2007/60/EC Flood Risk Regulations 2009	The EU Floods Directive, transposed into UK law as the Flood Risk Regulation 2009 sets out a three stage process to approach flood risk management • Member states to undertake preliminary Flood Risk Assessments by 2011 for all river basins and associated coastal zones • Where risks exist, flood hazard maps and flood risk maps to be developed by 2013 • By 2015, Flood Risk Management Plans to be produced for the identified areas outlining measures to reduce probability of flooding and its potential consequences These steps should be reviewed every 6 years in a cycle coordinated with the Water Framework Directive (WFD) implementation cycle.
Future Water, February 2008	Sets the Government's vision for water in England to 2030. The strategy sets out an integrated approach to the sustainable management of all aspects of the water cycle, from rainfall and drainage, through to treatment and discharge, focusing on practical ways to achieve the vision to ensure sustainable use of water. The aim is to ensure sustainable delivery of water supplies, and help improve the water environment for future generations.
Groundwater Directive 80/68/EEC	To protect groundwater against pollution by 'List 1 and 2' Dangerous Substances.
Habitats Directive 92/44/EEC and Conservation of Habitats & Species Regulations 2010	To conserve the natural habitats of wild fauna and flora with the main aim to promote the maintenance of biodiversity taking account of social, economic, cultural and regional requirements. In relation to abstractions and discharges, it can require changes to these through the Review of Consents (RoC) process if they are impacting on designated European Sites. Also, it is the legislation that provides for the designation of Special Areas of Conservation, provides special protection to certain non-avian species and sets out the requirement for Appropriate Assessment of projects and plans likely to have a significant effect on an internationally designated wildlife site.
Land Drainage Act 1991	Sets out the statutory roles and responsibilities of key organisations such as Internal Drainage Boards, local authorities, the Environment Agency and Riparian owners with jurisdiction over watercourses and land drainage infrastructure.
Making Space for Water, 2004	Outlines the Government's strategy for the next 20 years to implement a more holistic approach to managing flood and coastal erosion risks in England. The policy aims to reduce the threat of flooding to people and property, and to deliver the greatest environmental,

	social and economic benefit.
National Planning Policy Framework	Planning policy in the UK is set by the National Planning Policy Framework (NPPF). Supported by the online Planning Practise Guidance (PPG). The NPPF advises local authorities and others on planning policy and operation of the planning system.
Natural Environment & Rural Communities Act 2006	Covering Duties of public bodies – recognises that biodiversity is core to sustainable communities and that Public bodies have a statutory duty that states that "every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity."
Pollution Prevention and Control Act (PPCA) 1999	Implements the IPPC Directive. Replaces IPC with a Pollution Prevention and Control (PPC) system, which is similar but applies to a wider range of installations.
Ramsar Convention	Provides for the designation of wetlands of international importance
Urban Wastewater Treatment Directive (UWWTD) 91/271/EEC	This Directive concerns the collection, treatment and discharge of urban wastewater and the treatment and discharge of wastewater from certain industrial sectors. Its aim is to protect the environment from any adverse effects caused by the discharge of such waters.
Water Act 2003	Implements changes to the water abstraction management system and to regulate arrangements to make water use more sustainable.
Water Framework Directive (WFD) 2000/60/EC	The WFD is the most significant piece of water legislation since the creation of the EU. The overall requirement of the directive is that all waterbodies in the UK must achieve "Good Status". The current review cycle has established this target for 2027. The definition of a waterbody's 'status' is a complex assessment that combines standards for water quality with standards for hydromorphology (i.e. habitat and flow quality) with ecological requirements. The Environment Agency is the body responsible for the implementation of the WFD in the UK. The Environment Agency have been supported by UKTAG[33], an advisory body which has proposed water quality, ecology, water abstraction and river flow standards to be adopted in order to ensure that water bodies in the UK (including groundwater) meet the required status[34]. 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 status of a waterbody[35]; and – development must not prevent future attainment of 'good status', hence it is not acceptable to allow an impact to occur just because other impacts are causing the status of a water body to already be less than good.
Water, People, Places, 2013	Guidance which outlines the process for integrating sustainable drainage systems (SuDS) into the master planning of large and small developments.
Water Resources Act 1991	Protection of the quantity and quality of water resources and aquatic habitats. Parts have been amended by the Water Act 2003. Also sets out flood defence responsibilities of the Environment Agency for main rivers
Wildlife & Countryside Act 1981 (as amended)	Legislation that provides for the protection and designation of SSSIs and specific protection for certain species of animal and plant among other provisions.

[33] The UKTAG (UK Technical Advisory Group) is a working group of experts drawn from environment and conservation agencies. It was formed to provide technical advice to the UK's government administrations and its own member agencies. The UKTAG also includes representatives from the Republic of Ireland.
[34] UK Environmental Standards and Conditions (Phase I) Final Report, April 2008, UK Technical Advisory Group on the Water Framework Directive.
[35] i.e. a reduction 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

Appendix B Relevant Planning Documents to the WCS

Category	Author	Document Name	Publication Date
Water Resources	Affinity Water Limited	Affinity Water Revised Draft Water Resources Management Plan 2020 - 2080	2019
	Thames Water Utilities Limited	Thames Water Revised draft Water Resources Management Plan 2019	2019
	Sutton and East Surrey Water	Sutton and East Surrey Water Revised draft Water Resources Management Plan 2019	2019
Local Plan			
Flood Risk	Surrey County Council	Surrey Local Flood Risk Management Strategy 2017 – 2032	2017
	AECOM, on behalf of Elmbridge Borough Council	Elmbridge Level 1 Strategic Flood Risk Assessment	2018

Appendix C STW Capacity Assessment Results

Modelling Software

Modelling of the quality permits required to meet the water quality objectives has been undertaken using RQP 2.5 (River Quality Planning), the Environment Agency's software for calculating permit conditions. The software is a monte-carlo based statistical tool that determines the statistical quality required from discharges in order to meet defined downstream targets, or to determine the impact of a discharge on downstream water quality compliance statistics.

It is recognised that RQP has limitations including:

- It can only calculate the river quality at the mixing point, and therefore the downstream sampling point (from which the waterbody status is defined) cannot easily be incorporated without some degree of uncertainty; and
- The tool is unable to assess the cumulative impact of growth of STW upstream.

The methodology detailed in this appendix has been developed in order to minimise the effect of the limitations and thereby reducing the uncertainty in the results produced.

To understand the impacts on and required mitigation of the proposed growth on the river environment in the River Wey, water quality modeling has been undertaken using existing SIMCAT and SAGIS models provided by the environment agency. River water quality modelling using the Environment Agency's SIMCAT modelling software is recognised as the best current approach to support decision making for water quality management, planning to achieve water quality standards and understanding and planning to limit the impacts of proposed development on the water environment. SIMCAT is used to help understand the current situation and, more significantly, predict the impacts of future changes.

The baseline for each SIMCAT and SAGIS model has been updated using river water quality, flow and effluent monitoring observations over the period 2013-2015 and growth scenarios 1 and 2. The models have been run to determine the permit requirements for Weybridge STW to meet current water quality targets.
Modelling assumptions - SIMCAT

Several key assumptions have been used in SIMCAT water quality modelling as follows:

STW discharge flow

- Current STW mean effluent flows were taken from 2010-2016 flow data provided by the Environment Agency and Thames Water. These data were used to update the original SIMCAT model, as provided by the Environment Agency, to create the "baseline" model which aims to be representative of conditions in 2019. The values used in the original and baseline model are shown in Table C-3.

Table C-3 Mean and Standard Deviation Values for STW Effluent Flow: Original and Baseline SIMCAT Model

Wastewater Treatment Works	Original SIMCAT Model		Updated Baseline Model Value	
	Mean flow	Standard Deviation	Mean Flow	Standard Deviation
Alton	7.812	2.49	10.944	2.22
Bentley	0.829	0.535	0.917	0.626
Bordon	8.079	2.276	8.111	2.575
Cranleigh	4.243	1.752	4.284	1.961
Elstead	1.533	0.625	1.629	0.665
Farnham	9.802	2.951	8.832	3.621
Godalming	7.375	1.741	8.082	1.858
Guildford	31.68	6.47	25.429	8.902

Hockford	4.352	1.342	4.838	1.405
Selborne	0.106	0.06	0.119	0.067
Shamley Green	2.925	0.767	3.011	0.85
Wisley	5.61	1.815	7.693	3.571
Woking	18.432	4.053	23.158	7.552
Ripley	8.211	3.697	9.187	5.244

- For SIMCAT modelling of future discharges, development increases in the catchment areas at the 14 STW upstream of Weybridge STW needed to be included in the model. The upstream STW fall within four local council areas: East Hampshire, Waverley, Guildford and Woking. The potential for future flows reaching Weybridge STW from the adjoining Runnymede Borough have also been considered but have been discounted as the WCS for Runneymede[36] shows no flows from this Borough reaching either Weybridge STW or other STW upstream of Weybridge. Future DWF figures for STW in Waverley[37] and Guildford[38] are provided in their local plan supporting information and future housing numbers have been provided by Woking BC up to 2027[39]. No information on proposed housing numbers in the relevant area of East Hampshire is currently available. The future discharges from the upstream STW have therefore been modelled as set out in Table C-4.
- For development in Elmbridge, Guildford and Woking local council areas the wastewater generation per new household is based on an assumed Occupancy Rate (OR) of 2.43 people per house and an average consumption of 125 l/h/d with an additional allowance value of 34% of additional flow for an increase in infiltration and 16 l/h/d added to factor in employment. The WCS for Waverley area used an assumed OR of 2.5 people per house. STW future flows were calculated by adding the volume of additional wastewater generated by new dwellings to the current DWF value used in the baseline model.

