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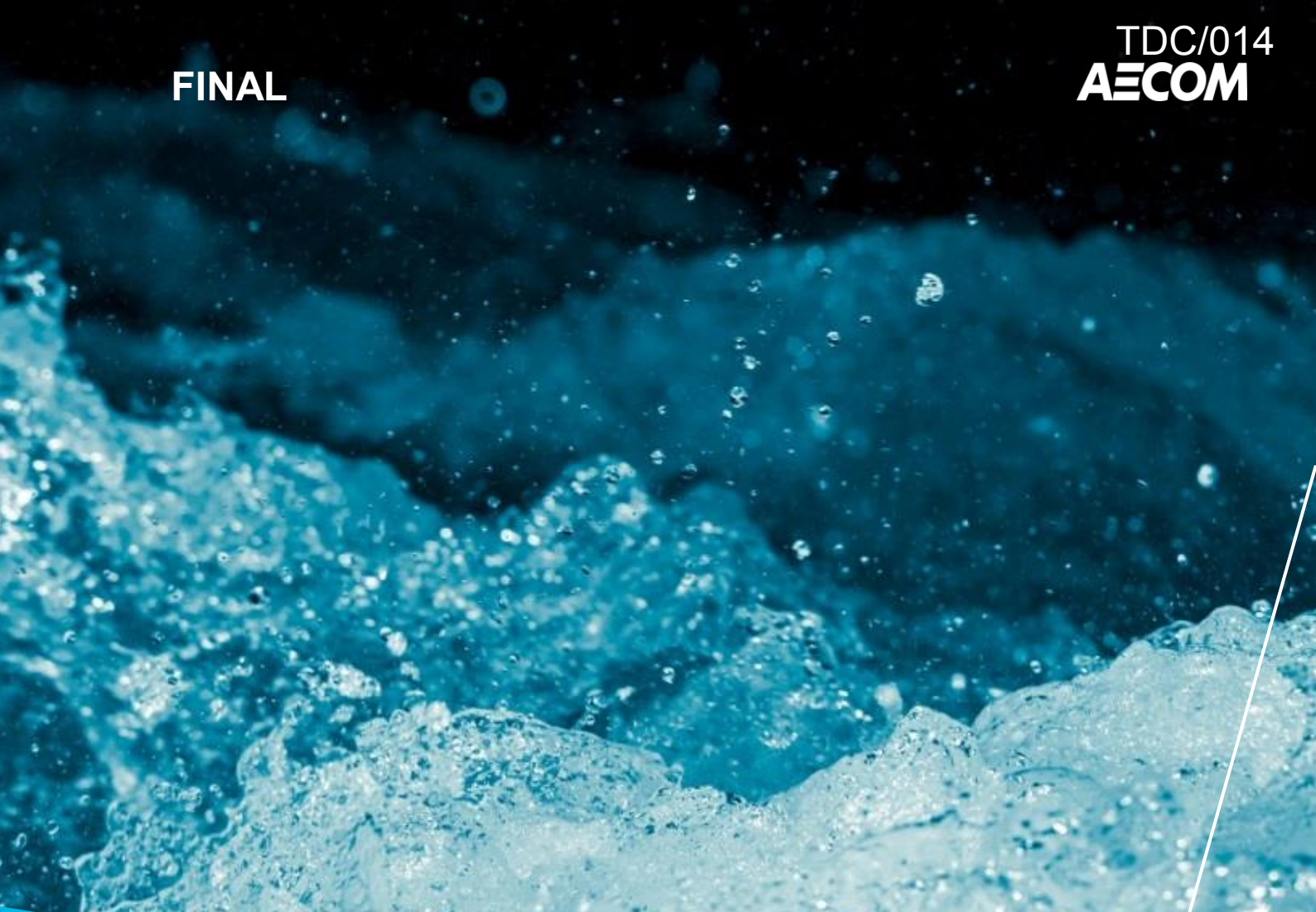

Tendring District Council Water Cycle Study

Final Report

Tendring District Council

September 2017

Quality information

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0	24/08/2017	First Draft	24/08/2017	Sarah Kelly	Regional Director
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List of Acronyms

AMP	Asset Management Plan
AW	Affinity Water
AWS	Anglian Water Services
BGS	British Geological Society
BOD	Biochemical Oxygen Demand
BREEAM	Building Research Establishment Environmental Assessment Method
CAMS	Catchment Abstraction Management Strategy
CBA	Cost Benefit Analysis
CIL	Community Infrastructure Levy
CIRIA	Construction Industry Research and Information Association
CLG	Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DWF	Dry Weather Flow
EA	Environment Agency
EFI	Environmental Flow Indicator
GI	Green Infrastructure
GWR	Greywater Recycling
HA	Highways Agency
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)
RQP	River Quality Planning (tool)
RWH	Rainwater Harvesting
S106	Section 106 (Town and Country Planning Act 1990)
SAC	Special Area for Conservation
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
TDC	Tendring District Council
UKTAG	United Kingdom Technical Advisory Group (to the WFD)
UKWIR	United Kingdom Water Industry Research group
UWWTD	Urban Wastewater Treatment Directive
WCS	Water Cycle Study
WFD	Water Framework Directive
WN	Water Neutrality
WRC	Water Recycling Centre
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

Non-Technical Summary

Tendring District Council is expected to experience significant growth, particularly in relation to domestic redevelopment, over the period 2017 to 2033. This growth represents a challenge in ensuring that both the water environment and water services infrastructure has the capacity to sustain this level of growth and development proposed.

This Tendring District Council Water Cycle Study (WCS) forms an important part of the evidence base that will help Tendring District Council determine the most appropriate options for development within the district (with respect to water infrastructure and the water environment) to be identified in the Council's New Local Plan (2013 to 2033).

Planned future development throughout the Tendring District 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 all development sites (committed and allocations), including recommendations on the policy required to deliver it.

Wastewater Strategy

Wastewater Treatment

The WCS identifies that in total, out of the 14 Water Recycling Centres (WRCs) in the Tendring District, 12 will serve the proposed future development across the District within. Table 1 below provides an indication of the WRCs which have available capacity and those that are likely to require changes to permits that control discharge and potentially infrastructure upgrades.

Table 1. WRC summary

WRC	Summary
Brightlingsea – Church Rd	Flow and treatment capacity for all proposed growth with some flow capacity for further growth.
Clacton -Holland Haven	Treatment process upgrades will be required from 2024 using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD[1] .
Colchester	Treatment process upgrades will be required from 2033 using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD.
Great Bromley	Flow and treatment capacity for all proposed growth with some flow capacity for further growth.
Harwich and Dovercourt	Flow and treatment capacity for all proposed growth with some flow capacity for further growth.
Jaywick	Treatment process upgrades will be required from 2025 using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD.
Little Bentley Tendring Rd	No growth is allocated.
Manningtree	Treatment process upgrades will be required from 2019 using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD.
St Osyth	Flow and treatment capacity for all proposed growth with some flow capacity for further growth.
Tendring Green	No growth is allocated.
Thorrington	Flow and treatment capacity for all proposed growth with some flow capacity for further growth.
Walton on the Naze	Flow and treatment capacity for all proposed growth with some flow capacity for further growth.
Wix	Flow and treatment capacity for all proposed growth with some flow capacity for further growth.

[1] Biochemical Oxygen Demand (BOD) is defined as the 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.

WRC	Summary
Wrabness – Wheatsheaf Close	Treatment process upgrades will be required using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD. Permit setting may be required for ammonia and phosphate.

Five WRCs (Clacton-Holland Have, Colchester, Jaywick New, Manningtree and Wrabness-Wheatsheaf Close) do not have sufficient capacity to accept all future development proposed within the plan period. Therefore solutions are required in order to accommodate the growth to ensure that the increased wastewater flow discharged does not impact on the current quality of the receiving watercourses, their associated ecological sites and also to ensure that the watercourses can still meet with legislative requirements.

Out of the abovementioned five WRCs, the first four discharge to coastal/transitional waterbodies, and only Wrabness-Wheatsheaf Close discharges to a fluvial water body.

The Load Standstill assessments for BOD show that improvements to Clacton-Holland Haven, Colchester, Jaywick New and Manningtree WRCs are possible using conventional wastewater treatment technologies currently available, demonstrating that an engineering solution is feasible and hence treatment capacity should not be seen as a barrier to growth.

The Wrabness-Wheatsheaf Close WRC is a small WRC, which serves a small catchment area, and the necessary datasets to implement the wastewater assessment were not available at the time of preparing the WCS. Based on high level assumptions and the calculated future dry weather flow at this WRC, it has been concluded that improvements to this WRC are possible using wastewater treatment technologies currently available. Due to the lack of data for this WRC and the receiving water environment, further assessments may be required to understand the impact of growth on the water quality permits for this WRC. This would need to be scoped and undertaken in consultation with the Environment Agency and Anglian Water.

The phasing of developments draining to the five WRCs will need to be discussed between Tendring District Council and Anglian Water to ensure no development occurs before the necessary upgrades are in place, and development is phased in line with Anglian Water's asset management plans. Development would need to be phased and potentially delayed until Anglian Water has accounted for the new development.

The WCS has concluded feasible solutions are possible to ensure environmental conditions and legislative objectives are met. However, this WCS recommends that Tendring District Council, the Environment Agency, and Anglian Water should work together to determine when solutions will implemented and hence conclude when and how much development can be accommodated across the study area in the early phases of the Local Plan delivery period.

To ensure that the planned level of development within the plan period does not result in a negative impact upon wildlife both inside and outside of designated sites, it is recommended 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, the WCS has concluded that, allowing for the planned resource management of Affinity Water's supply areas in the District, the water supply companies would have adequate water supply to cater for growth over the plan period.

The WCS has identified that the Water Resource Zone will be in surplus at Dry Year Critical Period 2040 and therefore, no water resources assessment is required for the period 2015-2040.

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 District 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 District understand the importance of using water wisely.

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

- Ensure all housing is water efficient, with new housing development meets the mandatory national standard as set out in the Building Regulations;
- Carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings. Aim to move towards delivery of 5% 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

The site assessments have highlighted some localised constraints with the water supply and wastewater network which need to be resolved and agreed between the relevant developer and water company (either Anglian Water or Affinity Water).

Overall, the water cycle study concludes there are no constraints with respect to water service infrastructure and the water environment to deliver the Local Plan development, on the basis that strategic water resource options and wastewater solutions are developed in advance of development coming forward.

1. Introduction

1.1 Background

The District of Tendring is located in the County of Essex. The District has experienced significant growth in the past decade, and is expected to experience a significant increase in housing requirement and economic growth over the period to 2033.

Tendring District Council is currently preparing a new Local Plan which will supersede the current Local Plan and will set out the Council's strategy for future development and growth to 2033 and beyond. The Draft Local Plan identifies 1,374 housing completions between 2013/14 and 2016/17. A further 10,627 homes are planned between 2017 and 2033.

This Water Cycle Study (WCS) forms an important part of the evidence base for the new Local Plan that will help to ensure that development does not have a detrimental impact on the water environment within the District. 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.

The objective of the WCS is to identify any constraints on planned housing growth that may be imposed by the water cycle. The WCS then identifies how these can be resolved i.e. by ensuring that appropriate Water Services Infrastructure (WSI) can be provided to support the proposed development.

1.2 WCS History

A Stage 1 (2008) and Stage 2 (2009) WCS were prepared for the Haven Gateway sub-region (HGSR), which comprised of the Local Authorities of Tendring, Colchester, Ipswich, part of Suffolk Coastal and part of Babergh, These studies considered a Local Plan period to 2021.

This report considers the previous WCS outputs as part of a revised baseline and re-considers the impact of growth up to 2033 to support the new Local Plan.

1.3 Study Governance

This WCS has been carried out with the guidance of the Steering Group established at the project inception meeting held on 3rd July 2017 comprising the following organisations:

- Tendring District Council;
- Anglian Water Services; and
- Environment Agency.

Affinity Water were unable to attend the inception meeting, however they have been consulted during the preparation of this report.

1.4 WCS Scope

This WCS provides information at a level suitable to ensure that there are deliverable Water Services Infrastructure (WSI) solutions to support growth for the preferred development allocations, including the policy required to deliver it.

The outcome is the development of a water cycle strategy for the District which informs the Council's new Local Plan, sustainability appraisals and appropriate assessments specific to the water environment and WSI issues.

The following sets out the key objectives of the WCS:

- provide a strategy for wastewater treatment across the District which determines if solutions to wastewater treatment are required and if required, whether those solutions are viable in terms of balancing environmental capacity with cost;

- describe how the wastewater treatment strategy might impact phasing of development;
- determine whether any Habitats Directive designated ecological sites have the potential to be impacted by the wastewater treatment strategy via a screening process;
- determine whether additional water resources, beyond those already planned by Affinity Water and Anglian Water are required to support growth;
- determine upgrades required to water supply infrastructure relative to potential options for growth through collaboration with Affinity Water and Anglian Water;
- consider whether growth can be delivered and achieve a 'neutral water use' condition;
- determine impact of infrastructure and mitigation provision on housing delivery phasing; and
- provide policy recommendations.

1.5 Key Assumptions and Conditions

1.5.1 Water Company Coverage

Two water companies operate within the District; Anglian Water is the wastewater undertaker for the entire District and Affinity Water supplies the majority of potable water to the District.

For the water supply assessment, the published measured household consumption for Affinity Water's Water Resource Zone 8 (WRZ8) of 133 litres per head per day (l/h/d) has been applied[2], as published in Affinity Water's Water Resources Management Plan (WRMP. This consumption has been assumed across the whole District. It is acknowledge that the 133 l/h/d assumption exceeds the current Building Regulations requirement of 125l/h/d for all new homes. However, analysis by water companies has shown that even when homes are built to a standard of 125l/h/d, the average household use increases over time due to various factors. The 125l/h/d requirement is an aspirational target only and Affinity Water is required under their remit to the industry regulator OFWAT, to plan for the expected actual use.

For the wastewater assessments, a different assumption was made on the likely consumption of water per new household going forward in the plan period. A starting assumption of 174l/h/d (litres per head per day)[3] was provided by Affinity Water to calculate wastewater demand per person. In addition, to account for infiltration of surface water, groundwater and misconnections to the sewer network in the future, an additional proportion of 'unaccounted for' flows has been included in the calculations. An additional flow of 43l/h/d[4] has therefore been added to the starting assumption of 174l/h/d, giving a final wastewater demand of 217 l/h/d.

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

1.5.2 Household Occupancy Rate

The latest Office for National Statistics (ONS) population projections[5] 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 2 below.

[2] Based on the Dry Year Annual Average (DYAA) Per Capita Consumption (PCC)
[3] Based on the Dry Year Critical Period (DYCP) Per Capita Consumption (PCC)
[4] As provided by Anglian Water
[5] Table: Household projections stage 1: household populations. Available at: https://www.gov.uk/government/statistical-data-sets/2014-based-household-projections-detailed-data-for-modelling-and-analytical-purposes
[6] Table: Household projections stage 1- households. Available at: https://www.gov.uk/government/statistical-data-sets/2014-based-household-projections-detailed-data-for-modelling-and-analytical-purposes

Table 2. Calculation of Occupancy Rate

Projection for 2033	
Population	156,143
Number of households	74,779
Calculated Occupancy Rate (people per household)	2.09

1.5.3 Wastewater Treatment

As a wastewater treatment provider, Anglian Water are required to use the best available techniques (defined by the Environment Agency as the best techniques for preventing or minimising emissions and impacts on the environment) to ensure emission limit values stipulated within each Water Recycling Centre (WRC)[7] permit conditions are met.

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)[8], ammonia and phosphate, and are provided in Table 3.

Table 3. Reliable limits of conventional treatment technology for wastewater

Water Quality Parameter	LCT
Ammonia	1.0 mg/l 95 percentile limit[9]
BOD	5.0 mg/l 95 percentile limit[9]
Phosphate	0.5 mg/l annual average[10]

1.6 Report Structure

The first stage of the WCS process is set out in Section 3 of this document and outlines the total proposed number of dwellings which will need to be catered for in terms of water supply and wastewater treatment. Understanding the level of growth and where it might be located informs the second 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 results of the assessment will identify the WRCs which are at capacity or have remaining capacity. The wider, supporting environment has also been considered, including local ecology.

In parallel to the wastewater assessment, Section 5 outlines water resource planning targets, discusses current and proposed water efficient measures and introduces the concept of water neutrality.

The report also covers the proposed major development sites (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 network capacity.

Ultimately, recommendations have been made as part of the WCS (Section 7) in regards to wastewater, water supply, surface water management and flood risk, ecology and stakeholder liaison.

[7] Anglian Water Services refer to their Wastewater Treatment facilities as Water Recycling Centres
[8] 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
[9] Considered within the water industry to be the current LCT using best available techniques
[10] Environment Agency (2015) Updated River Basin Management Plans Supporting Information: Pressure Narrative: Phosphorus and freshwater eutrophication

2. Study Drivers

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

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; and

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

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

Other relevant studies that have a bearing on the provision of WSI for development include, but are not limited to, key documents including the Tendring District Council SFRA Update (Place Services, 2017), Affinity Water's WRMP and the Environment Agency's latest Anglian River Basin Management Plan (RBMP) (2015).

