Waveney District Council Water Cycle Study

Waveney District Council

FINAL – June 2017

Quality information

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List of Acronyms

AMP	Asset Management Plan
AWS	Anglian Water Services
BAP	Biodiversity Action Plan
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
CRC	Carbon Reduction Commitment
DEFRA	Department for Environment, Food and Rural Affairs
DWF	Dry Weather Flow
EA	Environment Agency
EFI	Environmental Flow Indicator
ESW	Essex and Suffolk Water
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
UKCIP02	United Kingdom Climate Impacts Programme 2002
UKCP09	United Kingdom Climate Projections 2009
UKTAG	United Kingdom Technical Advisory Group (to the WFD)
UKWIR	United Kingdom Water Industry Research group
UWWTD	Urban Wastewater Treatment Directive
WCS	Water Cycle Study
WDC	Waveney District Council
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

Waveney District Council is expected to experience significant growth, particularly in relation to domestic development to 2036. 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 Water Cycle Study (WCS) forms an important part of the evidence base that has helped Waveney 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 (2036).

Planned future growth across the District, including the three growth scenario options have been assessed with regards to water supply capacity, sewage 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 from property is treated at Anglian Water's Water Recycling Centres (WRCs) across the District. The WCS identifies that in total, up to twenty one WRC will serve the proposed future development across the District Area. Of these treatment facilities, the vast majority would have sufficient capacity to receive and treat the additional wastewater without the need for the permit to discharge to be altered. For these WRC, the WCS concludes that there are no significant upgrades or restrictions to growth required to support the plan. However, the WRCs set out in the table below would require a new discharge permit.

WRC without sufficient permitted treatment capacity in Waveney

WRC	Impact
Beccles – Marsh Lane WRC	Permitted treatment capacity would be exceeded under Scenario 2 (significant growth in Beccles option) and Scenario 3 (development spread across market towns and rural areas).
Ringsfield- Redisham Road WRC	Small WRCs where new permits to discharge would be required due to growth apportionment in the catchment but only in scenario 3.
Rumburgh-Abbey Farm WRC	
Stoven WRC	

New permits and infrastructure solutions are required in order to accommodate the growth at these WRC 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.

Detailed water quality assessments have been completed and show that, in order to meet in-stream standards required to ensure legislative compliance, improvements to all four WRC are possible using wastewater treatment technologies currently available (conventional), demonstrating that an engineering solution is feasible and hence treatment capacity should not be seen as a barrier to growth.

Investment will be required by Anglian Water to ensure the full quantum of growth can be delivered and this will be agreed between Anglian Water and the Environment Agency as certainty regarding development locations increases. The phasing of developments draining to these WRCs will need to be discussed between Waveney District Council, and Anglian Water to ensure development is phased in-line with Anglian Water's asset management plans.

Several proposed site allocations would need some degree of developer and Anglian Water investment in wastewater networks serving the allocations, and in a small number of cases, significant upgrades will be required by Anglian Water to provide strategic network solutions. The WCS has identified these locations using a Red, Amber, Green (RAG) coding process and recommends that pre-development enquiries are undertaken by

these site promoters as part of the planning process to ensure that development phasing accommodates likely infrastructure upgrade requirements.

Water Supply Strategy

Based on the growth assessed, the WCS has concluded that, allowing for the planned resource management of Essex & Suffolk Water's supply areas supplying the District, the company would have adequate water supply to cater for growth over the plan period.

However, the WCS has identified that there is significant water stress in some areas of the District and limitations locally in available water resources. Hence there are key drivers requiring that water demand is managed across the District for all new development, in order to achieve long term sustainability in terms of water resources.

In order to reduce reliance on raw water supplies from rivers and aquifers, the WCS has set out ways in which demand for water, as a result of development, can be minimised without incurring excessive costs or resulting in unacceptable increases in energy use. In addition, the assessment has considered how far development in the 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 across the plan period has taken place. A pathway for achieving neutrality as far as practicable has been set out, including advice on:

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

Different 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 meeting the optional 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 10% 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

Overall, the water cycle study concludes there are no major constraints with respect to water service infrastructure and the water environment to deliver the New Local Plan development, on the basis that strategic water resource options and wastewater solutions are developed in advance of development coming forward. Investment in infrastructure will be required by the water companies serving the District, but these would not affect the current proposed phasing or spatial allocation.

1. Introduction

1.1 Background

The District of Waveney is located in the County of Suffolk. The District has experienced moderate population growth in the past decade, and is expected to experience a significant increase in housing requirement and economic growth over the period to 2036.

Waveney District Council (WDC) is currently preparing a new Local Plan setting out the Council's strategy for future development and growth up to 2036. The Objectively Assessed Housing Needs (OAHN) Study for Waveney identified 381 dwellings per annum would be required in the District from 2011 to 2036. This target will be met under the new Local Plan which sets out the strategy for the growth of the District from 2014 to 2036. The Council have also stated that this target is likely to increase and have therefore brought the total housing target for the District from 2014 to 2036 up to 440 new residential dwellings per annum by 2036. These homes will be located primarily in the Towns and Service Villages as well as a number of strategic growth locations.

This Water Cycle Study (WCS) forms an important part of the evidence base that will help to ensure that development does not have a detrimental impact on the water environment within the 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. Furthermore, it provides a strategic approach to the management and use of water which ensures that the sustainability of the water environment in the area is not compromised.

1.2 WCS History

A scoping level WCS was completed for the District in March 2009[1], as part of a joint study with Great Yarmouth Borough Council. The study considered potential water environment and infrastructure constraints in relation to growth at the time of planning.

Since the development of potential spatial growth strategies, water environment and infrastructure issues relevant to the Waveney District have been identified during consultation for the new local plan. Responses from the Environment Agency and Anglian Water highlighted potential issues regarding the capacity of the wastewater network and treatment infrastructure serving new development in parts of the District.

1.3 Study Governance

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

- Waveney District Council;
- Anglian Water Services (AWS); and,
- The Environment Agency.

Information from Essex and Suffolk Water (ESW) has also been used in the study.

1.4 WCS Scope

This WCS provides information at a level suitable to ensure that there are likely deliverable 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.

[1] http://www.eastsuffolk.gov.uk/assets/Planning/Waveney-Local-Plan/Water-Cycle-Strategy-Scoping-Study.pdf

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 the solutions are viable in terms of balancing environmental capacity with cost;
- describe how the wastewater treatment strategy might impact phasing of development;
- determine whether any 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 ESW are required to support growth;
- determine where upgrades might be required to water and wastewater network infrastructure relative to potential options for growth through collaboration with AWL and ESW;
- consider whether growth can be delivered and achieve a 'neutral water use' condition;
- provide a pathway to achievement of water neutrality;
- determine impact of infrastructure and mitigation provision on housing delivery phasing; and
- provide recommendations to support the Local Plan and policy development.

1.5 Key Assumptions and Conditions

1.5.1 Water Company Coverage

Two water companies operate within the District. AWS is the wastewater undertaker for the entire district providing wastewater treatment via a number of Water Recycling Centres (WRC) and ESW supplies potable water for the entire district.

1.5.2 Water Use

For the water supply assessment, the published measured household consumption for ESW "Northern Central" Resource Zone of 149l/h/d has been applied.

It is acknowledged that the 149l/h/d assumption exceeds the current Building Regulations requirement of 125l/h/d for all new homes. Analysis has shown that even when homes are built to a standard of 125l/h/d, the average household use increases over time due to various factors. The 125l/h/d requirement is an aspirational target only and ESW are 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 131l/h/d (litres per head per day) was provided by AWS 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 45l/h/d[2] has therefore been added to the starting assumption of 131l/h/d, giving a final wastewater demand of 176l/h/d.

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

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

[2] As provided by AWS

1.5.3 Household Occupancy Rate

The latest Office for National Statistics (ONS) population projections[3] and household projections[4] have been used to determine the occupancy rate of each household coming forward in the plan period, and have been provided in Table 1 below.

Table 1 Calculation of Occupancy Rate

Projection for 2033

Population	124200
Number of households	57967
Calculated Occupancy Rate (people per household)	2.14

Source: ONS

1.5.4 Wastewater Treatment

As a wastewater treatment provider, AWS 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 WRCs 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)[5], ammonia and phosphate, and are provided in Table 2.

Table 2 Reliable limits of conventional treatment technology for wastewater

Water Quality Parameter	LCT
Ammonia	1.0 mg/l 95 percentile limit[6]
BOD	5.0 mg/l 95 percentile limit
Phosphate	0.5 mg/l annual average[7]

1.6 Report Structure

The first stage of the WCS process is set out in Section 3 of this document and outlines the total proposed number of dwellings which will need to be catered for in terms of water supply and wastewater treatment. Understanding what the level of growth is and where it might be located informs the second stage of the study (reported in Section 4), 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 hydrologically linked ecological designations.

Subsequent 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.

Finally, 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.

[3] 2014-based Subnational Population Projections (ONS) (May 2016). Available at https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29
[4] 2014-based Household Projections to 2039 for England (ONS) (July 2016). Available at https://www.gov.uk/government/statistical-data-sets/live-tables-on-household-projections
[5] 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
[6] Considered within the water industry to be the current LCT using best available techniques
[7] Environment Agency (2015) Updated River Basin Management Plans Supporting Information: Pressure Narrative: Phosphorus and freshwater eutrophication

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.

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, wastewater and water quality; 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.

Other relevant studies that have a bearing on the provision of water services infrastructure for development are provided in Appendix B and include, but are not limited to, key documents including the ESW's Water Resources Management Plan (WRMP) and the Environment Agency's latest Anglian 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[8]

2.1.1 Price Review and wastewater investment

As the wastewater undertaker for the District, AWS 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 AWS 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.

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

Consequently, to avoid potential inefficient investment, AWS 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 relevant to this WCS are:

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

These environmental objectives are legally binding, and all public bodies should have regard to these objectives when making decisions that could affect the quality of the water environment. The Environment Agency publishes the status and objectives of each surface waterbody on the Catchment Data Explorer[9], and describes the status of each waterbody as detailed in Table 3.

Table 3 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

[9] 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, including water resources, wastewater infrastructure, water quality, flood risk, surface water drainage and aquatic ecology. The increased development is to accommodate the minimum housing requirement for the WDC. This level of projected growth has required WDC to revise their spatial approach of future expected development up to 2036. These growth figures therefore form the basis for the WCS.

The administrative area of WDC covers the towns of Lowestoft, Halesworth, Beccles and Bungay, and the key service villages of Kessingland, Corton, Blundeston, Wrentham and St James South Elmham. Figure 2 illustrates WDC's administrative boundary, main towns, villages and watercourses within the District.

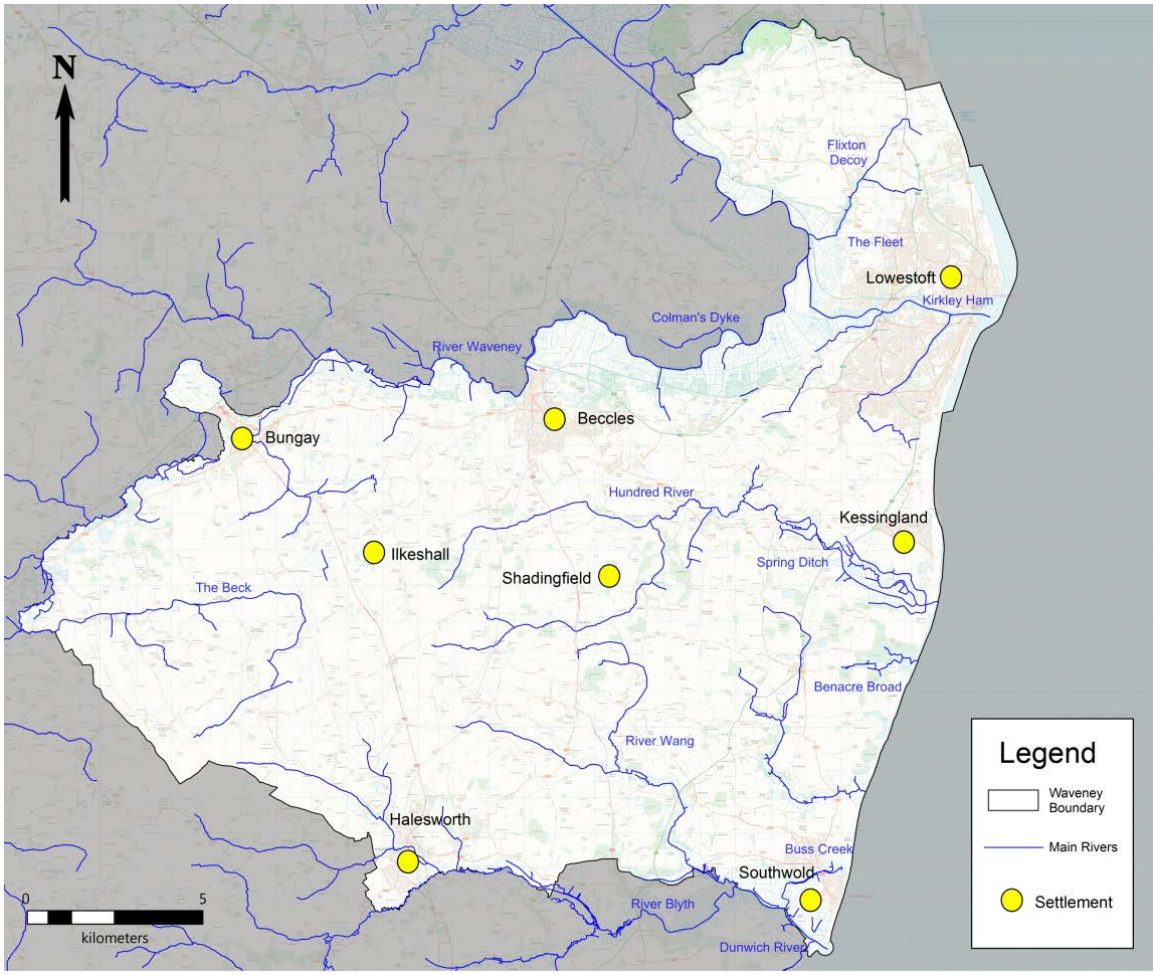

Figure 2 Main rivers, urban areas and administrative boundary of Waveney District Council

3.2 Housing

The OAHN Study for Waveney identified 381 dwellings per annum would be required in the District from 2014 to 2036. This target will be met under the new Local Plan which sets out the strategy for the growth of the District from 2014 to 2036.

For assessment of sensitivity, 15% uplift has been applied to the annual completion target to housing numbers used in this study, giving an annual completion of 438 over 22 years. This gives a total of 9,636 dwellings for assessment.

Of this total, 271 homes have already been built between 2014 and 2016, giving a residual number of dwellings for assessment of 9,365. The 271 completed dwellings have not been included within the WCS assessments, as it is assumed that they are already catered for in terms of WSI connections and wastewater flow from the houses is already included in monitored flow data. The WCS therefore incorporates all proposed development across the District at differing stages of planning as follows:

- Committed developments (with planning permission, under construction);
- Outstanding commitments (with planning permission, construction not yet started);
- Current allocations (without full planning permission); and,
- Proposed allocations (without full planning permission).

Table 4 provides an overview of the number of dwellings to be assessed as part of the WCS.

Table 4 Waveney District Council Housing Commitments and Allocations

Type of Site	No. Dwellings
Existing Commitments	4,079
Proposed Allocations	5,324
Total potential dwellings to be assessed	9,365

3.2.1 Growth Spatial Scenario Overview

Three different spatial growth scenarios up to 2036 have been assessed in the WCS, each scenario reflecting different spatial permutations of expanding existing settlements. Each growth scenario meets the total requirement of 9,365 dwellings across the HMA. The scenarios are:

- Scenario 1- Focus growth on Lowestoft,
- Scenario 2- Significant Growth in Beccles, and,
- Scenario 3- Spread development across market towns and rural areas.

The numbers of housing proposed for each settlement is shown in Table 5.

Table 5 Growth Scenarios and numbers of housing per settlement

Settlement	Existing Commitments	Allocations		
		Option 1 - Focus Growth in Lowestoft	Option 2 - Significant Growth in Beccles	Option 3 - Spread Development across market towns and rural areas
Lowestoft with Carlton Colville and Oulton	3,134	3,921	2,476	1,994
Beccles with Worlingham	131	825	2,270	1,306
Bungay	216	0	0	157
Halesworth and Holton	114	344	344	633
Southwold with Reydon	39	235	235	524
Rural areas	445	0	0	671
Total	4,079	5,324	5,324	5,286
Scenario Total (including existing commitments)	-	9,403	9,403	9,369

For scenario 3, the spatial distribution of the rural allocation element was not certain in every case. Estimates of potential new allocations and windfall locations were available for 580 of the 671 rural dwelling totals and for the purposes of the wastewater treatment assessment, these were used to allocate growth to the nearest rural WRC catchment. For the remaining 91, these were distributed evenly to the identified other rural locations provided by BDC and an assumed connection to the nearest WRC adopted.

3.3 Employment

The WCS also takes account of the projected increase in employment across the District up to 2036: a total of approximately 1,973 new jobs. 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).

4. Wastewater Treatment Strategy

4.1 Wastewater in the District

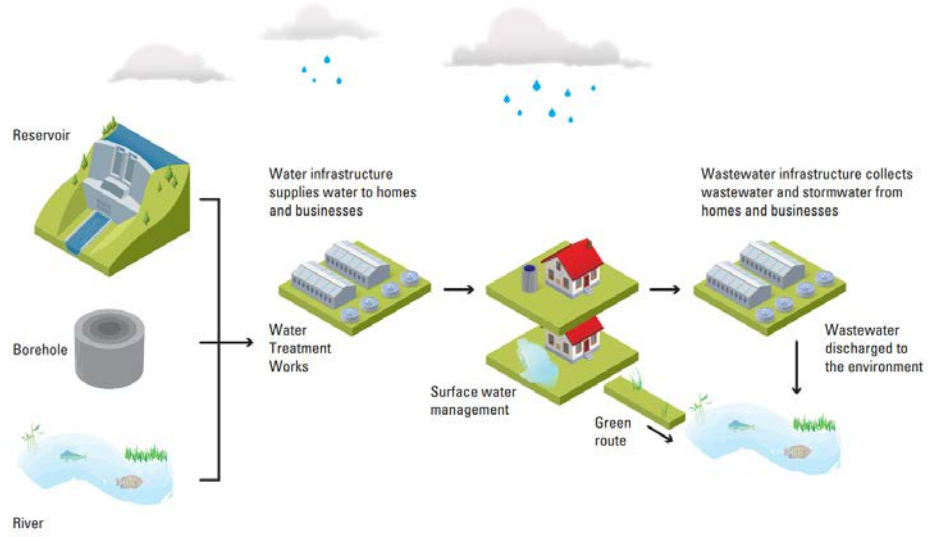

Figure 3 The water environment and infrastructure components[10]

A broad overview of how water and wastewater infrastructure interacts with the water 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 wastewater recycling centres (WRCs) operated and maintained by AWS, ultimately discharging treated wastewater to a nearby water body. Each of the WRCs is connected to development by 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 33 WRCs (illustrated in Figure 4). After analysing the spatial distribution of sites, the following 21 WRC catchments are expected to receive additional wastewater as a result of growth:

- Barsham (Suffolk)
- Beccles-Marsh Lane
- Bungay
- Halesworth
- Ilkeshall St Andrew
- Ilkshall St Lawrence
- Ilkshall St Margaret
- Kessingland
- Lowestoft
- Redisham-Station Road
- Rumburgh-Abbey Farm
- Shipmeadow- Locks Lane
- Somerleyton
- Southwold-The Common
- Sotherton
- Stoven
- Wangford
- Westhall
- Willingham-Fox Farm
- Wrentham- Southwold Road

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

- Ringsfield- Redisham Road

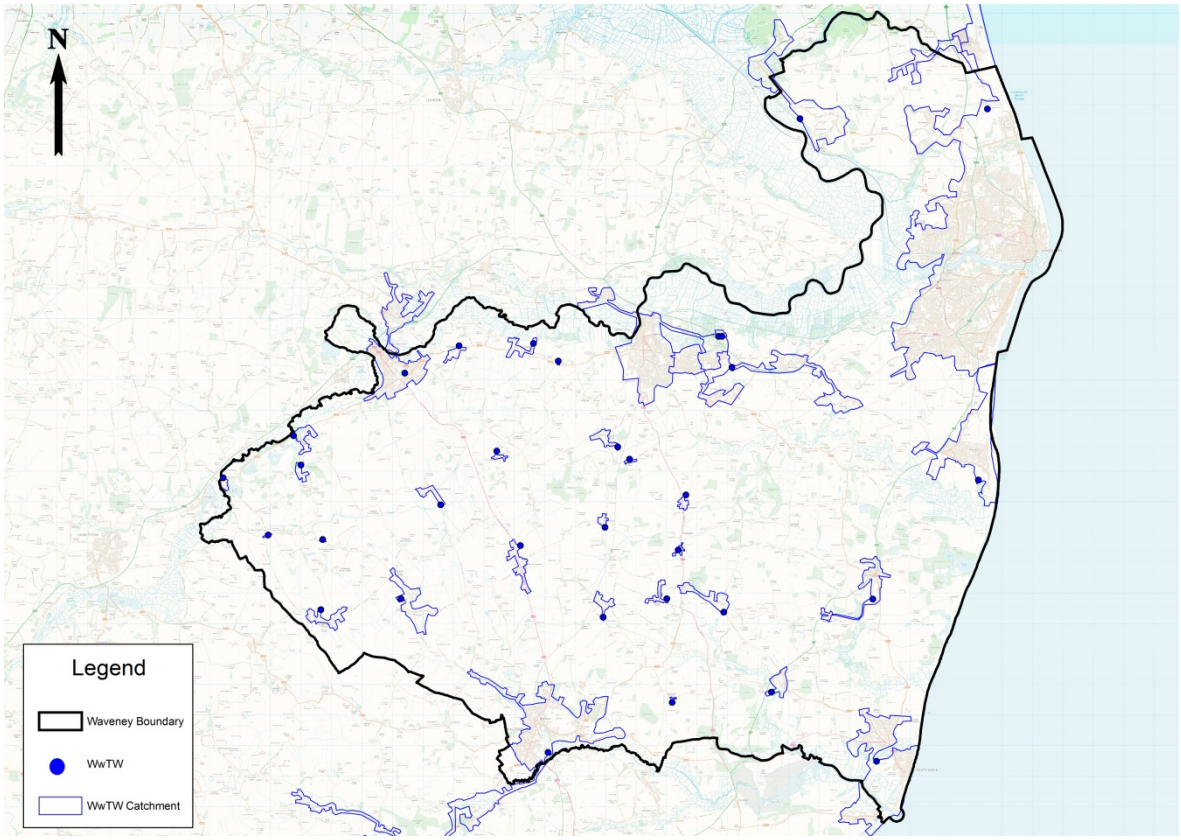

Figure 4 Location of WRC's in Waveney

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 waterbody. 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 waterbody 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[11] and would not affect downstream water quality; this agreement has been made with the Environment Agency. This headroom therefore determines how many additional properties can be connected to the WRC catchment before AWS 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).

