

# 1 Introduction

## 1.1 Purpose of the Water Cycle Study

The Regional Spatial Strategy (RSS<sup>1</sup>) 14 policy WAT2 (Water Resource and Wastewater Infrastructure Development) requires Water Cycle Studies (WCS) to be undertaken to:

- Ensure a co-ordinated approach to identify water supply and wastewater infrastructure to support development;
- Avoid negative impact on European sites of nature conservation (e.g. Broads and Wensum Special Areas of Conservation [SAC]);
- Provide an evidence base for Local Development Documents (LDD) to site development so they can:
  - Maximise potential of existing infrastructure;
  - Minimise need for new infrastructure.

This study is needed to ensure that water supply, water quality, sewerage and flood risk management issues can be addressed in the three Local Authorities (Norwich City Council, Broadlands District Council and South Norfolk Council) to enable the growth planned to 2031. It is a key part of the evidence base for the Joint Core Strategy (JCS) and is required by RSS14.

Funding has mainly been provided by Department for Communities and Local Government (DCLG) and Stage 1 of the Greater Norwich Water Cycle Study (GNWCS) was undertaken by Scott Wilson and completed in November 2007. It has involved the participation of the local authorities, the Environment Agency, Anglian Water (AWS) and Natural England (NE). The main aims of the WCS are to ensure:

- Water infrastructure is in place to support housing and employment growth;
- There is a strategic, co-ordinated approach to the management and usage of water; and
- There are no adverse impacts on European environmental sites (e.g. Broads and Wensum Special Protection Areas (SPAs) and SACs);

It will therefore:

- Inform Local Development Framework (LDF) site choice and enable phasing;
- Minimise infrastructure costs and the need for new infrastructure;
- Inform developers of any flood mitigation needs and costs;
- Provide evidence for Anglian Water investment plans with the Office of Water Services (OFWAT);
- Promote water efficient development.

It is considered that WCS are “living” documents and that although they are based on the best available data, they should be updated once further data becomes available.

## 1.2 Stage 1

### 1.2.1 Background

Stage 1 provided a WCS for the Greater Norwich Development Partnership (GNDP) in light of their required housing and employment growth targets, as set out in the RSS. It is intended to provide the following:

- A review of the growth areas in terms of the integrated water related features, such as flood risk, water supply, wastewater treatment and the environment;
- Identify, using a traffic light system, the level of risk for each of these growth areas to enable a visual representation of the suitability of development within these areas;
- Identify the financial contribution methodologies which could be sourced from third parties;
- Undertake an outline Appropriate Assessment of the findings of the study<sup>2</sup>;
- Provide a scope and fee proposal for Stage 2 of the WCS.

### 1.2.2 Potential Growth Areas (PGAs)

The RSS has set out the growth of development in the Greater Norwich area. The area has been sub-divided into two policy areas (Norwich Policy Area [NPA] and Rural Policy Area [RPA]) that have been outlined below.

*NB. The NPA references have been altered between Stage 1 and Stage 2 to align with changes in the JCS. Appendix A provides a table which shows the relation between these references. All references in this document related to the amended references.*

#### Norwich Policy Area

The Norwich Policy Area (NPA) is defined in the Structure Plan as an area including the Norwich urban area, first ring of surrounding villages and Wymondham (the Structure Plan definition also includes Long Stratton but the precise boundary is subject to confirmation in the JCS<sup>3</sup>).

#### Rural Policy Area

The Rural Policy Area (RPA) comprises of the remainder of the South Norfolk Council and Broadland District Council areas, outside of the NPA.

The Study Area is shown in Appendix B and growth targets which have been provided for the Study Area are outlined below:

<sup>1</sup> Published May 2008

<sup>2</sup> The Appropriate Assessment for the RSS had not been agreed at the time of writing

<sup>3</sup> JCS for Broadland, Norwich and South Norfolk

**Table 1-1: Policy Area Development Targets – 2031**

Policy Area	Growth Target (No of Properties)
NPA1-10	30,000
NPA11	14,500
Total Norwich Policy Area (NPA)	44,500
Rural Policy Area (RPA)	6,500
<b>TOTAL</b>	<b>51,000</b>

### 1.2.3 Possible Dwelling Scenarios (PDS)

Each of these PGAs has been assigned a Possible Dwelling Scenario (PDS) with a minimum and maximum number for each. These PDS are summarised below:

**Table 1-2: PDS**

Policy Area	PDS					
	0	1,000	5,000	10,000	15,000	20,000
NPA	0	1,000	5,000	10,000	15,000	20,000
RPA	0	100	500	1,000	2,000	

## 1.3 Outcomes of Stage 1

Stage 1 of the WCS identified the limitations for growth within each of the PGAs based in the following disciplines:

- Flood risk;
- Water Resources;
- Wastewater;
- Environment.

