



Warwickshire sub-regional Water Cycle Study Warwick District Council Final report

Halcrow Group Limited

Burderop Park

Swindon

SN4 0QD

01793 812479

http://www.halcrow.com/html/our_markets/watercycleplanning.htm

March 2010

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Warwickshire sub-regional Water Cycle Study

Warwick District Council

Scoping and outline final water cycle study report

Revision schedule

Date	Document reference	Stage	Author	Approver
6 th Nov 2009	v 0.1	Substantive draft	Ali Cotton	Andy McConkey
19 th Feb 2010	v1.0	Draft final	Ali Cotton	Andy McConkey
15 th March 2010	v2.0	Final	Ali Cotton	Katherine Pygott





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1 Introduction

1.1 Background to the water cycle study

The West Midlands Regional Spatial Strategy (RSS)¹ sets a target of 41,000 new homes to be built in the Warwickshire sub-region by 2026. The Warwickshire sub-region includes five local planning authorities:

- North Warwickshire Borough Council;
- Nuneaton & Bedworth Borough Council;
- Rugby Borough Council;
- Stratford-on-Avon District Council, and;
- Warwick District Council.

Building new homes is not simply a matter of constructing the buildings themselves. To operate effectively as a home, and as part of a wider community, each building is also dependant on a range of services, and the infrastructure necessary to provide these. A critical component of this infrastructure is associated with water; the provision of clean water for drinking and washing; the safe disposal of waste water; and protection from flooding.

The addition of a small number of new homes may not represent a significant additional burden on existing water infrastructure. However when large numbers of houses are built, there is a risk that existing infrastructure will be overwhelmed, and both the environment and people's quality of life, will suffer.

There is a finite capacity within the environment, and it cannot simply provide more and more water to serve new development. Equally, there is a limit to the amount of waste water that can be safely returned to our rivers and the sea without having a detrimental impact on the environment. Furthermore, we know that extreme rainfall can overwhelm drains and overtop flood defences. Climate change is bringing fresh challenges as patterns of rainfall are predicted to change, with more intense rainfall events. We must also make sure that water infrastructure contributes to the shift to a low carbon economy that is essential if greenhouse gas emissions are to be reduced. Planning for water has to take into account these natural constraints, and factors such as the timing and location imposed by the development itself.

The five planning authorities are currently preparing, or have prepared, their draft Core Strategies, as part of the Local Development Framework (LDF) process. LDF documents submitted to the Secretary of State must include demonstrable evidence of a strategic approach within their evidence base. An integrated Water Cycle Strategy provides the ideal means by which to address this need and can be undertaken in a phased manner to suit the staged levels of detail required by the planning process.

¹http://www.wmra.gov.uk/Planning_and_Regional_Spatial_Strategy/RSS_Revision/RSS_Revision_Phase_2/Preferred_Option.aspx





To this end a water cycle study (WCS) has been commissioned to provide the evidence base which will be used to support the preparation of the Core Strategy. The evidence base should demonstrate that development will not have a detrimental impact on the environment and that the necessary water infrastructure can be provided in a timely manner to support growth.

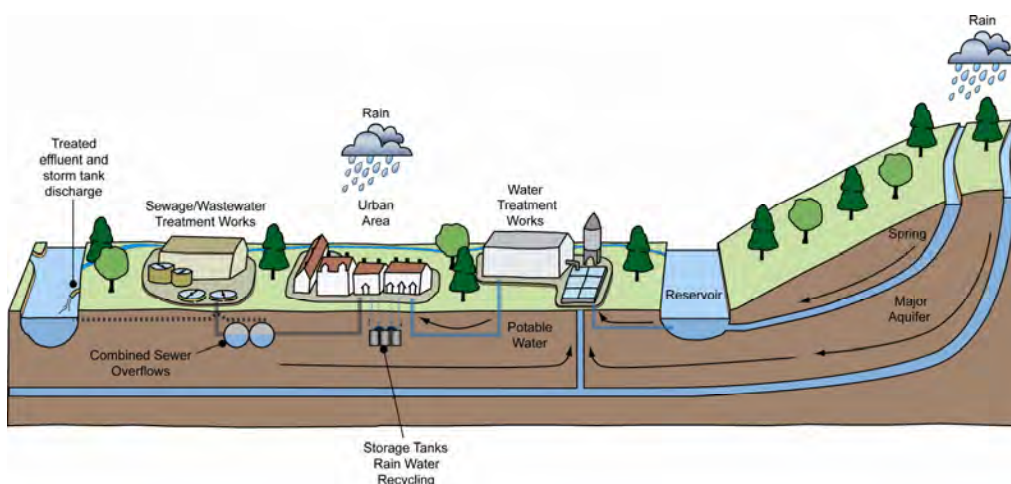
Halcrow Group Ltd were commissioned to undertake a WCS for the five planning authorities in the Warwickshire sub-region, in consultation with the Environment Agency and Severn Trent Water. The Environment Agency and Severn Trent Water provided input, and data and information throughout the WCS.

1.2 Water cycle processes

The water cycle includes the processes and systems that collect, store, or transport water in the environment. Water cycle processes are both above and below ground level, and can be either natural or man-made. In an undeveloped area, the water cycle includes rainfall landing on the ground, where it is either transferred into above ground streams, rivers, wetlands, floodplains, and estuaries to the sea, or is absorbed into the soil, ending up in groundwater storage aquifers. The cycle is completed by evaporation from these systems back into the atmosphere.

In a developed area, the natural processes and systems are sometimes adapted for development or public health reasons. For example, water is taken from rivers, treated, and piped via water supply systems into urban areas. Wastewater produced by houses is collected in a below ground sewerage system, where it is transported to a wastewater treatment works before being discharged to the sea, rivers or to groundwater.

The natural processes are extremely important for wildlife and ecology, and even man made systems can have biodiversity and wildlife interest. It is important than when building new homes, or even redeveloping existing areas we understand the impact on the natural environment.



1.3 Objectives of the water cycle study

The key objectives of the WCS, as defined by the Partner Authorities (the five local planning authorities), are:

- undertake a review of existing water cycle processes and infrastructure capacity;

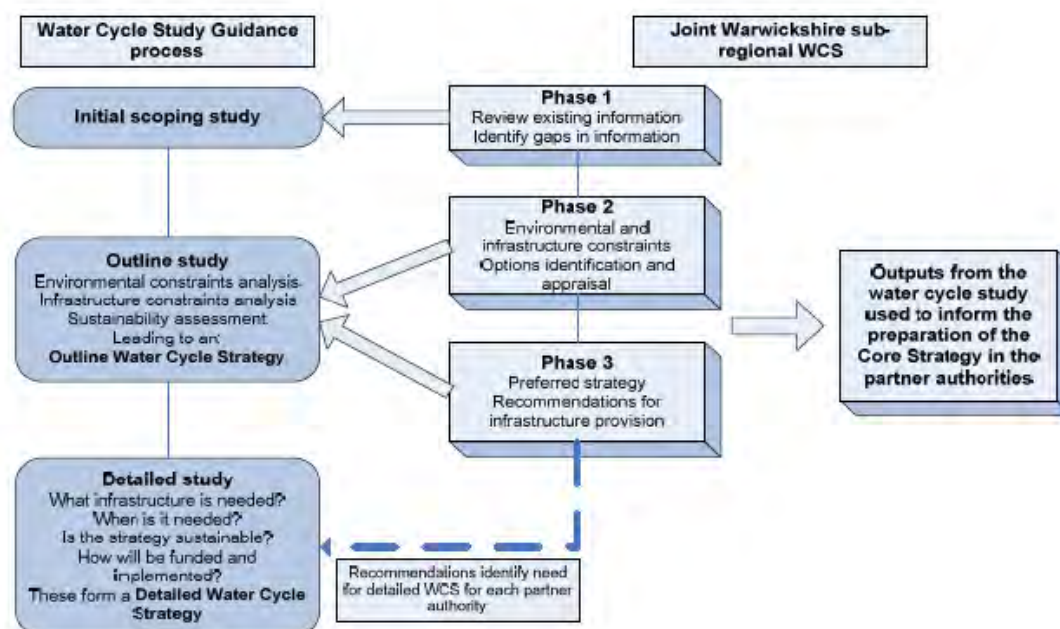
Chapter 1 Introduction

- provide all partners with a clear understanding of viable and deliverable water and waste water infrastructure options to accommodate planned growth;
- recommend the most appropriate infrastructure option to accommodate planned growth including a indication of costs and delivery times;
- recommend any necessary flood risk mitigation and environmental management measures to avoid adverse impacts, and;
- produce a strategy that can be defended at examination and used to inform the business plans of water and sewerage companies.

The water cycle study will be used to inform the five planning authorities' LDF documents, sustainability appraisals, and appropriate assessments, which are subject to inspection by an independent inspector. Therefore, the water cycle study must provide the evidence base to ensure that development does not have a detrimental impact on the environment, and that water services infrastructure is provided in a timely manner.

1.4 Approach adopted for the water cycle study

The approach adopted for the WCS was mapped against the Environment Agency guidance on undertaking water cycle studies². The Environment Agency guidance highlights a three-stage process for WCS; scoping, outline and detailed. The guidance suggests that the need for a detailed WCS is identified as an output from the outline WCS. A detailed WCS is only required where an outline WCS identifies the need for one. An outline study should scope out any further work required.



² <http://publications.environment-agency.gov.uk/pdf/GEHO0109BPFF-e-e.pdf>



When mapped to the Environment Agency guidance, the Warwickshire WCS can be considered as a combined scoping and outline WCS. The WCS has been divided into three phases of work:

- Phase 1 – initial planning – phase 1 existing focussed on collating existing sources of information and liaising with the planning authorities and other stakeholders. In addition the development scenarios to be examined were confirmed. The purpose of phase 1 was to establish a comprehensive and up to date baseline with regards to environmental processes and infrastructure capacity.
- Phase 2 – options identification and appraisal – the technical analysis of environmental and infrastructure constraints to growth was undertaken as part of the phase 2 assessment. To overcome these constraints will require a combination of mitigation measures and infrastructure upgrades, and environmental and infrastructure options to accommodate planned growth have been identified.
- Phase 3 – production of the water cycle strategy – the phase 2 analysis informed the preferred strategy and provided a ‘road map’ for infrastructure delivery for each of the partner authority. The key issues, actions and recommendations for the sub-region and for each local authority have been identified, alongside an assessment of where a detailed study may be required.

The five planning authorities are currently at different stages of the LDF process. Rugby Borough Council and Stratford-on-Avon District Council have prepared their draft Core Strategy, and have identified strategic sites for developments. Warwick District Council is at the preferred options consultation stage. North Warwickshire Borough Council and Nuneaton & Bedworth Borough Council have recently completed their Issues and Options consultation; at the time of the WCS they did not have preferred locations for development. As a result a flexible approach was required to ensure that the evidence base could be provided for each planning authority.

Where proposed strategic sites (or preferred options) have been identified as part of the draft Core Strategy the approach adopted sought to identify the environmental and infrastructure constraints within these sites, and the options to mitigate constraints. The key questions to be addressed for the strategic sites included:

- Is there sufficient wastewater capacity in the network and at the sewage treatment works?
- Is there sufficient water supply capacity in the network?
- If not has capacity been planned (or can it be achieved)?
- Is there sufficient land at lower flood risk?
- What surface water policies will need to be in place?
- Are there ecological constraints within the strategic allocations?

For the remainder of development, either non-strategic or where preferred options have not yet been developed, the approach sought to identify preferred locations for development from an environmental and water services infrastructure perspective. The approach assessed a range of settlements where housing development could potentially occur and identified the key wastewater, flood risk, surface water and ecological constraints to developments in these settlements. The outputs from this assessment were used to identify a ranked list of settlements to inform preferred locations for development.



1.5 Report structure

The report has been structured to facilitate each of the partner authorities. Chapter 2 provides a discussion on the regional planning context of the WCS. Chapter 4 discusses the regional assessment of water resources and demand management undertaken as part of the WCS, and chapter 5 provides an overview of flood risk and surface water management. Chapter 6 provides a summary of the WCS findings for Warwick District Council; the technical analysis is in Appendix D.





2 Regional planning context

2.1 West Midlands Regional Spatial Strategy

Under Planning Policy Statement 1 (PPS1): Delivering Sustainable Development, regional planning bodies are required to prepare and produce a Regional Spatial Strategy (RSS) “reflecting the needs and aspirations for development and land use for a ten to fifteen year period.”³

The emerging West Midlands RSS phase 2 revision, prepared by the West Midlands Regional Assembly, has set a development target of 365,600 dwellings to be provided in the West Midlands by 2026. Of this, the RSS identifies 41,000 new homes to be provided within the study area. A breakdown of the RSS requirements by local planning authority is highlighted below:

- North Warwickshire Borough Council – 3,000 new homes;
- Nuneaton & Bedworth Borough Council – 10,800 new homes;
- Rugby Borough Council – 10,800 new homes;
- Stratford-on-Avon District Council – 5,600 new homes, and;
- Warwick District Council – 10,800 new homes.

In January 2008 the West Midlands Regional Assembly expressed concerns that in light of the level of housing indicated for the region within the National Housing and Planning Advice Unit (NHPAU) report, the West Midlands RSS phase 2 revision was not making provision for sufficient housing.

The Government Office for the West Midlands (GOWM) appointed Nathaniel Lichfield and Partners (NLP) to identify a range of options for delivering higher housing numbers. The options were appraised to produce growth scenarios showing how the Region might increase housing provision whilst maintaining as many principles of the RSS as possible. The results of the study were drawn upon by the GOWM in framing its response to the phase 2 RSS.

The NLP study presented three potential growth scenarios proposing between 417,100 and 445,600 housing units to be delivered in the West Midlands up to 2026. These represent housing allocations between 51,500 and 80,000 higher than the West Midlands' phase 2 RSS revision.

As a result, this WCS will look at two development scenarios: the minimum development to meet required RSS housing numbers, and increased development to accommodate those specified by each local authority and the NLP report. Each of the partner authorities identified a baseline and higher development scenario to be tested as part of the WCS. The WCS has not considered employment sites, due to the potential to double count of over-estimate the additional water resources of wastewater infrastructure required to support growth.

³ <http://www.communities.gov.uk/documents/planningandbuilding/pdf/147396.pdf>



2.2 North Warwickshire Borough Council

The RSS requirement for North Warwickshire is to build 3000 new homes by 2026, of which 309 were completed between 2006 and 2008. There are therefore 2,691 homes remaining to be planned as part of the LDF process. The council has consulted on its issues and options paper, and no strategic allocations have been made.

The higher development scenario to be examined is an incorporation of an additional 2000 homes within the borough.

The planning authority has identified the settlements which should be considered as part of the WCS analysis, alongside a minimum and maximum number of houses within each which can be seen in Table 2-1. The outputs of the WCS should help to identify preferred locations for development, alongside an estimate of the number of houses that can be accommodated. Initial screening should identify where development would not cause environmental or infrastructure constraints, even if the maximum development were to occur.

Scenario	Minimum	Maximum
Category 1 - Main Towns		
Atherstone / Mancetter	500	1500
Polesworth / Dordon	500	1500
Category 2 - Green Belt Market Town		
Coleshill	300	3000
Category 3 - Local Service Centres		
Old and New Arley (together, as a single network of villages)	30	150
Grendon/Baddesley Ensor (together, as a single network of villages)	30	150
Hartshill with Ansley Common	30	400
Kingsbury	30	100
Water Orton	30	100
Category 4 - Other settlements with a development boundary		
Ansley	10	20
Austrey	10	20
Curdworth	10	20
Fillongley	10	20
Hurley	10	20
Newton Regis	10	20
Piccadilly	10	20
Shuttington	10	20
Shustoke	10	20
Warton	10	20
Whitacre Heath	10	20



Scenario	Minimum	Maximum
Wood End	10	20

Table 2-1 North Warwickshire settlements identified for analysis

2.3 Nuneaton and Bedworth Borough Council

The RSS requirement for Nuneaton and Bedworth is 10,800 new homes by 2026, of which 3,000 have been completed or given planning permission since 2006. Of the 7,800 homes which need to be provided for, it is estimated that there is capacity for 1,800 in the main urban centres, with the remaining 6,000 homes to be provided outside existing urban areas (e.g. urban extensions or greenfield). The council is currently consulting on its issues and options paper, and no strategic allocations have been made.

The higher development scenario is for an additional 1,900 new homes. In addition to this there may be implications for overspill in development from Coventry, which could constitute up to 3,500 further new homes.

The Issues and Options document outlined 8 potential options for growth within the Borough; some of these options had overlapping proposed areas for development. Because water services infrastructure serves relatively large geographical areas, the WCS has focussed on assessing broad geographical options, which can be mapped to the options contained within the Issues and Options paper. The WCS has focussed on the broad geographical areas, and are mapped to the options outlined in the Issues and Options paper:

- Nuneaton North – this area includes options 1, 2, 3a and 5
- Nuneaton East (Eastern development would incorporate northern area of Bulkington) – this area includes option 3b
- Nuneaton South – this area includes options 2, 3b, and 5
- Nuneaton West – this area includes options 2 and 3c
- Bedworth East – this area includes options 4, 7 and 8
- Bedworth West – this area includes options 2 and 4
- Land North of M6 – this area includes options 4, 7 and 8
- Land South of M6 – this area includes options 6 and 8
- Bulkington South West – this area includes option 5.

For the WCS no information has been provided on the number of dwellings which can be accommodated for each option. The findings from the WCS can be used to inform preferred locations for development from a water cycle perspective.

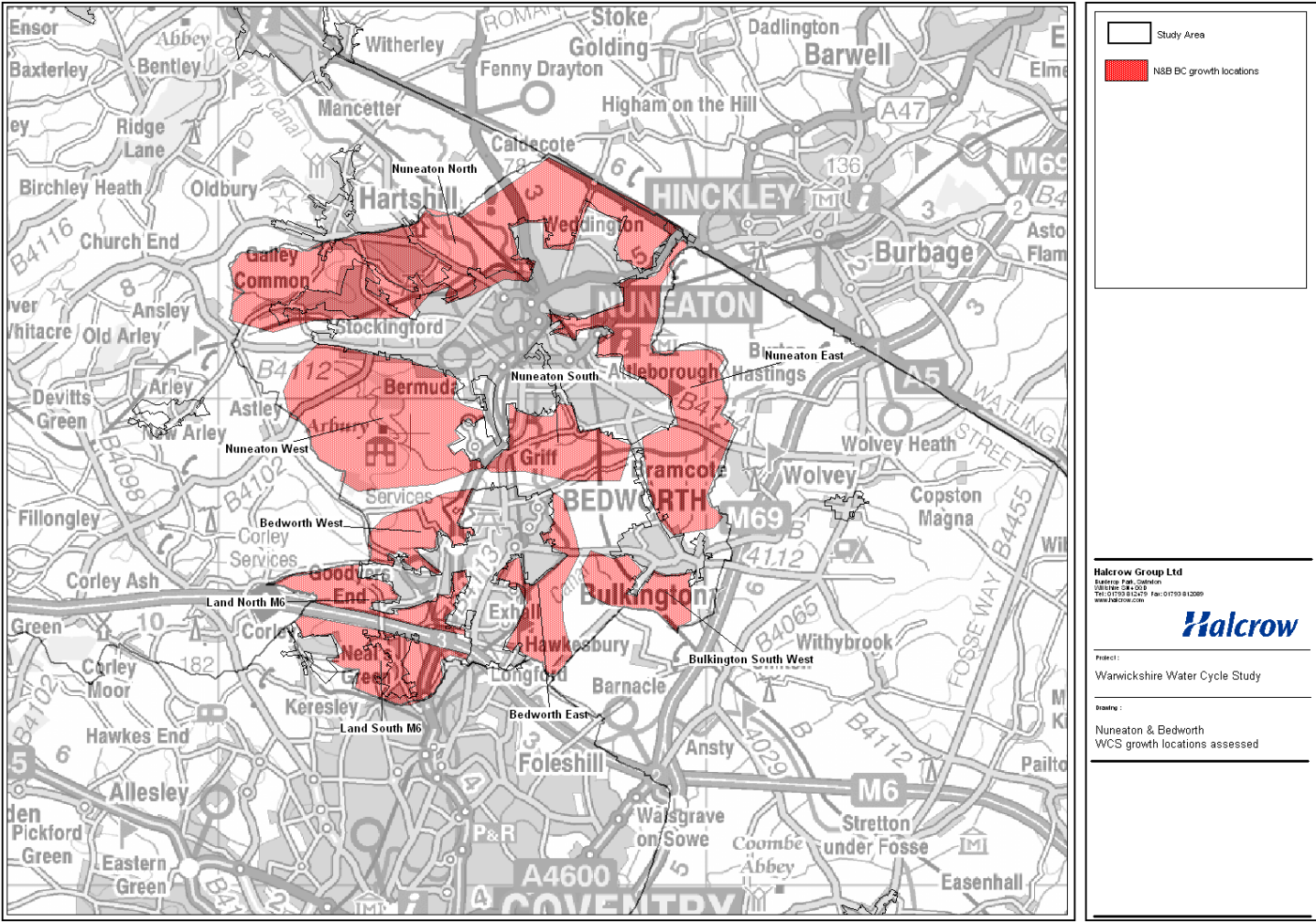


Figure 2-1 Potential growth locations for Nuneaton & Bedworth BC



2.4 Rugby Borough Council

Rugby is required to accommodate 10,800 new homes as part of the RSS Phase 2 Revision requirement. Of this, 2,599 new homes have been built between 2006 and 2009. The residual RSS requirement is therefore 8,201.

At the time of writing, Rugby Borough Council has prepared its Proposed Submission Core Strategy, and has identified two strategic allocations as major urban extensions; Gateway Rugby and Rugby Radio Station. The proposed development plan can be seen in Table 2-2.

Rugby Borough Council's development strategy aims to ensure that the Rugby urban area is the primary focus for meeting strategic growth targets. The development strategy supports this, however, by providing scope for development in the following larger rural settlements in order to enable development that supports the local community:

- Long Lawford
- Dunchurch
- Wolston
- Binley Woods
- Brinklow
- Ryton on Dunsmore
- Stretton on Dunsmore
- Wolvey
- Clifton on Dunsmore

Specific development numbers for non-strategic development locations are not available for testing. Where analysis completed as part of the WCS has required estimates as to the levels of development that could occur within these settlements, sites put forward as part of the Strategic Housing Land Availability Assessment (SHLAA) have been used.



Location	Housing 2011-2016	Housing 2016-2021	Housing 2021-2026	Total
Gateway Rugby	650	650		1,300
Rugby Radio Station ⁴	1,148	1,602	2,250	5,000
Other windfall and SHLAA sites capacity	633	634	634	1,901
Sum	2,431	2,886	2,884	8,201

Table 2-2 Rugby BC strategic allocations

The higher development scenario to be examined as part of the WCS is for an additional 3,586 new homes to the south of Rugby, which is noted in draft Core Strategy policy CS5 as “a Long Term Growth Direction”. Sites included in the Council’s SHLAA that are located in this area have been used to estimate the level of development that could come forward in this area, as set out in draft Policy CS5. In total, the housing requirement for the higher growth scenario tested as part of the WCS is therefore 11,787, as demonstrated in Table 2-3.

Site	Housing 2011-2016	Housing 2016-2021	Housing 2021-2026	Total
RSS (from above table)	24,31	2,886	2,884	8,201
Long Term Growth Direction Policy CS5	1,195	1,195	1,196	3,586
Sum	3,626	4,081	4,080	11,787

Table 2-3 Higher development scenario for Rugby BC

⁴ It should be noted that at Rugby Radio Station there is potential for up to 6200 houses; the additional 1200 homes could be provided prior to 2026, or building could continue after 2026. For the purposes of the WCS, development has been assumed as 5000 homes for this site, but any constraints to development identified should consider the implications for an additional 1200 homes.

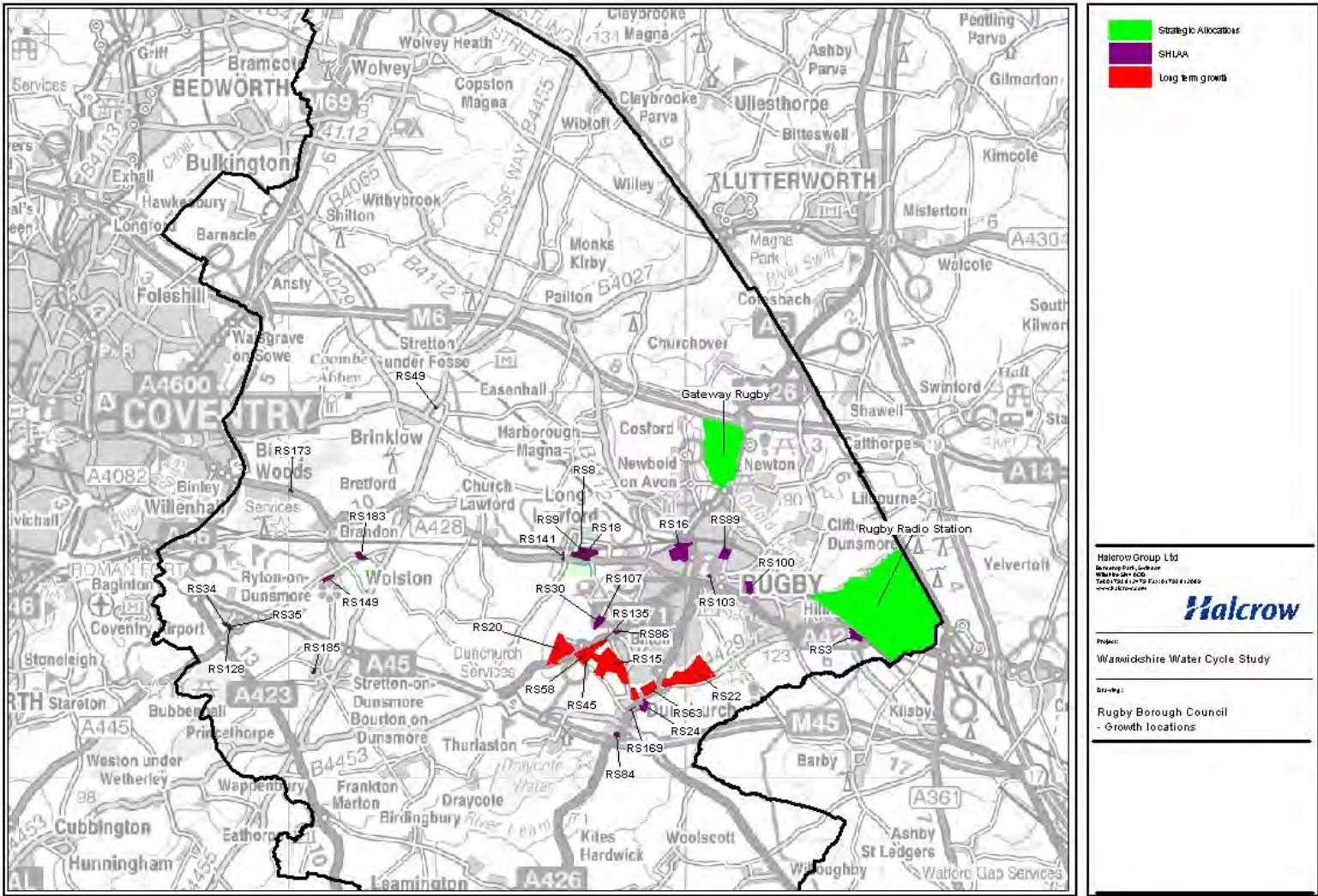


Figure 2-2 Growth locations with Rugby Borough



2.5 Stratford-on-Avon District Council

The RSS requirement for Stratford is for an additional 5,600 new homes to be built by 2026, of which 1,219 had been completed up to March 2008. This leaves a residual RSS requirement of 4,381 new homes. Stratford has prepared its draft Core Strategy and identified strategic allocations to meet the required growth providing 4,537 new homes, marginally higher than the RSS requirement, located as shown in Table 2-4.