2.1 OFWAT Price Review

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

Figure 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 1. Proposed timescales for PR19 (Water 2020) programme[11]

As the wastewater undertaker for the District, Anglian Water 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 Affinity Water has sufficient funds to finance its functions, and at the same time protect consumers' interests. The price controls affect the bills that customers pay and the sewerage services consumers receive, and ultimately ensure wastewater assets are managed and delivered efficiently.

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

Consequently, to avoid potential inefficient investment, Anglian Water generally do not provide additional infrastructure to accommodate growth until there is certainty that development is due to come forward.

2.2 Water Framework Directive

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

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

These environmental objectives are legally binding, and all public bodies should have regard to these objectives when making decisions, or creating and adopting plans that could affect the quality of the water environment. The Environment Agency publish the status and objectives of each surface water body on the Catchment Data Explorer[12], and describe the status of each water body as detailed in Table 4.

Table 4. 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

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

3. Proposed Growth

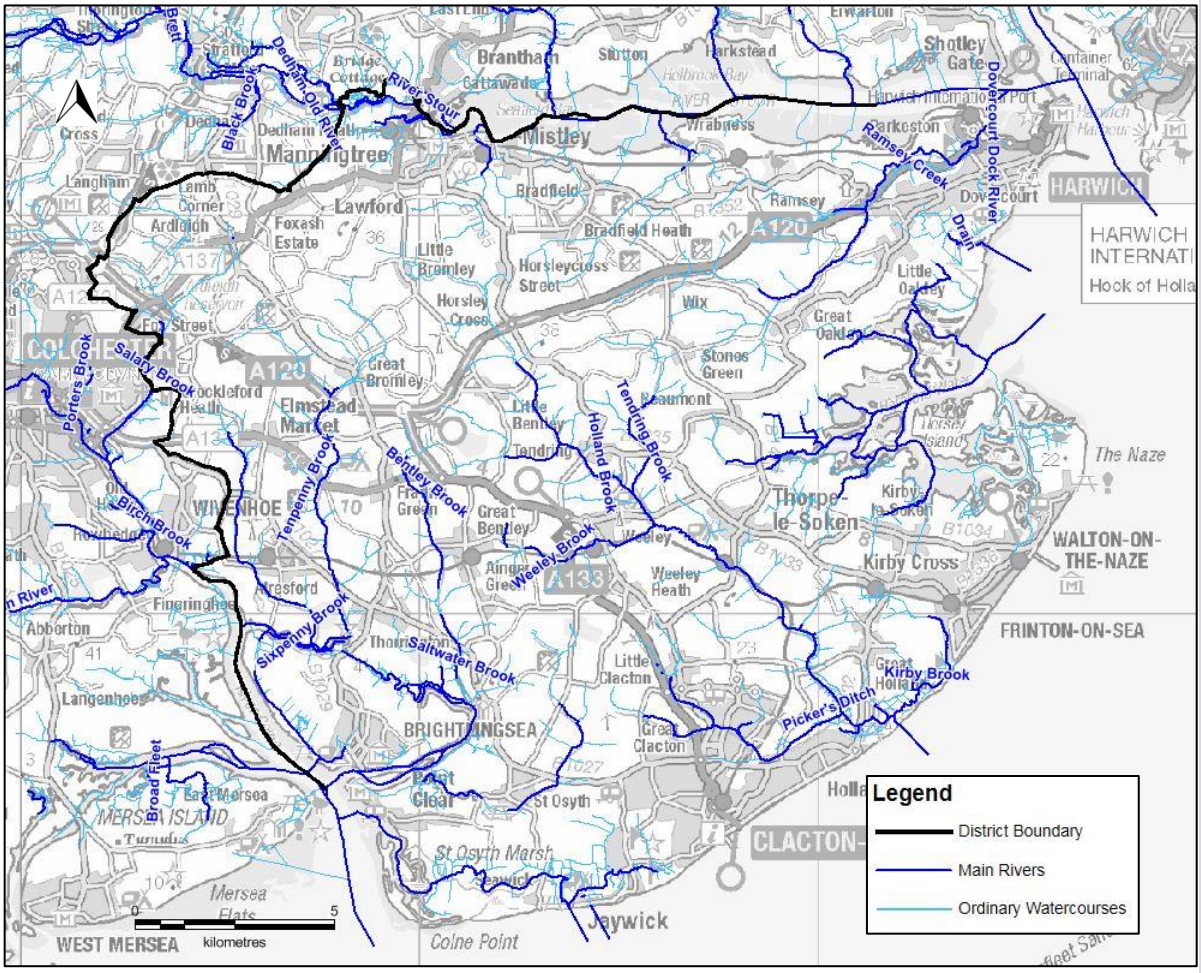
3.1 Preferred Growth Strategy

The purpose of the WCS is to assess the potential impact of increased development upon the water environment and WSI across the District. The increased development is to accommodate the minimum housing requirement for the Council. This level of projected growth has required the Council to revise their spatial approach of future expected development up to 2033. These growth figures therefore form the basis for the WCS and are described in detail in section 3.2.

The administrative area of Tendring District Council covers the urban areas of Clacton-on-Sea, Walton, Brightlingsea, Harwich and Manningtree. Significant villages in the District include St Osyth and Great Bentley.

Figure 2 illustrates Tendring District Councils administrative boundary, main towns, and villages in relation to key watercourses within the District which inform an important part of the WCS baseline.

Figure 2. Tendring District boundary including location of key watercourses



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3.2 Housing

The Draft Local Plan identified 10,627 dwellings within the Plan Period (2017 to 2033). The net dwellings completions to date are 1,374 (between 2013 and 2017).

The WCS incorporates the following development types including;

- Large Sites with Planning Consents (with/without signed S106 Agreements);
- Small Sites with Planning Consents;
- Strategic Allocations - Mixed Use (SAMU Policies);
- Strategic Allocations – Housing (SAH Policies);
- Medium Sized Allocations (MSA Policies) and
- The Tendring Colchester Borders Garden Community (covering the number of houses expected to be delivered within the Local Plan period i.e. to 2033)[13].

Table 5 below provides an overview of the number of dwellings to be built within the plan period and, therefore, assessed as part of the WCS.

Table 5. Tendring District Council Housing Commitments and Allocations

Type of Site	No. Dwellings
Net Dwelling Completions 2013-2017	1,374
Large Sites with Planning Consents (with/without signed S106 Agreements)	4,779
Small Sites with Planning Consents (with Trend Based Completions)	1,399
Strategic Allocations - Mixed Use (SAMU Policies)	2,230
Strategic Allocations – Housing (SAH Policies)	464
Medium Sized Allocations (MSA Policies)	505
Tendring Colchester Borders Garden Community	1,250
Totals	**12,001**

3.3 Employment

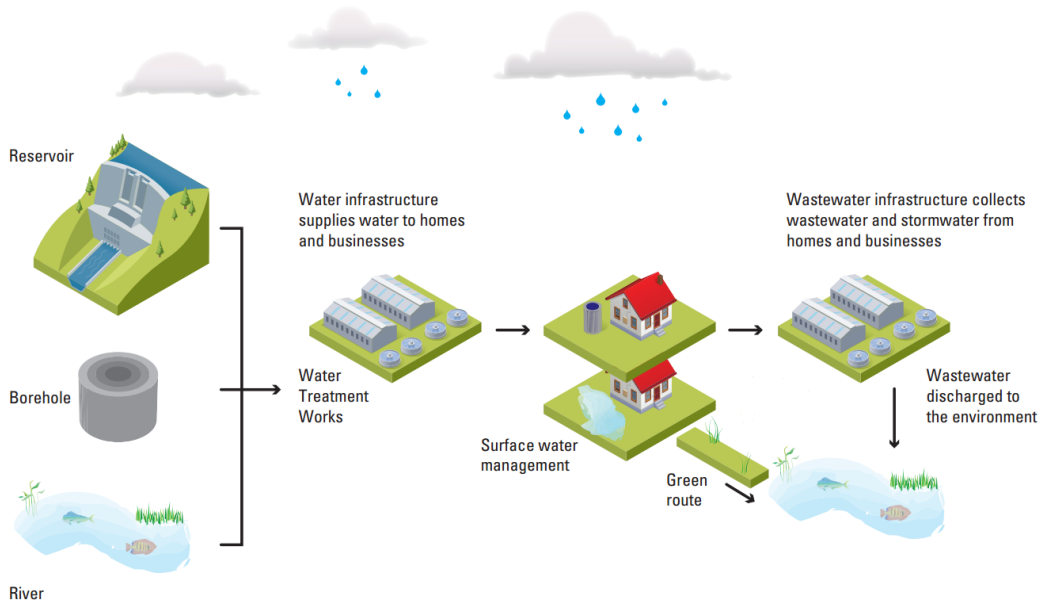
The WCS also takes account of the projected increase in employment across the District up to 2033; a total of approximately 9,700 new jobs (606 jobs per year). A percentage of the projected employment growth has been assigned to each of the proposed employment sites, based on the size (hectare) of each site (i.e. the larger the site, the greater the proportion of full time employment jobs allocated).

[13] Garden Communities will have growth 40+ years in excess of the local plan period and this growth is being considered in a separate Integrated Water Management Strategy (IWMS) being developed for the Garden Communities.

4. Wastewater Treatment

4.1 Wastewater in the District

Figure 3. The water environment and infrastructure components[14]



A broad overview of the water cycle and the role of water and wastewater infrastructure within the cycle is illustrated in Figure 3. Wastewater is generally produced following the use of potable water in homes, businesses, industrial processes and in certain areas can include surface water runoff.

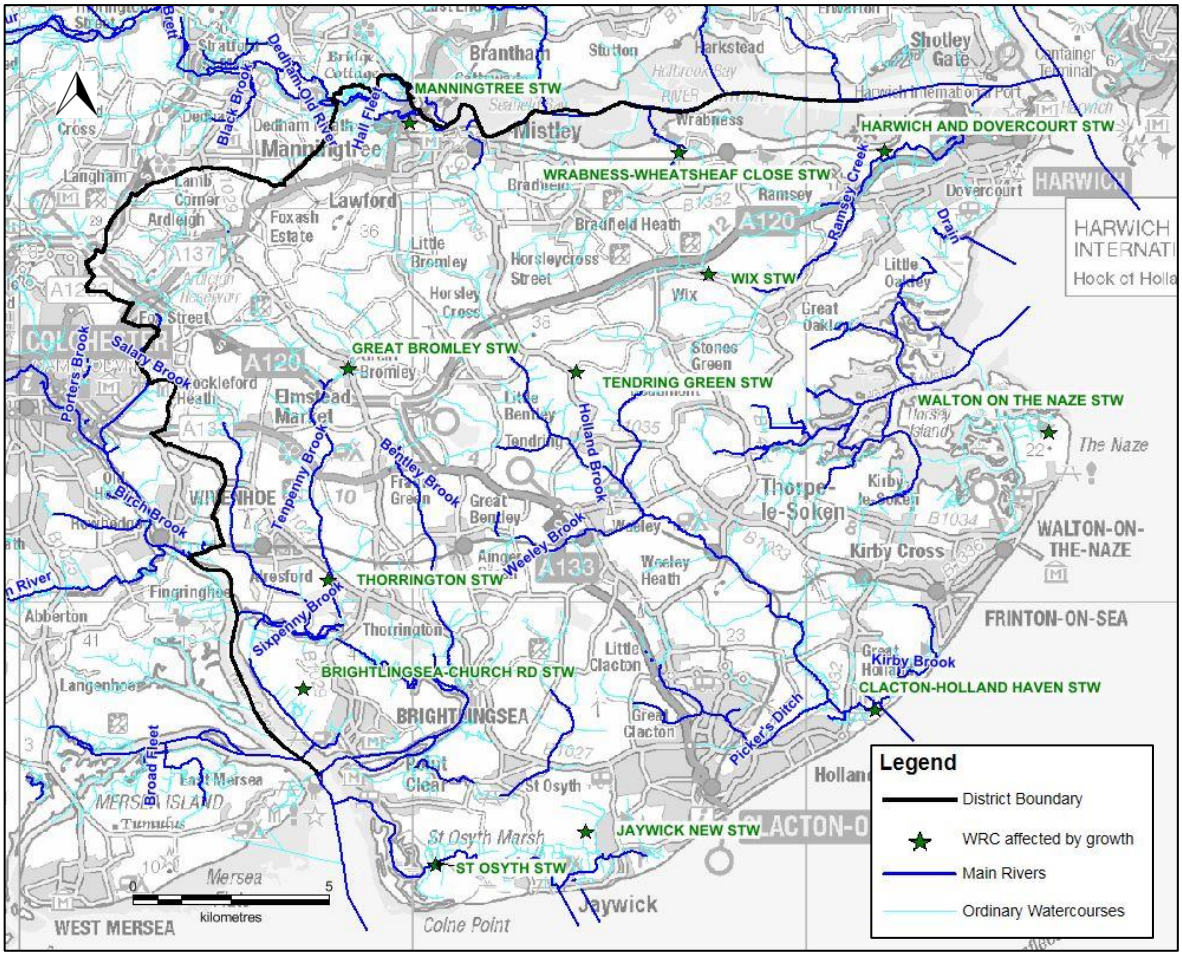
Wastewater treatment in the District is provided via water recycling centres(WRCs) operated and maintained by Anglian Water, ultimately discharging treated wastewater to a nearby water body (river, estuary or the sea). Each of the WRCs is connected to a network of wastewater pipes (the sewerage system) which collects wastewater generated by homes and businesses to the WRC; this is defined as the WRCs 'catchment'.

Wastewater from the District is treated at 14 WRCs. The following 12 WRC catchments are expected to receive additional wastewater as a result of growth and their location. The WRC locations are illustrated in Figure 4:

- Brightlingsea-Church Road
- Clacton-Holland Haven,
- Colchester,
- Great Bromley,
- Harwich and Dovercourt,
- Jaywick,
- Manningtree,
- St Osyth,
- Thorrington,
- Walton On The Naze,
- Wix,
- Wrabness-Wheatsheaf Close.

[14] Adapted from the Sustainable Urban Drainage Scottish Working Party's Water Assessment and Drainage Assessment Guide (2017)

Figure 4. Location of WRC's affected by Local Plan development



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4.2 Management of WRC Discharges

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

The flow element of the discharge permit determines an approximation of the maximum number of properties that can be connected to a WRC 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 water body is not adversely affected, up to the maximum permitted flow of the discharge permit.

For the purposes of this WCS, the assumption is applied that the permitted headroom is usable[15] and would not affect downstream water quality. This headroom therefore determines how many additional properties can be connected to the WRC catchment before Anglian Water 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).

[15] In some cases, there is a hydraulic restriction on flow within a WRC which would limit full use of the maximum permitted headroom.

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 WRC would result in an increase in the pollutant load[16] of some substances being discharged to the receiving water body. This may have the effect of deteriorating water quality and hence in most cases, an increase in permitted discharge flow results in more stringent (or tighter) conditions on the quality of the discharge.

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

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

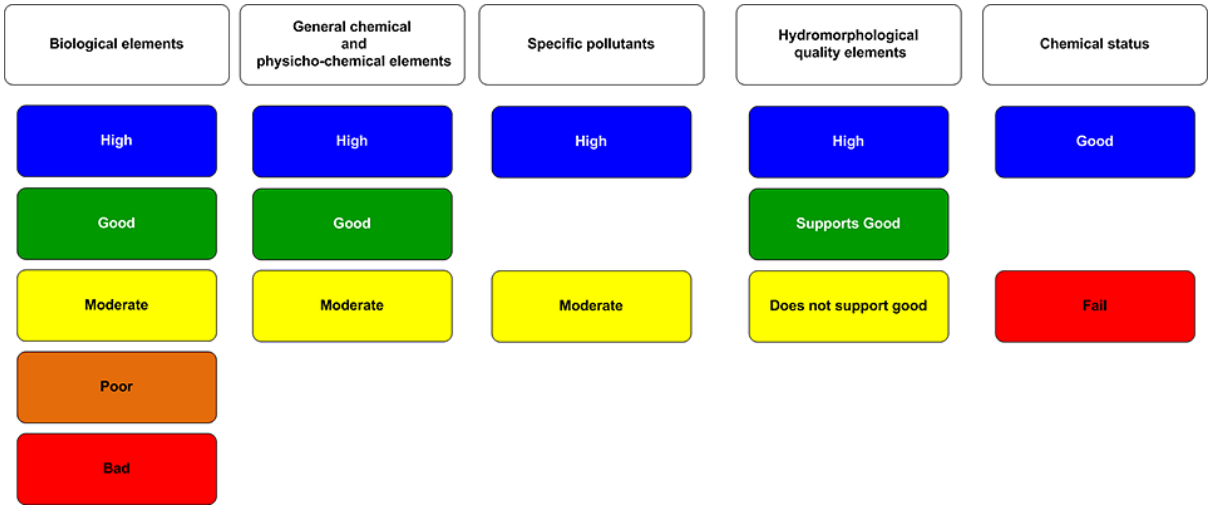
4.3 WFD Compliance

The definition of a surface water body'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 water body catchment. A water body's 'overall status' is derived from the classification hierarchy made up of 'elements', and the type of water body will dictate what types of elements are assessed within it. The following is an example of the classification hierarchy and Figure 5 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)

Figure 5. WFD status classifications used for surface water elements



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

- Development must not cause a deterioration in WFD status of a water body[17]; and

[16] Concentration is a measure of the amount of a pollutant in a defined volume of water, and load is the amount of a substance discharged during a defined period of time.
[17] i.e. a reduction 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

- Development must not prevent a water body from achieving its future target status (usually at least Good status).