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

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

increased flow of wastewater received at the WRC would result in an increase in the pollutant load[12] of some substances being discharged to the receiving waterbody. This may have the effect of deteriorating water quality and hence in most cases, an increase in permitted discharge flow results in more stringent (or tighter) conditions on the quality of the discharge.

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 drivers which determine the quality conditions of any new permit to discharge are the WFD and the Habitats Directive (HD) as described in the following subsections.

4.2.1 WFD Compliance

The definition of a surface waterbody's overall WFD 'status' comprises an ecological status and a chemical status and the overall status can classified as Bad, Poor, Moderate, Good or High. The ecological status element combines standards for specific pollutants, physico-chemical quality, hydromorphology (river morphology and flow conditions) quality, with the biological (ecological) requirements of an individual water body catchment. Figure 5 illustrates the classifications applied.

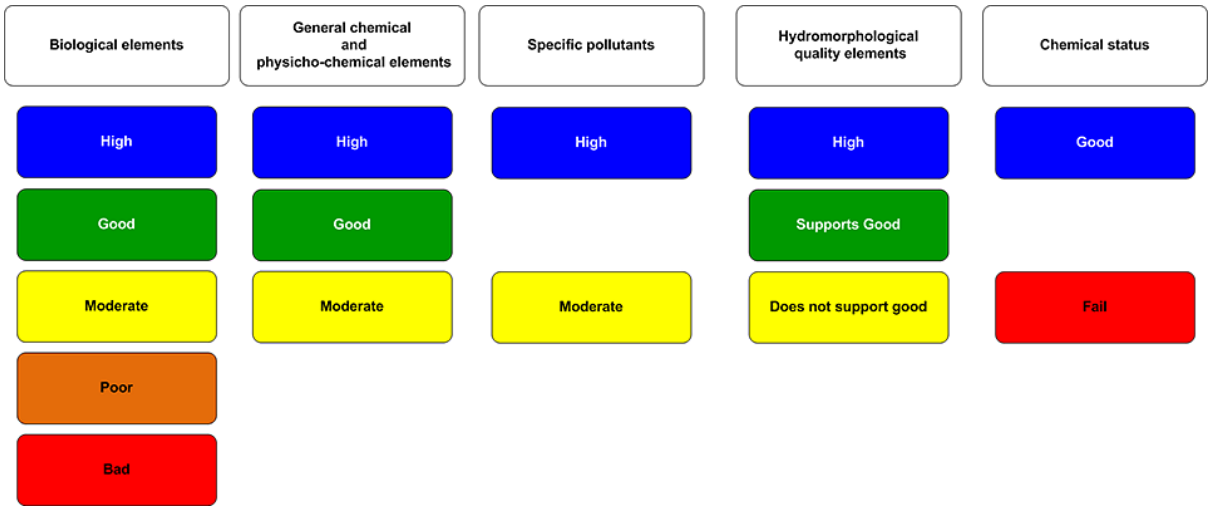

Figure 5 WFD status classifications used for surface water elements

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 waterbody[13]; and
- Development must not prevent a waterbody from achieving its future target status (usually at least Good status).
- It is not acceptable to allow deterioration from High status to Good status, even though the overall target of Good status as required under the WFD is still maintained, this would still represent a deterioration. In addition, if a waterbody's overall status is less than Good as a result of another element, it is not acceptable to justify a deterioration in another element because the status of a waterbody is already less than Good.

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

[12] 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.
[13] 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

or revised discharge permit to ensure the two policy requirements of the WFD are met. The modelling process (assumptions and modelling tools) is described in detail in Appendix C.

4.2.2 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 4.6 of this chapter (Ecological Appraisal).

4.3 Wastewater Treatment Assessment Overview

4.3.1 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.

4.3.2 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 these steps, the following assessment techniques were developed (details of the procedures can be found in Appendix C);

- A flow headroom calculation spreadsheet was developed; and,

- A water quality modelling procedure was agreed with the Environment Agency using Environment Agency software (RQP) designed for determining discharge permit quality conditions.

4.3.2.1 Allocation of housing and employment to WRC

Proposed housing growth has been allocated to each WRC by identifying the WRC catchment that the housing falls within. Due to lack of headroom capacity in Worlingham WRC and limitations on the capacity of the receiving watercourse, housing located within the Worlingham catchment has been allocated to Beccles-Marsh Lane WRC. This approach was agreed with AWS and the Environment Agency as a future strategy within Beccles and Worlingham. This approach will result in the need for investment in wastewater network changes by AWS to ensure that wastewater can be efficiently transferred to the Beccles catchment, particularly in relation to development east of Worlingham at locations around Mutford and Barnby. New strategic connections are likely to be required and AWS would seek funding to implement network configurations in the next investment period.

Proposed housing that did not fall within a WRC catchment has been allocated to the nearest WRC. Employment growth has also been assessed and has been allocated to the nearest WRC. Employment for the parish of Ellough has been allocated to Weston STW and the village of Gisleham has been allocated to Lowestoft. This is because they did not fall within a WRC catchment and have therefore been allocated to the nearest WRC.

4.3.3 Assessment Results

The results for each WRC assessment 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.

- **Green** – water quality 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 water quality 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 water quality 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.

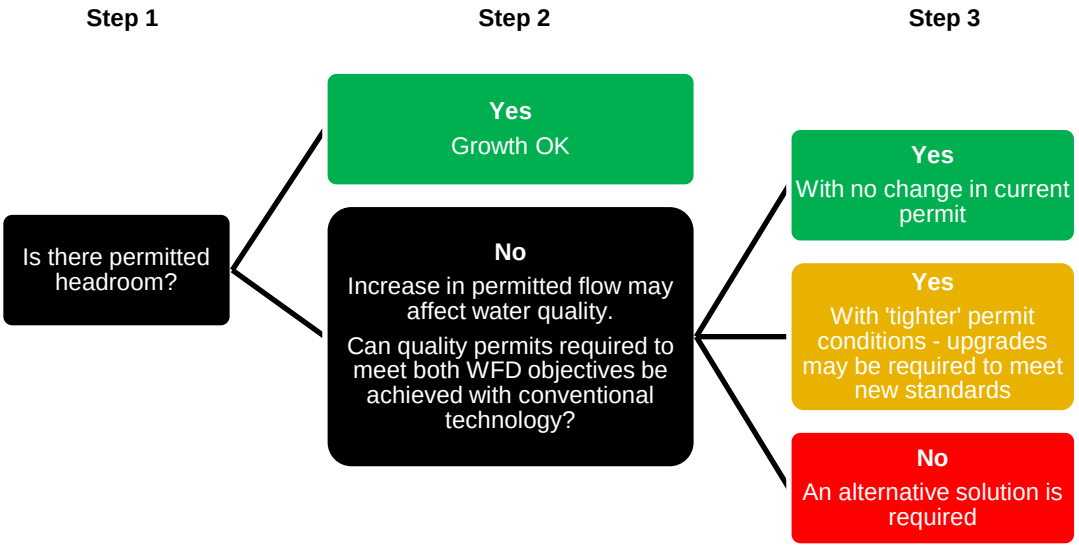

Figure 6 RAG Assessment process diagram for WRC capacity

4.4 WRC Headroom Assessment

For WRCs with a numerical discharge permit (and hence no records of measured treated flow), the maximum volume of wastewater, measured as Dry Weather Flow (DWF[14]), 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 to determine whether each WRC would have adequate permitted headroom. The maximum volume has been determined by using the spatial growth scenario with the highest growth proposed for each WRC catchment.

For WRCs which have descriptive permits and no measured flow data a different capacity assessment method was required. The current estimated Population Equivalent (PE) was obtained from AWS and the PE of the proposed growth in each WRC catchment was calculated to determine the potential increase in PE at each WRC. It was agreed with the Environment Agency that if growth results in a WRC's PE increasing beyond 250 PE, the WRC would require a new numerical discharge permit and hence capacity would be deemed to be exceeded.

4.4.1 Assessment of growth scenarios

The analysis of WRC permitted headroom capacity demonstrated that growth scenario 1 would not result in any WRCs in the District exceeding their permitted headroom capacity and hence water quality impacts would be unlikely to result from the delivery of growth scenario 1.

In growth scenario 2, only Beccles-Marsh Lane WRC would exceed its permitted flow headroom and hence require water quality assessment. However, growth scenario 3 would result in several WRCs exceeding their flow headroom and/or PE allowance and hence water quality assessment was required for several WRCs.

The permitted headroom assessment results are presented in the following sub-section and have been reported in the following order;

- Further detail on WRC catchments where growth can be accepted within the current permitted flow headroom for all growth scenarios are detailed in Section 4.4.2; and
- Further detail on those WRCs where permitted headroom would be exceeded in at least one of the growth scenarios, and hence a water quality assessment has been reported in Section 4.4.3.

4.4.2 WRC with Permitted Headroom - all growth scenarios

Table 6 (WRC with numerical permits) and Table 7 (WRC with descriptive permits) detail the WRC where existing permitted headroom (or PE allowance) is sufficient to accommodate all of the proposed growth in all three growth scenarios and hence no wastewater treatment infrastructure upgrades are required to deliver the proposed growth in these locations irrespective of the growth scenario taken forward.

Growth in these WRC catchments would not compromise WFD or HD 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 assuming the growth scenario with the highest number of potential new sites for that WRC.

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

Table 6 WRC with numerical permits and permitted headroom capacity in all growth scenarios

WRC	Most Growth Scenario	Current DWF Permit (m^3/d)	Current Headroom Capacity		Quantity of proposed dwellings	Future 2036 DWF after growth (m^3/d)	Headroom Assessment after growth (2036)	
			Current DWF (m^3/d)	Headroom (m^3/d)			Headroom Capacity (m^3/d)	Approx. housing capacity
Bungay WRC	3	1,287	668	619	380	819	468	1240
Halesworth WRC	3	1,700	692	1,008	763	980	720	1909
Kessingland WRC	3	1,090	854	236	178	921	169	448
Lowestoft WRC	1	25,192	15,377	10,535	7,267	18,121	7,791	20,661
Southwold-The Common WRC	3	1800	1267	533	563	1482	318	844
Wrentham- Southwold Road WRC	3	230	137	93	111	179	51	136

Table 7 WRC with descriptive permits and permitted headroom capacity

WRC	Most Growth Scenario	Residential Population Equivalent (PE) Population	Total PE population	Quantity of proposed dwellings	Estimated future PE
Barsham (Suffolk) WRC	3	17	17	9	214
Ilketshall St Andrew WRC	3	70	71	11	155
Ilketshall St Lawrence WRC	3	178	189	22	14
Ilketshall St Margaret WRC	3	64	66	8	167
Redisham-Station Road WRC	3	59	68	7	167
Shipmeadow- Locks Lane WRC	3	102	111	9	120
Sotherton WRC	3	23	26	7	209
Wangford WRC	3	95	104	56	26
Westhall WRC	3	163	178	16	38
Willingham-Fox Farm WRC	3	89	97	30	89

4.4.3 WRC without Permitted Headroom

The calculations of flow headroom capacity found that in when considering at least one of the three growth scenarios, five WRCs would not have sufficient headroom (Table 8) or PE capacity (Table 9) once all the growth within the WRC catchment is accounted for.

With the exception of Beccles-Marsh Lane WRC, likely exceedance of permitted flow (or PE capacity) would only occur in growth scenario 3. Beccles-Marsh Lane WRC would exceed its permitted flow headroom in both Scenarios 2 and 3, but would not exceed the headroom in Scenario 1.

Table 8 WRC with numerical permits and without permitted headroom capacity

WRC Catchment	Growth Scenario affected	Current DWF Permit (m^3/d)	Current Headroom Capacity		Quantity of proposed dwellings	Future 2036 DWF after growth (m^3/d)	Headroom Assessment after growth (2036)	
			Current DWF (m^3/d)	Calculated Headroom (m^3/d)			Headroom Capacity (m^3/d)	Approx. residual housing capacity
Beccles-Marsh Lane WRC	2 & 3	2617	2129	488	2416	3,402	**-425**	-1126
Somerleyton WRC	3 only	130	109	21	60	132	**-2**	-4

Table 9 WRC with descriptive permits and without permitted headroom capacity

WRC Catchment	Growth Scenario affected	Residential Population Equivalent (PE) Population	Total PE population	Quantity of proposed dwellings	PE Capacity post growth
Ringsfield- Redisham Road WRC	3 only	138	141	52	**-2**
Rumburgh-Abbey Farm WRC	3 only	184	200	33	**-21**
Stoven WRC	3 only	131	144	50	**-1**

If the relevant growth scenario were pursued, these WRCs would exceed their maximum permitted DWF under their existing discharge permits. Additional headroom can be made available through an application by AWS for a new or revised discharge permit from the Environment Agency.

To ensure that the increase in permitted DWF required to serve the proposed growth scenario would not impact on downstream WFD requirements, water quality modelling has been undertaken for the WRCs listed in Table 8 (existing numerical permits) and Table 9 (existing descriptive permits) to determine whether theoretically achievable quality conditions can be applied to a revised discharge permit.

The exception is Somerleyton, where the potential exceedance of permitted DWF is minor and only occurs in Scenario 3. Given the conservative nature of the assessment of increase in flows[15] it is unlikely that permitted flow would be exceeded for this WRC and hence water quality assessment has not been undertaken.

For the WRCs assessed, a summary of the results of the water quality modelling are provided below, with detailed results from the modelling provided in Appendix C.

4.5 Water Quality Assessment

The four WRCs which have been identified as having insufficient permitted flow headroom, all discharge to freshwater, inland waterbodies. Therefore, statistical based water quality modelling (using RQP software) has been performed to check for compliance with the WFD objectives in terms of permit conditions for ammonia, BOD and phosphate as well as potential deterioration within the waterbody as a result of growth. This approach follows Environment Agency guidelines and best practice (see Appendix C).

A summary of the results and proposed infrastructure upgrades required are included in the following subsections for each of the WRCs assessed.

[15] This in includes a 15% increase in OAHN targets, a conservative estimate of likely wastewater flow given the need for new build to meet Building Regulations targets on water use, and does not take account of changing demographics, household occupancy and reducing water demand in existing homes which would reduce the rate of wastewater generated from existing population by the end of the plan period.

4.5.1 Descriptive Permit Modelling Assumptions

Due to the nature of descriptive permits and the locations of the WRC discharges, environmental data required for the model is limited; therefore some assumptions have been applied where suitable data is unavailable. The following assumptions have therefore been applied in the modelling for Ringsfield WRC, Rumburgh WRC and Stoven WRC.

4.5.1.1 Upstream river flow

The river flow upstream of each WRC has been provided by the Environment Agency. Combinations of data sources have been used to derive the mean river flow and Q95 river flow, details have been provided in Appendix C.

4.5.1.2 Upstream river quality

Due to the lack of any water quality sampling points located upstream of the WRC's, the water quality at the downstream sampling points has been used in the modelling as the best alternative (as per Environment Agency guidelines) to determine the likely water quality upstream of the WRC's. The distance of the sampling points downstream of the WRC are shown in Table 10.

Table 10 Sampling point distances for WRC with descriptive permits

WRC	Sampling Point	Distance downstream (km)
Ringsfield	LTH005	12
Rumburgh	WAV056	12
Stoven	WNG030	4

4.5.1.3 WRC discharge flow

Due the nature of the descriptive permits, no measured discharge flow data for the WRC's is available. Therefore, a future DWF for each WRC was calculated based on PE data. The method for calculation has been provided in Appendix C.

4.5.1.4 Discharge Quality

Due the nature of the descriptive permits, no discharge quality sampling data for the WRC's is available. Therefore, the discharge quality sampled at the nearby Wangford WRC has been used as a surrogate data source due to it having a similar DWF to Ringsfield, Rumburgh and Stoven WRC's and therefore assumed to have similar treatment performance.

4.5.2 Results - Beccles-Marsh Lane WRC

4.5.2.1 Environmental Baseline

Beccles-Marsh Lane WRC discharges to the River Waveney. The River Waveney currently has an overall waterbody status of 'Moderate', with the alternative objective to maintain 'Moderate' status by 2021. Its current overall status is limited to Moderate due to the status of invertebrates and phosphate. The current status for ammonia is High.

As Beccles-Marsh Lane WRC discharges to the freshwater River Waveney, a range of scenarios have been modelled, as agreed with the Environment Agency, (see Appendix C for details) to check for compliance with various water quality objectives in terms of permit conditions for ammonia and phosphate. A load standstill calculation has been used to determine the future BOD permit conditions.

4.5.2.2 10% Deterioration Test

Modelling has been undertaken to take account of the increased wastewater flows from the proposed development, whilst limiting deterioration to no more than 10% of the current downstream quality[16]. The results showed that a revised (tighter) ammonia quality condition would be needed to ensure the 10% deterioration limit is adhered to. No changes need to be made to the phosphate quality condition. The tighter ammonia quality conditions can be achieved with current conventional treatment technologies (within the limits of conventional treatment) and would also ensure no deterioration in ammonia status.

4.5.2.3 WFD Compliance – No Deterioration

Further modelling has also been undertaken, taking into account increased wastewater flows from development, to determine what ammonia and phosphate quality conditions would be required to ensure no deterioration in ammonia and phosphate status (i.e. irrespective of the 10% deterioration limit). The results showed that a revised ammonia quality condition on the discharge permit would be required to ensure no deterioration in status. The revised ammonia are less stringent than those required to limit deterioration to no more than 10%, and would be considered more achievable with current conventional treatment technologies.

The results of the load standstill calculation for BOD also showed that a revised (tighter) BOD quality condition on the discharge permit would be required and would maintain the current BOD quality downstream. The tighter BOD quality condition can also be achieved with current conventional treatment technology (within limits of conventional treatment).

4.5.2.4 WFD Compliance – Achieve Future Target Status and Habitats Directive

The latest RBMP for the Anglian River Basin District states that the River Waveney does not have a target to reach Good status by 2027. It currently has an alternative objective of 'Moderate' Ecological status. The alternative objective has been set due to the need for a technically infeasible solution to resolve the less than Good status of phosphate. The Reasons for Not Achieving Good (RNAG) as outlined in the Anglian RBMP, relevant to the River Waveney have been provided in Table 11 below and a detailed explanation for the reason behind the alternative objective has been provided in Appendix F.

Table 11 Reasons for not achieving good status on the River Waveney

Category	Activity	Activity Certainty	Classification Element	Objective
Waste water treatment	Sewage discharge (continuous)	Confirmed	Phosphate	Moderate by 2021
Agriculture	Livestock field	Probable		

The River Waveney currently has high phosphorous concentrations attributable to surrounding agricultural land uses and point sources of wastewater discharge. The high nutrient concentration as a result of these activities has also had an impact on the biological quality of the waterbody, specifically on the invertebrate's communities, preventing the waterbody from achieving 'Good' Ecological status.

Despite the alternative target status for the River, modelling has been undertaken to assess the impact of growth on preventing the future 'Good' Ecological status being reached in the River Waveney for phosphate; this is largely because the target required to achieve Good Status (0.1mg/l) equates to the in-stream target for phosphate required under the HD for the Broads SAC to which the River Waveney and the discharge from the WRC flows.

The modelling has shown that future Good status and the HD target for phosphate cannot be achieved with the current discharge volumes using current conventional treatment technology. Therefore, it can be concluded that it is not growth but current limits in available technology that would prevent future Good status for phosphate or achievement of the phosphate standards required under the HD from being achieved.

[16] This is required by the Environment Agency for freshwater discharges to inform their hierarchical approach to the WFD 'no deterioration' targets used to identify indicative permits. This approach helps with consideration of the relative technical feasibility of ensuring 'no deterioration'.

4.5.2.5 Infrastructure Upgrade Requirements

To accept and treat all of the additional wastewater flow expected from development, process upgrades at Beccles WRC are likely to be required before 2036 when based on Local Plan projections, permitted headroom would be exceeded if growth scenario 2 or 3 are realised[17]. The exact technical specification of the upgrades required should be determined by AWS for the AMP7 (2020 – 2025) asset planning period, in line with revised quality conditions for ammonia, BOD and phosphate. Based on the worst case growth scenario trajectory, headroom could be exceeded by 2026 and hence investment would need to be planned prior to this point.

The future permit quality conditions detailed in Table 12 will be required to ensure deterioration is either limited to 10% of current water quality, or as a minimum, ensure no deterioration in status. To achieve these tighter permit conditions, current conventional treatment technologies would be sufficient (i.e. the quality conditions are within the limits of conventional treatment) but would need to be implemented by AWS at some point in the future. This demonstrates that a technical solution is feasible.

Table 12 Required permit quality conditions for Beccles-Marsh Lane WRC by the end of the plan period

Water Quality Parameter	Current permit quality condition	Future permit quality condition required to…		
		Limit to 10% deterioration + Ensure no deterioration in status	Ensure no deterioration in status only	Achieve future target status and Habitats Directive
BOD (mg/l 95%ile)	20	14.0		N/A
Ammonia (mg/l 95%ile)	20	7.8	15.5	N/A
Phosphate (mg/l annual average)	1	1.2	8.5	Current: **0.4** Future: **0.3**

Whilst the assessment has demonstrated that current technology limits the attainment of future Good Status and the Broads SAC HD target for phosphate (and not the impact of growth), it should be noted that national trials by water companies (due to report in 2017) are demonstrating that reliable treatment levels beyond current assumptions of conventional treatment limits (0.5mg/l) are likely to be possible. Such trials are being undertaken by AWS within the Waveney District and evidence from trials is being used to evidence that permit conditions more stringent than defined by conventional treatment could be implemented in the future. If such technologies can be implemented at Beccles WRC, future WFD targets for Good Status and the required HD target could be met and there would be no limiting factor.

4.5.2.6 Phasing of Upgrades

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

Information provided in this WCS represents the first stage in providing the most up to date information for development coming forward in the plan period, and can be used by AWS to inform their investment programme (AMP7) to ensure the provision of additional capacity is planned and development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed. It is considered there is sufficient time before development comes forward within the WRC catchment for AWS to plan their investment and to deliver the necessary upgrades.

