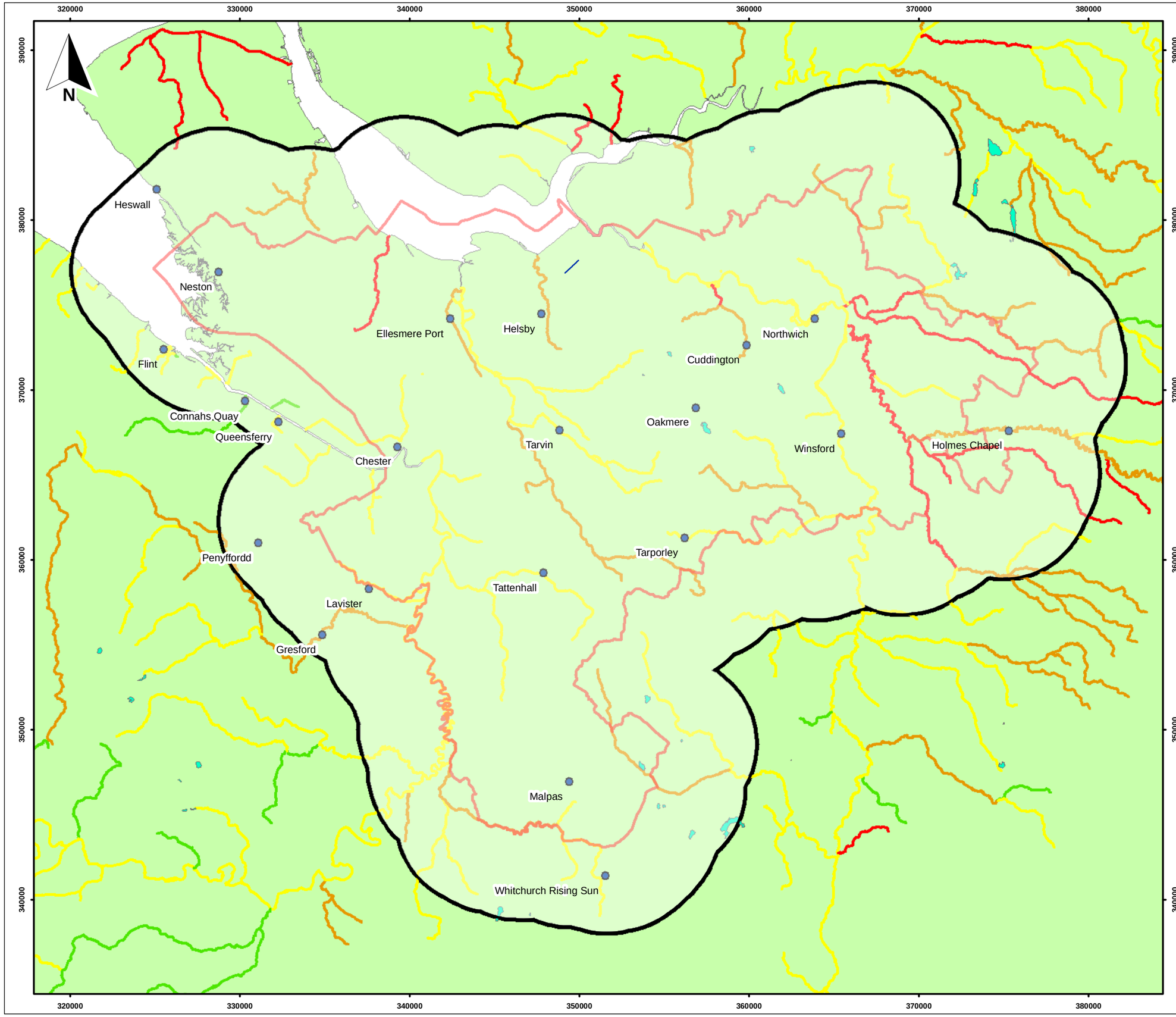

Key:

- CWaC area
- Buffer zone
- Main wastewater treatment works

River water overall quality

- Bad
- Poor
- Moderate
- Good

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 4.7
Water Framework Directive classifications
Current overall status

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Box 4	Confirmation of water quality and wastewater issues: Outline Stage

Water quality of the many of the rivers draining the study area is moderate or poor status. Nutrient (nitrate and phosphate) levels are high. This is partly due to wastewater treatment discharges but contributions of pollutants from other sources including industrial discharges, agriculture and urban runoff are also important. Some of the measures identified in the North West and Dee RBMP as described in the preceding section, are likely to contribute to water quality improvements.

Tackling urban runoff by separating clean and foul drainage (e.g. incorporating SuDS as part of new developments) offers a significant potential to improve water quality in urban catchments. Measures aimed at other sectors, particularly agriculture may also return a significant improvement in water quality, particularly in headwater catchments.

The risk of not achieving good status / failure of a water quality standard alone does not necessarily present a barrier to development so long as mitigation measures are implemented. For example, an increase in effluent flow could be mitigated by treating effluent to a higher standard.

4.4 Designated Sites

The legislative drivers for maintaining or improving water quality are presented in Table 4.6. This includes European legislation to protect receiving waters and their dependant habitats that are considered particularly sensitive. The SEA of the West Cheshire and North East Wales Sub-RSS states that there is a *"high concentration of designated sites at local, national and international level which must be afforded protection including Natura 2000 sites"* (under Habitats Directive) (page 10). It also states that, *"few Welsh Sites of Special Scientific Interest (SSSIs) [are] in a favourable condition"* (page 10) (Hyder, 2007). This highlights the pressure that development in this area must take into account. Table 4.6 summarises the main types of designation and the level of protection that each one is awarded. Boxes 5 to 11 summarise the key features of the designated sites that are within the study area. These sites, and nearby designated sites that are outside of the study area are illustrated in Figure 4.8.

Table 4.6 Summary of Protected Sites Designations and Level of Protection

Designation	Level of Protection
Ramsar (Global importance)	Ramsar sites are wetlands of international importance designated under the Ramsar Convention (Convention on Biological Diversity). Many Ramsar sites are also Special Protection Areas (SPAs) classified under the Birds Directive
Special Area of Conservation (European importance)	Special Areas of Conservation (SACs) are strictly protected sites designated under the EC Habitats Directive. These sites make a significant contribution to conserving the habitat types and species identified in the Directive considered to be most in need of conservation at a European level (excluding birds). These sites form part of the European Natura 2000 network.
Special Protection Area (European importance)	Special Protection Areas (SPAs) are strictly protected sites classified in accordance with the EC Birds Directive. They are classified for rare and vulnerable birds, and for regularly occurring migratory species. These sites form part of the European Natura 2000 network.
Sites of Special Scientific Interest (SSSI). (National importance)	SSSI sites provide statutory protection for the best examples of the UK's flora, fauna, or geological or physiographical features. SSSIs have been notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs were introduced by the Countryside and Rights of Way Act 2000 (in England and Wales).
SACs and SPAs are European Designated Sites and are part of the Natura 2000 sites. It is Government policy to include sites listed under the Convention on Wetlands of International Importance (Ramsar) as part of the Habitats Regulations Assessment.	

The designated sites in and around the West Cheshire area are shown in Figure 4.8. It shows that the majority of designated sites are SSSIs and these are distributed across the study area. The globally important Ramsar site, and the European important SPAs, and SACs are concentrated in the Dee and Mersey Estuaries. Detail on the designations in the Dee and Mersey estuaries and the Dee and Bala Lake is provided in Boxes 5, 6 and 7. Information on designated sites has been provided by Natural England and the Countryside Council for Wales.

The Environment Agency has confirmed that the Rivers Dee and Mersey are important *Cyprinid* (waters capable of supporting fish belonging to the cyprinids such as carp) or *Salmonid* Waters (i.e. waters which enable salmon and trout migration and breeding). Cyprinid monitoring points are also located on the River Weaver, River Dane, the Wincham Brook, the Croco, Chester Lane Brook, and the Shropshire Union Canal. It is hoped that ongoing environmental improvements will generate suitable habitats for salmon migration in other rivers across the region.

Through its Review of Consents process, the Environment Agency has identified diffuse pollution to be a major factor in causing unfavourable conservation status of European sites (such as SPAs and SACs), including rivers, wetlands and estuaries/maritime sites. Sewage and some industrial effluent discharges also contribute to increased nutrients in the European sites. The Environment Agency has recently completed a review of its consents for wastewater discharges. The conclusions have not yet been made available. In the interim, the Environment Agency has stated that it is unable to conclude that current levels of some discharges are not adversely affecting the integrity of some European sites.

Box 5 Mersey Estuary Habitat and Species

The Mersey Estuary is a large, sheltered estuary which comprises large areas of saltmarsh and extensive intertidal sand and mudflats, with limited areas of brackish marsh, rocky shoreline and boulder clay cliffs, within a rural and industrial environment. The intertidal flats and saltmarshes provide feeding and roosting sites for large and internationally important populations of waterfowl. During the winter, the site is of major importance for duck and waders.

The site is also important during spring and autumn migration periods, particularly for wader populations moving along the west coast of Britain. The nutrient status of the water is eutrophic to mesotrophic (moderate to high nutrient levels).

Source: JNCC 2008a.

Box 6 Dee Estuary Habitat and Species

The Dee Estuary is one of the top five estuaries in the UK for wintering and passage waterfowl populations, supporting internationally important numbers of waterfowl and waders. It has extensive areas of intertidal sand and mudflats as well as saltmarsh. The site includes an assemblage of nationally scarce plants and the sandhill rustic moth *Luperina nickerlii gueneei*, a British Red Data Book species (i.e. it is endangered).

The two shorelines of the estuary show a marked contrast between the industrialised usage of the coastal belt in Wales and residential and recreational usage in England. The nutrient status of the water is mesotrophic (moderately high nutrient levels).
Source: JNCC, 2008b.

Box 7 River Dee and Bala Lake

The Dee River Basin District is home to over 500,000 people and covers an area of 2,251 km^2 of North East Wales, Cheshire, Shropshire and the Wirral. The district consists of a single river basin that of the River Dee, its tributaries and estuary. The district is characterised by a varied landscape. It ranges from the mountains and lakes of the Snowdonia National Park in the upper part of the basin, through the Vale of Llangollen in the middle reaches, to the open plains of Cheshire and the mudflats of the Dee Estuary in the lower basin.

The site is characterised by tidal rivers, estuaries, mud flats, sand flats, lagoons, salt marshes, salt pastures, and salt steppes. There are inland water bodies (standing water and running water), improved grassland and broad-leaved deciduous woodland. The designation reflects the importance of the whole river ecosystem for the river Dee and its catchment area, in particular the range of river types and migratory fish that it supports.

Source: Central Ellesmere Port Area Action Plan Habitats Regulations Assessment (EPNBC, 2009)

Box 8 Midland Meres and Mosses (Ramsar Phase 1)

The Meres and Mosses form a geographically discrete series of 16 lowland open water and peatland sites in the north-west Midlands of England. The sites support a number of rare species of plants associated with wetlands including five nationally scarce species. These sites are vulnerable to eutrophication through atmospheric pollution and agricultural run-off. There is no major tourism or recreational use apart from some angling and boating and motor sports (water-skiing) in one or two cases. Many sites are accessible through a network of public footpaths.

Source: Natura 2000 Data Form: http://www.jncc.gov.uk

Box 9 Midland Meres and Mosses (Ramsar Phase 2)

The Meres and Mosses form a geographically diverse series of 18 lowland open water and peatland sites in the north-west Midlands of England and north-east Wales. The sites support a number of rare species of plants associated with wetlands. There are 16 species of British Red Data Book (endangered) insect listed. Conservation objectives have yet to be defined. The sites are vulnerable to eutrophication through atmospheric pollution and agricultural run-off. There is a network of public footpaths, and angling and boating also takes place with increased use in the summer.

Source: Natura 2000 Data Form: http://www.jncc.gov.uk

Box 10 Oak Mere

Oak Mere is a lake formed within sediments that are low in nutrients and oligotrophic (low nutrients). It is a large waterbody that has formed in a kettle hole in the fluvio-glacial sands of the Cheshire Plain. The site has clear water of low nutrient status characteristic of oligotrophic waters and a marginal zone of shore weed *Littorella uniflora*. The site supports an assemblage of plants that are now rare in the lowlands of England. Further nutrient enrichment and chemical pollution are potential threats via discharges into the Mere's only surface inflow. The risks from these point sources are being investigated by English Nature and the Environment Agency.

Water-level changes are the subject of monitoring and management is in hand to tackle the threat to shoreline communities of resultant desiccation and invasion by birch and willow. There is a continual possibility of accidents and spillages on the busy road network on the sides of the Mere.

