Cheshire West and Chester Council

Water Cycle Strategy

Outline Stage – Final Report

June 2010










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Executive Summary

Purpose of this Report

Growth in West Cheshire and Chester is part of wider growth plans across the North West of England. As part of the plan to deliver significant and prosperous economic growth Cheshire West and Chester Council is exploring growth options to deliver 2,700 new homes between 2007/8 and 2016/17 (on top of the requirement for 11,853 homes set out in the North West Regional Spatial Strategy). The area has been awarded Growth Point status by the department for Communities and Local Government, attracting government funding to support the growth. One condition of that award is the completion of this water cycle study, required to demonstrate that the growth proposals are sustainable. At the time of writing the new government has announced its intention to abolish Regional Spatial Strategies. Cheshire West and Chester Council are still working to those figures and the growth point proposals.

This report has been produced for the purpose of providing an initial overview of the water cycle and its constraints to development across West Cheshire and Chester, providing strategic level advice on water infrastructure and environmental capacity to inform the development of the Core Strategy and a preferred spatial strategy.

The strategic **objectives** for the Outline Water Cycle Study are to:

- Identify whether environmental resources can cope with further development, with particular reference to Water Framework Directive targets and UKCP09 climate change projections; (i.e. can growth be accommodated without breaching water quality and abstraction limits);
- Identify if, where, and when development might overload existing infrastructure, and if capacity exists for development without the need for additional infrastructure;
- Identify if, where, and when new infrastructure or management interventions are needed to allow development;
- Establish effective liaison with adjoining Growth Point areas to enable any potential cumulative impacts on the water environment to be identified;
- Identify any potential impacts of development on the Dee Estuary SPA/Ramsar and the River Dee and Bala Lake SAC and other sites or features of significant nature conservation importance, within and outside the West Cheshire area, resulting from additional abstraction and wastewater discharge;
- Contribute to the evidence base for the Local Development Framework Core Strategy, the Infrastructure Plan and the Habitats Regulations Appropriate Assessment.

The study has involved working with the key stakeholders: Cheshire West and Chester Council (CWaC), the Water Companies, and the Environment Agency to establish the key constraints within the water cycle and to identify integrated solutions in order to achieve sustainable development. Data for this study has been collated from

Cheshire West and Chester Council, United Utilities, Dŵr Cymru Welsh Water, Dee Valley Water, and the Environment Agency (North West region and Wales region).

Incoming information (referenced within the document) has been reviewed and the information and findings summarised.

A Regional (North West) Scoping study was completed for the Environment Agency in 2009. Entec has completed a more localised scoping assessment, prepared in accordance with the Environment Agency Water Cycle Studies guidance. This assessment reviewed the content and conclusions of the Regional Scoping study and identified additional issues in the Dee catchment and surrounding areas that were not included in the North West study. The local Scoping Study collated and reviewed existing information on the water environment within the CWaC area and identified key issues for subsequent stages of work. It was assumed that the information made available to Entec was accurate and complete.

This Outline report builds on the findings of those scoping studies and takes account of additional feedback from the key stakeholders. It examines how water resources, wastewater treatment, water quality, sewerage and flood risk could constrain growth across the study area. The location and severity of these constraints are presented together with recommendations that could resolve the constraints and an evaluation of the implications for growth.

Contents

Glossary

AMP	Asset Management Period	Five year period in which water companies implement planned upgrades and improvements to their asset base. Activities are subject to funding review.
BAP	Biodiversity Action Plan	Each Local Biodiversity Action Plan works on the basis of partnership to identify local priorities and to determine the contribution they can make to the delivery of the national Species and Habitat Action Plan targets.
BOD	Biological Oxygen Demand	A widely used measure of polluting potential - a measure of oxygen use, or demand, by bacteria breaking down the biodegradable load in sewage treatment plants or environmental waters.
BREEAM	Building Research Establishment Environmental Assessment Method	A voluntary measurement rating for green buildings that was established in the UK by the Building Research Establishment.
CAMS	Catchment Abstraction Management Strategy	The assessment of how much water can be extracted to meet its many economic uses – agriculture, industry, and drinking water supply – while leaving sufficient water in the environment to meet ecological needs.
CLG	Communities and Local Government	Communities and Local Government sets policy on local government, housing, urban regeneration, planning and fire and rescue.
CFMP	Catchment Flood Management Plan	A strategic planning tool through which the Agency will seek to work with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.
CSH	Code for Sustainable Homes	Signals a new direction for building standards. Wherever practical DCLG intend to develop and introduce a system of sustainable building standards based on voluntary compliance.
CSO	Combined Sewer Overflow	A system for allowing a certain flow of combined sewerage and stormwater to be discharged into watercourses untreated during storm events to prevent the sewerage system backing up and flooding.
DCWW	Dŵr Cymru Welsh Water	Water supply and sewerage company that provides sewerage services to Chester and the surrounding areas.
Defra	Department for Environment, Food and Rural Affairs	Department that brings together the interests of farmers and the countryside; the environment and the rural economy; the food we eat, the air we breathe and the water we drink.
DPD	Development Plan Document	Details the spatial representation of housing and employment land allocations in response to the regional spatial strategy.
DVW	Dee Valley Water	Water supply only company that provides water supply to Chester and its surrounding areas.
DWF	Dry Weather Flow	The measure of the flow influx to a WwTW derived from human activity (both domestic and trade), but excluding any storm-induced flows.
EA	Environment Agency	A government body that aims to prevent or minimise the effects of pollution on the environment, issues permits to monitor and control activities that handle or produce waste, and promotes efficient use of resources. It also provides up-to-date information on waste management matters, water efficiency advice, and flood protection advice.
GIS	Geographical Information System	A system for capturing, storing, analyzing and managing data and associated attributes which are spatially referenced to the earth.
GQA	General Quality Assessment	The Environment Agency's method for classifying the water quality of rivers and canals is known as the General Quality Assessment scheme (GQA). It is designed to provide an accurate and consistent assessment of the state of water quality and changes in this state over time.

LDF	Local Development Framework	A folder of local development documents that outlines how planning will be managed in the area.
l/h/d	Litres per head per day	A unit for measuring the amount of water consumed and waste flow from households.
LPA	Local Planning Authority	The local authority or Council that is empowered by law to exercise planning functions. Often the local borough or District Council. National parks are also considered to be local planning authorities. County Councils are the authority for waste and minerals matters.
Ofwat	The Water Services Regulation Authority	The Water Services Regulation Authority is known commonly as Ofwat. Ofwat regulates how much revenue a water company can collect from its customers to fund services and asset management over each five year planning period (See Periodic Review)
Pcc	Per capita consumption	A phrase referring to the amount of water consumed per person.
PE	Population equivalent	A term used in the water industry to express the capacity of a wastewater treatment works in a standard unit. It is NOT a measure of the population served, and consequently it is incorrect to add population and Population Equivalent values.
PPS25	Planning Policy Statement 25	Sets out the Government's national policies on development and flood risk. The policies in these statements apply throughout England and focus on procedural policy and the process of preparing local development documents.
PR	Periodic Review (for water companies' investment plans)	One of Ofwat's main tasks is to set price limits for the water and sewerage companies in England and Wales. Ofwat do this in order to protect consumers from the monopoly providers of these services. However it is also their duty to enable efficient companies to finance their functions. They make sure that consumers receive reliable services and value for money and that each company is able to meet its environmental obligations now and in the future. Price limits are reviewed every five years. Prices were set at the price review in 2004 for the 2005 – 2010. This current price review (PR09) covers the five years from April 2010.
RBMP	River Basin Management Plan	The River Basin Management Plans describe the river basin district, and the pressures that the water environment faces. It shows what this means for the current state of the water environment in the river basin district, and what actions will be taken to address the pressures in line with the requirements of the Water Framework Directive. It sets out what improvements are possible by 2015.
RSS	Regional Spatial Strategy	A broad regional development strategy for a 15 to 20 year period prepared by the Regional Planning Body.
SAC	Special Area of Conservation	A site designated under the European Community Habitats Directive, to protect internationally important natural habitats and species.
SFRA	Strategic Flood Risk Assessment	A document that informs the planning process of flood risk and provides information on future risk over a wide spatial area. It is also used as a planning tool to examine the sustainability of the proposed development allocations.
SPA	Special Protection Area	Sites classified under the European Community Directive on Wild Birds to protect internationally important bird species.
SSSI	Site of Special Scientific Interest	A site identified under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000) as an area of special interest by reason of any of its flora, fauna, geological or physiographical features (basically, plants, animals, and natural features relating to the Earth's structure).
SuDS	Sustainable Drainage Systems	Sustainable drainage systems or sustainable (urban) drainage systems: a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques (may also be referred to as SDS).
SWMP	Surface Water Management Plan	A framework through which key local partners with responsibility for surface water and drainage in their area work together to understand the causes of surface water flooding and agree the most cost effective way of managing surface water flood risk

WCS	Water Cycle Study	A study aimed at ensuring that future development is sustainable in terms of flood risk management, water quality and water supply.
WFD	Water Framework Directive	A European Union directive which commits member states to ensure all water bodies (surface, estuarine and groundwater) are in good ecological status (or good potential) by 2015.
WRMP	Water Resource Management Plan	Plan prepared by water supply undertakers every 5 years outlining how they aim to meet predicted demand for water over the next 25 years
WRZ	Water Resource Zone	Defined by the water company, and the scale at which the supply/demand balance in a region is calculated. A zone is defined as an area in which all customers receive the same level of service in terms of reliability of water supply.
WwTW	Wastewater Treatment Works	Separates solids from liquids by physical processes and purifies the liquid by biological processes. Discharge from Wastewater Treatment Works may contain a range of pollutants and need to be carefully monitored.
UKCIP	United Kingdom Climate Change Impacts Programme	Mainly funded by the Department for Environment, Food and Rural Affairs it helps co-ordinate scientific research into the impacts of climate change, and helps organisations adapt to those unavoidable impacts.
UKWIR	United Kingdom Water Industry Research	This organisation facilitates collaborative research for UK water operators.
UU	United Utilities	Water supply and sewerage company that provides water supply and sewerage services to the majority of the study area.

1. Introduction

1.1 Aims and Objectives

A Water Cycle Study (WCS) is required to fulfil the requirements of Growth Point status, which Cheshire West and Chester has been awarded. The aim of this WCS is to investigate the capacity and opportunities within the environment and water services infrastructure to enable growth to be sustainable. The study examines the whole Cheshire West and Chester area but focuses on the four main locations identified for growth: Chester, Ellesmere Port, Northwich, and Winsford.

A WCS is one of a number of strategic studies used by Local Planning Authorities as part of the evidence base for Local Development Frameworks. The Study identifies necessary infrastructure and policy requirements to achieve the planned growth without compromising, and where possible enhancing, the water environment. It recommends phasing water infrastructure requirements to align with the timing of the proposed development. Where environmental constraints on housing growth exist that cannot be accommodated by infrastructure solutions these also need to be identified.

The key issues that are addressed in the WCS include:

- Assessing the capacity of the current water infrastructure to accommodate growth without adversely affecting the environment by considering:
  - the availability of water resources;
  - the capacity of the drainage network;
  - the potential to increase flood risk;
  - the capacity of existing wastewater infrastructure;
  - the environmental capacity of receiving watercourses to receive wastewater;
- Determining the potential impact of the proposed development in the context of requirements of environmental legislation including the Water Framework Directive, Habitats Directive and other relevant water cycle policy;
- Identifying the infrastructure necessary to achieve the proposed growth within the constraints of the environment and legislation; and
- Developing a strategy for a phased approach to development that allows key growth targets to be met whilst providing sufficient time for the identified infrastructure to be adopted.

The Outline Study provides a mechanism to bring together the range of water related issues under a single framework and ensure that all stakeholders have their say. Most of the data and information used in this study was already held within stakeholder organisations and one of the key benefits of the partnership approach is unlocking and joining up this understanding and making the information accessible.

1.2 National Guidance on Water Cycle Studies

The Environment Agency has issued a National Guidance document to ensure that water cycle studies are carried out in a consistent way (Environment Agency, 2009a). This guidance outlines the required approach for the Scoping, Outline and Detailed phases of water cycle studies, as described below.

Scoping: The primary aim of the Scoping Phase is to collate and review existing information (e.g. previous studies and monitoring data) on the water environment within the CWaC area, identify development plans and engage with key stakeholders, including the Environment Agency, water companies and drainage authorities, to identify key issues that require consideration in the following stages of the work. The Scoping Phase should clarify the principles and objectives to be followed throughout the rest of the process.

Outline: The primary aim of the Outline Phase is to identify potential environmental and water infrastructure constraints to development to provide an evidence base to support the Core Strategy and identification of preferred sites for development. The study should identify areas of uncertainty that may require further detailed studies.

Detailed: The Detailed Phase aims to resolve areas of uncertainty identified in the Outline Phase. It identifies what water cycle management measures and infrastructure are needed, where and when they are needed, who is responsible for providing the systems, and by what deadline. This may involve an assessment of the costs and benefits of options. It also provides guidance to the local authorities to facilitate implementation and funding of the Strategy.

1.3 How to Use this Outline Study

This Outline report builds on information used and the conclusions found from the a North West of England regional scoping WCS (Halcrow, 2009) and a scoping study specific to the Cheshire West and Chester Council (CWaC, 2010).

This Outline study brings together environmental and water infrastructure information that has been provided by the Environment Agency and the water companies. It highlights the environmental and infrastructure features that may constrain growth across West Cheshire. The constraints are ranked, and a traffic light system demonstrates the level of resource that may be required to overcome these constraints.

The Council is at an early stage in developing its spatial strategy and has not yet identified specific sites for development. The outputs of this study will inform development of the spatial strategy and identification of

particular sites. The study has been based on an initial assessment of potential suitable sites that comply with the existing planning strategy for the area (i.e. development is focused on previously developed sites in the existing urban areas of Chester, Ellesmere Port, Northwich and Winsford). It represents a snapshot of the best information available at the time of the study being undertaken. It does not represent the Council's preferred strategy which has yet to be developed based on this and other studies and evidence.