[17] Growth scenario 1 would not result in the flow permit of Beccles WRC being exceeded

4.5.2.7 Overall RAG Assessment

Beccles WRC

The development in the Beccles WRC catchment is given an Amber status based on the following requirements:

- revised quality conditions on the new permit for ammonia and BOD,
- a new ammonia and BOD quality condition for the new permit, and
- likely process upgrades at the WRC to achieve the revised quality conditions.

If the above requirements are met, it would ensure development does not compromise the WFD objective of no deterioration in status and could be achieved with current conventional treatment technologies. The requirements listed above would be necessary from 2026 (when headroom could be exceeded) to ensure development can be delivered without compromising WFD objectives. Funding for the upgrades is not required immediately and can be planned for by AWS as certainty on the quantum of development increases.

4.5.3 Ringsfield- Redisham Road WRC

4.5.3.1 Environmental Baseline

Ringsfield WRC discharges to the Lothingland Hundred River. The Lothingland Hundred River currently has an overall waterbody status of 'Moderate', with the objective to achieve 'Good' status by 2027. Its current overall status is limited to Moderate due to the 'Poor' status of fish and 'Moderate' status of dissolved oxygen. The current status for ammonia is 'High' and phosphate is 'Good'.

4.5.3.2 WFD Compliance – No Deterioration

As Ringsfield WRC discharges to the freshwater Lothingland Hundred River, two scenarios have been modelled to determine the impact of growth on the current river quality and how this might inform the necessary review of the current descriptive permit into a numerical permit with quality conditions for ammonia, BOD and phosphate.

The results in Table 13 show that the current downstream quality for each determinand is modelled to be currently at 'Bad' status, suggesting that the WRC discharge may already cause a deterioration in status for some reach of the Lothingland Hundred River. However, sampling data at the downstream sampling point located 12km downstream shows that the water quality does improve to the current WFD status.

To provide some indication of the acceptability of growth, modelling was first used to determine whether downstream quality could be maintained to within 10% of current modelled quality once additional flow from the PE increase was included in the modelling. Results in Table 13 demonstrate that the impact of growth would cause less than a 10% deterioration in water quality for each determinand (based on the assumptions detailed in Section 4.5.1).

Table 13 Current and Future effect of WRC discharge in the Lothingland Hundred River

Determinand	Current WFD status	Current WFD status threshold (mg/l)	Modelled quality downstream (current) (Mg/L)	Equivalent WFD status	Modelled quality downstream (future) (Mg/L)	Percentage Deterioration
Ammonia	High	< 0.3	9.21	Bad	9.67	5%
BOD	Moderate	5.0 – 6.5	17.01	Bad	17.47	3%
Phosphate	High	< 0.056	4.21	Bad	4.52	7%

This may still result in a significant increase in the pollutant load in the watercourse and therefore it may be necessary to implement quality conditions to ensure growth does not cause a deterioration in current WFD status at the monitoring point.

In order to determine the quality conditions that might be required of a new numerical discharge once growth is considered, an assumption was applied that the water body would need to improve on the modelled current mixing point quality of 'bad' status, to 'poor' status. The new quality conditions (Table 16) can all be achieved with current conventional treatment technologies (within the limits of conventional treatment) and would ensure no deterioration in status.

Table 14 Future discharge permit quality conditions for Ringsfield WRC

Determinand	Ensure less than 10% deterioration	Achieve future target status
Ammonia (mg/l 95%ile)	3.9	N/A
BOD (mg/l 95%ile)	12.9	N/A
Phosphate (mg/l annual average)	1.6	N/A

4.5.3.3 WFD Compliance – Achieve Future Target Status

Modelling was not required to assess the impact of growth on preventing the future target status being reached in the Lothingland Hundred River for the following reasons:

- BOD - No BOD status for the Lothingland Hundred River,
- Ammonia - Already at 'High' status, and
- Phosphate - Already at 'Good' status.

4.5.3.4 Infrastructure Upgrade Requirements

To accept and treat all of the additional wastewater flow expected from development by the end of the plan period, process upgrades at the WRC are likely to be required before 2036 when based on Local Plan projections, the current descriptive permit would need to be replaced with a numerical permit. The exact technical specification of the upgrades required should be determined by AWS for the AMP7 (2020 – 2025) asset planning period, in line with revised quality conditions for ammonia, BOD and phosphate.

4.5.3.5 Phasing of Upgrades

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

Information provided in this WCS represents the first stage in providing the most up to date information for development coming forward in the plan period, and can be used by AWS to inform their investment programme (AMP7) to ensure the provision of additional capacity is planned and development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed. It is considered there is sufficient time before development comes forward within the WRC catchment for AWS to plan their investment and to deliver the necessary upgrades.

4.5.4 Rumburgh- Abbey Farm WRC

4.5.4.1 Environmental Baseline

Rumburgh WRC discharges to The Beck. The Beck currently has an overall waterbody status of 'Moderate', with the objective to achieve 'Moderate' status by 2021. Its current overall status is limited to 'Moderate' due to the 'Moderate' status of invertebrates, 'Moderate' status of phosphate and 'Bad' status of dissolved oxygen. The current status for ammonia is 'Good'.

4.5.4.2 WFD Compliance – No Deterioration

As Rumburgh WRC discharges to a freshwater watercourse, two scenarios have been modelled to determine the impact of growth on the current river quality and how this might inform the necessary review of the current descriptive permit into a numerical permit with quality conditions for ammonia, BOD and phosphate.

The results in Table 15 show that the current downstream quality for each determinand is modelled to be currently at 'Bad' status, suggesting that the WRC discharge may already cause a deterioration in status for some reach of the Lothingland Hundred River. However, sampling data at the downstream sampling point located 12km downstream shows that the water quality does improve to the current WFD status.

To provide some indication of the acceptability of growth, modelling was first used to determine whether downstream quality could be maintained to within 10% of current modelled quality once additional flow from the PE increase was included in the modelling. Results in Table 15 demonstrate that the impact of growth would cause less than a 10% deterioration in water quality for each determinand (based on the assumptions detailed in Section 4.5.1).

Table 15 Current and Future effect of WRC discharge in The Beck

Determinand	Current WFD status	Current WFD status threshold (mg/l)	Modelled quality downstream (current) (Mg/L)	Equivalent WFD status	Modelled quality downstream (future) (Mg/L)	Percentage Deterioration
Ammonia	Good	0.3 – 0.6	9.82	Bad	10.12	3%
BOD	Bad	> 9.0	18.11	Bad	18.32	1%
Phosphate	Moderate	0.093 – 0.219	4.82	Bad	4.97	3%

This may still result in a significant increase in the pollutant load in the watercourse and therefore it may be necessary to implement quality conditions to ensure growth does not cause deterioration in current WFD status.

In order to determine the quality conditions that might be required of a new numerical discharge once growth is considered, an assumption was applied that the water body would need to improve on the modelled current mixing point quality of 'bad' status, to 'poor' status. The new quality conditions (Table 16) can all be achieved with current conventional treatment technologies (within the limits of conventional treatment) and would ensure no deterioration in status.

Table 16 Future discharge permit quality conditions for Rumburgh WRC

Determinand	Ensure no deterioration in status	Achieve future target status
Ammonia (mg/l 95%ile)	3.7	N/A
BOD (mg/l 95%ile)	11.8	N/A
Phosphate (mg/l annual average)	1.4	N/A

4.5.4.3 WFD Compliance – Achieve Future Target Status

Modelling was not required to assess the impact of growth on preventing the future target status being reached in The Beck for the following reasons:

- BOD - No BOD status for The Beck
- Ammonia - Already at 'Good' status, and
- Phosphate - Already at 'Moderate' status (target status for phosphate).

4.5.4.4 Infrastructure Upgrade Requirements

To accept and treat all of the additional wastewater flow expected from development by the end of the plan period, process upgrades at the WRC are likely to be required before 2036 when based on Local Plan projections, the current descriptive permit would need to be replaced with a numerical permit. The exact technical specification of the upgrades required should be determined by AWS for the AMP7 (2020 – 2025) asset planning period, in line with revised quality conditions for ammonia, BOD and phosphate.

4.5.4.5 Phasing of Upgrades

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

Information provided in this WCS represents the first stage in providing the most up to date information for development coming forward in the plan period, and can be used by AWS to inform their investment programme (AMP7) to ensure the provision of additional capacity is planned and development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed. It is considered there is sufficient time before development comes forward within the WRC catchment for AWS to plan their investment and to deliver the necessary upgrades.

4.5.5 Stoven WRC

4.5.5.1 Environmental Baseline

Stoven WRC discharges to the River Wang. The River Wang currently has an overall waterbody status of 'Moderate', with the objective to achieve 'Moderate' status by 2021. Its current overall status is limited to 'Moderate' due to the 'Poor' status of fish, 'Moderate' status of phosphate and 'Moderate' status of dissolved oxygen. The current status for ammonia is 'High'.

4.5.5.2 WFD Compliance – No Deterioration

As Stoven WRC discharges to the freshwater River Wang, two scenarios have been modelled to determine the impact of growth on the current river quality and how this might inform the necessary review of the current descriptive permit into a numerical permit with quality conditions for ammonia, BOD and phosphate.

The results in Table 17 show that the current downstream quality for each determinand is modelled to be currently at 'Bad' status, suggesting that the WRC discharge may already cause a deterioration in status for some reach of the River Wang. However, sampling data at the downstream sampling point located 4km downstream shows that the water quality does improve to the current WFD status.

To provide some indication of the acceptability of growth, modelling was first used to determine whether downstream quality could be maintained to within 10% of current modelled quality once additional flow from the PE increase was included in the modelling. Results in Table 17 demonstrate that the impact of growth would cause less than a 10% deterioration in water quality for each determinand (based on the assumptions detailed in Section 4.5.1).

Table 17 Current and Future effect of WRC discharge in the River Wang

Determinand	Current WFD status	Current WFD status threshold (mg/l)	Modelled quality downstream (current) (Mg/L)	Equivalent WFD status	Modelled quality downstream (future) (Mg/L)	Percentage Deterioration
Ammonia	High	< 0.3	9.37	Bad	9.77	4%
BOD	Moderate	5.0 – 6.5	17.01	Bad	17.72	4%
Phosphate	Poor	0.222 – 1.113	4.43	Bad	4.72	7%

This may still result in a significant increase in the pollutant load in the watercourse and therefore it may be necessary to implement quality conditions to ensure growth does not cause deterioration in current WFD status.

In order to determine the quality conditions that might be required of a new numerical discharge once growth is considered, an assumption was applied that the water body would need to improve on the modelled current mixing point quality of 'bad' status, to 'poor' status. The new quality conditions (Table 18) can all be achieved with current conventional treatment technologies (within the limits of conventional treatment) and would ensure no deterioration in status.

Table 18 Future discharge permit quality conditions for Stoven WRC

Determinand	Ensure no deterioration in status	Achieve future target status
Ammonia (mg/l 95%ile)	3.9	N/A
BOD (mg/l 95%ile)	12.3	N/A
Phosphate (mg/l annual average)	1.4	N/A

4.5.5.3 WFD Compliance – Achieve Future Target Status

Modelling was not required to assess the impact of growth on preventing the future target status being reached in the River Wang for the following reasons:

- BOD - No BOD status for the River Wang,
- Ammonia - Already at 'High' status, and
- Phosphate - Already at 'Moderate' status (Target Status for phosphate).

4.5.5.4 Infrastructure Upgrade Requirements

To accept and treat all of the additional wastewater flow expected from development by the end of the plan period, process upgrades at the WRC are likely to be required before 2036 when based on Local Plan projections, the current descriptive permit would need to be replaced with a numerical permit. The exact technical specification of the upgrades required should be determined by AWS for the AMP7 (2020 – 2025) asset planning period, in line with revised quality conditions for ammonia, BOD and phosphate.

4.5.5.5 Phasing of Upgrades

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

Information provided in this WCS represents the first stage in providing the most up to date information for development coming forward in the plan period, and can be used by AWS to inform their investment programme (AMP7) to ensure the provision of additional capacity is planned and development is not delayed. Once funding has been confirmed, there will be a lead-in time for the necessary upgrades to be completed. It is considered there is sufficient time before development comes forward within the WRC catchment for AWS to plan their investment and to deliver the necessary upgrades.

4.6 Ecological Appraisal

WRCs that do not need to change their current discharge permits are not discussed in this appraisal. This is on the basis that the ecological impacts of permits that do not require change should have already been considered as part of the permitting process and/or (for European designated wildlife sites) through the Environment Agency's RoC process.

To undertake this appraisal, those WRCs that would exceed current discharge permits as a result of the need to accommodate the planned future development in their catchments were identified. The headroom assessment identified two WRCs that do not have sufficient consent headroom and as such, they would exceed their maximum permitted DWF under their existing discharge permits. A further two WRCs where descriptive consents

are likely to require conversion to a numerical consent as a result of growth, were also identified. These WRCs are:

- Beccles – Marsh Lane WRC
- Ringsfield – Redisham Road WRC
- Rumburgh – Abbey Farm WRC; and
- Stoven WRC

4.6.1 Impact on Designated Sites

Having identified the WRCs exceeding current discharge permits, the receiving watercourses for those WRCs were traced downstream from the WRC discharge location. Where a receiving watercourse enters, or passes adjacent to, a statutory or non-statutory designated wildlife site that has potential to be vulnerable to changes in hydrology (based on the available information such as citations), these are identified and discussed in the following section. The discussion relating to individual WRCs includes, where required, recommendations to ensure that future development does not adversely affect statutory or non-statutory designated wildlife sites. Where available, reasons for designation of the wildlife sites have been gathered primarily from the following sources:

- Joint Nature Conservation Committee (JNCC);
- Environment Agency;
- Natural England (NE); and
- Waveney District Council.

Non-statutory wildlife sites commonly lack specific citations which can result in difficulty in identifying the specific interest features (particularly related to the hydrological linkages). Where no citation is available and only a site name exists, an online search was undertaken to determine the key habitats present. If the online search did not identify habitats present then the precautionary principal has been used. Where it was not possible to determine if a site was hydrologically linked to the watercourse (i.e. merely in close proximity), the site was included in the discussion of the assessment as a precaution.

Following this process, seventeen statutory and nineteen non-statutory designated wildlife sites have been identified as being hydrologically connected to WRCs that are unable to meet expected development needs during the Plan period without a change to their discharge permits. All other designated sites identified within the district are remote from watercourses into which WRCs discharge treated effluent. The ecological background to the statutory designated sites, including the details of the interest features and relevant condition assessments (where available), is provided in Appendix E. Table 19 lists the wildlife sites and the relevant WRC with a hydrological linkage.

Table 19 Wildlife Sites that contain linking pathways to each relevant WRC

WRC	Wildlife Site	Comments
Beccles-Marsh Lane (discharges into the River Waveney)	North Cove Alder Carrs (County Wildlife Site)	0.5 km downstream on the River Waveney
	Broadland (SPA)	1.8 km downstream on the River Waveney
	The Broads (SAC)	1.8 km downstream on the River Waveney
	Broadland (Ramsar)	1.8 km downstream on the River Waveney
	Barnaby Broad and Marshes (SSSI)	1.8 km downstream on the River Waveney
	Share Marsh Dykes (CWS)	6.7 km downstream on River Waveney
	Oulton Marsh Dykes (CWS)	9.0 km downstream on Oulton Broad
	Sprat's Water & Marshes Carlton Colville	9.1 km downstream on Oulton Broad

WRC	Wildlife Site	Comments
	(SSSI)	
	Dairy Farm Marshes (CWS)	9.2 km downstream on Oulton Broad
	Somerleyton and Blundeston Marshes (CWS)	9.5 km downstream on River Waveney
	Brooke Yachts and Jeld-Wen Mosaic (CWS)	12.9 km downstream on Lake Lothing
	Herringfleet Marshes (CWS)	13.4 km downstream on River Waveney
	Breydon Water (Ramsar)	21.8 km downstream on the River Waveney
	Breydon Water (SPA)	21.8 km downstream on the River Waveney
	Breydon Water (SSSI)	21.8 km downstream on the River Waveney
	Halvegate Marshes (SSSI)	22.6 km downstream on the River Waveney
Ringsfield- Redisham Road (discharges into the Lothingland Hundred river)	Marsh Lane Farm Marsh (County Wildlife Site)	7.2 km downstream on the Lothingland Hundred River
	The Hundred River and Associated Dykes (CWS)	11.2 km downstream on the Lothingland Hundred River
	Kessingland Levels (CWS)	12.9 km downstream on the Lothingland Hundred River
	Pakefield to Easton Bavents (SSSI)	17.1 km downstream on the Lothingland Hundred River
	Benacre to Easton Bavents (SPA)	17.2 km downstream on the Lothingland Hundred River
	Benacre to Easton Bavents Lagoons (SAC)	17.2 km downstream on the Lothingland Hundred River
Rumburgh-Abbey Farm (discharges into River Beck which runs into the River Waveney)	Limborne Common Dykes (CWS)	13.6 km downstream on the River Waveney
	New Dyke and Shipmeadow Marshes (CWS)	33.2 km downstream on the River Waveney
	Rectory Meadow Ponds (CWS)	37.1 km downstream on River Waveney
	Broadland (SPA)	39.1 km downstream on the River Waveney
	The Broads (SAC)	39.1 km downstream on the River Waveney
	Broadland (Ramsar)	39.1 km downstream on the River Waveney
	Geldeston Meadows (SSSI)	39.1 km downstream on the River Waveney
	River Waveney (CWS)	40.1 km downstream on River Waveney
	Beccles Marshes (CWS)	40.1 km downstream on River Waveney
	Stanley & Alder Carrs (SSSI)	42.2 km downstream on the River Waveney
	North Cove Alder Carrs (CWS)	44 km downstream on River Waveney
	Barnaby Broad and Marshes (SSSI)	49.8 km downstream on the River Waveney

WRC	Wildlife Site	Comments
	Share Marsh Dykes (CWS)	50.2 km downstream on River Waveney
	Oulton Marsh Dykes (CWS)	52.5 km downstream on Oulton Broad
	Dairy Farm Marshes (CWS)	52.5 km downstream on Oulton Broad
	Somerleyton and Blundeston Marshes (CWS)	53.0 km downstream on River Waveney
	Brooke Yachts and Jeld-Wen Mosaic (CWS)	56.5 km downstream on Lake Lothing
	Herringfleet Marshes (CWS)	56.9 km downstream on River Waveney
	Sprat's Water & Marshes Carlton Colville (SSSI)	57.1 km downstream on the River Waveney
	Breydon Water (Ramsar)	69.8 km downstream on the River Waveney
	Breydon Water (SPA)	69.8 km downstream on the River Waveney
	Breydon Water (SSSI)	69.8 km downstream on the River Waveney
	Halvegate Marshes (SSSI)	70.6 km downstream on the River Waveney
Stoven (discharges into River Wang which runs into the River Blythe)	Wangford Marshes (CWS)	3.7 km downstream on the River Wang
	Minsmere-Walberswick (Ramsar)	7.0 km downstream on the River Wang
	Minsmere-Walberswick (SPA)	7.0 km downstream on the River Wang
	Minsmere-Walberswick Heaths and Marshes (SSSI)	7.0 km downstream on the River Wang
	Reydon Marshes (CWS)	9.0 km downstream on the River Blythe
	Minsmere-Walberswick Heaths and Marshes (SAC)	10.1 km downstream on the River Blythe
	Havenbeach Marshes (CWS)	11.2 km downstream on the River Blythe
	Walberswick Saltmarsh (CWS)	11.2 km downstream on the River Blythe

The internationally important wildlife sites that are geographically close to this part of the District include:

- Broadland (SPA and Ramsar site) and The Broads (SAC) which receive water from watercourses connected to both the Beccles – Marsh Lane and Rumburgh – Abbey Farm WRC (although the latter WRC is nearly 40km upstream).
- Benacre to Easton Bavents SPA and Benacre to Easton Bavents Lagoons SAC which receive water from watercourses connected to Ringsfield – Redisham Road WRC.
- Minsmere-Walberswick SPA and Ramsar and Minsmere-Walberswick Heath and Marshes SAC which receive water from watercourses connected to Stoven WRC.
- Breydon Water SPA and Ramsar are north of the Waveney District boundary however these internationally designated sites receive water from watercourses connected to both the Beccles – Marsh Lane and Rumburgh – Abbey Farm WRC.

All four of these WRCs would contribute nutrients to watercourses which drain into internationally designated wildlife sites which are hydrologically connected to watercourses downstream of discharge locations. Of these, the most significant connectivity is Beccles-Marsh Lane WRC, being 1.8km upstream of Broadland SPA and Ramsar site and The Broads SAC.

4.6.2 Effects of Nutrient Inputs upon Ecological Receptors

Designated wildlife sites identified in Table 19 are in general, either freshwater aquatic habitats, terrestrial habitats that are influenced by inundation from freshwater riverine environments. In the case of some non-statutory sites where information is lacking, they have been included because it cannot be confirmed that they are not influenced by discharged flood waters.

This section discusses the potential impacts of modelled determinands (BOD, ammonia and phosphate) on freshwater aquatic habitats, terrestrial habitats influenced by riverine conditions and their associated flora and fauna.

4.6.2.1 Biochemical Oxygen Demand (BOD)

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

4.6.2.2 Ammonia

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

Nitrification of ammonia results in increased nitrogen in freshwater environments. Nitrogen is a growth-limiting nutrient in terrestrial and marine environments, although generally not in freshwater. Elevated levels of nitrogen can result in increased plant growth of those plant species that can readily take advantage of increased levels of nitrogen, outcompeting less competitive plant species, thus potentially altering the species composition of a site.

4.6.2.3 Phosphate

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

4.6.3 Beccles-Marsh Lane WRC

Water quality modelling has identified that development proposals within this WRC catchment will result in an exceedance of the consented effluent discharge volume. Modelling has shown that the increase in flow will require water quality permit conditions to be more stringent for ammonia to avoid additional load affecting the WFD status of the water body. Changes to phosphate water quality permit conditions will not be required, and as such are not discussed further in relation to ecological impact.

This WRC discharges into the River Waveney. Downstream of the discharge point by 0.5km the River Waveney flows past the North Cove Alder Carrs CWS. Alder Carrs are wet woodlands which are generally waterlogged and therefore likely to be regularly flooded by the River Waveney. The River Waveney also flows past and through several SSSI and CWS which are designated for their marshland habitats (see Table 17) between 1.8km and 22.6km downstream of the discharge point. Given the nature of these habitats and their geographic location they are also likely to be hydrologically connected to the River.