Table C-4 Current and Future STW Discharges Used in SIMCAT Modelling

STW	Baseline Model		2030 Scenario	
	Mean Flow	Standard Deviation	Mean Flow	Standard Deviation
Alton[a]	10.944	2.220	16.144	4.843
Bentley[a]	0.917	0.626	1.120	0.336
Bordon[a]	8.111	2.575	10.988	3.296
Weybridge Scenario 1	7.524	2.008	8.891	2.964
Weybridge Scenario 2	7.524	2.008	9.399	3.133
Guildford	25.429	8.902	29.585	9.862
Hockford	4.838	1.405	4.923	1.641
Cranleigh[b]	4.284	1.961	5.304	1.591
Elstead[c]	1.629	0.665	**1.400**	**0.420**
Farnham[c]	8.832	3.621	**8.728**	**2.619**
Shamley Green[b]	3.011	0.85	**2.942**	**0.882**
Haselmere	4.574	0.100	5.077	1.523
Selborne[d]	0.119	0.067	0.119	0.067
Wisley[d]	7.693	3.571	7.693	3.571

[36] Runnymede Outline Water Cycle Study, AECOM, Final Report, March 2018
[37] Waverley Borough Council Water Quality Assessment, Amec Foster Wheeler, June 2017
[38] Guildford Borough Council Water Quality Assessment, Stage 2 - Final Report, AECOM, October 2017
[39] Obtained via Elmbridge Borough Council for this assessment, 28 May 2019

Woking[d]	23.158	7.552	23.882	7.961
Ripley	9.187	5.244	9.609	3.203
Godalming[e]	8.082	1.858	8.715	2.615

[a] No housing figures provided. Assume the STW is operating at the DWF limit in 2032. Calculate mean flows and standard deviation as per SIMCAT user manual[40], mean flow = (1.25 x DWF)/1000, standard deviation = 0.3 x mean flow

[b] Impacts of development provided in WCS in terms of increase in DWF. Future mean flow and standard deviation calculated as per SIMCAT user manual

[c] Impacts of development provided in WCS in terms of increase in DWF. However, using the data provides results in a projected increase in mean flow below the current value (**figures in bold**). The current values are therefore retained in the model.

[d] Housing figures provided only to 2027. Impacts on flows in 2030 therefore calculated assuming 100% completion. A total of 1491 new houses are planned for and it is assumed that all additional flows are seen at Woking STW due to lack of capacity at Selborne and Wisley.

[e] Total of impacts on DWF and mean flow from both Waverley WCS and Guildford WQA.

STW discharge quality

The current discharge quality for each determinand (Ammonia, BOD and Phosphate) was calculated from the available STW discharge quality monitoring data provided by the Environment Agency and current measured flow data provided by Thames Water. The future discharge quality for ammonia and BOD were estimated by scaling the current mean and standard deviation values for effluent quality by the proposed increase in flow following development (Table C-5).

[40] Production of SIMCAT model structures for England and Wales: Final Report, WRc/Environment Agency, WRc Ref UC7189, September 2006

Table C-5 Original, Baseline and Future Ammonia and BOD Concentrations use in SIMCAT modelling

STW	Original Model				Baseline Model				
	Mean Ammonia Concentration (mg/l)	Standard Deviation Ammonia Concentration (mg/l)	Mean BOD Concentration (mg/l)	Standard Deviation BOD Concentration (mg/l)	Mean Ammonia Concentration (mg/l)	Standard Deviation Ammonia Concentration (mg/l)	Mean BOD Concentration (mg/l)	Standard Deviation BOD Concentration (mg/l)	M Amr Conce (m
Alton	0.505	0.773	4.315	1.529	0.583	0.599	5.048	5.857	0.
Bentley	0.212	0.277	4.717	1.759	0.228	0.305	5.388	3.151	0.
Bordon	0.236	0.548	3.552	2.026	0.775	2.731	4.263	3.801	1.
Weybridge	2.3	1.431	5.189	1.842	2.275	1.378	6.278	2.485	2.
Guildford	2.006	1.261	8.713	3.696	2.348	1.19	10.408	3.919	2.
Hockford	0.518	0.401	4.63	1.924	0.48	0.374	4.55	1.67	0.
Cranleigh	0.871	0.659	3.853	1.959	0.954	0.808	4.614	1.992	1.
Elstead	1.209	0.777	7.79	2.332	1.383	1.04	8.579	2.91	1.
Farnham	0.101	0.048	1.704	1.071	0.402	1.751	2.383	1.023	0.
Shamley Green	0.989	0.479	6.21	2.042	1.334	0.801	7.114	2.515	1.
Haselmere	0.179	0.266	2.082	1.168	0.258	0.369	2.484	1.13	0.
Selborne	0.957	1.138	1.771	1.183			2.425	0.955	0.
Wisley	1.151	0.708	3.155	1.402	1.26	1.012	3.815	1.419	1.
Woking	0.589	1.544	8.104	2.185	0.495	1.088	8.864	2.391	0.
Ripley	0.252	0.662	1.546	1.078	0.201	0.38	2.24	0.69	0.
Godalming	1.368	1.265	7.761	1.724	1.35	1.016	6.866	1.929	1.

- In 2020 and 2024 the allowable discharge limit for phosphate will significantly reduce at all STW in the Wey catchment as part of the National Environment Programme, with the exception of Weybridge STW. This means that considering the effects of the proposed additional discharges at Weybridge in isolation would give misleading information on future water quality.
- The original SIMCAT model was updated to reflect mean phosphate concentrations currently observed in STW effluent (based on data provided by the EA) at set out in Table C-6, which creates the baseline model scenario. Note that phosphate monitoring only takes place where permits are currently in force and the STW at Bentley, Elstead, Shamley Green and Selborne currently have no phosphate limit in place. Data from the original model were therefore retained in the baseline model. Current and future discharge quality limits for phosphate are set out in Table C-6 and for future scenario modelling it is assumed that the new phosphate limits will be being met for mean concentrations in 2030 and that the standard deviation for phosphate concentrations remains the same.

Table C-6 Current and Future Effluent Phosphate Concentration at STW

	Original Model (mg/l)		Baseline Model (mg/l)		Current Phosphate Limit (mg/l)	2030 Model (mg/l)	
STW	Mean	Std Dev	Mean	Std Dev	Mean	Mean	Std Dev
Alton	1.294	0.301	1.482	0.745	2.00	0.25	0.745
Bentley	1.883	2.011	1.883	2.011	None	0.90	2.011
Bordon	0.982	0.477	1.244	1.325	1.00	0.24	1.325
Weybridge	1.180	0.453	1.333	0.701	2.00	2.00	0.701
Guildford	1.178	0.498	1.347	0.676	2.00	0.25	0.676
Hockford	0.824	0.298	0.844	0.388	2.00	0.30	0.388
Cranleigh	0.444	0.262	0.593	0.336	2.00	0.40	0.336
Elstead	4.837	1.106			None	1.00	
Farnham	1.280	0.700	1.468	0.970	2.00	0.30	0.970
Shamley Green	3.315	0.897	3.315	0.897	None	0.70	0.897
Haselmere	0.800	0.589	1.263	0.456	2.00	0.25	0.456
Selborne	7.524	1.844	7.524	1.844	None	1.00	1.844
Wisley	1.180	0.613	1.115	0.574	2.00	0.25	0.574
Woking	1.441	0.450	1.545	0.430	2.00	0.25	0.430
Godalming	1.173	0.267	0.992	0.691	2.00	0.30	0.691
Ripley	0.982	0.476	1.032	0.489	2.00	0.25	0.489

River water flow and quality

- River flow gauge records for the period of record (up to December 2018) have been provided by the Environment Agency for 11 flow gauges in the catchment. The flow data in the model has been updated to reflect the data in the current record (Table C-7) and these values have been maintained in the 2030 model. The flow gauging station on the Hoe Stream at Woking was not present in the original SIMCAT model as provided by the Environment Agency and was added in to the baseline model.
- River water quality monitoring data were provided by the Environment Agency for the period 2009-2015. These data were used to update the original SIMCAT model, as set out in Table C-3, and create and calibrate the “baseline” model. These data included 11 sample points which were not included in the original model and were added in to the baseline model (Table C-8).