Site	Housing 2011-2016	Housing 2016-2021	Housing 2021- 2026	Total
SUA1 - Western Road/ Wharf Road, Stratford-upon-Avon (SUA)	33	33	34	100
SUA.2 - Rother Street/ Grove Road, SUA	33	33	34	100
SUA.3 - Bridgeway/Bridgefoot, SUA	16	17	17	50
SUA.4 - West of Shottery, SUA	266	267	267	800
SUA.6 - Bishopton Lane, SUA	25	25	25	75
SUA.7 - South of Kipling Road, SUA	33	33	34	100
SUA.8 - North of Banbury Road, SUA	16	17	17	50
ALC.2 - East of Kinwarton Farm Road, Alcester	41	42	42	125
ALC.3 - Land within bypass north of Allimore Lane, Alcester	83	83	84	250
BID.1 - North of Bramley Way, Bidford-on-Avon	16	17	17	50
BID.2 - North of Salford Road, Bidford	25	25	25	75
KIN.1 - Banbury Road, Kineton	25	25	25	75
SHIP.1 - North and South of Campden Road and former Norgren Factory, Shipston	83	83	84	250
SOU.1 - West and East of Banbury Road Southam	66	67	67	200
SOU.2 - West of Coventry Road, Southam	25	25	25	75
Dwellings permitted but not started at 31.03.08	260	261	261	782
Windfall allowance (for period 2021-2026 only)			750	750
Sites identified in SHLAA (not otherwise included above)	151	152	152	455
Sum	1,255	1,263	2,019	4,537

Table 2-4 Stratford-on-Avon DC strategic allocations

N.B. The above sites are only potential sites identified for testing by the WCS. Whilst there has been some local consultation on these sites they have not been included within the Council's Draft Core Strategy

The higher development scenario for the WCS identifies an additional 1,805 new homes to be built, located as in Table 2-5 below. It should be noted that the higher development scenario tested as part of the WCS falls short



of the additional housing in the NLP study and further sites would need to be identified and tested to meet the NLP scenario, if required.

Site	Housing 2011-2016	Housing 2016-2021	Housing 2021- 2026	Total
RSS (from above table)	1,255	1,263	2,019	4,537
SUA.A - Bishopton Area, SUA	500	500	500	500
SUA.B - East and West of Birmingham Road, SUA	300	300	300	300
ALC.A - South of Allimore Lane, West of Alcester	150	150	150	150
BID.A - Extension to BID.1	50	50	50	50
BID.B - Extension to BID.2	75	75	75	75
HEN.A - Bear Lane, Henley-in-Arden	50	50	50	50
KIN.A - East of High School, Kineton	75	75	75	75
SHIP.A - Extension to SHIP.1	50	50	50	50
SOU.A - East of the Bypass, Southam	300	300	300	300
South of Gunners Lane, Studley	50	50	50	50
WELL.A - Extension to WELL.1	80	80	80	80
West of Kineton Road, Wellesbourne	125	125	125	125
Sum	1,852	1,867	2,623	6,342

Table 2-5 Stratford-upon-Avon higher development allocations

There are also 21 villages which have been identified as potential areas for non-strategic development, which have been included in the WCS:

- Bishops Itchington
- Brailes
- Claverdon
- Ettington
- Fenny Compton
- Harbury
- Ilmington
- Lighthorne Heath
- Long Compton
- Lond Itchington
- Napton-on-the-Hill
- Newbold Stour
- Quinton
- Salford Priors
- Snitterfield
- Stockton
- Tiddington
- Tysoe
- Welford-on-Avon
- Wilmcote
- Wootton Wawen

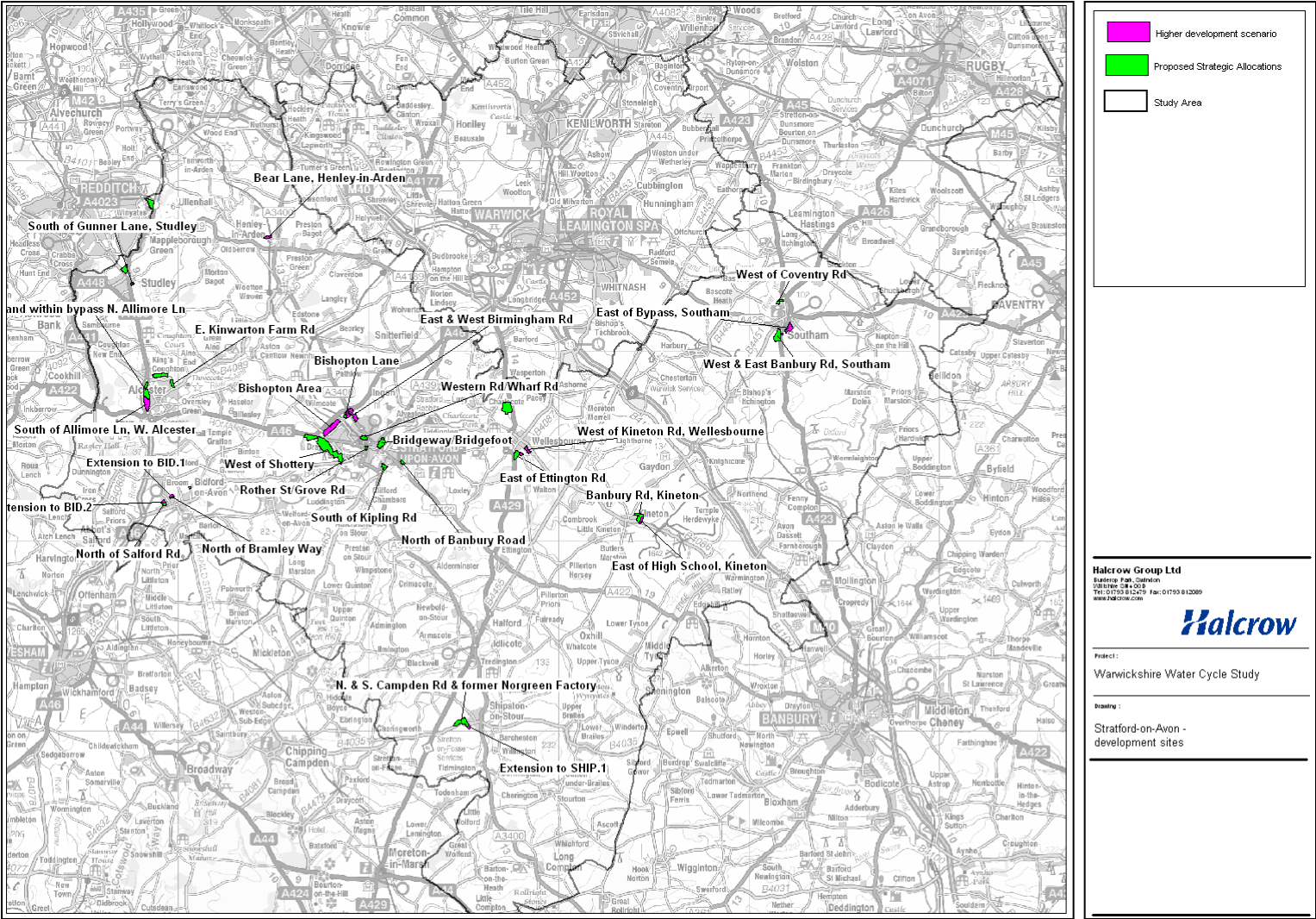


Figure 2-3 Growth locations in Warwick District



2.6 Warwick District Council

Warwick has a requirement to build 10,800 new homes by 2026, under the RSS. Of this, 8,100 new homes are still to be found to meet the emerging RSS requirements. The Core Strategy Preferred Options Document has been prepared, which outlines potential sites to provide 5,525 new homes; the remainder of the requirement is to be met through windfall or non-strategic brownfield sites. Potential sites are shown in Table 2-6.

To assess likely windfall development (2,575 homes) the WCS was advised to focus on the following locations:

- Warwick
- Leamington Spa
- Whitnash
- Kenilworth

The majority of non-strategic development is proposed to be met through windfall development in urban and rural locations (approximately 80% in Warwick/Leamington Spa, 5% in Kenilworth, and 15% in rural locations). There is no certainty as to which locations will become available, or when. Therefore the WCS should identify recommendations which should be put in place when windfall developments occur.

Site	Housing 2011-2016	Housing 2016-2021	Housing 2021- 2026	Total
Land west of Europa Way, Warwick (1E)	1,250			1,250
Land at Lower Heathcote Farm, south of Harbury Lane (1F, 2F & 3F)	450	1,050	1,000	2,500
Land at Thickthorn, between Kenilworth and the A46 (2G)		800		800
Land at Woodside Farm, north of Harbury Lane, Whitnash (1D)	250			250
Land South of Sydenham and east of Whitnash (1C)	200			200
Land at Warwickshire College, Warwick New Road (3H)			300	300
Land at Station Approach, Leamington (1B)	150			150
Land at Former Ford's Foundry, Leamington (1A)	75			75
New homes on urban and rural windfall sites	275	550	1,275	2,100
Non-strategic urban brownfield sites	30	260	185	475
Sum	2,680	2,660	2,760	8,100

Table 2-6 Warwick DC potential sites (Source: Core Strategy Preferred Options Document)



The alternative option sites for the WCS has identified a further 5,650 new homes, which gives a total of 13,750 homes including the RSS requirement. Table 2-7 outlines the sites which would come forward should the alternative option scenario occur.

The wastewater treatment and water quality technical analysis had been based on total development of 14,100 homes which includes two additional sites at Heathcote and Land at Gogbrook Farm. The wastewater treatment capacity and water quality assessment would be relatively unaffected by the small change in development numbers, and therefore the findings of this report are based on an assessment of up to 14,100 homes in Warwick district.

Site	Housing 2011-2016	Housing 2016-2021	Housing 2021-2026	Total
RSS requirements (from above table)	2,680	2,660	2,760	8,100
Land at Red House Farm, Campion Hills (L23)		200		200
Southcrest Farm (K17)	310	140		450
Land North of Milverton (L07)	100	1,000	400	1,500
Finham (overspill from Coventry) – Land at Kings Hill Road, Gibbet Hill, Green Lane, Finham (I0)		500	3,000	3,500
Sum	2,680	4,000	6,160	13,750

Table 2-7 Alternative option scenario for Warwick DC

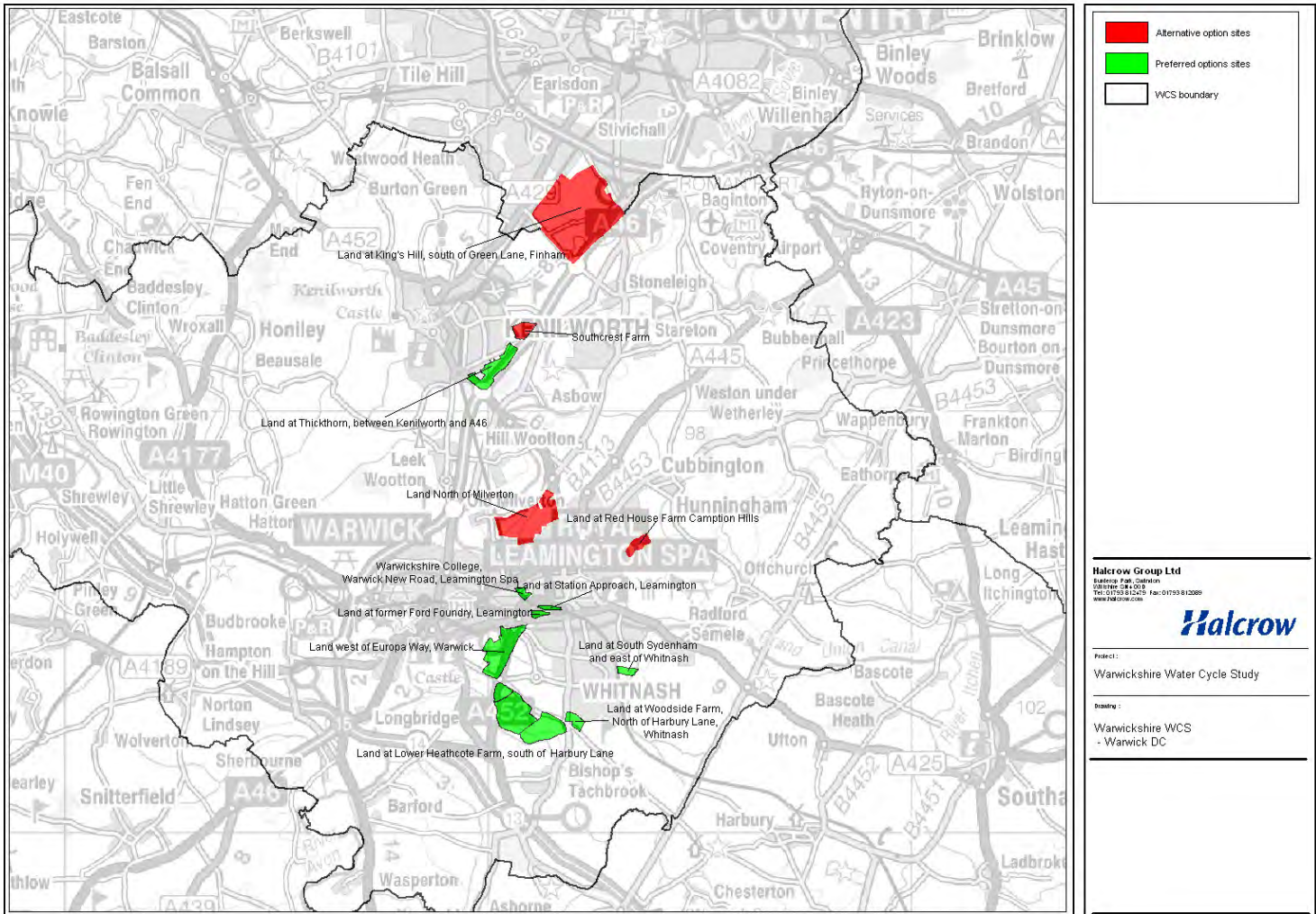


Figure 2-4 Growth locations in Warwick District



2.7 Development summary

A summary of the development requirements for the five local planning authorities within the Warwickshire sub-region can be found in Table 2-8. The WCS assessment will focus upon the sites of strategic allocation as specified by the LPAs, with testing for both RSS and higher development scenarios. Where no strategic allocation has been determined, settlements identified by the LPAs will be assessed to identify preferred locations for development.

Coventry City Council's Core Strategy has identified that up to 7,000 new homes may be required to outside of its administrative boundary, to meet the emerging RSS requirements. Of the 7,000 new homes, the WCS has the tested the implications of 3,500 being built in Nuneaton & Bedworth Borough Council, and 3,500 in Warwick DC.

Local Planning Authority	Stage of LDF	Preferred options identified	Remaining RSS allocation	Remaining RSS + higher development allocation
North Warwickshire	Issues and options consultation completed	No	2,691	4,691
Nuneaton and Bedworth	Issues and options consultation completed	No	7,800	9,700 (13,200*)
Rugby	Core strategy prepared	Yes	8,201	11,787
Stratford	Core strategy prepared	Yes	4,537	6,342
Warwick	Preferred Options consultation	Yes	8,100 (+ 3,500 overspill from Coventry)	13,750*

* Including overspill from Coventry.

Table 2-8 Summary of current LPA position and development requirements



3 Background information and methodology

3.1 Introduction

This chapter of the report outlines background information and the methodology adopted for each of the technical elements of the WCS.

3.2 Flood risk

3.2.1 Background

A review of flood risk management options during the early phases of a water cycle study is essential to ensure that:

- The risk of flooding from all sources to the development areas is considered and development is steered away from high risk areas (in particular, Flood Risk Zones 2 and 3).
- The potential impact of development proposals on catchment flood response is considered.
- Any flood risk mitigation measures are planned in a strategic, rather than unplanned fashion.
- There is no deterioration to existing communities' standard of protection.

The Water Cycle Study Guidance (Environment Agency, 2009) states that the output of the Outline water cycle study should answer the following question:

“Is there enough land available for development – without increasing flood risk or building vulnerable properties in flood risk areas?”

The water cycle study is not intended to replace site-specific flood risk assessments by developers. Instead, it identifies the potential for developers, local planning authorities and the Environment Agency to work together in providing strategic solutions that benefit the catchment as a whole.

The aims and scope of this flood risk and surface water assessment are therefore as follows:

- to review the findings of recent studies of flood risk in Warwickshire;
- to determine existing flood risk to the proposed development areas from all sources of flooding, in order to aid the local planning authority in selecting preferred areas;
- to identify the potential for strategic solutions to mitigate the effects of development and improve flood risk protection standards in the study area; and
- to identify if there are data or knowledge gaps that require a phase 2 detailed water cycle study.



3.2.2 Methodology

A number of studies have been undertaken within the study area assessing flood risk and providing flood risk policies. Studies on flood risk management in the relevant catchments are listed below. These have been reviewed as part of the work carried out for this water cycle study. It should be noted that much of this work is currently in progress, meaning that only draft reports or indicative findings were available to inform the outline water cycle study.

The documents available for review include:

- Final Level 1 Strategic Flood Risk Assessments (SFRAs) for the Districts and Boroughs of Warwickshire (January 2008)
- River Severn Final Main Stage Report Catchment Flood Management Plan (CFMP) (September 2008)
- River Trent Final Main Stage Report Catchment Flood Management Plan (CFMP) (September 2008)
- West Midlands Regional Flood Risk Appraisal (RFRA)
- Planning Policy Statement 25: Development and Flood Risk

For proposed strategic allocations (or preferred sites) in the study area, the hydrological analysis considered the existing flood risk to the development through an analysis of the Environment Agency's Flood Zone 2 and 3 maps and other sources of flood risk. The combined area of Flood Zones 2 and 3 within each proposed site allocation was calculated to determine the level of fluvial flood risk. For each proposed site allocation, an assessment was then undertaken to determine whether there is sufficient land at low flood risk (for the purposes of this study low flood risk is classified as land within flood zone 1) to accommodate the proposed housing allocation. The assumption was made that housing density would be 40 properties per hectare and a further 15% of the site will remain as open space. The SFRA was used to identify flooding from other sources at the strategic locations.

For non-strategic development within the study area a high level approach to the assessment has been undertaken. This has focussed on the key constraints and opportunities to development in relation to flood risk to help identify preferred settlements for development on the basis of flood risk and surface water management. A high level review of the Environment Agency's Flood Zone maps has been undertaken in relation to each settlement and its surrounding area to identify any major constraints to development. The Level 1 SFRA data has also been used to identify flood risk from other sources including surface water, groundwater and impounded water bodies (e.g. canals and reservoirs).

3.3 Surface water drainage

The surface water drainage assessment for the Warwickshire WCS has been carried out to:

- identify the types of Sustainable Drainage Systems (SUDS) which may be applicable for the proposed development locations;



- make policy recommendations about the use of sustainable surface water drainage techniques across the study area, and;
- identify the runoff rates and volumes required from strategic allocations to ensure that runoff rate and volume from the development site does not exceed greenfield runoff rates and volumes up to the 1 in 100 year rainfall event, plus an allowance for climate change.

3.3.1 Background

The effect of development is generally to reduce the permeability of a site. The consequence of this, if no measures are put in place, is to increase the volume of water and the peak flow rate from the developed site during and after rainfall event. Increases in the volume of water and the peak flow rate can cause flooding to occur both within a development site, and can increase flood risk downstream of the development.

The ethos of sustainable surface water drainage is to mimic, as far as possible, the surface water flows (volume and peak flow rate) from the site prior to development. This can be achieved through drainage infrastructure which can reduce the volume of water and peak flow rate from the development site; this drainage infrastructure has become commonly known as Sustainable Drainage Systems (SUDS). SUDS are used to reduce the peak flow rate and volume of water from a development site, and SUDS techniques can be used to improve the quality of surface water runoff and provide amenity and biodiversity benefits.

A SUDS management train should be adopted to manage surface water drainage sustainably and to mimic natural catchment processes as closely as possible. As a general rule, surface water should be managed as close to source as is practicable. The SUDS management train, illustrated in Figure 3-1 has four principle components (Source: SUDS manual C697, CIRIA 2007):

- **Prevention** - The use of good site design and site housekeeping measures to prevent runoff and pollution (e.g. sweeping to remove surface dust and detritus from car parks), and rainwater harvesting. Prevention policies should generally be included within the site management plan.
- **Source control** - Control of runoff at or very near its source (e.g. soakaways, other infiltration methods, green roofs, pervious pavements).
- **Site control** - Management of water in a local area or site (e.g. routing water from building roofs and car parks to a large soakaway, infiltration or detention basin).
- **Regional control** - Management of runoff from a site or several sites, typically in balancing ponds or wetland.

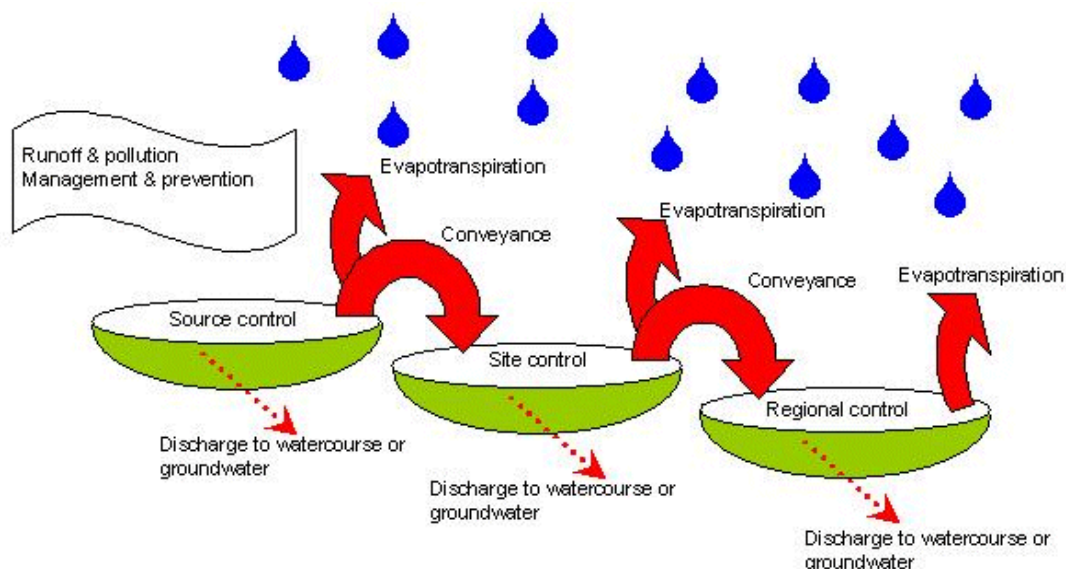


Figure 3-1 SUDS management train (http://www.ciria.com/suds/suds_management_train.htm)

Different sustainable drainage techniques will be applicable at different scales and for performing different functions. For small developments or extensions to the curtilages of existing properties, source control approaches will be more applicable and should be adopted to mitigate surface water runoff rate and volume. Evidence from the Integrated Urban Drainage pilot studies indicated that extensions to existing properties (also known as ‘urban creep’) can increase surface water flood damages as significantly as climate change. It is therefore critical to manage additional surface water runoff from urban creep. It is particularly challenging to manage urban creep effectively; this is often due to the lack of available space in high density urban areas to attenuate or infiltrate surface water runoff. The techniques which might work to reduce surface water runoff from ‘urban creep’ include:

- soakaways;
- pervious pavements, and;
- rainwater harvesting or water butts (which perform a limited function to reduce runoff).

In general, the policy to deal with urban creep should seek to reduce runoff, where possible using sustainable drainage techniques. Any additional surface water which is discharged to watercourse or sewer should be discussed with the Environment Agency and the sewerage company, respectively.

In larger development sites, the SUDS management train will be more applicable, and a series of source, site and regional drainage structures will be more applicable. Even in larger developments, source control measures should be encouraged and adopted before measures further down the train are adopted.

Sustainable surface water drainage should be adopted for all new developments (including redevelopment of brownfield land). Surface water runoff volume and peak flow rate from the development sites should not exceed greenfield runoff rate and volume up to and including the 100 year, 6 hour rainfall event (including an allowance



for climate change). In brownfield developments, it may not be possible to achieve greenfield runoff rate and volume, but a reduction in surface water runoff should be achieved after the redevelopment and developers should agree the surface water drainage requirements with the Environment Agency early on in the development application process.

The Floods and Water Management Bill has proposed significant legislative changes to the management of surface water. The Bill is currently undergoing Parliamentary Review, and may become an Act of Parliament in 2010. A summary of the key clauses in the Bill related to sustainable drainage is outlined.

- County council and upper tier authorities will become responsible for the adoption and maintenance of new build SUDS; new build includes all new development and redevelopment.
- County council and upper tier authorities will become the approving body for all new build SUDS. The requirements for approving new build SUDS will be outlined in forthcoming national standards on the construction and operation of surface water drainage.
- There will be a removal of the automatic 'right to connect' surface water drainage to the public sewerage network. New surface water drainage systems will need to be approved in line with the National Standards before any connection to the public sewerage network is made.
- The Bill outlines a hierarchy of approaches to manage surface water runoff. Preference is given to to infiltrating runoff, with drainage to a watercourse or sewer providing successively less desirable solutions.⁵

3.3.2 Methodology

The data and information used for this section of the outline WCS is outlined below:

- Environment Agency Groundwater Vulnerability maps (GIS);
- Environment Agency Source Protection Zones (GIS);
- British Geological Survey drift and bedrock geology (GIS);
- Nitrate Vulnerable Zones (GIS), and;
- Defra/EA Preliminary Rainfall Runoff Management for New Developments, R&D Technical Report W5-074/A/TR/1.