It is not acceptable to allow a deterioration from High status to Good status, even though the overall target of Good status as required under the WFD is still maintained, this would still represent a deterioration. In addition, if a water body'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 water body is already less than Good.

Where permitted headroom at a WRC would be exceeded by proposed growth, 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 B.

4.4 Habitats Directive

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.

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

Where permitted headroom at a WRC would be exceeded by 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). This assessment is reported in Section 4.8 of this chapter (Ecological Appraisal).

4.5 Wastewater Assessment Overview

4.5.1 Approach

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

- **Infrastructure Capacity**: defined in this WCS as the ability of the wastewater infrastructure to collect, transfer and treat wastewater from homes and business.
  - What new infrastructure is required to provide for the additional wastewater treatment?
  - Is there sufficient treatment capacity within existing wastewater infrastructure treatment facilities (WRCs)?
- **Environmental Capacity**: defined in this WCS as the water quality needed in receiving waterbodies to protect the aquatic environment and its wildlife. This is ultimately based on water quality targets required to protect wildlife.
  - Can the waterbodies receiving the WRC discharge cope with the additional flow without affecting water quality?

There are therefore two elements to the assessment of existing capacity (and any solutions required) with respect to wastewater treatment.

4.5.2 Methodology

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

In order to complete the following steps, the following assessment techniques were developed (details of the procedures can be found in Appendix B);

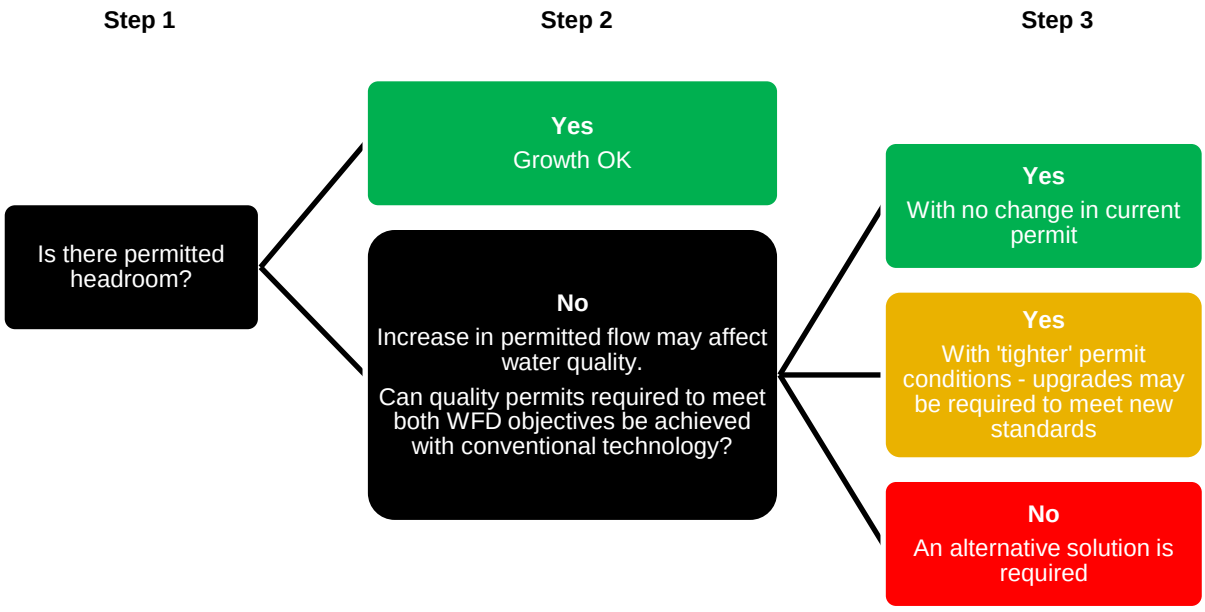
- A flow headroom calculation spreadsheet was developed; and,
- A water quality assessment procedure was agreed with the Environment Agency.

4.5.3 Assessment Results

The results for each WRC are presented in a Red/Amber/Green (RAG) Assessment for ease of planning reference. The RAG code refers broadly to the following categories and the process is set out in Figure 6. RAG Assessment process diagram for infrastructure capacity

- **Green** – WFD objectives will not be adversely affected. Growth can be accepted with no significant changes to the WRC infrastructure or permit required.
- **Amber** – in order to meet WFD objectives, changes to the discharge permit are required, and upgrades may be required to WRC 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.

Figure 6. RAG Assessment process diagram for infrastructure capacity



4.6 Water Recycling Centre Headroom Assessment

The assessment results are presented in this section and have been reported in the following order;

- Firstly, further detail on WRC catchments where growth can be accepted within the current permitted flow headroom, reported together in Section 4.6.1;
- Secondly, further detail on those WRCs requiring a new discharge permit and hence a water quality assessment have been undertaken and reported in Section 4.6.2 and 4.7.

4.6.1 WRC with Permitted Headroom

The volume of wastewater, measured as Dry Weather Flow (DWF)[18], which would be generated from the proposed housing and employment growth over the plan period within each WRC catchment has been calculated and compared to the treatment capacity at each WRC. DWF is a measure of the flow to a WRC which excludes direct surface water inputs from rainfall[19].

Table 6 details the WRCs where existing permitted headroom is sufficient to accommodate all of the proposed growth. Whilst AWS may need to review biological treatment processes to accommodate additional flow, no change new discharge permit is required and it is assumed that no significant wastewater treatment infrastructure upgrades are required to deliver the proposed growth in these locations.

Growth in these WRC catchments would not compromise either of the WFD objectives and, hence, there is no barrier to delivering the proposed growth. These WRCs are assessed as Green in the RAG assessment and, therefore, do not require any further assessment.

Table 6 also provides an approximation of the number of additional dwellings that could be connected before the flow condition of the discharge permit would be exceeded.

Table 6. WRC with permitted headroom capacity

Water Recycling Centre	Current DWF Permit (m^3/d)	Current Capacity Headroom		Quantity of proposed dwellings	DWF post growth (2033) (m^3/d)	Headroom Assessment post growth (2033)	
		Current DWF (m^3/d)	Calculated Headroom (m^3/d)			Headroom Capacity (m^3/d)	Approximate Residual housing capacity
Brightlingsea-Church Rd	2160	1619	**541**	174	1,698	**462**	**1,000**
Great Bromley	365	204	**161**	73	237	**128**	**300**
Harwich and Dovercourt	6782	5251	**1,531**	966	5,759	**1,023**	**2,300**
St Osyth	1600	1325	**275**	278	1,451	**149**	**300**
Thorrington	2400	1598	**802**	669	1,915	**485**	**1,100**
Walton On the Naze	6364	4490	**1,874**	1,009	4,947	**1,417**	**3,100**
Wix	160	126	**34**	10	131	**29**	**<100**

4.6.2

[18] Until recently, Dry Weather Flow (DWF) was defined as "the average daily flow to the treatment works during seven consecutive days without rain (excluding a period which includes public holidays) following seven days during which the rainfall did not exceed 0.25 millimetres on any one day". A viable alternative definition of DWF has been established, based on use of the 20th percentile of daily flows, using 2006 guidelines of UK Water Industry Research

[19] It should be noted that the current DWF of each WRCs is calculated as the Q80 (20th percentile) of the provided measured flows of each WRC.

4.6.3 WRC without Permitted Headroom

The calculations of flow headroom capacity found that five WRCs would not have sufficient headroom once all the growth within the WRC catchment is accounted for as detailed in Table 7. These WRCs would exceed their maximum permitted DWF under their existing discharge permits. Additional headroom can be made available through an application by Anglian Water for a new or revised discharge permit from the Environment Agency.

Table 7. WRC without permitted headroom capacity

Water Recycling Centre	Current DWF Permit (m^3/d)	Current Headroom Capacity		Quantity of proposed dwellings	DWF post growth (2033) (m^3/d)	Headroom Assessment post growth (2033)	
		Current DWF (m^3/d)	Calculated Headroom (m^3/d)			Headroom Capacity (m^3/d)	Residual housing capacity
Clacton-Holland Haven	10546	10009	537	2,619	**11,236**	-690	-1,523
Colchester	29284	24817	4,467	15,597	**31,906**	-2,622	-5,800
Jaywick New	5000	4812	188	856	**5,200**	-200	-441
Manningtree	2999	2857	142	1,147	**3,385**	-386	-852
Wrabness-Wheatsheaf Close	6.53	5.224	1	18	**13**	-7	-15

The growth assigned to Colchester WRC includes growth allocated from Colchester Borough in addition to the growth allocated from Tendring District. The number of dwellings allocated for the plan period from growth within Colchester Borough (shown in Colchester WCS[20]) is 14,188. This includes 1,650 dwellings from the Tendring-Colchester Border Garden community – Colchester area. The number of dwellings allocated to Colchester WRC from Tendring District is 1,409, including 1,250 dwelling from the Tendring – Colchester Border Garden community – Tendring area.

It should be noted that no current DWF flow datasets were available for the Wrabness-Wheatsheaf Close WRC. Correspondence with Anglian Water indicated that as this is a small WRC with a current DWF permit of approximately 7 m^3/d, measurements are not recorded (Anglian Water's threshold for measurement recordings is 50m^3/d). Therefore, it was assumed that the current DWF for this WRC is 80% of its current DWF permit, which is the average ratio of current DWF over current DWF permit of the WRCs in the District.

The following report sub-sections provide a summary of phasing implications for each WRC catchment, demonstrating the year in which available headroom would be utilised based on the outline phasing of growth in the developing Local Plan. Up to the point at which headroom is utilised, there would be no significant implications for proposed development sites, however beyond this point, water quality impacts of a revised permit need to be considered, and a water quality assessment process has been undertaken. A summary of the results of the water quality assessment are provided in Section 4.7, with detailed results provided in Appendix B.

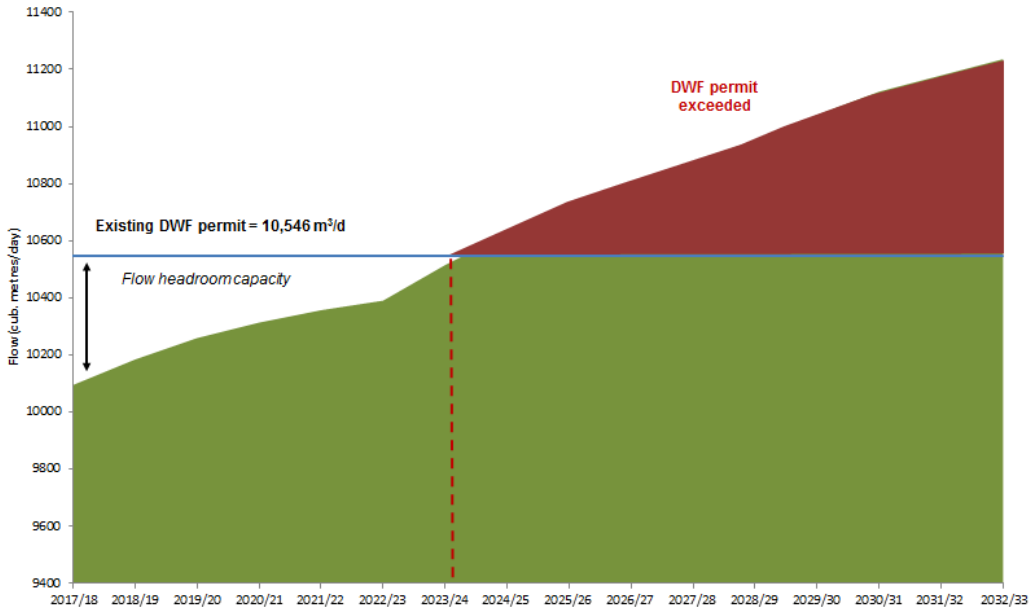
4.6.3.1 Clacton-Holland Haven WRC

The headroom assessment has demonstrated that Clacton Holland-Haven WRC currently has flow headroom available in its existing discharge permit and can accept development of 1185 dwellings[21], after which the discharge permit will be exceeded. Based on the latest housing trajectory provided by Tendring District Council, the existing discharge permit will be exceeded in 2024 as shown in Table 7.

[20] AECOM (2016) Colchester Borough Council Water Cycle Study
[21] Calculated based on key assumptions

Unless additional flow headroom can be made available at the WRC to accept development beyond 1,185 dwellings, further development connecting to the WRC would result in the existing discharge permit being exceeded, and by a total volume of 690 m^3/d (equivalent to approximately 1,520 dwellings) by the end of the plan period as shown in Table 7.

Figure 7. Clacton-Holland Haven WRC DWF across plan period and DWF permit exceedance



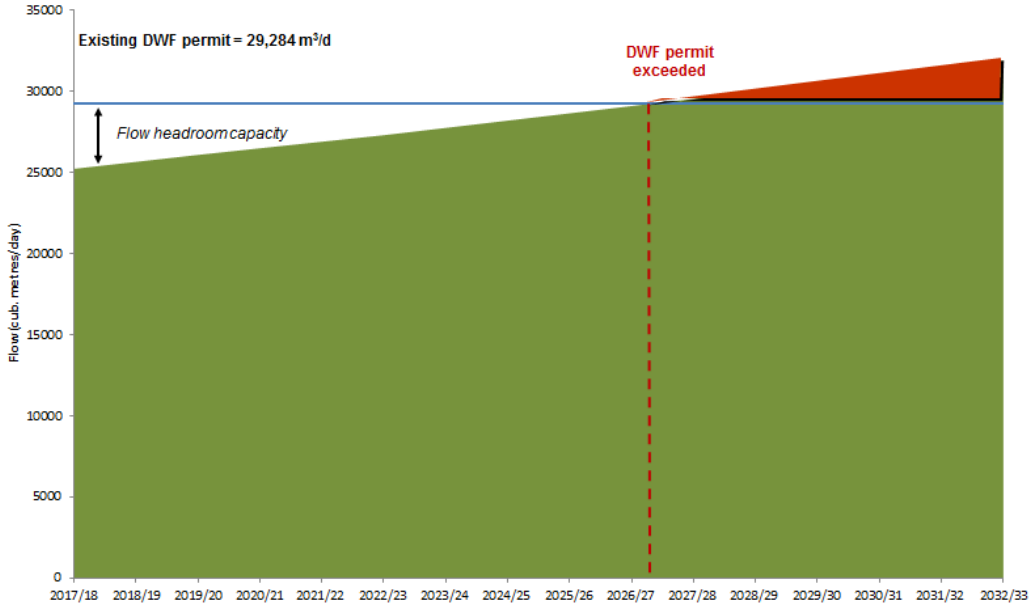
4.6.3.2 Colchester WRC

The headroom assessment has demonstrated that Colchester WRC currently has sufficient flow headroom in its existing discharge permit and can accept development of approximately 9,860 dwellings[22], after which the discharge permit will be exceeded. Based on the latest housing trajectory provided by Tendring District Council, the existing discharge permit will be exceeded in 2027 as shown in Table 7.

Unless additional flow headroom can be made available at the WRC to accept development beyond 9,860 dwellings, further development connecting to the WRC would result in the existing discharge permit being exceeded, and by a total volume of 2,622 m^3/d (equivalent to approximately 5,800 dwellings) by the end of the plan period as shown in Table 7.

[22] Calculated based on key assumptions

Figure 8. Colchester WRC DWF across plan period and DWF permit exceedance

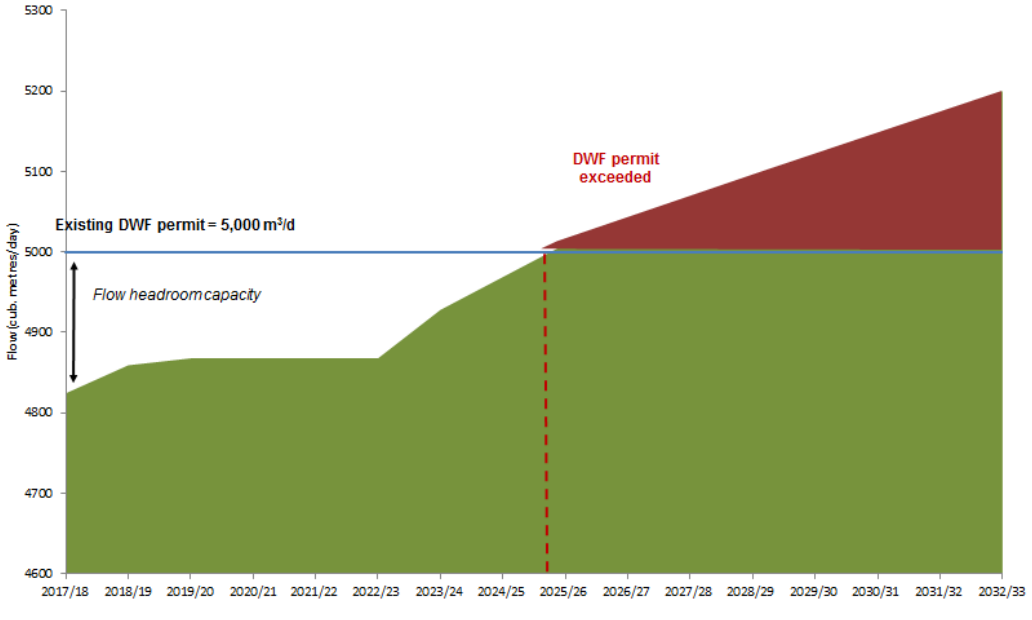


4.6.3.3 Jaywick New WRC

The headroom assessment has demonstrated that Jaywick New WRC currently has sufficient flow headroom in its existing discharge permit and can accept development of 415 dwellings[21], after which the discharge permit will be exceeded. Based on the latest housing trajectory provided by Tendring District Council, the existing discharge permit will be exceeded in 2025 as shown in Figure 9. Jaywick New DWF across plan period and DWF permit exceedance

Unless additional flow headroom can be made available at the WRC to accept development beyond 415 dwellings, further development connecting to the WRC would result in the existing discharge permit being exceeded, and by a total volume of 200 m^3/d (equivalent to approximately 440 dwellings) by the end of the plan period as shown in Table 7.