Table C-7 River Flow Values (Ml/d) used in the Original and Updated SIMCAT model

Watercourse		Original mean flow	Original Q95	Mean (Ml/d)	Q95 (Ml/d)
Law Brook	Albury	8.64	6.048	9.13	5.90
North Wey	Alton Town High Street	4.32	0	6.33	0.00
Caker Stream	Alton Caker Stream	6.912	0	7.87	0.00
North Wey	Alton Kings Pond	8.64	0.864	9.49	0.17
Cranleigh Waters	Bramley	97.632	14.688	97.00	17.11
North Wey	Farnham	36.288	5.184	69.52	16.07
Wey	Guildford	513.216	221.184	530.96	196.13
Tillingbourne	Shalford	44.064	30.24	46.44	27.39
Wey	Tilford	270.432	127.872	281.30	113.18
Wey	Weybridge	667.008	289.44	638.68	212.54
Hoe Stream	Woking	Not included	Not included	57.89	10.20

Table C-8 River Water Quality Sample Point Data: Original and Baseline SIMCAT Model

	Phosphate Sample Data						Ammonia Sample Data						BOD Sample Data					
	Original Model			Baseline Model			Original Model			Baseline Model			Original Model			Baseline Model		
Sample Point	No. Samples	Mean	Std Dev	No. Samples	Mean	Std Dev	No. Samples	Mean	Std Dev	No. Samples	Mean	Std Dev	No. Samples	Mean	Std Dev	No. Samples	Mean	Std Dev
PWER0004	36	0.093	0.034	59	0.093	0.034	36	0.079	0.063	59	0.08	0.07						
PWER0006	39	0.18	0.144	15	0.123	0.068	36	0.158	0.149	56	0.17	0.17						
PWER0008	39	0.08	0.032	15	0.068	0.015	36	0.051	0.042	56	0.05	0.03	36	2.10	1.04	44	2.13	0.93
PWER0015	63	0.125	0.026	39	0.128	0.023	36	0.041	0.028	72	0.04	0.02						
PWER0016	37	0.19	0.106	49	0.185	0.109	37	0.205	0.13	57	0.26	0.32	34.00	2.26	0.79	44	2.97	3.59
PWER0018	24	0.298	0.027	38	0.284	0.038	37	0.046	0.018	57	0.05	0.02	35	1.20	0.53	43	1.33	0.39
PWER0022	19	0.417	0.171	37	0.39	0.169	36	0.032	0.033	58	0.04	0.03	18.00	1.43	0.88	29	1.54	0.71
PWER0023	39	0.358	0.16	15	0.299	0.105	36	0.06	0.061	56	0.06	0.05						
PWER0024	19	0.441	0.157	37	0.398	0.14	36	0.041	0.029	58	0.08	0.16	16.00	1.07	0.48	29	1.76	1.69
PWER0026	23	0.511	0.268	71	0.286	0.118	36	0.08	0.029	71	0.12	0.10						
PWER0027	36	0.183	0.063	48	0.179	0.07	37	0.043	0.024	57	0.07	0.08						
PWER0029	42	0.164	0.039	18	0.148	0.029	36	0.035	0.029	57	0.04	0.02						
PWER0034	34	0.223	0.051	57	0.209	0.051	34	0.129	0.071	57	0.15	0.07						
PWER0037	39	0.226	0.061	15	0.18	0.038	36	0.1	0.057	56	0.11	0.06						
PWER0038	39	0.239	0.06	15	0.176	0.033	39	0.102	0.056	15	0.11	0.05						
PWER0046				44	0.21	0.053				44	0.05	0.03						
PWER0089	36	0.076	0.061	72	0.098	0.083	36	0.045	0.061	72	0.05	0.05	17	1.041	0.526	29	1.48	1.26
PWER0091	34	0.04	0.016	50	0.063	0.087	34	0.033	0.031	50	0.12	0.52	18.00	1.46	1.05	29	1.66	0.97
PWER0110	999	0	0	12	0.166	0.041	999	0	0	12	0.05	0.03						
PWER0126	71	0.268	0.118	15	0.455	0.242	23	0.0681	0.089	15	0.25	0.67						
PWER0127	999	0	0	12	0.161	0.03	999	0	0	12	0.03	0.00						
PWER0128	999	0	0	36	0.05	0.013	999	0	0	36	0.06	0.03						
PWER0129	32	0.128	0.047	44	0.128	0.054	32	0.086	0.051	44	0.09	0.05						
PWER0150				15	0.175	0.026				15	0.10	0.03						
PWER0151	39	0.191	0.049	15	0.155	0.024	39	0.074	0.044	15	0.08	0.05						

PWER0152				46	0.047	0.033				46	0.08	0.16
PWER0153	32	0.161	0.024	44	0.165	0.054	32	0.035	0.021	44	0.06	0.07
PWER0214	32	0.022	0.00485	68	0.025	0.007	32	0.029	0.022	68	0.04	0.01
PWER0231				68	0.071	0.042				68	0.05	0.03
PWER0289				72	0.116	0.033				72	0.08	0.08
PWER0318				69	0.101	0.038				69	0.07	0.13
PWER0319				69	0.047	0.026				69	0.08	0.11
PWER0320				68	0.035	0.012				68	0.04	0.02
PWER0321				68	0.028	0.015				69	0.04	0.01
PWER0322				68	0.026	0.005				68	0.04	0.01
PWER0323				15	0.076	0.03				15	0.05	0.04

Model Runs - SIMCAT

The SIMCAT model was run as follows:

1) The Original SIMCAT model, as received from the EA, was run in mode 0 (to ensure the model ran correctly and did not produce erratic results), then in mode 6 to calibrate with the original model datasets for flow and quality.
2) The Baseline Model was developed by updating the original model using observed river flows and water quality and updated STW effluent quality and flows. This model was also run initially in mode 0
3) A Calibrated Baseline Model was created by re-running the Baseline Model in mode 6 to calibrate it using the updated datasets. The Calibrated Model shows the impacts of the existing inputs on water quality in the River Wey.
4) Scenario 0: A future scenario, representing the effects of new development and new phosphate limits upstream of Weybridge by adjusting the flows and effluent concentrations used in the Calibrated Model as set out in the tables above for the 2030 model scenario. This model was run in mode 4 for scenario testing and provides the future baseline for flows in the River Wey without additional development in Elmbridge.
5) Scenario 1: As scenario 0, but with additional flows at Weybridge STW to account for development in Elmbridge under scenario 1. This model was run in mode 4
6) Scenario 2: As scenario 0, but with additional flows at Weybridge STW to account for development in Elmbridge under scenario 2. This model was run in mode 4

Model Results - SIMCAT

The SIMCAT model results are presented in Figure C-1 for the original, baseline and calibrated model for locations along the main River Wey only. This shows the effects of updating the model with more recent data.

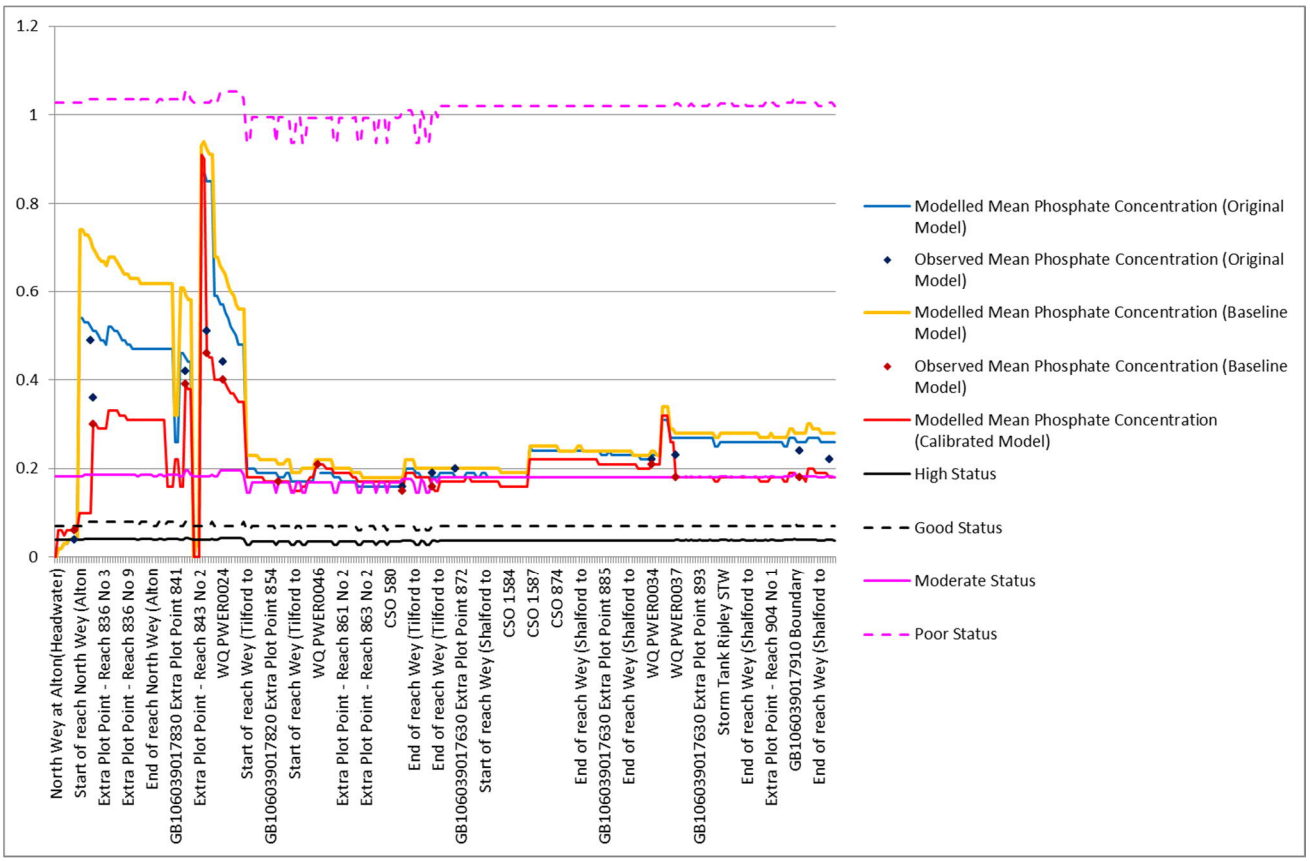


Figure C-1 Phosphate Concentrations in the River Wey: Original, Baseline and Calibrated Baseline Model

The overall effects of the recalibration are to lower the modelled phosphate concentrations in the upper and lower reaches of the Wey, while for most of the central reach of the Wey the three models produce similar results. The calibrated model reflect that fact that the sampling data for phosphate in the River Wey show a

declining trend, possibly through reduced inputs through farming and other activities. The calibrated model is considered to be more representative of current conditions and an appropriate baseline for scenario testing. The model also shows that the current water quality status is poor or borderline moderate for phosphate in the Wey, which is consistent with observed data, and that most of the deterioration in quality occurs in the upper reaches, where there is less water available for dilution, and is associated with STW inputs. The modelling also shows that the current impact of the Weybridge STW discharges is small, with an increase in concentrations from upstream of 0.03mg/l.