⁵ The ability of the ground to infiltrate runoff should be assessed through infiltration tests, and should not be based on geological maps. Geological maps are useful to provide a strategic assessment, but should always be confirmed by site specific tests.



The surface water drainage assessment for the WCS has identified the appropriateness of Sustainable Urban Drainage Systems (SUDS) for each proposed development locations in relation to the underlying geology, soil type and groundwater classification. It is the developer's responsibility to undertake the analysis required to provide the evidence base to prove that flood risk will not be exacerbated as a result of the development. This should be included within the planning application.

For the proposed strategic allocations a detailed assessment of drainage and SUDS requirements has been carried out. Approximate storage volumes and allowable runoff rates have been calculated for strategic development sites greater than 10ha. The calculation method is outlined in the joint Defra / Environment agency R&D technical Report "Preliminary rainfall runoff management for developments" (Environment Agency 2007). This method provides initial, conservative estimates of the increase in peak flow and volume of runoff from proposed developments⁶.

For each site the outputs provide indicative runoff rates and volumes to match existing greenfield runoff rates and volumes, and include:

- maximum runoff rate (l/s) required for 100 year event to manage runoff rate to existing rate – this is the rate of discharge required from the developed site to ensure that runoff rate is no greater than greenfield runoff rate;
- maximum long term storage discharge rate required – discharge from the attenuation storage is allowed to be discharged at 2 l/s/ha;
- total estimated storage required – the sum of the attenuation volume and attenuation storage (or long term storage), to ensure that both runoff rate and volume match the existing rate and volume;
- total maximum discharge rate from the developed site – the sum of the maximum runoff rate from the attenuation storage and the discharge from long term storage at 2 l/s/ha.

The percentage of total site area which will be taken up by storage, assuming no infiltration occurs, has been calculated to assess whether there is sufficient developable land in light of the surface water drainage storage requirements.

For non-strategic sites it is not possible to undertake a definitive assessment of surface water management and SUDS requirements. The assessment can be used to indicate where sustainable surface water management will be more readily achievable based on underlying geology, soil type and groundwater classification.

3.4 Water resources

3.4.1 Background – statutory water resources planning

The majority of public water supply to Warwickshire is provided by Severn Trent Water (STW). Supply areas are divided into six Water Resource Zones (WRZs), with Warwickshire lying predominantly within the Severn

⁶ Assumed that 15% of land is left as open space; 50% of land is developed (i.e. made impermeable) for purely residential, 75% of land is developed for mixed use, and 100% is developed for purely commercial development.



Resource Zone (WRZ3) which serves 95% of the study area population. Parts of North Warwickshire and Stratford are covered by STW's Birmingham Resource Zone (WRZ4) and South Staffordshire Water Plc, equating to 4.5% and 0.6% of the study area population respectively. The area served by South Staffordshire Water has been omitted from this study due to its small area of influence.

STW supplies water to 3.1 million households, around 7.4 million people. It also supplies 220,000 commercial and non domestic properties. 40% of water is supplied from direct river abstraction, 30% from groundwater boreholes or wells, and 30% from surface water reservoirs. We have assumed that the status quo will be maintained and that STW will remain responsible for the provision of water resources for the development areas within the study area. Other companies may supply water to development sites via Inset Appointments⁷, but this has not been included as part of the WCS assessment.

STW currently has a raw water reservoir capacity of 24700 Mega litres (ML), a total of 180 borehole sites ranging from 1ML/s to 30ML/d, and imports up to 345 ML/d from the Elan Valley Reservoirs and exports up to 60ML/d to Yorkshire Water Services Ltd. Treated water is provided by 17 major treatment works in the region of 2400 ML/d, with agreements with neighbouring undertakers to import up to 65 ML/d and export up to 12 ML/d.

The existing potable water supply network for Warwickshire is operated and maintained by STW within its Water Resource Zones 3 and 4. Water available for use in each WRZ is shown in Table 3-1.

Water Resource Zone	Population	Water Available for Use	Deployable Output	Distribution Input
Severn	2,377,000	611.8 ML/d	648.7 ML/d	641.9 ML/d
Birmingham	1,138,000	323.5 ML/d	343.9.0 ML/d	295.9 ML/d

Table 3-1 Resource Zone 3 & 4 Statistics 2006-07

The majority of Warwickshire falls within the Warwickshire Avon water abstraction catchment. The River Avon and its tributaries are located throughout this catchment and make up 15 surface water resources. There are also 7 groundwater sources in the catchment which support large abstractions for water supply in the area. There are approximately 1,500 licences in the catchment with 81% of the total licensed quantity used for public water supply.

Part of northern Warwickshire falls within the Tame, Anker and Mease abstraction catchment with surface water sources including the Rivers Tame, Anker, Cole and Trent. Groundwater sources include those at Nuneaton and Meriden. A number of rivers within this catchment are subject to large artificial influences as a result of dense population and industry, and the catchment is a net importer of water from the Elan Valley for public supply. Most licences issued are for the purpose of agriculture, though these volumes are small. The volumetric majority of licensed water abstraction is for industrial use (37.6%).

⁷ The inset appointment process is the route by which one company replaces the incumbent as the appointed water and/or sewerage company for a specified area. As such the replacement appointed water company will have all of the same duties and responsibilities as the previous statutory water company for the specified area. More information is available at <http://www.ofwat.gov.uk/legacy/aptrix/ofwat/publish.nsf/content/insetappointments1205.html>



Although the STW Resource Zones may be treated as separate entities, there are a number of water connections between these zones. This Strategic Water Grid provides flexibility, enabling water to be moved around the region dependant upon supply and demand.

Environment Agency Water Resource Management

The Environment Agency manages water resources at a local level through Catchment Abstraction Management Strategies (CAMS), which are prepared on a 6 yearly cycle.

Within the CAMS, the Environment Agency's assessment of the availability of water resources is based on a classification system which states the perceived resource availability status, indicating:

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

The categories of resource availability status are shown in Table 3-2 below. The classification is based on an assessment of a river system's ecological sensitivity to abstraction-related flow reduction.

Indicative Resource Availability Status	Licence Availability
Water available	Water is likely to be available at all flows including low flows. Restrictions may apply.
No water available	No water is available for further licensing at low flows. Water may be available at high flows with appropriate restrictions.
Over-licensed	Current actual abstraction is such that no water is available at low flows. If existing licences were used to their full allocation they could cause unacceptable environmental damage at low flows. Water may be available at high flows with appropriate restrictions.
Over-abtracted	Existing abstraction is causing unacceptable damage to the environment at low flows. Water may still be available at high flows with appropriate restrictions.

Table 3-2 CAMS Resource Availability Status Categories

This classification can be used to help assess the potential for additional water resource abstraction opportunities.

Within the study area there are two main abstraction catchments, the Warwickshire Avon CAMS, the majority of which lies within WRZ3; and the Tame, Anker and Mease CAMS, which covers WRZ4 and the north east of WRZ3.



The overwhelming majority of the resources in these areas are classed as “No Water Available” and are forecast to remain so to 2018. This leaves no water available for further licensing at low flows and places restrictions on abstraction during high flows.

There are a number of other CAMS located on the fringes of the Warwickshire boundary, namely Sour, Cotswolds and Cherwell. Due to their small areas of influence these have been omitted from this study.

WRZ4 lies predominantly within the Tame, Anker and Mease CAMS and any abstraction within the zone will be limited to the prescriptions within this CAMS. WRZ3 is large with approximately 2/3 of its area lying outside the Warwickshire Avon CAMS. Therefore water supplied by WRZ4 to Warwickshire may not be abstracted from the Warwickshire Avon CAMS.

The flexible nature of the Strategic Water Grid and its import/export capability between WRZs show that water supply within the study area is not dependant on abstraction within the area, and is a product of the overall WRZs deployable output and supply links between WRZs. This is further detailed within Severn Trent Water Resource Management Plan 2009 (WRMP09).

Figure 3-2 shows the Environment Agency’s assessment of the relative water stress throughout England, and it can be seen that the water resources in the Warwickshire area are under moderate stress, with some surrounding areas under serious stress. The effects of climate change are likely to further reduce supply and could increase demand.

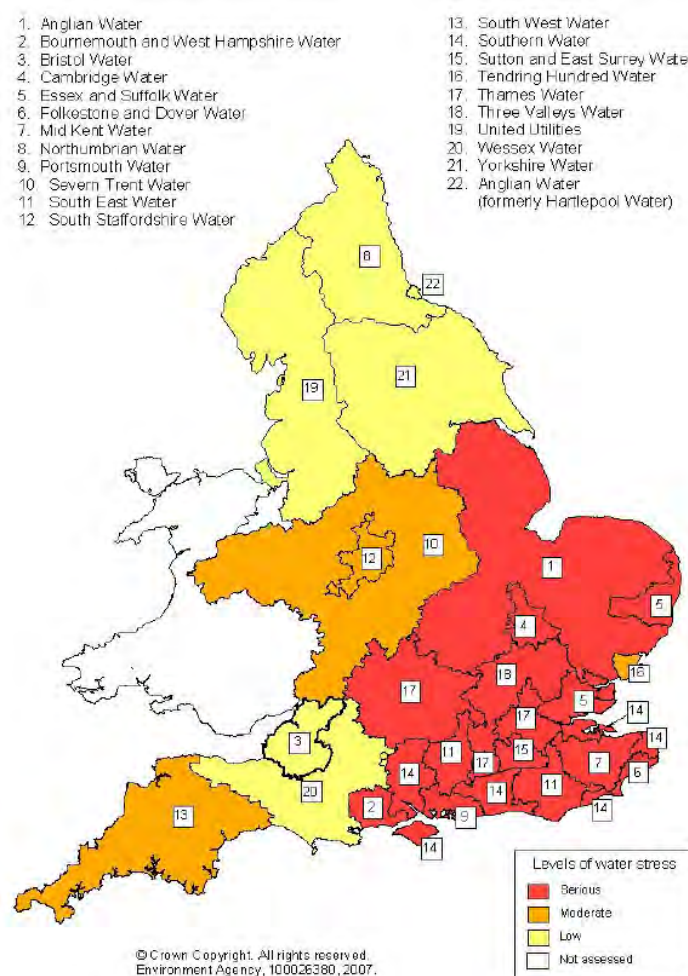


Figure 3-2 Map of Areas of Relative Water Stress (source: Areas of Water Stress, Final Classification; Environment Agency)

Water Company Planning

As the appointed water company, STW has a responsibility to provide sufficient quantity and quality of water to meet the needs of its customers, whilst also minimising their impacts on the environment. This responsibility also applies to new customers and population growth, as well as changing demands within the existing customer base and so must be comprehensively planned for.

All water companies have a duty to produce water resources plans covering the next 25 years. These plans set out how companies intend to provide sufficient water to meet their customers' needs. Although not previously compulsory, companies have prepared 25 year water resource management plans on a voluntary basis, and shared these with the Government and regulators, since 1999. On 1 April 2007 these plans became compulsory under changes to the Water Industry Act 1991, and this year for the first time they are also subject to public consultation before they are finalised.

Information regarding the strategic water resources for the study area has been obtained from the STW draft Water Resources Management Plan 2009 (WRMP09), released for public consultation in 2008. The final documents are to be submitted late 2009 and it should be noted that the strategies and conclusions may vary



from the draft to the final submission. As this WCS coincides with the preparation of STW's new WRMP, the information used for the WCS is the most comprehensive and up-to-date possible. This also means; however, that the information remains subject to change pending the outcome of the final WRMP.

Whilst strategic plans for meeting future demand over a 25 year period are set out in the WRMP, detailed design of schemes is not undertaken until works have been granted funding by Ofwat.

Any improvements to the water services infrastructure needs to be programmed into a water company's capital programme, which runs in five year Asset Management Plan (AMP) cycles. We are currently in transition between the AMP4 period (2005-2010) and AMP5 period (2015 – 2020) and water companies have recently received the final determination of their business plan by Ofwat, which determines its allowable capital expenditure for AMP5 (2010-2015). This funding cycle and its associated constraints can have implications for the phasing of development, and it is important that water companies are involved in the planning process to ensure that infrastructure can be provided in time.

3.4.2 Background –national, regional and local policies on demand management National Policy

The Government's new water strategy for England, *Future Water* was published February 2008. *Future Water* outlines a strategic and integrated approach to the sustainable management of our water resources to 2030, for the public water supply as well as for the provision of healthy ecosystems and the services they provide.

The Vision by 2030 includes the following measures:

- Reduced per capita consumption of water through cost effective measures, to an average of 130 litres per person per day (l/p/d) by 2030 or possibly even 120 litres per person per day depending on new technological developments and innovation
- Amend the Building Regulations to include a requirement for a minimum standard of water efficiency in new homes. The requirement will be in the form of a calculated whole building performance standard set at 125 litres per day (l/p/d).
- In areas of serious water stress it is believed that near universal metering will be needed by 2030.

In response to the Strategy the Environment Agency have stated that in water stressed areas the introduction of universal metering needs to be undertaken earlier. The Environment Agency would like to see the majority of households in areas where water is scarce to be metered by 2015 with the remainder in water scarce areas being metered by 2020. The Environment Agency also wish to promote the metering of all new properties, including flats.

Code for Sustainable Homes (CSH)

The Code for Sustainable Homes introduces a step-change in sustainable development and forms a basis for future developments to the Building Regulations. As of May, 2008 the Government has made it mandatory that all new homes have a rating against the Code for Sustainable Homes. The Code measures the sustainability of a new home against nine categories of sustainable design, rating the 'whole home' as a complete package. The



Code uses a 1 to 6 star rating system to communicate the overall sustainability performance of a new home. The Code sets minimum standards for energy and water use at each level.

The relevant sections in relation to the water cycle study are:

- Water Efficiency;
- Surface Water Run-off; and
- Energy / CO₂ (relating to heating water).

A minimum requirement for each of the nine categories is necessary to achieve the base rating of Level 1. Beyond this, threshold values must be attained for both 'Water' and 'Energy' to achieve higher code levels. Hence to achieve for example Code Level 3, the requirements for both carbon and water efficiency must be achieved in addition to the minimum points system requirement. Points may be awarded in the other sustainability categories for initiatives and measures implemented beyond the base level requirement for Code Level 1.

Table 3-3 defines the Carbon and Water Efficiency requirements for each Code Level rating. This assumes the basic entry requirements are met for the other six categories.



Achieving a sustainability rating					
Minimum Standards					
Energy			Water		
Code Level	Standard (Percentage better than Part L' 2006)	Points Awarded	Standard (litres per person per day)	Points Awarded	Other Points* Required
1(★)	10	1.2	120	1.5	33.3
2(★★)	18	3.5	120	1.5	43.0
3(★★★)	25	5.8	105	4.5	46.7
4(★★★★)	44	9.4	105	4.5	54.1
5(★★★★★)	100 ²	16.4	80	7.5	60.1
6(★★★★★★)	A zero carbon home ³	17.6	80	7.5	64.9

Notes

1. Building Regulations: Approved Document L (2006) – 'Conservation of Fuel and Power.'
2. Zero emissions in relation to Building Regulations issues (i.e. zero emissions from heating, hot water, ventilation and lighting).
3. A completely zero carbon home (i.e. zero net emissions of carbon dioxide (CO₂) from all energy use in the home).
4. All points in this document are rounded to one decimal place.

Table 3-3 Code Level requirements for energy and water efficiency

(Source: Code for Sustainable Homes – A Step Change in Sustainable Home Building Practice. Crown Copyright, 2006.)

All new social housing already has to be built to CSH level 2, and the Water Act 2003 places a requirement on LPAs to take steps wherever practicable to encourage the conservation of water. It should be noted that to attain Code Level 3, a home must satisfy the criteria for carbon AND water efficiency. The reduction in use of heated water can therefore contribute towards achieving higher targets for both carbon and water efficiency.

The Environment Agency recommends that measures are adopted to allow the efficient use of water in all new homes with water efficiency set at 105 litres per head per day (i.e. level 3/4 for water within Code for Sustainable Homes) or better.

Regional Policy

Under the Water Act 2003, (part 3 sections 81 & 83), relevant authorities must, where appropriate, take steps to encourage the conservation of water. Warwickshire is covered by the West Midlands Regional Spatial Strategy (RSS) which will guide policy until 2026. The initial strategy (formerly RPG11) published in 2004 has undergone public examination and is awaiting the secretary of state proposed changes. The draft RSS policy relating to water resources is as follows, subject to amendment within the RSS phase 2 revision.



Policy

Policy QE9: The Water Environment.

- A. Development plan policies and plans of the Environment Agency and other agencies should be coordinated, where necessary across local authority and Regional boundaries, to:
- i) protect or improve water quality and where necessary significantly reduce the risk of pollution especially to vulnerable surface and groundwater in order to improve health and well-being;
 - ii) manage demand, conserve supply, promote local recycling of water and the multiple use of water resources;
 - iii) protect and enhance wetland species and habitats, particularly those subject to local biodiversity partnerships;
 - iv) ensure that abstraction from watercourses and aquifers does not exceed sustainable levels;
 - v) reduce any adverse effects of development on the water environment by encouraging consideration of sustainable drainage systems where appropriate at an early stage in the design process;
 - vi) ensure the timing and location of development respects potential economic and environmental constraints on water resources; and
 - vii) maintain and enhance river and inland waterway corridors as key strategic resources, particularly helping to secure the wider regional aims of regeneration, tourism and the conservation of the natural, built and historic environment.
- B. Development that poses an unacceptable risk to the quality of groundwater or surface water in this or other regions should therefore be avoided.

The RSS continues to state that in preparing development plans, local authorities should take advice from the Environment Agency, at the earliest possible stage, on the implications for their plans of the Water Framework Directive, which is being implemented progressively from 2003. In particular they should seek advice from the Environment Agency on those areas in the region most at risk from over abstraction and pollution, and where these are already detrimental to the environment. Development plans should also promote the efficient use of water in order to maximise the use of existing supplies.

Local Authority Policy

The draft West Midlands RSS phase 2 revision sets out sustainable design and construction policy (policy SR3) for LPAs to ensure that all new buildings are designed and constructed to the highest possible environmental standards. It requires that all new homes meet the Code for Sustainable Homes level 3, of 105 litres per head per day, with consideration given to meeting level 6, 80 litres per head per day, by 2016.



3.4.3 Methodology

The assessment of water resources is not intended to replace the work already undertaken as part of STW's statutory planning carried out for the WRMP. For the WCS a thorough review has been undertaken of the WRMP which provides an indication of the current and planned water available based on evidence from both STW and the Environment Agency.

Further to the analysis of the WRMP, the implication of reducing demands for water through demand management measures has been assessed. This has been carried out to assess the effectiveness of reducing demand for water in both the new and existing housing stock. As part of the WCS, six demand management scenarios have been assessed, and these are further discussed in chapter 4. Policies which can be adopted by the local planning authorities to reduce water demand from the new and existing housing stock have been assessed and included in the report.

3.5 Wastewater infrastructure

3.5.1 Background

The wastewater that we produce from our homes and our businesses is collected by the drainage system below ground from where it is transported by gravity or via pumping to wastewater treatment works. This drainage system is known as the sewerage system, and can be either a separate or combined sewerage system.

A separate system comprises a foul system which conveys wastewater or foul drainage only to the wastewater treatment works, and a surface water system that collects roof and highway runoff and discharges the clean runoff into rivers and coastal waters. Combined systems collect both rainfall runoff and foul water, and in times of very heavy rainfall can be at risk of being overwhelmed and causing dilute sewage to flood above ground. Where this is the case, the combined system will have what is known as a combined sewer overflow (CSO).

A CSO acts as a relief valve during times of very heavy rainfall and allows dilute storm sewage to be discharged into river and coastal waters. The design of such overflows ensures that discharges only occur during times of very heavy rainfall when there is sufficient dilution in the receiving water to ensure the discharge does not cause pollution or environmental damage.

New residential developments that connect to the existing sewerage system can cause an increase in foul flooding and surface water flooding, and an increase in discharges from combined sewer overflows in combined sewerage systems, therefore it is important to understand the nature and capacity of the downstream sewerage system when allocating land for development.

Incapacity in the sewerage system is unlikely to be an absolute showstopper to development; where there is incapacity, upgrades to the existing sewerage system or new strategic sewer mains can provide additional capacity, subject to funding being provided. However, the time required to plan, finance and deliver sewerage upgrades depends on the length of upgrade required, and the land use below which the existing or new system would drain. Major upgrades through the existing urban area can cause significant disruption within the existing urban area and hence take longer to plan and deliver than new strategic systems through greenfield land. However, new strategic solutions can be significantly more costly.

Severn Trent Water is responsible for the operation and maintenance of the existing foul drainage network and wastewater treatment facilities within the study area. Water companies have a legal obligation under Section 94 of



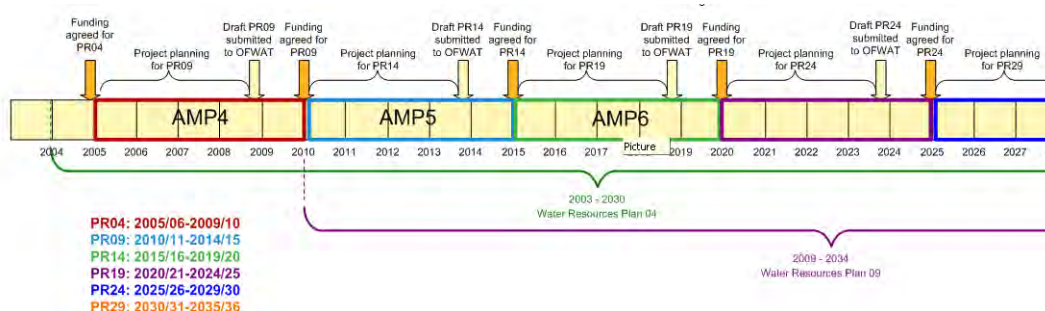
the Water Industry Act 1991 to provide additional capacity as and when required. It is commonplace for a developer to use the power of requisition under section 98 of the Water Industry Act 1991 to require a sewerage undertaker to provide a new public sewer to serve its development. The sewerage undertaker has powers to deliver new sewers over third party land and the developer has to cover the whole cost of both providing the new infrastructure and upgrading the existing system to cope with the additional demands that will be placed upon it.

Perhaps less well known, until recently, was the right of a developer to connect into an existing public sewer under section 106 of the same Act. This right is useful where new development takes place next to an existing public sewer and, crucially, the developer cannot be required to pay for anything more than the cost of the connection into the existing sewer. Nevertheless it is important that development proposals are discussed with the relevant water company at the earliest possible opportunity to ensure that the appropriate wastewater infrastructure is in place in a timely manner.

Assessing the available headroom at any particular treatment works is problematical. This is because, typically, flows to the works vary with time, particularly in relation to changes in trade discharges. Thus, an exact evaluation of spare capacity at any particular works is not possible. In addition to this, the forthcoming introduction of the Water Framework Directive (WFD) may lead to a tightening of discharge consents.

Limited information on wastewater treatment works and network capacity has been available to support the WCS, and this is recognised as a limitation on the findings of the study. It has been possible to identify where further, more detailed wastewater capacity assessments might be required. It is critical that early consultation between the local planning authority and the sewerage undertaker occurs, to ensure timely and adequate provision of wastewater infrastructure.

Any improvements to the treatment works will be programmed into the water companies' capital programme, which runs in five year Asset Management Plan (AMP) cycles. We are currently in the AMP4 period (2005-2010) and the water companies have prepared their draft business plans, to determine their regional capital expenditure for AMP5 (2010-2015). This funding cycle and its associated constraints may have implications for the phasing of development. Early consultation with water companies is required to support their capital expenditure programme for AMP6 and beyond. If required, investment which has not been included in the capital expenditure programme can occur (e.g. investment in AMP5 which has not been planned for), and the water companies can reclaim the expenditure as part of their AMP6 programme.





3.5.2 Methodology

The assessment of wastewater infrastructure capacity has been carried out in close consultation with STW. STW has provided the information to inform the WwTW capacity assessment. With regards to infrastructure capacity at the WwTW the methodology adopted is outlined below:

- identify which WwTW will be affected by proposed development, and identify the proposed number of houses which will drain to each WwTW;
- estimate the existing population equivalent (PE) at each WwTW affected by growth;
- estimate the additional PE which would drain to each WwTW due to growth (where additional PE is calculated by number of houses * occupancy rate of 2.3 people per house);
- STW has indicated the current hydraulic and treatment process capacity at each WwTW – this was used to identify when capacity might be reached at a WwTW, and;
- STW has subsequently indicated whether there are any constraints to upgrading the WwTW.

With regards to the wastewater infrastructure network capacity, STW has undertaken a strategic assessment of the key constraints to development. This has included an assessment of known flooding problems, existing combined sewer overflows, and strategic trunk sewer and pumping station capacity, which may be affected by growth. STW has also identified locations where capital investment schemes are likely to occur over the next 2-3 years, and which may resolve existing capacity issues in the identified catchment.

For all new developments, it has been assumed that foul flows only will be connected to the sewer system; this assumes that all surface water is not connected to the sewer system and is managed through separate systems (e.g. SUDS). It is recommended that foul flows and surface water flows are kept separate for all new developments, although it is recognised that in some brownfield locations there may be no alternatives other than to discharge surface water to the sewer network.

3.6 Water quality

3.6.1 Background

A review of water quality is required during the development process to ensure that development does not adversely affect water quality, and does not hinder the ability of a water body to meet the WFD.

Development can adversely affect water quality in two principal ways:

- increases in final effluent load from WwTW which causes a deterioration of water quality, and;
- increases in intermittent discharges from combined sewer overflows (CSOs), pumping stations, and storm tanks at WwTW – the potential for development to affect the operation of overflows has been assessed as part of the wastewater assessment.



The future expansion potential of a wastewater treatment works with respect to water quality is determined by assessing the discharge consent, set by the Environment Agency. This consent is based on the ecological sensitivity of the receiving watercourse and specifies a maximum flow and a minimum effluent quality that the WwTW has to achieve to meet water quality targets without causing environmental damage.

As the population connected to a sewage treatment works increases, the amount of treated wastewater (or effluent) being discharged to the receiving water generally increases in proportion to the population increase. When this increased population causes the treatment works to exceed the current consented maximum discharge volume allowed by the Environment Agency consent, improvements are likely to be required to the treatment works to improve the standard of treatment and to ensure river quality does not deteriorate.

The quantity of treated effluent discharged from each treatment works and its quality is specified by the legal discharge consent, issued by the Environment Agency under the Water Resources Act 1992. The consent is normally based upon the dry weather flow (DWF) of the treated effluent, and stipulates limits for the concentration of biochemical oxygen demand (BOD), total suspended solids (TSS) and ammoniacal nitrogen (NH₃). Compliance is determined by means of statistical analysis of effluent quality data. To this end the DWF and quality of discharge from a WwTW forms the “planned water quality”; that is the water quality the Environment Agency would expect if the WwTW was discharging at its DWF and discharge consent. The planned water quality has typically been based on the River Ecosystem Classification of a river reach.