Figure 9. Jaywick New DWF across plan period and DWF permit exceedance

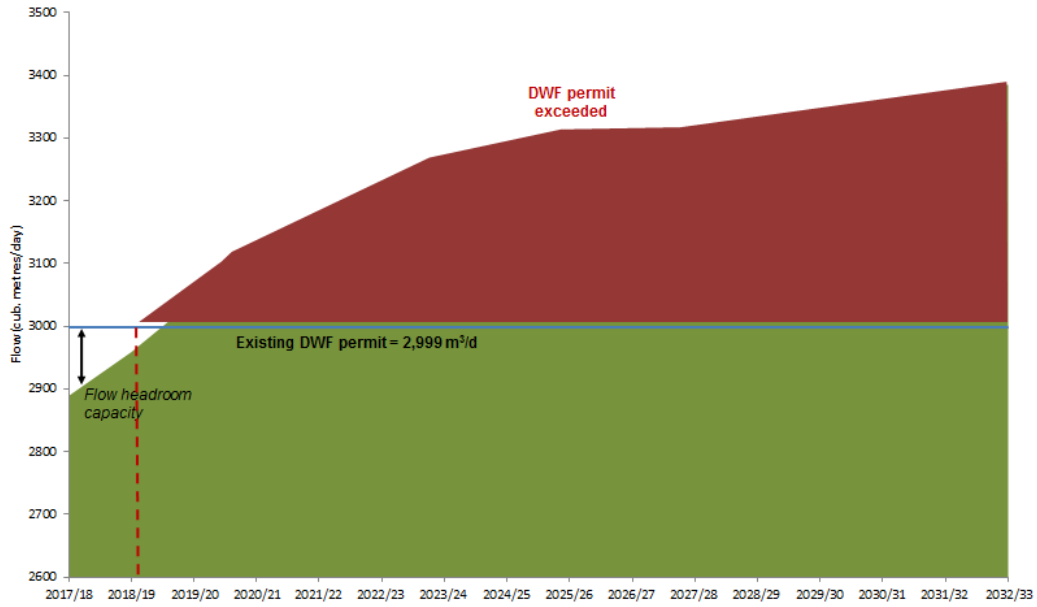


4.6.3.4 Manningtree WRC

The headroom assessment has demonstrated that Manningtree WRC currently has flow headroom available in its existing discharge permit and can accept development of 313 dwellings[21], after which the discharge permit will be exceeded. Based on the latest housing trajectory provided by Tendring District Council, the existing discharge permit will be exceeded in 2019 as shown in Figure 10. Manningtree DWF across plan period and DWF permit exceedance

Unless additional flow headroom can be made available at the WRC to accept development beyond 313 dwellings, further development connecting to the WRC would result in the existing discharge permit being exceeded, and by a total volume of 386 m^3/d (equivalent to approximately 850 dwellings) by the end of the plan period as shown in Table 7.

Figure 10. Manningtree DWF across plan period and DWF permit exceedance



4.7 Water Quality Assessment

For the WRCs which have been identified as having insufficient permitted flow headroom to accept all the proposed growth within their catchments, four (Clacton-Holland Haven, Colchester, Jaywick New and Manningtree) discharge directly into coastal or transitional environments and one WRC (Wrabness-Wheatsheaf Close) discharges to a freshwater inland water body.

Regarding the WRCs that discharge to coastal or transitional waterbodies, load standstill calculations have been used to determine the future permit conditions for BOD. This approach follows Environment Agency's guidelines and best practice. Conventional permits for Ammonia and Phosphate for coastal waterbodies have not been set by the Environment Agency.

The Wrabness-Wheatsheaf Close WRC discharges to the Wrabness Brook (fluvial watercourse), just upstream of the confluence with the tidal River Stour. Ammonia, BOD and Phosphate permits are not available for this WRC as it is only a small WRC, therefore the application of a statistical based water quality modelling tool was not possible.

Based on the current DWF permit and the calculated future DWF at Wrabness-Wheatsheaf WRC, it is assumed that any permitted quality limits for Ammonia, Phosphate and BOD would need to be either put in place or tightened within the Limits of Conventional Treatment. This assumption has been based on the fact that the future DWF is almost double its current permit; however it is still relatively low.

As an example, based on our previous assumptions and a further assumption that an existing BOD permit at Wrabness-Wheatsheaf Close WRC is set at 30mg/l, then using a high level Load Standstill BOD assessment, the quality permit required for BOD at the Wrabness-Wheatsheaf Close WRC would be 12.1 mg/l. This confirms that if a permit was in place, it would require tightening in order to incorporate the development.

A summary of the results and where infrastructure upgrades may be required are included in the following subsections for each of the WRCs where water quality assessment was undertaken (except for Wrabness-Wheatsheaf Close WRC). A summary of the Load Standstill calculations are provided in Table 8.

Table 8. Summary of BOD Load Standstill calculations for WRCs discharging to coastal or transitional waterbodies

	Clacton-Holland Haven WRC	**Colchester WRC**	**Jaywick New WRC**	**Manningtree WRC**
	North Sea	River Colne (Saline Estuary)	North Sea	Wignall Brook Stour Estuary
Current BOD Limit of Conventional Treatment (mg/l)	5	5	5	5
Current DWF Permit (m^3/day)	10,546	29,284	5,000	2,999
Current DWF (m^3/day)	**10,009**	**24,817**	**4,812**	**2,857**
Permit limits (95% percentile)	100	35	100	50
Permit exceeded?	No	No	No	No
Discharge Permit required				
Future DWF (m^3/day)	**11,236**	**31,906**	**5,200**	**3,385**
Effluent Quality permit required for BOD	**89.1**	**27.2**	**92.5**	**42.2**
Result - Will Growth prevent WFD "No deterioration status" from being achieved?	No. But permit needs tightening	No. But permit needs tightening	No. But permit needs tightening	No. But permit needs tightening

Key to "Effluent Quality Required"

Green value - no change to current permit required

Amber value - permit tightening required, but within limits of conventionally applied treatment processes

Red value - not achievable within limits of conventionally applied treatment processes

4.7.1 Clacton-Holland Haven, Colchester, Jaywick New and Manningtree WRCs

As demonstrated in Table 8, the results for the assessment of the four tidal discharges indicate that to accept and treat all of the additional wastewater flow expected from the developments by the end of the plan period, process upgrades at the WRCs are likely to be required at some point before the end of plan period , when based on growth projections permitted headroom would be exceeded as follows:

- For Clacton-Holland Haven WRC (which discharges to the North Sea, classified by the Environment Agency as Controlled Sea), upgrades will be required at 2024;
- For Colchester WRC(which discharges to the River Colne, classified by the Environment Agency as Saline Estuary), upgrades will be required in 2027;
- For Jaywick New WRC (which discharges to the North Sea, classified by the Environment Agency as Controlled Sea), upgrades will be required in 2025 and

- For Manningtree WRC (which discharges to Wignall Brook Estuary, classified by the Environment Agency as Freshwater Estuary), upgrades will be required in 2019.

The exact technical specifications of the upgrades should be determined by Anglian Water for the relevant asset planning period, for the revised quality conditions for BOD. To achieve these tighter permit conditions, current conventional treatment technologies would be sufficient (i.e. the quality conditions are within LCT) but would need to be implemented by Anglian Water at some point in the future. This demonstrates that a technical solution is feasible for BOD.

4.8 Ecological Appraisal

There are 11 statutory and three non-statutory designated sites that have been identified as potentially being connected to WRCs within the Tendring District that are expected to exceed existing consents as a result of planned future growth. These are as follows:

- Colne Estuary (Mid-Essex coast phase 2) SPA and Ramsar site
- Colne Estuary SSSI
- Essex Estuaries SAC
- Holland Haven Marshes SSSI
- Hopping Bridge Marsh Local Wildlife Site
- Jaywick Marshes Local Wildlife Site
- Languard Common SSSI
- Orwell Estuary SSSI
- Stour Estuary SSSI
- Stour and Orwell Estuaries SPA and Ramsar site
- Upper Colne Marshes SSSI
- Wrabness Depot and Marsh Local Wildlife Site

Any other designated sites not listed are remote from watercourses that WRCs are discharging to or are designated for their non-ecological features. The details of the ecological designation of the statutory sites are included in in Appendix D and illustrated in Figure 11.

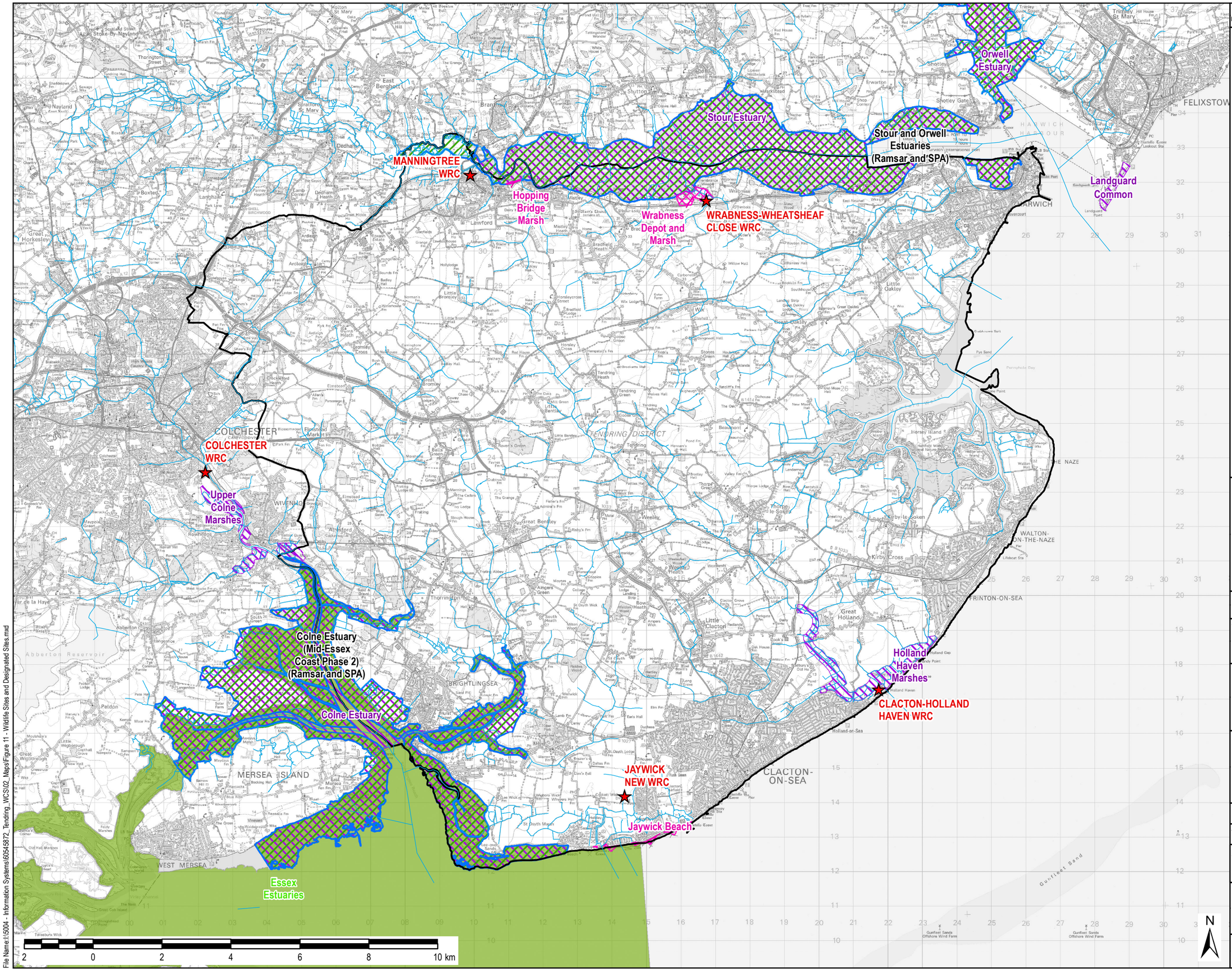
There are five WRCs that have been identified to exceed their discharge capacity as a result of planned future growth and thus need to be assessed. These are as follows:

- Clacton-Holland Haven WRC
- Colchester WRC
- Jaywick New WRC
- Manningtree WRC
- Wrabness-Wheatsheaf Close WRC

Clacton-Holland Haven, Colchester, Jaywick New, and Manningtree WRCs discharge directly into saline environments, and Wrabness-Wheatsheaf Close WRC discharges into a freshwater watercourse just upstream of the confluence with the saline River Stour estuary.

4.8.1 Impact on Designated Sites

Table 9 lists the wildlife sites that have potential to interact with the WRC unable to accommodate expected levels of future growth within existing discharge consents. Table 9 also details the distances from the designated wildlife sites from the WRC discharge points.



THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Tendring District Boundary
- Watercourse
- WRC
- Local Wildlife Site
- Ramsar
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Site of Special Scientific Interest (SSSI)

Purpose of Issue
FINAL

Client
TENDRING DISTRICT COUNCIL

Project Title
TENDRING DISTRICT COUNCIL WATER CYCLE STUDY.

Drawing Title
WILDLIFE SITES THAT INTERACT WITH WRCS WITHIN TENDRING DISTRICT THAT WILL REQUIRE AN INCREASE TO THEIR DISCHARGE CONSENTS

Drawn	Checked	Approved	Date
CN	JW	IHH	29/09/2017

AECOM Internal Project No. 60545872
Scale @ A3 1:100,000

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Alencon Link, Basingstoke
Hampshire, RG21 7PP
Telephone (01256) 310200
Fax (01256) 310201
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Drawing Number
FIGURE 11

Rev

File Name:I:\5004 - Information Systems\60545872_Tendring_WCS\02_Maps\Figure 11 - Wildlife Sites and Designated Sites.mxd

Table 9. The distances of statutory and non-statutory wildlife sites from the WRC that cannot accommodate the planned levels of future growth within existing discharge consents.

Water Recycling Centre (RWC)	Wildlife Site	Comments
Clacton-Holland Haven WRC Discharges into the North Sea	Holland Haven Marshes SSSI (TM212179)	Discharges via Holland Haven Marshes
	Essex Estuaries SAC (UK0013690 – TM103048)	8.6km downstream of discharge point
Colchester WRC Discharges into the River Colne (saline estuary)	Upper Colne Marshes SSSI (1004936 – TM027225	1km downstream of discharge point
	Colne Estuary SSSI (TM062161)	3.8km downstream of discharge point
	Colne Estuary (Mid-Essex coast phase 2) Ramsar site (UK11015 – TM058134)	3.8km downstream of discharge point
	Colne Estuary (Mid-Essex coast phase 2) SPA (UK9009243 – TM058134)	3.8km downstream of discharge point
	Essex Estuaries SAC (UK0013690 – TM045001)	3.8km downstream of discharge point
Jaywick New WRC Discharges into the North Sea	Jaywick Marshes Local Wildlife Site	Discharges via Jaywick Marshes
	Essex Estuaries SAC (UK0013690 – TM103048)	2.1km downstream of discharge point
	Colne Estuary (Mid-Essex coast phase 2) Ramsar site (UK11015 – TM058134)	3.1km downstream of discharge point
	Colne Estuary SSSI (TM062161)	3.1km downstream of discharge point
	Colne Estuary (Mid-Essex coast phase 2) SPA (UK9009243 – TM058134)	3.1km downstream of discharge point
Manningtree WRC Discharges into the Wignall Brook of the River Stour (saline estuary)	Stour and Orwell Estuaries Ramsar site (UK11067 – TM172335)	0.5km downstream of the discharge point
	Stour Estuary SSSI (1064495 – TM173327)	0.5km downstream of the discharge point
	Stour and Orwell Estuaries SPA (UK9009121 – TM172335)	0.5km downstream of the discharge point
	Hopping Bridge Marsh Local Wildlife Site	1.6km downstream of discharge point
	Wrabness Depot and Marsh Local Wildlife Site	7.5km downstream of discharge point
	Orwell Estuary SSSI (1009588 – TM251345)	16.9km downstream of discharge point
	Languard Common SSSI (1009295 – TM282313)	20.5km downstream of discharge point
Wrabness-Wheatsheaf Close WRC Discharges into the Wrabness Brook before joining the River Stour (saline estuary)	Wrabness Depot and Marsh Local Wildlife Site	Discharges directly into Wrabness Marsh
	Stour and Orwell Estuaries Ramsar site (UK11067 – TM172335)	0.5km downstream of the discharge point
	Stour Estuary SSSI (1064495 – TM173327)	0.5km downstream of the discharge point
	Stour and Orwell Estuaries SPA (UK9009121 – TM172335)	0.5km downstream of the discharge point
	Orwell Estuary SSSI (1009588 – TM251345)	11.3km downstream of discharge point
	Languard Common SSSI (1009295 – TM282313)	15km downstream of discharge point

4.8.1.1 Clacton-Holland Haven WRC

This WRC discharges directly into the North Sea at Holland Haven Marshes SSSI which is formed around the Holland Brook. Its saltmarshes rely on occasional flooding from the North Sea towards the downstream end of the site. Following this, 8.6km downstream is the Essex Estuaries SAC.