The results of Stage 1 are summarised below and contained within Appendix C<sup>4</sup>:

- Stage 1 has identified water infrastructure and environmental constraints related to development of proposed growth option locations in both the NPA and the RPA. This is based on existing infrastructural and environmental capacity.
- PGAs in the NPA were assessed for development of up to 20,000 dwellings at each location and for up to 2,000 dwellings at RPA locations.
- Within existing constraints, 33,000 new dwellings could be developed in the NPA and 2,300 in the RPA;
- Flood risk is most relevant on some brownfield sites in Norwich and in NPA8;
- Whitlingham Wastewater Treatment Works (WWTW) has high volumetric capacity available (for 51,860 further dwellings), but there is a need for wastewater network mains improvements and technological improvements (to reduce phosphorus emissions) to protect The Broads SAC.

<sup>4</sup> Note - the overall growth numbers between Stage 1 and Stage 2 have increased.

- Limited sewer capacity in central Norwich reduces the potential for development to the north and west of Norwich unless new sewerage infrastructure is provided and may be an issue for future development of brownfield sites in the city centre.

## 1.4 Stage 2

Stage 2 will use and develop Stage 1 findings and will be undertaken in two sub-stages:

**Stage 2a.** This sub-stage will inform the Preferred Options of the JCS and must be complete by the end of autumn 2008. It will identify how the constraints identified in stage 1 in all the PGAs could be overcome through investment in new infrastructure. It will then make recommendations on which are the most appropriate locations for growth based on a ranking system which will predominantly informed:

- Costs of providing infrastructure to the PGA;
- Impact on environment;
- Flood risk considerations.

**Stage 2b.** This sub-stage will look in more detail only at the sites chosen as the Preferred Options. It will be complete by late 2008, dependant on the progress of the JCS. It will provide a detailed timeline of infrastructure upgrades required for the chosen growth sites.

*This document should be read in conjunction with Stage 1 of the GNWCS.*

## 2 Stage 2a

### 2.1 Scope of Stage 2a

Stage 2a is intended to provide part of the evidence base for the choice of development locations in the Preferred Options of the JCS. The following Sections were identified in the Tender submission for Stage 2a, and are addressed along with the appropriate amendments in the following Sections.

- Identify and address the data gaps (see Section 2.2);
- Update existing condition (see Section 2.3);
- Sewer/water supply modelling (see Section 2.4);
- Site go/no go identification (see Section 2.5);
- Develop cost schedule (see Section 3);
- Selection of preferred options (see Section 0).

A number of modifications of the scope of service have evolved between the tender and the inception periods of Stage 2a. These modifications are identified and addressed in the Sections below.

### 2.2 Data Gaps

A number of data gaps were identified in Stage 1 which are summarised below and outlined in Appendix D.

- The updated Flood Zones Maps from the SFRA;
- Inclusion of the impacts of climate change onto all facets of the study;
- Provide greater clarity on the impacts of development to the groundwater and the water resources in the study area;
- Liaison with AWS to identify what growth has been earmarked<sup>5</sup>;
- Identification of process bottlenecks on each of the WWTWs;
- Information pertaining to appropriate Sustainable Drainage Solutions (SUDS);
- An assessment of the capacity of the receiving watercourse;
- An assessment of the capacity of the sewer network;
- The Review of Consents (RoC) for the WWTW;
- Review the project in light of the Water Framework Directive (WFD) and identify and address any potential constraints at an early stage;
- Address any low flow issues in the River Wensum.

<sup>5</sup> Outputs of this may be commercially sensitive hence not available, in which case assumptions will have to be made

#### 2.2.1 Updated Flood Zone Maps

The SFRA has been incorporated where necessary into the WCS. The updated flood zone maps which have been undertaken as part of the SFRA have been used in the analysis within Stage 2a. This should be reviewed in **Stage 2b**.

#### 2.2.2 Climate Change

Climate change has been incorporated into the updated flood zone maps within the SFRA. These form the basis of the assessment of flood risk as a constraint within this report. The impact of climate change was considered in three aspects:

- The sewer network capacity has been addressed by assuming that there is no spare capacity within the system, as discussed in Section 2.4;
- The analysis of the capacity of the receiving watercourse used flows which considered climate change impacts.
- The effect of climate change on water resource availability has been taken into account via AWS's calculation of required headroom in supply and demand in their latest draft Water Resources Management Plan (2008).