In the foreseeable future, consent limits will be set with a view to meeting the requirements of the Water Framework Directive (WFD) whose aim is to ensure that good river quality standards are met throughout each waterbody (a detailed overview of the WFD is provided in Appendix A). The intention is to set the discharge consent limits based upon the quality and volume of the receiving watercourse and the volume of wastewater effluent at the point of discharge. However, the means of applying these principles to an individual discharge when upstream quality is already unsatisfactory, or when upstream flow provides inadequate dilution to maintain “good” quality status using best available techniques (BAT) for treatment, is presently unclear.

3.6.2 Methodology

The data used for this section of the WCS has been sourced from the following locations:

- Receiving water – Severn Trent Water and Environment Agency
- Current WwTW quality consents – Severn Trent Water and Environment Agency
- Measured DWF – Severn Trent Water and Environment Agency
- Consented DWF – Severn Trent Water and Environment Agency
- Housing numbers/employment land info – Local Planning Authorities
- WFD classifications – taken from the Environment Agency WFD mapping



- Per Capita Consumption, infiltration, people per dwelling – Severn Trent Water

To assess the environmental impact of growth we have assessed the maximum number of houses likely to be connected to each WwTW to assess whether a new consent would be required due to growth. The methodology employed is outlined below.

- calculate current measured DWF at each WwTW based on 20%ile flows provided by the Environment Agency;
- calculate the proposed increase in DWF to each WwTW due to proposed growth, based a per capita consumption of 120 litres/per head/per day, allowance for infiltration of 40%⁸, and occupancy rate of 2.3 people per house, and;
- compare the revised DWF due to growth with the current consented DWF and identify whether growth is likely to cause a breach of current consented DWF (up to 2026).

If growth will not cause a breach of the current consented DWF then it is fair to assume that there will not be deterioration of planned water quality (that is the water quality the Environment Agency expects if a WwTW was discharging at its DWF and discharge consent). Even if growth will not cause breach of consented DWF at the WwTWs there may need to be tightening of discharge consents at the WwTWs to help meet the more stringent environmental standards required by the WFD. However, the purpose of the water quality assessment in a WCS is to identify where development may cause deterioration of water quality; the WCS does not consider the wider implications of meeting the WFD, which is beyond the scope and purpose of a WCS.

For those WwTWs which breach the current flow consents with the proposed growth up to 2026, a load standstill calculation has been undertaken. The load standstill calculation identifies the consents required at the WwTW to ensure no overall increase in load to the receiving watercourse with growth (where load = flow * concentration). These calculations provide an estimate of the quality consent required to prevent a deterioration of the WwTW discharge. They are not based on the requirements of the river (also known as “river needs consent” or RNC), but will ensure that there will be no deterioration of water quality. It should be noted that load standstill calculations can only be carried out where there are existing discharge consents, and has only been assessed for BOD and ammonia. Given the majority of WwTW do not have current phosphate consents, an assessment of no deterioration was undertaken using the following method:

- identify the nearest sampling point downstream of the WwTW and identify the observed phosphate quality;
- based on the observed phosphate downstream of the WwTW identify what WFD classification current observed phosphate falls into (e.g. high, good, moderate, poor);

⁸ In new development infiltration is likely to be quite low, but over time this is likely to increase due to misconnections and deterioration in pipes which will allow water to get into the foul system



- based on the current WFD classification identify the 'target' phosphate to ensure no deterioration of class;
- identify the observed river flows and phosphate quality upstream of the WwTW, and;
- run a mass balance calculation to identify what consents would be needed at the WwTW to ensure no deterioration of WFD class downstream of the WwTW, with growth up to 2026.

Further to the load standstill calculation, an assessment has been made to establish the likely consents required to meet good WFD status. This analysis has been done using the Environment Agency River Quality Planning (RQP) toolkit), which is used to calculate the WwTW discharge consent to meet a specified target (in this case good status). The following information has been inputted to the RQP calculations:

- river flow upstream of the WwTW has been taken from the Environment Agency regional SIMCAT models (mean and low flow);
- river quality upstream of the WwTW has been assumed to be at mid-point of 'good status' – this assumes that all sources of pollution upstream of the WwTW have been addressed and this allows an assessment to be made of the discharge consents from the WwTW to 'play its part' in meeting WFD good status;
- future DWF from the WwTW (2026) is the sum of the current measured DWF and the future calculated DWF, and;
- WFD good status targets have been taken from the UKTAG standards (http://www.wfduk.org/UK_Environmental_Standards/LibraryPublicDocs/UKTAG%20ReportAug%202006UKEnvironmentalStandardsandConditionsFinalReport).

It is important to note that the no deterioration assessment and analysis of standards to meet good status are separate mechanism. Where it is not demonstrated that growth can achieve no deterioration of water quality without exceeding the limits of conventional treatment (also known as Best Available Technology [BAT]), this would represent a potential barrier to growth. With respect to achieving good status, it should be demonstrated that growth will not make it more difficult to achieve good status.

The methodology used to assess the growth and the WFD has been based on the Environment Agency document "Considering the Water Framework Directive in WCSs" (November 2009). A copy of this document has been provided in Appendix B.



4 Assessment of Warwickshire water resources

4.1 Overview

The WCS has collated the latest information on water resources from Severn Trent Water's draft Water Resource Management Plan (dWRMP) to identify significant water resource constraints across the study area. Further scenarios have also been examined, and a road map has been identified towards more sustainable use of water resources.

STW released their draft Water Resources Management Plan 2009 (WRMP09) for public consultation in 2008. Subsequent to comments received on the draft, STW released a Statement of Response (SoR), which summarises proposed changes to be made for the final WRMP09 due to be published in 2010. The information within this WCS and the Demand Scenarios examined are based upon the information provided within the draft WRMP09. Detailed data concerning the final planning approach for the final WRMP09 was not available at the time of writing and thus the Demand Scenarios tested are based upon final planning tables from the draft WRMP09 and do not include proposals from the SoR. It should be noted that as information remains subject to change, strategies and conclusions may vary from the draft to final submission version of the WRMP09.

4.2 Severn Trent Water Resource Strategy

4.2.1 Current

Within WRMP04 STW identified a number of shortfalls in water resource capacity affecting their ability to meet target levels for the Severn Zone (WRZ3). A strategy was developed for implementing investment schemes during AMP4 which would remove this shortfall by 2010. Progress was made towards meeting the 2010 targets but a key component scheme for the Severn Zone which would have provided the required capacity was deferred until later in the 25 year planning scheme. Problems were associated with obtaining an increase in abstraction license for a 30Ml/d river intake and Water Treatment Works (WTW) at Ombersley near Worcester.

The WRMP04 strategy for the Birmingham Zone (WRZ4) involved investment proposals to create a more integrated strategic grid, benefiting deployable output (DO) for both WRZ3 and WRZ4, and is on target for completion by the end of the AMP4 period. Table 4-1 below provides information for the current and predicted situation in the WRZs of interest.

		Severn WRZ3		Birmingham WRZ4	
Description	UNITS	Scenario Year 2006-07	2009-10	Scenario Year 2006-07	2009-10
Deployable Output	MI/d	648.46	658.46	330.00	344.33
Potable Water Imported	MI/d	15.00	35.00	0.00	0.00
Potable Water Exported	MI/d	0.00	0.00	0.10	20.10
Unmeasured Household - Population	000's	1,653.48	1,590.07	932.41	906.05
Measured Household - Population	000's	682.12	791.81	188.59	232.95
Unmeasured Household - PCC	l/h/d	147.72	146.21	148.37	145.93



Measured Household - PCC	l/h/d	128.55	131.70	121.09	125.52
Total Leakage	MI/d	165.61	162.46	77.66	76.58
Supply-Demand Balance	MI/d	-51.66	-21.70	15.54	11.30

Table 4-1 Information from STW draft WRMP09 Tables

Metering

Metering by 2006-07 in the STW region was 28%, which is ahead of the meter penetration projected in WRP04. No policy is currently in place for compulsory metering of existing homes, though there are plans for the 2010-2015 period to meter households on a “change of occupier” basis in a number of WRZs, where options for long term resource development are limited. The baseline assumption is that at a minimum, current levels of free water meter uptake will continue and a penetration of 66% of households will be reached by 2035.

Over the last 10 years there has been a 3% increase in household demand and a 14% decrease in commercial demand, thus despite a growing population total demand has remained approximately stable. A number of consumer demand management activities are currently employed by STW:

- Free cistern displacement devices.
- Discounted water butts and rain saver kits.
- Targeting of top 250 commercial and industrial users in efforts to raise water efficiency awareness.
- Trials on retrofitting water efficient devices.
- Numerous education programs.

Leakage

Leakage is currently estimated at 27% of treated water. There have been various measures undertaken through the AMP4 strategies to drive down leakage such as:

- Improving leakage control processes and use of technology.
- Accountability zones to improve leakage reporting.
- Water main replacement.
- Installation of continuous pressure monitoring.
- Subsidised pipe repairs/replacement.



Projections for leakage targets as agreed with OFWAT for 2010 are 171Ml/d for the Severn Zone WRZ3 and 72Ml/d for the Birmingham Zone WRZ4. Baseline projections for leakage are based on the maintenance of these figures for the 25 year scenario and assumes neither improvement nor deterioration. Existing household underground supply pipe leakage (USPL) has been assumed to be 44l/p/d for projections, and is consistent with that reported in STW's 2007 June return. New households are predicted to have negligible USPL.

Strategic Water Grid

Around 75% of STW customers are linked by a strategic treated water transfer grid composed of a series of large diameter pipes that run from Derbyshire southwards through Leicestershire and Birmingham and into Warwickshire, Worcestershire and Gloucestershire. The nature of this grid is that water can be imported or exported around the STW region dependant upon varying demand or production. Current imports and exports can be found in Table 4-2.

	Severn WRZ3		Birmingham WRZ4	
	Ml/d	to/from	Ml/d	to/from
Potable Water				
Import from:	20	WRZ4	0	-
	15	WRZ6		
Export to:	0	-	20	WRZ3
Accountable in DO				
Import from:	5	WRZ6	31	WRZ3
	24	South Staffs Water		
	6	WRZ4		
Export to:	1.76	WRZ5	6	WRZ3
	0.39	WRZ2	0.1	South Staffs Water
	4	WRZ1		
	31	WRZ4		

Table 4-2 Imports and Exports

4.2.2 Baseline Forecast

In producing the draft WRMP09, STW have looked at the current supply-demand balance and predicted future supply-demand balance. The planning scenario addressed is a dry year annual average supply-demand scenario as prescribed within the EA's Water Resource Planning Guidelines (WRPG). This baseline scenario demonstrates what the supply-demand outlook would be based on STW projected changes to future demand and water available for use (WAFU), assuming no change to current AMP4 demand management and leakage policies, and depicts a hypothetical situation where every year is dry year up to 2035 with unrestricted demand. The baseline and forecast DO from the WRZs serving the study area can be found in Table 4-3 below. The major forecast reduction in DO is due to predicted groundwater quality deterioration and climate change.



Water Resource Zone	DO WRMP04 (Ml/d)	Baseline DO WRMP09 (Ml/d)	DO at 2035 (Ml/d)
Severn (WRZ3)	644.1	658.5	638
Birmingham (WRZ4)	329.6	344.3	331.1
Total	973.7	1002.8	969.1

Table 4-3 Baseline and Forecast Deployable Output

Climate Change

In forecasting future baseline DOs and demand within the draft WRMP09 STW have factored the possible impacts of climate change as per the EA's guidelines. These impacts have been found to be significant in a number of WRZs. An increase of 1.8% in consumption has been put forward by the research for this scenario which STW have spread evenly over 27 years from 2003-03 to 2029-30. STW have expressed a lack of confidence in the results of applying the prescribed climate change methodology which results in a significant deterioration in supply-demand balance during AMP5 for a number of its WRZs, including the Severn area. STW intend to carry out more detailed assessments to understand the causes of associated impacts and develop appropriate investment responses for the final version of WRMP09. Uncertainties of the impacts have been included within the headroom assessment for the draft WRMP09.

Water Quality

A major forecast reduction in DO continues to be due to groundwater quality deterioration. STW's analysis indicates that there are uncertainties concerning increasing concentration of nitrates in many groundwater sources, mostly due to agricultural practices. Future projections are that output from several sources may be lost or severely reduced due to nitrate loadings. Nitrate problems may be managed over time and a degree of risk has been included within the AMP5 supply-demand balance. Due to the uncertainty of the long term impacts of nitrate contamination on DO, the uncertainties have only been factored into headroom requirements to 2020, with reviews to be undertaken during each successive AMP. Funding for possible investments required to mitigate nitrates will be through the STW Quality Programme, and proposed solutions presented within STW's Business Plan.

Sustainable Abstraction

The EA program Restoring Sustainable Abstraction (RSA) has a potential to impact future DO. The aim of the programme is to investigate impacts on the environment due to abstractions of water, and where such impacts arise, the possible reduction of the abstractions or other mitigating schemes. Potential reductions have been incorporated into the STW baseline planning assumptions for draft WRMP09 and amount to around 11Ml/d by 2015. The majority of investigations have yet to reach the stage where sustainability reductions can be defined, though these will be progressed for as much inclusion as possible within the final WRMP09.

Population and Consumption

In forecasting water demand future housing growth rates have been derived from Regional Spatial Strategies (RSS) affecting the region, population growth estimates from the Office of National Statistics and Designated



Growth Points as announced by the Department for Communities and Local Government. STW express some uncertainty within these figures, where RSS projections show an increase of over 30% in new connections, compared with those seen by STW over the last 10 years. This uncertainty has been included in the supply-demand headroom assessment. Household populations and water consumption have been predicted to change over the forecast period as shown in Table 4-4.

Water Resource Zone	Unmeasured			Measured		
	Population Numbers			Population Numbers		
	(Household consumption Ml/d)			(Household consumption Ml/d)		
	2006/07	2014/15	2034/35	2006/07	2014/15	2034/35
Severn	1,653,479 (244.25)	1,467,245 (210.07)	1,037,842 (135.01)	682,115 (87.68)	956,756 (129.61)	1,552,066 (229.28)
Birmingham	932,414 (138.34)	825,887 (120.9)	634,008 (79.65)	188,593 (22.84)	307,130 (39.96)	610,211 (84.81)

Table 4-4 Population and Consumption for Unmeasured and Measured Households

Changes in behaviour and other factors such as emerging technology partially offset the expected increase in household consumption. The net result on total water delivered trends in the WRZs is a small increase from the base year to end of forecast period.

Outage and Water Available for Use (WAFU)

For their WRMP09, STW have adopted a risk-based approach to assessing outage and target headroom uncertainty to derive an overall probability of supply-demand balance up to the end of the 25 year forecast period. This is based on the methodology outlined by UKWIR and seeks to derive an overall probability of supply-demand balance sufficiency.

Outages were calculated using the 80th percentile values of outage probabilities, giving outages of 2.96% and 0.88% of total DO for WRZ3 and WRZ4 respectively. The resulting impact on WAFU is shown in Table 4-5 below. The majority of outages forecast are planned maintenance at WTWs, though pollution at rivers is significant in Birmingham WRZ4.

Water Resource Zone	Baseline DO	Outage	Process Loss	WAFU
Severn (WRZ3)	658.5 Ml/d	19.45 Ml/d	17.21 Ml/d	609.34 Ml/d
Birmingham (WRZ4)	344.3 Ml/d	3.03 Ml/d	3.45 Ml/d	336.86 Ml/d
Total	1002.8 Ml/d	22.48 Ml/d	20.66 Ml/d	946.2 Ml/d

Table 4-5 Baseline Water Available for Use

Target Headroom

Target headroom is the minimum buffer planned between WAFU and demand, and caters for uncertainties within the supply-demand scenario. The adoption of target headroom has been based on an 80% level of confidence in meeting levels of service required. This level of confidence is reduced progressively to 50% by the



end of the 25 year period. These levels of confidence were used by STW to reflect medium to long term uncertainties, such as the assessment of DO, magnitude of climate change and trends in nitrate levels; and that many of these uncertainties can be managed over time.

4.2.3 Supply-Demand Balance

The baseline scenario as shown by STW within draft WRMP09 describes the supply-demand outlook based on projected changes to future demand and water available for use. It assumes a hypothetical situation where every year up to 2035 is a dry year with unrestricted demand and no changes to current AMP4 demand management and leakage policies, with resources, outage and headroom determined by a probabilistic approach. The equation is given by:

Balance of supply = Deployable Output – Outage – Headroom – Demand

The predicted effect of the baseline “do nothing” supply-demand scenario is summarised below. STW draft WRMP09 preferred plans for balancing supply-demand are described in the following section 4.2.4.

Severn Zone

WRP04 demonstrated a significant risk in the Severn Zone on meeting supply level targets and outlined strategies to achieve a supply-demand balance of 80% confidence by 2010. Good progress was made on leakage reduction, metering and water conservation, but problems were encountered with a new water treatment works on River Severn. Ombersley Water Treatment Works near Worcester would supply 30Ml/d but was unable to be delivered before 2010 due to issues around planning permission and abstraction licensing. WRP04 also proposed the installation of Granular Activated Carbon (GAC) treatment at Frankley WTW to allow more conjunctive use of River Severn and Elan Valley supply systems and increase the deployment of treated water to the Severn zone by 20Ml/d. The scheme is due to be completed by 2009/2010 and will benefit DO of both Severn and Birmingham WRZs.

In summary there is a continued supply-demand risk in Severn WRZ which worsens over the forecast period. Supply-demand balance became negative in 2006/07 and remains negative thereafter. By end AMP6 shortfall is 70Ml/d. By 2034/35 shortfall is 100Ml/d.

Birmingham Zone

WRP04 demonstrated a risk in the Birmingham Zone on meeting supply level targets, which resulted in the strategy to improve Frankley WTW using GAC. This provided a forecast 100% confidence of supply to 2015 and around 90% up to 2025. The supply-demand balance remains positive until 2018/19 with a small shortfall of around 2Ml/d at the end of AMP6, which moves back into a small surplus of 3Ml/d by 2034/35. It is clear that an appropriate means of restoring and maintaining a positive supply-demand balance is required in the Severn WRZ. The baseline supply-demand position can be seen in Table 4-6.



Baseline Supply-Demand Balance Position at the End of Successive AMP Periods (Ml/d)						
Zone	Year Supply Becomes Negative	2014/15	2019/20	2024/25	2029/30	2034/35
Severn	2006/07	-56.03	-71.67	-80.85	-86.79	-96.61
Birmingham	2018/19	5.41	-1.9	-2.01	2.66	2.71

Table 4-6 Baseline Supply-Demand Position

4.2.4 STW Preferred Plan to Balance Supply and Demand

To manage the supply-demand balance over time STW's WRMP09 has identified and evaluated a range of potential investment options to manage projected supply-demand deficits. These options are grouped under:

- Customer side demand management.
- Distribution side demand management.
- Production side demand management.
- Supply side demand management.

An unconstrained list was produced which underwent a screening assessment, incorporating a Strategic Environmental Assessment, to score potential options and separate those unfeasible or with unacceptable adverse effects. Each feasible option was taken forward for a more detailed assessment including whole life cost optimisation (WiLCO) modelling and a selection of preferred options was derived by applying the principles of the UKWIR report "Economics of balancing Supply and Demand."

STW's AMP5 strategy summary is:

1. Drive down leakage to 475Ml/d by 2015.
2. Increase rate of household meter uptake over and above those seen in AMP4, through promotion of free meter option and targeted policy of metering upon occupant change.
3. Increase water efficiency activities beyond AMP4 levels.
4. Maximise use of existing water resources by improving strategic grid connectivity and resilience of the supply network. Proposals for major capital investment schemes.

Long Term Strategy

Severn WRZ

The Ombersley scheme has been reassessed and still forms part of the proposed supply-demand strategy but has been deferred until later in the period due to options of utilising existing water resources through strategic grid capability, and to also provide additional time to address promotion and approval issues.

The long term strategy assumes 20Ml/d of supply will be available from the East Midlands WRZ via the East-West Link element of the strategic grid. A scheme proposed to increase the capacity of the Derwent Valley Aqueduct (DVA) will supply more water from WTW along the River Derwent to the south of the East Midlands



Zone and hence provide further support to the East-West Link. This will increase DO to the Severn zone and provide resilience benefits.

The Frankley GAC scheme due for completion in 2009-10 will enable a further 20Ml/d of treated water to be transferred to the Severn zone from the Birmingham zone. A further 2.4Ml/d is anticipated from the Mill End GAC scheme near Kenilworth proposed for 2025-2030. The scheme will involve a new water treatment process at the Mill End groundwater source, rectifying the water quality problems associated with its current closure.

Timings of various schemes are as follows:

- AMP5 2010-2015 – DVA duplication providing additional support to the East-West Link of the strategic grid (additional 20 Ml/d)
- AMP7 2020-2025 – Ombersley WTW (additional 30 Ml/d)
- AMP8 2025-2030 – Mill End GAC (additional 2.4 Ml/d)

In addition to the above in each AMP period there will be an ongoing drive to control leakage through a combination of active leakage control, mains replacement and pressure control; and the promotion of household retrofit of meters and other water efficiency options.

Birmingham WRZ

The Frankley GAC scheme set out in WRMP04 is due for completion in 2009-10 and will benefit both the Birmingham and Severn WRZs. Due to sufficient headroom predicted within the supply-demand balance the strategy going forward is for ongoing leakage management and water efficiency activities, as in the Severn zone, but with no proposals for additional resources or treatment schemes.

4.2.5 Conclusion

In summary, the assessment of STW's dWRMP and the Environment Agency CAMS indicates that:

- the Severn WRZ currently has a significant supply-demand balance deficit, and the Birmingham WRZ has a current surplus of supply compared to demand;
- the available water (also known as deployable output) is predicted to deteriorate over the next 25 years due to climate change, increases in population, deterioration in the water quality of sources of water, and the Environment Agency's RSA programme;
- a key component of the AMP4 strategy to deliver Ombersley Water Treatment Works has been delayed until AMP7;



- the majority of the water resources in the study area are classified as “No Water Available” in the CAMS, and;
- the region currently imports a large amount of its water supply from other areas via STW’s strategic grid and this is set to expand with proposed future investment schemes based on improvements to the strategic grid that will allow increased transfer of flows into the region.

Overall there is a shortfall in the supply-demand balance in the study area which is predicted to worsen over the next 25 years. STW’s proposed schemes will help to address some of the shortfall, but strong planning policies and demand management measures are clearly required to a) manage demand in new development, and b) reduce demand within the existing housing stock. The following demand management scenarios have been undertaken as part of the WCS to assess methods of mitigating increased demand due to new development in the study area.

4.3 Future Demand Scenario Testing

All the analysis within the STW draft WRMP undergoes a rigorous testing and review process with Defra, Ofwat and the Environment Agency, as well as public consultation. The assumptions made by STW have been stated above and the baseline case provided by STW has been accepted for use within the future demand scenario testing undertaken for the WCS.

The water company has a statutory requirement to supply water to a specific level of service. The way that it is regulated means that it cannot rely on promises by developers or local authorities to manage demand; therefore the water company planning process tends to take a conservative approach to predicting future demand. Hence, the per capita consumption (PCC) scenarios used by STW in its demand assessment does not look at more aspirational demand management scenarios that can only be achieved with strong planning policies. This study has therefore considered demand management scenarios that go beyond STW’s plans.

The Office of National Statistics (ONS) publishes mid-year population estimates for local authority areas on an annual basis. The most recent data is for June 2006 and was published in August 2007. These have been used to estimate the current WRZ and WCS area populations.

The WCS area lies proportioned across both the Severn and Birmingham WRZs. The proportion of current WCS area populations within each WRZ has been estimated using the ONS lower-layer super output area (LSOA) population data. The LSOA data, which is consistent with the ONS published district population totals, allows a population-based determination of the proportion of a district that lies within a specific water resource zone; this is more accurate than the commonly used method of deriving a population estimate based on the relative geographical areas. The most recent LSOA data, for 2006, has been used to assess the proportions of the 2006 local authority area populations within a resource zone; the same proportions are then assumed to apply to the more recent 2007 mid-year estimate population data.

The 2006/07 populations for each WRZ are identified by STW as 2,376,993 for the Severn zone and 1,138,253 for the Birmingham zone. Data from the Office of National Statistics (ONS) records a population of 2,407,011 for the Severn WRZ and 1,160,617 for the Birmingham WRZ. There is less than 5% difference between these two sets of data and therefore the population figures provided from STW are considered to be correct and have been used in the demand scenario testing. The population of the water cycle study area within the Birmingham WRZ, parts of both North Warwickshire and Stratford, has been calculated from the ONS data to be 23,417.



This is less than 5 percent of the total study area population and thus demand scenarios relating to the Birmingham WRZ are not included in the assessment.

The demand management scenarios considered are based upon information provided in the STW draft WRMP09 and use a simplification of the draft WRMP09 Baseline Planning Supply Demand Components⁹ for the Severn WRZ as a “baseline” for the assessment of more ambitious consumption reduction scenarios. They show how various demand management strategies can affect the requirement for additional water resources in the study area due to increases in housing from new development; and what would need to be done to achieve demand reductions in the existing urban areas and the new development sites.

The demand scenarios do not include a number of proposed changes for the final WRMP09 as stated in STW's SoR as detailed data was not available at time of writing. These changes are summarised in Section 4.5 and conclusions are formed around what effect these changes would likely have on the scenario test results.

- We have calculated the current total potable water demand for the WCS area by factoring the current total domestic population in the Severn WRZ to the 95 percent of the WCS area domestic population it covers. This factor was used to apportion all demand values, including non use (e.g. leakage) and non household demand.
- We have assumed that baseline water consumption for existing metered and unmetered properties remains constant during the plan period. This differs from STW assumption in the draft WRMP09 that PCC for metered properties increases throughout the planning period and decreases for unmetered properties.
- We have assumed that non-household demand remains the same during the planning period. STW have assumed that unmeasured non-household consumption remains constant but that measure non-household consumption decreases over the planning period.
- We have used STW baseline and forecast occupancy rates for new properties provided in their draft WRMP09. We have assumed the occupancy rate in the existing housing remains constant throughout the planning period at the average baseline rate of 2.39. The STW draft WRMP09 assumes that the occupancy rate decreases for measured households and increases for unmeasured households during the planning period.
- Within the assessment we have used both the new development figures provided in the RSS up to 2026 and the higher development figures provided by NLP. These may differ from the values in the draft WRMP09. As mentioned earlier, the draft WRMP undergoes a rigorous testing and review process with Defra, Ofwat and the Environment Agency, as well as public consultation. One of the key areas for scrutiny in this process is the forecast dwelling and population assumptions; therefore we are not undertaking any additional review of the accuracy of STW forecast population or dwelling numbers.

⁹ Data from data tables WRP4-BL of STW draft WRMP09, 2008.