1.4 Structure of the Report

This report is structured with by the following chapters:

- **Chapter 2: Development and Growth**, provides an overview of the regional, national and local policies relevant to growth and the water environment in the District;
- **Chapter 3: The Water Cycle**, introduces the elements of the natural and urban water cycle and relevant legislation;
- **Chapter 4: Existing Water Environment**, presents the baseline scenario of water resources, water quality, wastewater treatment, sewerage and flood risk;
- **Chapter 5: Climate Change**, reviews the impacts that should be considered from climate change on the water cycle;
- **Chapter 6: Potential Constraints**, reviews the baseline data to determine existing constraints to growth in the study area, and the capacity of existing infrastructure to support growth;
- **Chapter 7: Development Strategy**, considers options available to overcome the constraints and deliver key growth targets; and
- **Chapter 8: Recommendations**, presents recommendations for policy documents and actions for the Council.

The data and analyses presented in this Outline study provide the evidence base for planning decisions at a strategic level. This evidence should be used by the Council to consider which options will best support the LDF Core Strategy and related policies. It highlights areas where further analysis is required. It does not provide an instant answer for determining planning applications.

Detailed information on the methods used to assess the environmental constraints, and on sustainable development features, such as demand management measures and sustainable drainage techniques, are included within a series of appendices.

1.5 The Study Area

The steering group (see below) agreed that the study area should include the whole of the Cheshire West and Chester Council boundary plus a 5km buffer around the perimeter, and the lower Dee. The implications of growth

on the Dee and Mersey estuaries, Lake Bala, and other environmental sites in the wider region from which public water supplies are sourced are also taken into account. The characteristics of the study area are described in Chapter 4.

1.6 Stakeholders

Development across West Cheshire will affect a large number of people and different organisations have different stakes in how development proceeds. The scoping study undertaken specifically for Cheshire West and Chester reviewed which stakeholders are relevant to this study. Understanding of the stakeholders is critical to the study and so the information in the scoping study is included again here.

A project steering group has been set up to bring together the core organisations involved in developing the water cycle strategy. These include the Council, United Utilities, Dŵr Cymru Welsh Water, Dee Valley Water and the Environment Agency. There are other stakeholders who are not directly involved but who are concerned with the environmental issues in the area, or who have other interests in the growth plans. The water cycle study provides a platform to identify and engage with all of these stakeholders in the most appropriate way, and creates opportunities for consultation early in the development planning process.

The stakeholders are categorised on the basis of their level of interest in the project and their potential impact on its success.

1. Cheshire West and Chester Council. The Council is responsible for ensuring delivery of new homes to meet the Growth Point target and the regional target in the North West Regional Spatial Strategy (RSS). The Council takes ownership of the project, and is responsible for funding the project. The Council requires outputs that will provide the evidence base for its LDF and Core Strategy.

2. The water companies (United Utilities, Dŵr Cymru Welsh Water and Dee Valley Water). The water companies are responsible for ensuring that water supply and sewerage services are maintained and developed to meet the needs of existing and new customers, at levels of service determined by the Company. The water companies' interest is to ensure capacity analyses are appropriate, to use the water cycle study outputs to inform asset planning, and to build longer term relationship with the local authority. The project requires commitment and action from the water companies. In particular, the water cycle study is reliant on data provided by the water companies.

3. The Environment Agency is responsible for ensuring that there is sufficient water to meet the needs of people and the environment. The Environment Agency is interested in developing a relationship with Council and the water companies to ensure future dialogue on development plans and to facilitate partnerships. The water cycle study is also reliant on data provided by the Environment Agency.

4. Natural England and the Countryside Council for Wales are not on the Steering group but have an interest to ensure that all designated sites are correctly identified and potential risks arising from development are identified. The project requires support required in later, more detailed stages of water cycle study.

5. The Mersey Dee Alliance represents the regional authorities with shared economic, social and environmental interests across the West Cheshire, Wirral and North East Wales area. This Alliance, the other growth points in the North West, and other neighbouring Councils have an interest in the progress of the study and the development plans. These stakeholders have been informed of the project but no action is required from them.

6. Private sector developers. There are a number of private sector developers interested in sites within the study area. This study serves as an opportunity to inform them of the environmental context within which their activities lie. At this stage no action is required from them.

Further information concerning stakeholders is presented in Appendix A.

2. Development and Growth

2.1 General Background

Cheshire West and Chester is located south of Liverpool across the Mersey estuary, south west of Manchester, and borders north east Wales. The local authority area covers approximately 941km^2 (363 square miles) and includes the four main towns of Chester, Ellesmere Port, Northwich, and Winsford. It is a predominantly rural area although parts of the Weaver Gowy catchment are heavily industrialised (Environment Agency, 2009b). A map showing the local authority area surrounded by a 5km buffer area is shown in Figure 2.1.

Geology is an important element of the water cycle study as the Regional Scoping study identified the risk of groundwater rebound (recovery of groundwater levels back to their natural conditions since coal mine dewatering and abstraction for industrial purposes has ceased).

The geology of the study area is primarily Triassic and Permian sandstone bedrock. Above this, the majority of the study area is covered by Quaternary Diamicton till. There are also pockets of sand and gravel, and alluvium superficial deposits. Sandstone has a relatively high permeability which will influence what kind of sustainable drainage systems are most appropriate in the study area.

2.2 Development Plan

Cheshire West and Chester Local Development Framework

At the time of writing the new government has announced its intention to abolish Regional Spatial Strategies. Cheshire West and Chester Council are still working to those figures and the growth point proposals.

Cheshire West and Chester is a growth point within the broader North West Regional Spatial Strategy. The Growth Point aims to deliver 2,700 homes between 2007/08 and 2016/17. This is in additional to the 11,853 homes set out in the Regional Spatial Strategy. The Council has a 'Programme of Development' specific to achieving the aims of the Growth Point. Further details on this and the RSS growth rates are available in Appendix B.

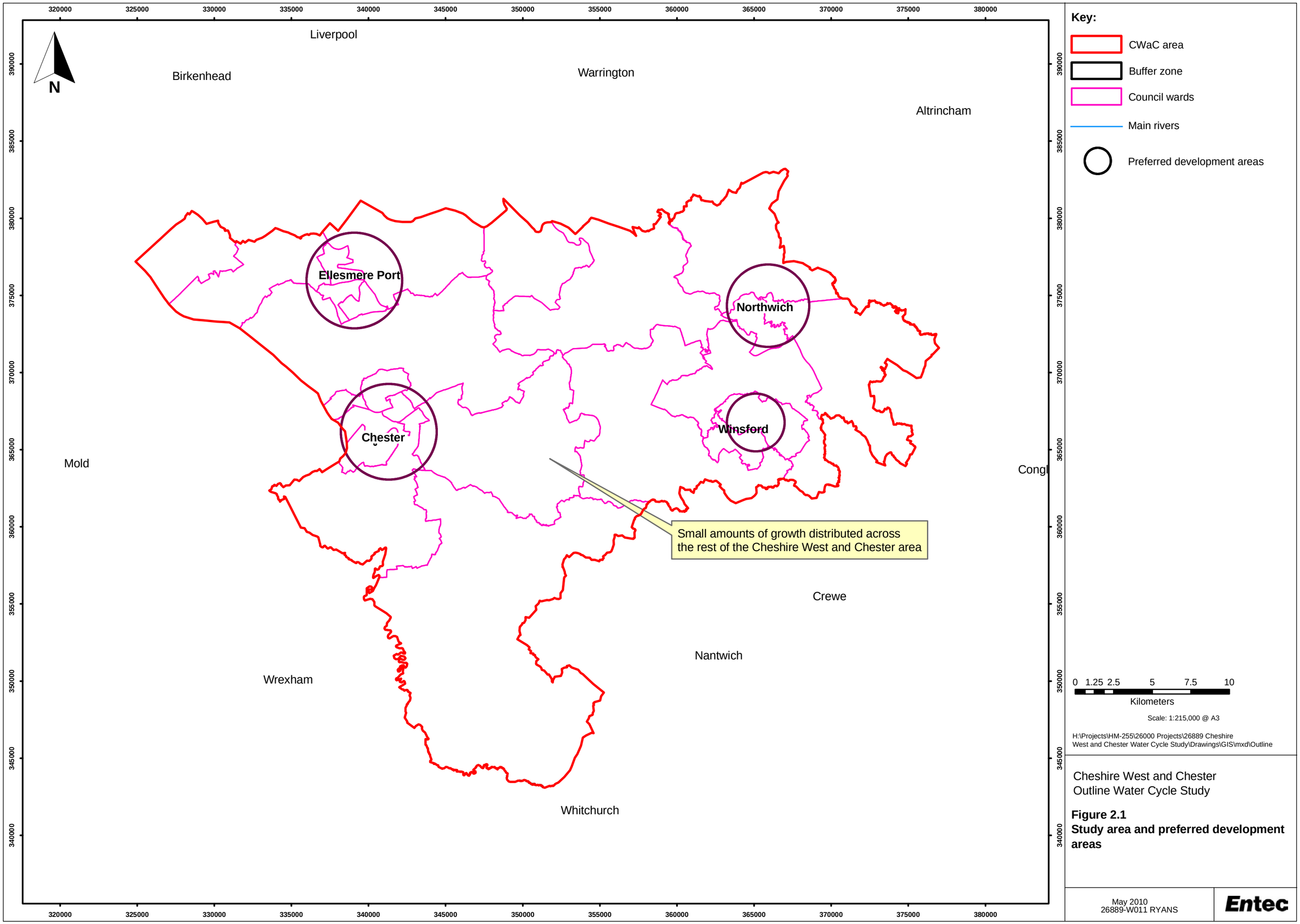
In accordance with the housing requirement set out in the Regional Spatial Strategy and Growth Point proposals, the Council is developing a strategy to deliver 27, 000 new homes over an 18 year period (2010/11 to 2027/28). This study evaluates the environmental constraints across the whole area but the main purpose is to test emerging proposals for housing development in a variety of locations across the borough.

The Council has provided outputs from an initial assessment of potentially suitable sites and timing for development. Figure 2.1 illustrates preferred locations for growth, whilst the potential scale and timing of

development across the study area is shown in Table 2.1. It is anticipated that the majority of growth will be in the four main towns of Ellesmere Port, Chester, Northwich, and Winsford. In the earlier stages of the growth period (between 2010 and 2015) most development will focus in Ellesmere Port and Chester. After 2015, growth will be more evenly distributed across the four main towns. In the later stages of the growth period, after 2020, the bulk of the planned growth will be in Northwich. Table 2.1 summarises the overall potential housing growth planned by Council ward. This information represents potential growth based on existing allocations in local plans; sites with planning permission or applications pending that are policy compliant; additional sites on brownfield land in existing urban areas; and recent development rates on small sites. A more detailed breakdown of growth per ward over time is presented in Appendix B. The information used for this study has been compiled in advance of a more thorough investigation of potential housing capacity, which is being undertaken through the Strategic Housing Land Availability Assessment. As such, it should be treated as indicative only and will be subject to change and clarification as work on the Local Development Framework progresses. Further information on national and regional planning context is provided in Appendix C.

Table 2.1 Summary of Potential Growth per Council Ward

Ward	Years 1 to 5	Years 6 to 10	Years 11 to 15	Years 16 to 18	Annual small site additional allowance	Total potential growth between 2010/11 and 2027/28
Abbey		134	45		8	299
Blacon		64	161		15	450
Boughton Heath and Vicars Cross	556				20	856
Broxton	172	30	100		15	527
Central and Westminster	2155	1710	1600	816	20	6581
City	948	617	613		50	2928
Eddisbury		292			5	367
Frodsham and Helsby	388	50			15	663
Gowy			155		10	305
Grange and Rossmore	39	103	40		20	482
Groves and Whitby		25			20	325
Hoole and Newton		123	15		20	438
Ledsham and Willaston	15	700	35		7	855
Marbury		664	912		5	1651
Mickle Trafford		74			10	224
Neston and Parkgate	12				10	162
Northwich East and Shakerley	416	1165	1003		20	2884
Northwich West	224	755	1231		20	2510
Overleigh		32	47		20	379
Sutton and Manor	87	470			20	857
Upton	173				20	473
Weaver	45		80		10	275
Winsford North and East	99	1025	470		20	1894
Winsford South and West	103	212			20	615



Key:

- CWaC area
- Buffer zone
- Council wards
- Main rivers
- Preferred development areas

0 1.25 2.5 5 7.5 10

Kilometers

Scale: 1:215,000 @ A3

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Cheshire West and Chester
Outline Water Cycle Study

Figure 2.1
Study area and preferred development areas

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CWaC is currently preparing its Local Development Framework (LDF), as required by the Planning and Compulsory Purchase Act 2004. The LDF is a series of documents, which form the basis for future planning decisions made in the area, and includes:

- Core Strategy;
- Development Plan Documents;
- Supplementary Planning Documents; and
- Village Design Statements.

The Core Strategy is the key document within the LDF setting out the Council's vision and spatial strategy for the future development to 2026. All other LDDs of the LDF need to conform to the Core Strategy. Having consulted on an Issues and Options report for the Core Strategy, the Council is currently (spring/summer 2010) preparing a Preferred Options document to be published for consultation in early 2011.

Box 1	**Confirmation of Housing Growth Issues: Outline Stage**
The growth plans examined in this Outline study cover the period 2010/11 to 2027/28 and the analysis is based on a development trajectory provided following the local Scoping Study Detailed provisional housing development data has been provided. Commercial/employment developments have not been included. The total housing provision between 2010/11 and 2027/28 is for 27,000 new homes. Growth data has been provided aggregated within five year blocks. The study examines constraints across the whole study area but focuses on the constraints relative to the preferred housing trajectory. Alternative spatial plans have not been provided but a lower and upper growth rate scenario is included in the study, to test the relationship between growth rates and the constraints.	