#### 2.2.3 Impact on Groundwater

The impacts of groundwater from the proposed growth areas are outlined below:

- The only additional local abstraction will be from groundwater sources and only up to their existing licensed amount;
- Where the RoC has identified a problem, such as with the River Wensum (including Costessey Abstraction Point (AP)), then any abstraction from these sources will not be increased.
- To minimise the impact of development, consideration will be given to a phased increase in transfers into the area. This is in line with AWS Strategic Document 2010-2035 which was published in December 2007.

#### 2.2.4 AWS Growth Plans

This information is not available, however Stage 2a has been undertaken in close consultation with all of the stakeholders to ensure that it does not conflict with other strategies, whether they are commercially sensitive or not. AWS is only obligated to plan its infrastructure to accommodate development adopted within existing local plans and sites with planning permission (windfall sites).

#### 2.2.5 WWTW Capacity Constraints

Stage 2a has only considered volumetric capacity at WWTW. Assessment of specific treatment process capacity constraints at the relevant WWTWs will be undertaken in **Stage 2b**. For the purposes of Stage 2a, it has been assumed that the unit cost of providing additional process capacity (i.e. nutrient removal) is the same for all treatment works. Comparison of the merits of providing additional process capacity at a treatment works as opposed to any other has therefore been based on the current existing process headroom at each treatment works.

## 2.2.6 SUDS

The SUDS chapter within the SFRA has been reviewed and the conclusions arising from it will be carried forward into this WCS. It is not considered that this will have an impact on Stage 2a. Site specific and area wide SUDS schemes will be considered as part of this Stage 2a, as well as in **Stage 2b**.

## 2.2.7 Capacity of Receiving Watercourse

It was considered that the flood risk from the watercourses may increase during peak flood flows as a result of the additional discharge from the WWTW. This is because the base flow within the rivers would increase as a result of the additional discharge from WWTWs through the development. It is not possible to ascertain exactly what the additional flood risk is from each of the WWTW without undertaking detailed hydraulic modelling to see how water levels would be affected and what the resultant impact would be on existing properties and land. However, a traffic light assessment of this has been undertaken on a site-by-site basis and is described in Section 3.4.2.

## 2.2.8 Capacity of Sewer

AWS have stated that there is no spare capacity within any of the networks as spare capacity will be required to:

- Accommodate additional flows which may arise from anticipated increases in flow (as a result of rainfall) through climate change;
- Remain reserved for infill and previously developed land within existing developed areas.

This has been verified through an independent analysis and is discussed in Section 2.4.

## 2.2.9 Review of Consents (RoC)

Through the process of undertaking the Stage 1 study, attention was drawn to a potential data gap in that the study did not fully take account of the implications of the impact of discharge of phosphorus and the impact of abstraction on the River Wensum SAC and The Yare Broads and Marshes SAC/SPA.

The Environment Agency is currently undertaking an assessment of the impact of discharges and abstractions potentially impacting on the European designated sites through the statutory RoC process. This process looks to determine which consents (both to discharge to and to abstract from water resources) are potentially having an adverse impact on the integrity of hydrologic ally dependent European sites, either in isolation or in combination with other consents. Specifically for the GNWCS, the key consents being considered as part of the assessment are:

- The abstractions direct from the Wensum at Costessey Abstraction Point (AP) as well as from boreholes in close proximity to the Wensum located at Costessey AP, potentially impacting the Wensum SAC;
- The impact of discharge from Whitlingham WWTW and other smaller WWTWs affecting the Yare Broads and Marshes SAC and SPA downstream; and
- The impact of other discharges on the Wensum SAC.

At the time of writing the GNWCS Stage 1 report, the RoC was in the process of reporting on its Stage 3 which reports on the Appropriate Assessment. As a result the Stage 3 reports were not available to determine whether the existing abstractions and discharges in the region were impacting on the designated sites. As such, it was not possible to determine whether there would

be a requirement for a change on the baseline assumptions before the impact of additional abstraction and discharge was assessed as part of the GNWCS.

During the assessment stages of this Stage 2a GNWCS, the Environment Agency completed Stage 3 of the RoC and have made available sections of the Appropriate Assessment reports for use in this study. The Environment Agency are currently in the process of reporting and discussing the results of the Stage 3 outcomes with consent owners and as such, full details from the Appropriate Assessment reports were not available. It has therefore not been possible in every case to determine which of the discharge consents and which of the abstractions are considered to be having an adverse impact on the protected sites. Despite this, several conclusions can be drawn from the Stage 3 RoC information that was made available for this Stage 2a report. These are outlined in Appendix E.