This WRC currently has a Dry Weather Flow (DWF) of 10,009 m^3/day and is not currently exceeding its DWF permit (10,546 m^3/day). Future development modelling predicts a DWF of 11,236 m^3/day. Whilst this will cause the Biochemical Oxygen Demand (BOD) to be in exceedance of consented limits this will not prevent the WFD target of 'No Deterioration' in status from being achieved, provided permit tightening is undertaken. The level of permit tightening required can be achieved within the limits of conventionally applied treatment processes.

Elevated BOD levels can result in low oxygen levels. The resulting anoxic conditions can cause mortality in plants and animals. However, due to the nutrient buffering nature of saltmarsh and with permit tightening, the BOD levels should have minimal deterioration to the water quality of Holland-Haven Marshes SSSI and associated ecology.

The Essex Estuaries SAC is a dynamic saline environment. It is influenced by wave action, tides and wind derived mixing. As a result, water is regularly replaced and the turbidity of the water column is relatively high. These conditions, combined with the distance (8.6km downstream from the discharge point) means that BOD levels from the WRC at Clacton-Holland Haven will both be diluted and flushed away regularly. The dynamic estuarine conditions of the Essex Estuaries SAC mean that it is less susceptible to excessive macro-algal summer growth and winter persistence. This is of contrast to the warmer, clearer and calmer waters of the south coast such as in the Solent where waters are more sensitive to increased BOD levels.

4.8.1.2 Colchester WRC

The Colchester WRC discharges directly into the River Colne Estuary. Following the watercourse, the discharge flows past the Upper Colne Marshes SSSI (1km downstream of the discharge point). After this the discharged water continues into the Colne Estuary SSSI, the Colne Estuary (Mid-Essex coast phase 2) SPA and Ramsar site, and the Essex Estuaries SAC (all located 3.8km downstream of the discharge point). After this, water is discharged into the North Sea.

Currently the DWF for this WRC is 24,817 m^3/day and is not exceeding its DWF permit (29,284 m^3/day). Modelling for the planned levels of development predicts a DWF of 29,341 m^3/day which will result in an exceedance of consented flows. Whilst this will result in an increase in BOD, the levels will not prevent the WFD 'No Deterioration Status' from being achieved, provided consents are tightened. The level of tightening required can be achieved within limits of conventionally applied treatment processes.

The conditions in the Colne Estuary are similar to that of the Essex Estuaries designated sites discussed in Section 4.8.1.1. The estuary is a dynamic tidal environment influenced by wave action, tidal and wind derived mixing. This means that water is replenished and effluent continually diluted. Relatively high turbidity and wave action means that macro-algal growth throughout the summer is minimal with less winter persistence. As the area is important for winter birds this means that invertebrates within the mudflats and sand flats remain accessible for grazing. Although the Upper Colne Marshes SSSI is relatively near to the point of discharge (1km), it is deemed that there will be minimal deterioration in water quality due to the conditions already described. As such, the remaining designated areas that are further downstream (the Colne Estuary designated wildlife sites and Essex Estuaries SAC) will also experience minimal deterioration to their water quality.

4.8.1.3 Jaywick New WRC

This WRC discharges into a series of drains before flowing into the North Sea at the Essex Estuaries SAC 2.1 km downstream from the discharge point. Following this the discharged water flows into the Colne Estuary (Mid-Essex coast phase 2) SPA and Ramsar site, and the Colne Estuary SSSI which are a further 3.1 km downstream of the point of discharge. These sites are important for their wintering birds and open expanses of mudflats and sandflats. It should be noted that the point at which the discharge flows into North Sea is on the upstream edge of the designated sites. At this point the sites are in the open sea as opposed to the shelter of an estuary. Consequently any discharge will be diluted and displaced with tidal currents and wave action.

The current DWF of this WRC is 4,812 m^3/day with a DWF permit of 5,000 m^3/day. Modelling for the planned level of development predicts a DWF of 5,200 m^3/day which is in exceedance of consented flows. This increase in water discharge will not prevent the WFD status of 'No Deterioration Status' from being achieved provided that the permit is tightened. Sufficient consent tightening can be achieved within limits of conventionally applied treatment processes.

As previously stated in sections 4.8.1.1 and 4.8.1.2 with the discharge being directly in the open North Sea, dilution, displacement and relatively high turbid conditions will hinder any BOD levels from having negative effects on the ecology of the designated sites.

4.8.1.4 Manningtree WRC

This WRC discharges into the tidal Wignall Brook of the River Stour Estuary where it flows into the Stour and Orwell Estuaries SPA and Ramsar site, and the Stour Estuary SSSI (all of which are 0.5km downstream of discharge point). These sites are typical estuarine environments, with open mudflats, turbid water and saltmarsh on the upper shoreline. Due to the nature of the North Sea environment, highly mixed water columns limit the amount of light entering the water column. This in turn reduces the growth macro-algae (Ulva spp. and Enteromorpha spp.). Where the growth of these species is uncontrolled, they can smother sediments, which may reduce oxygen and limit accessibility for grazing birds. With additional BOD levels from WRC this could have adverse effects to the flora and fauna within the designated areas.

At Manningtree WRC the current DWF is 2,857 m3/day of which is below the current DWF permit of 2,999 m3/day. Modelling of planned development predicts a future DWF of 3,385 m3/day, which is in exceedance of consented flows. As such the permit needs to be tightened to ensure that BOD levels from the proposed future growth will not prevent the WFD 'No Deterioration Status' from being achieved. Permit tightening required can be achieved within the limits of conventionally applied treatment processes. Therefore, this assessment suggests that future BOD levels will not have a negative impact to the ecology of the designated sites that are immediately downstream of the point of discharge (the Stour and Orwell Estuaries SPA and Ramsar site, and the Stour Estuary SSSI).

The remaining designated sites (Orwell Estuary SSSI and Languard Common SSSI) are deemed to be far enough downstream (16.9 and 20.9km respectively) that any relatively high levels of BOD will not have a negative impact due to being diluted and dispersed from tidal waters entering the estuary.

4.8.1.5 Wrabness-Wheatsheaf Close WRC

This WRC discharges into the freshwater Wrabness Brook, just upstream of the confluence into the saline estuary environments of the tidal River Stour at Wrabness Depot and Marsh Local Wildlife Site. Approximately 0.5 km downstream from the discharge point, discharged water flows into the Stour and Orwell Estuaries SPA and Ramsar site and the Sour Estuary SSSI.

For this assessment, Wrabness-Wheatsheaf Close WRC was not included in the RQP assessment as its flow is too small to measure (i.e. less than 50m^3/day). Notwithstanding this, deterioration in BOD can result in anoxic conditions, and ultimately lead to the death of flora and fauna. The wildlife sites discussed above and identified in Table 9 are typical estuarine environments, with open mudflats, turbid water and saltmarsh on the upper shoreline. Due to the highly dynamic nature of the estuarine conditions and the associated tidal, wave action, and wind derived mixing, water is regularly replaced and the turbidity of the water column is relatively high which means that water is replenished and BOD levels continually diluted and are unlikely to be adversely impacted upon wildlife sites and their associated features.

It has been concluded that permits of the WRC need to be tightened. This can be achieved within the limits of conventionally applied treatment processes.

4.8.2 Impacts on Ecology outside Designated Sites

This Water Cycle Study has focused on the potential impacts that the identified WRCs will have on the ecology of designated wildlife sites. However, it does not highlight any impacts to the wider ecology within the Tendring District. A WCS is limited in its scope for an exhaustive discussion.

It should be noted that whilst impacts to designated ecological sites have been identified, there are a range of other UK and Essex BAP species/habitats or protected/notable species/habitats that may be affected by discharge from WRCs. These may well have a presence within the Tendring District, and are listed as follows (habitats listed are all in the Essex BAP):

- Water vole (protected through Wildlife & Countryside Act 1981 and a UK BAP species)
- Grass snake (partially protected through Wildlife & Countryside Act 1981)
- Common toad (UK BAP species)
- Great crested newt (legally protected through Conservation of Habitats & Species Regulations 2010, Wildlife & Countryside Act 1981 and a UK BAP species)
- Birds such as bittern, kingfisher (protected through Wildlife & Countryside Act 1981 and a UK BAP species), lapwing and snipe; and
- Otter (legally protected through Conservation of Habitats & Species Regulations 2010, Wildlife & Countryside Act 1981 and a UK/ Essex BAP species)
- Floodplain and coastal grazing marsh
- Reedbeds
- Coastal saltmarsh
- Rivers & streams

To identify the impacts that changes to discharge flows may have on the more general ecology of Tendring District would require more detailed species surveys of each watercourse. Additionally, it would be necessary to utilise detailed flow and quality data/modelling of which have not been available in this study for the majority of watercourses.

This study has not provided the impacts that phosphate and ammonia may have to the designated wildlife sites. These nutrients can have adverse impacts to the ecology by increasing algal growth. This in turn may reduce oxygen levels that may harm plants and animals. This study has also identified that the majority of the designated sites impacted are marine environments and thus are limited by nitrate. However, in freshwater environments, phosphate is the limiting nutrient. Manningtree WRC was identified to flow into the Wignall Brook, where increase phosphate may cause eutrophic conditions. Precautionary measures should therefore be considered in the developments.

4.8.3 Ecological Opportunities Associated with Proposed Development Locations

It is recommended that policy is implemented within the Local Plan to ensure that developments to do not result in any negative impacts to species and habitats inside and outside of designated wildlife sites. It may therefore be necessary for new infrastructure or phased infrastructure to be implemented to ensure water quality remains within the waterbodies' WFD status and within consent levels. A further recommendation is that any ecological risks resulting from proposed water cycle changes are considered within the relevant flood risk and surface water management proposals. These opportunities and the reduction of identified risks can be incorporated into the detailed design of the developments and local green infrastructure plans.

4.9 Wastewater Summary

Five WRCs are shown to exceed their volumetric permits and have undergone water quality modelling. Four WRCs (Clacton-Holland Haven, Colchester, Jaywick New and Manningtree) discharge directly into coastal or transitional environments and one WRC (Wrabness-Wheatsheaf Close) discharges to a freshwater inland water body. The results demonstrate that there is environmental capacity for the proposed options for growth as long as permit changes and any required upgrades are undertaken.

AWS is responsible for any upgrade at these WRCs and the exact nature of these upgrades will be identified by AWS and funded through their business plan and Price Review process with Ofwat. The necessary improvements may include options such as removal or surface water flows, optimisation of the works, or treatment process upgrades and will depend on individual circumstances, how development is built out and other environmental drivers

Therefore, from a WFD perspective there is capacity to accept growth and comply with current WFD targets based on the limits achievable with current technology. However, environmental capacity should be considered to be ultimately limited on the basis that limitations on current treatment technologies are preventing the optimal target of future good status from being achieved. The capability and performance of treatment technologies are likely to improve over time, and hence capacity for additional wastewater flow would need to be reconsidered in the context of achieving good status up to the end of the plan period and beyond.

Table 10 provides a summary of the RAG assessment of the WRCs within the District which have been assessed as not having sufficient headroom to accommodate growth.

Table 10. Wastewater treatment works assessment summary

WRC	Watercourse	Is Headroom available for anticipated growth?	Is a revised quality condition for BOD required?	Ensure no deterioration in status for BOD?	Overall RAG
Clacton - Holland Haven	North Sea	Headroom only up to 537 dwellings	Yes	Yes	Changes or upgrades to the WRC are likely to be required from 2024 using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD.
Colchester	River Colne (Saline Estuary)	Headroom only up to 4,467 dwellings	Yes	Yes	Changes or upgrades to the WRC are likely to be required from 2033 using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD.
Jaywick	North Sea	Headroom only up to 188 dwellings	Yes	Yes	Changes or upgrades to the WRC are likely to be required from 2025 using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD.
Manningtree	Wignall Brook Stour Estuary	Headroom only up to 142 dwellings	Yes	Yes	Changes or upgrades to the WRC are likely to be required from 2019 using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD.
Wrabness – Wheatsheaf Close		Headroom only up to 1 dwelling	Yes	Yes	Changes or upgrades to the WRC are likely to be required using conventional treatment technologies to meet river quality targets. Permit setting recommended for BOD. Permit setting may be required for ammonia and phosphate.

5. Water Supply Strategy

5.1 Introduction

Water supply for the study area is provided by Affinity Water. An assessment of the existing environmental baseline with respect to locally available resources in the aquifers and the main river systems has been completed. The assessment has been based on the Environment Agency's Essex Catchment Abstraction Licensing Strategy[23].

This study has also used Affinity Water's 2014 WRMP[24] 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 in Affinity Water's WRMP.

5.2 Abstraction Licensing Strategies

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

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

The categories of resource availability status are shown in Table 11. 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 11. 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 classification for each of the Water Resource Management Units (WRMU) in the District has been summarised for surface waterbodies in Table 12.

[23] Environment Agency Essex abstraction licensing strategy (2017) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/636594/ALS_2017_Essex.pdf
[24] Affinity Water Final Water Resources Management Plan (2014) https://stakeholder.affinitywater.co.uk/docs/FINAL-WRMP-Jun-2014.pdf

Table 12. Resource availability classification

River – WRMU	Surface Water (flow exceedance scenarios)			
	Q30	Q50	Q70	Q95
AP10 Salary Brook				
AP12 Sixpenny Brook				
AP13 Tenpenny Brook				
AP14 Holland Brook				

Salary Brook, Sixpenny Brook and Tenpenny Brook are defined as having no water available for licensing during the very low flow period (Q95). Salary Brook and Sixpenny Brook are defined as having restricted water available for licensing during the low flow period (Q70). Also, Holland Brook is defined as having restricted water available for licensing during the Q50 - Q70 period. Furthermore, all the surface waterbodies have potential for local abstractions during periods of high flows (Q30) and Salary Brook, Sixpenny Brook and Tenpenny Brook have potential for local abstractions during periods of medium flows (Q50) as well.

This analysis indicates that there is limited potential for local abstraction to support major site development at a local level during very low and low flows; however, there is potential for local abstractions at the abovementioned waterbodies during high and medium flows. This may be beneficial to supplying water resources.

5.3 Water Resource Planning

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

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.

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 Resource Planning in the District

In reviewing Affinity Water's Final 2014 WRMP and through liaison with Affinity Water it has been established that the growth figures assessed for this WCS study are catered for in the 2033 prediction of supply and demand deficits in the relevant WRZs under average conditions. Therefore, the WRMP can be used directly in the WCS assessment to determine available solutions for supplying the proposed growth with potable water supplies.