4.3.1 Water resource testing scenarios

The list of scenarios below provides detail of the components of each scenario tested. These are summarised in Table 4-7. The outcomes of these demand management scenarios are shown in Figure 4-1

It is important to note that the intent of the results is not to show an overall position for supply-demand balance, as this is mentioned previously and well covered within STW's draft WRMP09. The intent is to show how differing demand management strategies may mitigate the increase in water demand associated with new housing development in the WCS area.

Scenario 1: Business as usual.

This scenario looks at how potable demand would increase should new development be in-line with the RSS levels of development and that STW draft WRMP09 forecast PCC rates be realised in the new development areas, assuming that all new properties are metered. The PCC for existing homes (metered and unmetered) is assumed to remain constant throughout the planning period at 128.55 l/h/d for existing metered homes and 147.72 l/h/d for existing unmetered homes. The meter penetration ratio of metered to unmetered homes is assumed to be in agreement with the STW draft WRMP09 forecast. This scenario has been used as the basis against which all other scenarios have been derived.

Scenario 2: Business as usual with NLP increased development.

This scenario looks at how potable demand would increase should new development be in-line with the NLP increased levels of development. We have assumed that all other variables are as detailed in Scenario 1.

Scenario 3: NLP increased development with new homes built to Code for Sustainable Homes Level 3.

This scenario looks at how the implementation of CSH water efficiency targets to CHS level 3 would affect potable demand with the NLP increased levels of development. All new homes built after 2009 will be required to achieve CSH level 3 (105 l/h/d). We have assumed that all other variables are as detailed in Scenario 1.

Scenario 4: Water Neutrality within WCS study area - New homes built to Code for Sustainable Homes Level 5 and reduction of existing metered PCC.

This scenario looks at how the implementation of water efficiency targets to CHS level 5 and a decrease in existing metered PCC by 2 litres per head per day each progressive year reduces the overall increase in demand to baseline levels. It maintains a water neutral position by the end of the planning period with NLP increased development. All new homes built after 2009 will be required to achieve CSH level 5 (80 l/h/d) and plans implemented to reduce the PCC for existing metered properties by 2 l/h/d, each year from 2010 to the end of the planning period.

Scenario 5: NLP increased development with new homes built to Code for Sustainable Homes Level 3 and increased meter penetration.

This scenario looks at how the implementation of water efficiency targets to CHS level 3 and increased meter penetration to 90% by 2020 affects the potable demand with increased NLP development. All new homes built



after 2009 will be required to achieve CSH level 3 (105 l/h/d) with all new properties will be metered and plans implemented to increase total meter penetration to 90% by 2020, which is a corresponding uptake of meters by around 11,000 existing homes each year from 2010 to 2020.

Scenario 6: NLP increased development with new homes built to Code for Sustainable Homes Level 3, increased meter penetration and reduction of existing metered PCC.

This scenario is as scenario 5 with the addition of a reduction in PCC for existing metered properties of 2 litres per head per day each year from 2009 to the end of the planning period. This equates to a total reduction in PCC of 32 l/h/d for existing metered properties over the planning period. Existing unmetered PCC remains constant at the 2006 baseline of 147.72 l/h/d.

Scenario	STW Metering (66% by 2035)	Other Metering	CSH 3	CSH 5	Reduction in Existing PCC
1	Yes	All new properties metered	No	No	No
2	Yes	All new properties metered	No	No	No
3	Yes	All new properties metered	Yes	No	No
4	Yes	All new properties metered	No	Yes	2 l/h/d reduction each year from 2010
5	No	90% metering of existing properties by 2020	Yes	No	No
6	No	90% metering of existing properties by 2020	Yes	No	2 l/h/d reduction each year from 2010

Table 4-7 Water resources scenarios assessed

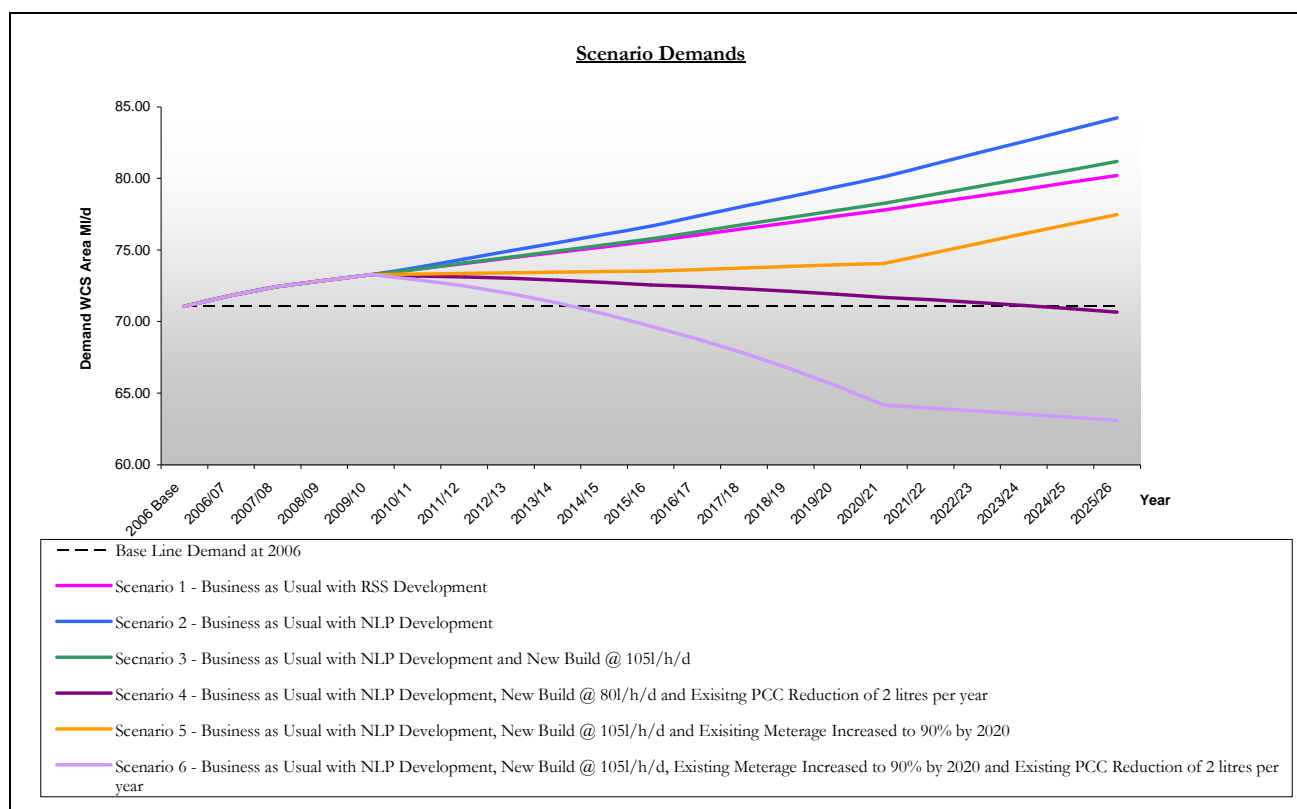


Figure 4-1 Potable water demand based on scenario analysis

Baseline potable water demand in the WCS area in 2006/07 was 71.07 Ml/d. The business as usual case (scenario 1) based upon constant existing PCC rates and varying new PCC rates shows that if no demand management measures were implemented other than the increased meter penetration proposed by STW, an additional 9.14 Ml/d of potable water will be required in the study area by 2026. This is approximately equivalent to over three and a half Olympic size swimming pools on a daily basis, or an increase in household demand of 12.9% between now and 2026. Severn Trent Water's proposals for meter penetration are to meet 66% metering by 2035 which is to work in tandem with other demand management procedures prescribed in the draft WRMP09. Warwickshire is currently in an area of moderate water stress with some surrounding areas under serious stress. Environment Agency's proposals are for the majority of homes to be metered by 2015 in areas of serious water stress.

The worst case is scenario 2 which describes the increased development suggested by NLP. This produces an increase in demand by 2026 of 13.17 Ml/d, which is 4.02 Ml/d greater than using the RSS development numbers. This equates to an increase in the household 2006 baseline demand of 18.5% over the planning period.

The implementation of various levels of the CSH has been tested alongside STW's proposals on metering (scenarios 3 and 4). It can be seen that the introduction of increasing levels of the CSH, in homes built from 2009 onwards reduces the impact of additional demand from new development. The introduction of increased water meter penetration reduces demand even further, as seen in the comparison between scenarios 3 and 5. A reduction in PCC demand from existing metered properties in conjunction with a suitable level of CSH can create a water neutral position at the end of the planning period. Combining increased CSH, meter penetration and reducing existing metered property PCC can dramatically reduce demand to levels below the baseline 2006 figure, creating a saving of 8 Ml/d by 2026.



The analysis shows that the greatest reduction in water demand can be achieved by reducing demand in the existing population. This is because the existing population account for a larger proportion of the total population than the population from new development. Therefore although measures such as CSH targeted at new developments have a positive impact upon total demand, they should be used in conjunction with proposals for the existing population in order to achieve maximum reductions in total demand. Comparing the scenarios it can be seen that the increase in demand is not as steep over the planning period with the use of CSH measures and reduces further with the use of increased meter penetration. However a reduction in PCC for the existing population can have a dramatic effect. Scenarios 4 and 5 detail a reduction in PCC each year for existing metered houses of 2 l/h/d which actually reduces the overall demand for the period. This results in existing metered properties with a PCC of 96.55 l/h/d by 2026, the equivalent in excess of CHS level 4. However it must be accepted that a reduction in 2 l/h/d per year cannot be sustained over the long-term and will be constrained by technology at some point.

Water neutrality (scenario 4) can be achieved from 2009 to 2026 by implementing a variety of measures. This includes STW proposals for meter penetration, though aims should be to reach the Environment Agency's proposals on compulsory metering of 95% of existing properties by 2016; the implementation of the CSH level 5 and a reduction in the existing PCC of the existing population of 2 l/h/d each year. This would need to be achieved through the implementation of water efficiency measures such as retrofitting, education and encouraging water efficient devices.

4.4 Summary of demand management scenarios

The scenarios tested above have attempted to predict future demand with various demand reduction measures in place. In summary, the demand management scenarios undertaken as part of the WCS show:

- without demand management scenarios in place (business as usual) new development would cause an additional 13-18.5% demand compared to current demand, and given the current shortfall in available water resources this is not considered a sustainable approach;
- adopting CSH in new developments does reduce the increase in water demand due to new development;
- reducing demand in the existing housing stock is critical to ensuring water demand does not increase due to new development, and;
- water neutrality can be achieved up to 2026 by adopting CSH level 5 in new developments and reducing existing per capita consumption by 2 l/h/d per year. It should be noted that it is highly uncertain whether a reduction of 2 l/h/d per year can be achieved in the existing housing stock, and at some point the limit of technology will be reached and/or costs will be unsustainable.

4.5 Statement of Response and Variance from the draft WRMP09

Following responses received from the publication of the draft WRMP09 in 2008, STW released a SoR to highlight resultant changes and likely impact for the final WRMP09. The SoR repeals a number of problems presented in the draft WRMP09 and through the proposed changes target headroom is now achieved throughout



the planning period. Proactive steps have been taken to reduce water demand in existing homes through greater water efficiency savings and increased metering. Main changes are summarised below:

- Projections on average normal year household usage have been revised down from 138 l/h/d to 133 l/h/d by 2035.
- Unmeasured household PCC is revised from having a downwards trend to remaining fairly static.
- Measured household PCC is revised to remain as an upwards trend but with a lower overall PCC than that in the draft.
- Metering is revised upwards to a penetration of 72% of households by 2035 (from 66%) in dWRMP).
- Non-household consumption has been revised downwards.
- Overall leakage target is revised down to 453 MI/d by 2014/15 (compared to 476 MI/d in dWRMP).
- Revised proposals for water efficiency producing 16.35 MI/d of savings by 2015.
- The adverse effect on DO due to climate change has been increased for the three WRZs of interest.
- There have been a number of revisions to proposed capital schemes. The Severn WRZ sees the removal of Ombersley Treatment Works and Mill End GAC but includes new proposed resilience schemes.
- Target headroom is revised to be achieved and maintained throughout all years within the planning period.

The above changes likely to enhance demand management within the WCS area which are over and above those set out in the draft WRMP09 are:

- Reduction in average household consumption to 133 l/h/d by 2035 including reduction of measured household PCC due to water efficiency savings and metering.
- Increased metering to 72% by 2035 and extended policy of metering upon change of occupancy.

The result of these actions on the demand scenarios is a reduced baseline demand. Though these measures are a positive action in respect to the draft WRMP09 baseline, they do not cover the more aspirational strategies as prescribed in the demand scenarios.



4.6 Recommendations

Due to the current and predicted supply-demand deficit within the study area, the local planning authorities should implement planning policies to ensure the efficient use of water in both the new and existing housing stock. It is recommended that all new development is built at CSH level 3/4 for water as a minimum, although achieving CSH level 5/6 should be considered as an aspiration of the partner authorities.

In addition the new development, demand must be reduced in the existing housing stock. The local planning authorities, in partnership with the Environment Agency and STW, should continue to encourage the uptake of metering in the existing housing stock, and should encourage more sustainable use of water resources through education programmes, for example.

During the course of the outline WCS a Habitats Regulation Assessment (HRA) has been undertaken by Stratford-on-Avon District Council. This study concluded that “on its own, the consultation Core Strategy [Stratford-on-Avon] will not have significant impacts on the integrity of any of these sites. However, in combination with other development being proposed in the West Midlands and South West, the Core Strategy could have significant impacts on the integrity of the Lyppard Grange Ponds SAC, the Severn Estuary sites and River Wye SAC due to water abstraction; and the Severn Estuary sites due to water pollution. It is therefore important that a regional approach is adopted to ensure water abstraction levels remain sustainable, and do not have a detrimental impact on the environment. This regional approach is already adopted by STW and the Environment Agency, who should work in partnership with all local planning authorities in the West Midlands to drive sustainable use of water in new developments (and the existing housing stock).

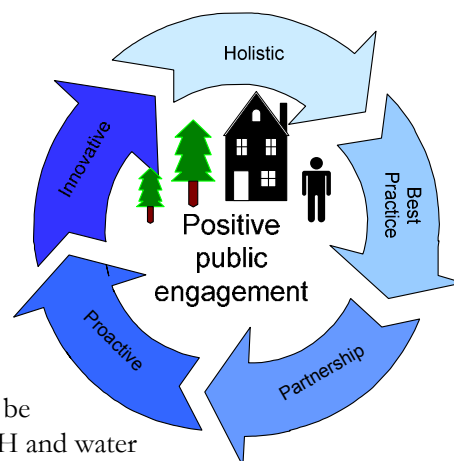
4.7 Indicative Action Plan

A possible future action plan could include:

Council Led

Local Development Framework policies:

- Given the well developed evidence base and clear policy at the regional level, the local planning authorities could include more stringent policy in their Local Development Framework requiring new development to be increasingly water efficient, inclusive of high levels of CSH and water resource augmentation such as rain water and stormwater harvesting.



Pride in our community campaign:

- **Objective:** engaging existing residents, making them proud of the natural and built environment.
- **Target:** raising public awareness of their environment.
- **Action:** review existing community facilities, are they good enough can they be improved? Brain storm additional facilities and events to improve quality of life.



- **Examples:** make sure all community areas are attractive, well maintained, with low water requirement. Identify areas of woodland with lesser ecological value, construct attractive activity park – aerial runway, mountain bike tracks, café etc. Introduce regular events to shout about the natural environment, kids after school activities e.g. green gym. Local competition for best wildlife or natural environment photo.

Importance of water campaign:

- **Objective:** engage existing residents on need to conserve water.
- **Action:** review existing community facilities and implement measures to reduce water e.g. spray taps, grey water recycling, rainwater harvesting, advertise action taken and results achieved.
- Education programmes in school. Public exhibition, water audit for typical household, water saving devices, details of cost and expected savings, make spray taps, flow restrictors, water butts etc available at subsidised cost. Provide details (with model?) of underlying aquifers. Public visits to headworks and treatment facilities. Articles in local papers. Lorry-side advertisement with volume of water consumed by typical households.

Reduction of water consumption in Social Housing:

- **Objective:** deliver significant water savings and catalyse residents of social housing to make pro-environmental changes.
- **Action:** appoint a facilitator to work with STW, housing authorities and other partners to support residents in green lifestyle changes through technological and behavioural change. Investigate options for joint water and power audit/saving campaign.
- Note: Waterwise (www.waterwise.org.uk) are in the process of appointing a number of such facilitators and may be able to provide assistance.

Water use audit of all public buildings:

- **Objective:** reduce water consumption.
- **Action:** structured audit of all public buildings. Measures implemented where appropriate to reduce consumption. Advertise successes in local paper etc.

Use of water efficient devices:

- **Objective:** raise awareness people's choices.



- **Action:** encourage all retailers to stock water efficient devices and prominently display water consumption ratings. Maintain and actively promote a register of green plumbers. Show house where water saving devices such as simple bath waste diverters, green walls, etc can be seen in action by the public.

Water Company Led

Increased metering:

- **Objective:** to provide economic incentive to conserve water and better data on system performance
- **Action:** progress enhanced metering scheme throughout the region with targeted advertising campaigns addressing the economic and environmental benefits of water metering.

Leakage reduction programme:

- **Objective:** reduce water abstraction and also increase acceptability of meters.
- **Action:** use improved data provided by universal metering to target areas of higher than average losses. Advertise successes in local paper etc.

Promotion of water efficiency devices:

- **Objective:** further general promotion of water efficiency devices.
- **Action:** subsidy and retrofit of water efficient devices for existing homes.





5 Assessment of Warwickshire flood risk and surface water management

5.1 Overview

The purpose of this chapter in the report is to provide a regional context for flood risk and surface water management. The subsequent chapters discuss the findings of the WCS and their implications for each local planning authority, but this chapter provides an over-arching summary for the study area. An overview of the methodology to assess flood risk and surface water management is provided in chapter 4.

5.2 Catchment Description

The County of Warwickshire contains two main river catchments: the River Tame and the River Avon. Towards the northern extent of the County, the Tame and its tributaries (Rivers Bourne, Blythe Cole and Anker) flow through the Council area of North Warwickshire; with the River Avon and its tributaries forming the main watercourses through the south eastern extent of the County.

5.2.1 River Avon Catchment

Through Warwickshire, the River Avon catchment includes most of Warwick District Council, Rugby Borough Council, and Stratford-on-Avon District Council, as well as parts of Nuneaton & Bedworth Borough Council. Its major tributaries include the River Sowe and Withy Brook, the River Leam, the River Dene, the River Itchen, the River Stour, the Rivers Arrow and Alne, the Bow Brook and the Piddle Brook.

The catchment is relatively shallow with little high ground. The majority of the catchment lies on impermeable rock (triassic mudstones in the north and Lower Lias clay in the south). It is the impermeable rocks beneath shallow topography, as well as the size of the catchment, which are the greatest factors contributing to fluvial flood risk within the Avon catchment. The catchment is also relatively urbanised, including the urban settlements of Leamington Spa, Warwick and Kenilworth (Warwick District), Rugby (Rugby Borough), and Stratford-upon-Avon (Stratford-on-Avon District) within the County of Warwickshire. All of these towns and cities are subject to some degree of flood risk from the Avon or its tributaries, although this is less pronounced in the north of the catchment near where the Avon and its tributaries rise (e.g. Kenilworth) than in the south.

5.2.2 River Tame Catchment

Within the County of Warwickshire, the River Tame catchment incorporates much of North Warwickshire Borough Council and Nuneaton & Bedworth Borough Council, as well as portions of Stratford-upon-Avon District Council, Warwick District Council and Rugby Borough Council.

There are no steep hills within the catchment. The underlying bedrock geology for the region is a mixture of Permian and Triassic sandstones (the major aquifer beneath much of Birmingham), Lower Westphalian coal measures and Westphalian & Stephanian beneath much of Walsall and the Black Country, and Triassic mudstones. Significantly, in terms of flood risk, the more permeable rocks (Triassic Sandstones and fissured Westphalian) are mainly beneath the urbanised areas largely covered with man-made impermeable materials. The impermeable mudstones are in the lower regions of the catchment which are less urbanised. Flood risk within



the Tame catchment is largely restricted to the flatter, lower regions underlain by impermeable mudstones (North Warwickshire Borough).

5.3 Flood risk and surface water in context

5.3.1 West Midlands Regional Flood Risk Appraisal (Halcrow, 2009)

A Regional Flood Risk Appraisal (RFRA) for the West Midlands was originally completed in September 2007. The original RFRA was commissioned during a transitional stage in flood risk planning policy and whilst the most up to date guidance at the time was used to complete the study, more guidance subsequently became available (including the PPS25 Practice Guide Companion) and therefore, the RFRA was updated in 2009 to incorporate the most up-to-date information. The updated RFRA provided a broader, more rigorous assessment of flood risk across the Region and provided a basis for further policy development, including the recommendation of sustainable flood risk management policy options for the Options Report for the Phase Three RSS options consultation and development of the Preferred Option in 2009.

Key recommendations of the RFRA relevant to the Warwickshire area are outlined below:

- Floodplains should be safeguarded from future development and local authorities must apply the Sequential Test to ensure all new development is directed towards Flood Zone 1 in the first instance. Opportunities should be taken to reinstate areas of functional floodplain which have been previously developed and Flood Zones 2 and 3 should be left as open space.
- Local authorities should be aware of the progress made in surface water modelling techniques and undertake Surface Water Management Plans (SWMPs) where high surface water flood risk has been identified. All new development should make allowance for climate change by designing safe and sustainable homes.
- Surface water should be appropriately managed in all Flood Zones, with Environmental Stewardship Schemes considered in rural and upland areas to help ensure farming practices help reduce runoff to decrease flood risk in urban areas downstream.
- It is recommended that for high flood risk/high growth areas where potential flood risk constraints to development have been identified, opportunities to locate future development in lower risk areas in the wider authority or in adjoining local authorities should be sought.
- Where development is located in residual risk areas, i.e. behind defences, downstream of reservoirs or adjacent to raised sections of canals, a Level 2 SFRA should assess breach and overtopping scenarios, determining if the level or residual risk is acceptable and the mitigation measures that should be put in place to make the developments safe. Detailed overtopping and breach analysis will provide more refined hazard information and allow LPA emergency planning teams to refine emergency plans or veto new development where the risk is too great.

5.3.2 Warwickshire Level 1 SFRA, 2008

Level 1 Strategic Flood Risk Assessments (SFRA) for Warwickshire have been produced for the Districts and Boroughs covered by this WCS. The purpose of the SFRA is to provide information on current and future



flood risk (taking into account climate change) from all sources to allow decision makers to allocate development and infrastructure in accordance with PPS25.

The Level 1 SFRA's were published in January 2008 and the following key recommendations from the Level 1 SFRA's are outlined below:

- The District and Borough Council's should undertake their Sequential Testing based upon the information presented in the Final Level 1 SFRA and the accompanying mapping and GIS datasets
- Following the completion of the Sequential Testing, any areas that cannot be located within a low flood risk area (i.e. Flood Zone 1) should be examined in more detail through a Level 2 SFRA. The purpose of a Level 2 assessment is to provide enough information to allow the relevant LPA to either re-apply their Sequential Testing, in light of further information or to apply the Exception Test to the proposed development site.
- As part of a Level 2 SFRA, it may be necessary to identify the function floodplain (Flood Zone 3b) and climate change. In instances where Flood Zone 3b does not exist (and therefore for the purposes of the Sequential Test Flood Zone 3b is deemed to be equal to 3a), and a 'more vulnerable' development has been allocated in Flood Zone 3a, it may be necessary to define Flood Zone 3b using flood mapping techniques.
- The functional floodplain should be protected from development
- Vulnerable development should be directed away from flood affected areas
- It must be ensured that all new development is 'Safe', meaning that dry pedestrian access to and from the development is possible without passing through the 1 in 100 year plus climate change floodplain, and emergency vehicular access is possible
- The use of SUDS should be promoted in all Flood Zones for both Brownfield and Greenfield sites, to achieve Greenfield discharge rates with a minimum reduction of 20%. Space should be set-aside for SUDS.
- Support should be given to flood alleviation measures under consideration by the Environment Agency by safeguarding possible sites for flood storage and other channel works
- Developer contributions should be sought (to be determined in consultation with the Environment Agency) via S106 planning obligations to fund (or part fund) strategic flood risk management facilities and bring benefit to the wider community
- It was noted that throughout a number of the District and Boroughs, flooding from field run-off is a problem, particularly in rural areas. It is therefore recommended that future development proposed in locations known to be at risk from flooding from field runoff is avoided.



5.3.3 Catchment Flood Management Plans (CFMPs)

Two CFMPs cover the study area (Figure 2.1); the River Severn and River Trent CFMPs. The settlements included in the WCS which are in the relevant CFMP areas are illustrated in Table 5-1.