The River Waveney flows through Broadland SPA and Ramsar site and The Broads SAC at 1.8km downstream of the discharge point. The Broads SAC and Broadland Ramsar site are designated for their interlinked mosaic of wetland habitats including open water, reed beds, carr woodland, fens, mires, bogs and grazing marsh all of which will be hydrologically linked to the River Waveney via a complex network of channels. The Broadland SPA and Ramsar are also designated for breeding and wintering bird populations including breeding bittern (*Botaurus*

stellaris) and marsh harrier (*Circus aeruginosus*); they are also designated for the sheer number of waders and waterfowl that they support. Breydon Water SPA and Ramsar are also designated for their breeding and wintering wader and water fowl populations including breeding common tern (*Sterna hirundo*) and wintering Bewick's swan (*Cygnus columbianus bewickii*) as well as supporting a very large number of wintering waterfowl. Breydon Water SPA and Ramsar site are both located 21.8km downstream of the discharge point.

The Environment Agency's Stage 3 RoC reports for The Broads SAC and Broadland SPA and Ramsar site indicated that the features for which these sites are designated (see Appendix E) are likely to be affected by wastewater discharge (in combination from water resource permissions). This is due to the sensitivity of the flora and fauna within the sites. The Broads SAC has a specific phosphate concentration standard (0.1 mg/l) that must be achieved in order to protect the site and Beccles-Marsh Lane WRC is sufficiently close to this international site that the ability of the works to meet this discharge standard is a significant consideration.

Breydon Water SPA/Ramsar site is theoretically vulnerable to increased nutrient loading. However, this particular works is physically small and located 20km upstream. There are thus large dilution factors involved and the SPAs on the Suffolk coast are generally less susceptible to smothering macroalgal blooms which cause problems in some other coastal SPAs due to a combination of low water temperature, high wave action and high sediment loading reducing light penetration. Therefore in the east coast estuaries the algal growth rate is generally sufficiently low, and the breakup of the mats over winter sufficiently high, that the problem does not arise except in some sheltered bays. As such, it is considered that The Broads SAC/Broadland SPA and Ramsar site are likely to be much more vulnerable to discharge from this WRC than Breydon Water SPA/Ramsar site, even in combination.

Modelling undertaken for this WCS has shown that a more stringent ammonia quality condition would be required to ensure no significant deterioration (i.e. no more than 10%) in downstream water quality. This can be achieved with current conventional treatment technologies. Revised quality conditions to ensure no deterioration in overall ammonia WFD status are less stringent than those required for no more than 10% deterioration and would thus be achievable within current conventional treatment limitations. In addition to ammonia, tighter BOD quality conditions will also be required to maintain current quality.

The Broads SAC, to which the WRC and the Waveney flows into, has an in-stream phosphorus target required by the HD target of 0.1mg/l which, for this water body at this location, equates to a "Good" Ecological status under the WFD. The Waveney currently has high phosphorous concentrations attributed to surrounding agricultural land uses and point source wastewater discharge, which has prevented the waterbody reaching "Good" Ecological status and hence also from achieving the HD target. Modelling has shown that this more stringent in river target would require a discharge quality of 0.4 mg/l when considering current discharge volumes which cannot be achieved using current conventional treatment technologies (limited to a quality of 0.5 mg/l). Therefore, current technology limits the attainment of the HD target (and WFD Good Status target) and not growth. Modelling has shown that growth would require a slightly more stringent discharge quality of 0.3 mg/l.

However, current national trials which include locations within the Waveney District (as referenced earlier in this report), are demonstrating that treatment levels beyond current conventional treatments are likely to be possible in the near future (below 0.3 mg/l). This would allow both the current discharge volumes and future discharge volumes to discharge at the required quality meaning growth would not be a key factor in preventing the HD target and WFD Good Status target being met.

To ensure that the planned level of development within the catchment of Beccles-Marsh Lane WRC does not result in an adverse in combination effect upon the integrity of The Broads SAC and Broadland Ramsar site, it is recommended that growth at this WRC is phased to ensure sufficient time for new treatment technologies to be installed at the WRC to treat to the required quality.

With regard to sites below the internationally important tier, the fact that no deterioration downstream can be achieved within the limits of current technology (and that a deterioration of less than 10% can also be achieved) provides adequate protection to the designated sites given the distances between these sites and the WRC. It is, however, recommended that policy is included within the Local Plan to ensure that for the necessary treatment process/infrastructure is in place prior to the delivery of new development.

If tighter ammonia and BOD quality control limits are adhered to and phased improvements are carried out at the WRC to ensure phosphorous targets required by the Habitats Directive are not affected by growth, it is unlikely that the increase in housing over the plan period will significantly negatively affect the designated sites downstream of the WRC.

4.6.4 Ringsfield – Redisham Road WRC

Modelling has identified that planned development within this WRC catchment will result in an exceedance of the consented effluent discharge volume. Modelling has shown that the increase in flow will increase the quantity of Ammonia, BOD and Phosphate in the waterbody unless quality conditions on the permit are altered.

Ringsfield WRC discharges into the Lothingland Hundred River. This river flows past Marsh Land Farm Marsh CWS 7.2km downstream of the discharge point. This wildlife site is designated due to its species rich wet grassland and is likely hydrologically connected to the River. Approximately 11.2km and 12.9km downstream of the discharge point are the Hundred River and Associated Dykes CWS and Kessingland Levels CWS; these sites are designated for their wetland and aquatic flora including grazing marsh. Kessingland Levels is also host to populations of Norfolk Hawker dragonfly (*Aeshna isoceles*) which is sensitive to river pollution.

Benacre to Easton Bavents SPA and Benacre to Easton Bavents Lagoons SAC are located 17.2km downstream of the discharge point. The SPA is designated for breeding populations of bittern, little tern (*Sterna albifrons*), and marsh harrier and the SAC is designated for coastal percolation lagoons which range in salinity from freshwater to fully saline and supports a number of specialist lagoon species. Percolation lagoons are formed through natural coastal processes when a shingle bank accretes in front of a depression allowing freshwater to accumulate in the depression but with varying saline influence from percolation through the shingle. The Hundred River has a (pumped) outfall at Benacre Dunes approximately 200m north of one of the lagoons (The Denes). It is understood that this lagoon was originally a pit created by gravel extraction. Although the southern three lagoons in the SAC (Benacre Broad, Covehithe Broad and Easton Broad) all receive some freshwater input from the local ditch and channel networks, it is understood that The Denes does not[18]. Presumably its freshwater input derives from rainfall. Therefore, there appears to be no mechanism for water quality in the Hundred River to influence water quality in this lagoon.

The breeding marsh harrier and bittern of the SPA are unlikely to be sensitive to small changes in nutrients although large changes could affect their habitat structure and (for the bittern) their food source. Moreover, it is understood that the SPA at the point the river discharges consists primarily of shingle and sand dune rather than heathland or marsh. The fenland habitats of relevance to the bittern and marsh harrier are understood to be much further south. The terns of the SPA breed in the shingle and feed by plunge diving at sea. They are unlikely to be affected by nutrient levels in the river which drains into the SPA through being pumped over the defences and onto the shingle beach. Therefore it is considered that there is also no realistic mechanism for discharge from Ringsfield-Redisham Road WRC to affect the SPA.

The overall waterbody status for the Lothingland Hundred River is currently “Moderate” with “Good” status to be achieved by 2027. The status for ammonia is currently “High” and “Good” for phosphate.

Modelling undertaken for this WCS has shown that a more stringent ammonia quality condition would be required to ensure no significant deterioration (i.e. no more than 10%) in downstream water quality. This can be achieved with current conventional treatment technologies. Revised quality conditions to ensure no deterioration in overall ammonia WFD status are less stringent than those required for no more than 10% deterioration and would be achievable within current conventional treatment limitations. In addition to ammonia, tighter BOD quality conditions will also be required to maintain current quality. Modelling for growth has therefore determined that downstream quality could be maintained within the 10% of current modelled quality.

If tighter quality control limits are put in place for all determinands and phased improvements are carried out over the plan period to ensure no deterioration in current status then it is unlikely that the increase in housing will negatively affect designated sites downstream of the WRC.

4.6.5 Rumburgh – Abbey Farm WRC

Modelling has identified that planned development within this WRC catchment will result in an exceedance of the effluent discharge volume. Modelling has shown that the increase in flow will increase the quantity of Ammonia, BOD and Phosphate in the waterbody.

This WRC discharges into The Beck which eventually flows into the River Waveney and past the Beccles – Marsh Lane WRC. The Beccles – Marsh Lane WRC discharges approximately 43.5km downstream of the

[18] Source: Natural England Site Improvement Plan for the SAC

Rumburgh – Abbey Farm WRC. The first county wildlife site after the discharge point at Rumburgh – Abbey Farm is Limborne Common Dykes CWS which is located 13.6km downstream on the River Waveney, no citation information is available on this site, but likely consists of water filled ditches and aquatic flora and fauna. Grazing meadows and marshes are also present along the River Waveney; these include New Dyke and Shipmeadow Marshes CWS (33.2 km downstream), Beccles Marshes CWS (40.1 km downstream) and Geldeston Meadows SSSI at 39.1 km downstream. Geldeston Meadows is a traditional floor plain grazing meadow and is maintained by a high water-table throughout the year. These conditions have led to the development of diverse plant communities. Stanley & Alder Carrs SSSI is located 41.2km downstream of the discharge point. The SSSI is designated for its alder carr wet woodland habitat and is the largest extent of regularly flooded woodland within the Waveney valley, therefore is hydrologically connected to the river and may be affected by changes in water quality. Further European, nationally and county designated sites along the River Waveney have also been discussed within section 1.3.1.1. Beccles – Marsh Lane WRC.

The overall waterbody status for The Beck is “Moderate” with an alternative objective of “Moderate” status by 2021. The water body is currently achieving a status of “Moderate” for phosphate, “Good” for ammonia and “Bad” for dissolved oxygen.

Modelling for growth has determined that downstream quality could be maintained within the 10% of current modelled quality using conventional treatment technologies. It is understood that a tightening of consent limits to achieve an improvement in WFD classification would be possible within the limits of conventional treatment, although upgrades within the WRC will be required before the end of the plan period in order to ensure no deterioration in status.

If tighter quality control limits are put in place for all determinands and phased improvements are carried out over the plan period to ensure no deterioration in current status then it is unlikely that the increase in housing will negatively affect designated sites downstream of the WRC.

4.6.6 Stoven WRC

Modelling has identified that planned development within this WRC catchment will result in an exceedance of the effluent discharge volume. Modelling has shown that the increase in flow will increase the quantity of Ammonia, BOD and Phosphate in the water body.

Stoven WRC discharges into the River Wang, which eventually flows into the River Blythe. Wangford Marshes CWS is located 3.7 km downstream of the discharge point. The site comprises marshland flora and is likely hydrologically connected to surface water from the river.

Minsmere-Walberswick SPA, SAC and Ramsar site is 7 km downstream of the discharge point and is designated for its extensive wetland habitats which include dykes, reed beds, mudflats and lagoons among other habitats including shingle and driftline, woodland and areas of lowland heath. The site also demonstrates a nationally rare transition in grazing marsh ditch plants from brackish to freshwater. The habitats are connected hydrologically to the surface water from the River Blythe and therefore may be affected by changes in water quality. The site also supports a range of nationally scarce plants and invertebrates which may be sensitive to changes in water quality. The SPA is designated for breeding avocet (*Recurvirostra avosetta*), bittern, little tern, marsh harrier, nightjar (*Caprimulgus europaeus*) and woodlark (*Lullula arborea*) as well as wintering hen harrier (*Circus cyaneus*). The breeding marsh harrier, bittern and avocet of the SPA are unlikely to be particularly sensitive to small changes in nutrients although large changes could affect their habitat structure and (for the bittern) their food source. The terns of the SPA will breed in the shingle and feed by plunge diving at sea. They are unlikely to be affected by nutrient levels in the river which drains into the site. The nightjar and woodlark interest of the SPA will be unaffected by changes in fluvial water quality. Despite its name the international interest features of the SAC are strandline vegetation, dry heathland and stony banks, none of which are hydrologically sensitive to fluvial sources. The SPA and SAC are unlikely to be affected by water quality in the river; however, the Ramsar interest features could be affected.

The River Wang has an overall status of “Moderate” with an alternative objective of “Moderate” by 2021 (i.e. no improvement in status is expected to be possible). The waterbody is currently achieving a status of “Moderate” for phosphate, “High” for ammonia and “Moderate” for dissolved oxygen.

Modelling for growth has determined that downstream quality could be maintained within the 10% of current modelled quality although upgrades within the WRC will be required before the end of the plan period in order to deliver this as well as ensuring no deterioration in status.

If tighter quality control limits are put in place for all determinands and phased improvements are carried out over the plan period to ensure no deterioration in current status then it is unlikely that the increase in housing will negatively affect designated sites downstream of the WRC.

4.6.7 Ecological Opportunities Associated with Proposed Development Locations

To ensure that the planned level of development within the Plan period does not result in a negative impact upon wildlife 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 and water quality at these locations will be improved to suitable WFD levels and permit levels. This may include the requirement for new infrastructure to be in place prior to the delivery of new development or the need for phased infrastructure to ensure that the WRCs can accommodate the increased capacity and not result in a detrimental impact upon wildlife features.

Further to recommended policy, it is also recommended that where ecological risks resulting from proposed water cycle changes have been identified, these 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.

4.7 Wastewater Summary

There is sufficient permitted headroom capacity in all WRCs to accommodate growth scenario 1. For growth scenario 2, Beccles-Marsh Lane WRC would require a new permit and likely process upgrades, and in growth scenario 3, Beccles-Marsh Lane WRC in addition to Ringsfield- Redisham Road, Rumburgh-Abbey Farm, and Stoven WRC would require a new permit and potential infrastructure upgrades to accommodate growth. The four WRCs which are shown to exceed their volumetric permits in scenarios 2 or 3 have undergone water quality modelling. The results demonstrate that there is environmental capacity for the proposed options for growth as long any required process upgrades are undertaken.

Therefore, from a WFD and a HD perspective there is capacity to accept growth 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 will improve over time and evidence from national trials is that significant improvements in phosphate treatment are likely in the near future. Subsequently, capacity for additional wastewater flow would need to be reconsidered in the context of achieving good status (and HD targets) up to the end of the plan period and beyond. Table 20 provides a summary of the RAG assessment of the WRCs within the District which have been assessed for water quality and environmental capacity.

Table 20 Summary of water quality assessment for WRC requiring new discharge permits

WRC	Watercourse	Is Headroom available?	Is a revised quality condition required?		Limit deterioration to 10% or less?	No Status deterioration?	Overall RAG
Beccles-Marsh Lane	River Waveney	Growth scenario 1 – Yes. Growth scenarios 2 and 3 – headroom only up to 1290 dwellings.	Ammonia	Yes	Yes	Yes	Treatment process upgrades will be required from 2021 using conventional treatment technologies to meet river quality targets. Permit setting recommended for phosphate. No likely impact on designated ecological sites.
			BOD	Yes	Yes	Yes	
			Phosphate	Yes	Yes	Yes	
Ringsfield-Redisham Road	Lothingland Hundred River	Growth scenarios 1 and 2 – Yes. Growth scenario 3 – PE will exceed 250.	Ammonia	Yes	Yes	Yes	Treatment process upgrades likely to be required by end of plan period using conventional treatment technologies to meet river quality targets. Permit setting recommended for ammonia, BOD and phosphate. No likely impact on designated ecological sites.
			BOD	Yes	Yes	Yes	
			Phosphate	Yes	Yes	Yes	
Rumburgh-Abbey Farm	The Beck	Growth scenarios 1 and 2 – Yes. Growth scenario 3 – PE will exceed 250.	Ammonia	Yes	Yes	Yes	Treatment process upgrades likely to be required by end of plan period using conventional treatment technologies to meet river quality targets. Permit setting recommended for ammonia, BOD and phosphate. No likely impact on designated ecological sites.
			BOD	Yes	Yes	Yes	
			Phosphate	Yes	Yes	Yes	
Stoven	River Wang	Growth scenarios 1 and 2 – Yes. Growth scenario 3 – PE will exceed 250.	Ammonia	Yes	Yes	Yes	Treatment process upgrades likely to be required by end of plan period using conventional treatment technologies to meet river quality targets. Permit setting recommended for ammonia, BOD and phosphate. No likely impact on designated ecological sites.
			BOD	Yes	Yes	Yes	
			Phosphate	Yes	Yes	Yes	

5. Water Supply Strategy

5.1 Introduction

Water supply for the study area is provided by ESW. 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 Catchment Abstraction Licensing Strategy. The study area falls within the Broadland and East Suffolk CAMS area (see Figure 7) therefore both management strategies have been used for this report.

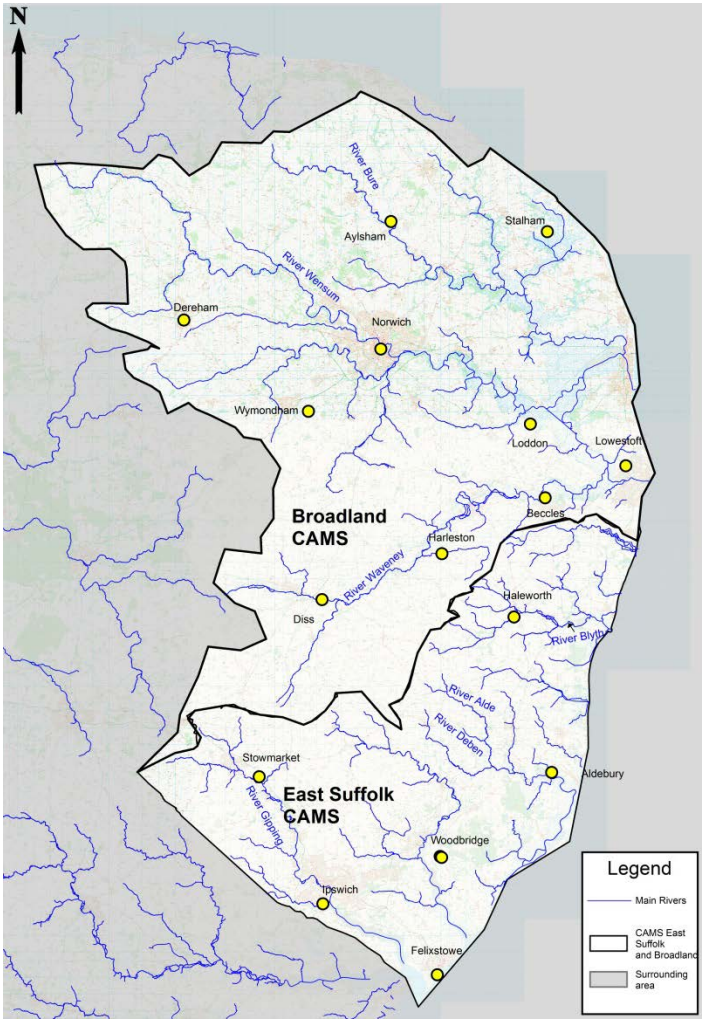

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Figure 7 CAMS areas in Waveney

This study has also used Essex and Suffolk Water (ESW) 2015 WRMP[19] 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 ESW's WRMP.

5.2 Abstraction Licensing Strategies

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

[19] Essex and Suffolk Water Final Water Resource Management Plan (2015) https://www.eswater.co.uk/_assets/documents/ESW_Final_Published_PR14_WRMP_Report_-_V3_-_08OCT14.pdf

- 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 21. 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 21 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 22.

Table 22 Resource availability classification

River – WRMU	CAMS Area	Surface Water (flow exceedance scenarios)			
		Q30	Q50	Q70	Q95
AP15- River Waveney (Billingford)	Broadland				
AP16- River Dove Red Bridge					
AP17- Lower River Waveney Shipmeadow					
AP1- Lothingland Hundred	East Suffolk				
AP2-River Wang Wangford GS					
AP3- River Blyth Blyford Bridge					

All rivers are defined as having restricted or no water available for licencing during periods of low flow (Q70-Q95). All the sites have some availability of water during higher flow. This analysis indicates that there is potential for local abstractions at all the sites during periods of high flow and in the southern part of the District, there may be water available for abstraction at average to low flows. This may be beneficial to supplying water resources locally.

5.3 Water Resource Planning

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

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 ESWL's Final 2014 WRMP it has been established that the growth figures assessed for this WCS study are catered for in the 2040 prediction of supply and demand deficits in the relevant WRZs under average conditions. Therefore, conclusions on available water supply from ESWL's Final 2014 WRMP can be used directly in this study to inform and support the Local Plan.

5.4.1 Demand for Water

The Waveney District falls within the Northern Central WRZ in the Suffolk supply area. Approximately 70% of the water supplied in the Northern/Central WRZ is sourced from surface water, and 30% sourced from groundwater in the south of the WRZ. Surface Water is provided from the following sources the River Waveney, the River Bure, Ormesby Broad, Lound Ponds and Fritton Lake. A map of the WRZ is shown in Figure 8.

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Figure 8 Essex and Suffolk Water Northern Central WRZ

The water available for use (WAFU) is projected to decrease during the course of the planning period due to the effects of climate change on the River Waveney abstraction. At the end of a dry year, the balance of supply with target headroom ranges from 14.60 Ml/d in 2014/15 to 6.14 Ml/d in 2034/2035. The balance of supply for the weighted annual average planning scenario in 2014/2015 was 14.879 Ml/d (including headroom). This decreases to 6.253 in 2034/5 (including headroom). This indicates that there is a predicted surplus in water supply for the resource zone therefore there will be enough water to meet demand during the plan period.

5.5 Water Efficiency Plan

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

Proposed demand management measures across both WRZs include:

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

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

5.5.1 Drivers and Justification for Water Efficiency

In 2013, some parts of the ESW supply area were classified by the Environment Agency as an 'Area of serious water stress' based on a 'Water Exploitation Index' as derived by the European Environment Agency. Part of this classification is based on climate change effects as well as increases in demand driven by Local Plan growth targets. This creates a very strong driver for new homes in the next 25 years to be made as efficient as economically possible to safeguard the future resources to be made available by ESW in the District.

It is predicted that climate change will further reduce the available water resources in the study area. Rainfall patterns are predicted to change to less frequent, but more extreme, rainfall events. ESW have recognised the risk climate change poses to the three crucial areas of their business, abstraction, treatment and distribution of water. Customers expect ESW 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.

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. ESW have accounted for the impact on the peak demand and the longer duration effect of a dry year through forecasting the increased demand of water and accounting for it in their plans.