Source: Natura 2000 Data Form (http://www.jncc.gov.uk)

Box 11	West Midland Mosses
West Midlands Mosses contains three pools (two of which are located at Abbots Moss within Delamere Forest), that are examples of dystrophic lakes and ponds in the lowlands of England and Wales, where this habitat type is rare. The dystrophic lakes and ponds at Abbots Moss are associated with Schwingmoor development, a characteristic of this habitat type in the West Midlands. Schwingmoor is an advancing floating raft of bog-moss *Sphagnum*, often containing a bog pool community, which grows from the edge of the pool and can completely cover over the pool. There are several sources of nutrient enrichment, including atmospheric deposition of nutrients that pose a potential threat at these sites. Source: Natura 2000 Data Form (http://www.jncc.gov.uk)	

The information in boxes 5 to 11 clearly demonstrates that designated sites across the study area are at risk, predominantly through point and diffuse pollution, resulting in increased nutrient levels in the water. Water abstraction for public water supply, agricultural and industrial use reduces the volume of water that is available to help dilute nutrients and concentrations of other material.

A localised scoping WCS specifically undertaken for Cheshire West and Chester examined Lake Bala in the context of the water cycle study as it is an important designated site in the area. As Lake Bala is upstream of the growth area, the main issue is the pressure to abstract water to meet increased demand. The lake is largely natural, but elevated water levels are maintained and operated to supply the local area by Dŵr Cymru Welsh Water. Direct abstractions are not used to supply West Cheshire, however, both Dee Valley Water and United Utilities abstract significant volumes of water downstream of the lake from the River Dee. Releases from the lake may be required to ensure flows in the Dee are maintained. Neither water company has been requested to reduce the volume abstracted from the Dee under the Habitats Directive Review of Consents. Similarly, neither company has forecast the need to increase its abstractions from the Dee to secure public water supplies. Section 4.5 examines water resources and supply in more detail.

N

310000 320000 330000 340000 350000 360000 370000 380000

390000 380000 370000 360000 350000 340000 330000

Mersey Narrows and North Wirral Foreshore pRamsar

Manchester Mosses SAC

Rixton Claypits SAC

Liverpool Bay pSPA

Rostherne Mere SAC

Dee Estuary/ Aber Dyfrdwy Ramsar, SPA and SCI

MMM Ramsar Phase 1

Heswall

Mersey Estuary Ramsar and SPA

Neston

Ellesmere Port

Helsby

MMM Ramsar Phase 1

Northwich

Halkyn Mountain SAC

Flint

MMM Ramsar Phase 2

Connahs Quay

Queensferry

Oakmere

West Midland Mosses SAC

Holmes Chapel

Chester

Tarvin

Oak Mere SAC

Winsford

Deeside and Buckley Newt Sites SAC

Alyn Valley Woods SAC

MMM Ramsar Phase 1

Penyffordd

Tarporley

Tattenhall

Lavister

Gresford

MMM Ramsar Phase 2

MMM Ramsar Phase 2

Berwyn and South Clywd Mountains SAC

MMM Ramsar Phase 1 & 2

Malpas

MMM Ramsar Phase 1 & 2

Berwyn and South Clywd Mountains SAC

Whitchurch Rising Sun

River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC

MMM Ramsar Phase 1

Brown Moss SAC

Berwyn SPA

MMM Ramsar Phase 2

Fenn's Whixall, Bettisfield, Wem abd Cadney Mosses SAC

Key:

- CWaC study area
- Buffer area
- Ramsar site
- Special area of conservation
- Special protection area
- Site of special scientific interest
- Main rivers
- Main wastewater treatment works
- Main development areas

MMM = Midland Meres and Mosses

0 2 4 8 12 16

Kilometers

Scale: 1:300,000 @ A3

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Figure 4.8
Designated sites close to the study area

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4.5 Water Supply

The water supply undertakers (water companies) have a statutory duty to provide public water supplies. The Environment Agency is responsible for managing the resources in the form of granting (or refusing) abstraction licences to abstract water for various purposes. It is the water companies' responsibility to manage that resource once it enters the water supply network from the point of abstraction.

Information on public water supply has been taken from United Utilities' and Dee Valley Water's WRMPs. Additional data has also been made available specifically for the purpose of this study. Water supply infrastructure information was provided by United Utilities and Dee Valley Water, including general comments on the capacity of the strategic supply network.

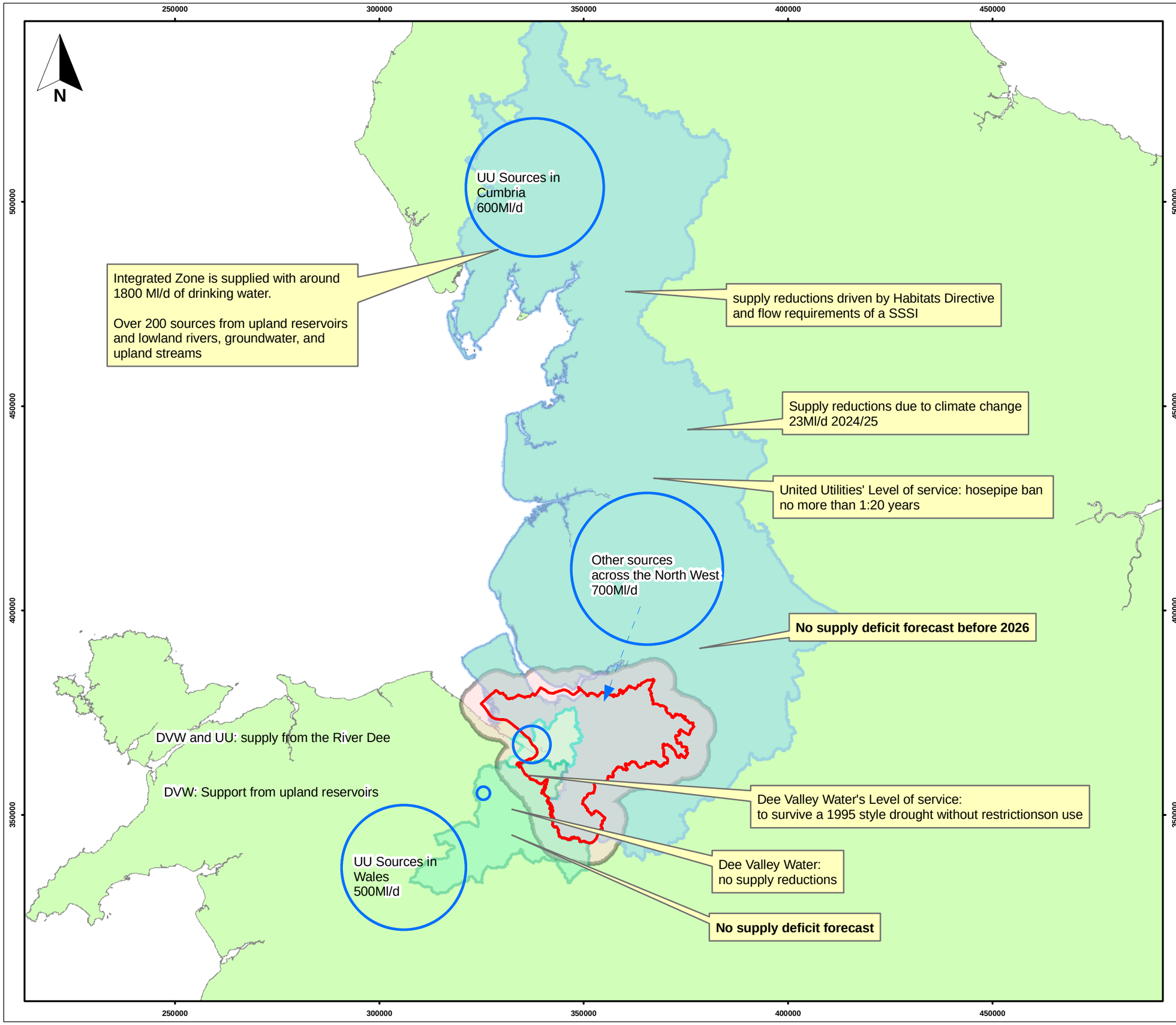
4.5.1 Regional Water Resources

The Cheshire West and Chester area is located within the Dee, and the Weaver Gowy catchments but water supply is sourced over a wide distance, from the Lake District to North Wales, because public water supply is managed at a strategic rather than a local level, based on water resource zones.

United Utilities and Dee Valley Water both supply water to the study area. Approximately two thirds of West Cheshire lies within United Utilities' Integrated water resource zone (which serves 6.5 million people living in South Cumbria, Lancashire, Greater Manchester, Merseyside, most of Cheshire, and a small part of Derbyshire). This zone supplies around 1,800 Ml/d[9] of drinking water, of which about 500 Ml/d comes from water sources in Wales and the rest from sources in North West England. The remaining third of West Cheshire, around Chester, is supplied by Dee Valley Water. The main area of Chester is within the Chester water resource zone (Chester makes up approximately 80% of the zone's surface area). The smaller villages to the south of Chester are supplied by Dee Valley from sources and infrastructure within the Wrexham water resource zone.

Information within the water companies WRMPs and inputs specific to this project have been used to map the relationship between the study area, and its main sources of water supply. This is shown in Figure 4.9 and it highlights which areas are supplied by United Utilities and Dee Valley Water, the regional extent of the water resource zones, and a very high-level illustration of the main source locations.

[9] 1 Ml = 1 Megalitre, or one million litres.



Key:

- CWaC area
- Buffer zone
- DVW Wrexham zone
- DVW Chester zone
- UU Integrated zone

UU = United Utilities
DVW = Dee Valley Water

0 4.5 9 18 27 36
Kilometers

Scale: 1:900,000 @ A3

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Cheshire West and Chester Water Cycle Study

Figure 4.9
Water supply zones

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There are significant water resources across all three water resource zones, from both groundwater and surface water sources. Both water companies have abstractions from the River Dee, as the primary source supplying the study area, particularly Chester. United Utilities uses water from Lake Vrynwy in Wales to augment supplies across Cheshire and the wider Integrated resource zone. Both companies also have a small number of groundwater resources local to the study area which are used to support supplies. However, it should be noted that by definition, all areas within a water resource zone share the same level of service which means that an increase in demand from new development or from existing customers increases pressure on all the water resources in the zone, not just the local sources.

The water supplied to Chester by Dee Valley Water is treated at the large Boughton treatment works within Chester itself. United Utilities treats water at Sutton Hall (near Ellesmere Port), Huntington (south of Chester) and Oswestry (treating water from Lake Vrynwy) prior to distributing it within the potable water network. A number of smaller water treatment works are located at borehole sources in United Utilities' supply area.

The average rainfall across the water resource zones ranges from approximately 1800mm/year (Lowther, near Penrith) to 700mm/year (Aldford Brook)[10]. Rainfall levels vary considerably in relation to the region's topography. Demand for supply from this rainfall is high and water resources are stressed, although the level of stress is low[11].

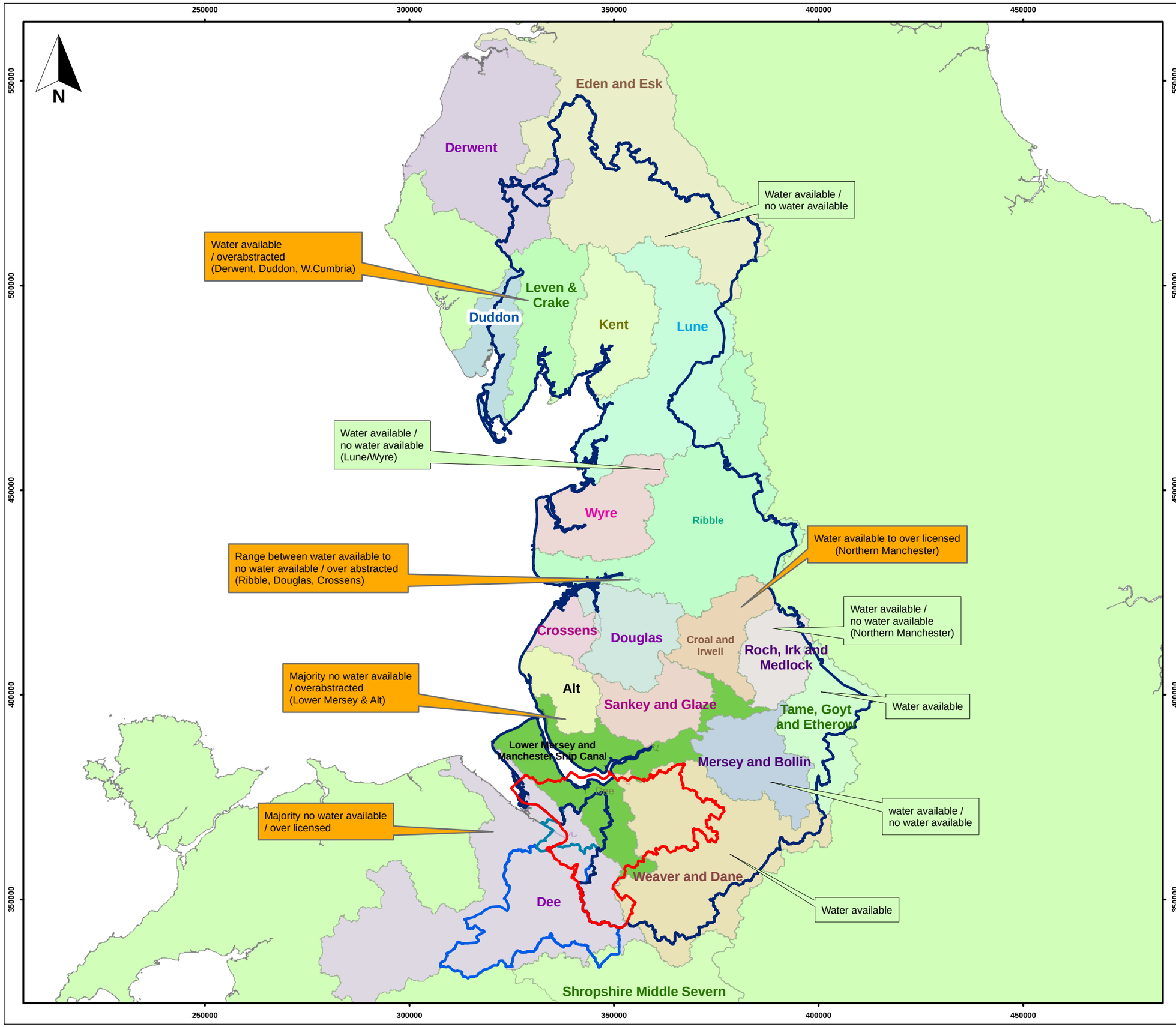
4.5.2 Catchment Water Resources (CAMS)

It is important to understand how much water there is in the environment and how much of it is available to abstract for public water supplies, as this could be a constraint to growth. The Environment Agency assesses water availability at a river catchment scale, considering existing abstractions (e.g. for public water supply, agricultural use etc) plus the water requirements of the environment.