2.3 Review of Neighbouring Areas

There are six growth points in the North West (Cheshire West and Chester, Mersey Heartlands, Mid Mersey, Central Lancashire and Blackpool, Greater Manchester, and Carlisle). The majority of growth will be in the southern half of the region, building on and improving the economic prowess of the Liverpool and Manchester City Regions, and delivering the regeneration needed in these areas. There will also be concentrated growth in Central Lancashire (Preston/Blackpool) and Carlisle. Growth in all of these areas is expected to stimulate economic growth in the wider region and every local authority in the region is expecting a steady annual increase in housing numbers.

Significant growth and therefore additional pressure on shared resources and shared infrastructure is a key consideration. Growth in distant areas may share strategic resources, such as water supply, whilst growth in neighbouring areas may also require services from local infrastructure, particularly sewerage and wastewater treatment works. Growth outside of the designated growth points should also be taken into consideration. Growth

is planned in every local authority area in the North West and North Wales. The relative growth rates are illustrated in Figure 2.2 and the numerical data is presented in Appendix B. This is based on the figures in the North West RSS and the North Wales sub-region housing projections.

Mid Mersey (potential competition for water services infrastructure from development in Halton)

The Mid Mersey Growth Point includes the three boroughs of St Helens, Halton and Warrington. The Mid Mersey Councils have identified a total of 11 key housing development sites, of which four are located in Halton borough, immediately adjacent to the Cheshire West and Chester area. Here a total of 6,295 new homes are proposed[1] which, due to geographic proximity, could increase competition for resources and services for the Frodsham and Helsby, Weaver, and Marbury Council wards.

Table 2.2 Key Housing Development Sites in Halton

Site Name	Number of homes	Delivery data
Runcorn Docks	4,000	Estimated from 2011
Canalside/Lakeside	355	Estimated from 2011
Sandymoor	781	Development commenced
Daresbury including Wharford Farm	1,159	Estimated from 2012 and 2015

Source: Halton Borough Council (2008).

Mersey Heartlands (potential future constraints on the Wirral peninsula)

The Mersey Heartlands Growth Point includes Wirral and Liverpool. The Wirral Growth Point will deliver 600 new dwellings per year between April 2008 and March 2017[2], leading to a total of 9,900 new homes in the Wirral by 2021. This development is likely to be focussed to the north east within the 'Newheartlands Pathfinder'[3] boundary. The Mersey Heartlands Growth Point Bid Schedule of Major Housing Sites (October 2008) identifies 11 sites in Wirral, all of which are focused around the Birkenhead area. This includes the Wirral Waters development, a planning application for which was submitted in December 2009 for a maximum of 13,251 new dwellings centred on the East Float in Birkenhead. Whilst this is not directly adjacent to the Cheshire West study area, this level of growth within the Wirral peninsula will increase pressure of water service infrastructure.

[1] Halton Borough Council (2010) Mid Mersey Housing Growth Point Update Spring 2010. Taken from www.mid-mersey.org.uk
[2] Wirral Council (2009) Annual Monitoring Report 2009. Available from http://wirral-consult.limehouse.co.uk/portal/amr_2009/amr2009?pointId=837173. Accessed 24 April 2010.
[3] The Newheartlands Pathfinder is a long term regeneration project. In Wirral, the boundary designated by the Government in April 2002, includes parts of Bidston, Birkenhead, Liscard, Tranmere and Seacombe.

Growth in the Cheshire West and Chester wards of Grange and Rossmore, Sutton and Manor, Ledsham and Willaston, Central and Westminster, and Neston and Parkgate could place pressure on the water cycle infrastructure in the adjacent wards of Heswall, Clatterbridge and Eastham. These areas are also supplied with water from United Utilities' Integrated Zone. United Utilities has confirmed that it is able to meet the increasing demand in this zone that is forecast to arise from an increasing population (see section 6.3). However, due to the geographic nature of this area options to improve infrastructure are more limited. United Utilities is planning to install a major duplicate trunk main in the Wirral that will improve security of supply across the whole area. A new trunk main in Ellesmere Port is also planned to improve flexibility in the network.

The constrained land area and the sensitivity of the surrounding waters (Dee and Mersey estuaries) have the potential to restrict future infrastructure options, particularly wastewater treatment. To understand the detail of the timing and extent of this constraint more detailed data on the proposed Wirral growth would be needed which is not yet available. Wirral is currently preparing a Strategic Housing Land Availability Assessment but the Council has confirmed that this is not finalised and the data is not yet available for use. Additional data and analyses to explore the capacity at the treatment works in the Wirral would also be required, which is beyond the scope of this Outline study.

West Cheshire and North Wales

The sub-RSS for West Cheshire and North Wales states that the preferred growth option is to focus development within Chester, Wrexham and the Deeside conurbation, but also on other areas in need of regeneration. In Flintshire, adjacent to the study area and sharing water supply resources provided by Dee Valley Water, the RSS sets out net annual growth of 403 homes per year. Flintshire's Unitary Development Plan indicates that the majority of growth will be in Connah's Quay, Mold, Queensferry, Buckley, Flint, Shotton/Aston, and Holywell. None of these areas are currently served by wastewater treatment works serving the Cheshire West study area. Depending on its location, development in Queensferry poses the largest potential competition to sewerage and wastewater treatment infrastructure, due to its proximity to Chester. Dŵr Cymru Welsh Water has confirmed that the Queensferry treatment works is already in need of a revised discharge consent (discharge consents are described in section 4.3.2). An application to increase the consent to allow an additional flow of 2000m^3/day has been submitted to the Environment Agency.

The Environment Agency will consider the environmental impacts of increased wastewater discharges into the Lower Dee and the Dee Estuary (Special Area of Conservation), taking account of discharges from other treatment works such as Chester. Further detail on wastewater treatment and capacity is provided in section 4.3.2.

The need to increase the discharge consent at Queensferry is a potential constraint to development outside the Cheshire West and Chester areas (Flintshire Council) but this highlights the importance for Cheshire West and Chester, Flintshire, and Dŵr Cymru Welsh Water to maintain close communications regarding their development plans and the progress/status of the discharge consent application.

The western part of the study area is also bordered by the Wrexham Council area, for which up to 7,000 new homes are proposed (between 2003 and 2021). Specific detail on the number that have already been completed, and the remaining proposals is not yet available. The main issue here is the potential increase of treated wastewater that could be discharged into the Clywedog river which flows into the River Dee. The Environment Agency will not grant or vary discharge consents that have the potential to cause a deterioration in water quality and so any growth in an area that discharges into the Dee will be constrained by the ability to discharge water. It is recommended that Dŵr Cymru Welsh Water and the Councils discuss their development proposals to allow the water company to consider its discharge consents and its wastewater treatment assets in a strategic manner.

South Cheshire and North Shropshire

In South Cheshire, 245 houses per year are proposed and most of this is expected to be in the main towns of Nantwich and Crewe. This is not a 'growth point' but there are plans for approximately 8,000 new homes between 2003 and 2021. This could potentially generate competition for resources/services with Winsford although due to the distance between these locations and the levels of growth proposed this is likely to be a relatively minor issue. The outskirts of Nantwich and Crewe are approximately eight and four miles south of Winsford respectively. Development in these areas is likely to be served by wastewater treatment works (WwTW) outside the study area (e.g. Crewe WwTW). Development in South Cheshire is supplied with water from United Utilities' Integrated water resource zone; the Company has confirmed that its demand forecast and strategy to secure supplies has taken regional level growth into account.

Growth plans for North Shropshire are set out in the West Midlands RSS. The West Midlands RSS Phase Two Revision Report of the Panel has recommended a housing figure of 27,500 additional new homes for Shropshire between 2006 and 2026. The town of Whitchurch just south of the Cheshire border is one of the main market towns in Shropshire where it is anticipated that housing growth will occur. This area receives its water supply services from Severn Trent Water and its wastewater services from Dŵr Cymru Welsh Water. See Appendix B for table of growth figures for the North West, North Wales, and North Shropshire.

North East Cheshire and South Manchester

Significant growth is also proposed for this area with 400 new homes per year around Macclesfield, and 300 per year around Congleton. Strategically, this will increase competition for water resources as this area also falls within United Utilities' Integrated water resource zone. However, the Company's plans show that supplies are expected to remain secure. Sewerage and wastewater treatment in this area is also provided by United Utilities. Due to the distance involved, development in Congleton and Macclesfield is unlikely to put pressure on wastewater treatment works within the study area. However, Congleton lies upstream of Northwich on the River Dane, a river which is already assessed as being in poor ecological status due to high nutrients (see section 4.3.1). New developments outside the study area draining to wastewater treatment works discharging to the River Dane may be constrained by the capacity of the River Dane to accept additional flows.

Summary of growth in neighbouring areas

This section has shown that considerable development is planned in areas adjacent to the Cheshire West and Chester boundary and across the wider region. Growth outside the Council area could put pressure on the same water services infrastructure as development within Cheshire West and Chester.

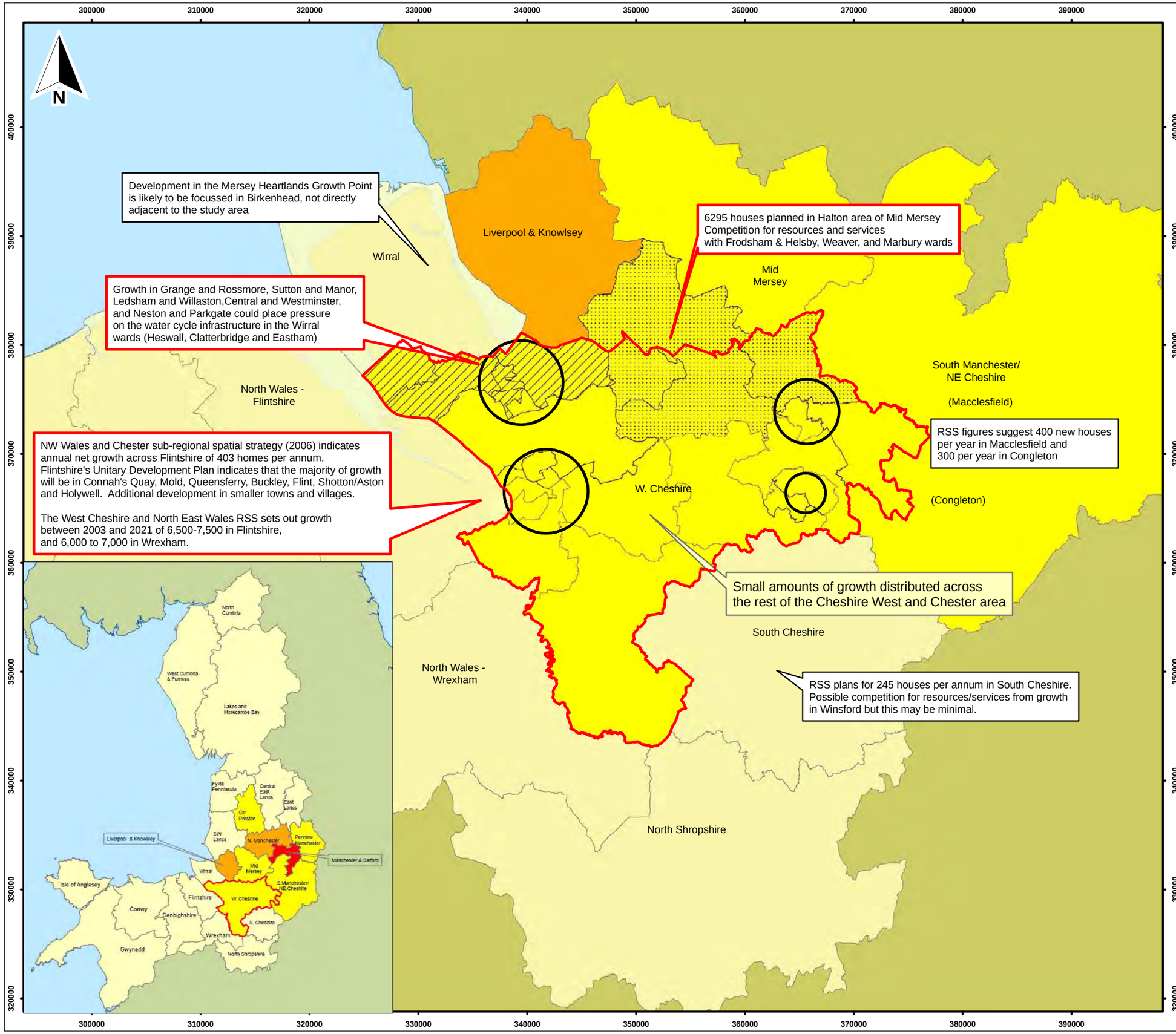
To address any potential 'cross border' issues it is recommended that the Council maintains dialogue with the water companies. This will ensure that the lead-in time for water companies to implement any water and wastewater service infrastructure enhancements is maximised. This will be particularly important when the Council has consulted on its Preferred Options, which will be used to inform the locations of new development.

Neighbouring Councils are at different stages of allocating new development. It is recommended that the Council uses the findings of this study to identify where there may be potential 'cross-boundary' issues and liaises with neighbouring Councils and the water companies to determine whether enhancements will be required.

Box 2 Confirmation of Neighbouring Growth Issues: Outline Stage

CWaC has uplifted its housing projections by 23% above those required in the NW RSS. Figure 2.2 and Appendix B show the projected growth across the whole region. For each of the six growth points the Regional scoping study presents the housing growth forecasts as set out in the RSS and the additional growth. Within the growth points alone, an additional 30,813 new homes (above the RSS) are planned.

Many water companies, under guidance from Ofwat, base their forward planning on growth as projected in the regional spatial strategies. Higher growth rates across the region would further increase demand for water services and increase pressure on the environment. The extent that this is an issue depends on the uplift/suppression applied by all the Councils in the region. Adjacent to Cheshire West and Chester, both the Mid Mersey growth point, and the Mersey Heartlands growth point intend to deliver more housing than was set out in the North West RSS. Central Lancashire and Blackpool growth point plans intend to accelerate rather than exceed the RSS housing plan in those local authority areas. Carlisle also intends to deliver the planned regional growth at an accelerated rate. Growth across Greater Manchester will be greater than the RSS as the four growth point local planning authorities intend to deliver growth in excess of their allocations in the RSS.