Although ESW have planned for the anticipated impacts of climate change, the view of ESW and other water companies is that, in order to manage the effects of climate change effectively, the single most cost effective step in water resources climate change resilience is to manage demand downwards. The reduction in demand will also help to reduce carbon emissions which aids in reducing impacts of climate change. Planning policy has a significant role to play in helping to achieve this.

5.6 Water Neutrality

Water neutrality is a concept whereby the total demand for water within a planning area after development has taken place is the same (or less) than it was before development took place[20]. 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.

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.

5.6.1 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[21]. Generally, these measures fall into two categories due to cost and space constraints, as those that should be installed in new developments and those which could be retrofitted. Appendix D provides more detail on the different types of device or system along with the range of efficiency savings they could lead to.

[20] Water Neutrality is defined more fully in the Environment Agency report 'Towards water neutrality in the Thames Gateway' (2007)
[21] Source: Water Efficiency in the South East of England, Environment Agency, April 2007.

5.6.2 Achieving Total Neutrality – is it feasible?

When considering neutrality within an existing planning area, it is recognised by the Environment Agency[22] 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 four water neutrality targets and sets out a 'pathway' for how the most likely target (or level of neutrality) can be achieved. Appendix D discusses the pathway concept in more detail, and highlights the importance of developing local policy in the study area for delivering aspirations like water neutrality as well as understanding the additional steps required beyond 'business as usual' required to achieve it.

5.6.3 Metering Assumptions

Installing water meters within existing residential properties is an important element of ESW's WRMP to manage their customers' demand for water. ESW's metering programmes as described in the WRMP has been applied to the four water neutrality scenarios and details the level of additional metering that could be undertaken.

The existing level of metering within the ESW WRZs is 65%. A projection has been made within the ESW WRMP for the end of the Local Plan period (2036), with a target of 75% meter penetration by 2036.

5.6.4 Water Neutrality Scenarios

5.6.4.1 Very High Scenario

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

The key assumptions for this scenario are that water neutrality is achieved; however it is considered as aspirational only as it is unlikely to be feasible based on existing research into financial viability of such high levels of water efficiency measures in new homes.

It would require:

- Meter installation into all existing residential properties (100% meter penetration);
- A significant funding pool and a specific joint partnership 'delivery plan' to deliver the required extremely high percentage of existing homes to be retrofitted with efficiency measures (+30% of homes);
- Strong local policy within the Local Plan on restriction of water use in new homes on a local authority scale which is currently unprecedented in the UK; and
- All new development to include water recycling facilities across the District.

5.6.4.2 High Scenario

The key assumptions for this scenario are that a high water neutrality percentage[23] is achieved but requires significant funding and partnership working, and adoption of new local policy which is currently unprecedented in the UK.

It would require:

- Meter installation up to the maximum planned (up to 2040) as per ESW WRMP by 2036 (75% meter penetration);
- Uptake of retrofitted efficiency measures to be very high (20% of existing housing stock);

[22] Environment Agency (2009) Water Neutrality, an improved and expanded water management definition
[23] WN percentage refers to the percentage of water use savings made by various measures against the total new demand if the business as usual demand were to continue

- A significant funding pool and a specific joint partnership 'delivery plan' to deliver the high percentage of retrofitting measures required; and,
- All new development would need to include rainwater harvesting.

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

5.6.4.3 Medium Scenario

The key assumptions for this scenario are that the water neutrality percentage[23] achieved is at least 50% of the total neutrality target and would require funding and partnership working, and adoption of new local policy which has only been adopted in a minimal number of Local Plans in the UK.

It would require:

- Meter installation estimated as a linear projection between 2016 and 2040 ESW WRMP figures (75% meter penetration by 2036);
- New housing development should go beyond mandatory Building Regulations requirements, to 110 l/h/d optional Building Regulations requirements;
- Uptake of retrofitting water efficiency measures to be reasonably high (15% of existing housing stock) in the District; and
- A significant funding pool and a specific joint partnership 'delivery plan' to deliver the high percentage of retrofitting measures required.

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

5.6.4.4 Low Scenario

The key assumptions for this scenario are that the water neutrality percentage[23] achieved is low but would require small scale level of funding and partnership working, and adoption of new local policy which is likely to be easily justified and straightforward for developers to implement.

It would require:

- Meter installation estimated as a linear projection between 2016 and 2040 ESW WRMP figures (75% meter penetration by 2036);
- New housing development should meet mandatory Building Regulations requirements;
- Uptake of retrofitting water efficiency measures to be fairly low (10% of existing housing stock); and
- A relatively small funding pool and a partnership working not moving too far beyond 'business as usual' for stakeholders.

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

5.6.5 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 18.13 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[24], 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 D).

For each neutrality scenario, total demand was calculated at three separate stages for housing as follows:

- Stage 1 – total demand post growth without any assumed water efficiency retrofitting for the differing levels of water efficiency in new homes;
- Stage 2 – total demand post growth with effect of metering applied for the differing levels of water efficiency in new homes; and,
- Stage 3 – total demand post growth with metering and water efficient retrofitting applied to existing homes. The percentage of uptake that is required to achieve 100% water neutrality for the differing levels of water efficiency in new homes. If neutrality is achieved, the result is displayed as green. If it is not, but is within 10%, it is displayed as amber. The results are provided in Table 23.

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

Table 23 Results of the Neutrality Scenario Assessments

Neutrality Scenario	New homes consumption rate (l/h/d)	Demand from Growth (Ml/d)	Total demand post growth* (Ml/d)	Total demand after metering (Ml/d)	Total demand after metering & retrofitting (Ml/d)	% of existing properties to be retrofitted	Percentage of neutrality
Baseline	149	3.11	21.24	**21.17**	**21.17**	0	**2%**
Low	125	2.62	20.74	**20.67**	**20.38**	10	**28%**
Medium	110	2.31	20.43	**20.36**	**19.62**	15	**52%**
High	80	1.69	19.81	**19.74**	**18.43**	20	**90%**
Very High	62	1.31	19.44	**19.20**	**17.56**	25	**118%**

5.6.6 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 24. It should be noted that these are only estimated costs based on strategic level research into water efficiency implementation and cost.

Table 24 Estimated Cost of Neutrality Scenarios for Scenario 1 and 2

Neutrality Scenario	New Homes		Existing Properties				Costs Summary		
	No.	Efficiency cost	Metering cost	Population Retrofit %	No. to retrofit	Retrofit cost	Developer	Non developer	Total
Low	9,403	-	£ 6,451,875	10%	5,161	£ 258,075	-	£ 6,709,950	£ 6,709,950
Medium	9,403	£ 84,627	£ 6,451,875	15%	7,742	£ 1,4171,028	£ 84,627	£ 7,922,903	£ 8,007,530
High	9,403	£ 25,359,891	£ 6,451,875	20%	10,323	£ 2,271,060	£ 25,359,891	£ 8,722,935	£ 34,082,286
Very High	9,403	£ 38,524,091	£ 6,451,875	25%	12,904	£ 2,838,825	£ 38,524,091	£ 9,290,700	£ 47,814,791

5.6.7 Preferred Strategy – Delivery Pathway

The assessment of water neutrality in this WCS has been undertaken to demonstrate whether moving towards neutrality is feasible and what the cost, and technological implications might be to get as close to neutrality as possible.

To achieve any level of neutrality, a series of policies, partnership approaches and funding sources would need to be developed. This WCS has assumed a 'medium' scenario would be favoured and sets out what would be required to support this strategy. This 'medium' WN scenario would allow a WN target of 52% to be reached if metering were to occur in line with the proposed ESW strategy. The medium scenario is considered to require a significant funding pool and a specific joint partnership 'delivery plan' to deliver the high percentage of retrofitting measures, as well as the adoption of new local policy within the Local Plan on restriction of water use in new homes on a District scale which goes beyond that seen generally in the UK. It would require:

- Meter installation estimated as a linear projection between 2016 and 2040 AWS WRMP figures (75% meter penetration by 2036);
- New housing development would not to go beyond mandatory Building Regulations requirements, to 110 l/h/d optional Building Regulations requirements;
- Uptake of retrofitting water efficiency measures to be reasonably high (20% of existing housing stock) in the District; and
- A significant funding pool and a specific joint partnership 'delivery plan' to deliver the high percentage of retrofitting measures required.

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

Depending on the success of the first step to neutrality, higher WN scenarios could be aspired to by further developing policies and partnership working to deliver greater efficiencies.

5.6.8 Delivery Requirements – Policy

In order to meet the medium water neutrality target scenario given above, specific planning policy will be required and recommendations are presented in Appendix D.

When considering planning applications for new development (regardless of size), the planning authority and statutory consultees would need to consider whether the proposed design of the development has incorporated water efficiency measures to try to limit water use to 110 l/h/d (optional Building Regulations requirements), including (but not necessarily limited to) garden water butts, low flush toilets, low volume baths, aerated taps, and water efficient appliances.

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

5.6.9 Delivery Requirements – Partnership Approaches

Housing association partners could be targeted with a programme of retrofitting water efficient devices, to showcase the policy and promote the benefits. This could be a collaborative scheme between Waveney District Council, ESW and Waterwise. In addition, Rainwater Harvesting (RWH) or greywater recycling (GWR) schemes could be implemented into larger council owned and maintained buildings, such as schools or community centres. RWH could be introduced to public toilets.

The retrofitting scheme could then be extended to non-Council owned properties, via the promotion and education programme.

A programme of water audits could be carried out in existing domestic and non-domestic buildings, again showcased by council owned properties, to establish water usage and to make recommendations for improving water efficiency measures. The water audits could be followed up by retrofitting water efficient measures in these buildings, as discussed above. In private non-domestic buildings water audits and retrofitting could be funded by

the asset owner, the cost of this could be offset by the financial savings resulting from the implementation of water efficient measures. Funding options for domestic properties are discussed above.

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

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

5.6.9.1 Responsibility

The recommendations above are targeted at Waveney District Council, and ESW, as these are the major stakeholders, although the Environment Agency and other statutory consultees can also influence future development to ensure the water neutrality target is achieved. It is therefore suggested that responsibility for implementing water efficiency policies be shared as detailed in Table 25.

Table 25 Responsibility for implementing water efficiency

Responsibility	Responsible stakeholder
Ensure planning applications are compliant with the recommended policies	Waveney District Council
Fitting water efficient devices in accordance with policy	Developers
Provide guidance and if necessary enforce the installation of water efficient devices through the planning application process	Waveney District Council
Ensure continuing increases in the level of water meter penetration	ESW
Retrofit devices within council owned housing stock	Waveney District Council
Retrofit devices within privately owned housing stock (via section 106 agreements)	Developers
Promote water audits and set targets for the number of businesses that have water audits carried out. Allocate a specific individual or team within each of the local authorities to be responsible for promoting and undertaking water audits 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.	Waveney District Council
Educate and raise awareness of water efficiency	Waveney District Council, ESW

A major aim of the education and awareness programme, as outlined by Policy Recommendation WS3 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.

5.6.9.2 Retrofitting funding options

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

Waveney District Council could consider developer contributions to the Community Infrastructure Levy (CIL) or through S106 agreements or even through development of an offset policy. Part 11 of the Planning Act 2008[25] (c. 29) ("the Act") provides for the imposition of a charge to be known CIL. This is a local levy that authorities can choose to introduce to help fund infrastructure in their area. CIL will help pay for the infrastructure required to serve new development, and although CIL should not be used to remedy pre-existing deficiencies, if the new development makes the deficiency more severe than the use of CIL is appropriate.

Section 106 (S106) of the Town and Country Planning Act 1990[26] allows a local planning authority (LPA) to enter into a legally-binding agreement or planning obligation with a landowner in association with the granting of planning permission, known as a Section 106 Agreement. These agreements are a way of delivering or addressing matters that are necessary to make a development acceptable in planning terms. They are increasingly used to support the provision of services and infrastructure, such as highways, recreational facilities, education, health and affordable housing.

However, there are considerable existing demands on developer contributions and it is unlikely that all of the retrofitting required in the District could be funded through these mechanism; they therefore need to look beyond developer contributions, possibly to the water companies, for further funding sources. Some councils offer council tax rebates to residents who install energy efficient measures (rebates jointly funded by the Council and Energy Company)[27]. Waveney District Council should consider a similar scheme, although this would require the agreement of AWS and ESW.

5.6.9.3 Retrofitting monitoring

During delivery stage, it would be important to ensure sufficient monitoring is in place to track the effects of retrofitting on reducing demand form existing housing stock. The latest research shows that retrofitting can have a significant beneficial effect and can be a cost effective way of managing the water supply-demand balance[28]. However, it is acknowledged that savings from retrofitting measures do diminish with time. This means that a long-term communication strategy is also needed to accompany any retrofit programme taken forward. This needs to be supported by monitoring, so that messages can be targeted and water savings maintained in the longer-term. The communication and monitoring message also applies to new builds to maintain continued use of water efficient fixtures and fittings.

[25] http://www.legislation.gov.uk/ukpga/2008/29/contents
[26] http://www.legislation.gov.uk/ukpga/1990/8/contents
[27] Cambridge (and surrounding major growth areas) WCS Phase 2, Halcrow, 2010
[28] Waterwise (2011): Evidence base for large-scale water efficiency, Phase II Final report

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 major development sites (sites containing more than 10 dwellings). The results are presented for each of the major development sites in Appendix G.

6.2 Site 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 combined sewer overflows (CSO) to river systems occur, resulting in ecological impact and deterioration in water quality.

As the wastewater undertaker for the District, AWS 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 AWS 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, AWS 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 AWS 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 network system using local operational knowledge for some of the potential allocation sites. The results are presented for each of the potential sites in Appendix G. A RAG assessment has been undertaken; a key indicating the coding applied to each assessment is provided in Table 26.

Table 26 Key for wastewater network RAG assessment

Development is likely to be possible without upgrades	**Pumping station or pipe size may restrict growth, or non-sewered areas, where there is a lack of infrastructure; a pre-development enquiry is recommended before planning permission is granted**	**There is limited capacity in the network, hence solution required to prevent further CSO discharges or sewer flooding – potential aimpact on phasing**

6.2.2 Flood Risk to Sites

6.2.2.1 Fluvial

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

6.2.2.2 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)[29] mapping produced by the Environment Agency.

The above site assessments have been produced to demonstrate where some sites may need specific investment in flood risk management infrastructure or mitigation and this should be considered as sites come forward via site specific Flood Risk Assessments (FRA) to support planning.

6.2.3 Infiltration SuDS Suitability

The potential for infiltration SuDS has been reviewed using the BGS Suds Suitability mapping data set. This determines whether there is a high, moderate or low potential for the use of infiltration based SuDS systems using information pertaining to Source Protection Zones, the permeability of the soils and/or underlying geology, and geohazard information such as depth to groundwater, likely ground stability and potential for pollutant attenuation.

The data has been used to present a RAG assessment of likely feasibility for infiltration SuDS at each site to inform site planning for management of surface water.

6.2.4 Main Rivers and Ordinary Watercourses Management

6.2.4.1 Main Rivers

Under the Water Resources Act, the Environment Agency is the permitting Authority for work affecting main rivers, and certain activities or works in, over, under or near a main river or a flood defence associated with a main river will need a permit. A main river is a watercourse that is shown on a main river map and includes any structure or appliance for controlling or regulating the flow of water into, in or out of the channel. For certain activities, developers need to obtain an Environmental Permit (Flood Risk Activity Permit) from the Environment Agency to ensure that their activities do not cause or make existing flood risk worse, interfere with Environment Agency work, and do not adversely affect the local environment, fisheries or wildlife.

6.2.4.2 Ordinary Watercourses

Under the Flood and Water Management Act 2010 (FWMA) Suffolk County Council (ECC) is designated the LLFA, and has a duty to lead and coordinate the management of local flood risk, which includes flood risk from ordinary watercourses.

SCC will seek to ensure that development is set back by at least 3m on one side of an Ordinary Watercourse for ongoing maintenance purposes. As of 6th April 2012 responsibility for the consenting of works by third parties on Ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010) transferred from the Environment Agency to the LLFA, SCC is now responsible for the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. This includes any works (including temporary) that will affect the cross sectional area of the channel (such as in channel structures or diversion of watercourses). It is advised that SCC is consulted early of proposed alterations.

6.2.4.3 Policy recommendations

The following policy recommendations are made with respect to sites which have a main river or ordinary watercourse flowing through or inn close proximity to the site boundary:

- Watercourses should not be culverted or straightened, as these activities cause deterioration of their quality;
- Where watercourses have in the past been culverted or straightened, reinstatement to a more natural landscape should form part of the development;
- Each development should enhance the quality of the local watercourse, and

[29] Previously referred to as the updated Flood Map for Surface Water (uFMfSW)

- For main rivers, a minimum easement of 8 meters from the top of bank of a main river is required to allow maintenance of the watercourse. For ordinary watercourses a minimum easement of 3 meters is required to allow for maintenance. Where possible a larger easement should be provided.

7. Water Cycle Strategy Recommendations and Policy

7.1 Recommendations for Policy Development

The following recommendations are made with respect to the development of policy to protect water quality and management wastewater and water supply infrastructure in a sustainable manner. This should be considered by Waveney District Council to ensure that the Waveney Local Plan considers potential limitations (and opportunities) presented by the water environment and water infrastructure on growth, and phasing of growth.

7.1.1 Wastewater

WW1 – Development and Sewerage Network

Development at sites indicated in the WCS to have potentially limited sewer network capacity (shown as Amber) should be subject to a pre-development enquiry with AWS to determine if upgrades are needed prior to planning permission being granted.

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 could 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 where possible. 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.

7.1.3 Surface Water Management and Flood Risk

SWM1 – Surface water discharge

Developers should ensure 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 should be taken.

SWM2 – SuDS and Green Infrastructure

Where possible, 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 – SuDS and Water Efficiency

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

SWM4 – 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 WFD.

7.1.4 Ecology

ECO1 – Biodiversity Enhancement

It is recommended that Waveney 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

It is recommended that key partners in the WCS maintain regular consultation with each other as development proposals progress. 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 ESW's WRMP (the next full review is due in 2019, although interim reviews are undertaken annually);
- Periodic review 2019 (PR19) (AWS' 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.

Directive/Legislation/Guidance	Description
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 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[30], 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[31]. 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.

[30] 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.
[31] UK Environmental Standards and Conditions (Phase I) Final Report, April 2008, UK Technical Advisory Group on the Water Framework Directive.

Appendix B Relevant Planning Documents to the WCS

Category	Document Name	Publication Date
Water	Environment Agency Anglian River Basin District. River Basin Management Plan	2015
Environment	Waveney District Council. Adopted Core strategy	2009
Housing	Waveney Strategic Housing Market Assessment and Objectively Assessed Housing Need Study	2016
Employment	Ipswich and Waveney Economic Areas Employment Land Needs Assessment	2016
Flood Risk	Suffolk Coastal and Waveney District Strategic Flood Risk Assessment Main Report	2008
Water	Essex & Suffolk Final Water Resource Management Plan 2015 - 2040	2014
Climate Change	United Kingdom Climate Projections 2009 (UKCP09)	2009

Appendix C WRC Capacity Assessment results

C.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 Occupancy Rate (OR) of 2.14 people per house and an average consumption of 176 l/h/d (as set out in Section 1.5);
- For WRC's with numerical permits, the WRC current discharge flows were taken as the current measured dry weather flow (DWF) (Q80) as provided by AWS. Future 2036 discharge flows were calculated by adding the volume of additional wastewater generated by new dwellings (using an OR of 2.29, a consumption value of 131l/h/d and an additional allowance of 45l/h/d for an increase in infiltration) to the current permitted DWF value;
- For WRC's with descriptive permits, the WRC current discharge flows were calculated based on the current PE as provided by AWS. Future 2036 discharge flows were calculated by adding the PE of growth predicted within each WRC catchment, then converting the future PE into the future 2036 discharge flow by multiplying the future PE by the per person consumption rate of 176 l/h/d;
- WRC current discharge quality was taken as the current permitted limits for each water quality element. Figures for the mean and standard deviation of each element were calculated based on these permit levels using RQP 2.5 software (discussed further below),
- River flow data for the RQP modelling has been provided by the Environment Agency as follows;
  - Ringsfield WRC: A combination of the Hulver Bridge gauged record and LowFlows Enterprise output for the point just upstream of the Ringsfield WRC discharge point.
  - Rumburgh WRC: LowFlows Enterprise output for the point just upstream of Rumburgh WRC (the Environment Agency then adjusted the mean flow to reflect the average annual runoff expected at the site based on the last 3 years of rainfall at the nearest rain gauge).
  - Stoven WRC: The runoff value given by LowFlows Enterprise has been used to provide an estimate for the mean flow (the Environment Agency then adjusted this value to reflect the average annual runoff expected at the site based on the last 3 years of rainfall at the nearest rain gauge).
- Raw water quality data for modelling was provided by Environment Agency water quality planners. The WFD 'no deterioration' target for each WRC are the downstream status, for each water quality element, based on river monitoring data for the most recent three years of sampling data. The mean value and standard deviation was calculated, using this raw data for BOD, ammonia and phosphate where available for both the upstream (of the WRC) and downstream (the discharge) inputs. Details are provided below along with the full results and outputs from the water quality modelling,
- The Environment Agency provided the most up to date WFD status.
- 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.

C.2 Assessment Techniques

Modelling of the quality permits required to meet the two WFD requirements has been undertaken, using RQP 2.5 (River Quality Planning), the Environment Agency's software for calculating permit conditions (with the exception of BOD for Beccles-Marsh Lane WRC where load standstill calculations were undertaken. The software is a monte-carlo based statistical tool that determines what statistical quality is required from discharges in order to meet defined downstream targets, or to determine the impact of a discharge on downstream water quality compliance statistics.

The first stage of the modelling exercise was to establish the discharge permit standards that would be required to meet 'No Deterioration'. This would be the discharge permit limit that would need to be imposed on AWS at the time the growth causes the flow permit to be exceeded. No deterioration is an absolute requirement of the WFD and any development must not result in a decrease in quality downstream from the current status. The Environment Agency require two parts to the 'No Deterioration' assessment to inform their hierarchical approach to the WFD 'no deterioration' targets used to identify indicative permits. This approach helps with consideration of the relative technical feasibility of ensuring 'no deterioration'.

The second stage was to establish the discharge permit standards that would be required to meet future Good Status under the WFD in the downstream waterbody. This assessment was only carried out for WRCs discharging to waterbodies where the current status of either the ammonia, BOD or phosphate element is less than Good (i.e. currently Moderate, Poor or Bad). This would be the discharge permit standard that may need to be applied in the future, subject to the assessments of 'technical feasibility' and 'disproportionate cost. Such assessments would be carried out as part of the formal Periodic Review process overseen by OFWAT in order to confirm that the proposed improvement scheme is acceptable.