Figure C2 shows the results of the scenario testing for water quality in entire the River Wey catchment, showing the locations of the STW inputs.

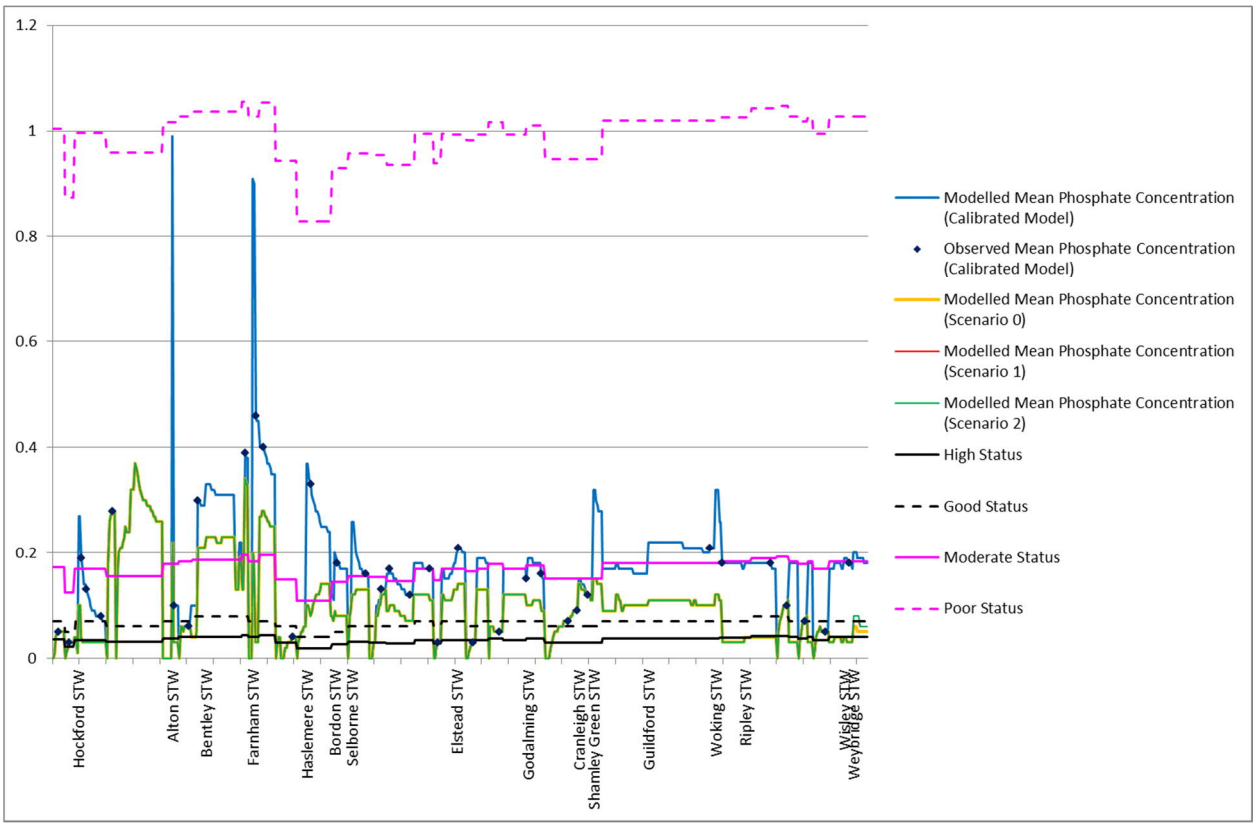


Figure C-2 Results of SIMCAT Scenario Testing for Phosphate in the River Wey

Following imposition of the new phosphate limits the impact of STW on water quality in the River Wey is much less significant. Although the water quality is still poor in the upper reaches of the Wey it reaches moderate status below Bordon STW and may even reach high status below Woking STW. In this scenario the additional input from Weybridge STW will reduce the water quality to good (from high) without development and would reduce the water quality to moderate, which is the target for this waterbody in 2027, under scenarios 1 or 2. There is no significant difference in water quality under either proposed scenario 1 or 2. In view of these results the Scenario 1 and Scenario 2 models were re-run in mode 7 to determine the required discharge limit at Weybridge STW should “good” status be required in the Wey following development in Elmbridge. This shows that god status in the Wey could be achieved by setting phosphate limits at Weybridge STW at 0.45mg/l.

Figures C-3 and C-4 show the results of the scenario testing for ammonia and BOD. The results have been reported as 95 percentiles and the water quality in the Wey is currently high at Weybridge and will remain so following additional development under scenarios 1 or 2 (the increase in BOD at the most downstream end of the Wey is not related to the Weybridge STW discharge).