Key

- CWaC area
- Local authority/sub-regional districts

Scale of proposed housing growth (RSS)

- < 1100 p.a
- 1100 - 2000 p.a
- 2000 - 2500 p.a
- > 5000 p.a
- Preferred development areas

CWaC = Cheshire West and Chester
RSS = Regional Spatial Strategy
p.a = Per Annum

Inset: growth projections across the North West and North Wales regions

0 2.5 5 10 15 20
Kilometers

Scale: 1:304,000 @ A3

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Cheshire West and Chester Water Cycle Study

Figure 2.2
Growth in adjacent areas

Data source: Table 7.1 of the North West Regional Spatial Strategy (2008)

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2.4 Planning for Water Infrastructure

Water resources are managed by the Environment Agency in England and Wales, in the form of granting or refusing abstraction licences to abstract water for various purposes. Once water has been abstracted from the environment the responsibility for public water supplies is transferred to the water undertakers who have a statutory duty to provide water supplies.

Public sewerage in the UK is provided for by the private water companies, whilst the Environment Agency regulates the discharge consents for flow volumes and quality.

In England and Wales the water only and water and sewerage companies set out their long term requirements for maintaining and enhancing their water and wastewater infrastructure in their Strategic Business Plans on a five yearly basis. The Strategic Business Plans form part of the Periodic Review (PR) process whereby Ofwat, in consultation with other organisations including Defra, the Environment Agency, Natural England and consumer organisations, determines the expenditure that the companies can make to maintain and enhance their infrastructure. The outcome of this determination is an Asset Management Plan (AMP) for the following five-year period.

The fourth AMP period finished in March 2010. Ofwat has recently published its final determination on the price review for each company, setting out the prices that the water undertakers can charge for providing water and wastewater services. These prices determine how much the water undertakers can spend over the next five years, from April 2010 to March 2015 i.e. for AMP5.

Water companies set out how they intend to manage water supplies in the long-term through Water Resource Management Plans (WRMPs). These plans are now statutory and are published every five years. The plans feed into the Water Companies' Strategic Business Plans. This Outline Study explores the water companies' business plans and WRMPs to determine the infrastructure and service upgrades that are planned and the extent to which this will support growth in West Cheshire and neighbouring areas.

3. The Water Cycle

3.1 Introduction

The water cycle describes the pathways and processes through which the water we use moves through the natural and built environment, as well as through the above and below ground infrastructure on which the domestic population and industry depend. Figure 3.1 illustrates the traditional image of the water cycle showing how water enters a river catchment, how it runs through and over the land, before returning to the river system and ultimately returning to the sea.

Figure 3.1 Traditional View of the Water Cycle without Artificial Influences

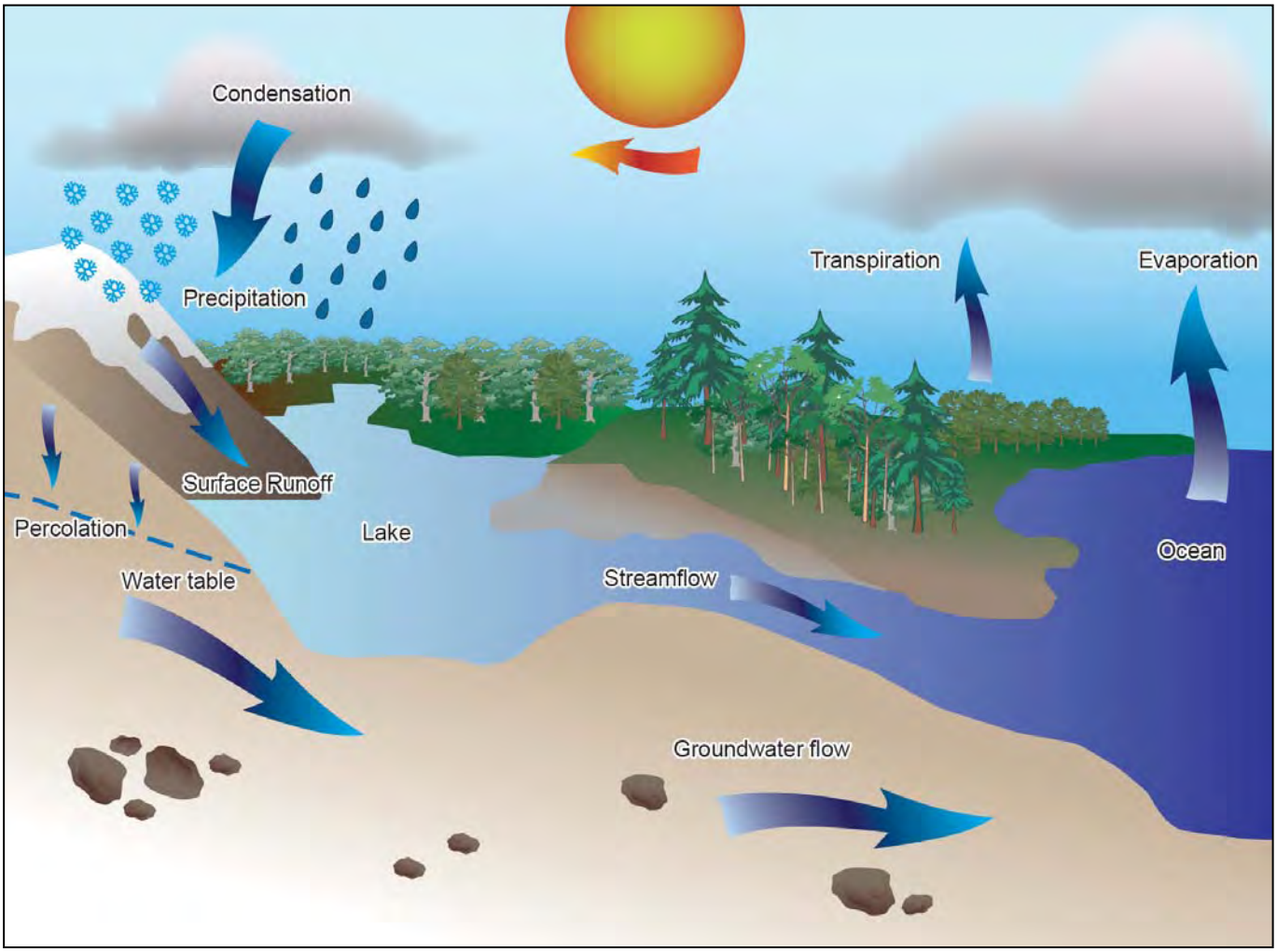
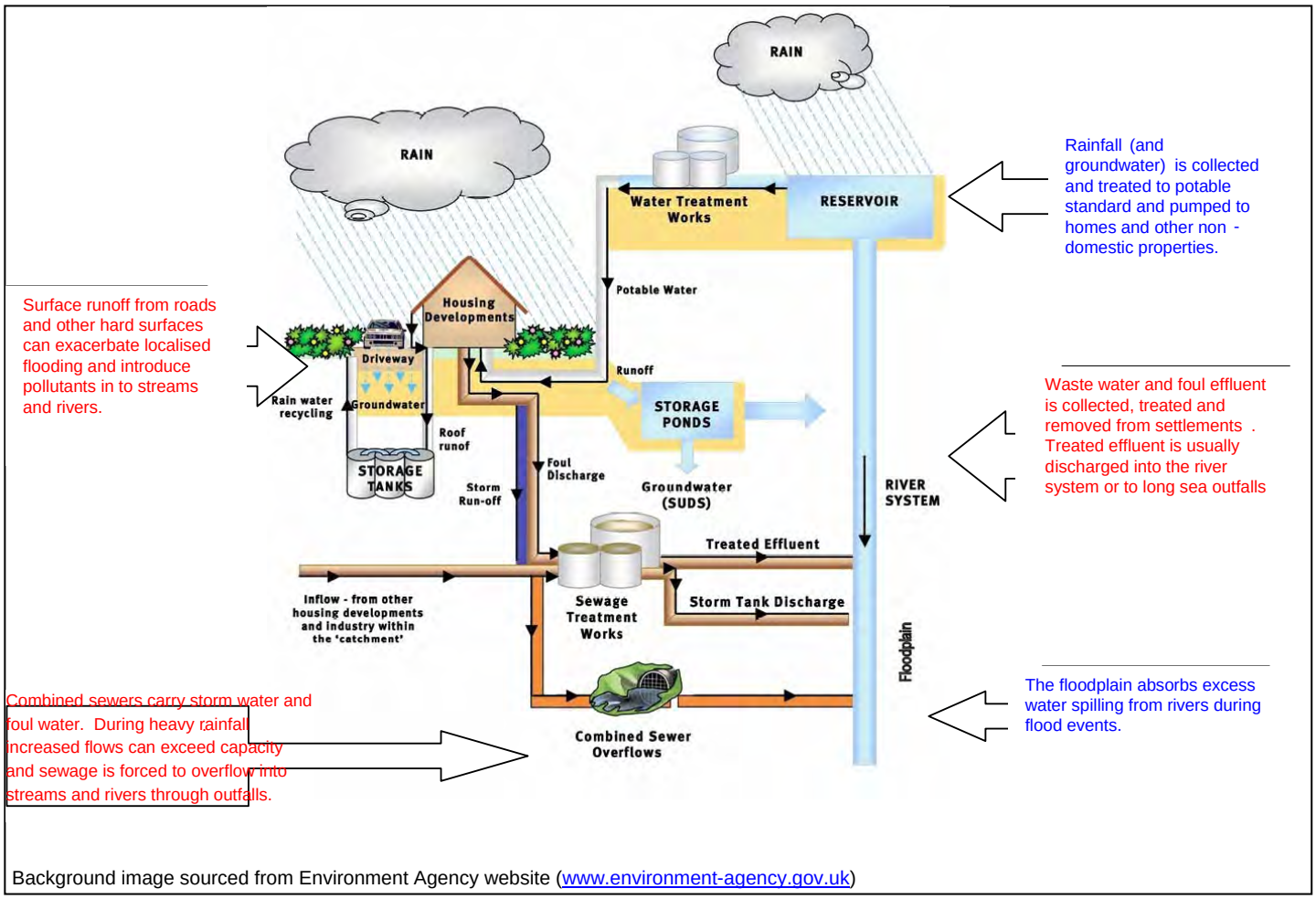


Figure 3.2 illustrates the added complexities within the urban water cycle (in schematic form) as a result of housing development and the infrastructure required to support it. The main differences between the natural and the urbanized water cycle relate to the rate of surface runoff (and percolation in to the ground), and the streamflow. In the urbanised cycle water is captured and stored for use, and this water only re-enters the river network once it has been used and then treated at wastewater treatment works. Hence, the timing and quality of water entering the river network can be significantly different in the urban version of the cycle.

Figure 3.2 Schematic of the Urban Water Cycle



Background image sourced from Environment Agency website (www.environment-agency.gov.uk)

It is important to understand the different scales at which the elements of the water cycle (water supply, sewerage and drainage) are managed, and the impacts this has on assessing constraints to growth. Water supply is managed strategically, as there is a high level of connectivity in the water supply network and water can be moved great distances from the raw water sources (rivers, reservoirs, or groundwater) to the point of delivery. Generally, new developments can be connected to the main system relatively easily, although this is dependent on the scale of the development and the hydraulic capacity of the existing water supply network. In contrast, wastewater treatment

works have much smaller defined catchment areas and so the location of development relative to the capacity of the nearest treatment works and receiving water can be critical. Although drainage issues are specific to individual developments, the integration of drainage development across sites offers significant potential for green space/habitat creation, in addition to reducing flood risk and potentially water demand.

3.2 Legislation and Regulations

Legislation, guidance and supporting evidence for water related issues, such as water quality, flood risk management and urban drainage, have a significant impact on the water cycle and are often the cause of changes in water infrastructure, as much as development pressures. Any adaptations to the water cycle must be compliant with such legislation and some are undertaken within the regulatory framework.

There is currently an unprecedented level of change in the legislation and guidance for water related issues. Some of these changes are driven by European directives; others are in response to national pressures, from the 2007 summer floods for instance. These changes are either currently being implemented, soon to be applied or likely to change in next five to ten years. For example, the timetable for the Water Framework Directive spans the next 18 years in three six-year cycles, the water companies expect to use the first period to carry out the majority of investigations to establish the necessary investment. This will provide an opportunity to assess the improvements delivered through other quality investments.

The primary pieces of legislation which set the context relating to the water cycle are summarised in Table 3.1 below.