The modelling of the descriptive consented WRC's was undertaken using the RQP monte-carlo statistical tool to determine the current and future quantity of each water quality element in the waterbody as a result of increased flow from the WRC.

C.3 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. For WRC with numerical consents, calculate the remaining permitted flow headroom at each WRC and for WRC with descriptive consents, calculate remaining PE capacity before PE would exceed 250;
4. Determine whether the growth can be accommodated within existing headroom (or PE allowance) by applying the scoping criteria detailed in Table C-1.

Table C-1 Scoping criteria

Scoped In	Scoped Out
WRCs where flow headroom (or PE of 250) is exceeded as a result of growth	WRCs where flow headroom (or 250 PE) is not exceeded as a result of growth
WRCs which already exceed their flow permit (or already treated a PE of 250) and receive any additional flow from growth	WRCs which already exceed their flow permit but do not receive any additional flow from growth[32]

C.4 Water Quality Assessment

For those WRCs which are scoped in after the headroom assessment, modelling has been undertaken to determine the new quality conditions required for each WRC discharge permit to ensure:

- No deterioration of more than 10% of the current water quality of the receiving waterbody, or if this is not technically feasible,
- No deterioration from the current WFD status of the receiving waterbody, and
- The future target WFD status is not compromised by growth.

Table C-2 provides detail on each of the calculation steps and the sequence in which these are performed.

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

The Environment Agency require 'no deterioration' calculations C1 and C3 for freshwater discharges to inform their hierarchical approach to the WFD 'no deterioration' targets used to identify indicative permits. This approach helps with consideration of the relative technical feasibility of ensuring 'no deterioration'.

Step 1 – 'No Deterioration' – C1, C2 and C3

Calculations were undertaken to first determine if deterioration can be limited to 10% of the current downstream quality. If this was not achievable within current limits of technology, the second step determines if the receiving watercourse can maintain no deterioration downstream from the current status with the proposed growth within limits of conventional treatment technology, and what permit limits would be required.

Table C-2 Step 1 – 'No Deterioration' – C1, C2 and C3

Ref	Calculation Name	Calculation Detail	Reason for Calculation
C1	Limit deterioration to 10%	No deterioration from current downstream quality + 10% with future effluent flow	To determine if it is technically feasible to limit deterioration to no more than 10% of the current downstream water quality
C2	No deterioration (Current)	No deterioration from current status with current effluent flow	To calculate what quality condition is currently needed to avoid deterioration in the current status downstream with the current flow
C3	No deterioration (Future)	No deterioration from current status with future effluent flow	To calculate what quality condition is needed in the future (post-growth) to avoid deterioration in the current status downstream with future flow
C6	Load Standstill	Required future quality permits with future effluent flow for coastal or estuarine waterbodies	To be used where the above calculations are not applicable such as for tidal discharges and calculating BOD quality conditions

If 'No Deterioration' could be achieved, then a proposed discharge permit standard was calculated which will be needed as soon as the growth causes the WRC flow permit to be exceeded, see Table B1.

Step 2 – Meeting Future 'Good' Status – C4 and C5

For all WRC where the current downstream quality of the receiving watercourse is less than good, a calculation was undertaken to determine if the receiving watercourse could achieve future 'Good Status', with the proposed growth within limits of conventional treatment technology and what permit limits would be required to achieve this.

The assessment of attainment of future 'Good Status' assumed that other measures will be put in place to ensure 'Good Status' upstream, so that the modelling assumed upstream water quality is at the midpoint of the 'Good Status' for each element and set the downstream target as the lower boundary of the 'Good Status' for each element.

If 'Good' could be achieved with growth with permits achievable within the limits of conventional treatment, then a proposed discharge permit standard which may be needed in the future has been given in Table B2.

If the modelling showed that the watercourse could not meet future 'Good' status with the proposed growth within limits of conventional treatment technology, a further assessment step three was undertaken.

Table C-3 Step 2 – Meeting Future 'Good' Status – C4 and C5

Ref	Calculation Name	Calculation Detail	Reason for Calculation
C4	Achieve Good status (Current)	Achieving good ecological status with current effluent flow	To test what effluent quality would be needed to achieve good status with the current flow permit
C5	Achieve Good status (Future)	Achieving good ecological status with future effluent flow	To assess whether the future quality permit limits needed to achieve good status will be significantly more onerous and difficult to achieve than those currently needed (calculation 4)

Step 3 – Is Growth the Factor Causing failure to meet future 'Good Status'?

In order to determine if it is growth that is causing the failure to attain future 'Good Status' downstream, the modelling in step 2 was repeated, but without the growth in place (i.e. using current flows) as a comparison.

If the watercourse could not meet 'Good Status' without growth (assuming the treatment standard were improved to the limits of conventional treatment technology), then it is not the growth that would be preventing future 'Good Status' being achieved and the 'No Deterioration' permit standard given in Table B1. (Step 1) above would be sufficient to allow the proposed growth to proceed.

If the watercourse could meet 'Good Status' without growth, then it is the growth that would be preventing future 'Good Status' being achieved. Therefore consideration needs to be given to whether there are alternative treatment options that would prevent the future failure to attain 'Good Status'. The methodology is designed to look at the impact of proposed growth alone, and whether the achievement of 'Good Status' will be compromised. It is important that AWS have an understanding of what permits may be necessary in the future. The RBMP and Periodic Review planning processes will deal with all other issues of disproportionate costs.

C.5 Assessment Tables

	Beccles WRC - Scenario 2		Beccles WRC - Scenario 3	
	Ammonia	Phosphate	Ammonia	Phosphate
River Downstream of Discharge	River Waveney		River Waveney	
Current permit quality condition (95%ile or AA)	20	1	20	1
Limit of Conventional Treatment (LCT) (95%ile or AA)	1	0.5	1	0.5
Current river quality downstream (90%ile or AA)*	0.16	0.11	0.16	0.11
10% No deterioration target (90%ile or AA)	**0.18**	**0.12**	**0.18**	**0.13**
Status no deterioration target (90%ile or AA)	0.30	0.23	0.30	1.10
Upstream sample point	WAV128		WAV128	
Downstream sample point	WAV160		WAV160	
10% No Deterioration Test				
Future DWF (m3/day)	**3046**		**2723**	
Future river quality (90%ile or AA)	**0.19**	**0.12**	**0.18**	**0.11**
Level of deterioration	**19%**	**9%**	**13%**	**0%**
Future development would cause a…	*19% deterioration from current quality*	*9% deterioration from current quality*	*13% deterioration from current quality*	*0% deterioration from current quality*
Future discharge quality if <10% deterioration (95%ile or AA)	**N/A**	1.2	**N/A**	1.3
Future discharge quality required to limit deterioration to 10% (95%ile or AA)	7.8	**N/A**	8.7	**N/A**
Status Deterioration Test				
Status deterioration target of d/s sample point	**High**	**Moderate**	**High**	**Moderate**
Origin of status target				
Downstream sampling point used for status				
Status no deterioration target (90%ile or AA)	0.30	0.23	0.30	0.23
Future DWF (m3/day)	**3046**		**2723**	
Future discharge quality required (95%ile or AA)	15.5	8.5	17.3	9.4
Will growth prevent WFD objective of 'No Deterioration' from being achieved?	**No**	**No**	**No**	**No**

'FUTURE TARGET STATUS' AND HABITATS DIRECTIVE ASSESSMENT

	Beccles WRC - Scenario 2		Beccles WRC - Scenario 3	
	Ammonia	Phosphate	Ammonia	Phosphate
River quality target (90%ile or AA)		0.10		0.10
Discharge Quality Required - Current				
Current DWF (m3/day)	**2129**		**2129**	
Discharge quality required (95%ile or AA)		**0.4**		**0.4**
Discharge Quality Required - Future				
Future DWF (m3/day)	**3046**		**2723**	
Discharge quality required (95%ile or AA)		**0.3**		**0.3**
Will Growth prevent WFD Good Status from being achieved ?	**No - it is not growth preventing the future target status from being achieved, but current limits in technology.**		**No - it is not growth preventing the future target status from being achieved, but current limits in technology.**	

LOAD STANDSTILL ASSESSMENT

	Beccles WRC - Scenario 2	Beccles WRC - Scenario 3
	BOD	BOD
Downstream of Discharge	River Waveney	River Waveney
No Deterioration target	**High**	**High**
River quality target (90%ile)	**4.0**	**4.0**
Limit of Conventional Treatment (LCT) (95%ile)	5	5
Current DWF Permit		
Current DWF Permit (m3/day)	**2129**	**2129**
Current permit quality condition (95%ile)	20	20
Discharge Permit Required		
0	**3046**	**2723**
Future permit quality condition required (95%ile)	14.0	15.6

Appendix D Water Neutrality

Water Neutrality is defined in Section 4, and the assumptions used outlined in Section 1.6. This appendix provides supplementary information and guidance behind the processes followed.

D.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[33], 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[34].

D.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;
- NHS buildings for new buildings and refurbishments;

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

- 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[35] 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 described in this section of the WCS 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.

D.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[36] 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)[37]. The typical savings in water bills of metered and unmetered households were compared by the Walker review, which gives an indication of the levels of water saving that can be expected (see Table D-1).

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

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

[35] Part G of the Building Regulations
[36] 2.3 is used for existing properties and new properties. This figure was agreed with STW prior to the assessment
[37] Independent Walker Review of Charging and Metering for Water and Sewerage services, DEFRA, 2009, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69459/walker-review-final-report.pdf

Low or Variable Flush Toilets

Toilets use about 30 per cent of the total water used in a household[38]. 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[39]per flush. A study carried out in 2000 by Southern Water and the Environment Agency[40] 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[41].

Pressure Control

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

Variable tariffs

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

The Walker review assessed variable tariffs for water, including:

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

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

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

[38] http://www.waterwise.org.uk/pages/indoors.html
[39] http://www.thegreenage.co.uk/tech/water-saving-toilet/
[40] The Water Efficiency of Retrofit Dual Flush Toilets, Southern Water/Environment Agency, December 2000
[41] http://www.thameswater.co.uk/cps/rde/xchg/corp/hs.xsl/9047.htm

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[42] 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 80l/h/d and 62l/h/d houses, The Building Regulations Water Efficiency Calculator has been used in association with the Department of Communities and Local Government – Housing Standard Review (September 2014). These are shown below in Table D-2.

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

Component	138 l/h/d Standard Home	Building Regulations 125 l/h/d	Building Regulations Optional Target 110 l/h/d	High 80 l/h/d	62 l/h/d (water recycling)
Toilet flushing	28.2	18.7 b	12.3 d	12.3 d	12.3 d
Taps	24.1 a	22.7 a	20.5 a	15.3 a	15.3 a
Shower	43.7	39.8	31.8	23.9	23.9
Bath	18.5 c	18.5 c	17.0 f	14.5 h	14.5 h
Washing Machine	15.6	15.6	15.6	15.6	15.6
Dishwasher	4.1	4.1	4.1	4.1	4.1
Recycled water				-13.4 e	-26.8 g
External Use	5	5	5	0	0

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

Component	138 l/h/d Standard Home	Building Regulations 125 l/h/d	Building Regulations Optional Target 110 l/h/d	High 80 l/h/d	62 l/h/d (water recycling)
Total per head	139.3	124.4	106.3	77.3	63.9
Total per household	292.4	261.3	223.3	162.4	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 D-2 highlights that in order for high and very high efficiencies to be achieved for water use under 80 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[43], the experience of AECOM BREEAM/CHS assessors is that it is theoretically possible to get close to 80l/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 80l/h/d or lower can be reached without some form of water recycling.

Rainwater Harvesting

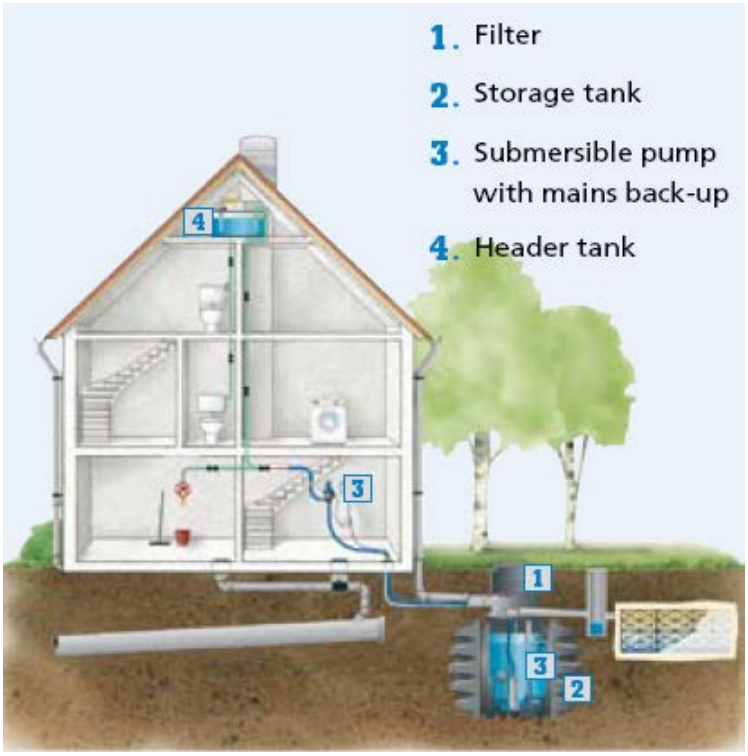
Rainwater harvesting (RWH) is the capture and storage of rain water that lands on the roof of a property. This can have the dual advantage of both reducing the volume of water leaving a site, thereby reducing surface water management requirements and potential flooding issues, and be a direct source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

RWH systems typically consist of a collection area (usually a rooftop), a method of conveying the water to the storage tank (gutters, down spouts and pipes), a filtration and treatment system, a storage tank and a method of conveying the water from the storage container to the taps (pipes with pumped or gravity flow). A treatment system may be included, depending on the rainwater quality desired and the source. Figure D-1 below gives a diagrammatic representation of a typical domestic system[44].

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[45].

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

Figure D-1: A typical domestic rainwater harvesting system



A recent sustainable water management strategy carried out for a proposed EcoTown development at Northstowe[46], approximately 10 km to the north west of Cambridge, calculated the size of rainwater storage that may be required for different occupant numbers, as shown below in Table D-3.

Table D-3: Rainwater Harvesting Systems Sizing

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

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

Greywater Recycling

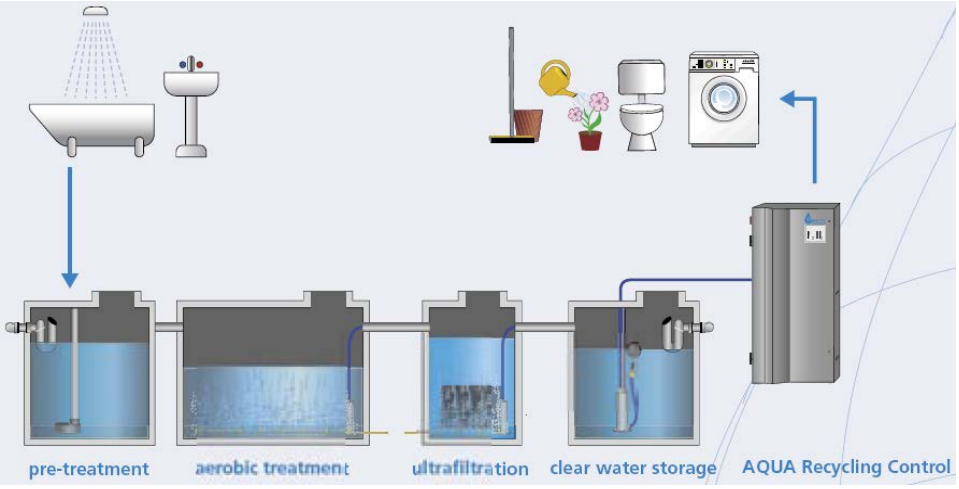
Greywater recycling (GWR) is the treatment and re-use of wastewater from shower, bath and sinks for use again within a property where potable quality water is not essential e.g. toilet flushing. Recycled greywater is not suitable for human consumption or for irrigating plants or crops that are intended for human consumption. The source of greywater should be selected by available volumes and pollution levels, which often rules out the use of

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

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 D-2 below gives a diagrammatic representation of a typical domestic system[47].

Figure D-2: A typical domestic greywater recycling system



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

The Northstowe sustainable water management strategy calculated the volumes of water that could be made available from the use GWR. These were assessed against water demand calculated using the BRE Water Demand Calculator[48].

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

Table D-4: Potential water savings from greywater recycling

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

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

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

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[49].

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

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

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

[49] Centre for the Built Environment, https://www.cbe.berkeley.edu/

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

WN Scenario	New development requirement			Retrofitting existing development	
	New development Water use target (l/h/d)	Water Efficient Fixtures and Fittings	Water Recycling technology	Metering Penetration assumption	Water Efficient Fixtures and Fittings
Low (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	97.5%	None
Low (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	97.5%	10% take up across study area: - WC 6/4 litres dual flush or - 4.5 litres single flush - Shower 10 l/min - Basin taps 6 l/min - Sink taps 8 l/min
Medium (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	97.5%	None
Medium (Building Regulations Optional Requirement + Retrofit)	110	- WC 4/2.6 litres dual flush - Shower 8 l/min - Bath 170 litres - Basin taps 5 l/min - Sink taps 6 l/min - Dishwasher 1.25 l/place setting - Washing machine 8.17 l/kilogram	None	97.5%	15% take up across study area: - WC 4/2.6 litres dual flush - Shower 8 l/min - Basin taps 5 l/min - Sink taps 6 l/min
High	80	- WC 4/2.6 litres dual flush;	Rainwater harvesting	100%	20% take up across study area:

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
		- 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			- WC 4/2.6 litres dual flush; - Shower 6 l/min - Basin taps 2 l/min - Sink taps 4 l/min
Very High	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	100%	25% take up across study area: - WC 4/2.6 litres dual flush; - Shower 6 l/min - Basin taps 2 l/min - Sink taps 4 l/min

D.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[50] 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 D-6.

Table D-6: Building Regulation Specification and costs

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

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

Water Recycling

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

Table D-7: Costs of greywater recycling systems[51]

Cost	Cost	Comments
Installation cost	£1,750	Cost of reaching Code Level 5/6 for water consumption in a 2-bed flat
	£2,000	For a single dwelling
	£800	Cost per house for a communal system
	£2,650	Cost of reaching Code Level 3/4 for water consumption in a 3-bed semi-detached house
Operation of GWR	£30 per annum[52]	
Replacement	£3,000 to replace23	It is assumed a replacement system will be required every 25 years

[50] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/354154/140911__HSR_CONSULTATION_DOCUMENT_-_FINAL.pdf

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

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

Cost	Cost	Comments
costs		

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

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

Installing a Meter

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

Retrofitting of Water Efficient Devices

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

Table D-8: Water saving methods

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

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

Appendix E Designated Site Background Detail

E.1 Broadland SPA

Introduction

Broadland SPA crosses the boundary between east Norfolk and northern Suffolk. The site is 5462.4ha in size and comprises of 26 Sites of Scientific Interest (SSSI);

- Alderfen Broad
- Ant Broads and Marshes
- Bamby Broad and Marshes
- Broad Fen, Dilham
- Bure Broads and Marshes
- Burgh Common and Muckfleet Marshes
- Calthorpe Broad
- Cantley Marshes
- Crostwick Marsh
- Decoy Carr, Acle
- Duncans Marsh, Claxton
- Geldeston Meadows
- Hall Farm Fen, Hemsby
- Halvergate Marshes
- Hardley Flood
- Limpenhoe Meadows
- Ludham-Potter Heigham Marshes
- Poplar Farm Meadows, Langley
- Priory Meadows, Hickling
- Shallam Dyke Marshes, Thurne
- Smallburgh Fen
- Sprat's Water and Marshes, Calton Colville
- Stanley and Alder Carrs, Aldeby
- Upper Thurne Broads and Marshes
- Upton Broad and Marshes
- Yare Broads and Marshes

The SPA is a low-lying wetland complex as part of the broads which are a series of flooded medieval peat cuttings. This is one the finest marshland complexes in the UK including open water, reedbeds, carr woodland, grazing marsh and fen meadow.

Qualifying Features[53]

This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive during the breeding season:

- Bittern (*Botaurus stellaris*) – 3 individuals representing up to 15% of the breeding population in Great Britain (count as in 1998).
- Marsh harrier (*Circus aeruginosus*) – 21 pairs representing up to 13.1% of the breeding population in Great Britain (count as at 1995).

Over winter:

- Bewick's swan (*Cygnus columbianus bewickii*) – 320 individuals representing up to 4.6% of the wintering bird population in Great Britain (5 year peak mean 1991/2 – 1995/6).

[53] http://jncc.defra.gov.uk/page-2022-theme=default [Accessed 09/05/2017]

- Bittern (*Botaurus stellaris*) – 6 individuals representing up to 6% of the wintering bird population in Great Britain (5 year peak mean 1987/8-1991/2).
- Ruff (*Philomachus pugnax*) – 96 individuals representing up to 13.7% of the wintering population in Great Britain (5 year peak mean 1987/8-1991/2).
- Whooper swan (*Cygnus Cygnus*) – 133 individuals representing up to 2.4% of the wintering population in Great Britain (5 year mean peak 1993/4-1997/8).

This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

- Gadwall (*Anas strepera*) – 605 individuals representing up to 2% of the wintering Northwestern Europe population (RSPB: count 1999/00).
- Pink-footed Goose (*Anser brachyrhynchus*) – 3,290 individuals representing up to 1.5% of the wintering Eastern Greenland/Iceland/UK populations (5 year peak mean 1994/5-1998/9).
- Shoveler (*Anas clypeata*) – 401 individuals representing up to 1% of the wintering Northwestern/Central Europe population (RSPB: count 1999/00).

Conservation Objectives[54]

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;
Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and,
- The distribution of the qualifying features within the site.