The Environment Agency uses its results to develop 'Catchment Abstraction Management Strategies' (CAMS) which help to inform abstraction licensing decisions and so provide a useful context in which to understand the environmental constraints affecting water supply options available to the water companies.

The CAMS spanning the Integrated water resource zone and Dee Valley Water's resource zones show a varied picture (Figure 4.10 and Table 4.7). Some catchments have water available, others are fully allocated, whilst some are over licensed, or even over abstracted at periods of low flow. The significance of these assessments with regard to growth in the study area depends on whether the water companies are forecasting that demand for water will exceed available supplies. Where this is the case, the CAMS assessments may affect the water supply options available to the water companies. Dee Valley Water has not forecast a deficit in either its Chester or Wrexham zones. United Utilities forecasts a very small surplus between demand and supply, with a deficit occurring after 2022.

[10] National River Flow Archive http://www.nwl.ac.uk/ih/nrfa/station_summaries/map.html
[11] Environment Agency (2007). Identifying areas of water stress



Key:

- CWaC area
- UU Integrated WRZ
- DVW Chester WRZ
- DVW Wrexham WRZ

CAMS

- Alt
- Croal and Irwell
- Crossens
- Dee
- Derwent
- Douglas
- Duddon
- Eden and Esk
- Kent
- Leven and Crake
- Lower Mersey and Manchester Ship Canal
- Lune
- Mersey and Bollin
- Ribble
- Roch, Irk and Medlock
- Sankey and Glaze
- Shropshire Middle Severn
- Tame, Goyt and Etherow
- Weaver and Dane
- Wyre

UU = United Utilities
DVW = Dee Valley Water

0 5 10 20 30 40
Kilometers

Scale: 1:900,000 @ A3

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Cheshire West and Chester Water Cycle Study

Figure 4.10
CAMS in the water resource zones

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Table 4.7 Summary of CAMS Resource Assessments in the Water Resource Zones Supplying Cheshire and Chester

CAMS	Resource Availability Assessment
Catchments providing a large amount of public water supply	
Dee (United Utilities and Dee Valley Water)	**No water available** (by 2014) and over licensed. This catchment provides much of the water supplied to Chester and parts of West Cheshire.
Catchments in West Cumbria (United Utilities Lake District Sources)	Wider variety between individual units (water available to **over abstracted**). Pressures from the Habitats Directive to reduce abstraction to prevent low river flows is reducing supply from this area.
Catchments providing a small amount of public water supply to the study area	
Weaver and Dane	Water available
Lower Mersey (boreholes)	No water available / **over abstracted**
Other catchments across the North West	
Ribble, Douglas, Crossens Croal and Irwell	Range between water available to over abstracted
Roch, Irk, and Medlock Tame, Goyt and Etherow Mersey and Bollin	Range between water available to over licensed

Note – this is the Resource Availability Status at low flows – water may be available for abstraction at higher flows subject to abstraction constraints.

4.5.3 Restoring Sustainable Abstractions

Where water company abstractions are suspected to be contributing to pressure on habitats protected under the Habitats Directive, those abstractions and their impact on river flows and /or groundwater levels are investigated, and if necessary, a reduction in the abstraction volume is sought by the Environment Agency. This type of reduction in abstraction quantities is called a 'Sustainability Reduction'. The reduction of any public water supply abstraction licences would require provision of alternative water resources.

United Utilities abstractions in the Lake District are affected by this and a reduction of 33Ml/d is required to comply with Habitats Directive and requirements to improve a SSSI. Dee Valley Water has confirmed that its supplies are unaffected by Habitats Directive assessments.

4.5.4 United Utilities' Water Supply Situation

United Utilities' Integrated zone is based upon major aqueducts which deliver water from the Lake District to South Cumbria, Lancashire and Greater Manchester, and from mid-Wales and the River Dee to Cheshire and

Merseyside. There are connections from the aqueducts (known as Large Diameter Trunk Mains, LDTMs) to most towns and centres of population in these areas, so that local sources (impounding reservoirs and boreholes) can be operated in a fully integrated manner with the major regional sources (United Utilities, 2008). United Utilities is currently constructing a strategic water main between Merseyside and North Manchester which is known as the West to East link to increase security of supply. This is due to be operational in 2011/12.

United Utilities has published its final Water Resource Management Plan, forecasting expected demand and supply yields within a 'dry year' planning scenario. The demand forecast takes account of planned growth, as set out in the RSS. Both the demand and the supply forecast take account of the potential impact of climate change.

The forecast for the Integrated zone shows that a small supply deficit could occur from 2022/23 (7Ml/d) and that this deficit is expected to increase to 75Ml/d by 2034/35 (Figure 4.11). A programme of solutions is required to maintain reliable water supplies in the Integrated Zone (United Utilities, 2009). The company has presented a strategy that will remove the deficit but will not generate a surplus. An allowance for uncertainty (headroom) is included but the forecast indicates that water resources (supplies) and demands across the whole zone will need to be monitored and managed carefully over time to prevent demand exceeding supply (Figure 4.12).

Figure 4.11 Baseline Supply-demand Balance (Integrated Zone)

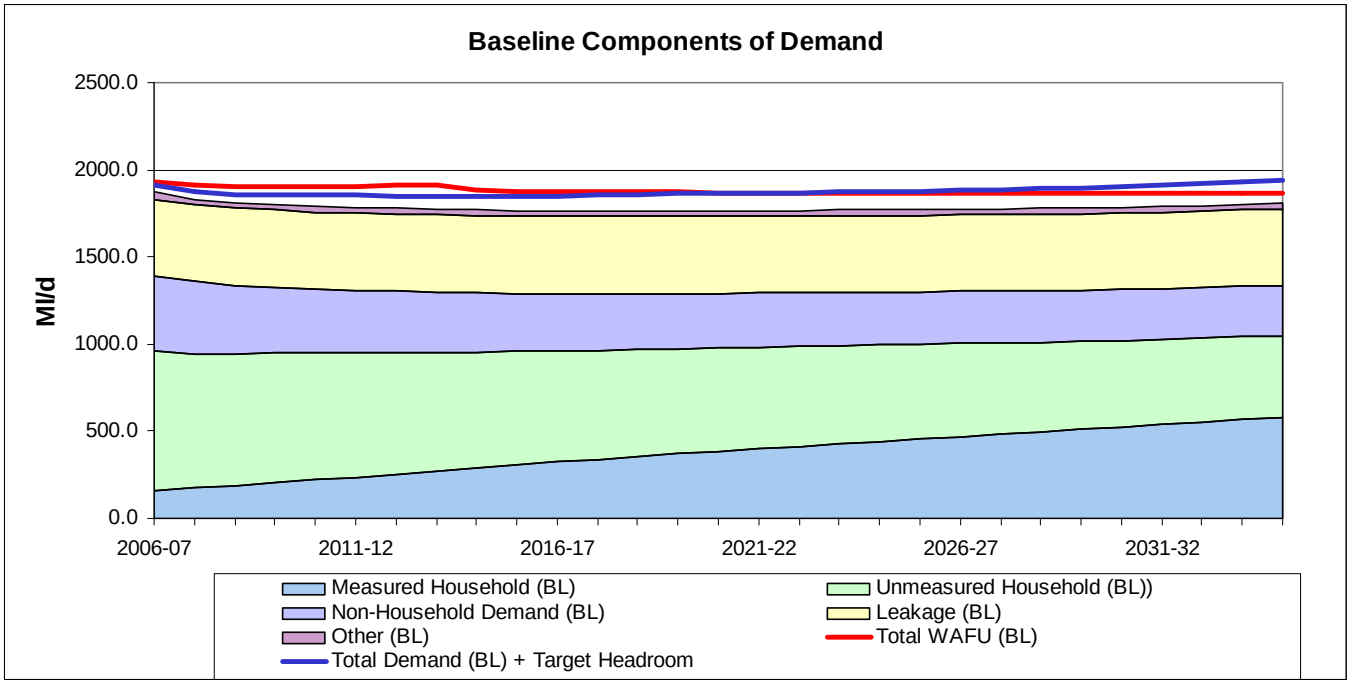
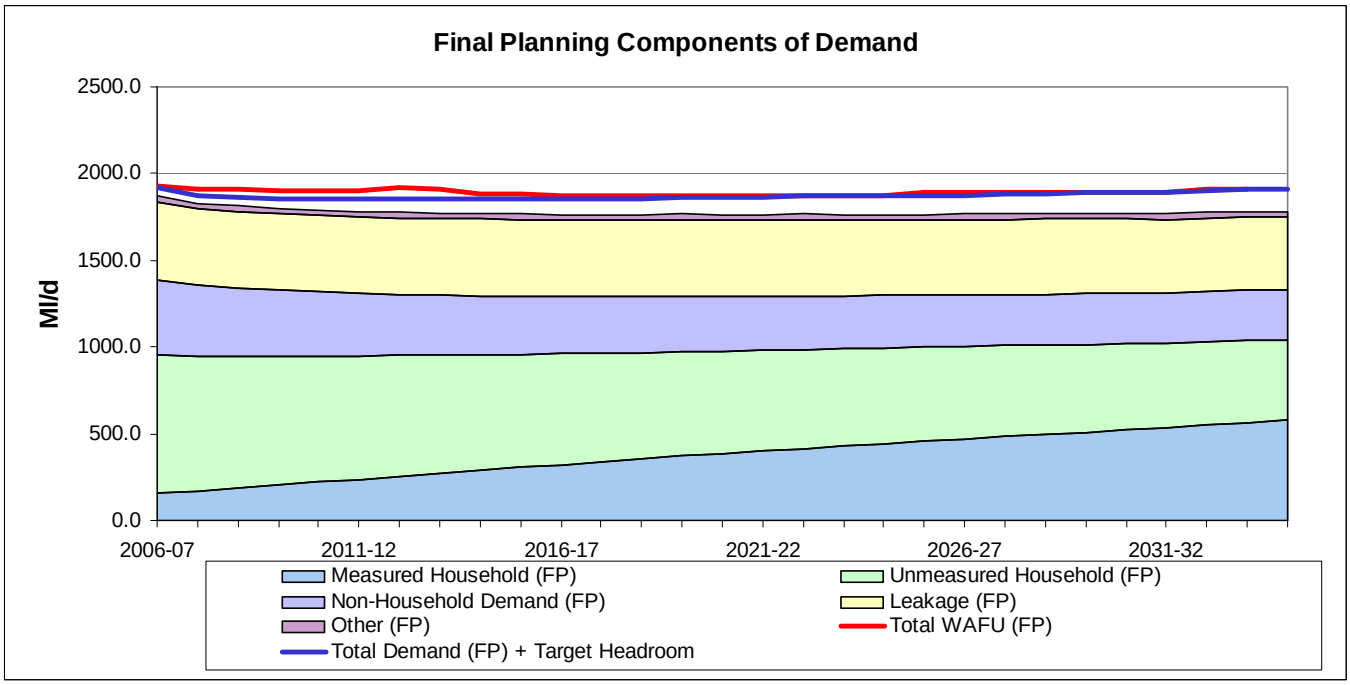


Figure 4.12 Final Planning (Company Strategy) Supply-demand Balance (Integrated zone)



4.5.5 Dee Valley Water - Water Supply Situation

In the Chester and Wrexham zones, the River Dee is the principal source of water, providing 85 per cent of supply to the area. The major drinking water abstractions are taken from the middle section of the River Dee[12]. Additional resources are available from upland reservoir sources and a spring (Wrexham zone), and a borehole (Chester zone). Dee Valley Water also has three permanent bulk imports (two from Dŵr Cymru Welsh Water and one from Severn Trent Water) and one bulk export (United Utilities). These are relatively small in size (less than 0.05Mld) and the Company assumes that these will not change.