Table 3.1 Primary Water Related Legislation

Legislation	Description
Water Framework Directive	The Water Framework Directive sets out a requirement to achieve good ecological status in rivers, estuaries and coastal waters, together with good status of groundwater by at least 2027. It presents a unique opportunity for holistic environmental management for all users of the water environment. A cross body Technical Advisory Group (UKTAG) has published a set of environmental standards which have been adopted.
Habitats Directive	As people make increasing demands on the environment our wildlife habitats are coming under more and more pressure. The Habitats Directive recognises this and aims to protect the wild plants, animals and habitats that make up our diverse natural environment. The European Directives created a network of protected areas of national and international importance. These are called 'Natura 2000' sites and include Habitats Directive Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). The Habitats Directive has been transposed into English law as the Conservation (Natural Habitats &c) Regulations 1994, now known as the Habitats Regulations. Existing and future water management has the potential to affect a number of these designations and the Environment Agency Review of Consents process has identified a series of amendments that will be required to existing abstraction licences and discharge consents if adverse effects on the European Sites are to be avoided. **The Dee and the Mersey Estuary are both designated under the Habitats Directive. There are also SPA and SAC sites upstream of the CWaC area, along the River Dee.**

Legislation	Description
Urban Wastewater Treatment Directive	The Urban Wastewater Treatment Directive (UWWTD) regulates the collection and treatment of wastewater from residential properties and industry. Under this Directive receiving waters can be designated as 'Sensitive' where additional levels of treatment are required at significant contributing discharges. These can either be direct discharges or those upstream of the designated reach / water body that serve a population equivalent in excess of 10,000. One type of sensitive area is the "Sensitive Area [Eutrophic]", where elevated nutrient concentrations, mainly nitrogen or phosphorus, present a risk to the ecological status of the receiving water. In these areas, larger sewage discharges must be treated to reduce nutrient loads. **The River Dane has been assessed as 'sensitive' as it is eutrophic (Defra, 2007).**
Nitrates Directive	Adopted by the European Union in 1991, this directive aims to reduce water pollution caused by nitrogen from agricultural sources and to prevent such pollution occurring in the future. The directive requires Defra and the Welsh Assembly Government to identify surface or groundwaters that are, or could be high in nitrate from agricultural sources. Nitrogen is one of the nutrients that can affect plant growth. Surface waters also have to be identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water. Once a water body has been identified, all land draining to that water is designated as a Nitrate Vulnerable Zone. Within these zones, farmers must observe an action programme of measures which include restricting the timing and application of fertilisers and manure, and keeping accurate records. **Water quality in the West Cheshire area has been assessed as poor and this is partly attributable to agricultural pollution in the form of nitrates**
Floods Directive	The Floods Directive is designed to help Member States prevent and limit floods and their damaging effects on human health, the environment, infrastructure and property. The Floods Directive came into force on 26 November, 2007 and was transposed into UK law in November 2009 via "The Flood Risk Regulations", SI No. 3042. The Directive requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU.
Floods and Water Management Bill	The Flood and Water Management Act was passed by parliament in April 2010. The final version implements the key recommendations made in Sir Michael Pitt's independent review into the summer 2007 floods and will transpose the requirements of the Flood Directive into law in England and Wales. The act requires that Local Planning Authorities at the county level become responsible for managing local flood risk, including surface water flooding.
Shellfish Water Directive	The Shellfish Waters Directive aims to protect waters with economically significant shellfish populations. It sets water quality standards in areas, mainly in estuaries, where shellfish grow and reproduce. The directive requires that certain substances are monitored in the shellfish waters. These substances can threaten the survival of shellfish, inhibit their growth or make them too expensive to treat before they can be used as a food source. In the UK, the directive is implemented by the Surface Waters (Shellfish) (Classification) Regulations 1997 and the Surface Waters (Shellfish) Directions 1997. The directive will be repealed in 2013 by the EC Water Framework Directive, which must provide at least the same level of protection to shellfish waters (which the WFD classifies as protected areas) as the Shellfish Waters Directive does. **The Dee Estuary is designated under the Shellfish Water Directive**
Bathing Waters Directive	The Bathing Waters Directive sets out water quality standards to protect the environment at bathing waters throughout the bathing season. It requires popular bathing waters to be 'designated' and monitored for water quality, particularly for human waste from sewage treatment works. In England and Wales the bathing water season runs from mid-May to September. The directive is implemented through the Bathing Waters (Classifications) Regulations 2003. A revised Bathing Water Directive became law in the UK in March 2008. As well as stricter water quality standards, it contains a requirement to provide more detailed and standardised information about bathing waters across Europe. **There are four points along the North coast of the Wirral peninsula that are designated under the Bathing Waters Directive**

3.3 Integrated Catchment Management

The capacity of the receiving water environment and thus development in the study area is constrained by environmental quality objectives enforced by UK and European legislation. The Water Framework Directive (WFD) is European legislation that aims to consolidate existing legislation. It came into force in December 2000, and was transposed into UK law in 2003. It introduces some new environmental standards that will help to improve the ecological health of inland waters to achieve 'good status'.

The main aims of the WFD are to prevent deterioration and enhance the status of the water environment, including groundwater. This will be achieved within a framework of River Basin Planning by:

- Reducing pollution;
- Promoting sustainable water use; and
- Contributing to mitigating the effects of floods and droughts.

Sustainable drainage systems (SuDS) is the name given to drainage techniques that aim to mimic natural processes, rather than using traditional piped urban systems. Traditionally piped drainage was designed to convey rainfall away from developments as quickly as possible; however this can lead to water entering rivers more quickly in urban areas compared to rural catchments and can result in flooding. Sustainable drainage systems use grassed ditches and ponds, for example, instead of pipes to control rainfall. These allow some rainfall to soak back into the ground, and this slows down the movement of rainfall runoff in the catchment. Vegetation in these systems can also reduce the amount of urban pollutants entering watercourses and groundwater sources.

In the UK, all water that is supplied to properties and business is treated to a standard suitable for drinking. Installing devices that use the least amount of water possible will also reduce the amount of wastewater that is discharged from buildings into the sewer network. These water efficiency measures help to reduce the amount of water abstracted from rivers and groundwater sources, reducing the pressure on natural ecosystems and increasing the volume of water available for diluting both point source and diffuse pollution.

The urban water cycle is complex and highly integrated with many feedback mechanisms. Advanced planning and appropriate management helps to ensure that the water cycle contributes to a safe, clean and healthy environment, rather than being a source of long term problems.

4. Existing Water Environment

In order to advise on the most sustainable approach to water management, an understanding of the existing natural environment and drainage infrastructure is required. The landscape, hydrology and river basin characteristics, water resources, water treatment and water supply infrastructure, water quality, wastewater treatment, sewerage and drainage of the study area have been summarised using information from various sources, including the Environment Agency; via consultations with the water companies (United Utilities, Dŵr Cymru Welsh Water, and Dee Valley Water) and the Council. These provide a baseline context for the district and for the water cycle study. This chapter provides a general background, followed by sections discussing the existing water quality, water supply and wastewater and sewerage arrangements.

4.1 River Basin Context

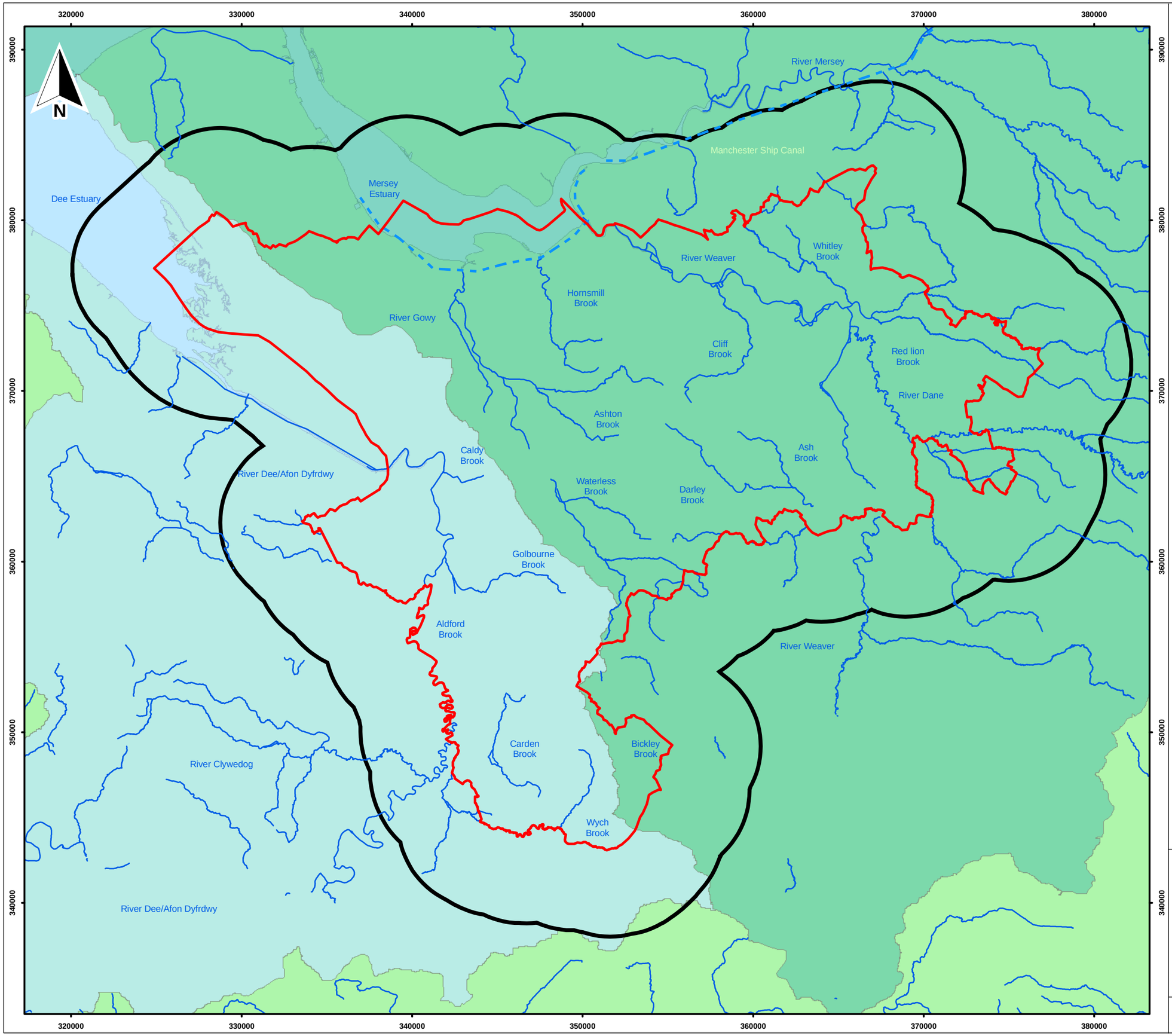
The Environment Agency has divided England and Wales into nine River Basin Districts in order to manage the requirements of the Water Framework Directive. CWaC lies within the North West and Dee River Basin districts. The main river systems in CWaC are the River Dee and its estuary, the River Gowy and its tributaries flowing into the Mersey Estuary, and the River Weaver (see Figure 4.1). The River Gowy and its tributaries lie wholly within the local authority area. The headwaters of the River Weaver are to the south of the local authority area and the river flows through Nantwich before crossing the Council boundaries. This will have an impact on the water quality and may exert an external constraint, particularly in terms of wastewater treatment in the Northwich area.

The River Dee flows from the uplands of North Wales and flows through Chester before exiting the local authority area as it flows into the Dee estuary. Various other smaller watercourses and brooks are present, draining into these main rivers. Groundwater underneath the area is largely within the sand and gravel substrate and is an important source of drinking water.

Rainfall across CWaC is slightly lower than the national average (approximate average rainfall of 730mm per year, 1961-1990 average rainfall on River Gowy at Huxley, and on the Aldford Brook) although considerably more rainfall is recorded on the Dee (average of 1,111mm at Chester Weir). The UK annual average is 832mm per year[4].

The coastal estuaries form major hydrological features in the study area, namely the Dee and the Mersey estuaries which are important ecological habitats. Section 4.4 presents a summary of the designated sites surrounding the CWaC area.

[4] National River Flow Archive http://www.nwl.ac.uk/ih/nrfa/station_summaries/map.html



Key

- CWaC area
- Buffer zone
- Dee River Basin
- North West River Basin
- Main rivers
- Manchester Ship Canal

0 1.5 3 6 9 12

Kilometers

Scale: 1:215,000 @ A3

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Figure 4.1
Main rivers and river basins

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4.2 Flooding

A Strategic Flood Risk Assessment (SFRA) for West Cheshire has been completed on behalf of the former Chester City Council, Ellesmere Port and Neston Borough Council, and Vale Royal Borough Council (Faber Maunsell, 2008). Area Flood Risk Assessments have also been completed for Northwich (Faber Maunsell, February 2009), and Winsford (Faber Maunsell March 2010). These studies examined all forms of flooding present and the risks associated with them. There are six types of flooding which affect West Cheshire:

- Tidal – from the Dee and Mersey Estuaries (flood defences are present);
- Fluvial – from the watercourses across the Council area both defended and undefended;
- Critical Watercourses – watercourses in urban areas, often culverted or constricted by adjacent development built right up to the watercourse;
- Pluvial – flooding of low lying and impermeable areas due to intense rainfall in excess of that which can infiltrate into the ground and/or be conveyed away by the drainage system;
- Sewer (foul and surface water) – exceedance of the capacity of these artificial systems; and
- Groundwater - this is not thought to be a problem across the Gowy/Weaver catchment (excluded from the Catchment Flood Management Plan).

Flood Zones

The Environment Agency's flood zones 3 and 2 delineate the main areas of flood risk constraint on development in the study area. Government guidance on development and flood risk (PPS25) takes a sequential approach to the placement of new development, aiming to direct all new development to Flood Zone 1 wherever possible. If there are no suitable sites in Flood Zone 1, then development may be acceptable in Flood Zone 2, and if not in Flood Zone 2, then potentially in Flood Zone 3. However, the vulnerability of some types of development is such that PPS25 indicates that these development types are not suitable for higher risk flood zones (see Figure 4.2).

Residential development is classified as "More Vulnerable", therefore to comply with the Sequential Test this type of development should not be permitted in Flood Zone 3, unless it can pass the Exception Test. To pass the Exception Test, developments should demonstrate that:

- The development provides a wider sustainability benefit to the community that outweighs flood risk;
- The development is on previously developed, or developable land; and
- The development will be safe from flooding without increasing flood risk elsewhere.

The Exception Test therefore provides a means of ensuing that where development is required in areas of flood risk, that appropriate actions are taken to manage and mitigate this risk. Figure 4.3 shows the existing flood zones

within the study area; two sets of flood zones are shown: the Environment Agency's basic flood outlines as shown on their online flood map and more detailed mapping based on more detailed hydraulic modelling and used to support the SFRA.