Environmental vulnerabilities[55]

- Water pollution – a threat to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, calcium rich fen dominated by great fen sedge, alder woodland on floodplains, Desmoulin's whorl snail, otter, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, Bittern, Bewick's swan, Whooper swan, Wigeon, gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, fen orchid, Little Ramshorn whirlpool snail;
- Climate change – a threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Invasive species – a pressure to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail, otter;
- Siltation – a pressure to: Bewick's swan, Pink-footed goose, gadwall, shoveler, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Inappropriate water levels – a pressure to: Bewick's swan, pink-footed goose, gadwall, shoveler, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Hydrological changes – a pressure/threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very

[54] http://publications.naturalengland.org.uk/publication/5310905998901248 [Accessed 09/05/2017]
[55] http://publications.naturalengland.org.uk/publication/5444118129934336 [Accessed 09/05/2017]

wet mires often identified by an unstable 'quaking' surface, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;

- Water abstraction – a pressure to: very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, Desmoulin's whorl snail, otter, fen orchid.
- Change in land management – a pressure/threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Inappropriate ditch management – a threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Inappropriate scrub control – a pressure to: purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, fen orchid;
- Changes in species distribution - calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Public Access/Disturbance – a threat to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Undergrazing – a pressure to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter, Desmoulin's whorl snail;
- Water pollution – a pressure to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Drainage – a pressure to: calcium-rich fen dominated by great fen sedge, Alder woodland on floodplains;
- Direct impact from third party – a threat to: Gadwall, Shoveler, Ruff;
- Inappropriate coastal management – a pressure/threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail; and,
- Air pollution: impact of atmospheric nitrogen deposition – a pressure to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid.

E.2 Broadland Ramsar

Introduction

Broadland Ramsar is low-lying wetland complex crossing the boundaries of east Norfolk and northern Suffolk. This area contains the river valley systems of the Bure, Yare and Waveney including their major tributaries. This contains an extensive network of wetland habitats including open water, reedbeds, carr woodland, grazing meadow and fen meadow. The site is 5488.61ha and comprises of 26 SSSIs;

- Alderfen Broad
- Ant Broads and Marshes
- Barnby Broad and Marshes

- Broad Fen, Dilham
- Bure Broads and Marshes
- Burgh Common and Muckfleet Marshes
- Calthorpe Broad
- Cantley Marshes
- Crostwick Marsh
- Decoy Carr, Acle
- Duncans Marsh, Claxton
- Geldeston Meadows
- Hall Farm Fen, Hemsby
- Halvergate Marshes
- Hardley Flood
- Limpenhoe Meadows
- Ludham-Potter Heigham Marshes
- Poplar Farm Meadows, Langley
- Priory Meadows, Hickling
- Shallam Dyke Marshes, Thurne
- Smallburgh Fen
- Sprat's Water and Marshes, Calton Colville
- Stanley and Alder Carrs, Aldeby
- Upper Thurne Broads and Marshes
- Upton Broad and Marshes
- Yare Broads and Marshes

Qualifying Features[56]

The Ramsar Criteria for which this site is designated is as follows:

- Criterion 2 – Annex 1 habitats directive: Calcerous fens with *Cladium mariscus*and species of the *Caricion davillianae* Calcium-rich fen dominated by great fen sedge, Alkaline fens, Alluvial forests with *Alnus glutinosa and Fraxinus excelsior (Alno-padion, Alnion incanae, Salicion albae),* Desmoulin's whorl snail (*Vertigo moulinisana*), Otter (*Lutra lutra*), Fen orchid (*Liparis loeselii*);
- Criterion 6 – Species/popuations occurring at levels of international importance:
  Species with peak counts in winter: Tundra swan (*Cygnus columbianus*), 196 individuals, representing an average of 2.4% of the Great Britain population (5 year peak mean 1998/9 – 2002/3), Eurasian wigeon (*Anas Penelope*), 6769 individuals, representing an average of 1.6% of the Great Britain population (5 year peak mean 1998/9 – 2002/3), Gadwall *(Anas strepera strepera*), 545 individuals representing an average of 3.1% of the Great Britain population (5 year peak mean 1998/9 – 2002/3), Northern shoveler (*Anas clypeata*), 247 individuals representing an average of 1.6% of the Great Britian population (5 year peak mean 1998/9 – 2002/3).

Conservation Objectives[57]

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;
Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and,
- The distribution of the qualifying features within the site.

[56] http://jncc.defra.gov.uk/page-1389 [Accessed 09/05/2017]
[57] http://publications.naturalengland.org.uk/publication/5310905998901248 [Accessed 09/05/2017]

Environmental vulnerabilities[58]

- Water pollution – a threat to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, calcium rich fen dominated by great fen sedge, alder woodland on floodplains, Desmoulin's whorl snail, otter, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, Bittern, Bewick's swan, Whooper swan, Wigeon, gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, fen orchid, Little Ramshorn whirlpool snail;
- Climate change – a threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Invasive species – a pressure to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail, otter;
- Siltation – a pressure to: Bewick's swan, Pink-footed goose, gadwall, shoveler, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Inappropriate water levels – a pressure to: Bewick's swan, pink-footed goose, gadwall, shoveler, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Hydrological changes – a pressure/threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Water abstraction – a pressure to: very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, Desmoulin's whorl snail, otter, fen orchid.
- Change in land management – a pressure/threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Inappropriate ditch management – a threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Inappropriate scrub control – a pressure to: purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, fen orchid;
- Changes in species distribution - calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Public Access/Disturbance – a threat to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Undergrazing – a pressure to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter, Desmoulin's whorl snail;
- Water pollution – a pressure to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;

[58] http://publications.naturalengland.org.uk/publication/5444118129934336 [Accessed 09/05/2017]

- Drainage – a pressure to: calcium-rich fen dominated by great fen sedge, Alder woodland on floodplains;
- Direct impact from third party – a threat to: Gadwall, Shoveler, Ruff;
- Inappropriate coastal management – a pressure/threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail; and,
- Air pollution: impact of atmospheric nitrogen deposition – a pressure to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich springwater-fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid.

E.3 The Broads SAC

Introduction

The Broads SAC is found crossing the border between Norfolk and Suffolk. This SAC is the richest area for charophytes in Britain. It consists of habitats including inland water bodies, bogs, marshes, water fringed vegetation and fens, heath and steppes. The area is 5889.43ha and contains 26 SSSIs:

- Alderfen Broad
- Ant Broads and Marshes
- Bamby Broad and Marshes
- Broad Fen, Dilham
- Bure Broads and Marshes
- Burgh Common and Muckfleet Marshes
- Calthorpe Broad
- Cantley Marshes
- Crostwick Marsh
- Decoy Carr, Acle
- Duncans Marsh, Claxton
- Geldeston Meadows
- Hall Farm Fen, Hemsby
- Halvergate Marshes
- Hardley Flood
- Limpenhoe Meadows
- Ludham-Potter Heigham Marshes
- Poplar Farm Meadows, Langley
- Priory Meadows, Hickling
- Shallam Dyke Marshes, Thurne
- Smallburgh Fen
- Sprat's Water and Marshes, Calton Colville
- Stanley and Alder Carrs, Aldeby
- Upper Thurne Broads and Marshes
- Upton Broad and Marshes
- Yare Broads and Marshes

Qualifying feature[59]

The site is designated as an SAC for the following primary Annex I habitats:

- Hard oligo-mesotrophic waters with benthic vegetation of Chara spp;
- Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation;
- Transition mires and quaking bogs;
- Calcareous fens with Cladium mariscus and speices of the Caricion davallianae;
- Alkaline fens; and
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

This site qualifies as an SAC for the following qualifying Annex I habitats:

- Molinia meadows on calcerous, peaty or clayey-silt-laden soils (Molinion caeruleae).

This site is designated an SAC for the following primary Annex II species:

- Desmoulin's whorl snail (*Vertigo moulinsiana*);
- Fen orchid (*Liparis loeselii*); and,
- Ramshorn snail (*Anisus vorticulus*)

This site qualifies as an SAC for the following qualifying Annex II species:

- Otter (*Lutra lutra*)

Conservation objectives[60]

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;
Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of qualifying species; and,
- The distribution of qualifying species within the site.

Environmental Vulnerabilities[61]

- Water pollution – a threat to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, calcium rich fen dominated by great fen sedge, alder woodland on floodplains, Desmoulin's whorl snail, otter, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, Bittern, Bewick's swan, Whooper swan, Wigeon, gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, fen orchid, Little Ramshorn whirlpool snail;
- Climate change – a threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich spring-water fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Invasive species – a pressure to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium rich fen dominated by great fen sedge,

[59] http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0013577 [Accessed 10/05/2017]
[60] http://publications.naturalengland.org.uk/publication/6190476679970816 [Accessed 10/05/2017]
[61] http://publications.naturalengland.org.uk/publication/5444118129934336 [Accessed 10/05/2017]

calcium-rich spring-water fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail, otter;

- Siltation – a pressure to: Bewick's swan, Pink-footed goose, gadwall, shoveler, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Inappropriate water levels – a pressure to: Bewick's swan, pink-footed goose, gadwall, shoveler, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Hydrological changes – a pressure/threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich spring-water fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Water abstraction – a pressure to: very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, Desmoulin's whorl snail, otter, fen orchid.
- Change in land management – a pressure/threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich spring-water fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Inappropriate ditch management – a threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich spring water fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Inappropriate scrub control – a pressure to: purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich spring-water fed fens, fen orchid;
- Changes in species distribution - calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich spring-water fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail;
- Public Access/Disturbance – a threat to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Undergrazing – a pressure to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter, Desmoulin's whorl snail;
- Water pollution – a pressure to: calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, otter;
- Drainage – a pressure to: calcium-rich fen dominated by great fen sedge, Alder woodland on floodplains;
- Direct impact from third party – a threat to: Gadwall, Shoveler, Ruff;
- Inappropriate coastal management – a pressure/threat to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich spring-water fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid, Little Ramshorn whirlpool snail; and,
- Air pollution: impact of atmospheric nitrogen deposition – a pressure to: Bittern, Bewick's swan, Whooper swan, Wigeon, Gadwall, Shoveler, Marsh harrier, Hen harrier, Ruff, calcium rich nutrient-poor lakes, lochs and pools, naturally nutrient-rich lakes or lochs which are often dominated by pondweed, purple moor-grass meadows, very wet mires often identified by an unstable 'quaking' surface, calcium-rich fen dominated by great fen sedge, calcium-rich spring-water fed fens, alder woodland on floodplains, Desmoulin's whorl snail, fen orchid.

E.4 Benacre to Easton Bavents SPA

Introduction

Benacre to Easton Bavents SPA is located on the North Sea coast on East Suffolk between Kessingland and Southwold. The SPA is 516.83ha and contains one SSSI:

- Benacre to Easton Bavents.

The site contains low-lying coast with shingle beaches and low cliffs, a natural brackish lagoon, deciduous woodland, fringing reed beds, grazing marsh fields and unimproved meadows.

Qualifying features[62]

This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive during the breeding season:

- Bittern (*Botaurus stellaris*), 1 individual representing at least 5% of the breeding population in Great Britain (count as at 1998);
- Little tern (*Sterna albifrons*), 53 pairs representing at least 2.2% of the breeding population in Great Britain (count as at 1997); and
- Marsh harrier (*Circus aeruginosus*), 6 pairs representing at least 3.8% of the breeding population in Great Britain (5 year peak mean 1993-1997).

This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive for overwintering birds:

- Bittern (*Botaurus stellaris*), 2 individuals representing at least 2% of the wintering population in Great Britain (count as at 1998).

Conservation Objectives[63]

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and,
- The distribution of the qualifying features within the site.

Environmental Vulnerabilities[64]

- Public access/disturbance – a pressure to: Little tern;
- Water pollution – a pressure to: Coastal lagoons;
- Physical modifications – a threat to: Bittern, Marsh harrier, Little tern, Coastal lagoons;
- Changes in species distributions – a threat to: Little tern;
- Fisheries: Commercial marine and estuaries – a threat to: Little tern.

[62] http://jncc.defra.gov.uk/page-2025-theme=default [Accessed 10/05/2017]
[63] http://publications.naturalengland.org.uk/publication/4750287944286208?category=6581547796791296 [Accessed 10/05/2017]
[64] http://publications.naturalengland.org.uk/publication/4812476415737856 [Accessed 10/05/2017]

E.5 Benacre to Easton Bavents Lagoons SAC

Introduction

Benacre to Easton Bavents Lagoons SAC is a series of percolation lagoons on the east coast of England. This area is 326.7ha and contains one SSSI:

- Pakefield to Easton Bavents

Qualifying Features[65]

The site is designated as an SAC for the following primary Annex I habitats:

- Coastal lagoons.

Conservation Objectives[66]

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats;
- The structure and function (including typical species) of qualifying natural habitats; and,
- The supporting processes on which qualifying natural habitats rely.

Environmental Vulnerabilities[67]

- Public access/disturbance – a pressure to: Little tern;
- Water pollution – a pressure to: Coastal lagoons;
- Physical modifications – a threat to: Bittern, Marsh harrier, Little tern, Coastal lagoons;
- Changes in species distributions – a threat to: Little tern; and,
- Fisheries: Commercial marine and estuaries – a threat to: Little tern.

E.6 Minsmere-Walberswick SPA

Introduction

Minsmere-Walberswick SPA is located on the Suffolk coast south of Southwold. It is comprised of two large marshes, the tidal Blyth estuary and associated habitats. Habitats include areas of marsh with dykes, extensive reedbeds, mud-flats, lagoons, shingle, woodland and areas of lowland heath. It supports the largest continuous stand od Common Reed (*Phragmites australis*) in England and Wales and also demonstrates the nationally rare transition in grazing marsh ditch plants from brackish to fresh water. The area is 2018.92ha and contains one SSSI:

- Minsmere-Walberswick Heaths and Marshes.

Qualifying features[68]

This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive during the breeding season:

- Avocet (*Recurvirostra avosetta*), 91 pairs representing at least 15.4% of the breeding population in Great Britain (RSPB 1996);
- Bittern (*Botaurus stellaris*), 7 individuals representing at least 35% of the breeding population in Great Britain (5 year peak mean 1993-1997);
- Little tern (*Sterna albifrons*), 28 pairs representing at least 1.2% of the breeding population in Great Britain (5 year peak mean 1992-1996);

[65] http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0013104 [Accessed 10/05/2017]
[66] http://publications.naturalengland.org.uk/publication/6349053717643264 [Accessed 10/05/2017]
[67] http://publications.naturalengland.org.uk/publication/4812476415737856 [Accessed 10/05/2017]
[68] http://jncc.defra.gov.uk/page-2009 [Accessed 10/05/2017]

- Marsh harrier (*Circus aeruginosus*), 16 pairs representing at least 10% of the breeding population in Great Britain (5 year peak mean 1993-1997);
- Nightjar (*Caprimulgus europaeus*), 24 pairs representing at least 0.7% of the breeding population in Great Britain (count as at 1990); and,
- Woodlark (*Lullula arborea*), 20 pairs representing at least 1.3% of the breeding population in Great Britain (RSPB, 5 year peak mean 1995-1999).

This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive for overwintering birds:

- Avocet (*Recurvirostra avosetta*), 278 individuals representing at least 21.9% of the wintering population in Great Britain (5 year peak mean 1991/2-1995/6);
- Bittern (*Botaurus stellaris*), 14 individuals representing at least 14% of the wintering population in Great Britain (count as at 1998); and,
- Hen harrier (*Circus cyaneus*), 15 individuals representing at least 2% of the wintering population in Great Britain (5 year peak mean 1985/6-1989/90).

Conservation Objectives[69]

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
  The distribution of the qualifying features within the site.

Environmental Vulnerabilities[70]

- Coastal squeeze – a pressure to: Gadwall;
- Public access/disturbance – a pressure to: Bittern, Gadwall, Shoveler, Avocet, Little tern, European nightjar, Woodlark, Greater white-fronted goose, Annual vegetation of drift lines, Coastal shingle vegetation outside the reach of waves, European dry heaths;
- Changes in species distributions – a pressure to: Marsh harrier, Little tern, European nightjar, Woodlark;
- Invasive species – a pressure to: Gadwall, Shoveler, Avocet, Greater white-fronted goose;
- Inappropriate pest control – a threat to: European nightjar, Woodlark;
- Air pollution: impact of atmospheric nitrogen deposition – a pressure/threat to: Gadwall, Shoveler, Avocet, European nightjar, Woodlark, Greater white-fronted goose, European dry heaths;
- Water pollution – a threat to: Gadwall, Shoveler, Avocet, Greater white-fronted goose;
- Deer – a threat to: Bittern, European nightjar, Woodlark, European dry heaths; and,
- Fisheries: commercial marine and estuarine – a pressure to: Little tern.

E.7 Minsmere-Walberswick Ramsar

Introduction

Minsmere-Walberswick Ramsar covers the same area as the Minsmere-Walberswick SPA. It is comprised of two large marshes, the tidal Blyth estuary and associated habitats. Habitats include areas of marsh with dykes, extensive reed beds, mud-flats, lagoons, shingle, woodland and areas of lowland heath. It supports the largest continuous stand od Common Reed (*Phragmites australis*) in England and Wales and also demonstrates the nationally rare transition in grazing marsh ditch plants from brackish to fresh water. The area is 2018.92ha and contains one SSSI:

- Minsmere-Walberswick Heaths and Marshes.

[69] http://publications.naturalengland.org.uk/publication/4528783260385280 [Accessed 10/05/2017]
[70] http://publications.naturalengland.org.uk/publication/5674608288071680 [Accessed 10/05/2017]

Qualifying Features[71]

The Ramsar criterion for which the site is designated is as follows:

- Criterion 1 - The site contains a mosaic of marine, freshwater, marshland and associated habitats, complete with transition areas in between. Contains the largest continuous stand of reed beds in England and Wales and rare transition in grazing marsh ditch plants from brackish to fresh water.
- Criterion 2 - This site supports nine nationally scarce plants and at least 26 red data book invertebrates. Supports a population of the mollusc Vertigo angustior (Habitats Directive Annex II; British Red Data Book Endangered), recently discovered on the Blyth estuary river walls.

Conservation Objectives[72]

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

Environmental vulnerabilities[73]

- Coastal squeeze – a pressure to: Gadwall;
- Public access/disturbance – a pressure to: Bittern, Gadwall, Shoveler, Avocet, Little tern, European nightjar, Woodlark, Greater white-fronted goose, Annual vegetation of drift lines, Coastal shingle vegetation outside the reach of waves, European dry heaths;
- Changes in species distributions – a pressure to: Marsh harrier, Little tern, European nightjar, Woodlark;
- Invasive species – a pressure to: Gadwall, Shoveler, Avocet, Greater white-fronted goose;
- Inappropriate pest control – a threat to: European nightjar, Woodlark;
- Air pollution: impact of atmospheric nitrogen deposition – a pressure/threat to: Gadwall, Shoveler, Avocet, European nightjar, Woodlark, Greater white-fronted goose, European dry heaths;
- Water pollution – a threat to: Gadwall, Shoveler, Avocet, Greater white-fronted goose;
- Deer – a threat to: Bittern, European nightjar, Woodlark, European dry heaths; and,
- Fisheries: commercial marine and estuarine – a pressure to: Little tern.

E.8 Minsmere-Walberswick Heath and Marshes SAC

Introduction

Minsmere-Walberswick Heath and Marshes SAC is on the Suffolk coastline. This site is one of two representatives of Annual vegetation of drift lines on the east coast of England; this area also includes lowland European dry heaths. The area is 1256.57ha and includes one SSSI:

- Minsmere-Walberswick Heath and Marshes

Qualifying Features[74]

The site is designated as an SAC for the following primary Annex I habitats:

- Annual vegetation of drift lines; and
- European dry heaths.

The site qualifies as an SAC for the following qualifying Annex I habitats

- Perennial vegetation of stony banks

[71] http://jncc.defra.gov.uk/page-1389 [Accessed 10/05/2017]
[72] http://publications.naturalengland.org.uk/publication/4528783260385280 [Accessed 10/05/2017]
[73][73] http://publications.naturalengland.org.uk/publication/5674608288071680 [Accessed 10/05/2017]
[74] http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0012809 [Accessed 10/05/2017]

Conservation Objectives[75]

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats
- The structure and function (including typical species) of qualifying natural habitats, and
- The supporting processes on which qualifying natural habitats rely.

Environmental Vulnerabilities[76]

- Coastal squeeze – a pressure to: Gadwall;
- Public access/disturbance – a pressure to: Bittern, Gadwall, Shoveler, Avocet, Little tern, European nightjar, Woodlark, Greater white-fronted goose, Annual vegetation of drift lines, Coastal shingle vegetation outside the reach of waves, European dry heaths;
- Changes in species distributions – a pressure to: Marsh harrier, Little tern, European nightjar, Woodlark;
- Invasive species – a pressure to: Gadwall, Shoveler, Avocet, Greater white-fronted goose;
- Inappropriate pest control – a threat to: European nightjar, Woodlark;
- Air pollution: impact of atmospheric nitrogen deposition – a pressure/threat to: Gadwall, Shoveler, Avocet, European nightjar, Woodlark, Greater white-fronted goose, European dry heaths;
- Water pollution – a threat to: Gadwall, Shoveler, Avocet, Greater white-fronted goose;
- Deer – a threat to: Bittern, European nightjar, Woodlark, European dry heaths; and,
- Fisheries: commercial marine and estuarine – a pressure to: Little tern.

E.9 Breydon Water SPA

Introduction

Breydon Water SPA is located on the coast of Norfolk. The site is an inland tidal estuary at the mouth of the River Yare, with extensive areas of mud-flats, which are the only mud-flats on the east coast of Norfolk. The area is 1202.94ha and includes two SSSIs:

- Breydon Water
- Halvergate Marshes

Qualifying features[77]

This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:
During the breeding season:

- Common tern (*Sterna hirundo*), 155 pairs representing up to 1.3% of the breeding population in Great Britain (4 count mean, 1991/2 – 1995/6).

Over winter:

- Avocet (*Recurvirostra avosetta*), 33 individuals representing up to 2.6% of the wintering population in Great Britain (5 year peak mean 1991/2 – 1995/6);
- Bewick's swan (*Cygnus columbianus*), 391 individuals representing up to 5.6% of the wintering population in Great Britain (5 year peak mean 1991/2 – 1995/6); and
- Golden plover (*Pluvialis apricaria*), 5040 individuals representing up to 2% of the wintering population in Great Britain (5 year peak mean 1991/2 – 1995/6).

The site also has an assemblage qualification as a wetland of international importance.
The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl and overwinter the area regularly supports 43.225 individual waterfowl (5 yeah peak mean 1991/2 – 1995/6).
Conservation Objectives[78]

[75] http://publications.naturalengland.org.uk/publication/5360166388105216 [Accessed 10/05/2017]
[76] http://publications.naturalengland.org.uk/publication/5674608288071680 [Accessed 10/05/2017]
[77] http://jncc.defra.gov.uk/page-2015 [Accessed 10/05/2017]

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

Environmental Vulnerabilities[79]

- Shooting/scaring – a threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, Water bird assemblage;
- Change in land management – a threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, Water bird assemblage;
- Public access/disturbance – a threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, Water bird assemblage;
- Hydrological changes – a threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, Water bird assemblage; and
- Fisheries: commercial marine and estuarine – a pressure/threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, Water bird assemblage.