Local Planning Authority	Settlement within River Severn CFMP	Settlement within River Trent CFMP
North Warwickshire BC	None	All settlements within River Trent CFMP
Nuneaton & Bedworth BC	Bedworth (southern parts) Keresley Exhall	Nuneaton Bulkington Bedworth (northern parts)
Rugby BC	All settlements except Wolvey within River Severn CFMP	Wolvey
Stratford-on-Avon DC	All settlements within River Severn CFMP	None
Warwick DC	All settlements within River Severn CFMP	None

Table 5-1 CFMPs & Settlements assessed within WCS

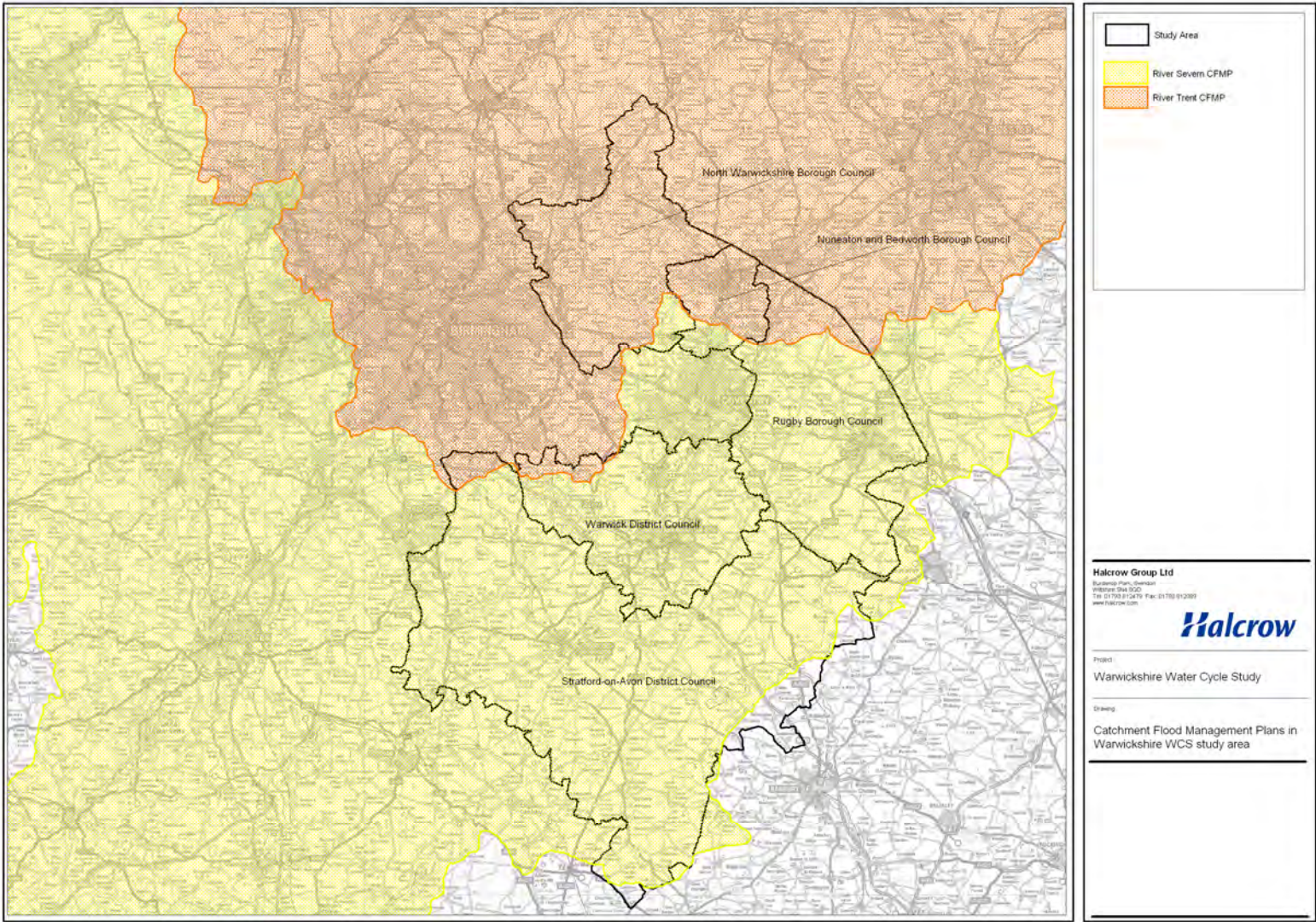


Figure 5-1 CFMP coverage within the Warwickshire water cycle study area



River Severn Catchment Flood Management Plan, Final Plan, (September 2008)

The River Severn Catchment Flood Management Plan (CFMP) covers the Districts and Boroughs of Stratford-on-Avon, Warwick, Rugby and Nuneaton and Bedworth. A small part of the Borough of North Warwickshire is also covered by the Severn CFMP. The CFMP is a high level document of strategic policies designed to plan for flood risk management in the catchment over the next 50-100years. A final plan of the CFMP was published in September 2008.

The River Severn CFMP area has been divided into 20 Policy Units, eight of which cover the area within the Warwickshire water cycle study area. The policy units within the Severn CFMP are based on clearly defined areas within the catchment and are based on Physical characteristics (including hydrology, ecology, geomorphology, land use etc) and current and future flood risk. Determination of policy units was also influenced by the wider objectives in the catchment. One preferred appropriate policy will be applied across the policy unit.

The eight policy units within the Warwickshire water cycle study are outlined in Table 5-2 along with the draft flood risk management policy selected for each unit.

Policy Unit	Policy Choice
9 - Redditch	Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)
11 - River Arrow & River Alne	Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)
12 - Middle Avon	Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)
13 - Coventry Clusters	Take further actions to reduce risk (now and/or in the future)
14 - Upper Avon	Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment
15 - Rugby	Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)
16 - Avon Tributaries	Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)

Table 5-2 CFMP flood management units



River Trent Final Main Stage Report Catchment Flood Management Plan (CFMP) (September 2008)

The River Trent Catchment Flood Management Plan (CFMP) predominantly covers the Districts and Boroughs of North Warwickshire and Nuneaton and Bedworth. Only a very small portion of the northern extent of the Borough of Rugby is covered by the Trent CFMP with the River Anker being the only watercourse that drains directly into the River Trent (via the River Tame). It is therefore unlikely that the Borough will be significantly affected by the policies within the Trent CFMP.

The River Trent CFMP considers flooding over an area covering the River Trent catchment and all of its tributaries, which is a total area of over 10,000 square kilometres. The document gives an overview of flood risk in the River Trent catchment and sets out a preferred plan for sustainable flood risk management over the next 50 - 100 years.

The River Trent CFMP area has been divided into 10 Policy Units, two of which cover the area within the Warwickshire water cycle study area. The policy units within the Severn CFMP are based on clearly defined areas within the catchment and are based on Physical characteristics (including hydrology, ecology, geomorphology, land use etc) and current and future flood risk. Determination of policy units was also influenced by the wider objectives in the catchment. One preferred appropriate policy will be applied across the policy unit.

The two policy units within the Warwickshire water cycle study are outlined in Table 5-3 along with the draft flood risk management policy selected for each unit.

Policy Unit	Policy Choice
6 – Mid Staffs and Lower Tame	Take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere within the catchment
9 – Upper Soar and Upper Anker	Take action to sustain current level of flood risk into the future (responding to potential increases in flood risk from urban development, land use change and climate change)

Table 5-3 CFMP management units

5.4 Key recommendations and policies across the sub-region

Flood risk management is an important consideration within Warwickshire. The County contains two main river catchments (River Tame and River Avon). Parts of some development sites and existing settlements are situated within existing Flood Zones 2 and 3 (as defined by the Environment Agency) and are therefore already at risk from fluvial flooding. In addition, there are a number of locations at risk of flooding from other sources. Key recommendations that apply throughout the sub-region are outlined below.

Developers need to follow the principles and requirements of national policy, most notably PPS25: Development and Flood Risk. Any new development should be located in the areas of lowest flood risk and



must not increase risk to existing development and areas identified as functional floodplain should be protected from development. Where parts of development sites are proposed within Flood Zones 2 and 3, developers should undertake a site-specific Flood Risk Assessment (FRA) to establish the extent of Flood Zones 2, 3a and 3b, and the future risk of climate change. Further modelling may be required to establish these risk areas.

For a number of locations within the County (North Warwickshire and Warwick) runoff from fields has been identified as a problem, particularly in rural areas. It is therefore recommended that future development proposed in locations known to be at risk from flooding from field runoff is avoided.

It must be ensured that all new development is 'safe,' meaning that dry pedestrian access to and from the development is possible without passing through the 1 in 100 year plus climate change floodplain, and emergency vehicular access is possible.

A number of flood defences are located within the WCS area which provides benefit to a number of residential and commercial properties. Future development within existing urban areas may be required behind these defences. A Level 2 SFRA will be required for any development proposed behind existing defences to assess the residual risk to the site from breach or overtopping and to properly inform new development in the area. In line with the recommendations outlined in the Severn and Trent CFMPs, defences must be properly maintained to ensure the required protection is provided in the future.

In addition, a number of canals are located within the sub-region. Whilst the risk of breach or overtopping is generally considered low, for any development proposed adjacent to canals, a Level 2 SFRA must be undertaken to assess the residual risk of breach or overtopping. This will enable the new development to be appropriately informed, and appropriate emergency plans developed by the LPA.

Account must be taken of storage areas within the sub-region, with support given to flood alleviation measures under consideration by the Environment Agency by safeguarding possible sites for flood storage and other channel works. Opportunities should be identified for setting back defences which will increase localised storage and could in turn allow for the creation of a more natural channel.

It may be possible to cluster potential development areas together to consider strategic flood risk management activities that would provide a strategic benefit and bring benefit to the wider community.

5.4.1 Recommendations and policies for dealing with windfall developments

For the purposes of development management, detailed policies will need to be set out to ensure that flood risk is taken account of appropriately for both allocated and non-allocated 'windfall' sites. The following reflects the minimum requirements under PPS25 (reference should be made to Tables D.1-D.3 in PPS25).

Future Development within Flood Zone 1

In this zone, developers and local authorities should realise opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development. There is no significant flood risk constraint placed upon future developments within the Low Probability Flood Zone 1, although for sites larger than one hectare, the vulnerability from other sources of flooding should be considered as well as the effect of the new development on surface water runoff.



Typically, a Drainage Impact Assessment will be required to demonstrate that runoff from the site is reduced, thereby reducing surface water flood risk. This will involve the use of SUDS techniques which should take into account the local geological and groundwater conditions. For green field sites, post-development runoff should be attenuated and discharge rates set at annual green field rates of flow. For re-development of brown field sites, post-development run off should be attenuated and at least a 20% reduction in discharge rates should be provided when compared to pre-development rates, as required by the Environment Agency.

Future Development within Flood Zone 2

Land use within Medium Probability Flood Zone 2 should be restricted to the 'water compatible', 'less vulnerable' and 'more vulnerable' category. Where other planning pressures dictate that 'highly vulnerable' land uses should proceed, it will be necessary to ensure that the requirements of the Exception Test are satisfied. The following should be considered:

- A detailed site-specific FRA should be prepared in accordance with PPS25 and Council planning policies.
- Floor levels should be situated above the 100 year plus climate change predicted maximum level plus a minimum freeboard of 600mm.
- The development should be safe, meaning that dry pedestrian access to and from the development should be possible above the 1 in 100 year plus climate change flood level and emergency vehicular access should be possible during times of flood.
- SUDS should be implemented to ensure that runoff from the site (post development) is reduced. For green field sites, post-development runoff should be attenuated and discharge rates set at annual green field rates of flow. For re-development of brown field sites, post-development run off should be attenuated and at least a 20% reduction in discharge rates should be provided when compared to pre-development rates, as required by the Environment Agency. Space should be set-aside for SUDS.
- The proposed development should be set-back from the watercourse with a minimum 8m wide undeveloped buffer zone, to allow appropriate access for routine maintenance and emergency clearance. This is an Environment Agency requirement.

Future development within High Probability Flood Zone 3a

Land-use with High Probability Flood Zone 3a should be restricted to the water compatible or 'less vulnerable' uses to satisfy the requirements of the Sequential Test. For 'more vulnerable' uses it is necessary to ensure that the requirements of the Exception Test are satisfied. The following should be considered:

- A detailed site-specific FRA should be prepared in accordance with PPS25 and Council planning policies. Properties situated within close proximity to formal defences or water retaining structures (reservoirs/canals) will require a detailed breach and overtopping assessment to ensure that the



potential risk to life can be safely managed throughout the lifetime of the development. The nature of any breach failure analysis should be agreed with the Environment Agency.

- The development should not increase flood risk elsewhere, and opportunities should be taken to decrease overall flood risk (such as use of SUDS and de-culverting). This can be achieved by developing land sequentially, with areas at risk of flooding favoured for green space.
- Floor levels should be situated above the 1% (100 year) plus climate change predicted maximum level plus a minimum freeboard of 600mm. Within defended areas the maximum water level should be assessed from a breach analysis.
- The development should allow dry pedestrian access to and from the development above the 1 in 100 year plus climate change flood level and emergency vehicular access should be possible during times of flood. An evacuation plan should be prepared. With respect to new developments, those proposing the development should take advice from the LPAs emergency planning officer and for large-scale developments, the emergency services, when producing an evacuation plan as part of a FRA. All access requirements should be discussed and agreed with the Environment Agency.
- Basements should not be used for habitable purposes. Where basements are permitted for commercial use, it is necessary to ensure that the basement access points are situated 600 mm above the 1 in 100 year flood level plus climate change.
- SUDS should be implemented to ensure that runoff from the site (post development) is reduced. For green field sites, post-development runoff should be attenuated and discharge rates set at annual green field rates of flow. For re-development of brown field sites, post-development run off should be attenuated and at least a 20% reduction in discharge rates should be provided when compared to pre-development rates, as required by the Environment Agency. Space should be set aside for SUDS.
- The proposed development should be set-back from the watercourse with a minimum 8m wide undeveloped buffer zone, to allow appropriate access for routine maintenance and emergency clearance.

Future development within Functional Floodplain Zone 3b

Development should be restricted to 'water-compatible uses' and 'essential infrastructure' that has to be there. Table D2 from PPS 25 (reproduced in Section 1.5.1 of this report) outlines the types of development included within this classification. It should be noted that 'essential infrastructure' includes essential transport infrastructure (including mass evacuation routes) which may have to cross the area at risk as well as strategic utility infrastructure such as electricity generating power station and grid and primary substations. Reference should be made to Table D2 of PPS 25 when considering development within Flood Zone 3b to ensure only appropriate development is considered. 'Essential infrastructure' in this zone must pass the Exception Test and be designed and constructed to remain operational in times of flood and not impede water flow.



5.4.2 Recommendations on the use of SUDS in the sub-region

In general, throughout the study area, any development (including developments in Low Probability Flood Zone 1) which does not incorporate SUDS may increase the risk of surface and/or fluvial flooding both on-site and off-site (downstream). As such effective planning policies should be implemented in accordance with the SUDS recommendations provided in this report. The use of SUDS in all Flood Zones should be promoted for both Brownfield and Greenfield sites. For green field sites, post-development runoff should be attenuated and discharge rates set at annual green field rates of flow. For re-development of brown field sites, post-development run off should be attenuated and at least a 20% reduction in discharge rates should be provided when compared to pre-development rates.

The Boroughs and Districts considered as part of this WCS have a mixture of soil types, ranging from slowly permeable and freely draining, slightly acidic, loamy and clayey soils. The more permeable sites should have priority given to infiltration drainage techniques, as opposed to discharging surface water to watercourses. Where less permeability is found and infiltration techniques that rely on discharge into the existing soils are not viable (also due to a high water table, source protection zones, contamination etc), discharging site runoff to watercourses is preferable to the use of sewers. Integrated urban drainage should also be used throughout the design process.

The entire study area has been highlighted by DEFRA as a Nitrate Vulnerable Zone (NVZ) with some areas in North Warwickshire (northern extent of Borough), Stratford-on-Avon (centre and east) and Warwick (west and north) classified as a Groundwater Source Protection Zone (GSPZ) by the EA. Any boreholes, water wells or other extraction points should also be identified and taken into account in the design process. For areas identified as GSPZ, attenuated storage of runoff will be required to prevent infiltration and contamination.

NVZs are generally indicative of the agricultural nature of the surrounding land and the use of fertilisers. Nitrate levels in many English waters are increasing principally due to surface water runoff from agricultural land entering receiving water bodies. The level of nitrate contamination will have an impact on the choice of SUDS and will have to be assessed for specific sites.

Runoff which is likely to be heavily contaminated must be treated by a proprietary device, which should be carefully considered to ensure the correct system is selected to remove pollutants. PPS 3 (2006) states that source control SUDS must be considered and incorporated where suitable. For example; the drainage system for a car park should incorporate a filter bed wherever possible before considering an interceptor device to remove contaminants.

If the local soil is contaminated then a lined system is generally required. This may include a drainage design which allows infiltration in the upper layer, but should incorporate an impermeable layer at its base to prevent contamination. In such cases lined underground attenuation storage is used to store a 1 in 100 year +20% (for climate change) storm event and discharges into a nearby watercourse.



The SUDS manual (C697) provides best practice guidance on the planning, design, construction, operation and maintenance of Sustainable Drainage Systems (SUDS) to facilitate their effective implementation within developments.¹⁰

¹⁰ The SUDS Manual - <http://www.ciria.org.uk/suds/publications.htm>





6 Warwick District Council

6.1 Introduction

This chapter presents the findings from the outline WCS for Warwick District Council. The chapter provides a summary of the key findings from the WCS and a list of recommendations for Warwick District Council. The evidence base to support the findings is provided in Appendix D.

6.2 Overview of key issues

The key issues and constraints from the outline WCS are identified below.

- There is no current hydraulic capacity at either Warwick-Longbridge and Finham-Coventry WwTW and STW need to identify when capacity can be accommodated at these WwTW's – this will influence the phasing of development in Warwick DC.
- The water quality analysis has identified that to meet 'good' status under the WFD would require phosphate discharge consents beyond currently accepted Best Available Technology (BAT) of 1 mg/l as an annual average. However, to achieve no deterioration of current water quality, the evidence suggests that it will be possible to set consents at the WwTW's within the limits of BAT, and this should therefore not pose a constraint to growth¹¹.
- There are significant wastewater network capacity issues downstream of the Land at South Sydenham and East of Whitnash (1C), Land at Red House Farm (Campion Hills), and Land North of Milverton. Capacity improvements to alleviate this flooding problem are currently being appraised as part of Severn Trent's sewer flooding investment programme, but further hydraulic analysis will be required to assess the impact of this development on sewer capacity and development should not occur until after these schemes are in place.
- Fluvial flood risk will generally not pose a significant constraint to development in the majority of locations, although this should be confirmed by site-specific Flood Risk Assessments (FRAs), and for all sites there is considered to be sufficient developable land outside of flood zones 2 & 3.
- There are a number of locations known to be affected by surface water flooding, and these must be adequately assessed through site specific FRAs. These are illustrated below.
 - Site 1D, 2F and 3F, Land at Lower Heathcote Farm, south of Harbury Lane - to east of the proposed development there are some recorded incidents of surface water flooding suggesting the site may drain to an area of existing surface water flood risk;

¹¹ In the Midlands region BAT is considered to be 10 mg/l for BOD (as a 95%ile), 3 mg/l for ammonia (as a 95%ile) and 1 mg/l for phosphate (as an annual average). In other parts of the country, BAT is considered 5 mg/l for BOD, and 1 mg/l for ammonia. Further discussions will be required with the Environment Agency and STW to agree BAT in the Midlands region.



- Land at Former Ford Foundry, Leamington - some recorded incidents of flooding to the north east of the site but the exact source of flooding is unknown, and;
- Land at King's Hill, south of Green Lane, Finham - some recorded incidents to the east of the site. The exact source of flooding is unknown.

6.3 Summary of WCS

The findings from the outline WCS are summarised in Table 6-2-Table 6-4 which outlines the key findings and overall assessment for each potential and alternative option site. A summary of the red, amber, green assessment is also illustrated.

Red, amber green	WwTW capacity description	Wastewater network capacity description	Flood Risk	Water Quality
RED	No existing capacity at the WwTW and/or there are known planning constraints to additional capacity	Significant existing capacity constraints exist, and require upgrading to accommodate growth	Concerns that there is not sufficient land at low flood risk to accommodate development	New consent needed and no deterioration cannot be achieved within BAT
AMBER	WwTW requires upgrade and there are no known planning issues	Minor upgrades to the sewer system likely to be required to accommodate growth	Flood risk may be a constraint in some parts of the settlements (either within the existing settlement, or on potentially developable land)	New consent needed and can be achieved within limits of BAT for no deterioration or to achieve good status
GREEN	WwTW has capacity to cater for proposed growth	Sewerage system has capacity to cater for proposed growth. CSO - upstream PE increasing by less than 10% of design PE	Flood risk not considered to be a constraint	New consent not required to meet planned water quality

Table 6-1 Criteria for RAG assessment



Location	WwTW infrastructure	Wastewater network infrastructure	Water quality	Flood risk	Surface water management
Land at Lower Heathcote Farm, south of Harbury Lane (1D)	There is no hydraulic capacity at the WwTW – STW are currently investigating options to upgrade the WwTW	Sewers in this area are currently predicted to surcharge but not flood and there are no entries on the sewer flooding register downstream and no ancillaries, thus, this is a relatively favourable site.	Current DWF breaches flow consent at Longbridge WwTW – growth in this catchment will require a new WwTW. New discharge consents can be set to ensure no deterioration, but to achieve good status would require tightening of phosphate beyond BAT	Site located fully in Flood Zone 1 and there is sufficient land at low flood risk for development to occur. One record of surface water flooding which should be considered	0-5% of site to be taken up by attenuation storage. A combination of SUDS is likely to be suitable
Land at Lower Heathcote Farm, south of Harbury Lane (1F)				A very small part of the site is affected by Flood Zones 2 and 3 towards the southern extent of the site. A drain runs through the centre of the site. There is sufficient land at low flood risk for development to occur.	0-5% of site to be taken up by attenuation storage. Infiltration SUDS likely to be suitable
Land at Lower Heathcote Farm, south of Harbury Lane (2F)				The western extent of the site is affected by the combined Flood Zones 2 and 3. The site is sufficiently large enough however for development to occur. To east of site there are some recorded incidents of surface water flooding suggesting the site may drain to an area of existing surface water flood risk	5-10% of site to be taken up by attenuation storage. A combination of SUDS is likely to be suitable
Land at Lower Heathcote Farm, south of Harbury Lane (3F)				The southern part of the site is affected by Flood Zones 2 and 3. Tach Brook flows along the southern boundary of the site but does not enter the site itself. Two small drains exist along the south eastern and south western boundaries of the site. There is sufficient land available for development to occur. To east of site there are some recorded incidents of surface water flooding suggesting the site may drain and area of existing surface water flood risk	5-10% of site to be taken up by attenuation storage. A combination of SUDS is likely to be suitable
Land west of Europa Way, Warwick (1E)				Entire site is in flood zone 1, although a number of minor watercourses exist and should be considered	5-10% of site to be taken up by attenuation storage. A combination of SUDS is likely to be suitable
Warwickshire		There are no known sewer		Some flood risk posed in development	0-5% of site to be taken up





Location	WwTW infrastructure	Wastewater network infrastructure	Water quality	Flood risk	Surface water management
College, Warwick New Road, Leamington Spa (3H)		flooding problems downstream of this site although the hydraulic modelling will be required to assess sewer capacity and performance on a downstream combined sewer overflow.		site	by attenuation storage. A combination of SUDS is likely to be suitable
Land at Station Approach, Leamington (1B)				Site is fully located in flood zone 1 and no recorded SW flooding	0-5% of site to be taken up by attenuation storage. Infiltration SUDS likely to be suitable
Land at former Ford Foundry, Leamington (1A)		Not expected to have any capacity issues due to growth – some highway sewer flooding is known to occur		Site is fully located in flood zone 1. A drain is located to the north east of the site which has some historical incidents of flooding	5-10% of site to be taken up by attenuation storage. Infiltration SUDS likely to be suitable
Land at South Sydenham and east of Whitnash (1C)		High no. of known flooding problems d/s of development – Capacity improvements currently being appraised as part of STW's sewer flooding investment programme		Approximately 7% of the site is located within the combined Flood Zones 2 and 3. The remainder of the site is located within Flood Zone 1.	0-5% of site to be taken up by attenuation storage. A combination of SUDS is likely to be suitable
Land at Thickthorn, between Kenilworth and A46 (2G)	Current capacity issues at Finham WwTW, although STW has indicated that capacity can be put in place to support growth, subject to new EA discharge consents.	Isolated flooding problems d/s of this development – some flooding problems are being appraised by STW	New DWF and discharge consents required at Finham WwTW, and load standstill indicates phosphate consent to maintain load would need to be set beyond current BAT. Potential constraint to development and requires further assessment by EA	Site fully in flood zone 1 and no minor watercourses within or adjacent to site	5-10% of site to be taken up by attenuation storage. Infiltration SUDS likely to be suitable

Table 6-2 Summary of potential sites – Warwick DC





Location	WwTW infrastructure	Wastewater network infrastructure	Water quality	Flood risk	Surface water management
King's Hill Road, Gibbet Hill, Green Lane	Drains to Finham WwTW which currently has not infrastructure capacity at the works. STW has indicated that infrastructure can be provided, subject to EA consents being granted	Good location due to proximity to Finham WwTW - may require some upgrading of network or new outfall sewer	New DWF and discharge consents required at Finham WwTW, and load standstill indicates phosphate consent to maintain load would need to be set beyond current BAT. Potential constraint to development and requires further assessment by EA	Site affected by Flood Zones 2 and 3 in southern extent from Finham Brook.	Attenuation SUDS likely to be most suitable. GSPZ to the north should be considered
Southcrest Farm				Site fully in flood zone 1, and no observed incidents of flooding from other sources	Infiltration SUDS likely to be applicable
Land North of Milverton	There is no hydraulic capacity at the WwTW – STW are currently investigating options to upgrade the WwTW	Have long flow pathways to the WwTW and are u/s of known flooding problems	Current DWF breaches flow consent at Longbridge WwTW – growth in this catchment will require a new WwTW. New discharge consents can be set to ensure no deterioration, but to achieve good status would require tightening of phosphate beyond BAT	Northern part of site marginally affected by Flood Zones 2 and 3 from unnamed tributary of River Avon	Attenuation SUDS likely to be most suitable. GSPZ to the north should be considered
Land at Red House Farm, Campion Hills				Site lies fully in flood zone 1	A combination of SUDS will be possible

Table 6-3 Summary of alternative option sites – Warwick DC

Settlement	Wastewater infrastructure	Water quality	Flood risk	Surface water management
Leamington	Of these sites, Warwick is preferred from the wastewater perspective. This is because these three areas drain to the same treatment works. However, as the works is in Warwick, development in that	Current DWF breaches flow consent at Longbridge WwTW – growth in this catchment will require a new WwTW.	In Warwick District the majority of non-strategic development is predicted to come	Infiltration SUDS may be appropriate depending on location of windfall development – need to consider GSPZ to the north





Settlement	Wastewater infrastructure	Water quality	Flood risk	Surface water management
Warwick	region is more proximate to the works and therefore has less impact on the sewer network. The more proximate the development can be to the works the less impact it is likely to have on the sewerage system, particularly with regards to existing flooding or ancillary performance.		forward from windfall development. There will always be uncertainty as to the location of these sites, and the specific locations of development cannot be predicted. For the non-strategic development the advice provided in section 6.5.1 should be adhered to.	Infiltration SUDS may be appropriate depending on location of windfall development – need to consider GSPZ to the north
Whitnash				
Kenilworth	Foul flows from Kenilworth drains to Finham WwTW. It drains by gravity for approximately 2.5km, and is then pumped to the works by Dalehouse pumping station. There are existing sewer flooding problems between Kenilworth and Dalehouse pumping station, which would need to be further assessed (and resolved if necessary).	New DWF and discharge consents required at Finham WwTW, and load standstill indicates phosphate consent to maintain load would need to be set beyond current BAT. Potential constraint to development and requires further assessment by EA		Infiltration SUDS may be appropriate depending on location of windfall development – need to consider GSPZ to the north

Table 6-4 Summary of non-strategic development locations – Warwick DC





6.4 Recommendations for Warwick District Council

In this section we have provided recommendations based on the findings of the WCS, and recommendations for further work. Further work can be addressed through a detailed WCS, or alternatively can be carried out as discrete packages of work, as required.

6.4.1 Water resources

Due to the current and predicted supply-demand deficit within the study area, the local planning authorities should implement planning policies to ensure the efficient use of water in both the new and existing housing stock. It is recommended that all new development is built at CSH level 3/4 for water as a minimum, although achieving CSH level 5/6 should be considered as an aspiration of the partner authorities.