Figure 4.2 PPS25 Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✔	✔	✔	✔	✔
	Zone 2	✔	✔	Exception Test required	✔	✔
	Zone 3a	Exception Test required	✔	✗	Exception Test required	✔
	Zone 3b 'Functional Flood plain'	Exception Test required	✔	✗	✗	✗

Key:

✔ Development is appropriate

✗ Development should not be permitted

320000 330000 340000 350000 360000 370000 380000

390000 380000 370000 360000 350000 340000

N

Key:

- Council wards
- CWAC Study Area
- SFRA Flood Zone 3b
- SFRA Flood Zone 3a
- SFRA Flood Zone 2
- Rivers
- Flood Defences
- EA Flood Zone 3
- EA Flood Zone 2

0 1.5 3 6 9 12

Kilometers

Scale: 1:215,000 @ A3

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Figure 4.3
Flood risk in the study area

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The CFMP and SFRA indicate that climate change will have the biggest impact on flood risk in the CWaC area (compared against land use change and land management practices). This is due to the tidal frontage of the district and the situation of key settlements at confluences where there is already limited channel capacity.

The SFRA identifies tidal flooding from the River Dee as a significant source of flood risk to central Chester (although the city is protected by well maintained flood defences to a 1 in 200 year standard). To the north of the city the Sealand Basin is a key area of development pressure where there is significant and more complex flood risk situation associated with both tidal (Dee Estuary) and fluvial sources (Finchetts Gutter and Sealand Main Drain) of flood risk. Part of the basin is a designated flood storage area.

Elsewhere in CWaC the risk of tidal flooding is particularly high at Ellesmere Port and the Ince Marshes, however significant flood defence infrastructure is present to manage flood risk at locations such as Stanlow. Fluvial Flood risk being associated with the Rivacre Brook, lower River Gowy and Thornton Brook. In combination flood risk occurs in the lower part of these watercourses where high fluvial flows may meet high tides. In isolated areas local pockets of flood risk are associated with minor watercourses and drainage infrastructure.

Inland, the main source of flood risk is the River Weaver and Dane; here flood risk is concentrated in the key towns of Winsford and Northwich as well as the industrial area around Frodsham. In particular, significant (300 houses) existing development in Northwich is at risk of fluvial flooding associated with the confluence of three rivers in Northwich.

However, the nature and severity of flood risk varies across the study area. As illustrated by the summer 2007 flooding, sources of flood risk such as pluvial flooding and minor watercourses mean that flooding could potentially occur throughout the study area. Table 4.1 summarises the various types of flood risk that affects each part of the study area.

With regards to surface water flooding, isolated events have been recorded historically throughout the CWaC study area although no concentrations have been identified. The Environment Agency has supplied surface water flooding GIS layers for the study areas, which identify areas where surface water would potentially concentrate to cause flooding. The data layers show that most of the areas at risk of surface water flooding have already been identified in the SFRAs as at risk from fluvial/tidal flooding. However, the surface water flood maps also identify other areas (outside of known at risk areas). Topographic features such as dry valleys or restricted drainage may cause surface water flooding. Areas identified at this high-level would need a site specific assessment to verify the degree of actual risk.

No instances of groundwater flooding were identified in the SFRA. However, the Regional WCS Scoping study highlighted groundwater rebound as a potential issue. Sewer flooding incidents have been observed across the catchment, the problem not being concentrated in any particular location. The SFRA notes that the aggregated format of the data supplied limits the ability to assess the actual areas at risk from sewer flooding. For the North West RSS, United Utilities supplied no details of instances of sewer flooding in the CWaC area. The SFRA identifies that more detailed location information is required to better assess risks.

The raised embankment of the Manchester Ship Canal reduces tidal flood risk along the Mersey Estuary. There is therefore a small residual risk to development adjacent to embanked canals in the region should these structures fail. Overall very limited information is available on culverted watercourses in the region, where new development is proposed in the vicinity of a culverted watercourse appropriate investigation will be required to confirm the degree of flood risk.

Table 4.1 Summary of Flood Risks in the Main Development Areas

Location	Flood Issue	Level of Risk
Chester	At risk from tidal and fluvial flooding from the River Dee. There is limited capacity in the river channel to absorb excess flood water There are many properties built in the floodplain. Sealand Road, Gladstone Avenue, Vernon Road, Catherine Street, Jesmond Road, the Greyhound Industrial Park, the Groves and the Sealand Basin are all at risk of flooding from the River Dee**	Parts located in Flood Zone 3 and 2. Some areas of Chester are vulnerable to deep flooding (up to 1 to 2m)*, in particular parts of the Sealand Basin fall within Flood Zone 3b (the functional floodplain).
- Sealand Basin (Chester Retail Park, Sealand Industrial Estate, Chester West Employment Park and Stadium)	There is development pressure in the Sealand Basin which is already at risk. This area is just above sea level (~5m AOD) and so is vulnerable to tidal flooding. The area is protected from tidal flooding by an earth embankment. Finchetts Gutter Flood Storage Reservoir is an area of functional floodplain designed to store floodwater.	Located in Flood Zone 3. Potentially vulnerable to deep flooding. Different levels of risk from different sources (i.e. higher risk of fluvial flooding, but consequences of tidal flooding would be greater).
- Upstream of Chester	Small number of areas at risk of flooding from the River Dee, with the village of Farndon being the main area of risk.	Limited number of properties in Flood Zone 3 and 2.
Ellesmere Port	Flood risk here is associated with relatively minor watercourses and local drainage infrastructure. There is a narrow zone of flood risk, affecting a small number of properties along the lower Rivacre Brook. A number of properties adjacent to the upper Rivacre Brook around Great Sutton at Manor Park and Farmers Heath and Farm suffer from regular flooding.	Areas in Flood Zone 3 and 2. Away from the Rivacre Brook, the level of flood risk associated with minor watercourses and drainage infrastructure is less certain.
- Stanlow industrial complex	The main risk is when tidal waters flow up the River Gowy at the same time as water flows into the Gowy from upstream. The embankments along the Manchester Ship Canal significantly reduce the risk of direct tidal flooding from the Mersey Estuary. Significant flood defences are in place to protect against tidal/fluvial flooding. This area is also likely to be at risk from pluvial flooding. The capacity of existing drainage systems can be exceeded when low lying areas are inundated behind the defences.	Flood hazard throughout the whole of the Stanlow complex is considered high. However extensive flooding would only occur if the flood alleviation scheme failed or was exceeded by an extreme event (more than 1:100 year fluvial flood, or 1:200 year tidal flood).
- Rural Gowy catchment	Away from the coastal zone flood risk in the River Gowy catchment is more limited due to its more rural nature, with flood risk locations being more isolated.	Flood defences along parts of the River Gowy with Standards of Protection (SoP) of between 1 in 50 and 1 in 150 years.

Location	Flood Issue	Level of Risk
- Ince Marshes	A low lying area (2.9m to 6m AOD) at high risk of fluvial and tidal flooding.	Environment Agency Flood Zones 2 and 3
- Areas adjacent to the estuary marshes	Parkgate, Little Neston and further south at Denhall Farm and Denna Hall in Ness can flood during high spring tides in the Dee (combined with strong winds). Impacts in the Neston area from the tidal Dee are low due to the area being on slightly higher ground.	Frequency of flooding from the Dee is unknown
Northwich	At risk of fluvial flooding from the confluence of the River Weaver, River Dane and the Peover Eye. Large scale regeneration programme planned in the town centre. An AFRA has been prepared.	High risk◆ Flood Zone 3 areas, at risk from combined high flows on the three tributaries that converge. Consequences of flooding high (large number of properties at risk).
- South of the town centre	Flooded by the River Weaver.	Areas in Flood 3 and 2.
- Winnington (industrial area)	At risk of flooding from the River Weaver. Flood risk is a major issue for the Winnington Urban Village which has outline planning permission.	Areas in Flood 3 and 2.
- Northwich Vision Regeneration Project	The Barons Quay Development Area, Marina Development Site, Lock Street Site and the land West of Queen Street site are at greatest risk of flooding. The loss of floodplain exacerbates this problem and compensatory floodwater storage is required upstream of Northwich✦.	Major floods in 1946, 1977 and 2000. 632 properties are at risk from a 1 in 100 fluvial flood event, mainly due to inadequate channel and floodplain capacity. Flood waters could be between 0.5 and 2m deep.
Winsford	At risk from flooding from the River Weaver. Large scale regeneration programme (Winsford Waterfront Regeneration Strategy. This strategy aims to reconnect the town with its waterfront and enable the re-use of key under-utilised sites. An AFRA has been prepared to support this strategy, and considers three reaches of the river: southern, urban and northern. • Southern – (Bottom Flash and some residential); • Urban – (lined buy residential and commercial property); and • Northern – (lined by industrial uses) Key potential development sites at risk of flooding are located at the eastern end of High Street, adjacent to the River Weaver. The report concludes that: *"for the purposes of this AFRA, the existing [Environment Agency] flood zone maps should be superseded by the 100 year plus climate change maps presented in Appendix A. This has the effect of placing the proposed development sites along the left (west) bank of the River Weaver outside of the 100 year plus climate change flood extent "*. The AFRA recommends raised floor levels and emergency access points.	No flood defences* shown on SFRA or EA flood map. 25 residential properties at risk.
Frodsham	Limited risk due to elevation above the River Weaver and Mersey Estuary. Mainly agricultural areas that are at risk.	Areas in Flood 3 and 2.

Location	Flood Issue	Level of Risk
- Developments along the A56 causeway (Weaver Park Industrial Estate, the edge of Newtown and Marshgate Farm)	At risk as they are low-lying (6m AOD) adjacent to the confluence of the River Weaver and the Manchester Ship Canal.	Areas in Flood 3 and 2.

*Chester SFRA

**CWaC water topic paper (CWaC, 2009)

◆ Northwich AFRA

✦Area Flood Risk Assessment

✶Winsford AFRA

4.2.1 Review of Current Flood Risk Assessment Guidance

The SFRA and AFRA documents provide guidance on future flood risk assessment requirements. It is recommended that flood defences in Chester should be maintained to protect against the 1 in 200 year event. Specific surface water management is recommended in the Ellesmere Port and Neston area, due to past flooding associated with sewers and culverted watercourses. The risk of flooding in developments along the Manchester Ship Canal and Shropshire Union Canal needs to be considered in more detail. The SFRA recommends that flooding at Ince Marshes is studied further to better understand the risk and sub-divide the area into Flood Zones 3a and 3b, with development to be limited in Flood Zone 3b areas. Development options in areas determined as Flood Zone 3b (functional floodplain) will be limited to essential infrastructure and water compatible development.

More detailed flood risk investigations have been undertaken for Northwich and Winsford to quantify current and future flood risk and to identify alleviation options to support the regeneration plan. Some historic sewer flooding is also identified in the Northwich area linked to fluvial flooding.

The SFRA details six flood risk policies for the Council, in summary these are:

- Policy 1 - The Need for a Flood Risk Assessment;
- Policy 2 - Development in areas deemed to be at Little-or-No Risk of flooding, (Flood Zone 1);
- Policy 3 - Development in areas deemed to be at High Risk of flooding (Flood Zones 2 and 3a);
- Policy 4 - Development involving building in areas identified as Washland or Functional Floodplain (Flood Zone 3b);
- Policy 5 - Sustainable Urban Drainage Systems (SuDS); and
- Policy 6 - Culverting of Open Watercourses.

Box 3	Confirmation of Flood Risk Issues: Outline Stage

The key flood risk areas in the WCS study area are Chester's Sealand Basin (fluvial/tidal), the Stanlow industrial complex (fluvial/tidal) and Northwich (fluvial). Farndon, Frodsham and Winsford are also at risk of fluvial flooding, although not to the same degree. The CFMPs identify the need to maintain the current high-standard of flood defences at Chester and Stanlow, and the need to implement a flood risk alleviation scheme in Northwich. The Manchester Ship Canal provides a high level of protection against tidal flooding to a large part of the area.

The SFRA has collated and presented fluvial and tidal flood risk data; however gaps have been identified principally associated with the lack of knowledge around sewer flooding locations, culverts and artificial waterbodies such as the area's canals, many of which are raised above adjacent low lying areas. Further investigation of these other sources of flooding will be required to bring forward development areas in at risk areas. Where required, investigations into these flood risk sources will need to be undertaken to support any proposed development.

The CFMP and SFRA indicate that climate change will have the biggest impact on flood risk in the CWaC area (compared against land use change and land management practices). This is due to the tidal frontage of the district and the situation of key settlements at confluences where there is already limited channel capacity.

4.3 Water Quality

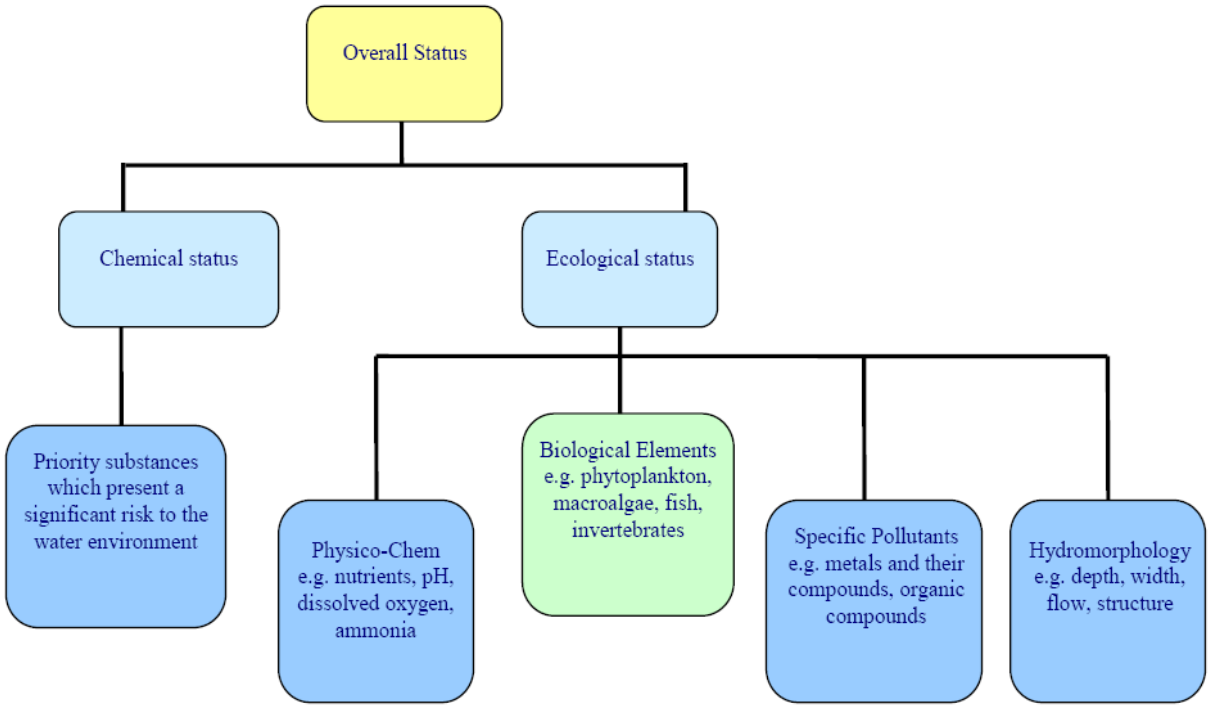
Water quality of rivers, lakes and groundwater is a good indicator of the general health of the water bodies in terms of their ecology, biodiversity and amenity. The WFD is the principal legislative driver dictating the targets for surface and groundwater quality and under which actions to achieve compliance are implemented and monitored. Other EC Directives, such as the Habitats Directive and the Urban Wastewater Treatment Directive also set objectives for specific designated waters, which contribute to the overall target of achieving good water body status and WFD compliance by 2015.