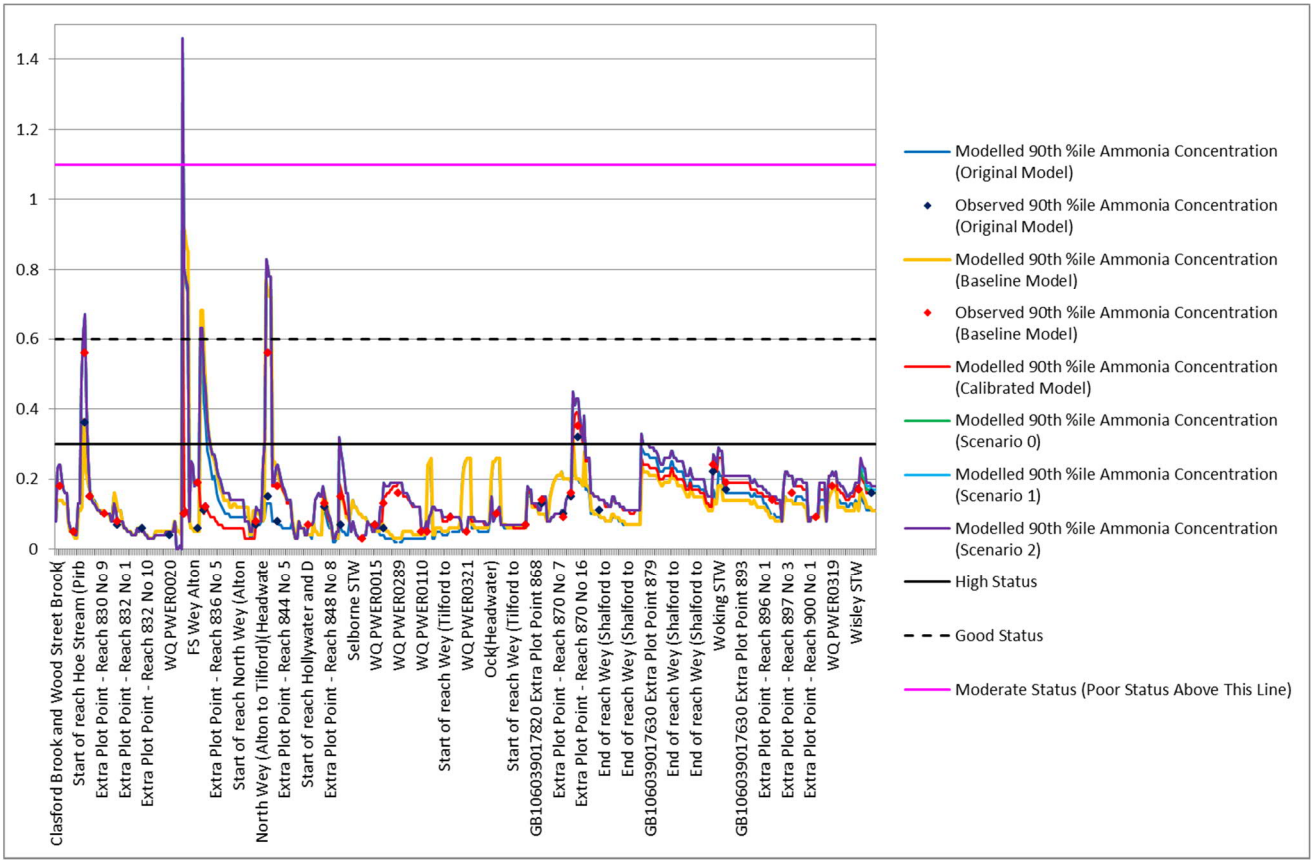


Figure C-3 SIMCAT Model Results: Ammonia

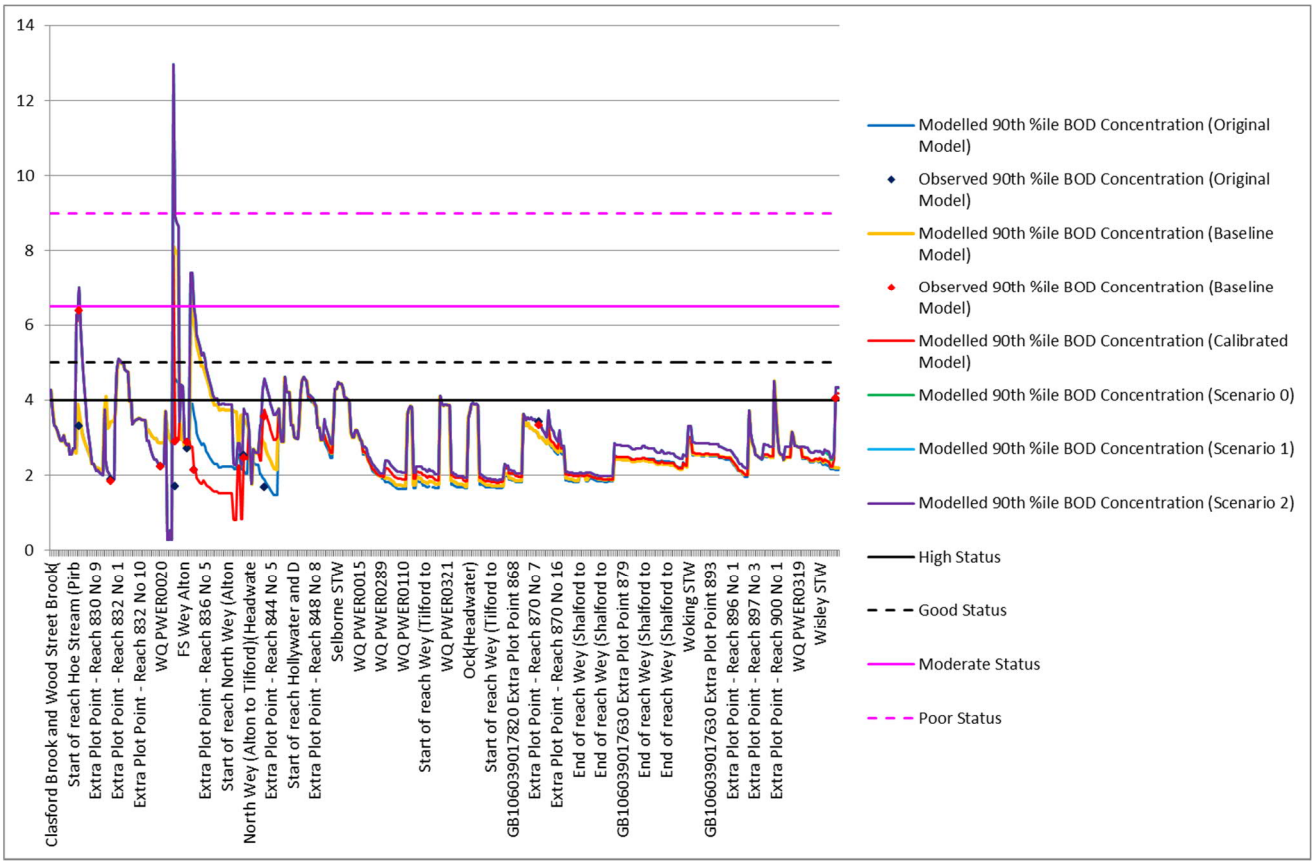


Figure C-4 SIMCAT Model Results: BOD

Water Quality Modelling Methodology - RQP

Baseline Review

Effect of Current Discharge By modelling the current STW discharge flow (pre-growth) and measured discharge quality, does the current STW discharge cause the river quality at the mixing point to fall below the status threshold?

Test 1-10% Deterioration

1a. Effect of current STW discharge Modelling the current STW discharge flow (pre-growth).	
1b. 10% deterioration limit Determine the 10% deterioration target for the 10% deterioration test.	
1c. 10% deterioration test Modelling of the future STW discharge flow (post-growth) and 10% deterioration target, is the future permit technically feasible with conventional technology?	
Yes: Limiting deterioration to 10% is possible. A tighter permit and treatment upgrades using conventional technology will be required.	No: Limiting deterioration to 10% is not possible because the tighter permit cannot be achieved with conventional technology.

Test 2- Status Deterioration Target

2a. Current permit required to ensure no deterioration in status Modelling of the current STW discharge flow (pre-growth) and current status, is the permit required technically feasible with conventional technology?	
2b. Future permit required to ensure no deterioration in status Modelling of the future STW discharge flow (post-growth) and current status, is the permit required technically feasible with conventional technology?	
Yes: Ensuring no deterioration in status is possible. A tighter permit and treatment upgrades using conventional technology will be required.	No: Ensuring no deterioration in status is not possible because the tighter permit cannot be achieved with conventional technology. Therefore, growth may cause a deterioration in status, unless improvements in technology or non-conventional technologies are used. Test 4.- Maintain current quality test needs to be carried out

Test 3-Maintain Current Quality Target

4. Revised future permit required to maintain current quality Modelling of the future STW discharge flow (post-growth) and current discharge quality, is the permit technically feasible with conventional technology to maintain current quality?	
Yes: maintaining current quality is possible. A tighter permit and treatment upgrades using conventional technology will be required.	No: maintaining current quality is not possible because the tighter permit cannot be achieved with conventional technology. Catchment modelling is required to provide sufficient confidence there will be no deterioration in status at the downstream sampling point.

Modelling Assumptions - RQP

Several key assumptions have been used in water quality and permit modelling as follows:

STW discharge flow

- STW current flows were taken as the measured DWF as provided by TWUL;
- The wastewater generation per new household is based on the average assumption of 136 l/h/d with an additional value of 30% of additional flow for an increase in infiltration and 16 l/h/d added to factor in employment; and
- STW future flows were calculated by adding the volume of additional wastewater generated by new dwellings to the current observed DWF value.

STW discharge quality

- The current discharge quality for each determinant (Ammonia, BOD and Phosphate) was calculated from the available STW discharge quality monitoring data provided by the Environment Agency and current measured flow data provided by TWUL;
- The future discharge quality for each determinant was calculated based on the available STW discharge quality monitoring data provided by the Environment Agency and future flow data derived from current measured flow data provided by TWUL. Additional calculated flow to represent the proposed level of growth was also used;
- BOD and Ammonia discharge qualities have been reported as 95 percentiles (as per discharge permits);

- Phosphate discharge qualities have been reported as annual averages (as per discharge permits); and
- For the purposes of this study, the limits of conventionally applied treatment processes are considered to be:
  - 5mg/l 95%ile for BOD;
  - 1mg/l 95%ile for Ammoniacal-N; and
  - 0.25mg/l annual average for Phosphate.

River water quality

- River water quality monitoring data was originally provided by the Environment Agency;
- However, as the sampling points provided are too far upstream from Esher STW, the Environment Agency advised using the published WFD status and the respective values.
- BOD and Ammonia river water qualities have been reported as 90 percentiles; and
- Phosphate river water qualities have been reported as means.

Assessment Tables - RQP

STW	Esher STW (Scenario 1)			Esher STW (Scenario 2)		
Is there flow headroom in the Permit? If so, what is the volume of flow headroom available after growth (m^3/d)	Yes (6,649 m^3/d)			Yes (1,609 m^3/d)		
Parameters considered	Ammonia (mg/l - 95%ile)	BOD (mg/l - 95%ile)	Phosphate (mg/l - mean)	Ammonia (mg/l - 95%ile)	BOD (mg/l - 95%ile)	Phosphate (mg/l - mean)
Permit condition	2	12	1	2	12	1
Limit of Conventional Treatment (LCT)	1	5	0.25	1	5	0.25
WFD receiving waterbody and ID	**Mole (Hersham to R. Thames conf at East Molesey) ID: GB106039017622**			**Mole (Hersham to R. Thames conf at East Molesey) ID: GB106039017622**		
Parameters considered	Ammonia (mgl - 90%ile)	BOD (mgl - 90%ile)	Phosphate (mgl - mean)	Ammonia (mgl - 90%ile)	BOD (mgl - 90%ile)	Phosphate (mgl - mean)
Receiving waterbody Quality Element Published Status (Cycle 2 - 2016)	**Moderate**	**Moderate**	**Poor**	**Moderate**	**Moderate**	**Poor**
Upstream sample point	**PMLR0033 (but not used according to EA's guidelines, as it is too far upstream)**			**PMLR0033 (but not used according to EA's guidelines, as it is too far upstream)**		
Measured quality upstream of discharge **(upstream mean quality) - Took the midclass point of the current Status band, according to EA's guidelines, for Phosphate - see comment at Phsophate's cell**	0.49	3.29	0.298	0.49	3.29	0.298
Quality Element Status based on measured data	**N/A**	**N/A**	**Poor**	**N/A**	**N/A**	**Poor**
Test 1 - 10% deterioration	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)
Mixing Point Quality with current STW flow (90 percentile Ammonia & BOD, annual average Phosphate)	0.84	5.46	0.33	0.84	5.46	0.33
Modelled status at mixing point with current flow	**Moderate**	**Moderate**	**Poor**	**Moderate**	**Moderate**	**Poor**
10% deterioration limit (90 percentile Ammonia & BOD, annual average Phosphate)	0.924	6.006	0.363	0.924	6.006	0.363
Permit condition required to be within 10% deterioration target (95 percentile Ammonia & BOD, annual average Phosphate) **(95% discharge quality)**	**3.57**	**15.03**	**0.94**	**3.40**	**14.04**	**0.86**
Test 2 - WFD Status: no deterioration (waterbody status)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)	Ammonia (mg/l)	BOD (mg/l)	Phosphate (mg/l)
Threshold at which status deterioration would occur (90 percentile Ammonia & BOD, annual average Phosphate)	1.10	6.50	1.000	1.10	6.50	1.000
permit condition required at mixing point - current STW flow (95 percentile Ammonia & BOD, annual average Phosphate) **(discharge quality 95%)**	**9.02**	**24.82**	**9.86**	**9.02**	**24.82**	**9.86**
permit condition required at mixing point - after growth (95 percentile Ammonia & BOD, annual average Phosphate)	**7.19**	**20.92**	**7.52**	**6.67**	**19.16**	**6.56**
Maintain current quality	N/A	N/A	N/A	N/A	N/A	N/A
Test 3 - Future Status	Ammonia 90%ile (mg/l)	BOD 90%ile (mg/l)	Phosphate mean (mg/l)	Ammonia 90%ile (mg/l)	BOD 90%ile (mg/l)	Phosphate mean (mg/l)
Is current status less than good for the quality element	Yes - Test Required	Yes - Test Required	Yes - Test Required	Yes - Test Required	Yes - Test Required	Yes - Test Required
Target future status (2027 published status target)	Good	Good	Moderate	Good	Good	Moderate
Permit condition required - current STW flow (95 percentile Ammonia & BOD, annual average Phosphate) **(Discharge quality - mean quality)**	**5.58**	**18.67**	**0.22**	**5.58**	**18.67**	**0.22**
Permit condition required - after growth (95 percentile Ammonia & BOD, annual average Phosphate)	**4.55**	**15.22**	**0.23**	**3.97**	**14.03**	**0.23**
Will Growth prevent future target status	No	No	Yes	No	No	Yes
Key to 'Effluent Quality Required'	**Green Value – no change to current permit required**	**Green Value – no change to current permit required**	**Red Value – not achievable within limits of conventionally applied treatment processes**	**Green Value – no change to current permit required**	**Green Value – no change to current permit required**	**Red Value – not achievable within limits of conventionally applied treatment processes**