5.5 Demand for Water

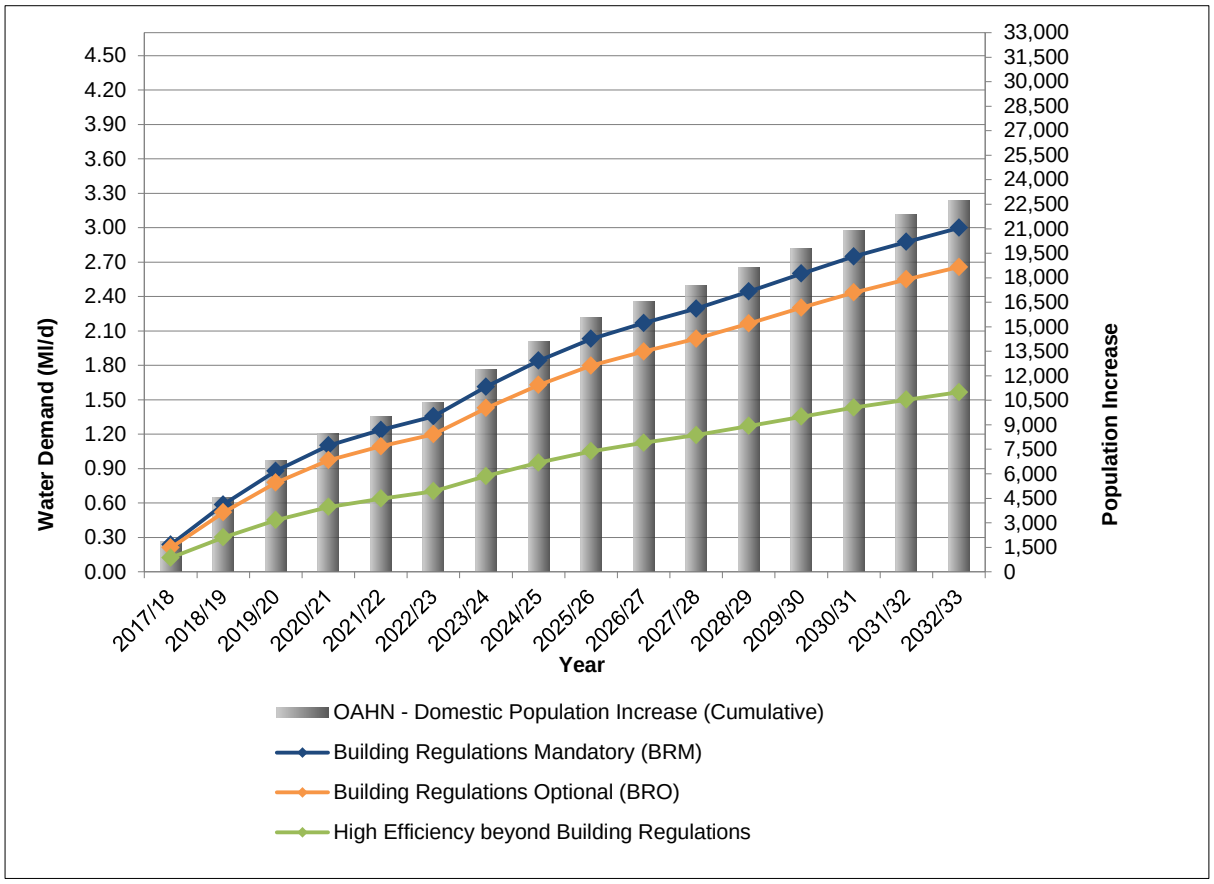
Likely increases in demand in the District have been calculated using three different water demand projections (compared to the Business As Usual Projection) based on different rates of water use for new homes that could be implemented through potential future policy.

The projections were derived as follows:

- **Projection 1** – Business as Usual. Existing homes would use 133 l/h/d, this reflects the consumption used currently by Affinity Water;
- **Projection 2** – Building Regulations Mandatory requirements. New homes would conform to (and not use more than) Part G of the Building Regulations requirement of 125 l/h/d;
- **Projection 3** - Building Regulations Optional requirements. Only applies where a condition that the new home should meet the optional requirement is imposed as part of the process of granting planning permission. Where it applies, new homes would conform to (and not use more than) Part G of the Building Regulations optional requirement of 110 l/h/d;
- **Projection 4** – High Efficiency beyond Building Regulations. New homes would include both greywater recycling and rainwater harvesting reducing water use to a minimum of 62 l/h/d.

Using these projections, the increase in demand for water could range between 1.57 and 3.18 Ml/d by 2033. The projections are shown in Figure 12.

Figure 12. Range of water demands across plan period in Tendring depending on efficiency levels of new homes



5.6 Planned Water Availability Summary

The final 2015 WRMP for Affinity Water has have been used to summarise water availability to meet the projected demand for the Tendring study area covering the planning period to 2040. The Tendring District is located in Affinity Water's Water Resource Zone 8 (WRZ8).

5.6.1 Water Resource Zone 8

The Affinity Water WRZ8 is usually supplied entirely by groundwater sources, however it can also import water from Ardleigh Reservoir jointly owned with Anglian Water This source of water is governed by the Ardleigh Reservoir Order of 1967. The Deployable Output of this source has been reduced due to water treatment

constraints. As joint owners, Affinity Water is entitled to 50% of the output but, under a short-term agreement, it is currently taking 30% of the total output, allowing Anglian Water to take 70% under a ten-year rolling Bulk Reservation Agreement that Affinity Water signed in 2010. The annual average and peak capacity that Anglian Water can receive from Affinity Water is 8.1 Ml/d.

Affinity Water predicts that, with these sources of supply, and even with the estimated increase in demand from growth, WRZ8 will be in surplus (1-10 Ml/d) at DYCP 2040[25] and therefore, no water resources assessment is required for the period 2015-2040. It can therefore be concluded that the growth proposed to 2033 can be adequately served by the existing groundwater sources and import of water from Ardleigh Reservoir.

5.6.2 Climate Change and Availability of Water

It is predicted that climate change will reduce water availability in the study area over time. Rainfall patterns are predicted to change to less frequent, but more extreme, rainfall events. Affinity Water has recognised the risk climate change poses to the three crucial areas of their business, abstraction, treatment and distribution of water. Customers expect Affinity Water to provide a continuous supply of water, but the resilience of the supply systems have the potential to be affected by the impact of climate change with severe weather-related events, such as flooding. In planning for future water resources availability, Affinity Water has accounted for the impacts of climate change within their supply-demand forecasts as follows.

5.6.2.1 Impact on Supplies

Affinity Water has undertaken analysis of the impacts of climate change on the future availability of their water resources on both their groundwater and surface water sources. It was concluded that, there would be no impact on the water available in the surface water reservoir. It was also found that groundwater sources in the area are not considered to be sensitive to climate change due to groundwater levels being significantly higher than borehole pump levels in the confined chalk aquifer. Nominal allowances, as used for the previous Affinity Water WRMP, of 1% reduction in output have been made for Affinity Water's chalk sources.

5.6.2.2 Impact on Demand

The main impact of climate change on demand is related to periods of extremely hot and dry weather that will increase the peak demand for water. Affinity Water has 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. Affinity Water has included a baseline level of the impact of climate change on demand in our demand forecast, and has accounted for the uncertainty of that forecast in their headroom assessment. The assessment of the small increase in demand as a result of climate change shows that the increase largely applies to garden watering, which has been verified by the micro-component study Affinity Water undertook in the summer of 2013, which is described in section 5.7.2.6 of the WRMP.

5.7 Water Neutrality

Although surplus water is available to meet the proposed demand, proposals for a Garden Community part located in the District means that in the longer term, there is a driver to consider more sustainable use of water and to attempt to limit the demand for water from new development through planning policy control.

The Environment Agency Water Stressed Areas classification[26], indicates that the Affinity Water (formerly Veolia Water East) WRZ8, where Tendring District is located, is classified as being under "Serious" water stress. The new methodology identifies areas of serious water stress where: (a) the current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand; or (b) the future household demand for water is likely to be a high proportion of the effective rainfall available to meet that demand.

Therefore, under the Regulations, water companies in areas classified as seriously water stressed need to evaluate compulsory metering alongside other options when preparing water resource management plans

[25] Dry Year Critical Period projection for year 2040
[26] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244333/water-stressed-classification-2013.pdf

(WRMPs) and, as a result, Affinity Water should evaluate the abovementioned options. Further assessment is provided in the following sections.

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[27]. If this can be achieved, the overall balance for water demand is 'neutral', and there is considered to be no net increase in demand as a result of development. In order to achieve this, new development needs to be subject to planning policy which aims to ensure that where possible, houses and businesses are built to high standards of water efficiency through the use of water efficient fixtures and fittings, and in some cases rainwater harvesting and greywater recycling.

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

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

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.

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 District as a whole.

5.7.1 Twin-Track Approach

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

In order to reduce water consumption and manage demand for the limited water resources within the District, a number of measures and devices are available[28]. 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 C provides more detail on the different types of device or system along with the range of efficiency savings they could lead to.

5.7.2 Achieving Total Neutrality – is it feasible?

When considering neutrality within an existing planning area, it is recognised by the Environment Agency[29] 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.

This WCS therefore considers three water neutrality targets and sets out a 'pathway' for how the most likely target (or level of neutrality) can be achieved. Appendix C discusses the pathway concept in more detail, and highlights the importance of developing local policy in the study area for delivering aspirations like water

[27] Water Neutrality is defined more fully in the Environment Agency report 'Towards water neutrality in the Thames Gateway' (2007)
[28] Source: Water Efficiency in the South East of England, Environment Agency, April 2007.
[29] Environment Agency (2009) Water Neutrality, an improved and expanded water management definition

neutrality as well as understanding the additional steps required beyond 'business as usual' required to achieve it.

5.7.3 Metering Assumptions

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.

The existing level of metering within the Affinity Water WRZ8 is 72% for household customers and 99% for non-household customers. Affinity Water currently has no targets for future meter penetration in WRZ8. However, correspondence with Affinity Water indicated that although currently there are no plans to drive greater meter penetration, the natural rate of rise should take the household metering proportion above 72% over time.

5.7.4 Water Neutrality Scenarios

5.7.4.1 Theoretical Scenario (Water Neutrality)

The scenario has been developed as a context to demonstrate what is required to achieve a neutral position in the District. 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.

They key assumptions for this scenario are:

- 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[45], 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 (24.7%) in the District.

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 District.

5.7.4.2 Optional requirements Scenario plus retrofit

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.

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.

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.

5.7.4.3 Mandatory requirement Scenario plus retrofit

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.

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.

5.7.5 Neutrality Scenario Assessment Results

To achieve total water neutrality, the demand post growth must be the same as, or less than existing demand. Based on estimates of population size, current demand in the District was calculated to be 17.87 Ml/d.

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[30], 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 13 which also includes the effect of just implementing Building Regulation Optional and Mandatory policy control without retrofit for context.

Table 13. Results of the Neutrality Scenario Assessment

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 retrofitting (Ml/d)	% Neutrality Achieved
Mandatory requirements	125	0	3.00	20.87	**20.87**	0%
Optional requirements	110	0	2.66	20.53	**20.53**	11%
Mandatory requirements plus retrofit	125	5	3.00	20.87	**20.81**	2%
Optional requirements plus retrofit	110	5	2.66	20.53	**20.47**	13%
Theoretical Water Neutrality	62	100	1.57	19.44	**17.87**	100%

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

Table 12 indicates 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; all water companies to meet maximum water meter penetration in existing housing stock; and, a large funding pot to allow retrofit of 100% of existing housing stock with water efficient fixtures and fittings. Therefore, two more realistic water demand management scenarios have been tested.

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

The water neutrality analysis demonstrated that both the mandatory and optional requirement scenarios would reduce post development demand in 2033. The mandatory requirements scenario plus 5% retrofit would potentially deliver a post development demand reduction of 0.24Ml/d (compared to the Business As Usual demand, which is 21.05 ML/d) whilst the optional requirement plus 5% retrofit would deliver a potential reduction of 0.58 Ml/d (compared to the Business As Usual demand). The Optional requirements scenario plus 5% retrofit, which would achieve 13% 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 relatively low, it would be advisable to extend meter penetration or to increase the number of retrofitting properties.

5.7.6 Financial Cost Considerations

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.

Using the information compiled, the financial costs per neutrality scenario has been calculated and are included in Table 14. It should be noted that these are only estimated costs based on strategic level research into water efficiency implementation and cost.

Table 14. Estimated Cost of Neutrality Scenarios

Neutrality Scenario	New Homes		Existing Properties					Costs Summary		
	No.	Efficiency cost	No. to be metered	Metering cost	Retrofit %	No. to retrofit	Retrofit cost	Developer	Non developer	Total
Optional requirements	10,627	£ 95,643	-	-	0%	0	-	£ 95,643		£ 95,643
Mandatory requirements plus retrofit	10,627	0	-	-	5%	3,217	£ 73,999	-	£ 73,999	£ 73,999
Optional requirements plus retrofit	10,627	£ 95,643	-	-	5%	3,217	£ 73,999	£ 95,643	£ 73,999	£ 169,642
Theoretical Water Neutrality	10,627	£ 43,538,819	-	-	100%	64,347	£ 1,956,353	£ 43,538,819	£ 1,956,353	£ 45,495,172

5.7.7 Preferred Strategy – Delivery Pathway

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 Tendring District Council 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.

Table 14 summarises the delivery requirement and includes a high level assessment of the likely ease with which each element could be perused and delivered, along with recommendations on the likely responsible organisation that could take each option forward.

Table 15. Water efficiency and retrofit measures and recommended responsible organizations

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[31]	Tendring District Council (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	Tendring District Council (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	Affinity Water
• 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)	Affinity Water in partnership with Tending's LPA – Affinity Water would need to fund this, but Tendring's 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	Tendring District Council (LPA)

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

Delivery requirements	Ease of adoption and delivery	Responsible stakeholder
	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.	
Educate and raise awareness of water efficiency[32]	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

[32] 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 Assessment

6.1 Introduction

Following the assessment of wastewater treatment capacity and water resources, this section of the WCS addresses infrastructure capacity issues, flood risk, surface water management and SuDS suitability for each of the allocated sites within the Local Plan. The results are presented for each of the allocated sites in Appendix E.

6.2 Assessment Methodologies

6.2.1 Wastewater Network

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

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

As the wastewater undertaker for the District, Anglian Water 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 Anglian Water has sufficient funds to finance its functions, and at the same time protect consumers' interests. The price controls affect the bills that customers pay and the sewerage services consumers receive, and ultimately ensure wastewater assets are managed and delivered efficiently.

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

AWS have undertaken an internal assessment of the capacity of the foul sewer and surface water network system using local operational knowledge.

The results are presented for each of the Preferred Sites in Appendix E. A RAG assessment has been undertaken; a key indicating the coding applied by Anglian Water to each assessment is provided in Table 16.

Table 16. Key for wastewater network RAG assessment

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

6.2.2 Water supply network capacity

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.

Affinity Water has undertaken a high level assessment of the capacity of the water supply system using local operational knowledge. Affinity Water's comments have been presented for each of the Preferred Sites in

Appendix E. A RAG assessment has been applied to the comments; a key indicating the coding applied to each assessment is provided in Table 17.

Table 17. Key for water supply network RAG assessment

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

6.2.3 Flood Risk

6.2.3.1 Fluvial

The flood risk to each of the major development sites has been considered using the Environment Agency Flood Maps for Planning. The Flood Zone within each development area is located is provided. The Tendring Strategic Flood Risk Assessment (SFRA) [33] has also been used to help identify the risk of fluvial flooding at each development site.

6.2.3.2 Surface Water Flood Risk

Surface water flooding has been reviewed for each of the large development sites using the Risk of Flooding from Surface Water (RoFSW)[34] mapping produced by the Environment Agency. The Tendring SFRA has also been used to help identify the risk of flooding from surface water at each development site.

6.3 Impact of Garden Communities

The proposed Tendring-Colchester Border Garden Community represents a significant proportion of Tendring District Council's future growth during the plan period (1,250 dwellings by 2033). In addition, Colchester Borough Council's Local Plan proposes a future growth of 1,650 dwellings within the Tendring-Colchester Border Garden Community by 2033. The combined growth has been assessed within this WCS.

Colchester WRC does not have sufficient headroom under the current DWF permit to accept the additional wastewater flow from growth in the garden community proposed within the plan period, from both Tendring District and Colchester Borough. As indicated in Section 4.7.1, Colchester WRC would require a revised DWF permit and tightening of the permits quality conditions in order to accept the additional wastewater flow from growth in the Tendring-Colchester Border Garden Community proposed within the plan period.

The North Essex Garden Communities Integrated Water Management Strategy (IWMS)35 identified the opportunities and constraints in terms of wastewater and water supply for each of the three proposed garden communities over the full development period, beyond 2033. It concluded that the preferred wastewater option for the Tendring-Colchester Border garden community would be to direct the growth to Colchester WRC. It also showed that no deterioration of WFD status is achievable within the current limits of conventional treatment by tightening the permit conditions for BOD and ammonia.

Further assessment will be required either as a Stage 2 to the IWMS or similar study work to consider each of the three garden communities in more detail, and identify and determine site specific water management measures which can serve to minimise demand for the strategic options as far as possible and set out how surface water and flood risk can be managed on site in an integrated way.

[33] Essex County Council Flood Services (June 2017), Tendring District Council Strategic Flood Risk Assessment Addendum
[34] Previously referred to as the updated Flood Map for Surface Water (uFMfSW)
[35] AECOM (2017), North Essex Garden Communities Integrated Water Management Strategy – Stage 1

7. Water Cycle Strategy Recommendations and Policy

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

7.1 Policy Recommendations Overview

7.1.1 Wastewater

WW1 – Development in the Clacton-Holland Haven, Colchester, Jaywick New, Manningtree and Wrabness-Wheatsheaf Close WRC catchments

It is recommended that a policy is developed by Tendring District Council that requires all developers to provide evidence to them that they have consulted with Anglian Water regarding wastewater treatment capacity, and the outcome of this consultation, prior to development approval. The Council should consider the response from Anglian Water when deciding if the expected timeframe for the development site in question is appropriate.

WW2 – Development and the Sewerage Network

It is recommended that Major Development sites assessed by Anglian Water as part of the WCS as having limited foul sewerage network capacity (Amber or Red) should be subject to a pre-planning enquiry[36] with Anglian 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 AWS'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.

WW3 – Treatment Capacity Review

It is recommended that Tendring District Council continues to update Anglian Water on future development phasing and changes to growth allocations to ensure that plans for WRC 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 WRC catchment.

7.1.2 Water Supply

WS1 – Water Efficiency in new homes and buildings

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

In order to move towards a more 'water neutral position', a policy could be developed to carry out a programme of retrofitting and water audits of existing dwellings and non-domestic buildings with the aim to move towards delivery of 15% of the existing housing stock with easy fit water savings devices

WS3 – Water Efficiency Promotion

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.