4.3.1 Overall Water Quality

The Environment Agency has been monitoring the health of all receiving waters (watercourses receiving effluent discharges) for a number of years through the previous General Quality Assessment (GQA) scheme based on chemistry, biology and nutrients. In 2007, the monitoring programme changed to align with WFD requirements. Previous results from the GQA scheme are not directly comparable with the current regime: it is the WFD standards that drive future improvements to water quality.

Under the new WFD programme, water quality targets are set in the River Basin Management Plans (RBMP), with the aim of reaching 'Good Ecological Status' in all waterbodies. The ecological status forms part of an overall status, the components of which are shown in Figure 4.4, as taken from the North West River Basin Management Plan (Environment Agency. 2009b).

Figure 4.4 The Components of Overall Status for the Water Framework Directive



Approximately two thirds of the study area lies within the Weaver Gowy river catchment in the North West River Basin. The remainder, including Chester, lies within the Middle Dee catchment in the Dee River Basin. A small area around Neston is within the Tidal Dee catchment.

Parts of the Weaver Gowy are affected by current and past industrial discharges. A legacy of poor water quality compounded by river modifications, including weirs and locks that act as barriers to fish migration, contributes to the low proportion of water bodies that are assessed as having good ecological status (or good potential). Only 13 per cent of water bodies in this catchment have good ecological status and this is expected to increase to just 16 per cent by 2015.

The biological and ecological quality in the Middle Dee is under pressure from diffuse urban and rural pollution, as well as nutrient pressure from point sources such as sewage works. The ecological status is also affected by physical modifications to the River Dee for flood alleviation and man made obstructions to fish migration. Consequently, the River Dee in this area has only Moderate Ecological Potential.

In fact, the majority of rivers in the study area have been designated as having 'Moderate Status'. However, the River Dane and the Redlion Brook upstream of Northwich are in a poor condition and have been designated 'Bad Ecological Potential' Status (downstream of Northwich this improves to Moderate Ecological Potential). In October 2007 the River Dane was identified as being a sensitive area. The main problem in this river is that the

water has been enriched by nutrients (it is *eutrophic*) accelerating growth of algae and other larger types of plant life. This disturbs the balance of organisms present in the water and reduces the quality of the water.

Some key actions for the Weaver Gowy catchment from the North West River Basin Management Plan (Environment Agency, 2009b) are to:

- Investigate pollutants and industrial inputs to the watercourses in Weaver catchment;
- Deliver a long-term nutrient study in the Cheshire Meres to identify and address nutrient inputs;
- Investigate waters that are at less than good status; and
- Improve United Utilities' assets at Northwich WwTW[5] to meet the requirements of the Freshwater Fish Directive and to contribute to achieving favourable condition at Over Water SSSI and Betley Mere SSSI[6].

Some key actions for the Middle Dee catchment and the Tidal Dee from the Dee River Basin Management Plan (Environment Agency, 2009c) are to:

- Upgrade the major sewage treatment works including removal of phosphate; and
- Initiatives to provide advice to farmers (to reduce agricultural diffuse pollution).

The Environment Agency will work with partners to deliver these actions to implement the river basin management plans. The asset upgrades are the responsibility of the water companies and this will largely be driven by the need to comply with Environment Agency discharge consents. These actions are funded through the Ofwat price determination based on the water company business plan submissions. The water quality studies are likely to be led by the Environment Agency supported by partners such as Natural England, farmers, riparian and other landowners.

The Council should be aware of these problems and the proposed actions, so that it may identify ways in which it could support the improvements, and to ensure that it does not permit activities that are contrary to delivering these objectives.

Table 4.2 presents the main statistics for the two catchments from the North West and Dee River Basin Management Plans.

[5] Completed at the end of AMP4 (2010)
[6] To be completed during AMP5 (2010-15)

Table 4.2 Overall Water Framework Directive Statistics for Catchments in the Study Area

River and Lake Waterbodies	Weaver Gowy*		Middle Dee**		Tidal Dee**	
	Now	2015	Now	2015	Now	2015
% at good status overall (chemical and ecological)	13	16	7	10	20	27
% improving for one or more components in rivers		41		14		7

*North West River Basin Management Plan

** Dee River Basin Management Plan

4.3.2 Wastewater Treatment Works

Figure 4.5 shows that there is a large number of wastewater treatment works in the study area. These works are located along the River Weaver and Gowy, the River Dee, and many of their tributaries, and this indicates that most of the watercourses in the study area receive discharges from wastewater treatment works. The proposed development locations have been mapped against the wastewater treatment catchments, and this identifies thirteen key treatment works that would be expected to serve the growth, in addition to existing demand (shown in Table 4.3).

The Environment Agency authorises water companies to discharge treated water from wastewater treatment works, into receiving water courses, with a permit called a 'discharge consent'. These consents incorporate the minimum water quality standards for treated effluent discharge as set out by the UWWTD. Consent limits are enforced by the Environment Agency. A consent also specifies a volume of water (defined as the Dry Weather Flow, DWF) that can be discharged in to the environment. Treatment works are designed to meet a pre-defined consented DWF. Compliance against the consent can be assessed by comparing the measured flow leaving the works, with the consented flow. Discharge consent data has been made available to this study for the Dŵr Cymru Welsh Water treatment works.

Table 4.3 Wastewater Treatment Works Identified as Receiving Growth

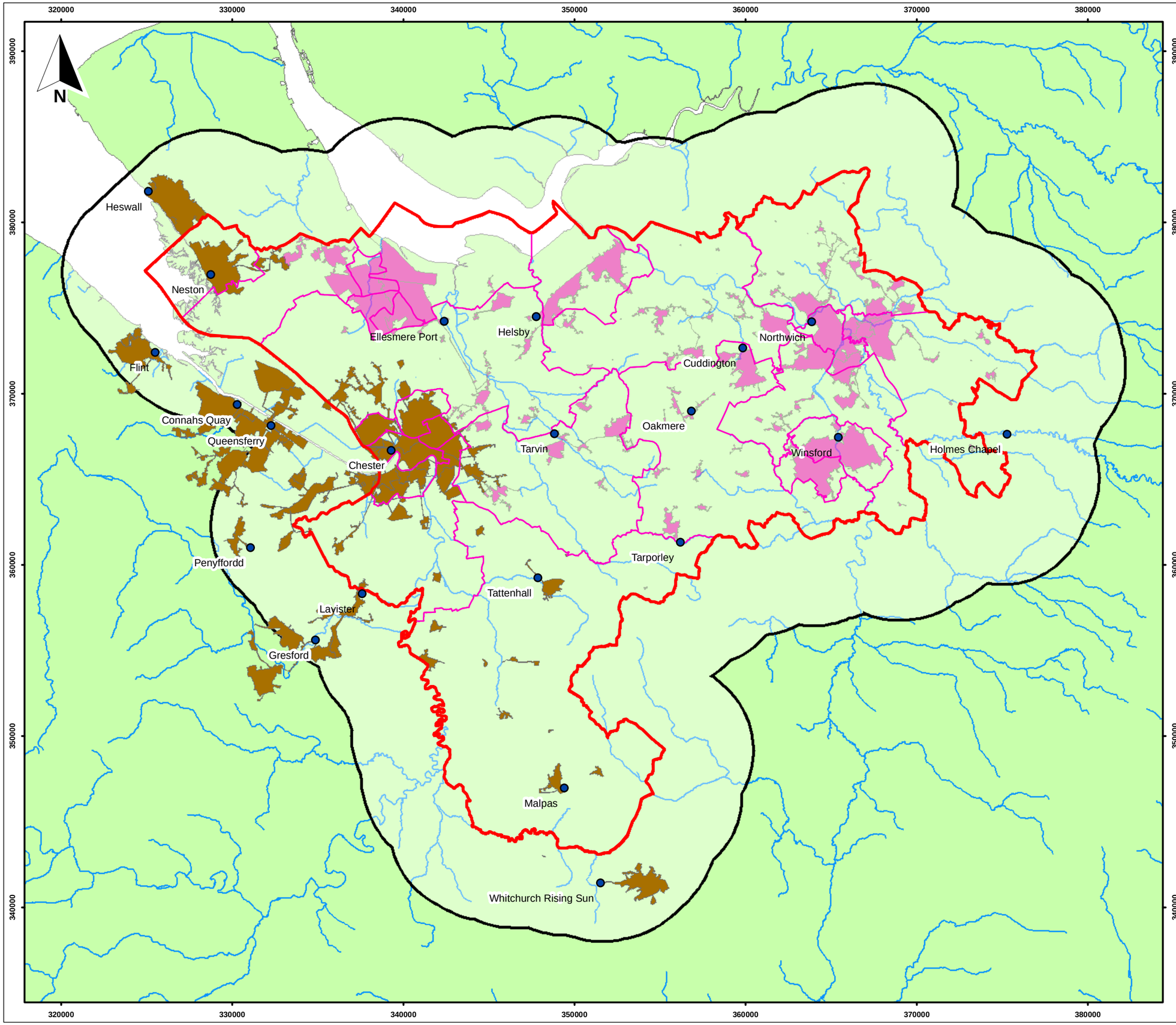
Wastewater Treatment Works	Operator	Current PE Served (persons)*	Consent Conditions				Receiving Watercourse
			BOD (mg/l)	Ammonia (mg/l)	Suspended Solids (mg/l)	Dry Weather flow (m^3/day)	
Ellesmere Port	United Utilities			Not available			Tributary of Stanney Mill Brook
Helsby	United Utilities			Not available			Peckmill Brook, Hoolpool Gutter at Ince Marshes.
Northwich	United Utilities			Not available			River Weaver (Dane to Frodsham)
Tarvin	United Utilities			Not available			Milton Brook
Oakmere	United Utilities			Not available			Fir Brook (drains into Cuddington Brook)
Winsford	United Utilities			Not available			River Weaver (Marbury Brook to Dane)
Holmes Chapel	United Utilities			Not available			River Dane (Cow Brook to Wheelock)
Tarporley	United Utilities			Not available			Wettenhall Brook
Cuddington	United Utilities			Not available			Cuddington (Cliffe) Brook
Chester	Dŵr Cymru Welsh Water	115,100	25	10	40	31,138	River Dee (Tidal River Dee – transitional waterbody)
Neston	Dŵr Cymru Welsh Water	15.900	24	N/a	45	4,074	Stanney Brook
Malpas	Dŵr Cymru Welsh Water	1,600	20	N/a	55	900	Un-named tributary of Wych Brook
Tattenhall	Dŵr Cymru Welsh Water	1,600	20	N/a	30	477	Golbourne Brook (tributary of the Aldford Brook)

*PE = Population Equivalent, rounded to nearest 100 persons

4.3.3 Existing Sewerage and Drainage Networks

These systems include foul only sewers, surface water only sewers, pumping stations and some combined sewers. Most surface water sewers convey rainwater away from urban areas and discharge directly into watercourses and estuary outfalls. The foul sewers form a network that convey waste flows to the wastewater treatment works, often

via pumping stations where gravity flow cannot be achieved. The area served by each wastewater treatment works is known as the catchment area. The wastewater catchment areas within the study area are shown in Figure 4.5.



Key:

- CWaC area
- Buffer zone
- Council wards
- Main wastewater treatment works
- UU WwTW catchment areas
- DCWW WwTW catchment areas
- Main rivers

UU = United Utilities
DCWW = Dwr Cymru Welsh Water
WwTW = Wastewater treatment works

0 1.5 3 6 9 12
Kilometers
Scale: 1:215,000 @ A3

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Cheshire West and Chester Water Cycle Study

Figure 4.5
Wastewater treatment works and catchments

May 2010
26889-W15 HASTJ

Entec

Figure 4.5 shows that there are four large wastewater catchments within the study area. These are Northwich, Winsford and Ellesmere Port (United Utilities) and Chester (Dŵr Cymru Welsh Water). Comparison with the growth areas shows that much of the growth within the study area will be within or in close proximity to these wastewater treatment works catchments. Outside these four large WwTW catchments, Figure 4.5 also shows large catchments for the following United Utilities WwTW at Helsby, Tarvin, Tarporley, Cuddington and Weaverham. The catchments of Neston, Malpas and Tattenhall works operated by Dŵr Cymru Welsh Water are also significant. Figure 4.5 also illustrates the point made in the previous section that although there are a large number of WwTW in the study area, the catchments of many of the rural works are small relative to those in the urbanised parts of the study area.

History of Sewer Flooding

Historical records of sewer flooding incidents can be used to identify where capacity of the wastewater network has been exceeded in the past, and thus indicate where there may be potential enhancements required in the sewer network if additional new development is to be connected. It is important to recognise that historical sewer flooding events may result from causes such as blockages or sewer collapses and do not necessarily relate to sewer capacity being exceeded. However, the data provided by the water companies for use in this study excludes other causes such as blockages and collapses.