As with the Integrated zone, there are competing demands for water from Dee Valley Water, outside of the study area. These include demand for public water supply from towns such as Wrexham, plus a non-potable demand from the Wrexham Industrial Estate. Dee Valley Water has been informed by the Environment Agency that the Company's licensed abstractions are unlikely to be affected by any sustainability reductions and hence no reductions have been allowed for in this Plan.

In its draft WRMP Dee Valley Water forecasts a surplus in both the Chester and Wrexham zones. This is illustrated in Figure 4.13 and Figure 4.14. In light of this the Company has not included options to resolve a supply/demand deficit.

[12] Dee RBMP, page 43

Figure 4.13 Baseline Supply-demand Balance (Dee Valley Water – Chester Water Resource Zone)

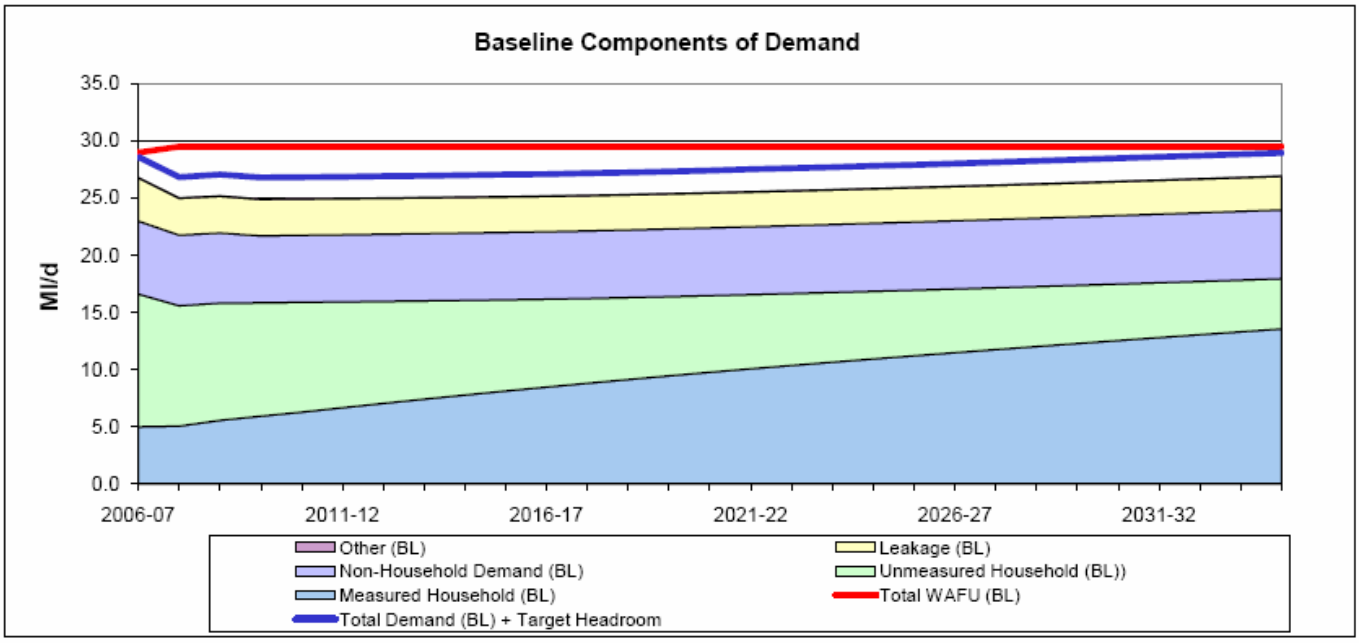
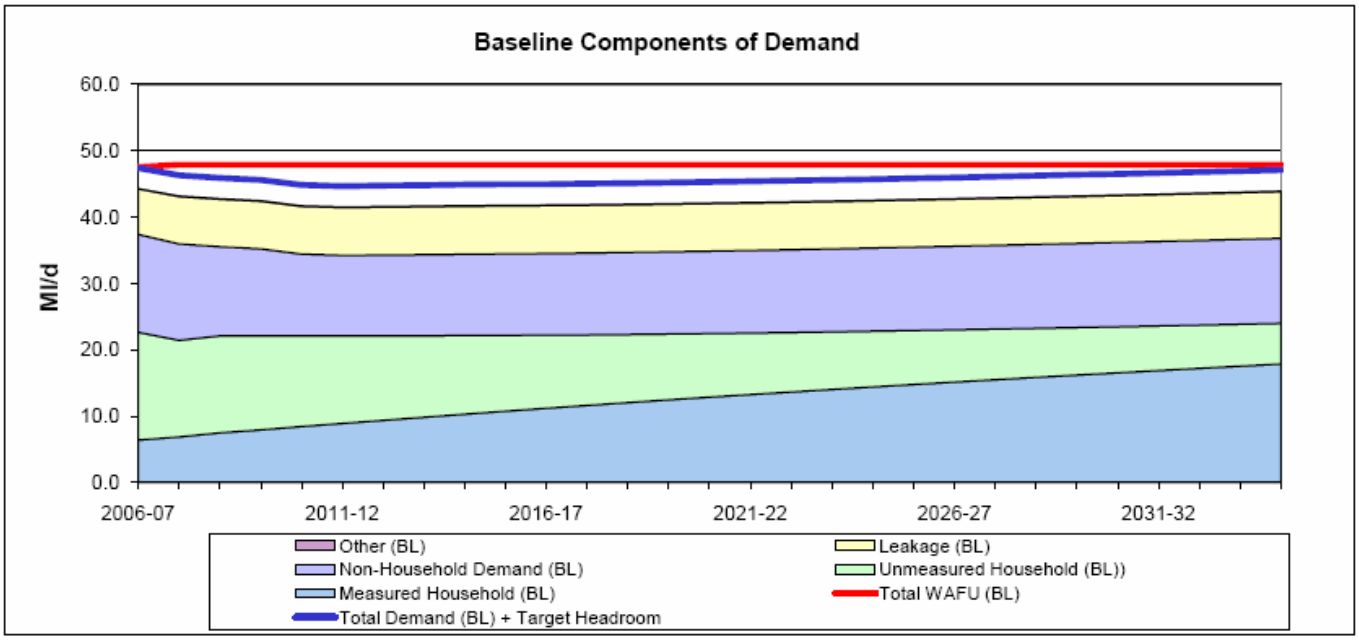


Figure 4.14 Baseline Supply-demand Balance (Dee Valley Water – Wrexham Water Resource Zone)



Despite the Environment Agency classifying the area as low water stress, many of the CAMS in the North West are assessed as being over licensed or over abstracted at periods of low flows. United Utilities is required to make reductions in its supply side capability to meet environmental objectives, whilst other factors such as the impacts of

climate change are likely to place further pressure on the supply demand balance. Conserving water through water efficiency measures will be fundamental to manage the demand from new and existing homes, to ensure public water supply is secure, and to protect the environment.

4.5.6 Groundwater Protection

Groundwater in the Dee River Basin District is an important source of drinking water (Environment Agency, 2009c). Surface activities that might cause pollution can put groundwater sources at risk. The closer the activity is to the source, the greater the risk. Groundwater sources in the West Cheshire area have been identified by the Environment Agency and assessed within one of the following source protection categories:

- Inner Zone: Pollution in this zone can travel to the groundwater source (above or below the water table) within 50 days. This zone also has a minimum 50 metre protection radius around the source;
- Outer Zone: Pollution can take up to 400 days to travel to the groundwater source in this zone. The Environment Agency considers 400 days to be the minimum required to dilute pollutants before reaching the borehole;
- Total Catchment: activities within the total catchment can affect abstraction or discharge from the groundwater source; and
- Zone of Special Interest: This is usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment area (Environment Agency, 2009c).

The Regional scoping study has identified five sub-catchments in the West Cheshire study area containing Source Protection Zones (SPZs) and the majority of these are in the Weaver Gowy catchment. According to this there are no ‘Inner Protection Zones’, or ‘Zones of Special Interest’ in the area. Figure 4.15 shows the SPZs across the study area. Development will need to ensure there is no potential pollution to SPZs.

330000 340000 350000 360000 370000

380000 370000 360000 350000 340000

N

Ellesmere Port

Chester

Wrexham

Winsford

Key

CWaC area

Buffer zone

Water Company Supply Areas

DVW Wrexham zone

DVW Chester zone

UU Integrated zone

Source Protection Zone

Zone 1

Zone 2

Zone 3

Preferred development areas

UU = United Utilities
DVW = Dee Valley Water

0 2 4 6 8

Kilometers

Scale: 1:215,000 @ A3

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Cheshire West and Chester
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Figure 4.15
Groundwater source protection zones

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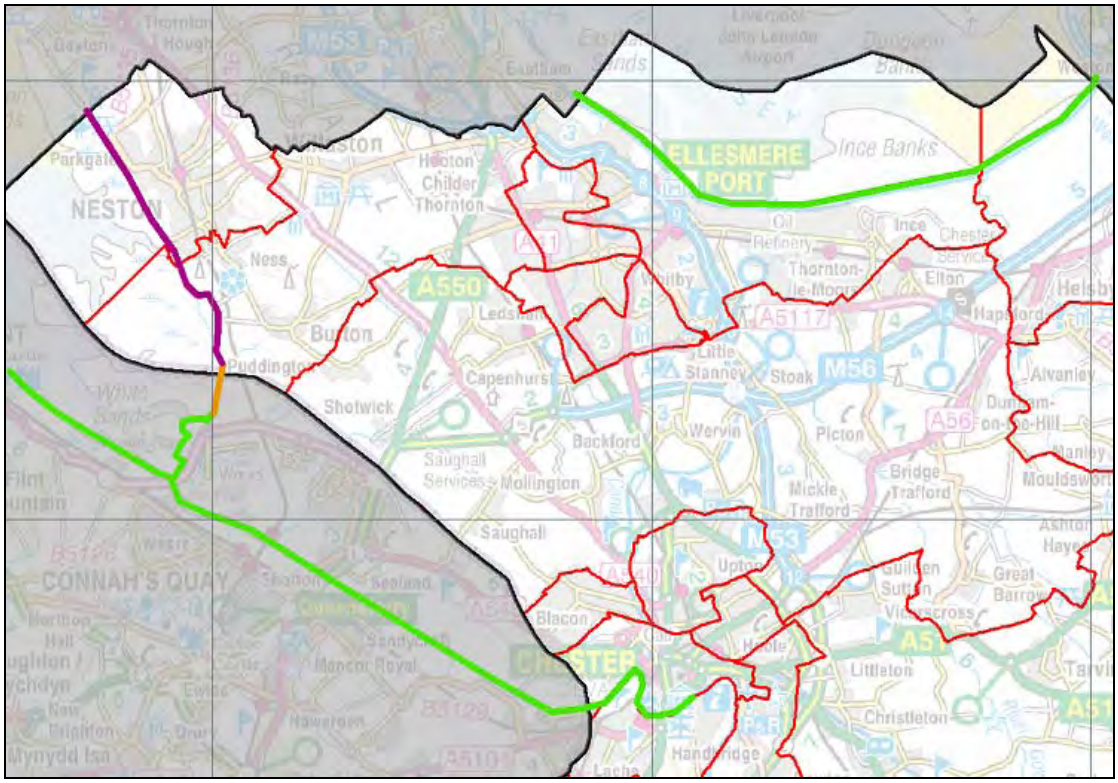
Entec

4.5.7 The Coastal Environment

The draft North West England and Wales Shoreline Management Plan (SMP) addresses the future management of the region's coastline. With regards to the Mersey Estuary within Cheshire West and Chester, the strategy for the next 100 years is to 'Hold the Line'. With regards to the River Dee the strategy proposes Holding the Line for the next 100 years between Flint Marsh and Sealand Rifle Range (including the Dee as far inline as Chester Weir). With regards to the coastal frontage at Sealand Rifle Range the strategy is only to 'Hold the Line' for the next 20 years, moving to managed realignment in the longer term. For the coastline north of here the strategy is 'No Active Intervention' over the next 100 years. Figure 4.16 shows the distribution of these policies along the CWaC coastline. Table 4.8 details the policies and justifications for each reach in more detail.

Figure 4.16 Cheshire West and Chester Coastline - Shoreline Management Plan Policies



Green = Hold the Line for the next 100 years, Orange = hold the Line for 20 years then managed realignment, Purple = No Active Intervention.