[36] Pre-planning enquiries to Anglian Water can be made via the Anglian Water website: http://www.anglianwater.co.uk/developers/pre-planning-service-.aspx

7.1.3 Surface Water Management and Flood Risk

SWM1 – Sewer Separation

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

- into the ground (infiltration);
- to a surface waterbody;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

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

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

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.

7.1.4 Ecology

ECO1 – Biodiversity Enhancement

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

7.2 Further Recommendations

7.2.1 Stakeholder Liaison

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

7.2.2 WCS Periodic Review

The WCS should remain a living document, and (ideally) be reviewed on a bi-annual basis as development progresses and changes are made to the various studies and plans that support it; these include:

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

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.
Building Regulations Approved Document G – sanitation, hot water safety and water efficiency (March 2010)	The current edition covers the standards required for cold water supply, water efficiency, hot water supply and systems, sanitary conveniences and washing facilities, bathrooms and kitchens and food preparation areas.
Eel Regulations 2009	Provides protection to the European eel during certain periods to prevent fishing and other detrimental impacts.
Environment Act 1995	Sets out the role and responsibility of the Environment Agency.
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 and providing for unitary and county councils to adopt SuDS for new developments and redevelopments. • 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 that will be issued by the SoS following a full public consultation.
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 and to conserve 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, can require changes to these through the Review of Consents (RoC) process if they are impacting on designated European Sites. Also 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). NPPF advises local authorities and others on planning policy and operation of the planning system. A WCS helps to balance the requirements of various planning policy documents, and ensure that land-use planning and water cycle infrastructure provision is sustainable.
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 Waste Water Treatment Directive (UWWTD) 91/271/EEC	This Directive concerns the collection, treatment and discharge of urban waste water and the treatment and discharge of waste water 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 regulatory arrangements to make water use more sustainable.
Water Framework Directive (WFD) 2000/60/EC	The WFD, for the first time, combines water quantity and water quality issues together. An integrated approach to the management of all freshwater bodies, groundwaters, estuaries and coastal waters at the river basin level has been adopted. The overall requirement of the directive is that all river basins must achieve 'good ecological status' by 2015 or by 2027 if there are grounds for derogation. The Environment Agency is the body responsible for the implementation of the WFD in the UK. The Environment Agency have been supported by UKTAG[37], 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[38]. Standards and water body classifications are published via River Management Plans (RBMP) the latest of which were completed in 2015.
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
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.
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.

[37] 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.
[38] UK Environmental Standards and Conditions (Phase I) Final Report, April 2008, UK Technical Advisory Group on the Water Framework Directive.

Appendix B WRC Capacity Assessment results

B.1 Modelling assumptions and input data

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

- the wastewater generation per new household is based on an assumed 2033 Occupancy Rate (OR) of 2.09 people per house and an average consumption of 217 l/h/d ;
- WRC current flows were taken as the current measured dry weather flow (DWF) (Q80) as provided by EA. Future 2033 flows were calculated by adding the volume of additional wastewater generated by new dwellings (using a consumption value of 147l/h/d, as a projected to 2033 value at DYCP) and an additional allowance of 43l/h/d for an increase in infiltration) to the current permitted DWF value;
- WRC current discharge quality was taken as the current permitted limits for each water quality element.
- For the purposes of this study, the limits of conventionally applied treatment processes are considered to be:
  - 5mg/l for BOD;
  - 1mg/l for Ammoniacal-N; and
  - 0.5mg/l for Phosphate.

B.2 Headroom Assessment

The permitted flow headroom capacity within an existing permit is assumed to be usable, therefore the following steps have been applied to calculate approximately how much available headroom each WRC has:

1. Determine the quantity of growth within a WRC catchment to determine the additional flow expected at each WRC;
2. Calculate the additional wastewater flow generated at each WRC;
3. Calculate the remaining permitted flow headroom at each WRC;
4. Determine whether the growth can be accommodated within existing headroom by applying the scoping criteria detailed in Table C-1.

Table C-1. Scoping criteria

Scoped In	Scoped Out
WRCs where flow headroom is exceeded as a result of growth	WRCs where flow headroom is not exceeded as a result of growth
WRCs which already exceed their flow permit and receive any additional flow from growth	WRCs which already exceed their flow permit but do not receive any additional flow from growth[39]

B.3 Water Quality Assessment

For those WRCs which are scoped in (headroom is exceeded), assessment has been undertaken to determine the new quality conditions required for each WRC discharge permit

Load Standstill calculations have been undertaken to identify the required future BOD quality permits with future effluent flow for coastal and estuarine waterbodies.

[39] If a WRC does not receive any growth, the assessment for the WRC is not within the scope of a WCS.

Appendix C Water Neutrality

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

C.1 Twin-Track Approach

Attainment of water neutrality requires a 'twin track' approach whereby water demand in new development is minimised as far as possible. 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[40], 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[41].

C.2 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;

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

- 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);
- 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[42] 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.

C.3 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 2.3[43] 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)[44]. 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 C-1).

[42] Part G of the Building Regulations
[43] 2.3 is used for existing properties and new properties. This figure was agreed with Anglian Water prior to the assessment
[44] Independent Walker Review of Charging and Metering for Water and Sewerage services, DEFRA, 2009, http://www.defra.gov.uk/environment/quality/water/industry/walkerreview/

Table C-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

As mentioned in section 5.9.3, Affinity Water indicated that although currently there are no current plans to drive greater meter penetration, the natural rate of rise should take the household metering proportion above 72% over time.

Low or Variable Flush Toilets

Toilets use about 30 per cent of the total water used in a household[45]. 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[46]per flush. A study carried out in 2000 by Southern Water and the Environment Agency[47] 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[48].

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,

[45] http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/house_and_garden/toilet_flushing.html
[46] http://www.lecico.co.uk/
[47] The Water Efficiency of Retrofit Dual Flush Toilets, Southern Water/Environment Agency, December 2000
[48] http://www.thameswater.co.uk/cps/rde/xchg/corp/hs.xsl/9047.htm

- 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

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[49] 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 C-2.

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

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

Table C-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[50], 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.

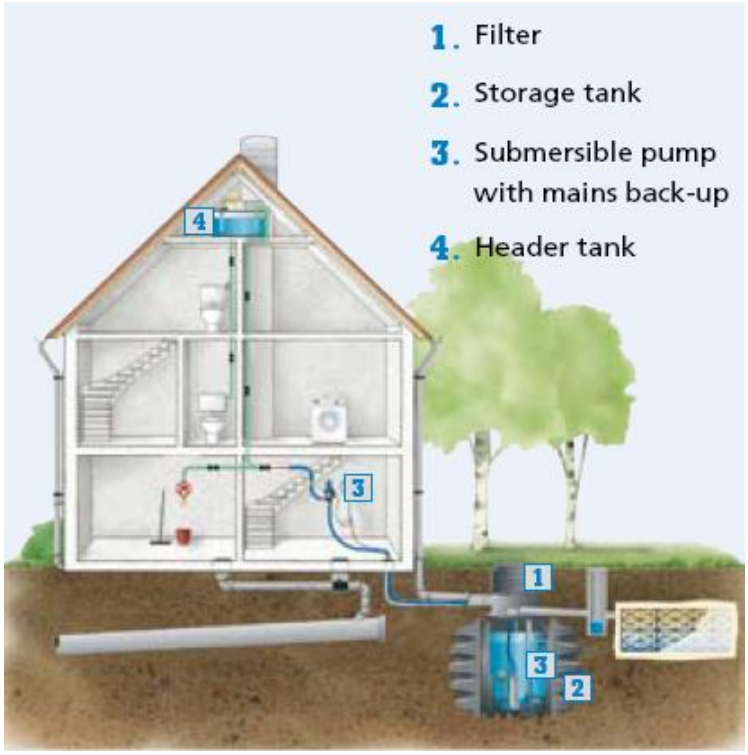
RWH systems typically consist of a collection area (usually a rooftop), a method of conveying the water to the storage tank (gutters, down spouts and pipes), a filtration and treatment system, a storage tank and a method of conveying the water from the storage container to the taps (pipes with pumped or gravity flow). A treatment

[50] http://www.thewatercalculator.org.uk/faq.asp

system may be included, depending on the rainwater quality desired and the source. Figure C-1 below gives a diagrammatic representation of a typical domestic system[51].

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[52].

Figure C-1: A typical domestic rainwater harvesting system



A recent sustainable water management strategy carried out for a proposed EcoTown development at Northstowe[53], 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 C-3.

Table C-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

[51] Source: Aquality Intelligent Water management, www.aqua-lity.co.uk
[52] Aquality Rainwater Harvesting brochure, 2008
[53] Sustainable water management strategy for Northstowe, WSP, December 2007

4	440	25	1.76	7.7	102.3
4	440	50	1.76	15.4	94.6

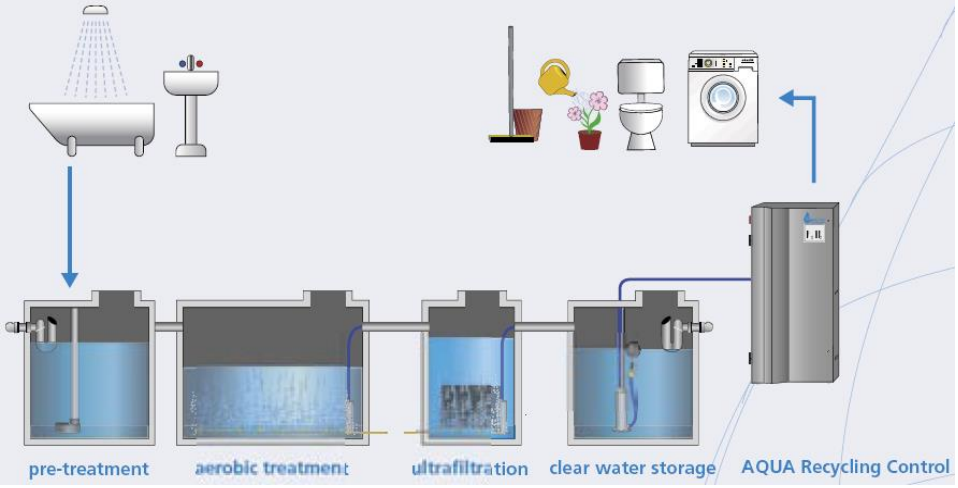
A family of four, with an assumed roof area of 50m^3, could therefore expect to save 61.6 litres per day if a RWH system were installed.

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 waste water as these tend to be most highly polluted. However, in larger system virtually all non-toilet sources can be used, subject to appropriate treatment.

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 C-2 below gives a diagrammatic representation of a typical domestic system[54].

Figure C-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[55].

Table C-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 C-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

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

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 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[56].

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 C-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.

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

Table C-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	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

		- Washing machine 8.17 l/kilogram			
Theoretical (Water Neutrality)	62	- WC 4/2.6 litres dual flush; - 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	Rainwater harvesting and Greywater recycling	72%	132% 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

C.4 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[57] 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 CSH based on the cost analysis undertaken by DCLG and as set out in Table C-6.

Table C-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 C-7.

Table C-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[58]
	£2,000	For a single dwelling[59]
	£800	Cost per house for a communal system[60]
	£2,650	Cost of reaching Code Level 3/4 for water consumption in a 3-bed semi-detached house[61]
Operation of	£30 per annum[62]	

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

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

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

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

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

Cost	Cost	Comments
GWR		
Replacement costs	£3,000 to replace23	It is assumed a replacement system will be required every 25 years

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 C-8 below.

Table C-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.

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

Appendix D Designated Site Background Detail

D.1 Stour and Orwell Estuaries Ramsar, SPA and Stour SSSI

The River Stour Estuary is located on the eastern Essex/Suffolk county boundary. It is a SSSI which is part of the Stour and Orwell Estuaries Wetland of International Importance under the Ramsar Convention. Additionally, it is part of the Stour and Orwell Estuaries Special Protected Area under the EEC Council Directive on the Conservation of Wild Birds (79/409/EEC).

Its reasons for designations are listed below:

- **Wintering and autumn passage for birds**. Thirteen species of wildfowl winter here and three species use the estuary for autumn passage.
- **Coastal saltmarsh of East England**. The Stour and Orwell estuaries have two of the three basic saltmarsh communities characteristic to the south-east and east of England (formerly grazed saltmarshes with *Puccinellia maritima* and *Aster tripolium* and ungrazed and lightly grazed saltmarshes dominated with *Atriplex portulacoides*).
- **Sheltered muddy shores (including estuarine muds)**. This habitat offers key roosting and feeding areas for nationally and internationally important birds. Additionally, there is a nationally important community of intertidal lower shore mixed substrata.
- **Scare marine invertebrates**. The estuary contains two nationally scare species listed in Schedule 5 of the Wildlife and Countryside Act 1981, (starlet sea anemone *Nematostella vectensis* and tentacle lagoon worm *Alkmaria romjni*).
- **Scarce vascular plant assemblages**. It exceeds the national threshold site-index value for scarce vascular plant assemblage of saltmarsh, mudflats and shingle (including *Limonium humile, Zostera noltii, Inula crithmoides, Verbascum pulverulentum, Parapholis incurve, Hordeum marinum, Carex divisa, Althaea officinalis, Lepidium latifolium* and *Sarcocornia perennis*).

D.2 Orwell Estuary SSSI

Situated north of the Stour Estuary, the Orwell is a long and relatively narrow estuary with mudflats and saltmarsh. Its designation is as follows:

- **Breeding and non-breeding birds.** It supports a nationally important breeding number of avocet (*Recurvirostra avosetta*). It is also important for its assemblages of breeding and non-breeding birds on open waters and margins with nine species of wintering waterfowl (including black-tailed godwit *Limosa limosa islandica*).
- **Vascular plant assemblages.** At least nine nationally scarce vascular plants are found at this site (including *Zosteria noltii, Bupleurum tenuissimum, Inula crithmoides, Limonium humile, Suaeda vera, Sarcocornia perennis* and *Carex divisa*).
- **Intertidal mud habitats.** This large area of rich littoral sediments (sandy muds) supports a high richness of invertebrates tide swept algae, sponges, ascidians and red algae.

D.3 Languard Common SSSI

This is a sand and shingle spit on the northern side of the mouth of the Stour and Orwell Estuaries. It contains large populations of colonizing shingle plant species (Crambe maritima, Lathyrus japonicas, yellow-horned poppy, sea sandwort and sea campion).

Further inland the SSSI supports rare and local flora including *Medicago minima, Trifolium ornithopodioides, T. glomeratum, T. suffocatum, T. striatum, Poa bubosa* and Lathyrus nissolia. Additionally, there are wet areas which support marsh and saltmarsh species which provide cover for small bird and migrant species.

D.4 Holland-Haven Marshes SSSI

This is an area of reclaimed estuarine saltmarsh and freshwater marsh situated between Holland-on-Sea and Frinton-on-Sea. It is divided by Holland Brook and its tributaries. The ditch network formed from the tributaries supports a number of nationally and locally scarce aquatic plant communities that are indicative of a freshwater to brackish water transition (including *Phalarus arundinacea, Sparganium erectum, Typha latifolia, Eleocharis palustris, Ranunculus sceleratus, Galium palustre, Polygonum hydropiper, Oenanth fistulosa*, *Eleocharis uniglumus, Ceratophyllum demersum* and *C. submersum*).

The site also supports grassland which comprises of coastal and freshwater grazing marsh. The area dominated by grasses such as *Agrostis stolonifera, Cynosurus cristatus, Festuca rubra, Lolium perenne* and *Hordeum secalinum.* Where there is seasonal flooding and seawater intrusion, saltmarsh vegetation has developed with two nationally uncommon species (*Hordeum marinum* and *Puccinellia fasciculata*).

Also notifiable are the birds which use the area. Hen Harrier and short-eared owl hunt over the marshes in the winter. In areas that are flooded, waders and wildfowl are present (wigeon, teal, pintail, shoveler, pochard, ruff and snipe).

D.5 Essex Estuaries SAC

This is an undeveloped, coastal plain estuarine system with open coast mudflats and sandbanks. It is made up of the major estuaries of the Colne, Blackwater, Crouch and Roach rivers which make it an important area of extensive contiguous estuarine habitat.

The SAC has a wide range of sediment communities which are characteristic to marine and estuarine environments. On the lower reaches there are rich sponge communities on mixed, tide-swept substrates. The sublittoral areas are rich in invertebrate fauna which include the reef-building worm *Sabellaria spinulosa,* the brittlestar *Ophiothrix fragilis*, crustaceans and ascidians. There are also large areas of important saltmarsh. Essex Estuaries is designated as an SAC for the following:

- **Mudflats and sandflats not covered by seawater at low tide.** The large expanse of mudflats and sandflats are made up of a wide range of sediment communities. These play host to extensive growths of eelgrass (*Zostera* spp.) on the open coast. The area of Maplin Sands is particularly important due to its large beds of the nationally important dwarf eelgrass (*Zostera noltii*) and associated animal communities.
- **Salicornia and other annuals colonizing mud and sand.** The transition from varied intertidal mud and sandflats to upper saltmeadows plays host to glasswort (*Salicornia* spp.). Due to erosion, secondary pioneer communities are present on the seaward edge.
- **Spartina swards (*Spartinion maritimae*).** The Essex Estuaries SAC host the most extensive remaining stand of the native small cord-grass *Spartina maritima* in the UK and possibly in Europe. It can be found at Foulness Point and covers approximately 0.17ha.
- **Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*).** Essex Estuaries represents Atlantic salt meadows in south-east England. Golden samphire (*Inula crithmoides*) can be found on both the lower marsh and the drift-line.
- **Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*).** It is currently restricted by sea-walls, but management retreat schemes offer the prospect of future expansion of this habitat type. Sea-lavenders (*Limonium* spp.) and sea-heath (*Frankenia laevis*) occur at Colne Point.
- **Sandbanks which are slightly covered by sea water all the time.**

D.6 Colne Estuary (Mid-Essex coast phase 2) Ramsar, SPA and Colne Estuary SSSI

The SSSI is within an area that is proposed as a Wetland of International Importance under the Ramsar Convention and a Special Protection Area under the EEC Council Directive on the Conservation of Wild Birds. It is a relatively short and branching estuary with five tidal arms flowing in to the main channel.