Although the outcomes of Stage 3 of the RoC are not unknown, NE has provided the following statement:

*Natural England are in support of the partnerships approach in developing the Greater Norwich Water Cycle Study. We are satisfied that at every stage, the consultants have reviewed the available information and also reviewed the conclusions of earlier stages of the study to ensure that any new work is based upon the best available information at each point in time.*

*Natural England will sign up to the Water Cycle Study on that basis. However, in so doing, we wish to raise a note of caution to decision makers in that the Water Cycle Study is due to be completed, and recommendations on the most appropriate growth areas presented, before the conclusion of Stage 4 of the Environment Agency's Review of Consents on key European sites, which is being carried out under Regulation 50 of the Conservation (Natural Habitats &c.) Regulations 1994.*

*Natural England are concerned that Anglian Water's Draft Water Resources Management Plan may not have taken a sufficiently precautionary stance in relation to the protection of flow on the River Wensum SAC, or achievement of the target levels of phosphate in relation to the Broads SAC. If realised, this scenario would have implications in relation to both the Costessey abstractions, and also discharges from the Whitlingham Wastewater Treatment Works. There are therefore higher levels of risk associated with selection of growth areas prior to the conclusion of Stage 4 of the EA Review of Consents than if the selection was informed by the conclusions of Stage 4.*

*The development of the Study has been an iterative process, and the report should be a living document which should be reviewed and adapted in light of the best available information at any given point in time. Natural England therefore recommend that the conclusions of the Norwich Integrated Water Cycle Study are reviewed following the conclusion of the Environment Agency's Review of Consents.*

## 2.2.10 Water Framework Directive (WFD)

The WFD will be addressed in the context of the WCS in **Stage 2b** as at the time of writing Stage 2a, there was no data available from the Environment Agency. It is understood that the programme of measures and water quality standards are due for release in draft form at the end of 2008 with the publication of the draft River Basin Management Plans, and until these are published only assumed data can be used.

### 2.2.11 River Wensum Low Flow Issues

Subsequent to submission of the Stage 1 report it was identified that there was concern over the low flow issues in the River Wensum. A meeting was held during the inception stage and attended by AWS, Natural England, the Environment Agency, Norwich City Council, Norfolk County Council and Scott Wilson to discuss the issue. It was agreed that while there were existing low flow issues in the Wensum, Natural England would support schemes which would ensure that abstraction from the River Wensum does not detrimentally affect the river.

## 2.3 Update Existing Condition

It was considered that once the data gaps above had been obtained that the existing condition constraint matrix provided in Stage 1 could be updated accordingly.

### 2.3.1 Wastewater Network

During Stage 1 the constraint matrix was prepared using the volumetric headroom of the WWTW, and because no data on the capacity of the wastewater network was available, this was noted and not considered further. Since Stage 1, however, AWS has stated that there is no existing capacity within the wastewater network (see Section 2.2.8). This means that whatever development is proposed, there will need to be additional wastewater collection and transfer infrastructure provided. *Therefore this constraint remains the same and has not been amended.*

### 2.3.2 Water Supply Network

The constraints matrix did not include any information on the water supply network and headroom as this data was not available. However an assessment will need to be made as part of this study. Therefore, in developing the cost schedule this will be addressed (see Section 3.2.1).

## 2.4 Sewer/Water Supply Modelling

In Stage 1 it was assumed that the sewer network and water supply network would be modelled in order to ascertain the existing capacity of these, and hence to apply this to the constraints matrices. However, AWS have stated that there are currently no models available to undertake the modelling, and that these are not likely to be available until 2010. This means that the proposed modelling described in the Stage 2 tender document and summarised in Section 2 will not be carried out, and is unlikely to be carried out as part of the Stage 2b of the WCS.

AWS have further stated that with the expected increase in runoff from climate change there is no spare capacity within the existing sewer network. This position has been assessed by undertaking calculations for critical Sections of the existing trunk sewers. The assessment broadly agrees with AWS position, and is outlined in Appendix F.

## 2.5 Site Go/No Go Identification

It was identified in the Stage 2a tender that there should be a workshop to examine on a site-by-site basis any 'showstopper' constraints which will rule out PGAs. These constraints could include the following, for example:

- Significant flood risk;
- Major impacts on water resources from abstraction;

- Limitations on the capacity of the receiving watercourse;
- Limitations on the receiving environment on a site basis and cumulative basis.

This would ensure that the assessment of site suitability was narrowed down to a plausible number of sites to undertake the assessment of the PDSs.

However, this approach was amended such that *all* of the sites would be considered and compared with each other. This means that the selection of preferred sites will have a transparent methodology. Furthermore, all of the sites will be 'ranked' based on:

- Costs of providing infrastructure to the PGA;
- Impact on environment;
- Flood risk considerations.

This ranking will form the basis for the GNDP to identify those sites to be carried forward for further analysis in **Stage 2b**. The ranking exercise is shown in Section 5.