Table 4.8 SMP Policies and Justification (Text from Draft SMP Document)

Coastline Section	Policy and Justification
Dee – SMP PU 11a 5.3 Flint Marsh to Chester Weir to Sealand Rifle Range (Inner Dee estuary, both banks)	0 to 100 years – Hold the Line: "*Manage flood risk by maintaining existing defences to an adequate standard. Possible localised Managed Realignment for flood storage or habitat creation- by constructing secondary set-back embankment, depending on outcome of further studies."* Manages flood and erosion risk to the railway, roads, industry and associated infrastructure and other assets in the flood zone such as cycle routes and footpaths. Policy helps maintains a navigable channel in the inner Dee Estuary. It should be noted that tidal flood risks extend further inland than the SMP boundary at Chester Weir. This will be exacerbated with sea level rise. Manages risk to industrial assets and landfill but potential squeeze of internationally designated intertidal habitat. Realignment / habitat creation may impact on channel morphology down estuary, increasing cost of defence and compromising navigation so would need appropriate consideration. The policies are economically viable due to the high value of the railway, infrastructure, gas terminal, and commercial and industrial properties in the flood risk area.
Dee – SMP PU 11a 5.4 Sealand Rifle Range to Burton Point	0 to 20 years –Hold the Line: *"To manage flood risk by maintaining existing defences to an adequate standard. Investigate opportunities to set"* 20 to 100 years - Managed Realignment: *"By constructing set-back embankment or phased retreat to higher land, depending on outcome of further studies."* Manages flood risk to the rifle range in the short term. Phased approach to realignment could defer loss of the rifle range to longer term. Investigate opportunities to set back defences to create space for estuary roll back and potential future habitat creation. Manages risk to the promontory fort Scheduled Monument at Burton Point in the short-term. The proposed policy is economically viable, although potential losses to rifle ranges and Scheduled Monument could increase economic justification, depending on choice of alignment.
Dee – SMP PU 11a 5.5 Burton Point to Thurstaston Cliffs	0 to 100 years - No Active Intervention – *"Allow natural erosion of cliffs, however, permit maintenance of existing private defences as long as they have no adverse affects on sediment movement / coastal processes and subject to gaining the necessary consents."* Maintenance of private defences in front of properties would be permissible as long as there are no adverse effects on sediment movement / coastal processes. Allows natural processes to continue, but results in the potential loss of golf club land at Wirral country park. Insufficient economic justification for new shoreline defences to whole unit, but further investigation of local sections recommended as part of the strategy development.
Mersey – SMP PU 11a 7.3 Eastham Ferry to Runcorn Bridge (south bank)	0 to 100 years - Hold the Line: *"Manage flood and erosion risk by maintaining existing defences to an adequate standard."* Maintains integrity of Ellesmere Port, Runcorn other conurbations, the Manchester Ship Canal, industry, docks, ports and infrastructure. Manages risks of pollution from erosion or flooding of historical landfills and industrial sites, but potential for damage to internationally designated sites in long term that needs to be offset elsewhere in the SMP2. Policy is likely to be economically viable, provided justification takes account of knock-on benefits from flood defence function of the Manchester Ship Canal, which lies between the estuary and a large flood risk area at Stanlow and Ince Marshes, protecting the industrialised hinterland and avoiding potential contamination.
SMP = Shoreline Management Plan, PU = Policy Unit	

4.6 Summary of the Existing Environmental Situation

There are a large number of sites of national importance (SSSIs) and a smaller number of sites that are important at a European (SPA and SAC) and global (Ramsar) level in an around the study area. The Dee and Mersey estuaries are exceptional in their fauna and flora and are vulnerable to changes in water quality and water flow that could negatively impact on the habitats (e.g. saltmarsh and mudflats) and the species they support. Water quality in the River Dee, Gowy, and Weaver could have a direct impact on these sites.

Flooding and drainage is a serious risk across the whole CWaC area, affecting both rural and urban areas. The SFRA has concluded that the main areas of concern are Chester's Sealand Basin, the Stanlow industrial complex and Northwich. The coastal areas (on the rim of the estuary) are at risk from both fluvial and tidal flooding.

Pluvial flooding, from rainfall runoff is a problem, and is exacerbated when drains are blocked either with surface debris, or sewerage flows. The problem of sewer flooding is present throughout the study area. Development anywhere in the study area will need to consider flood risk and mitigation measures.

Water quality across the area is generally poor, due to current and historical effluent/trade discharges, and diffuse pollution. There are ambitious targets to increase water quality in rivers to meet WFD objectives but it has been recognised that the objectives will not be met by 2015 due to the disproportionate costs and unfeasible technology that would be required. Instead targets to meet WFD objectives have been set for 2027. This means that wastewater discharges are likely to be controlled and monitored rigorously by the Environment Agency and applications for discharge consents that are contrary to the WFD targets are unlikely to be granted. To accommodate future development some of the smaller treatment works near Ellesmere Port, and in Neston may require revisions to their discharge consents, although in many cases the preference may not be to develop small works but instead develop network solutions to transfer effluent to larger WwTW. This decision ultimately is the responsibility of United Utilities and that decision must be informed well in advance of planning and development by the Councils' housing plans. United Utilities needs to understand what growth is planned in each area and when. It is recommended that the Councils' increase dialogue with each other and the water companies to map out their development proposals. The housing plans are subject to change but this should not preclude these discussions. There will come a point when the water companies have to commit their expenditure on wastewater treatment. Whilst the treatment strategy should be informed by the housing proposals, once committed the housing plans should consider any updates or alternative plans within this context. Catchment wide actions are also planned to reduce the impact of land management practices on water quality.

Water resources are less of an issue to the study area but the very fine balance between supply and forecast demand in the Integrated water resource zone confirms that water supply cannot be taken for granted and planners must not be complacent in considering the impact on demand of additional growth. Rainfall in the region is slightly higher than the national average but the large population and high individual demands, combined with other non-household demands for water, mean that in some areas abstraction is damaging habitats and so resources must be managed differently. Water supply infrastructure within the study area enables water resources to be operated in a

fully integrated manner. However, poor connectivity to existing infrastructure may require enhancements to enable development to proceed.

There is groundwater beneath the CWaC area and protection zones have been designated in the central part of the study area, within the Gowy catchment. If development is planned in the areas that have been highlighted then measures will be required to ensure that surface activity does not contaminate the groundwater. This could be an important consideration if sustainable drainage systems (particularly infiltration systems) are to be incorporated into new developments.

5. Climate Change

5.1 Background

Climate change is likely to have major direct impacts on the water cycle as a result of changes in rainfall patterns, temperature and evaporation. Furthermore, climate change will affect patterns of water usage and have wider impacts on land use. Current climate change modelling broadly indicates that there will be wetter warmer winters and drier hotter summers and that some of these impacts will become evident within the timescale of the revised RSS up to 2021. Climate change has also been identified as a key issue in the North West Regional Spatial Plan and the National WCS guidance.

In particular, climate change may have the following impacts:

- Reduction of water resources availability due to reduced annual rainfall and increased temperature - increased evapo-transpiration may reduce aquifer recharge;
- Increased intensity and frequency of storms. This is likely to increase the intensity and frequency of fluvial flooding and urban drainage related flood events;
- Changes to water usage particularly in relation to irrigation of gardens and parkland using potable water. The benefits of rainwater harvesting and storage will also be affected. Demand for summer irrigation water for agriculture is also likely to increase;
- Changes in water table levels may also affect infiltration and leakage of water from the sewerage system;
- Reduced summer rainfall will result in lower river flows which would reduce dilution of wastewater discharges. Compliance with environmental quality standards is, in some cases, based on 90 percentile values which tend to occur during the summer period; reduced river flows may have a magnified impact on compliance; and
- Stress on wetlands. Consequently, these systems are likely to become less resilient to other perturbations such as impacts of abstractions and discharges.

The potential impacts outlined above change the context in which impacts of housing growth on the water cycle occur and should therefore be considered as part of the WCS process.

5.2 Climate Change Modelling and UKCP09

Assessment of climate change impacts is based on global climate models which include a representation of land, air, ocean, ice, hydrological cycle and the carbon cycle. Detailed scenarios for the UK are generated using a regional climate model. This is a high resolution model which is part of the full global climate model. This model

produces the output that forms the basis of the climate change predictions produced by the UK Climate Programme (UKCP). The climate range models have been run for a range of scenarios to account for uncertainty regarding future carbon emissions.

The first set of scenarios was produced in 1998 and is known as UKCIP98. These were superseded in 2002 by UKCIP02, which are still used in some guidance documents, such as PPS25 and in water company plans. Recently, in June 2009 new output has been released, known as United Kingdom Climate Projections 2009 (UKCP09). The latest output uses the same climate change models but in contrast to previous output, probabilistic output has also been produced based on a range of model set ups and referencing output from other climate change models. The output is also at a higher resolution than previous UK scenarios, with data being available at a 25km resolution. This provides much greater spatial detail but also means that topographic features, such as air flow over hills and descriptions of catchments, should be more accurate.

For the first time, daily and sub-daily data will be available from a weather generator. This is a tool which provides information on future climate which is statistically consistent with the probabilistic climate projections.

5.3 Climate Change and the Study Area

Figure 5.1 to Figure 5.3 show predicted changes in average annual temperature, summer precipitation and winter precipitation for the Medium Emissions scenario.

The key findings for North West England in the 2050s under the medium emissions scenario are listed below and are taken from the UKCP09 Climate Change Projections report[13]:

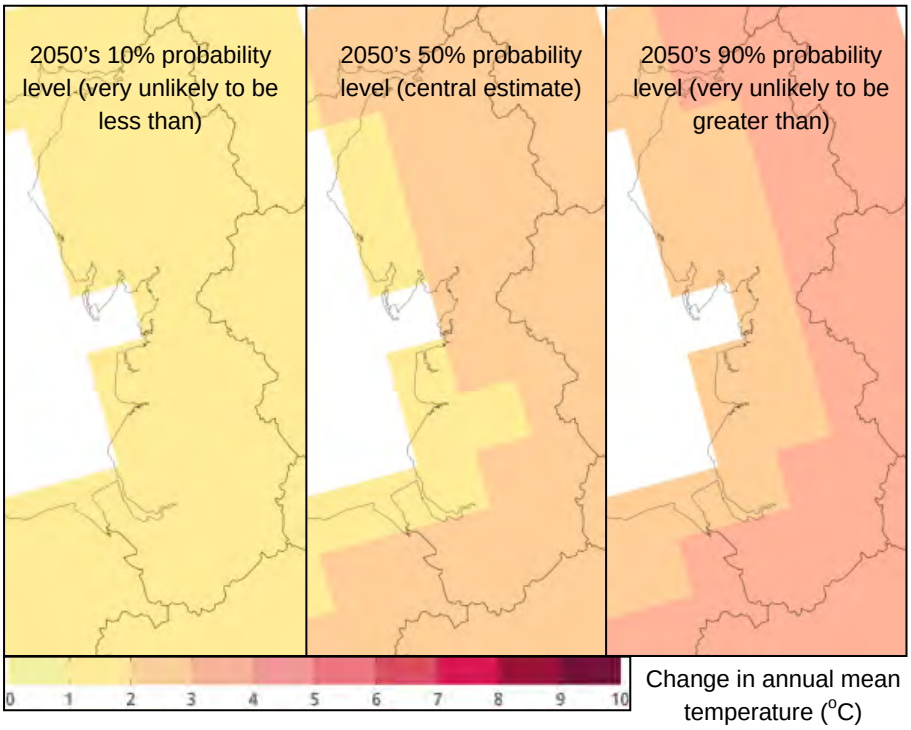
- The central estimate of increase in winter mean temperature is 2.0ºC; it is very unlikely to be less than 1.0ºC and is very unlikely to be more than 3.0ºC;
- The central estimate of increase in summer mean temperature is 2.6ºC; it is very unlikely to be less than 1.2ºC and is very unlikely to be more than 4.1ºC;
- The central estimate of change in winter mean precipitation is 13 per cent it is very unlikely to be less than 3 per cent and is very unlikely to be more than 26 per cent; and
- The central estimate of change in summer mean precipitation is –17 per cent it is very unlikely to be less than –34 per cent and is very unlikely to be more than 1 per cent.

The rainfall patterns in the study area and high percentage of surface water resources are likely to be particularly vulnerable to climate change impacts in the immediate term. Furthermore, agricultural demand for water will be increased as temperature rises in addition to reduced summer rainfall; this is likely to affect some rural parts of the

[13] Murphy, J.M., Sexton, D.M.H., Jenkins, G.J., Boorman, P.M., Booth, B.B.B., Brown, C.C., Clark, R.T., Collins, M., Harris, G.R., Kendon, E.J., Betts, R.A., Brown, S.J., Howard, T. P., Humphrey, K. A., McCarthy, M. P., McDonald, R. E., Stephens, A., Wallace, C., Warren, R., Wilby, R., Wood, R. A. (2009), *UK Climate Projections Science Report: Climate change projections*. Met Office Hadley Centre, Exeter.