The estuary has a narrow intertidal zone with a composition of flats of fine silt and mud flat sediment communities that are indicative of south-east estuaries. The dominating fauna present include *Hydrobia ulvae, Macoma balthica*, *Scrobicularia plana, Hediste diversicolor* and *Nephtys hombergii.* Where the substratum becomes sandier, *Zostera noltii* and *Zostera marina* have been recorded.

At Geedon Saltings, Colne Point and the Strood, there are large saltmarsh colonies. It is dominated by saltmarsh-grass (*Puccinellia maritima*), sea purslane (*Halimione portulacoides*), annual sea-blite (*Sueda maritima*), glasswort (*Salicornia* spp.), sea aster (*Aster tripolium*) and cord grass (*Spartina* spp.). Where there are extensive saltpans, shorter swards of saltmarsh-grass can be found (including *Armeria maritima* and *Limonium vulgare*). There are also nationally uncommon species at the upper marsh such as golden samphire (*Inula crithmoide*) and shrubby sea-blite (*Sueda vera*). Additional nationally uncommon species found here are rock sea-lavender (*Limonium binervosum*) and sea heath (*Frankenia laevis*).

The saltmarsh and intertidal mud flats provide extensive feeding areas for internationally and nationally important numbers of brent geese black-tailed godwit, redshank, dunlin, sanderling, shelduck, goldeneye and ringed and grey plovers.

The shell, sand and shingle spits found throughout the estuary provide nesting habitats for little terns and ringed plover. Furthermore, the shingle ridges at Colne Point have been colonized by sea campion (*Silene maritima*), yellow horned-poppy (*Glaucium flavum*) and mosses and lichens. The sand-dunes above the shingle ridge at Colne Point form one of the few dune systems in Essex with characteristic species. Species present include marram grass (*Ammophila arenaria*), sand couch (*Elymus farctus*), sea holly (*Eryngium maritimum*) and sea sandwort (*Honkenya peploides*).

There are areas of unimproved neutral grassland on the seawalls, foldings and grazing marsh. This is made up of herb-rich and scattered scrub. Grasses present include sea couch (*Elymus pycnanthus*), couch (*Elymu repens*), creeping bent (*Agrostis stolonifera*), meadow barley (*Hordeum secalinum*), red fescue (*Festuca rubra*) and the nationally uncommon sea barley (*Horeum marinum*). Anthills have provided additional habitat for plants such as lady's bedstraw (*Galium verum*). Furthermore, former saltmarsh creeks and ditches within the grazing marsh are dominated by water dock (*Rumex hydrolapathum*), grey club-rush (*Schoenoplectus tabernaemontani*), lesser pond-sedge (*Carex acutiformis*), divided sedge (*C. divisa*), common reed (*Phragmites australis*) and sea club-rush (*Scirpus maritimus*). These habitats all provide areas of cover, feeding and breeding for birds such as whinchats, bearded tits and pochard. There is also the presence of barn owls, short-eared owls and hen harriers.

The Langenhoe Marsh is the Essex site for aquatic invertebrates outside of the Thames Estuary. The ditches filled with sea club-rush host the nationally scarce and rare insects (including the mosquito *Aedes flavescens*, the meniscus midge *Dixella attica*, the rare water beetle *Graptodytes bilineatus* and the nationally rare scare emerald damselfly *Lestes dryas*.

D.7 Upper Colne Marshes SSSI

This SSSI lies along both sides of the River Colne and Roman River to the south-east of Colchester. The habitats here consist of grazing marsh and associated ditch and open water habitats, tidal salt marshes, sea walls and a small area of intertidal mud. It is a designated SSSI as it supports an outstanding assemblage of nationally scarce plants and an unusual diversity of brackish ditch-types. Furthermore, there is interest in the terrestrial and aquatic invertebrates and breeding and wintering birds.

The grazing marshes and sea walls and unimproved neutral grassland with dominant grasses including creeping bent (*Agrostis stolonifera*), sea couch (*Elymus pycnanthus*), meadow barley (*Hordeum secalinum*), red fescue (*Festuca rubra*), the nationally scarce sea barley (*Hordeum marinum*) and the nationally scarce species stiff saltmarsh-grass (*Puccinellia rupestris*).

In the fresh water courses that run through the grazing marshes the dominant plants include common reed (*Phragmites australis*), reed canary-grass (*Phalaris arundinacea*), floating sweet-grass (*Glyceria fluitans*), hard rush (*Juncus inflexus*), jointed rush (*Juncus articulatus*), false fox-sedge (*Carex otrubae*) and hairy sedge (*Carex hirta*). In the water courses that are saline, sea club-rush (*Scirpus maritimus*) is dominant with a presence of the nationally scarce brackish water-crowfoot (*Ranunculus baudotii*). This site is one of the two best in North Essex for its range of brackish ditch-plant communities.

The saltmarshes also make up the other major habitat type. The marshland is dominated by common saltmarsh-grass (*Puccinellia maritima*), sea aster (*Aster tripolium*) and common lavender (*Limonium vulgare*). Also present are the nationally uncommon lax-flowered sea-lavender (*Limonium humile*) and sea wormwood (*Artemisia maritima*). These saltmarshes are one of the few sites in Essex where there is a natural transition to a high marsh community. This community is dominated by common reed, sea club-rush and blackthorn (*Prunus spinosa*) which is apparent on a natural scrub community.

Invertebrate communities are also of interest in this complex of coastal habitats. The nationally scarce Roesel's bush-cricket (*Metrioptera roeselii*) can be found in abundance. Other uncommon invertebrates present include the ground beetle (*Pterostichus macer*). Dragonflies and damselflies can be found in the characteristic habitat of fresh and brackish water.

The breeding birds that can be found on the site include redshank (*Tringa tetanus*), lapwing (*Vanellus vanellus*), shelduck (*Tadorna tadorna*), reed bunting (*Emberiza schoeniclus*) and reed and sedge warblers (*Acrocephalus scirpaceus* and *A. schoenobaenus*). The site is also used by wintering waders and wildfowl on the undisturbed mudflats at the mouth of the Roman River. Predatory birds such as barn owls (*Tyto alba*) and kestrels (*Falco tinnunculus*) are also present.

Appendix E Allocated Site Assessments

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Site Reference	Site name	Site use	Dwelling in the proposed Plan period (2017-2033) from Local Plan	Site Area (ha)	Planning Status	Receiving WRC	Water Supply network (Affinity Water comments)	WRC Capcity (AWS RAG assessment)	Foul Sewerage Network Capacity (AWS RAG assessment)	Surface Water Network Capacity (AWS RAG assessment)	Receiving waterbody	SuDS types	Flood Zone (1, 2 3)	Surface water flood risk (High, Medium, Low, Very Low)
LP Allocation SAMU3	Oakwood Park	Mixed use	600	48.79	Allocated Site	Clacton-Holland Haven	Reinforcements would be required. The development is located in a critical area and the issue has already been confirmed by previous studies done for a similar application received a while ago.	**Red**	**Amber**	**Red**	North Sea	Opportunities for bespoke infiltration SuDS	**1**	1% low risk, 0.3% medium risk, 0.1% high risk
LP Allocation SAMU2	Hartley Gardens	Mixed use	600	114.5	Allocated Site	Clacton-Holland Haven	Potentially requires reinforcements. A dedicated study should be carried out to confirm.	**Red**	**Amber**	**Red**	North Sea	Opportunities for bespoke infiltration SuDS/Very significant constraints are indicated	**1**	15% Low risk, 6% Medium risk, 4% High risk
LP Allocation SAMU4	Rouses Farm	Mixed use	600	41.7	Allocated Site	Jaywick	Potentially requires reinforcements. A dedicated study should be carried out to confirm.	**Red**	**Amber**	**Red**	North Sea	Very significant constraints are indicated / Opportunities for bespoke infiltration SuDS	**1**	Low risk
LP Allocation MSA6	Waterworks Drive	Residential	90	2.19	Allocated Site	Jaywick	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			North Sea	Very significant constraints are indicated	**1**	Low risk
LP Allocation MSA5	Station Gateway	Residential	60	1.58	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Red**	**Amber**	**Red**	North Sea	Opportunities for bespoke infiltration SuDS	**1**	8% low risk, 2% medium risk
LP Allocation MSA4	R/o 522-524 St. John's Road	Residential	43	1.23	Allocated Site	Jaywick	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	North Sea	Very significant constraints are indicated	**1**	Low risk
LP Allocation MSA3	Orchard Works	Residential	20	0.38	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	North Sea	Very significant constraints are indicated	**1**	Low risk
LP Allocation MSA2	Cotswold Road	Residential	12	0.67	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Green**	**Amber**	**Red**	North Sea	Very significant constraints are indicated	**1**	12% Low risk, 7% Medium Risk, 4% High risk
LP Allocation SAH2	Low Road	Residential	200	16.12	Allocated Site	Harwich and Dovercourt	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	River Stour estuary	Opportunities for bespoke infiltration SuDS/ Highly compatible for infiltration SuDS	**3**	Low risk
LP Allocation MSA8	Harwich & Parkeston FC	Residential	89	0.57	Allocated Site	Harwich and Dovercourt	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	River Stour estuary	Opportunities for bespoke infiltration SuDS	**1**	30% low risk, 15% medium risk, 30% high risk
LP Allocation SAH1	Greenfields Farm	Residential	164	7.3	Allocated Site	Harwich and Dovercourt	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	River Stour estuary	Opportunities for bespoke infiltration SuDS	**1**	Low risk
LP Allocation MSA7	Land at Mayflower Primary	Residential	15	0.4	Allocated Site	Harwich and Dovercourt	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	River Stour estuary	Opportunities for bespoke infiltration SuDS	**1**	Low risk
LP Allocation MSA12	The Farm, Kirby Road	Residential	47	2.1	Allocated Site	Walton On The Naze	A dedicated study should be carried out to confirm that no local reinforcements are required	**Green**	**Amber**	**Red**	Holland Brook	Opportunities for bespoke infiltration SuDS	**2**	10% low risk, 10% medium risk, 10% high risk

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Site Reference	Site name	Site use	Dwelling in the proposed Plan period (2017-2033) from Local Plan	Site Area (ha)	Planning Status	Receiving WRC	Water Supply network (Affinity Water comments)	WRC Capcity (AWS RAG assessment)	Foul Sewerage Network Capacity (AWS RAG assessment)	Surface Water Network Capacity (AWS RAG assessment)	Receiving waterbody	SuDS types	Flood Zone (1, 2 3)	Surface water flood risk (High, Medium, Low, Very Low)
LP Allocation MSA11	Station Yard/Avon Works	-	40	1.16	Allocated Site	Walton On The Naze	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			Holland Brook	N/A	**1**	Very Low risk
LP Allocation MSA10	Southcliffe Trailer Park	Residential	15	0.8	Allocated Site	Walton On The Naze	A dedicated study should be carried out to confirm that no local reinforcements are required	**Green**	**Amber**	**Red**	Holland Brook	Opportunities for bespoke infiltration SuDS	**1**	Very Low risk
LP Allocation MSA9	Old Town Hall Site	Mixed Use	15	0.14	Allocated Site	Walton On The Naze	A dedicated study should be carried out to confirm that no local reinforcements are required	**Green**	**Amber**	**Red**	Holland Brook	Opportunities for bespoke infiltration SuDS/Very significant constraints are indicated	**3**	5% high risk
LP Allocation SAMU1	EDME Maltings	-	150	2	Allocated Site	Manningtree	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			Wignall Brook Stour Estuary	Opportunities for bespoke infiltration SuDS	**1**	Very Low risk (<5% medium and high risk point flooding)
LP Allocation SAH3	Robinson Road Phase 2	Residential	100	4.48	Allocated Site	Brightlingsea-Church Road	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			River Colne estuary	Opportunities for bespoke infiltration	**1**	Very low risk
LP Allocation SP7	Colchester Borders Garden Community	Mixed Use	1250	N/A	Allocated Site	Colchester	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			River Colne estuary	Opportunities for bespoke infiltration / Highly compatible for infiltration SuDS / Very significant constraints are indicated	**3**	5% low risk, 1% medium risk, 0.4% high risk
LP Allocation MS14	Montana Roundabout	Residential	35	2.36	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	North Sea	Opportunities for bespoke infiltration SuDS	**1**	6% Low risk, 3% Medium risk, 2% High risk
LP Allocation SAMU5	R/o Council Offices	Mixed Use	280	18.54	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			North Sea	Opportunities for bespoke infiltration SuDS	**1**	Low risk
LP Allocation MSA1	TDC Council Offices	Residential	24	0.81	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	North Sea	Opportunities for bespoke infiltration SuDS	**1**	Low risk
Employment Allocations 1	Mercedes Site	Employment	-	6	Allocated Site	Harwich and Dovercourt	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	River Stour estuary	Opportunities for bespoke infiltration SuDS	**3**	10% low risk, 17% medium risk, 0.4% high risk
Employment Allocations 2	Carless	Employment	-	4.5	Allocated Site	Harwich and Dovercourt	A dedicated study should be carried out to confirm that no local reinforcements are required	**Green**	**Amber**	**Red**	River Stour estuary	Very significant constraints are indicated / Opportunities for bespoke infiltration SuDS	**2**	Very low risk
Employment Allocations 3	Stanton Euro Park	Employment	-	3	Allocated Site	Harwich and Dovercourt	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	River Stour estuary	Very significant constraints are indicated	**3**	28% low risk, 10% medium risk, 2% high risk

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Site Reference	Site name	Site use	Dwelling in the proposed Plan period (2017-2033) from Local Plan	Site Area (ha)	Planning Status	Receiving WRC	Water Supply network (Affinity Water comments)	WRC Capcity (AWS RAG assessment)	Foul Sewerage Network Capacity (AWS RAG assessment)	Surface Water Network Capacity (AWS RAG assessment)	Receiving waterbody	SuDS types	Flood Zone (1, 2 3)	Surface water flood risk (High, Medium, Low, Very Low)
Employment Allocations 4	EDME Maltings	Employment	-	0.3	Allocated Site	Manningtree	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			Wignall Brook Stour Estuary	Opportunities for bespoke infiltration SuDS/Very significant constraints are indicated	**3**	5% low risk, 0.8% medium risk, 0.6% high risk
Employment Allocations 5	Lanswood Park	Employment	-	1.2	Allocated Site	Thorrington	A dedicated study should be carried out to confirm that no local reinforcements are required	**Amber**	**Amber**	**Red**	River Colne estuary	Opportunities for bespoke infiltration SuDS /Very significant constraints are indicated	**1**	5% low risk
Employment Allocations 6	Weeley	Employment	-	1	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Red**	**Amber**	**Red**	North Sea	N/A	**1**	0.02% low risk
Employment Allocations 7	Land south of Long Road, Mistley	Employment	-	2	Allocated Site	Manningtree	A dedicated study should be carried out to confirm that no local reinforcements are required	**Red**	**Amber**	**Red**	Wignall Brook Stour Estuary	**No site boundary available therefore site could not be assessed**		
Employment Allocations 8	Land East of Pond Hall Farm, Harwich	Employment	-	4.8	Allocated Site	Harwich and Dovercourt	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			River Stour (transitional)	N/A	**3**	15% low risk, 5% medium risk, 5% high risk
Employment Allocations 9	Brook Park West, Clacton	Employment	-	4.8	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			North Sea	**No site boundary available therefore site could not be assessed**		
Employment Allocations 10	Plough Road, Gt Bentley	Employment	-	2.7	Allocated Site	Thorrington	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			River Colne estuary	**No site boundary available therefore site could not be assessed**		
Employment Allocations 11	Sato UK, Harwich	Employment	-	1.2	Allocated Site	Harwich and Dovercourt	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			River Stour estuary	**No site boundary available therefore site could not be assessed**		
Employment Allocations 12	Land East of Park Road, Clacton CO15 1HQ	Employment	-	0.2	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			North Sea	**No site boundary available therefore site could not be assessed**		
Employment Allocations 13	Homestead Caravan Park, Thorpe Road, Weeley CO16 9JN	Employment	-	0.92	Allocated Site	Clacton-Holland Haven	A dedicated study should be carried out to confirm that no local reinforcements are required	**Anglian Water RAG assessment unavailable for this site**			North Sea	**No site boundary available therefore site could not be assessed**		

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