Appendix D Water Neutrality

Water Neutrality is defined in Section 5. This appendix provides supplementary information and guidance behind the processes followed.

Twin-Track Approach

Attainment of water neutrality requires a 'twin track' approach whereby water demand in new development is minimised as far as possible. At the same time measures are taken, 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[41], including:

- cistern displacement devices;
- flow regulation;
- greywater recycling;
- low or variable flush replacement toilets;
- low flow showers;
- metering;
- point of use water heaters;
- pressure control;
- rainwater harvesting;
- variable tariffs;
- low flows taps;
- water audits;
- water butts;
- water efficient garden irrigation; and,
- water efficiency promotion and education.

The varying costs and space and design constraints of the above mean that they can be divided into two categories, measures that should be installed for new developments and those which can be retrofitted into existing properties. For example, due to economies of scale, to install a rainwater harvesting system is more cost effective when carried out on a large scale and it is therefore often incorporated into new build schools, hotels or other similar buildings. Rainwater harvesting is less well advanced as part of domestic new builds, as the payback periods are longer for smaller systems and there are maintenance issues. To retrofit a rainwater harvesting system can have very high installation costs, which reduces the feasibility of it.

However, there are a number of the measures listed above that can be easily and cheaply installed into existing properties, particularly if part of a large campaign targeted at a number of properties. Examples of these include the fitting of dual-flush toilets and low flow showers heads to social housing stock, as was successfully carried out in Preston by Reigate and Banstead Council in conjunction with Sutton and East Surrey Water and Waterwise[42].

The Pathway Concept

The term 'pathway' is used here as it is acknowledged that, to achieve any level of neutrality, a series of steps are required in order to go beyond the minimum starting point for water efficiency which is currently mandatory for new development under current and planned national planning policy and legislation.

There are no statutory requirements for new housing to have a low water use specification as previous government proposals to make different levels compulsory have been postponed pending government review. For non-domestic development, there is no statutory requirement to have a sustainability rating with the Building Research Establishment Environmental Assessment Method (BREEAM), only being mandatory where specified by a public body in England such as:

- Local Authorities incorporating environmental standards as part of supplementary planning guidance;
- NHS buildings for new buildings and refurbishments;
- Department for Children, Schools and Families for all projects valued at over £500K (primary schools) and £2million (secondary schools);

[41] Water Efficiency in the South East of England, Environment Agency, April 2007.
[42] Preston Water Efficiency Report, Waterwise, March 2009, www.waterwise.org.uk

- The Homes and Communities Agency for all new developments involving their land; and,
- Office of Government Commerce for all new buildings.

Therefore, other than potential local policies delivered through a Local Plan, the only water efficiency requirements for new development are through the Building Regulations[4] where new homes must be built to specification to restrict water use to 125l/h/d or 110l/h/d where the optional requirement applies. However, the key aim of the Localism Act is to decentralise power away from central government towards local authorities and the communities they serve. It therefore creates a stronger driver for local authorities to propose local policy to address specific local concerns.

In addition to the steps required in new local policy, the use of a pathway to describe the process of achieving water neutrality is also relevant to the other elements required to deliver it, as it describes the additional steps required beyond 'business as usual' that both developers and stakeholders with a role (or interest) in delivering water neutrality would need to take, for example:

- the steps required to deliver higher water efficiency levels on the ground (for the developers themselves); and,
- the partnership initiative that would be required beyond that normally undertaken by local authorities and water companies in order to minimise existing water use from the current housing and business stock.

Therefore, the pathway to neutrality requires a series of steps covering:

- technological inputs in terms of physically delivering water efficiency measures on the ground;
- local planning policies which go beyond national guidance; and,
- partnership initiatives and partnership working.

The following sections outline the types of water efficiency measures which have been considered in developing the technological pathway for the water neutrality target scenarios.

Improving Efficiency in Existing Development

Metering

The installation of water meters in existing housing stock has the potential to generate significant water use reductions because it gives customers a financial incentive to reduce their water consumption. Being on a meter also encourages the installation and use of other water saving products, by introducing a financial incentive and introducing a price signal against which the payback time of new water efficiency measures can be assessed. Metering typically results in a 5-10 per cent reduction from unmetered supply, which equates to water savings of approximately 50l per household per day, assuming an occupancy rate of 2.49 for existing properties.

In 2009, DEFRA instructed Anna Walker (the Chair of the Office of Rail Regulation) to carry out an independent review of charging for household water and sewerage services (the Walker view)[43]. The typical savings in water bills of metered and unmetered households were compared by the Walker review, which gives an indication of the levels of water saving that can be expected (see Table D-1).

Table D-1 Change in typical metered and unmetered household bills

2009-10 Metered	2009-10 Unmetered	2014-15 Metered	2014-15 Unmetered	% change Metered	% change Unmetered
348	470	336	533	-3	13

Low or Variable Flush Toilets

Toilets use about 30 per cent of the total water used in a household[44]. An old style single flush toilet can use up to 13 litres of water in one flush. New, more water-efficient dual-flush toilets can use as little as 2.6 litres[45] per

[43] Independent Walker Review of Charging and Metering for Water and Sewerage services, DEFRA, 2009, http://www.defra.gov.uk/environment/quality/water/industry/walkerreview/
[44] http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/house_and_garden/toilet_flushing.html
[45] http://www.lecico.co.uk/

flush. A study carried out in 2000 by Southern Water and the Environment Agency[46] on 33 domestic properties in Sussex showed that the average dual flush saving observed during the trial was 27 per cent, equivalent to a volumetric saving of around 2.6 litres per flush. The study suggested that replacing existing toilets with low or variable flush alternatives could reduce the volume of water used for toilet flushing by approximately 27 per cent on average.

Cistern Displacement Devices

These are simple devices which are placed in the toilet cistern by the user, which displace water and therefore reduce the volume that is used with each flush. This can be easily installed by the householder and are very cheap to produce and supply. Water companies and environmental organisations often provide these for free.

Depending on the type of devices used (these can vary from a custom made device, such bag filled with material that expands on contact with water, to a household brick) the water savings can be up to 3 litres per flush.

Low Flow Taps and Showers

Flow reducing aerating taps and shower heads restrict the flow of water without reducing water pressure. Thames Water estimates that an aerating shower head can cut water use by 60 per cent with no loss of performance[47].

Pressure Control

Reducing pressure within the water supply network can be an effective method of reducing the volume of water supplied to customers. However, many modern appliances, such as Combi boilers, point of use water heaters and electric showers require a minimum water pressure to function. Careful monitoring of pressure is therefore required to ensure that a minimum water pressure is maintained. For areas which already experience low pressure (such as those areas with properties that are included on a water company's DG2 Register) this is not suitable. Limited data is available on the water savings that can be achieved from this method.

Variable tariffs

Variable tariffs can provide different incentives to customers and distribute a water company's costs across customers in different ways.

The Walker review assessed variable tariffs for water, including:

- rising block tariff;
- a declining block tariff;
- a seasonal tariff; and,
- time of day tariff.

A rising block tariff increases charges for each subsequent block of water used. This can raise the price of water to very high levels for customers whose water consumption is high, which gives a financial incentive to not to consume additional water (for discretionary use, for example) while still giving people access to low price water for essential use.

A declining block tariff decreases charges for each subsequent block of water used. This reflects the fact that the initial costs of supply are high, while additional supply has a marginal additional cost. This is designed to reduce bills for very high users and although it weakens incentives for them to reduce discretionary water use, in commercial tariffs it can reflect the economies of scale from bulk supplies.

A seasonal tariff reflects the additional costs of summer water supply and the fact that fixed costs are driven largely by the peak demand placed on the system, which is likely to be in the summer.

Time-of-day tariffs have a variable cost per unit supply according to the time of the day when the water is used; this requires smart meters. This type of charging reflects the cost of water supply and may reduce an individual household's bill; it may not reduce overall water use for a customer.

Water Efficient Appliances

[46] The Water Efficiency of Retrofit Dual Flush Toilets, Southern Water/Environment Agency, December 2000
[47] http://www.thameswater.co.uk/cps/rde/xchg/corp/hs.xsl/9047.htm

Washing machines and dishwashers have become much more water efficient over the past twenty years; whereas an old washing machine may use up to 150 litres per cycle, modern efficient machines may use as little as 35 litres per cycle. An old dishwasher could use up to 50 litres per cycle, whereas modern models can use as little as 10 litres. However, this is partially offset by the increased frequency with which these are now used. It has been estimated[48] that dishwashers, together with the kitchen tap, account for about 8-14 per cent of water used in the home.