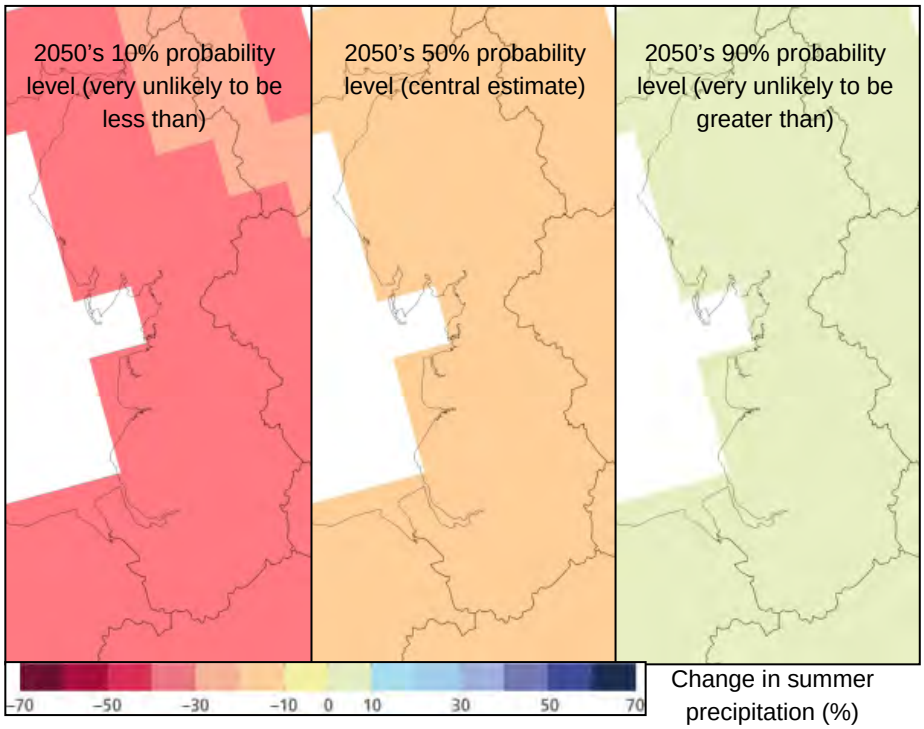
study area, particularly where restrictions to the supply of water exist to protect low flows. Increased winter rainfall and more intense summer storms will increase flood risk. The climate change flood zones presented in the SFRAs should be considered to take account of future risks.

Figure 5.1 Change in Annual Average Daily Temperature for the 2050's under the Medium Emissions Scenario (UKCP09)



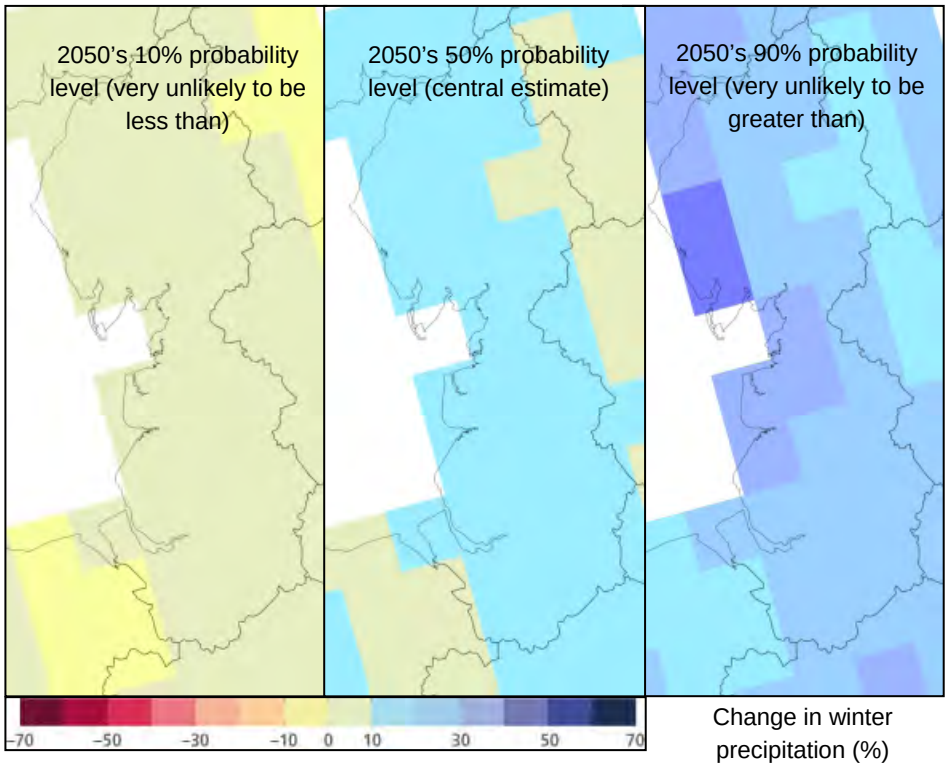
Source http://ukclimateprojections.defra.gov.uk/content/view/1154/543/

Figure 5.2 Change in Summer Mean Precipitation for the 2050's under the Medium Emissions Scenario (UKCP09)



Source http://ukclimateprojections.defra.gov.uk/content/view/1154/543/

Figure 5.3 Change in Winter Mean Precipitation for the 2050's under the Medium Emissions Scenario (UKCP09)



Source http://ukclimateprojections.defra.gov.uk/content/view/1154/543/

5.4 Climate Change and Flood Risk

The predicted climate change induced rises in sea level and increases in the intensity and duration of rainfall events will lead to an increase in flood risk. Guidance for the assessment of these impacts in England is included in table B.1 and B.2 of the current version of PPS25 (as revised in March 2010). This provides guidance on how to make allowances for climate change impacts in the application of the recommended methodologies to assess flood risk. Specifically these tables provide precautionary sensitivity guidance on allowances for increases in:

- sea level (1990 to 2025: 2.5mm pa; 2025 to 2055: 7.0mm pa; 2055 to 2085: 10.0mm pa; 2085 to 2115: 13.0mm pa);
- rainfall intensity (design lifetime up to 2085: +20%; up to 2115: +30%); and
- peak river flow (all design lifetimes up to 2115: +20%).

When including for the potential impact of climate change, developers should ensure that the most up to date planning guidance on climate change factors is utilised in their assessments. These changes should be applied over the appropriate lifetimes for development (typically 100 years for residential and 60 years for commercial/industrial

development). PPS25 advocates that the analysis is incorporated into Strategic Flood Risk Assessments. A recent review of the UKCIP09 climate change impacts has been undertaken by the Environment Agency, and they have recommended that the climate change allowances within PPS25, based on the UKCIP02 climate change projections, should still be used for assessing flood risks.

With regards to climate change the West Cheshire SFRAs have used available climate change data, mainly prepared as part of the Catchment Flood Management Plans (CFMPs) for the River Dee and Rivers Weaver and Gowy. For the River Dee at Chester recommendations have been made for improvements to flood defences where the current Standard of Protection may reduce in future due to climate change. The SFRA prepared for the former Vale Royal district contains details of the River Weaver/Gowy CFMP climate change assessment, including predictions of increases in the number of properties at risk and increases in annual average damages from flooding. The AFRA (Area Flood Risk Assessments) prepared for Winsford and Northwich use more detailed hydraulic modelling data to assess the risk of flooding at these locations in more detail. The Northwich AFRA has identified potential increased risks of flooding in future as flows increase due to climate change, however the Winsford SFRA has identified that the key development sites will remain free from flood risk.

6. Potential Constraints to Development

This chapter uses all the available information to assess at a high level the capacity of the environment (in terms of water quality of rivers draining the study area and the underlying groundwater) to receive (potentially increased) effluent loads without detrimental effects, Water Framework Directive (WFD) failures or breach of other regulations and to supply additional demand for public water abstraction. The potential capacity of existing wastewater infrastructure, owned and operated by Dŵr Cymru Welsh Water and United Utilities, to accommodate the proposed growth in terms of both the sewerage network and wastewater treatment assets is also included at a strategic scale. No detailed analyses have been undertaken.

6.1 Constraints to Development

The constraints for development are presented below in a traffic light context, for each topic area. The key for the traffic light system is as follows:

	Development ok, no constraints identified
	Development may be ok, minor constraints identified, minor mitigation required to meet planned trajectory
	Constraints identified, development may be ok with major mitigation to meet growth targets against Core Strategy timescale
	Development should not proceed due to major constraint

The assessment of water cycle constraints is focussed on the four development areas of Chester, Ellesmere Port, Winsford and Northwich as these areas will be the main growth centres of the District and therefore most likely to potentially impact on either the environment or infrastructure.

6.2 Environmental Constraints

6.2.1 Water Quality

An overview of the water quality in the rivers across the study area is provided in section 4.3. This illustrates the current status of the receiving waters and the pressures acting upon them. WFD objectives are also presented along with specific measures that will be used to achieve them. Section 4.3.4 also highlights that current phosphorous levels in rivers across the study area already exceed the WFD standards. However, due to the sparse nature of summary data examined and the sampling frequency of the monitoring on which this summary data is derived, it is not clear whether this is caused primarily by WwTW discharges.

The extent to which this could constrain growth depends on site specific issues relating to particular river reaches, the quality of existing wastewater discharges and the ability to improve existing treatment facilities (discussed in section 4.3.2). The WFD requires that there is 'no deterioration' in water quality. This means that rivers that are currently achieving 'Good Status' do not necessarily provide a 'green light' for growth if this would lead to deterioration in status. Conversely, rivers that are currently failing to achieve Good Status do not necessarily provide a constraint to growth provided that additional wastewater from development would not lead to further deterioration.

The high levels of phosphates and nitrates illustrate the limited environmental capacity of most receiving waters to receive any additional pollution load. Treatment capacity of the WwTWs has not been assessed in this study and the impact of growth on discharge quality therefore cannot be determined. Detailed water quality modelling would be required to confirm this. However, the Environment Agency will continue to monitor and set the discharge limits from WwTWs with regard to quality, to ensure that water quality does not deteriorate further. If required, stricter discharge consents could impact on the amount of investment required by United Utilities and DCWW to update treatment works. Investigating the impacts and potential mitigation measures would fall under the remit of a Detailed Water Cycle Study.

Through the River Basin Planning process the Environment Agency will work with all stakeholders and co-delivery partners, including the water companies to ensure catchment and water quality planning achieves a sustainable balance between meeting our needs in terms of water supply and wastewater treatment and those of water environment (i.e. dependant flora and fauna). In treating wastewater to meet ever tighter standards the wider sustainability implications should also be considered, in terms of additional carbon, energy and the use of raw materials, and balanced against the ecological benefits in the receiving water.

The extent to which water quality may constrain growth in the study area is summarised in Table 6.1. It is important to recognise that this is based on the limited information that has been made available to this study and that further investigations including water quality modelling are recommended as part of a detailed water cycle study.

Table 6.1 Water Quality Constraints

Development area	Water Quality Constraints
Chester Ellesmere Port Winsford Northwich Remainder of study area	Water quality throughout the study area is currently failing the WFD standards at many locations. This is particularly the case for phosphorus and ammonia, where the standard is exceeded extensively. Nitrate levels are also high in much of the study area. This does not necessarily form a constraint to development in any of these areas, provided that 'no deterioration' in water quality will result from wastewater treatment. However, **upgrades to meet tighter consent conditions to meet WFD or other EU or National statutory requirements could influence the phasing of development.**
	Constraints identified, development may be ok with major mitigation to meet growth targets against Core Strategy timescale

6.2.2 Groundwater

Section 4.5.6 has set out the location of groundwater protection zones across the study area. Where these exist, mitigation measures are needed to prevent development activities from polluting the groundwater. Some types of development may be prohibited depending on their proximity to the various protection zones, e.g. a petrol station should not be built within an Inner Protection Zone due to the significant risk of contamination direct into the groundwater. Elsewhere mitigation measures, such as ground filters, may be required to prevent spillages from travelling to the groundwater.

Table 6.2 lists the towns in the study area that are within the protection zones and highlights where the Councils' preferred development sites overlap.

Table 6.2 Groundwater Protection Zone Constraints

Development Area	Groundwater Protection Zone Constraints
Chester	None of the proposed development sites are within a groundwater protection zone. Any alternative locations proposed in the Guilden Sutton area, or north of Littleton would be within at least a protection zone 3.
Ellesmere Port	Most of the proposed development in Ellesmere Port is not located near groundwater protection zones. However, the proposed retirement village in Helsby is on the edge of a protection zone 1. Operational activity at this site is unlikely to be constrained but construction processes will need to take this into account. The development at the Former waterworks in Neston is directly above a protection zone 1 and 2. Mitigation measures will be required here, depending on the type of development.
Winsford	No protection zones in this area.
Northwich	No protection zones in this area.
Remainder of study area	No developments are planned within protection zones. Any alternative locations must consider the presence of protection zones in the Delamere/Tarporley area, and the Broxton/Burwardsley area
	Development ok, no constraints identified
	Development may be ok, minor constraints identified, minor mitigation required to meet planned trajectory

The risk of developing within a source protection zone is only present in rural areas as there are no protection zones within the main towns of Chester, Ellesmere Port, Northwich, and Winsford. If a developer wishes to develop sites within a source protection zone they must demonstrate that there will be no risk to the source during construction or post-construction stages. Developments in these zones will be subject to consultation with the Environment Agency, which will require evidence that the proposals will not put the source at risk. Developments within 'Inner Protection Zones' will be subject to the most rigorous scrutiny: certain types of development will be restricted, and significant mitigation measures are likely to be required. Outside of the inner zones development proposals will also be examined in detail but the restrictions and mitigation requirements will be less stringent. The level of protection may affect developers' land use and construction plans. Potential risks to groundwater can arise from; laying foundations; construction traffic and associated runoff; land use management such as pesticide use in gardens public spaces etc; and the release of hydrocarbons from subterranean fuel storage, discharges into open

drains and urban flooding, etc. The use of infiltration drainage as part of SuDS systems is also likely to be restricted by the presence of a source protection zone.