In addition to new development, demand must be reduced in the existing housing stock. The local planning authorities, in partnership with the Environment Agency and STW, should continue to encourage the uptake of metering in the existing housing stock, and should encourage more sustainable use of water resources through education programmes, for example.

During the course of the outline WCS a Habitats Regulation Assessment (HRA) has been undertaken by Stratford-on-Avon District Council. This study concluded that “on its own, the consultation Core Strategy [Stratford-on-Avon] will not have significant impacts on the integrity of any of these sites. However, in combination with other development being proposed in the West Midlands and South West, the Core Strategy could have significant impacts on the integrity of the Lyppard Grange Ponds SAC, the Severn Estuary sites and River Wye SAC due to water abstraction; and the Severn Estuary sites due to water pollution. It is therefore important that a regional approach is adopted to ensure water abstraction levels remain sustainable, and do not have a detrimental impact on the environment. This regional approach is already adopted by STW and the Environment Agency, who should work in partnership with all local planning authorities in the West Midlands to drive sustainable use of water in new developments (and the existing housing stock).

6.4.2 Flood risk management

General

Developers need to follow the principles and requirements of national policy, most notably PPS25: Development and Flood Risk. Any new development should be located in the areas of lowest flood risk and must not increase risk to existing development and areas identified as functional floodplain should be protected from development.

For a number of locations, instances of surface water flooding from artificial drainage, surface water and field runoff have also been identified as a problem, particularly at times of heavy and prolonged rainfall. It is therefore recommended that future development proposed in locations known to be at risk from surface water flooding is avoided. Appropriate surface water management policies should be developed to ensure that flood risk is not increased within the site or to locations downstream.

It must be ensured that all new development is ‘safe,’ meaning that dry pedestrian access to and from the development is possible without passing through the 1 in 100 year plus climate change floodplain, and emergency vehicular access is possible.



It may be possible to cluster potential development areas together to consider strategic flood risk management activities that would provide a strategic benefit and bring benefit to the wider community.

Recommendations for Warwick DC

On the whole, flood risk is relatively high in Warwick DC; however the proposed development sites are generally not constrained by flood risk issues. The following recommendations are made in light of the findings of the WCS:

- There are a number of proposed locations in the district behind existing flood defences, and any development behind a flood defence will need to be accompanied by a detailed site specific FRA, to understand the residual risk of flooding.
- Similarly, where development is adjacent to a canal this will need to be assessed as part of the site specific FRA.
- The findings of the WCS have indicated there is insufficient land outside of flood zones 2 & 3 to accommodate the proposed development at Warwickshire College (although this is based on our assumptions of density at 40 houses/hectare). A detailed FRA will need to ensure that development is located away from high flood risk areas first, and less vulnerable water uses are located in flood zones 2 & 3.
- There are a number of locations which are known to suffer from surface water flooding. As part of the site specific FRAs, surface water flooding must be included, and appropriate strategies must be included in the FRA to mitigate surface water flooding.

6.4.3 Surface water management

General

The following recommendations are made in light of the findings of the outline WCS:

- As a minimum runoff rates and volumes from the development site should not be greater than runoff rates and volumes prior to development up to the 100 year 6 hour rainfall event (plus an allowance for climate change). In brownfield development sites a reduction of runoff rates and volumes should be achieved compared to the existing rates and volumes. The runoff requirements for a development site should be agreed with the Environment Agency at an early stage in the planning process.
- In accordance with PPS25, and the forthcoming Floods and Water Management Bill (and associated national SUDS standards) SUDS are required to be implemented at all scales of development. At the household level there should be a presumption away from connecting property extensions or additional hard-standing area to the sewerage network. The additional runoff should be managed at source, where possible, or connected to a watercourse (in agreement with the Environment Agency).



- Infiltration SUDS should be promoted where it is practical. Where infiltration SUDS are not applicable surface water should be discharged to a watercourse (in agreement with the Environment Agency) at a rate no greater than greenfield.
- Where infiltration SUDS are proposed, this must be supported by a groundwater risk assessment, carried out by the developer, to ensure groundwater is not polluted. Groundwater flooding should also be considered where infiltration SUDS are proposed. The presence of Nitrate Vulnerable Zones (NVZs) must also be considered as part of the development proposal.
- Surface water should not be connected to the sewerage network, unless there is no practicable alternative. Where surface water is required to be connected to the sewerage network, runoff rate from the development site should be controlled to greenfield
- In greenfield developments there should be no flooding (from all sources) on properties up to the 100 year flood event. This can be achieved through effective master planning of the development site, and may need to include an allowance for managing exceedance flows¹² if surface water drainage infrastructure is exceeded. In brownfield development it may not be possible to achieve this level of protection depending on the nature of the existing risk, but there should be a presumption against building in areas of high risk

Recommendations for Warwick DC

The sustainable surface water management recommendations for Warwick DC district include:

- Across large parts of the district, infiltration type SUDS will be suitable, and they should be promoted by Warwick DC, where possible. This must be confirmed by infiltration tests on site.
- To ensure runoff from the developed sites is equivalent to greenfield runoff, the drainage assessment has shown that less than 10% of the development sites would be taken up by storage requirements. The drainage assessment proposed allocations were all less than 10% of the development site area. Therefore, there is sufficient land to ensure that surface water is managed within development sites. Developers should consider the required drainage provision at early stages of the planning applications, and the strategic provision of surface water drainage infrastructure (e.g. large attenuation basins) should be explored.

6.4.4 Wastewater infrastructure

General

- Surface water should be kept out of the sewerage network, where possible. The removal of the automatic right to connect as proposed in the Floods and Water Management Bill will help sewerage

¹² Guidance of managing exceedance flows is provided in “Designing for Exceedance in urban drainage – good practice C635, CIRIA, 2006)



undertakers reduce surface water connections to the sewerage network. It is recognised that in some locations there will be no practicable alternative other than connecting surface water to the sewerage network, but it is the responsibility of the developer to demonstrate that all other possible drainage alternatives have been explored in the first instance.

- Foul flows from new developments can be reduced through implementation of water efficiency measures and metering of all new development. This will reduce the new net burden on the wastewater network and at the WwTW.
- All development proposals should be discussed with STW at the earliest possible opportunity, to understand the constraints for development and potential upgrades required.

Recommendations for Warwick DC

- It is critical that STW identify when they will be able to provide additional capacity at Finham and Warwick WwTWs. The phasing of development will be heavily influenced by the provision of adequate infrastructure and Warwick DC should liaise with STW to agree an implementation timetable for infrastructure provision.
- Downstream of the Land at South Sydenham and East of Whitnash, Land at Red House Farm Campion Hill and Land North of Milverton there are significant network capacity constraints. Capacity improvements to alleviate this flooding problem are currently being appraised as part of Severn Trent's sewer flooding investment programme. Further hydraulic analysis will be required to assess the impact of this development on sewer capacity. The phasing of development should consider the delivery of this infrastructure.

6.4.5 Water quality

General

- In general WwTW which discharge to watercourses with a higher dilutive capacity should be considered preferable for growth, because the WwTW will have a lower impact on the watercourse.
- Growth must not cause deterioration of water quality and should not hinder the ability of a water body to meet the WFD.
- Early discussions should take place between the Environment Agency, the local planning authority and STW to confirm the new consents needed to serve growth.
- Where development is upstream of a combined sewer overflows (CSO), an Urban Pollution Management (UPM) study should be instigated by STW to assess whether there will be deterioration in water quality. A UPM study follows a risk-based approach, requiring a level of detail which is proportional to the problem in question. As a minimum an assessment should be made by STW as



to the predicted increases in volume and frequency of overflows. The scope of any UPM assessment will need to be agreed with the Environment Agency and STW.

Recommendations for Warwick DC

- The Environment Agency needs to confirm, at the earliest possible opportunity, whether they will grant a new discharge consent at the WwTWs. It is recognised that it may not be possible to set phosphate consents to achieve good status for WFD (irrespective of growth).





Appendix A. The Water Framework Directive

A1 The Water Framework Directive

The Water Framework Directive (WFD) came into force in December 2000, and was transposed into UK law in December 2003. It is the most substantial piece of European Commission water legislation to date and is designed to improve and integrate the way water bodies are managed throughout Europe. Under the WFD all Member States must:

- prevent deterioration in the classification status of aquatic ecosystems, protect them and improve the ecological condition of waters;
- aim to achieve at least good status for all waters. Where this is not possible, good status should be achieved by 2021 or 2027;
- promote sustainable use of water as a natural resource;
- conserve habitats and species that depend directly on water;
- progressively reduce or phase out releases individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants, and;
- contribute to mitigating the effects of floods and droughts.

A1.1 No deterioration

The first principle of the WFD is to prevent deterioration in aquatic ecosystems. No deterioration must be met in all but very exceptional circumstances. Exceptional circumstances apply when the deterioration is caused by physical modifications to the waterbody, for example for flood risk management reasons, or the result of sustainable new human development activities. Even in such cases it is necessary to demonstrate that there was no better way to achieve the desired development, that there are no possible mitigation measures, and that it is technically infeasible or disproportionately expensive to do so. In addition, no deterioration requires that a water body does not deteriorate from its current ecological or chemical classification, and applies to individual pollutants within a water body. The Directive allows for deterioration within the limits of a status or classification. For example, if dissolved oxygen was currently classified as moderate status, then the first principle of the WFD would be to ensure no deterioration from moderate class, and the limited numerical deterioration acceptable within each classification or status would not constitute a breach of the Directive or be reported as deterioration. In exceptional



circumstances only, it is acceptable to allow a deterioration of chemical status from high to good status only.

Box A.1 shows article 4.7 of the Directive which covers the exemptions from no deterioration

Box A.1: Text of Water Framework Directive Article 4.7

Member States will not be in breach of this Directive when:

- *failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water or groundwater is the result of new modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater, or*
- *failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities*

and all the following conditions are met:

- (a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;*
- (b) the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;*
- (c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and*
- (d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.*

A1.2 Good status

Under the WFD the objective is for all water bodies to meet good ecological status by 2015. For surface waters (rivers, lakes, transitional waters), good ecological status can be defined as:

- good chemical status for the relevant substances (there are also a series of daughter directives);
- good physico-chemical status on the scale high, good, moderate, poor and bad;

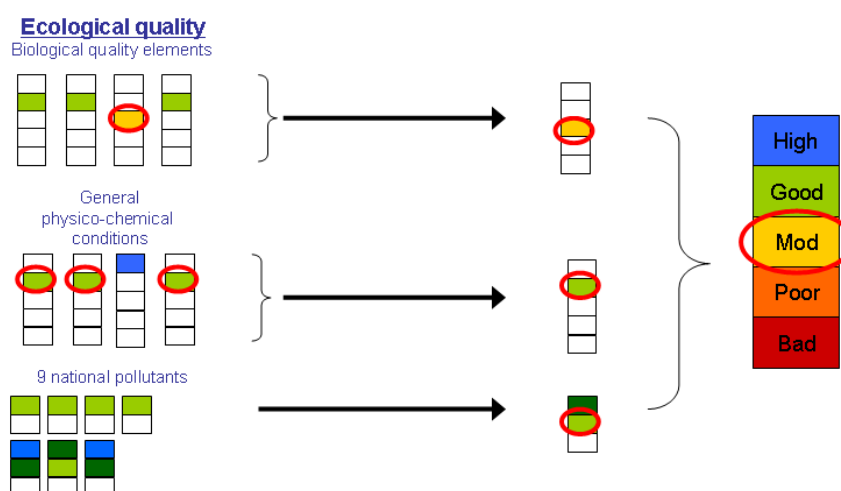


- good biological class, and;
- good hydro-morphological class.

The status of a water body is measured through a series of specific standards and targets that have been developed by the UK administrations, supported by the WFD UK Technical Advisory Group (www.wfduk.org).

The manner in which overall status is assessed is by using a 'one out, all out' approach. That is, the status is determined by the lowest common denominator. The following diagram shows how this works in practice. In the example the lowest biological quality element status is moderate, the lowest physico-chemical element status is good and the lowest status of the other pollutants quality is good. Assuming the 'one out, all out' approach, the lowest status of all three of these criteria is moderate and therefore the waterbody status will be moderate.

Determining Water body Status



A1.3 Alternative objectives

Although the WFD specifies that good status should be met by 2015 there are circumstances where it is possible to delay meeting good status until 2021 or 2027, or where a lesser objective will be required. These circumstances include technical feasibility, disproportional costs, or natural conditions (recovery times). In most instances it is likely that these circumstances will lead to an extended deadline (i.e. 2021 or 2027) to meet good status, rather than setting a less stringent objective. A less stringent objective can be set for specific bodies of water when they are so affected by human activity, or their natural condition is such that the achievement of these objectives would be infeasible or disproportionately expensive. This is subject to certain conditions being met. These conditions include that the environmental and socioeconomic needs served by such human activity cannot be achieved by other means, which are a significantly better environmental option not entailing disproportionate costs, that the highest ecological



and chemical status possible is achieved, given impacts that could not reasonably have been avoided due to the nature of the human activity or pollution, and that no further deterioration occurs.

Under Article 4 (3) of the WFD it is possible to designate water bodies as artificial or heavily modified water bodies. The WFD recognises that some water bodies have been modified to provide valuable social or economic benefits, and it is recognised these water bodies are not able to achieve natural conditions, and hence should not be required to achieve good ecological status. Artificial or heavily modified water bodies therefore have an alternative objective of meeting “good ecological potential” and these are identified in the draft River Basin Management Plans.

A1.4 River Basin Management Plans

In England and Wales, the Environment Agency is the lead authority in ensuring delivery of the WFD. The Environment Agency has prepared draft River Basin Management Plans (dRBMP), published for consultation in December 2008, which set out:

- the current status for each water body (including confidence limits);
- the objectives and targets for each water body;
- the main pressures for each water body;
- an action plan outlining what will be required, by whom, and when to meet good ecological status, and;
- justification for setting an alternative objective by 2015.

Following the consultation of the dRBMP, they will be adopted as the first RBMP in December 2009, with the aim of meeting the main environmental objectives by December 2015. RBMPs will then be periodically reviewed and updated every six years (i.e. 2021, 2027).

The Warwickshire water cycle study area lies predominantly in two river basin districts, Warwickshire Avon in the Severn RBMP areas and Tame, Anker and Mease in the Humber RBMP area.

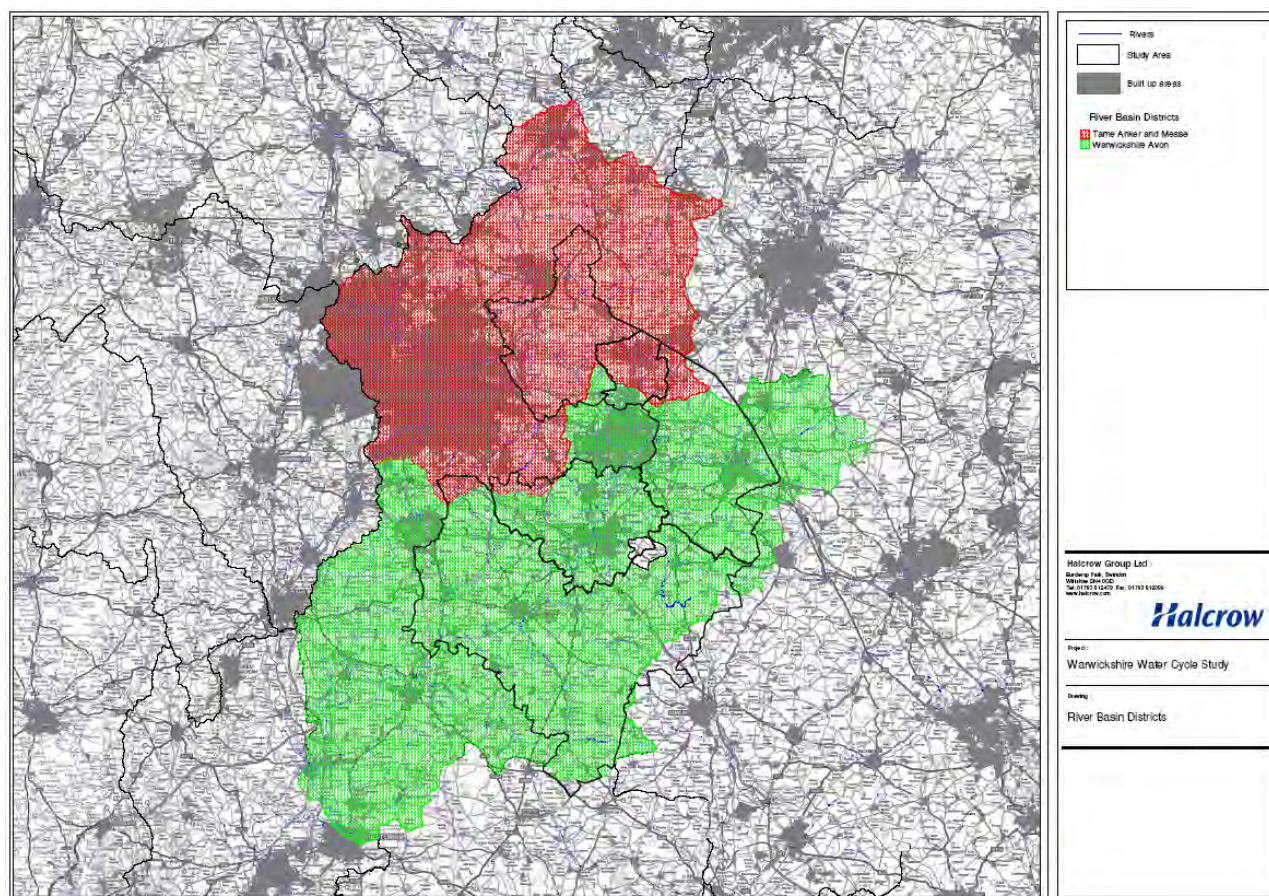


Figure A-1 River Basin districts in the Warwickshire water cycle study area

A1.5 Warwickshire Avon

In the Warwickshire Avon district there are currently 11% of water bodies at good ecological status. In 2015 this figure is expected to remain the same however 9% of the water bodies are predicted to improve for at least one ecological element of good status.

River and lake water bodies	Now	2015
% at good ecological status or potential	11	11
% assessed at good or high biological status *	35	40
% assessed at good chemical status	81	88
% at good status overall (chemical and ecological)	11	11
% rivers improving for one or more element		9
* 77 water bodies assessed		

Table A-1 Current and future water bodies' status in Warwickshire Avon river basin district



A1.6 Tame, Anker and Mease

River and lake water bodies	Now	2015
% at good ecological status or potential	3	3
% assessed at good or high biological status *	19	26
% assessed at good chemical status	75	75
% at good status overall (chemical and ecological)	3	3
% improving for one or more element in rivers		38

* 53 water bodies assessed

Table A-2 Current and future water bodies' status in Warwickshire Avon river basin district

In the Tame, Anker and Mease district there are currently only 3% of water bodies at good ecological status and this figure is expected to remain the same by 2015. The key reasons for the failures in the catchment are point source discharges from water industry sewage works, run-off from urban areas and physical modifications due to the watercourses.

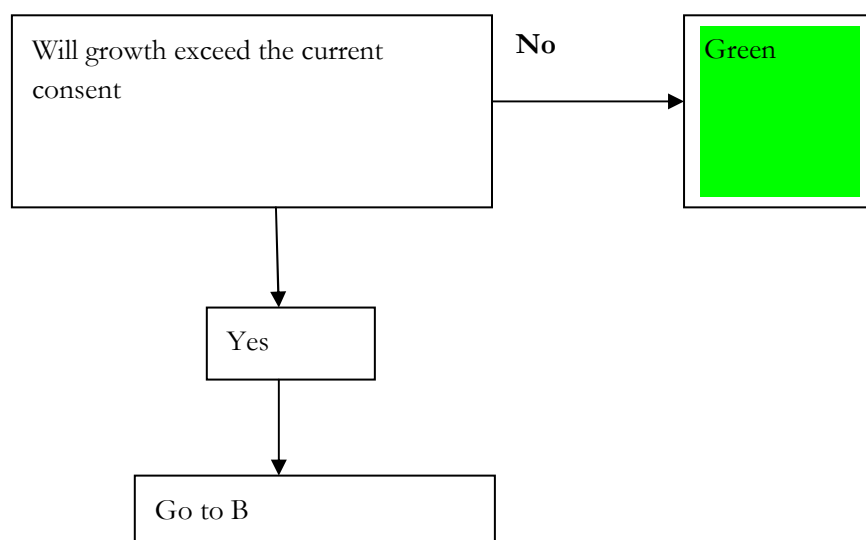


Appendix B. Considering the WFD in WCSs

The following flow diagrams have been taken from the Environment Agency document “Considering the Water Framework Directive in WCSs” (November 2009).

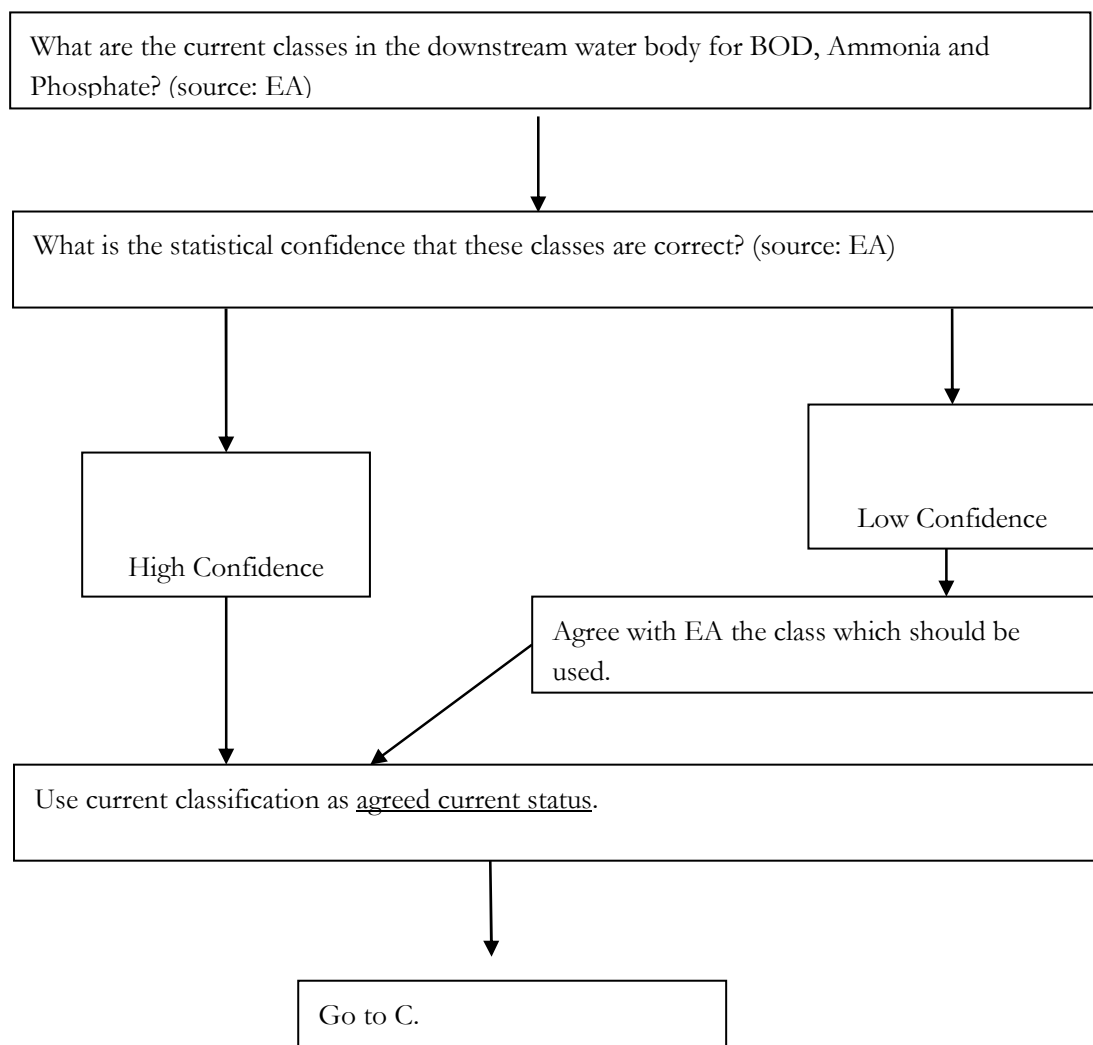
1. We identify developments as Red, Amber or Green with respect to the impact on water quality where:
 - a. Green: there is no significant impact
 - b. Amber: the impact can be mitigated through sustainable extensions to the works
 - c. Red = no mitigation is identified.
2. For sites which are red measures should be taken to avoid increasing the consented load from the works by having the development elsewhere, diverting the effluent elsewhere, or by managing the demand for water and subsequent flows to the sewage system.