The Water Efficient Product Labelling Scheme provides information on the water efficiency of a product (such as washing machines) and allows the consumer to compare products and select the efficient product. The water savings from installation of water efficient appliances therefore vary, depending on the type of machine used.

Non-Domestic Properties

There is also the potential for considerable water savings in non-domestic properties; depending on the nature of the business water consumption may be high e.g. food processing businesses. Even in businesses where water use is not high, such as B1 Business or B8 Storage and Distribution, there is still the potential for water savings using the retrofitting measures listed above. Water audits are useful methods of identifying potential savings and implementation of measures and installation of water saving devices could be funded by the asset owner; this could be justified by significant financial savings which can be achieved through implementation of water efficient measures. Non-domestic buildings such as warehouses and large scale commercial (e.g. supermarkets) property have significant scope for rainwater harvesting on large roof areas.

Water Efficiency in New Development

The use of efficient fixtures and fittings as described in above also apply to the specification of water use in the building of new homes. The simplest way of demonstrating the reductions that use of efficient fixtures and fitting has in new builds is to consider what is required in terms of installation of the fixtures and fittings at different ranges of specification to ensure attainment of building regulation and building regulation optional water use requirements. Part G of The Building Regulations 2010 has been used to develop these figures. For 62l/h/d houses, The Building Regulations Water Efficiency Calculator has been used in association with the Department of Communities and Local Government – Housing Standard Review (September 2014). These are shown below in Table D-2.

Table D-2 Summary of water savings borne by water efficiency fixtures and fittings

Component	133 l/h/d Standard Home	Building Regulations 125 l/h/d	Building Regulations Optional Target 110 l/h/d	62 l/h/d (water recycling)
Toilet flushing	22.8	18.7 b	12.3 d	12.3 d
Taps	24.9 a	22.7 a	20.5 a	15.3 a
Shower	42.3	39.8	31.8	23.9
Bath	18.5 c	18.5 c	17.0 f	14.5 h
Washing Machine	15.6	15.6	15.6	15.6
Dishwasher	4.1	4.1	4.1	4.1
Recycled water	-			-26.8 g
External Use	5	5	5	0
Total per head	133.2	124.4	106.3	63.9
Total per household	278.2	261.3	223.3	134.2

- a Combines kitchen sink and wash hand basin
- b 6/4 litre dual-flush toilet (f) recycled water
- c 185 litre bath
- d 4/2.6 litre dual flush toilet
- e Rainwater harvesting for external and toilet use

[48] Water Efficiency Retrofitting: A Best Practice Guide, Waterwise, 2009, www.waterwise.org.uk

- f 170 litre bath
- g Rainwater/greywater harvesting for toilet, external and washing machine
- h 145 litre bath

Table D-2 highlights that in order for high and very high efficiencies to be achieved for water use of 62 l/h/d; water re-use technology (rainwater harvesting and/or greywater recycling) needs to be incorporated into the development.

In using the BRE Water Demand Calculator[49], the experience of AECOM BREEAM assessors is that it is theoretically possible to get close to 62l/h/d through the use of fixture and fittings, but that this requires extremely high specification efficiency devices which are unlikely to be acceptable to the user and will either affect the saleability of new homes or result in the immediate replacement of the fixtures and fittings upon habitation. This includes baths at capacity below 120 litres, and shower heads with aeration which reduces the pressure sensation of the user. For this reason, it is not considered practical to suggest that 62l/h/d or lower can be reached without some form of water recycling.

Rainwater Harvesting

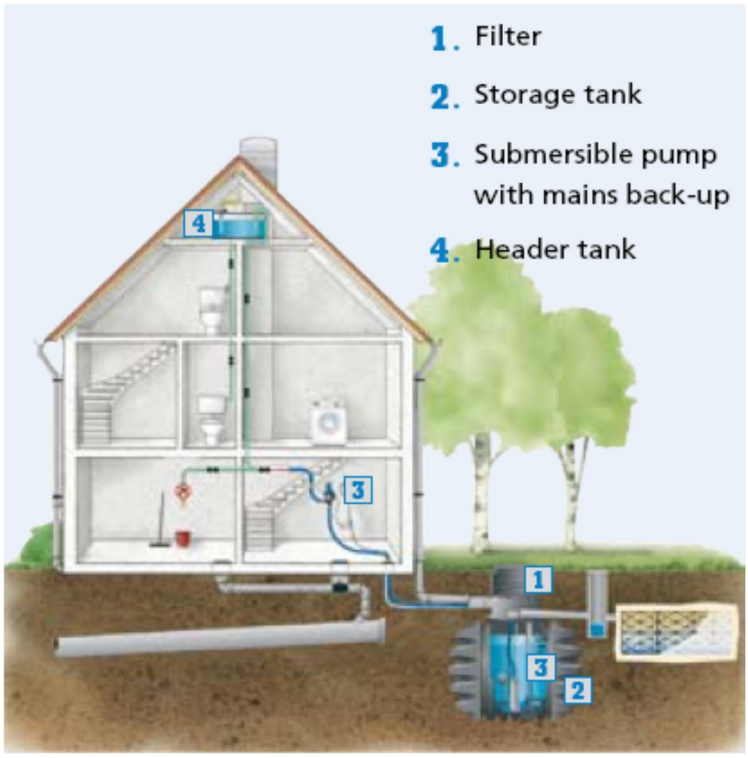
Rainwater harvesting (RWH) is the capture and storage of rain water that lands on the roof of a property. This can have the dual advantage of both reducing the volume of water leaving a site, thereby reducing surface water management requirements and potential flooding issues, and be a direct source of water, thereby reducing the amount of water that needs to be supplied to a property from the mains water system.

RWH systems typically consist of a collection area (usually a rooftop), a method of conveying the water to the storage tank (gutters, down spouts and pipes), a filtration and treatment system, a storage tank and a method of conveying the water from the storage container to the taps (pipes with pumped or gravity flow). A treatment system may be included, depending on the rainwater quality desired and the source. Figure D-1 below gives a diagrammatic representation of a typical domestic system[50].

The level to which the rainwater is treated depends on the source of the rainwater and the purpose for which it has been collected. Rainwater is usually first filtered to remove larger debris such as leaves and grit. A second stage may also be incorporated into the holding tank; some systems contain biological treatment within the holding tank, or flow calming devices on the inlet and outlets that will allow heavier particles to sink to the bottom, with lighter debris and oils floating to the surface of the water. A floating extraction system can then allow the clean rainwater to be extracted from between these two layers[51].

[49] http://www.thewatercalculator.org.uk/faq.asp
[50] Source: Aquality Intelligent Water management, www.aqua-lity.co.uk
[51] Aquality Rainwater Harvesting brochure, 2008

Figure D-1 A typical domestic rainwater harvesting system



A recent sustainable water management strategy carried out for a proposed EcoTown development at Northstowe[52], approximately 10 km to the north west of Cambridge, calculated the size of rainwater storage that may be required for different occupant numbers, as shown below in Table D-3.

Table D-3 Rainwater Harvesting Systems Sizing

Number of occupants	Total water consumption	Roof area (m2)	Required storage tank (m3)	Potable water saving per head (l/d)	Water consumption with RWH (l/h/d)
1	110	13	0.44	15.4	94.6
1	110	10	0.44	12.1	97.9
1	110	25	0.88	30.8	79.2
1	110	50	1.32	57.2	52.8
2	220	25	0.88	15.4	94.6
2	220	50	1.76	30.8	79.2
3	330	25	1.32	9.9	100.1
3	330	50	1.32	19.8	90.2
4	440	25	1.76	7.7	102.3
4	440	50	1.76	15.4	94.6

A family of four, with an assumed roof area of 50m^3, could therefore expect to save 61.6 litres per day if a RWH system were installed.

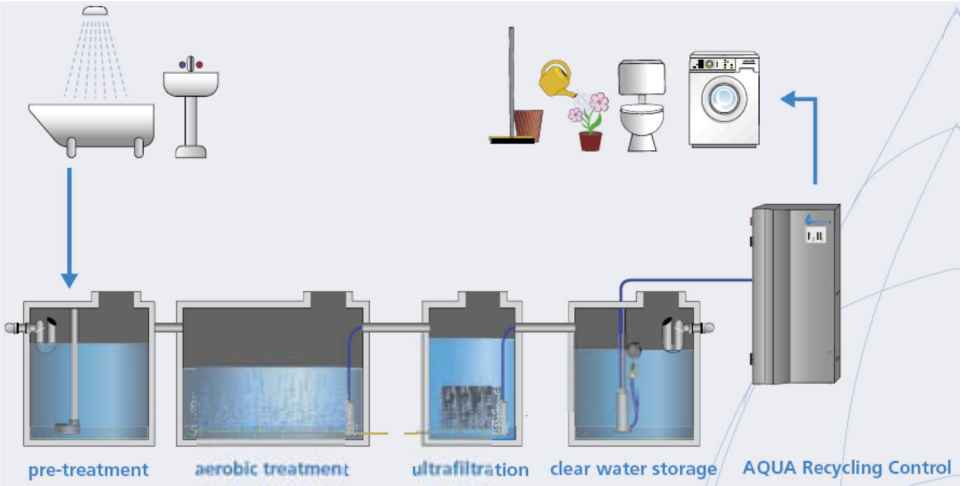
Greywater Recycling

Greywater recycling (GWR) is the treatment and re-use of wastewater from shower, bath and sinks for use again within a property where potable quality water is not essential e.g. toilet flushing. Recycled greywater is not suitable for human consumption or for irrigating plants or crops that are intended for human consumption. The source of greywater should be selected by available volumes and pollution levels, which often rules out the use of kitchen and clothes washing wastewater as these tend to be most highly polluted. However, in larger system virtually all non-toilet sources can be used, subject to appropriate treatment.