In most cases the use of SuDS techniques is beneficially to water quality. This is because infiltration helps to slow down and prevent the transfer of contaminants from land into water courses. However, directly above a groundwater source, SuDS need to be carefully managed to prevent *in-situ* contamination through infiltration. Groundwater can be protected by lining subterranean storage facilities, installing filter drains, petrol interceptors (petrol stations not applicable in the most protected zones), and installing a series of drainage elements such as filter drains, swales, and reed beds. The key point is that a drainage system must be designed taking into account the characteristics of the specific site. Detailed guidance is available on SuDS techniques from the CIRIA website (http://www.ciria.org.uk/suds).

6.2.3 Flood Risk

The study area comprises significant areas, identified in the main growth centres, that are in the lower flood risk zones (see section 4.2) and these should be used in preference for new development wherever possible. The effect of climate change, such as increases in the extent of the flood zones, should also be taken into consideration when making planning decisions to understand the flood risk throughout the development lifetime. CWaC has investigated flood risk across the authority area, both at the strategic scale (SFRA), and supplemented by the two AFRAs prepared for the key development areas in Northwich and Winsford. These documents provide the necessary investigation of flood risk in order to apply the Sequential and Exception Tests, for development options across the study area. A further site-specific flood risk assessment would need to be submitted with any planning applications in these areas, and should build on the findings of the SFRA and AFRAs as well as consultation with CWaC and the Environment Agency.

The extent of flood risk constraint to development is shown in Figure 4.3 for the study area. These maps show the extent of Flood Zones 1 to 3 in relation to Ward boundaries. The findings of this assessment are also summarised in Table 6.3.

Table 6.3 Flooding Constraints

Ward	Details of Flood Risk Constraints			
	Tidal	**Fluvial**	**Surface Water**	**Overall**
Abbey	N/A	River Weaver and River Dane	Dispersed areas and river valleys	Limited Development in areas at risk
Blacon	Adjacent to (but set above) tidal River Dee flood zones.	River Dee to south and west, Finchett's gutter to the east. Low lying area at Abbot's Mead.	Potential areas at low points in the east of the ward.	Limited Development in areas at risk

Ward	Details of Flood Risk Constraints			
	Tidal	**Fluvial**	**Surface Water**	**Overall**
Boughton Heath and Vicars Cross	Areas immediately adjacent to River Dee	Rivers Dee, Alyn and Aldford Brook	Potential areas along river valleys and upstream of road/railway embankments in the area.	Limited Development in areas at risk
Broxton	N/A	River Dee and upper Aldford Brook	Isolated areas, otherwise along River Valleys	Limited Development in areas at risk
Central and Westminster	Large areas of tidal flooding around Thornton, Stanlow and Ince	Large areas of fluvial flooding around Thornton, Stanlow and Ince	Isolated areas mainly within areas at risk of tidal/fluvial flooding	Main Development sites are outside of flood zones
(Chester) City	River Dee – especially at the Sealand basin area	River Dee – especially at the Sealand basin area	Within the Sealand basin area and potentially east of Chester city centre adjacent to railway lines (Flookersbrook).	City centre broadly OK. Away from city centre (Sealand Basin) significant development is proposed in areas at significant risk of flooding
Eddisbury	N/A	Limited areas along minor river valleys	Isolated areas across the ward	Limited Development in areas at risk
Frodsham and Helsby	Tidal areas of the River Weaver and Hornsmill Brook	River Weaver and Hornsmill Brook	Potentially low lying areas along the M56 and A56	Limited Development in areas at risk
Gowy	N/A	Along River Gowy and tributaries	Only along main river valleys	Limited development in areas at risk
Grange and Rossmore	N/A	Along the Rivacre Brook	Along the Rivacre Brook	Limited development in areas at risk
Groves and Whitby	N/A	N/A	Limited	Limited development in areas at risk
Hoole and Newton	N/A	N/A	Potentially area to west adjacent to railway lines (Flookersbrook).	Limited development in areas at risk Adjacent to railway lines potential surface water issue
Ledsham and Willaston	N/A (Tidal Dee area in the west, although this area is saltmarsh within the open estuary).	Shotwick Brook and Dibbinsdale Brook	Areas near the Dee Estuary, and Shotwick/Dibbinsdale Brooks	Limited development in areas at risk
Marbury	N/A	Rivers Dane/Weaver and the Cogsmill/Wade/Wincham Brooks confluence at Northwich	Within river valleys (notable areas along the Arley Brook in the northeast)	Major development proposed within Northwich Elsewhere, limited development in areas at risk

Ward	Details of Flood Risk Constraints			
	Tidal	Fluvial	Surface Water	Overall
Mickle Trafford	Western edge runs parallel to edge of Flood Zone 2 from the Dee Estuary.	Areas adjacent to River Dee/Gowy, Shotwick/Rivacre/Hornsmill Brooks and Finchett's Gutter	Generally along river valleys, notable areas along Gowy and Hornsmill.	Limited development in areas at risk
Neston and Parkgate	Dee estuary – low lying properties along coastal frontage.	Brook through Neston and upper Shotwick Brook	Potential routes along brook in Neston and upper Shotwick Brook	Limited development in areas at risk
Northwich East and Shakerley	N/A	Weaver navigation (River Weaver) and River Dane and tributaries and the Wade/Wincham Brooks	Isolated areas and along river valleys	Major development areas adjacent to Northwich Elsewhere limited development in areas at risk
Northwich West	N/A	Weaver navigation (River Weaver) and River Dane	River valley areas, isolated areas across the ward with a slight concentration of potential areas around Winnington	Major development areas adjacent to Northwich Elsewhere limited development in areas at risk
Overleigh	River Dee	River Dee	Area on Dee floodplain at Handbridge to the east, and adjacent to railway line in the west.	Limited development in areas at risk
Sutton and Manor	N/A	Upper Rivacre Brook	Isolated areas across the ward/along Rivacre Brook	Limited development in areas at risk
Upton	N/A	Finchett's Gutter to west	Along Finchett's Gutter/Bache Brook and adjacent to railway line	Limited development in areas at risk
Weaver	Lower Weaver Navigation	Weaver Navigation/Hornsmill Brook	Mainly along river valleys	Limited development in areas at risk
Winsford North and East	N/A	River Weaver/Weaver Navigation	Mainly along river valleys. Potential issues at Wharton.	Potential issues at Winsford waterside redevelopment Elsewhere, limited development in areas at risk
Winsford South and West	N/A	River Weaver/Weaver Navigation * Chesterlane/Ash Brook to west	Mainly along river valleys.	Potential issues at Winsford waterside redevelopment Elsewhere, limited development in areas at risk

Ward	Details of Flood Risk Constraints			
	Tidal	Fluvial	Surface Water	Overall

Development ok, no constraints identified

Development may be ok, minor constraints identified, minor mitigation required to meet planned trajectory

Constraints identified, development may be ok with major mitigation to meet growth targets against Core Strategy timescale

Detailed information on groundwater flood risk was not available (SFRA states that the study area is generally considered to be at low risk)

The table does not include an assessment of potential risks from drainage systems and culverted watercourses for which insufficient information was available to categorise wards.

For all developments there will be potential flood risk constraints, although in a lot of cases this will be limited to the provision of appropriate surface water management (i.e. SuDS)

Box 12 Summary of Flooding Constraints

The flood zones provided in the Strategic Flood Risk Assessments for the study area should be used in conjunction with the Environment Agency's flood map to review flood risks for individual site allocations.

The main flooding constraint from natural sources is from the River Dee (tidal/fluvial) and tributaries at Chester, the Mersey estuary and tributary watercourses at Stanlow, and the River Weaver/Dane and tributaries at Northwich and Winsford,. In these areas, the Environment Agency is likely to object to residential development unless it is in line with the requirements of PPS25.

6.3 Water Supply Constraints

6.3.1 Demand for Water

Forecast demand is a critical component of the WRMP. United Utilities plans to secure supplies based on projections of population growth and per capita consumption (pcc) and states that the demand forecast has been assessed by taking account of various official regional forecasts including the North West growth point proposals, the RSS up to 2021, the National Housing and Planning Advice Unit growth prediction, and consideration of the economic downturn[14]. Dee Valley Water has also taken account of the growth figures within the North West RSS when developing its demand forecasts. For Wales, the Company liaised with the local authorities to understand their predictions for housing and population growth.

United Utilities' pcc forecast is based on the assumption that water efficiency policies and activities will successfully reduce individuals' demand for water. Dee Valley Water has forecast pcc to remain fairly stable until 2034/35.

[14] United Utilities (2009). Final Water Resources Management Plan, p102

Demand management measures planned by the water companies

United Utilities intends to continue metering all new properties and providing meters free of charge to households that request a meter. In parallel, the company will continue to reduce its own leakage and carry out its baseline water efficiency programme (the promotion of water efficiency to customers). In addition to its baseline activities, United Utilities also plans to distribute free water efficient shower heads and it expects this to save approximately 0.2Ml/d day (200,000 litres per day) across the Integrated zone by 2026/27. Beyond 2030, the company will also carry out more customer visits, fixing leaks and installing meters as requested, saving approximately 500,000 litres per day. The Company's demand forecast also assumes that customers will purchase more water efficient appliances/fixtures (e.g. washing machines) in line with market trends and manufacturing trends, so that the use of less efficient models is gradually phased out.

Sensitivity of demand to growth rate and per capita consumption

Entec has undertaken sensitivity analyses to test the implications of alternative growth scenarios and alternative pcc levels on household demand in the study area. The Council has supplied its projected growth rates (per ward) and these have been applied to the water resource zones. By agreement with the Council an upper and lower projection has been calculated (15% above and below the preferred growth rate respectively).

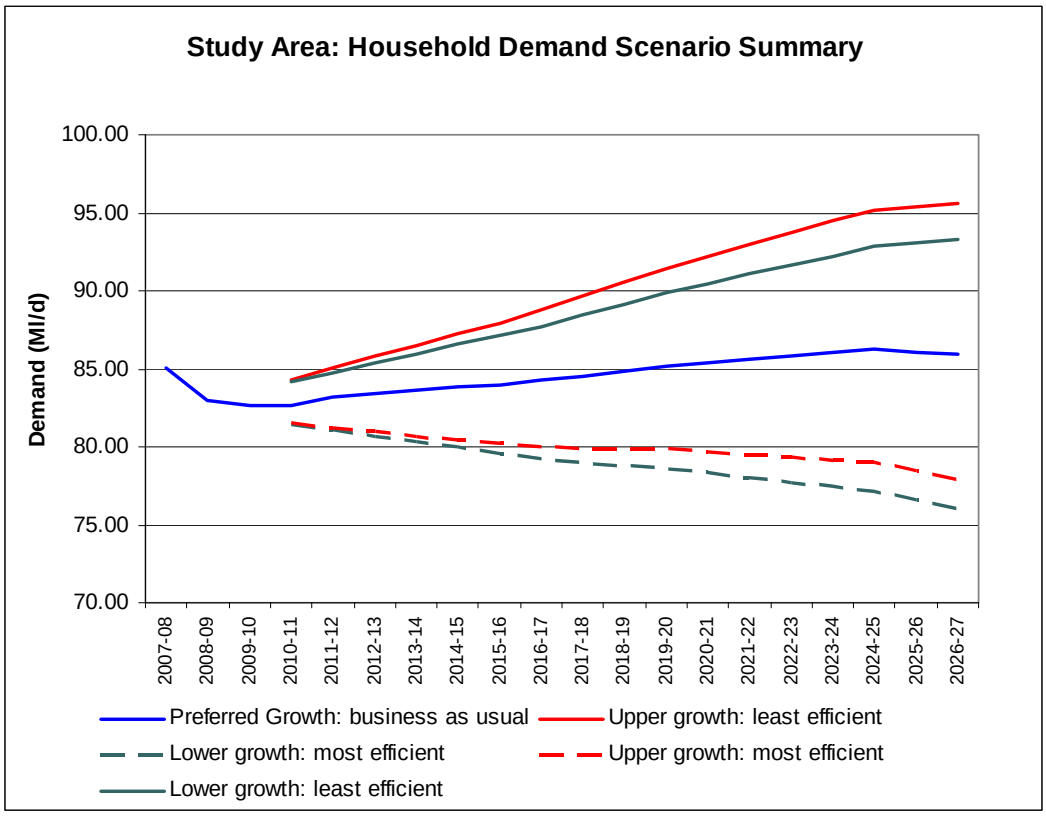
To each of these growth rates, nine alternative demand scenarios has been applied (ranging from business as usual, to very water efficient) based on the expected amount of water used per person. The demand (in litres per head per day) is based on an assumed percentage of new homes meeting various design-based levels of water efficient consumption, and assumptions on the pcc in existing homes. A summary of the scenarios is presented in Table 6.4 below. The demand model assumes that population grows linearly with housing growth, which is unlikely in reality, and so may represent an overestimate of what could be expected.