E.10 Breydon Water Ramsar

Introduction

Breydon Water Ramsar covers the same area of land as Breydon Water SPA. The site is an inland tidal estuary at the mouth of the River Yare, with extensive areas of mud-flats, which are the only mud-flats on the east coast of Norfolk. The area is 1202.94ha and includes two SSSIs:

- Breydon Water
- Halvergate Marshes

Qualifying Features[80]

The Ramsar Criteria for which this site is designated is as follows:

- Criterion 5 – Species with peaks counts in winter; 68175 waterfowl (5 year peak mean 1998/99 – 2002/2003)
- Criterion 6 – Species/populations occurring at levels of international importance;
  Species with peak counts in winter: Tundra swan (*Cygnus columbianus bewickii*) 171 individuals representing an average of 2.1% of the Great Britain population (5 year peak mean 1998/9 – 2002/3); Northern lapwing (*Vanellus vanellus*), 20142 individuals representing an average of 1.3% of the Great Britain population (5 year peak mean 1998/9 – 2002/3).

Conservation Objectives[81]

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely

[78] http://publications.naturalengland.org.uk/publication/6376690053808128 [Accessed 10/05/2017]
[79] http://publications.naturalengland.org.uk/publication/6364048115367936 [Accessed 10/05/2017]
[80] http://jncc.defra.gov.uk/page-1389 [Accessed 10/05/2017]
[81] http://publications.naturalengland.org.uk/publication/6376690053808128 [Accessed 10/05/2017]

- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

Environmental Vulnerabilities[82]

- Shooting/scaring – a threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, water bird assemblage;
- Change in land management – a threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, water bird assemblage;
- Public access/disturbance – a threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, water bird assemblage;
- Hydrological changes – a threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, water bird assemblage; and

Fisheries: commercial marine and estuarine – a pressure/threat to: Bewick's swan, Avocet, Golden plover, Northern lapwing, Ruff, Common tern, water bird assemblage.

[82] http://publications.naturalengland.org.uk/publication/6364048115367936 [Accessed 10/05/2017]

Appendix F Reason for Alternative Objective

Where certain conditions apply and are met then alternative objectives have been set for water bodies; these involve taking an extended time period to reach the objective or meeting a lower status or a combination of both. In some water bodies it is recognised that time constraints on putting actions in place, or the time taken for the environment to respond once actions are implemented, mean that the objective will only be achieved over more than one river basin management planning cycle. An objective of less than good status is set where:

- there is currently no solution to the problem;
- the costs of taking action exceed the benefits; and/or
- background conditions in the environment mean achieving good status is not possible.

F.1 Justification for 'Moderate' Ecological Status Objective for River Waveney, The Beck and River Wang

Section 5.4 of the Anglian RBMP Part 2: River basin management planning overview and additional information[83] sets out the specific circumstances for the particular elements and the justification behind the alternative objective. The individual sub-elements 'Invertebrates', 'Surface Water' and 'Phosphate' of the River Waveney (GB105034045903) waterbody have had alternative objectives of 'Moderate' status to be achieved by 2021 and 2027. This has then been applied to the overall waterbody, which has an objective of 'Moderate' Ecological status by 2021.

The individual sub-elements 'Invertebrates', 'Dissolved Oxygen and 'Phosphate' of The Beck (GB105034045830) waterbody have had alternative objectives of 'Bad' status for Dissolved Oxygen and 'Moderate' status for Invertebrates and Phosphate by 2021 and 2027. This has then been applied to the overall waterbody, which has an objective of 'Moderate' Ecological status by 2021.

The individual sub-element 'Phosphate' of the River Wang (GB105035046300) waterbody has an alternative objective of 'Moderate' status to be achieved by 2021. This has then been applied to the overall waterbody, which has an objective of 'Moderate' Ecological status by 2021.

The reason the alternative objective for both waterbodies has been set is described as '**Technically infeasible – No known technical solution is available**'.

The explanation for the use of this exemption, as detailed in Table 6 of the Anglian RBMP, is provided below.

In England it is generally currently considered to be technically infeasible to build a sewage treatment works that will reduce phosphate in discharges to less than 0.5mg/l.

If a water body requires discharges of less than 0.5mg/l phosphate to achieve good status then this reason has been used to justify a less stringent objective under Article 4(5).

The exemptions apply to the phosphate and the impacted biological elements such as phytobenthos and macrophytes.

Trials are underway involving water and sewerage companies to investigate sewage treatment technologies that could be used to reduce phosphate below 0.5 mg/l. The trials will determine how effective these technologies are and are due to be complete by 2017. The results of the trials will inform the review and update of river basin management plans in 2021.

This exemption has been used when the environmental and socioeconomic needs served by the sewage treatment works to dispose of sewage cannot be achieved by other means which are a significantly better environmental option not entailing disproportionate costs, as required by article 4(5)(a).

[83] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500573/Part_2_River_basin_management_planning_process_overview_and_additional_information.pdf

Appendix G Development Site Assessment

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
19	Halesworth Road, Redisham, Beccles	0.21	5		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
24	Homestead Farm, Ringsfield Road, Beccles	14.48	260		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
17	Former Lothingland Hospital, Union Lane, Oulton	3.90	60		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
84	Land off Parkhill, Oulton, Lowestoft, Suffolk	2.12	42		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
54	Land between Harbour Road and the west end of the old Shell site, Lowestoft	1.03	0		29%	63%	8%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
5	Brambles Drift, Green Lane, Reydon, Southwold, Suffolk	2.53	75		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
148	The Sawmill, Sandy Lane, Holton, Halesworth, Suffolk	1.37	27		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
157	West of Redisham Road, Brampton	3.12	62		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
151	Town Farm 1, off Harrisons Lane, Halesworth, Suffolk	1.54	46		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
152	Town Farm 2, off Harrisons Lane, Halesworth, Suffolk	5.45	110		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
153	Town Farm 3, off Harrisons Lane, Halesworth, Suffolk	2.92	0		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
154	Town Farm 4, off Harrisons Lane, Halesworth, Suffolk	0.69	14		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
155	Town Farm 5, off Harrisons Lane, Halesworth, Suffolk	0.53	10		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
136	Rear of 11, 15,17,19 & 21 Birds Lane, Lowestoft	0.23	0		73%	27%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
6	Broadside Park Farm, Reydon, Southwold	2.95	0		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
133	Owls Cottage, Marsh Lane, Worlingham, Beccles, Suffolk	0.53	20		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
10	Cromwell Road, Ringsfield and Weston	1.16	24		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
100	Land south of 1-4 North End, All Saints South Elmham	0.11	5		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
66	Land north of 1-4 East View, All Saints South Elmham	0.17	4		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
4	Blundeston Road (west end), Corton, Lowestoft	1.59	45		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
147	The Old Rifle Range, A12 London Road, Pakefield, Lowestoft	19.69	230		95%	3%	2%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
71	Land north of Hulver Street, Henstead	3.86	46		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
156	West of A145 London Road, Beccles	9.67	240		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
144	Station Road and Moll's Lane, Brampton, Halesworth	2.04	14		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
92	Land on the South Side of Southwold Road Brampton	1.23	31		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
95	Land opposite 1-8 Wood End Cottages Southwold Road Stoven	0.44	8		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
97	Land opposite Stoven Row Southwold Road Stoven	0.60	15		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
132	Orchard Farm, New Road, Barnby	2.02	20		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
131	Orchard Farm Rear Field, New Road, Barnby	2.11	42		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
7	Burnt Hill Lane to Marsh Lane, Carlton Colville	31.81	0		99%	0%	1%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
37	Land at Dukes Bridge, Beccles Road, Bungay	1.58	0		100%	18%	62%	YES	NO	There is a very significant potential for one or more geohazards associated with infiltration.
143	St James Lane, St James South Elmham	1.08	5		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
150	The Street, St James South Elmham	3.30	5		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
86	Land off Saxons Way, Halesworth	2.60	8		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
104	Land south of The Street, Wissett	1.77	11		16%	15%	69.00%	YES	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
3	Ashfield Stables, Hall Lane, Oulton, Lowestoft	0.93	0		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
8	Chenery's Land (East), Cucumber Lane, Beccles / Land at Chenery's Farm, Beccles	10.00	240		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
9	Chenery's Land (West), Cucumber Lane, Beccles / Land at Chenery's Farm, Beccles	3.10	100		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
21	Hall Road, Carlton Colville	3.99	120		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
94	Land on the west side of London Road, Willingham - Shadingfield	1.17	23		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
123	Lock's Road, Westhall	1.88	24		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
93	Land on the South Side of Southwold Road Brampton (2)	0.96	24		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
112	Land to the north of the A146, Beccles Road, Lowestoft (2)	4.23	0		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
111	Land to the north of the A146, Beccles Road, Lowestoft	1.37	0		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
103	Land south of The Street, Holton (adjacent to 36 Holton Road, Halesworth)	0.85	17		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
107	Land to the East of London Road, Beccles	2.57	30		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
81	Land off Darby Road, Chenery's Farm, Beccles	20.53	411		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
145	The Bull Field, Ringsfield Road, Beccles	3.13	62		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
36	Land at Cromwell Road and London Road, Weston	10.83	108		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
60	Land east of College Lane, Worlingham	5.08	140		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
62	Land east of Ellough Road, Worlingham	12.00	360		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
102	Land south of Sparrowhawk Road, Halesworth	27.27	0		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
76	Land north of Sparrowhawk Road, Halesworth	3.04	0		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
165	Land west of A12 Yarmouth Road, Corton	22.09	530		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
166	Land east of A12 Yarmouth Road, Corton	50.57	750		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
11	Cromwell Road, Ringsfield, Beccles Opposite 1 Rose Villa	2.23	51		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
15	Firs Garage, Church Road, Uggeshall	0.50	0		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
58	Land east of 17-25 Sotherton Corner, Sotherton and Wangford with Henham	1.82	27		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
129	Old horticultural nursery to the north of Oakleigh, Market Lane, Blundeston, Lowestoft, Suffolk	2.29	46		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
16	Former Beccles Heat Treatment, Gosford Road, Beccles	0.48	19		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
114	Land to the south of Church Lane, Corton, Suffolk	4.45	75		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
140	Site to the rear of 51 Old Station Road, Halesworth (1)	0.51	10		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
141	Site to the rear of 51 Old Station Road, Halesworth (2)	1.18	24		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
126	Marsh Lane, Worlingham	0.44	8		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
130	Old Rectory Poultry Unit, Benacre Road, Hulver Street, Henstead	1.87	15		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
45	Land at St Johns Road, Bungay, Suffolk	4.65	90		92%	5%	3.00%	YES	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
124	London Road, Weston, Beccles, Suffolk	8.10	137		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
113	Land to the north west of 1-4 Wangford Road, Uggeshall	2.12	42		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
12	Low Meadows, Cucumber Lane, Weston	1.13	0		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
1	19-21 Ravensmere, Beccles, Suffolk	0.10	5		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
137	Rear of Nos 485 & 487 London Road South, Lowestoft, Suffolk	0.66	14		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
55	Land between Pilgrim's Way and Wingfield Street, Bungay, Suffolk	1.04	50		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
31	Land adjacent to Little Priory, Church Street, Wangford	0.25	3		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
18	Glebe Farm plus adjoining land, Church Avenue, Oulton	1.08	0		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
13	Fairview Farm, Norwich Road, Halesworth	6.78	83		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
52	Land at Toodley Farm, Station Road, Brampton	0.55	8		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
57	Land between The Street and A146, Barnby	2.80	45		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
83	Land off Mill Lane, Barnby	0.92	0		100%	0%	0%	YES	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
50	Land at the junction of Copland Way and the A146 Beccles / Lowestoft Road	7.73	46		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
72	Land north of Lowestoft Road, Beccles RUFC Common Lane (land north west and south east of Common Lane)	18.01	0		97%	3%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
20	Hall Road, Blundeston, Suffolk	0.34	7		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
119	Land to the west of St Edmunds Church, Kessingland	0.28	10		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
69	Land north of Church Lane, Ellough	1.31	30		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
14	Field, Saxon Way, Halesworth	0.95	12		70%	10%	20.00%	YES	NO	There is a very significant potential for one or more geohazards associated with infiltration.
121	Land west of Moores Cottages, Upper Holton	0.33	0		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
73	Land north of Moores Cottages, Upper Holton	0.69	0		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
87	Land on Bungay Road, Holton, Halesworth, Suffolk	1.13	22		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
109	Land to the North of 109 London Road, Kessingland	0.36	8		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
23	Holly Farm, Wood Lane, Oulton, Lowestoft, Suffolk	1.66	0		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
51	Land at The Old Rectory, Church Lane, Oulton	2.09	5		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
38	Land at Green Lane, Reydon	6.11	100		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
146	The Hill, Shipmeadow, Beccles, Suffolk	2.03	10		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
142	Southwold Police Station and former Fire Station site, Blyth Road, Southwold	0.29	12		97%	3%		NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
30	Land adjacent to Elms Lane, Wangford	10.00	200		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
68	Land North of Charters Piece, Willingham	0.64	13		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
59	Land east of Charters Piece, Willingham	1.01	20		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
134	Playing Field, Off A145 London Road, Willingham	1.21	20		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
64	Land east of Woodfield Close, Willingham	0.57	8		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
135	Playing Field, Somerleyton	3.18	80		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
74	Land north of Morton Peto Close, Somerleyton	0.27	5		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
128	Mill Farm, Somerleyton	1.19	15		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
127	Mill Farm Field, Somerleyton	3.03	75		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
2	Allotment land, Somerleyton	1.60	25		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
99	Land south east of Brickfields, Somerleyton	0.47	11		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
47	Land at the Former Garage, Somerleyton	0.65	13		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
75	Land North of Snakes Lane, The Street, Lound	0.41	12		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
79	Land off Blocka Road, Ashby Dell	0.55	6		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
63	Land East of Flixton Road, Blundeston	12.10	242		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
101	Land south of Hill Cottages, Shadingfield	0.41	6		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
26	Jubilee, Green Lane, Reydon	1.22	12		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
88	Land on Hulver Road, Mutford	4.93	0		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
89	Land on Lodge Road, Holton, Halesworth	1.42	15		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
22	Hammonds Farm, London Road, Gisleham, Lowestoft	4.10	117		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.

Site Ref	Site Location	Site Area (ha)	Dwellings Proposed in Plan Period	Foul Sewerage Network Capacity	% of Site in FZ1	% of Site in FZ2	% of Site in FZ3a	Main River	Ordinary Watercourse	SuDS Suitability
85	Land off Rider Haggard Lane, Kessingland	2.66	0		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
90	Land on The Hill, Barnby, Beccles	1.40	98		100%	0%	0%	YES	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
91	Land on the junction of St Olaves Road / Sluggs Lane, Herringfleet, Lowestoft	0.80	16		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
48	Land at The Green, Barnby	4.07	60		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
43	Land at Montrose Garage, London Road, Beccles	1.32	30		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
70	Land north of Hall Lane, Oulton	2.30	30		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
44	Land at Sandpit Lane, Worlingham	1.31	40		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
80	Land off Church Lane, Carlton Colville	3.51	60		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
40	Land at Laurel Farm, Hall Lane, Oulton	2.74	80		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
46	Land at Swan Lane, Barnby	4.68	90		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
49	Land at The Homestead, Lound Road, Blundeston, Suffolk	0.88	13		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
42	Land at Market Lane, Blundeston	7.02	140		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
41	Land at London Road, Kessingland (former Ashley Nurseries site)	1.42	54		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.

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158	Wood Cottage, London Road, Brampton, Suffolk	0.29	4		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
168	Land south of Union Lane, Oulton / Land adjacent 19 Union Lane, Oulton	0.18	5		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
110	Land to the north of Black Street, Gisleham	2.33	19		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
65	Land north and east of Hill Farm Road Halesworth	16.47	115		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
122	Land west of Norwich Road, north of Old Station Road, Halesworth	5.28	118		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
27	Land (off) The Loke, Blundeston, Lowestoft, Suffolk	0.43	5		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
33	Land adjacent to Travelodge Hotel, Leisure Way, Lowestoft	0.72	21		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
138	Saint Felix School (Land between St Georges Square and Lakeside Park Drive), Halesworth Road, Reydon	3.21	0		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
118	Land to the west of Laurel Farm Reydon, Reydon (primary area)	2.95	58		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
39	Land at Grove Farm, Mettingham	7.70	120		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
96	Land opposite St Michael's Church, Church Lane, Oulton	0.39	4		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
98	Land rear of Elizabeth Terrace, A12 London Road, Gisleham	1.80	30		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
108	Land to the east of London Road, Beccles (south of John Lawrence Close)	1.63	50		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

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53	Land between Church Lane and Church Avenue, Oulton	2.38	47		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
29	Land adjacent Millennium Green, Church Road, Blundeston	1.67	25		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
125	Manor Farm Barns, Church Road, Kessingland	0.66	13		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
120	Land west of London Road, Wrentham	1.11	22		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
67	Land north of Chapel Road, Wrentham	1.13	25		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
56	Land between Rushmere Road and Fairhead Loke, Carlton Colville	5.58	110		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
34	Land at Bell Farm, Carlton Colville (primary area)	5.00	130		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
35	Land at Bell Farm, Carlton Colville (secondary area)	13.38	320		78%	1%	21.00%	YES	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
61	Land east of Copland Way, Ellough Industrial Estate	16.64	0		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
106	Land to north of 34-48 Old Station Road, Halesworth	1.36	27		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
115	Land to the west of Halesworth (Block 1)	14.40	288		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
116	Land to the west of Halesworth (Block 2)	18.48	333		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
77	Land off Benacre Road, Ellough, Beccles (Site 1)	36.98	450		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

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78	Land off Benacre Road, Ellough, Beccles (Site 2)	1.24	0		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
139	Shoe Devil Lane, Ilketshall St Margaret	1.82	5		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
82	Land off Ellough Road, Beccles	59.18	950		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
32	Land adjacent to The Oaks, Beccles Road, Upper Holton, Halesworth, Suffolk	0.56	0		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
25	Hulver Street, Hulver, Beccles, Suffolk	1.04	15		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
149	The Street, Saint Margarets South Elmham, Harleston, Norfolk	1.92	5		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
117	Land to the west of Laurel Farm Reydon, Reydon	19.80	79		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
159	West of A144 opposite Triple Plea, Halesworth / Spexhall	0.99	15		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
161	Dairy Hill, Halesworth	3.12	50		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
162	South of Wissett Road, Halesworth	0.20	6		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
160	Basley Ground, Bramfield Road, Halesworth	0.87	0		28%	5%	67.00%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
163	West of Roman Way, Halesworth	1.91	40		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
164	Land west of Northern Spine Road/north of Pleasurewood Farm	18.70	390		100%	0%	0%	YES	YES	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

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167	Land north of Church Lane, Lound	6.86	137		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
169	Land south of Union Lane and west of Red House Close, Oulton	5.44	162		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
170	Land to south west of Union Lane, Oulton	4.10	82		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
171	Land west of Flixton View, Flixton	5.32	106		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
172	Land west of Parkhill, Oulton (south of Spinney Farm)	1.16	24		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
173	Street Field, Mill Road, Wissett	1.74	12		65%	3%	32.00%	YES	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
174	West of Ringsfield Road, Beccles	1.96	30		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
175	Land to the north of the Evergreens Garden Centre, Weston	1.10	22		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
176	Land to the west of the A145	0.57	0		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
177	Southwold Road / Blyford (B1123), Holton	1.56	23		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
178	Carlton Motors, Rushmere Road, Gisleham	0.39	5		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
179	Eades Farm, Beccles Road, Carlton Colville	37.96	900		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

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180	Hall Lane, Oulton	3.07	60		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
181	Land at the former Lothingland Hospital site, off Airey Close and Allington-Smith Close, Lowestoft	2.59	47		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
182	Land south of 324 Yarmouth Road and east of Pleasurewood Hill north of Gunton Avenue, Lowestoft	0.93	15		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
183	Land to the south of Hall Lane, Oulton	0.86	0		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
184	Oakenshaw, Parkhill, Oulton	2.54	76		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
185	Parkhill, Oulton	2.27	0		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
186	Part of Rookery Park Golf Club, Carlton Colville	0.55	0		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
187	Plot 'H', Blundeston Road, Oulton	0.61	9		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
188	Rear of 334 Beccles Road, Carlton Colville	0.69	0		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
189	Land south of Wangford Road, Reydon	10.87	152		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
190	Land off Hall Road, Blundeston	6.08	91		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
191	The Geranium Pot, Mariawood, Hulver Street	0.88	7		100%	0%	0%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
192	Opposite Osborne House Barn, Ilketshall St Lawrence	0.38	10		83%	14%	3.00%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.

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193	School Farm, Ilketshall St Lawrence	2.39	40		100%	0%	0%	YES	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
194	Between The Street and The Village Green, Lound	0.45	15		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
195	Lound Campus, Church Lane, Lound	6.88	137		100%	0%	0%	NO	NO	The subsurface is likely to be suitable for free-draining infiltration SuDS.
196	School Lane, Ringsfield	2.56	38		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
197	Adjacent Mill Bungalow, Rumburgh	1.40	14		100%	0%	0%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
198	Chenery's Loke, Cucumber Lane, Weston	0.45	6		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
199	Land adjacent to Park Farm House, Weston	0.65	12		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
200	Corner of Rumburgh Road and Chediston Street, Wissett	0.82	15		100%	0%	0%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
201	Land opposite Box Farm, Wissett	2.21	30		62%	3%	35.00%	YES	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
202	Land north of Keens Lane, Reydon	6.27	250		100%	0%	0.00%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
203	Land adjacent to Chediston Street, Halesworth	9.17	91		100%	0%	0.00%	NO	NO	There is a very significant potential for one or more geohazards associated with infiltration.
204	Harbour Road, Lowestoft	1.20	30		37%	7%	56.00%	NO	NO	The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions.
205	Old MJ Hales Scrapyard and Landloc, Cucumber Lane, Weston	2.33	70		100%	0%	0.00%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

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206	Land rear of Bungay High School	12.00	240		100%	0%	0.00%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
207	Land to the west of Evergreens Garden Centre, Weston	0.54	0		100%	0%	0.00%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
208	Broadside Park Farm, Reydon	33.57	0		91%	2%	7.00%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.
209	Land south of Mountbatten Road, Bungay	10.28	206		100%	0%	0.00%	NO	NO	The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions.

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