Figure 4.6 illustrates the incidents of sewer flooding that have occurred in the study area during AMP4 (2005 to 2009). The figure shows that there have been incidents of sewer flooding in most developed areas and concentrations of incidents reflect the relative population densities. The figure also shows that the vast majority of incidents have been external (in a broad sense means not flooding household properties). There have been a much smaller number of internal flooding incidents. The water companies have identified these flooding events and have identified a programme of improvements during the five years from 2010 to 2015. It is not within the scope of this Outline study to examine this in detail.

320000 330000 340000 350000 360000 370000 380000

390000 380000 370000 360000 350000 340000

Key:

- CWAC study area
- Greater than 1 in 10 - internal
- 1 in 10 to 1 in 30 internal
- Less frequent than 1 in 30 internal
- Serious External
- Other External
- DCWW WwTW catchment areas
- UU WwTW catchment areas

DCWW = Dwr Cymru Welsh Water
WwTW = Wastewater treatment works

0 1.5 3 6 9 12
Kilometers

Scale: 1:215,000 @ A3

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Cheshire West and Chester Water Cycle Study

Figure 4.6
Sewer Flooding

May 2010
26889-W16 BREAR

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4.3.4 Receiving Waters

Sewage is a rich source of phosphorus (P) and nitrates (N) and increased inputs of these nutrients into waterbodies encourages algal growth and degrades water quality (as seen in the River Dane). Wastewater treatment works are designed to remove phosphorus and nitrates from raw sewage before discharging the treated water back into the river (receiving water)[7]. Ammonia is toxic to fish and macro-invertebrates, and is a product of the decay of nitrogenous organic wastes and animal and vegetable wastes. A major source of ammonia in rivers is sewage effluent, although diffuse agricultural sources are also important[8]. As shown in Table 4.3 the Dŵr Cymru Welsh Water WwTW at Chester has an ammonia consent of 10 mg/l. United Utilities commented on a draft of this report that their larger WwTWs in the study area have ammonia consents, with which they are compliant.

The WFD status of the watercourses throughout the study area are shown in Figure 4.7, whilst the watercourses that receive flow from the thirteen main wastewater treatment works in the study area is shown in Table 4.4. This shows that all watercourses that receive flows from these works are currently assessed as either poor or moderate status. The overall score is based on the lowest result, i.e. if one component is poor, the water body is categorised as poor. It should be noted that in some cases (e.g. the Oakmere WwTW and the Fir Brook), the status of the watercourse is not specified in the RBMP. In these cases the downstream watercourse status has been used which, in the case of the Fir Brook, is the Cuddington Brook.

[7] No United Utilities WwTW in the study area currently has a phosphorus consent. Some of being introduced during AMP5 (2010-2015) mainly in Cheshire East. United Utilities confirmed that phosphorus consents will be achieved through chemical dosing at the WwTW.

Table 4.4 Summary of Compliance with WFD Targets for Selected Water Quality Parameters and Waterbody Status and Objectives

Receiving Water	Overall WFD Status	Current Phosphate	Ammonia*	Current Ecological Status or Potential	Overall Status Objectives	Protected area designation	Treatment Works∞	Reason for not achieving by 2015
Tributary of Stanney Mill Brook	Poor (Potential)	Poor (Very Certain)	Good	Poor (Very Certain)	Good by 2027 Good ecological potential by 2027	Freshwater Fish Directive, Nitrates Directive	Ellesmere Port	Disproportionately expensive, Technically infeasible
Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Poor	Moderate	Good	Poor (Quite Certain - WoE†)	Good by 2027 Good ecological status by 2027	Natura 2000 (Habitats and/or Birds Directive), Nitrates Directive	Helsby	Disproportionately expensive, Technically infeasible
River Weaver (Dane to Frodsham)	Moderate (Potential)	Poor (Very Certain)	Bad (Very Certain)	Moderate (Very Certain WoE†)	Good by 2027 Good Ecological Potential by 2027, Good Chemical Status by 2027	Freshwater Fish Directive, Nitrates Directive, Urban Waste Water Treatment Directive	Northwich	Disproportionately expensive, Technically infeasible
Milton Brook	Moderate	Poor (Very Certain)	Good	Moderate (Very Certain)	Good by 2027 Good ecological status by 2027	Freshwater Fish Directive, Nitrates Directive	Tarvin	Disproportionately expensive, Technically infeasible
Fir Brook (drains into Cuddington Brook)	Poor	Poor (Very Certain)	Moderate (Very Certain)	Poor (Quite Certain – WoE†)	Good by 2027 Good ecological status by 2027	Freshwater Fish Directive, Nitrates Directive	Oakmere	Disproportionately expensive, Technically infeasible

Receiving Water	Overall WFD Status	Current Phosphate	Ammonia*	Current Ecological Status or Potential	Overall Status Objectives	Protected area designation	Treatment Works[∞]	Reason for not achieving by 2015
River Weaver (Marbury Brook to Dane)	Moderate (Potential)	Poor (Very Certain)	Moderate (Certain)	Moderate (Very Certain)	Good by 2027 Good Ecological Potential by 2027, Good Chemical Status by 2027	Freshwater Fish Directive, Nitrates Directive, Urban Waste Water Treatment Directive	Winsford	Disproportionately expensive, Technically infeasible
River Dane (Cow Brook to Wheelock)	Poor	Poor (Very Certain)	High	Poor (Quite Certain – WoE[†])	Good by 2027 Good ecological status by 2027	Freshwater Fish Directive, Nitrates Directive, Urban Waste Water Treatment Directive	Holmes Chapel	Disproportionately expensive
Wettenhall Brook	Moderate	Poor (Very Certain)	Poor (Uncertain)	Moderate (Very Certain)	Good by 2027 Good ecological status by 2027	Freshwater Fish Directive, Nitrates Directive	Tarporley	Disproportionately expensive
Cuddington (Cliffe) Brook	Poor	Poor (Very Certain)	Moderate (Very Certain)	Poor (Quite Certain – WoE[†])	Good by 2027 Good ecological status by 2027	Freshwater Fish Directive, Nitrates Directive	Cuddington	Disproportionately expensive, Technically infeasible
River Dee (Tidal River Dee – transitional waterbody)	Moderate (Potential)	N/a for transitional water	N/a for transitional water	Moderate (Uncertain)	Good by 2027 Good Ecological Potential by 2027, Good Chemical Status by 2015	Bathing Water Directive, Natura 2000 (Habitats and/or Birds Directive), Nitrates Directive, Shellfish Water Directive	Chester	Disproportionately expensive

Receiving Water	Overall WFD Status	Current Phosphate	Ammonia*	Current Ecological Status or Potential	Overall Status Objectives	Protected area designation	Treatment Works[∞]	Reason for not achieving by 2015
Stanney Brook	Moderate (Potential)	N/a for transitional water	N/a for transitional water	Moderate (Uncertain)	Good by 2027 Good Ecological Potential by 2027, Good Chemical Status by 2015	Bathing Water Directive, Natura 2000 (Habitats and/or Birds Directive), Nitrates Directive, Shellfish Water Directive	Neston	Disproportionately expensive
Un-named tributary of Wych Brook	Moderate	Poor (uncertain)	Good	Moderate (Uncertain)	Good by 2027. Good Ecological Status by 2027	Nitrates Directive	Malpas	Disproportionately expensive
Golbourne Brook (tributary of the Aldford Brook)	Moderate	Poor (Very Certain)	Good	Moderate (Very Certain)	Good by 2015 Good Ecological Status by 2015, Good Chemical Status by 2015	Freshwater Fish Directive Nitrates Directive	Tattenhall	-

* Ammonia data status is for Ammonia (Phys-Chem) and Ammonia (Annex 8) as reported in Annex B of the River Basin Management Plans.

[†]WoE is an abbreviation of 'Weight of Evidence'. This indicates where there is uncertainty over some or all of the elements considered in the assessment of ecological status. In these cases the Environment Agency's assessment of certainty is based on weight of evidence. For example, in some cases a water body does not meet the required standard for phosphorus but the biological community shows no sign of damage. In this case it is misleading to state that it is 'very certain' that the water body is at less than good status. However, the 'weight of evidence' indicates that there is an impact. More information can be found in Annex B of the River Basin Management Plans.

[∞]Wastewater treatment works are listed for reference. This does not imply that the WwTW is responsible for failures against WFD objectives

Table 4.4 shows that that the overall status objective for most of these watercourses is to achieve good ecological potential or good ecological status by 2027. Only in the case of Aldford Brook is good status an objective by 2015. The reason given in all other cases is that it is either disproportionately expensive or technically infeasible to achieve good status or potential by 2015. Also listed in Table 4.4 are the protected area designations for each watercourse, showing that watercourses throughout the region are extensively designated under the Fresh Water Fish Directive, the UWWTD, the Nitrates Directive , Bathing Water Directive and Habitats/Birds Directive.

In almost all watercourses the phosphate status is currently assessed as poor, except the Peckmill Brook and Hornsmill Gutter, where the status is assessed as moderate. Ammonia status across the study area is more variable. In most tributaries of the River Weaver and the Weaver itself, the ammonia status is either poor or moderate. In the River Weaver (River Dane to Frodsham) the ammonia status is currently assessed as bad. The exception to this is the upper reach of the River Dane where ammonia status is assessed as high. In the tributaries of the River Dee and the River Gowy shown in Table 4.4 the ammonia status is good.

Unless wastewater treatment works can deliver the capacity to serve the planned housing growth, levels of phosphorus and ammonia in the water courses could increase. This would risk failure against phosphorus standards, as compliance with WFD standards is measured using the specific 'type' of phosphorus to which treated effluent from wastewater treatment works can make a significant contribution. Therefore WFD water quality objectives may present a constraint to growth if water quality is predicted to deteriorate due to development.

Further information on nutrient status of watercourses within the study area is presented in Table 4.5, including quantitative information on nitrate and phosphate levels. These data are taken from the Environment Agency website and have been obtained for the nearest downstream watercourse where this information is available. The data show that both nitrate and phosphate levels are generally elevated in the rivers in the study area. Phosphate levels are mostly graded as very high, with the exception of the Worthenbury Brook where phosphate levels are exceptionally high. Nitrate levels are graded as very high or high in most of the rivers, the exceptions being the reaches of the River Dane and the River Dee located downstream of Holmes Chapel and Chester WwTW, where nitrate levels are graded as moderately low and low respectively.

Although the water quality data are shown for the watercourses downstream of WwTW, it is important to emphasise that the wastewater treatment works discharges may not be the source of these elevated nutrient levels, for example nutrients can be sourced from runoff from farmland and urban areas.

Climate change may also affect the capacity of the receiving waters to absorb wastewater discharges. The most recent climate change analysis presented by the UK Climate Impacts Programme (UKCIP) 2009 indicate that rainfall patterns are set to change with wetter winters and drier summers (see section 5 for more detail). Reduced summer rainfall may lead to less flow in the rivers. This may reduce the ability of rivers to assimilate existing volumes of wastewater during times of lower flows, although this is a complex relationship which is influenced by linkages with groundwater levels and controlled releases from reservoirs. It is possible that discharge consents may be revisited and investigated in the future, taking account of 'new' hydrological regimes under 'climate changed'

conditions. It is not possible to predict or quantify the magnitude of this possible change in the scope of this Outline study.

Table 4.5 Nutrient Data and Grading Downstream of WwTW

Treatment works	Receiving Water	Downstream sampling point	Nitrate (average for 2008, mg/l)	Grade	Phosphate (average for 2008, mg/l)	Grade
Ellesmere Port	Tributary of Stanney Mill Brook	Gowy, Lower Hall Huxley To Mill Bk.	32.10	5 (High)	0.41	5 (Very High)
Helsby	Peckmill Brook, Hoolpool Gutter at Ince Marshes.	No water quality data available				
Northwich	River Weaver (Dane to Frodsham)	Weaver Bogart Brook to Witton Brook.	38.94	5 (High)	0.62	5 (Very High)
Tarvin	Milton Brook	Willington/Milton Bk. Qsl At Quarry Bank To Oscroft Bridge	31.11	5 (High)	0.30	5 (Very High)
Oakmere	Fir Brook (drains into Cuddington Brook)	Cuddington Bk. Qsl At Lower Mill To Grange (Cliff) Bk	32.05	5 (High)	0.84	5 (Very High)
Winsford	River Weaver (Marbury Brook to Dane)	River Weaver (Winsford Stw To Bogart Brook)	40.24	6 (Very High)	0.70	5 (Very High)
Holmes Chapel	River Dane (Cow Brook to Wheelock)	River Dane (Holmes Chapel STW to River Croco)	18.22	3 (Moderately low	0.32	5 (Very High)
Tarporley	Wettenhall Brook	Ash Brook (Wettenhall Brook to Weaver)	36.39	5(High)	0.41	5 (Very High)
Cuddington	Cuddington (Cliffe) Brook	Cuddington Brook (Lower Mill To Grange (Cliff) Brook)	32.05	5(High)	0.84	5 (Very High)
Chester	River Dee (Tidal River Dee – transitional waterbody)	Chester Weir - Conf.Caldy Brook	8.83	2 (Low)	0.12	4 (High)
Neston	Stanney Brook	No downstream water quality data available				

Treatment works	Receiving Water	Downstream sampling point	Nitrate (average for 2008, mg/l)	Grade	Phosphate (average for 2008, mg/l)	Grade
Malpas	Un-named tributary of Wych Brook	Worthenbury Brook (Conf.Trib.Lwr Wych - Conf.Iscoyd Bk.)	47.64	6 (Very High)	1.10	6 (Excessively High)
Tattenhall	Golbourne Brook (tributary of the Aldford Brook)	No downstream water quality data available in close proximity to works				

All data taken from the Environment Agency website. http://www.environment-agency.gov.uk/homeandleisure/37793.aspx