Table 6.4 Water Efficiency Scenarios used to Examine Sensitivity of Demand to per Capita Consumption

BUSINESS AS USUAL pcc in existing households is as per the water company baseline forecast pcc in forecast households is as per existing measured customers baseline forecast*			
HIGHLY WATER EFFICIENT pcc in existing households is 10% below the water company final planning forecast* Forecast households:			
Scenario 1a.	35% at 80 l/h/d	65% at 105 l/h/d	The most water efficient scenario. All new homes reach Code for Sustainable Homes (CSH) level 4 as a minimum
Scenario 1b.	35% at 105 l/h/d	65% at 120 l/h/d	A third of new homes reach CSH level 4
Scenario 1c.	35% at 125 l/h/d	65% at 130 l/h/d	Demand in new homes misses CSH levels but demand is in line with Defra pcc target.
MODERATELY WATER EFFICIENT pcc in existing households is as per the water company final planning forecast* Forecast households:			
Scenario 2a.	25% at 80 l/h/d	75% at 105 l/h/d	All new homes reach CSH level 4 as a minimum
Scenario 2b.	25% at 105 l/h/d	75% at 120 l/h/d	A quarter of new homes reach CSH level 4
Scenario 2c.	25% at 125 l/h/d Represents water company and Defra policy forecasts	75% at 130 l/h/d	Demand in new homes misses CSH levels but demand is in line with Defra pcc target.
LEAST WATER EFFICIENT pcc in existing households is 10% above the water company final planning forecast* Forecast households:			
Scenario 3a.	45% at 105 l/h/d	55% at 120 l/h/d	Over half of new homes reach CSH level 1
Scenario 3b.	3b. 45% at 120 l/h/d	55% at 125 l/h/d	Less than half of new homes reach CSH level 1
Scenario 3c.	3c. 45% at 130 l/h/d	55% at 150 l/h/d	pcc in new homes is significantly higher than CSH levels, and Defra target
l/h/d = litres per head per day			

Figure 6.1 illustrates a summary of the results. By applying the Company pcc forecasts and occupancy rates to the existing housing stock, and Council preferred growth (27,000 new homes between 2010/11 and 2027/28), household demand in the study area is expected to increase from 83Ml/d to approximately 86Ml/d. This is derived by multiplying how much water is forecast to be used per person, by the average number of people per household based on the annual growth rate allocated to each water resource zone. This calculation has been performed by Entec, specific to the study area, using but not adding to the zonal forecasts calculated by United Utilities and Dee Valley Water.

Figure 6.1 Summary of Alternative Growth Rate and Demand Scenario Forecasts



Higher growth (15% higher than the Council's preferred plan) combined with increasing pcc (i.e. unsuccessful demand management strategies) could see demand in the study area increase to 95Ml/d, although this inherently assumes an increase in population. This is a worst case scenario in which pcc in 55% of new households is 150l/h/d and the pcc of existing customers is 10% greater than in the companies' strategy forecasts.

In contrast, lower growth (15% lower than the Council's preferred plan) combined with very effective demand management in both new and existing homes could lead to total household demand falling to 76Ml/d, which is less than existing total household demand. To achieve this existing customers' pcc would have to be 10% less than forecast by the water companies, and all new homes would have to be built to deliver pcc levels of 105l/h/d or less (i.e. meeting at least Code for Sustainable Homes (CSH) level 3/4 for water consumption). It shows how even under a lower growth scenario, demand would be higher than the business as usual projection if demand is not managed effectively.

This shows that demand in the study area could fluctuate by ± 9Ml/d from the water company estimate. Both water companies include a headroom element in their demand forecast, to allow for uncertainties in future housing growth, population, and pcc (and supply uncertainties). For United Utilities the available headroom is more than 100Ml/d until 2034/35 (in relation to the 1,800 Ml/d that it puts into supply). Dee Valley Water has much less uncertainty to manage due to the size of the company and it has included an uncertainty allowance of

approximately 4.5Ml/d and 6.5Ml/d in its Chester and Wrexham zones respectively. This means that between the two companies there should be sufficient resource in the plan to allow for unexpected higher demands, without further impacting on the environmental status of the CAMS resource units. However, these allowances also cover uncertainties in demand across the whole resource zones, and other non-demand related elements of uncertainty (e.g. impact of climate change on supply etc).

6.3.2 Feasibility of Water Neutrality

The concept of water neutrality has been developed to examine how new developments can be accommodated sustainably within existing water resource limits. Water neutrality means that there is no increase in the overall water consumption of the supply area after development (i.e. new houses and increased population). In simple terms, water neutrality is achieved by delivering significant water efficiency measures within new buildings, whilst undertaking extensive demand management in the existing housing stock to counterbalance the demand from new development. Therefore, the following key elements must be considered:

- The geographical area that will be identified, targeted and assessed for water neutrality. Ideally, the area should contain enough existing households to make it feasible to offset demand from the new development, but should also be defined around an existing town or community, to enable a coherent water conservation message to be delivered.

- The current and planned levels of consumption in existing homes. The opportunity for delivering water neutrality will be greater in areas when current and planned levels of household consumption are relatively high – i.e. where there is a greater opportunity to deliver savings in water use. Conversely, water neutrality will be more challenging where existing households already have a low average rate of consumption.

- The external drivers for water neutrality, such as the level of water stress and/or the social and political will to implement exemplary levels of sustainable development. The costs and benefits of water neutrality, compared to other, more conventional approaches to balancing supply and demand should also be considered.

An estimate of the reduction in demand required in existing development to achieve water neutrality in the Cheshire West and Chester area is presented in Table 6.5.

Table 6.5 Illustrative assessment of potential for water neutrality in the study area

Element of water neutrality calculation	Quantity
Total number of existing households in the study area (2007/08)	248,426
Average occupancy rate in existing households (2026/27)	2.02
Total residents in existing housing stock	500,682
Total existing household demand in study area (Ml/d) 2026/27	78.62
Total number of new houses by end of growth period	27,000
Average occupancy rate in new households	2.53
Total forecast increase in population (new residents)	68,257
Total forecast household demand (new households) at end of growth period Ml/d	7 Ml/d
Reduction in pcc of existing customers required to cancel out the new demand	Approximately 14 litres

Average occupancy rates are taken from WRMPs. Forecast demands are based on information within the WRMPs proportioned to the study area. It assumes that all new developments will be occupied by people not previously resident within the study area. A more detailed analysis would be applicable if required in a detailed WCS

The result shows that every existing household resident in the study area would be required to reduce their pcc by approximately 14 litres/head/day (l/h/d) to achieve water neutrality, over and above the reductions included in water company pcc forecasts. United Utilities has forecast average pcc to fall from 150 l/h/d to 143 l/h/d by 2026/27 (demand from metered customers is forecast to decrease to 130 l/h/d). Per capita consumption is higher in Dee Valley Water's Chester and Wrexham zones. In the Wrexham water resource zone demand is forecast to fall from 153 l/h/d to 144 l/h/d by 2026/27. In Chester pcc is forecast to reduce from 158 l/h/d to 155 l/h/d by 2026. To provide context, the current national average pcc is around 150 l/h/d and in the Government strategy for water, there is an aspiration to decrease this to 130 l/h/d by 2030 (Defra, 2008).

Further reductions beyond those forecast in the company plans may be achievable, but would require the implementation water efficiency measures in addition to those planned by the water companies (metering, issuing free water efficient devices etc). Studies have shown that achieving water neutrality is expensive due to the cost of retrofitting existing homes (Environment Agency, 2007), whilst there are a number of social equality issues that water neutrality raises including:

- pcc in the Chester area is significantly higher than elsewhere in the study area – should more effort be made to reduce these customers consumption by more than 14 litres?

- Unmetered customers' pcc is forecast to be very high across the area – should more effort be made to drastically reduce the demand of a smaller number of customers?
- Should all customers be targeted to avoid a net increase in demand arising from new developments?
- Should a smaller number of customers, more local to the specific development sites be targeted to achieve even greater pcc reductions to reach neutrality?
- Who should be responsible for implementing and funding actions required to achieve neutrality?

Specific water neutrality goals are not considered appropriate given the current state of water resources in North West England in general, and in the study area in particular. This section also highlights some of the ethical and socio-political challenges posed by water neutrality, as well as some difficult practical considerations. Nevertheless, the Council can implement policies that help to move toward water neutrality by supporting water company efforts to reduce the demand for water in existing development, and by requiring new households to be designed to deliver consumption rates of 105 l/h/d, in-line with Level 3/4 of the CSH.

Local Authority options to reduce demand in existing housing stock

The water companies in England and Wales have a statutory duty to promote the efficient use of water. Many water companies have worked on collaborative water efficiency projects with local authorities in the past. Schemes such as the Government's Community Energy Saving Programme present opportunities for Councils and water companies to work together to carry out house to house calls and offer water and energy saving measures for taps and showers in the most deprived areas of the UK (Waterwise, 2010). Such opportunities for collaborative working between the Council and the water companies to promote water efficiency should be explored.

Other measures that could be taken by the Council to promote the efficient use of water include:

- Distributing leaflets and information about the financial and environmental benefits of metering and water efficiency measures;
- Leading by example and installing water efficient devices in Council owned or Council managed properties; and
- Providing links from the Council website to direct the public to existing water efficiency information on water company and Environment Agency websites.

Other local authorities across the country take an active role in promoting water efficiency. For example, Hampshire County Council will be hosting its 8th annual water festival this July to celebrate its water environment and provide opportunities for the public to learn how they can help to protect it[15]. Kent County Council operates an Energy and Water Investment Fund. Part-funded by the Carbon Trust, this fund enables long-term investment in

[15] http://www.hampshirewaterfestival.co.uk/index.htm

energy and water efficiency in schools and Kent County Council buildings. Under the scheme, interest-free loans are spent on projects that save electricity, gas, oil or water, and payback within 5 years[16].

6.3.3 Water Supply

Information provided by both water supply companies indicates that water supply infrastructure is not a strategic constraint to growth. It is expected that some improvements and extensions to the distribution mains will be required to connect the new developments to the existing system and the water companies will require lead in time to plan and deliver this. However, neither company expects significant new infrastructure, such as service reservoirs and pumping stations, will be required to transfer water to the new developments. The actual level of constraint with regards to water supply infrastructure (pipes etc) will depend on the size of a development and its location. Figure 6.2 illustrates at a high level the location of key water supply infrastructure in the study area, and the level of constraint that exists. This is summarised in Table 6.6 below.

The lead in time to plan extensions to connect most new developments may be between 6 to 18 months[17] and so does not represent a significant constraint to growth, as long as this is planned in advance. In some areas this lead in time may be extended if the water companies are required to undertake Environmental Impact Assessments. This can add a further 12 months lead in time to the project. By liaising with the water companies, informing them of large scale developments at the time of approving the planning application, the Council will help to avoid delays between construction and sale/handover of new developments. Further by liaising in this way the two organisations will be more likely to identify opportunities to bring development forward, or ensure infrastructure projects consider multiple opportunities. For example, Dee Valley Water is planning a scheme in its Wrexham zone to provide supplies to a planned large scale commercial development and the company has stated that there could be opportunities to design this scheme so that it improves capacity in the Chester zone, if this is required.

Table 6.6 Water Supply Constraints

Development area	Water Supply Constraints
Chester	Growth is not constrained by either water resource availability or local supply infrastructure. Some lead in time may be required for the water companies to prepare connections infrastructure but no major enhancements are anticipated. Demand is an issue though and all new developments should be built adopting water efficiency measures, aiming to reach CSH level 3/4.
Ellesmere Port	
Winsford	
Northwich	
Remainder of study area	

[16] http://www.kent.gov.uk/environment_and_planning/environment_and_climate_change/eco-schools/find_out_more/resources.aspx

[17] Environmental impact assessments may be required to determine species that may be impacted by construction of pipelines (e.g. badgers, newts). These are typically 12 months in duration, but may be longer.

Development area	Water Supply Constraints
	Development ok, no constraints identified

Local Authority options to influence water efficiency in new developments

The recommendation that new homes should be developed to CSH level 3/4 requires developers to deliver new homes that meet a design standard pcc of 105 l/h/d (excluding allowance for outside use). The Code for Sustainable Homes (CSH) water use calculator can be used by developers to calculate the water consumption of new homes based on the water fittings and fixtures that they install. Previous studies have shown that it is possible to design a new home to meet CSH level 3/4 using different combinations of fixtures and fittings. For example, in homes with a very low flush dual toilet (<4 litres effective flush), slightly higher flow rates in bathroom or kitchen taps might be acceptable. More advanced water efficiency measures such as rainwater harvesting systems are not required to meet CSH level 3/4. Further detailed guidance on how to achieve these targets is available from CLG[18].

Currently, all new homes must be assessed against the CSH but so far only new social housing has a mandatory target to reach level 3. By reducing expected pcc in new homes to 105 l/h/d, the Council will significantly support the water company's aim to reduce overall pcc.

[18] Communities and Local Government (2009). *Code for Sustainable Homes – technical guide.* www.planningportal.gov.uk/uploads/code_for_sustainable_homes_techguide.pdf