[52] Sustainable water management strategy for Northstowe, WSP, December 2007

The storage volumes required for GWR are usually smaller than those required for rainwater harvesting as the supply of greywater is more reliable than rainfall. In domestic situations, greywater production often exceeds demand and a correctly designed system can therefore cope with high demand application and irregular use, such as garden irrigation. Figure D-2 below gives a diagrammatic representation of a typical domestic system[53].

Figure D-2: A typical domestic greywater recycling system



Combined rainwater harvesting and greywater recycling systems can be particularly effective, with the use of rainwater supplementing greywater flows at peak demand times (e.g. morning and evenings).

The Northstowe sustainable water management strategy calculated the volumes of water that could be made available from the use GWR. These were assessed against water demand calculated using the BRE Water Demand Calculator[54].

Table D-4 demonstrates the water savings that can be achieved by GWR. If the toilet and washing machine are connected to the GWR system a saving of 37 litres per person per day can be achieved.

Table D-4: Potential water savings from greywater recycling

Appliance	Demand with Efficiencies (l/h/day)	Potential Source	Greywater Required (l/h/day)	Out As	Greywater available (80% efficiency) (l/h/day)	Consumptions with GWR (l/h/day)
Toilet	15	Grey	15	Sewage	0	0
Wash hand basin	9	Potable	0	Grey	7	9
Shower	23	Potable	0	Grey	18	23
Bath	15	Potable	0	Grey	12	15
Kitchen Sink	21	Potable	0	Sewage	0	21
Washing Machine	17	Grey	17	Sewage	0	0
Dishwasher	4	Potable	0	Sewage	0	4
TOTAL	103		31		37	72

The treatment requirements of the GWR system will vary, as water which is to be used for flushing the toilet does not need to be treated to the same standard as that which is to be used for the washing machine. The source of the greywater also greatly affects the type of treatment required. Greywater from a washing machine may contain suspended solids, organic matter, oils and grease, detergents (including nitrates and phosphates) and bleach. Greywater from a dishwasher could have a similar composition, although the proportion of fats, oils and grease is likely to be higher; similarly for wastewater from a kitchen sink. Wastewater from a bath or shower will contain

[53] Source: Aquality Intelligent Water management, www.aqua-lity.co.uk
[54] http://www.thewatercalculator.org.uk/faq.asp

suspended solids, organic matter (hair and skin), soap and detergents. All wastewater will contain bacteria, although the risk of infection from this is considered to be low[55].

Treatment systems for GWR are usually of the following four types:

- basic (e.g. coarse filtration and disinfection);
- chemical (e.g. flocculation);
- physical (e.g. sand filters or membrane filtration and reverse osmosis); and,
- biological (e.g. aerated filters or membrane bioreactors).

Table D-5 below gives further detail on the measures required in new builds and from retrofitting, including assumptions on the predicted uptake of retrofitting from the existing housing and commercial building use.

[55] Centre for the Built Environment, www.cbe.org.uk

Table D-5 Water Neutrality Scenarios – specific requirements for each scenario

WN Scenario	New development requirement			Retrofitting existing development	
	New development Water use target (l/h/d)	Water Efficient Fixtures and Fittings	Water Recycling technology	Metering Penetration assumption	Water Efficient Fixtures and Fittings
Building Regulations	125	- WC 6/4 litres dual flush or - 4.5 litres single flush - Shower 10 l/min - Bath 185 litres - Basin taps 6 l/min - Sink taps 8 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	None	72%	None
Building Regulations + Retrofit	125	- WC 6/4 litres dual flush or - 4.5 litres single flush - Shower 10 l/min - Bath 185 litres - Basin taps 6 l/min - Sink taps 8 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	None	72%	5% take up across study area: - WC 6/4 litres dual flush - Shower 6 l/min - Basin taps 2 l/min - Sink taps 4 l/min
Building Regulations Optional Requirement	110	- WC 4/2.6 litres dual flush - Shower 8 l/min - Bath 170 litres - Basin taps 5 l/min - Sink taps 6 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	None	72%	None
Building Regulations Optional Requirement + Retrofit	110	- WC 4/2.6 litres dual flush - Shower 8 l/min - Bath 170 litres - Basin taps 5 l/min - Sink taps 6 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	None	72%	5% take up across study area: - WC 6/4 litres dual flush - Shower 6 l/min - Basin taps 2 l/min - Sink taps 4 l/min
Theoretical (Water	62	- WC 4/2.6 litres dual flush;	Rainwater harvesting and	72%	132% take up across study area:

Neutrality)	- Shower 6 l/min - Bath 145 litres - Basin taps 2 l/min - Sink taps 4 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	Greywater recycling	- WC 6/4 litres dual flush - Shower 6 l/min - Basin taps 2 l/min - Sink taps 4 l/min

Financial Cost Considerations for Water Neutrality scenarios

The financial cost of delivering the technological requirements of each neutrality scenario have been calculated from available research and published documents.

New Build Costs

The Department for Communities and Local Government (DCLG) published the Housing Standards Review in September 2014. A cost impacts report[56] formed part of this publication, providing the costs of the proposed standards, including the proposed Building Regulations optional requirement water efficiency standard.

Costs for water efficiency in new property have been provided based on homes achieving different code levels under the Code of Sustainable Homes (CSH) based on the cost analysis undertaken by DCLG and as set out in Table D-6.

Table D-6 Building Regulation Specification and costs

	1B Apartment	2B Apartment	2B Terrace	3B Semi-detached	4B Detached
Cost all dwellings (extra over usual industry practice)					
Water, Code Level 1	-	-	-	-	-
Water, Code Level 2	-	-	-	-	-
Water, Code Level 3	£6	£6	£6	£9	£9
Water, Code Level 4	£6	£6	£6	£9	£9
Water, Code Level 5	£900	£900	£2,201	£2,697	£2,697
Water, Code Level 6	£900	£900	£2,201	£2,697	£2,697
Alternative standards					
Rainwater only	£887	£887	£2,181	£2,674	£2,674

An additional cost was required for the 'very high' neutrality scenario that included for greywater recycling as well as rainwater harvesting and this is detailed in the following section.

Water Recycling

Research into the financial costs of installing and operating GWR systems gives a range of values, as show in Table D-7.

Table D-7 Costs of greywater recycling systems

Cost	Cost	Comments
Installation cost	£1,750	Cost of reaching Code Level 5/6 for water consumption in a 2-bed flat[57]
	£2,000	For a single dwelling[58]
	£800	Cost per house for a communal system[59]
	£2,650	Cost of reaching Code Level 3/4 for water consumption in a 3-bed semi-detached house[60]
Operation of GWR	£30 per annum[61]	
Replacement	£3,000 to replace23	It is assumed a replacement system will be required every 25 years

[56] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/353387/021c_Cost_Report_11th_Sept_2014_FINAL.pdf

[57] Code for Sustainable Homes: A Cost Review, Communities and Local Government, 2008

[58] http://www.water-efficient-buildings.org.uk/?page_id=1056

[59] http://www.water-efficient-buildings.org.uk/?page_id=1056

[60] Code for Sustainable Homes: A Cost Review, Communities and Local Government, 2008

[61] Environment Agency Publication - Science Report – SC070010, Greenhouse Gas Emissions of Water Supply and Demand Management Options, 2008

Cost	Cost	Comments
costs		

There is less research and evidence relating to the cost of community scale systems compared to individual household systems, but it is thought that economies of scale will mean than larger scale systems will be cheaper to install than those for individual properties. As shown above, the Cost review of the Code for Sustainable Homes indicated that the cost of installing a GWR system in flats is less than the cost for a semi-detached house. Similarly, the Water Efficient Buildings website estimates the cost of installing a GWR system to be £2,000 for a single dwelling and £800 per property for a share of a communal system.

As it is not possible to determine how many of the outstanding housing developments in Colchester Borough will be of a size large enough to consider communal recycling facilities, an approximation has been made of an average per house cost (£1,400) using the cost of a single dwelling (at £2,000) and cost for communal (at £800). This has been used for the assessment of cost for a greywater system in a new property required for the 'very high' neutrality scenario.

Installing a Meter

The cost of installing a water meter has been assumed to be £500 per property. It is assumed that the replacement costs will be the same as the installation costs (£500), and that meters would need to be replaced every 15 years.

Retrofitting of Water Efficient Devices

Findings from the Environment Agency report Water Efficiency in the South East of England, costs have been used as a guide to potential costs of retrofitting of water efficient fixtures and fittings and are presented in Table D-8 below.

Table D-8 Water saving methods

Water Saving Method	Approximate Cost per House (£)	Comments/Uncertainty
Variable flush retrofit toilets	£50 - £140	Low cost for 4-6 litre system and high cost for 2.6-4 litre system. Needs incentive to replace old toilets with low flush toilets.
Low flow shower head scheme	£15 - £50	Low cost for low spec shower head; high costs for high spec. Cannot be used with electric, power or low pressure gravity fed systems.
Aerating taps	£10 - £20	Low cost is med spec, high cost is high spec.

Toilet cistern displacement devices are often supplied free of charge by water companies and this is therefore also not considered to be an additional cost.