A: Check compliance with DWF consent

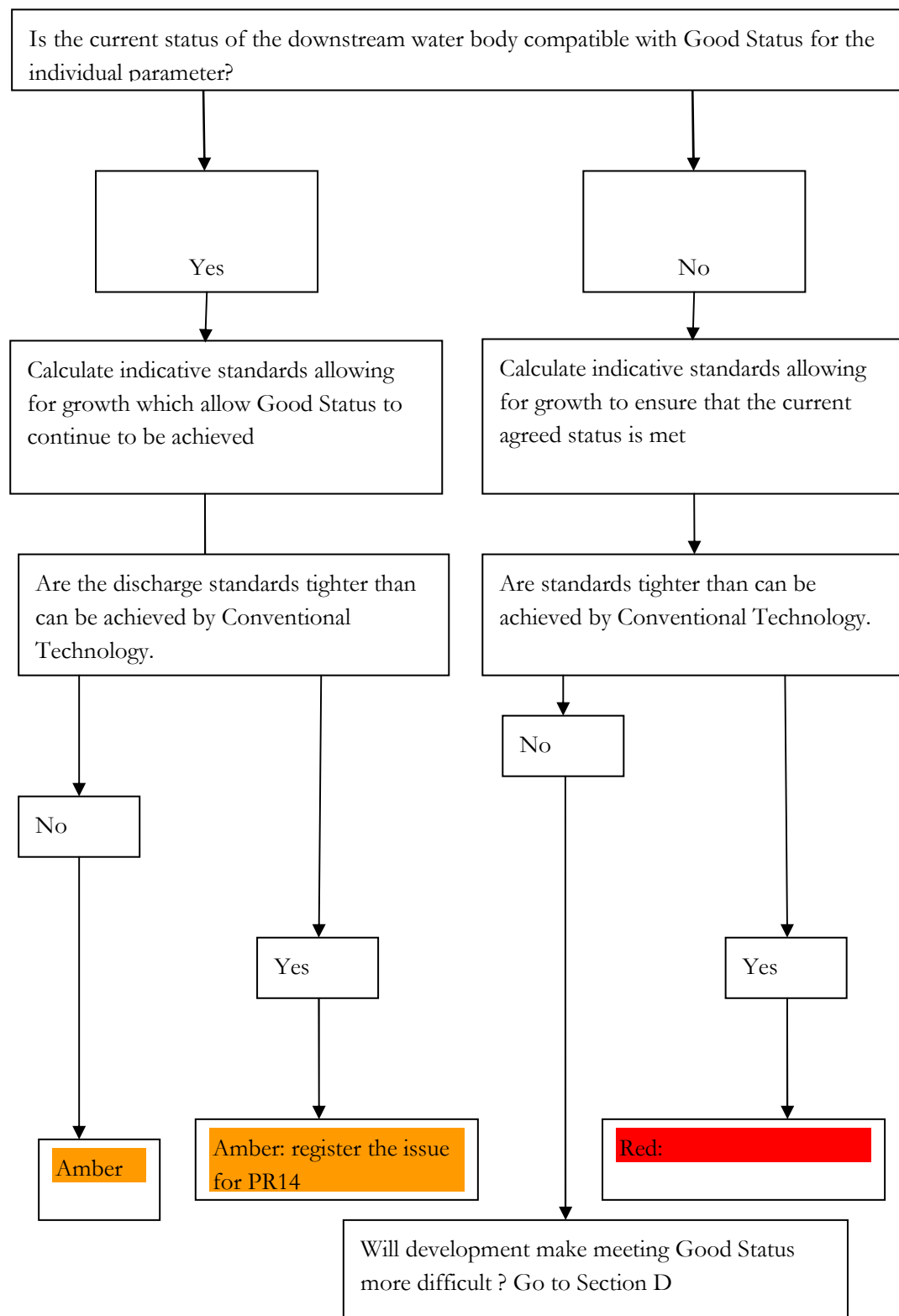




B: The classes to be used to ensure No Deterioration

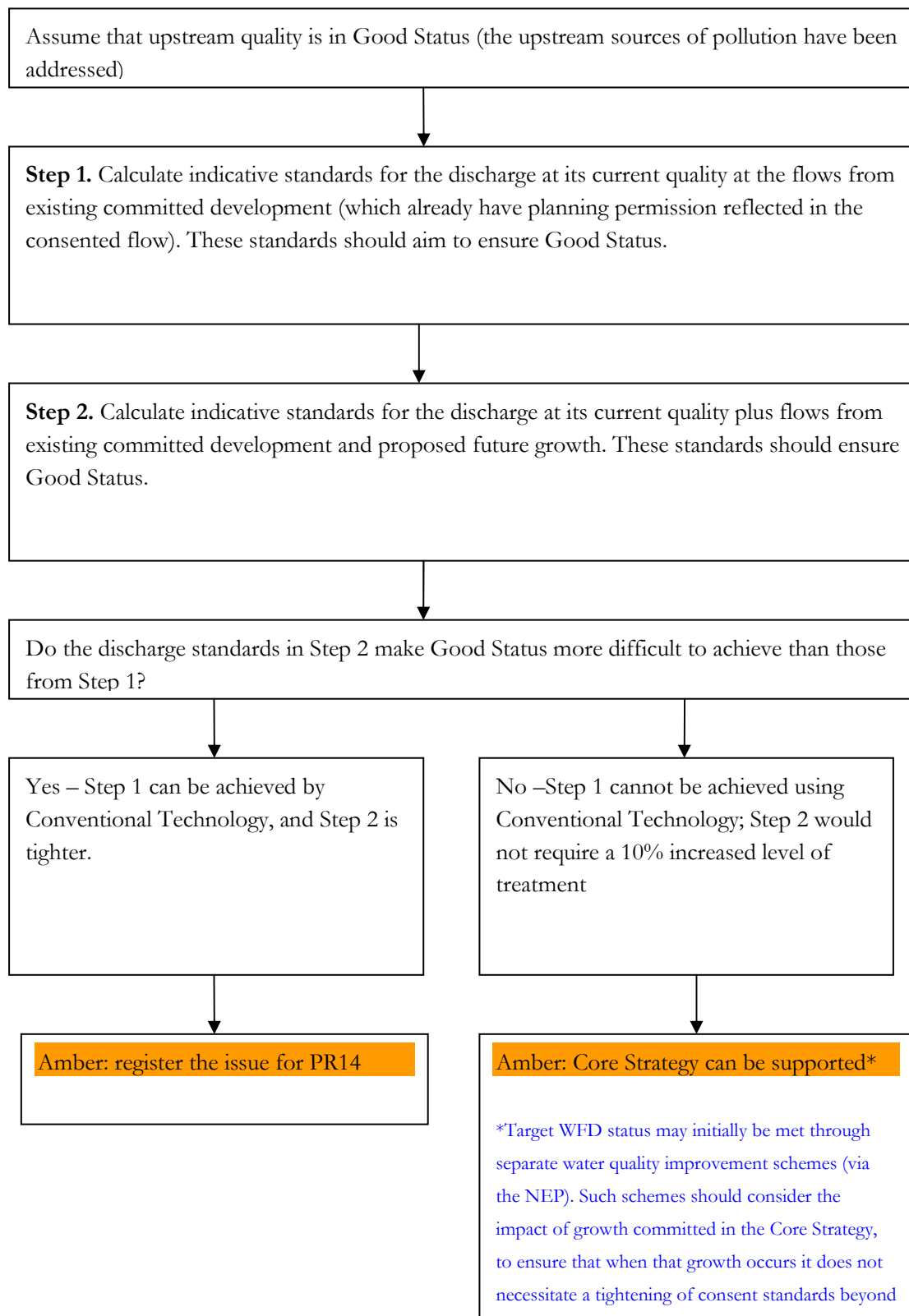


C: Calculate the discharge standards to ensure no deterioration and to determine the impacts of growth on achieving the objective of Good Status.





D: Assess whether growth will make Good Status more difficult to achieve in the future





Appendix C. Overview of options for demand management

C1 Options for Demand Management

The estimated average use of water in England is 150 litres per head per day. Many other countries in Europe already appear to be using considerably less than this. The perception is that our water consumption could be significantly reduced without major impact upon services or quality of life.

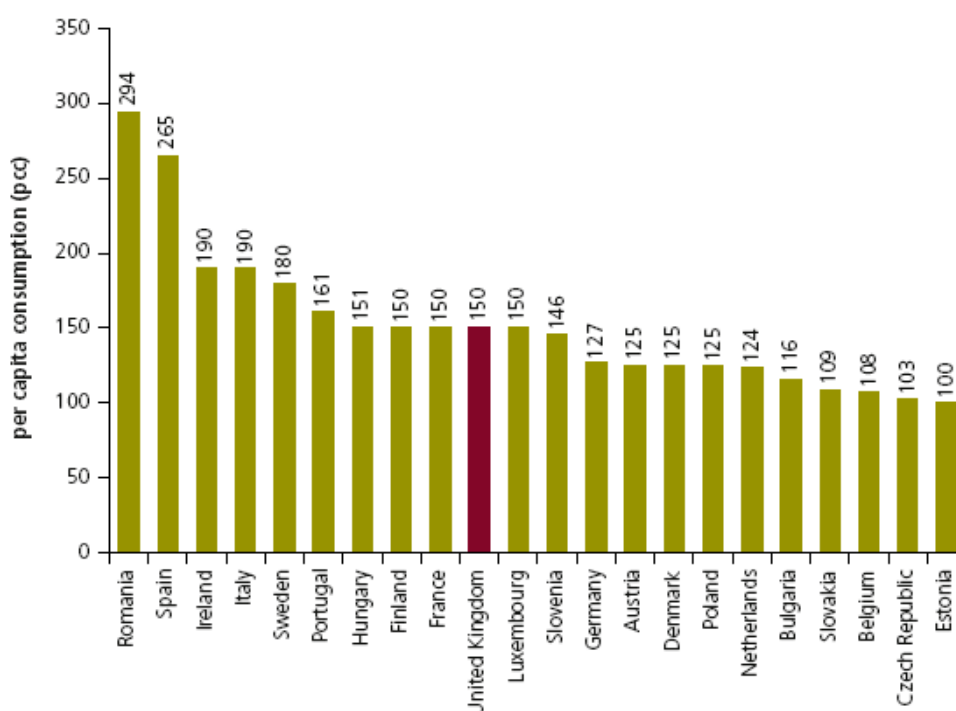


Figure C-1 EU per Capita Water Consumption (Future Water, 2008)

Key measures that in combination help achieve water neutrality, or limit the impact of development on the environment can include:

- Expanded metering;
- Enhanced regulation for water efficiency;
- Water efficient devices and retrofitting;
- Greywater recycling;
- Rain water and stormwater recycling;



- Education and community wide public awareness
- Economic measures and tariff structures.

The overall objective is that new development should have a benign effect upon the water environment. Where water neutrality cannot be achieved options for augmenting water resources can be considered, i.e. rain water harvesting.

C1.1 Metering

The measures included in the demand scenarios, in some cases, will not be practical to implement. The implementation of Environment Agency metering of 95% of existing properties by 2016 is an ambitious target and requires around 12,750 properties a year from 2010 to 2016 to be connected to a meter in the WCS area, at a cost of up to £500 each. In 2006 28% of STW customers were connected to a meter, which is about the national average. Since October 2007, water companies within seriously water stressed areas have been given extended powers to increase compulsory metering. STW have no current policy for compulsory metering in the Severn WRZ but provide free water meters and assume that current levels of water meter take up will continue through the planning period to 66% by 2035. It is suggested that measures are implemented to accelerate these levels of meter take up.

C1.2 Water Consumption in New Properties

A range of water consumption targets have been identified for new properties. The governments strategy has a requirement for a standard of 120 litres per day (l/p/d) for new properties which it anticipates will be achieved by ensuring that all new homes have fittings with a good standard of water efficiency. New requirements on water efficiency will be introduced into Building Regulations.

It is recommended that the Code for Sustainable Homes is supported as much as practicably possible depending upon each individual development. The code should be specifically targeted through local planning regime at the largest developments where the benefits from development wide collection systems would be greatest. Staggering development should also be considered so the largest developments are built later within the planning period, in the hope that by which time the code may be statutory and technology will be in place to make the more stringent levels of the code more cost-efficient and feasible.

C1.3 Water Efficient Devices and Education

The government expects the demand for water efficient products from new housing to help drive the market and improve the efficiency of everyday water using products over time. To further facilitate these improved levels of efficiency, the Water Supply (Water Fittings) Regulations 1999 will be reviewed. These cover for example the maximum water use of toilets, urinals, washing machines etc. The review will also consider enforcement issues, advances in technical standards and water conservation, and the case for setting new performance standards for key water fittings. This will also support the CSH.

An example of progressive reduction in water use is shown in Table C-1 below. It displays a comparison of water use, by component, for a standard home and the same home fitted with the best available water saving products, with progressing levels of water efficiency. Within this example the majority of water



savings are made by water efficient devices either installed during new build or by retrofit replacement at the end life of existing devices, and the progressive options are detailed within the notes.

In combination with these devices water consumption is also assumed to decline through the effects of education and structured tariffs.

Component	Water Use (l/d/capita)					
	150 Standard Home	130	120 CSH Level 1/2	115	105 CSH Level 3/4	80 CSH Level 5/6
Toilet Flushing	28.8	19.2 ^(b)	19.2 ^(b)	16.8 ^(d)	16.8 ^(d)	8.4 + 8.4 ^(f)
Taps ^(a)	42.3	42.3	31.8	31.8	24.9	18
Shower	30	24	24	22	18	18
Bath	28.8	25.6 ^(c)	25.6 ^(c)	25.6 ^(c)	25.6 ^(c)	22.4 ^(c)
Washing Machine	16.7	15.3	15.3	15.3	15.3	7.65 + 7.65 ^(f)
Dishwasher	3.9	3.6	3.6	3.6	3.6	3.9
Recycled Water ^(f)	-	-	-	-	-	-16.1
Total per Capita	150.5	130	119.5	115.1	104.2	78
Outdoor ^(g)	11.5	11.5	11.5	11.5	11.5	11.5
Total per Home	366.68	319.3	293.52	284.136	257.412	195.58

Table C-1 Targets for Water Use and Efficiency Measures¹³

- Notes:
- (a) combines kitchen sink and wash hand basin
 - (b) 6/3 litre dual-flush toilet
 - (c) 160 litre bath filled to 40% capacity, frequency of use 0.4/day
 - (d) 4.5/3 litre dual flush toilet
 - (e) 120 litre bath
 - (f) recycled water (rainwater/greywater harvesting)
 - (g) assumed garden use

Most water companies offer water efficient devices either free of charge or at a reduced price. This can include cistern displacement devices (such as hippos, save-a-flush), water butts, trigger hose attachments, water audits and supply pipe replacement or repairs. Water efficiency campaigns can be very successful in reducing water consumption and are continuously undertaken by water companies. As part of the government's water strategy it has published a list of top water saving tips. STW promotes a range of water efficiency measures and is involved in a number of trials and schemes to raise awareness of and promote water efficiency.

The promotion of water efficient devices and awareness of water saving measures should continue to be encouraged, such as those to be implemented by STW. Whether this can achieve a reduction in water consumption used in the scenarios above and whether this reduction per year can be maintained is uncertain. It's likely that initially with efficiency devices and education a reduction in water consumption is feasible in the initial stages of the planning period. However to continue the decrease in water

¹³ Table based upon Environment Agency Publication - Science Report – SC070010: Greenhouse Gas Emissions of Water Supply and Demand Management Options, 2008.



consumption beyond a certain level will be difficult as campaigns saturate the customer base and existing technologies are utilised. By this point it may be that consumption can be reduced to a level whereby measures, such as additional water resources or licences to support the increase in supply will not be required.

Education and Community Wide “Soft” Measures

Water efficiency campaigns can be very successful in reducing water consumption. Public involvement is crucial if water resources are to be managed without the need for economic measures. Community wide soft measures are broadly designed to change water use behaviour and practices and create a water saving and efficiency culture. Provision of clear information about water use and the impact on the environment is of paramount importance if householders are to make informed decisions on water saving.

Water conservation messages can be quite difficult to market, encouraged by the perception of plentiful rainfall and the prevalence of flat rate pricing for water. Public awareness campaigns need to target long term changes in individual behaviour through:

- Creating awareness and interest;
- Educating;
- Providing necessary skills to effect change.

Components could include:

Young persons’ campaigns: young people are agents of change. Engaging and making them interested in protecting water resources will help and impact the change of behaviour and habits from an early stage on. With the help of information and education materials, interactive games, cartoons, outdoor activities, etc. the young generation can learn about the importance of water in its different environments. Emphasis can also be placed on creative work incorporating water into different means of expression e.g. photographs, videos, theatre plays.

Adult campaigns: these can include lectures, small workshops, exchanges with experts, public exhibition, water audit for typical household, water saving devices, details of cost and expected savings, provide details (with model?) of raw water sources used for public water supply and potential impact of over abstraction, public visits to headworks and treatment facilities, articles in local papers, lorry with volume of water consumed by typical household

Self or water company led home water audits: water audits provide householders with a complete picture of how and where water is used in the home and hence provides necessary information to be able to assess opportunities to save water.



Water company led audits can provide more easily accessible information on areas of high consumption or waste and the payback period of water conserving equipment. There is some merit in undertaking water audits with energy audits since reducing hot water consumption also reduces energy use.

Raising the profile of aquatic environment: the objective of these measures would be to engage existing residents in the local environment and in particular the aquatic environment, and hence increase their desire to protect and conserve it. Actions could include making sure all community areas are attractive, well maintained, with low water requirement; increasing access to the environment by for example, constructing attractive activity park(s) in areas of less ecological value – aerial runway, mountain bike tracks, café etc, regular events to shout about the local natural environment, kids after school activities e.g. green gym, local competition for best wildlife or natural environment photo

Green labelling: clear labelling of the water efficiency of equipment such as washing machines, dishwashers. Labelling is a simple and direct way of communicating information about a product to purchasers. There are a number of different green labelling schemes including Waterwise's Marque.



The Marque is awarded annually to products which reduce water wastage or raise the awareness of water efficiency. 27 Marques have been awarded across a broad spectrum of products including dishwashers, showerheads, water storing gels for the garden, toilets and urinals, drought resistant turf, domestic water recycling products, water butts, a waterless carwash, tap flow restrictors, a shower timer and devices to reduce the amount of water used when flushing the toilet.

Councils could be proactive in encouraging all retailers to display green labels and provide information on the different schemes where appropriate.

Green plumbers: council maintained and advertised register of plumbers having attended an accredited training programme on their role in protecting the environment.

Economic Measures – Volumetric Charging

Traditionally water use in England has been unmetered with customers paying according to the rateable value of the property. Volumetric charging increases the cost of billing but is deemed to be a fairer pricing mechanism and encourages water saving.

At present the Government does not compel water companies to install meters, although residents have a right to pay a metered charge and can request the water company install a meter free of charge, unless for particular reasons the cost is prohibitive.

As mentioned STW propose an accelerated metering programme with an aim to meter 72% customers by 2035, as updated in the SoR, and continue to promote and maintain free optant metering.



Due to historic pricing policies, economic instruments have not been widely used to promote water conservation in the UK and limited data is available on the elasticity of demand. The recent introduction of volumetric charging for some households (in particular those electing to have a meter and new build houses) has had a limited impact on domestic water consumption (reported reduction of 10% over unmetered users). This is considered to be due to the relatively low price of water in the UK rather than the inherent value of the instrument as a means of reducing water consumption.

Notwithstanding significant real price increases since privatisation of the water companies, average water and sewerage charges in England are approximately 1% to 2% of household income. This compares to the recommended maximum (WHO) of 4% to 5% of household income.

The EU Water Framework Directive reinforces use of economic concepts to control water resource management. Article 9.1 states that member states shall ensure that, by 2010, water pricing policies provide adequate incentives to ensure the efficient use of water.

Assuming the adoption of volumetric charging, the options are as follows:

Type of meter: dumb or smart, smart meters are approximately 3 to 5 times the price of dumb meters but provide greater opportunities for the introduction of varying tariff structures, more cost effective reading (and hence more frequent reading) and facilitate improved leakage detection. Smart meters also provide the opportunity of providing customers with an easily accessible readout of water use;

Level of charges: water use being related to level of charges;

Tariff structure: rising block and or seasonal tariff structure can provide good incentives to reduce excessive water consumption without raising the basic rate for low volume water use. Seasonal tariffs are appropriate to encourage consumers to be extra careful with water during the summer months when water is less plentiful.

It is recognised that compulsory metering is not universally welcomed. Therefore, prior to the metering programme, consideration could be given to undertaking an intensive education and public awareness campaign together with the provision of subsidised water saving devices (cistern displacement, tap aerators, flow restrictors etc). Meters could be installed and read for a minimum of 3 months prior to the application of the new tariffs; this would allow residents to appreciate volumes of water used and undertake measures as appropriate to reduce consumption.

During this period, the water company could also consider undertaking a high profile leakage detection and reduction. In addition to reducing water abstraction, this will be designed to increase acceptance of water saving measures by existing households (surveys indicate a reticence on the part of the public to make savings whilst a significant proportion of water into supply is “lost”).



In authorising the proposed tariff structure and level of charges, it is assumed that the economic regulator will make due allowance for the investment made by the water company in order to protect the environment at the cost of loss of sales.

Economic Measures - Local Environmental Tax

The objective of the local environmental tax would be to provide economic incentive to conserve water and raise revenue for local projects. In principle, if viable and legal the tax for environmental conservation could be set by local council, collected by the water service provider and ring-fenced for local community projects. Alternatively the tax could be applied nationally and managed on similar lines to the land fill tax.

C1.4 Additional Water Efficiency Options

Greywater Recycling

Greywater is wastewater from showers, baths, washbasins, washing machines and kitchen sinks, which can be reused to reduce water demands.

The physical and microbiological characteristics of greywater vary significantly depending on its origin. Water from baths, showers and wash basins is generally less heavily contaminated than that originating from the kitchen or laundry, which can contain detergents, fats, nitrogen and phosphorous. For this reason most domestic greywater reuse or recycling systems exclude the latter.

Greywater can be reused directly, i.e. without treatment, if it is not stored for any length of time. Direct reuse of greywater is generally limited to:

- Subsoil garden irrigation;
- Toilet flushing.

Untreated grey water can be used for more general use in the garden. For example once cooled it may be stored in a water butt for above ground irrigation. However, care should be taken avoid long storage periods, sprinkler or spray systems and direct reuse on fruit and vegetable crops. Short retention systems containing simple valves are available to discharge greywater either to storage for outside use or to waste. Systems are also available to automatically empty tanks if water turnover is poor.

Rain Water Recycling

Rain water harvesting systems (Figure B-2) potentially offer the combined benefits of reduced water consumption from the public water supply system and reduced surface water runoff discharged to the public sewerage system. Available systems vary from installation of a simple water butt for garden watering to propriety units providing treatment, storage and delivery; depending on the level of treatment provided harvested water can be used for all purposes except drinking and food preparation



At its simplest rainwater can be collected in above ground butt for outdoor use such as garden watering and car washing. Typical systems for indoor use comprise:

- First flush diverter - To divert initial rainfall containing dust or other material from the roof;
- Filter - to removes debris from the collected rainwater and discharge it to a soakaway or the storm water sewer;
- Water storage tank – such as “green wall” systems, consisting of modular sections of polyethylene vertical tank with high storage volume-low footprint designs (www.waterwall.com.au); or rainsaver storage gutters (www.rainsaverstoragegutters.com) fed by gravity to toilet cisterns or garden watering, with overflow going direct to the storm drain or discharge system.

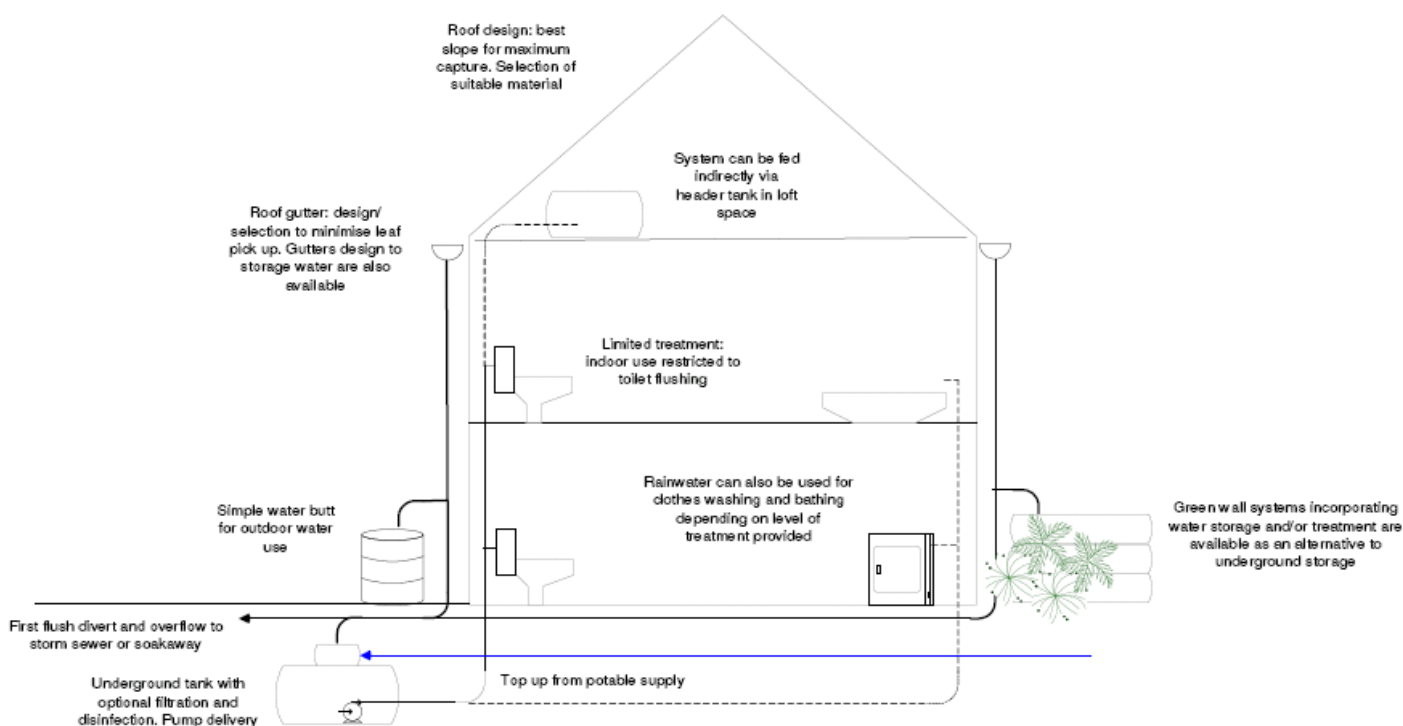


Figure C-2 Rainwater Harvesting

Stormwater Harvesting

Stormwater Harvesting can be defined as the diversion, storage and treatment of stormwater runoff from urban catchments for reuse. Roof water harvesting differs from this in that it harnesses only relatively uncontaminated runoff from roof areas. Stormwater harvesting can include roof water harvesting and non-urban runoff as part of a broader scheme.



The components of a stormwater harvesting system are:

- Stormwater catchment generating stormwater runoff;
- Conveyance system (conveying stormwater to the diversion) which could be a mix of overland and piped flows;
- Stormwater quality treatment system such as a bio-retention basin as part of a Sustainable Urban Drainage System;
- Diversion to take the primary treated stormwater to stormwater storage;
- Stormwater storage system (above or below ground);
- Water treatment system (to ensure water is fit for purpose);
- Treated water distribution system (pumped and piped reticulation).

Urban stormwater runoff can be considered a primary cause of aquatic ecosystem degradation due to pollution impacts on water quality, physical stream disturbance, sedimentation and alteration of riparian flow patterns.

The environmental benefits of stormwater harvesting and its associated water savings are not only reduced overall water demand, which could delay the need to build further infrastructure, but include the potential to:

- Reduce pollutant loads entering aquatic ecosystems;
- Manage peak stormwater flows discharged from urban catchments;
- Reduce the volume and frequency of stormwater runoff;
- Provide a valuable source of water to meet urban water demands.



A recent study was commissioned by the Queensland Water Commission on Stormwater Harvesting¹⁴, involving case studies on two new mixed use developments in South East Queensland, Australia. The resulting factors for successful stormwater harvesting were found to be:

- Large scale development;
- High water demands;
- Moderate slopes which drain to single/few points;
- Low cost storage.

In addition to the environmental benefits, the cost of stormwater was found to be around the lower end of costing for rain tanks, with cost of land for storage the main issue; though storage in an existing drainage reserve or aquifer significantly reduces costs.

¹⁴ [Stormwater Infrastructure Options to Achieve Multiple Water Cycle Outcomes](#), Bligh Tanner and Design Flow, August 2009

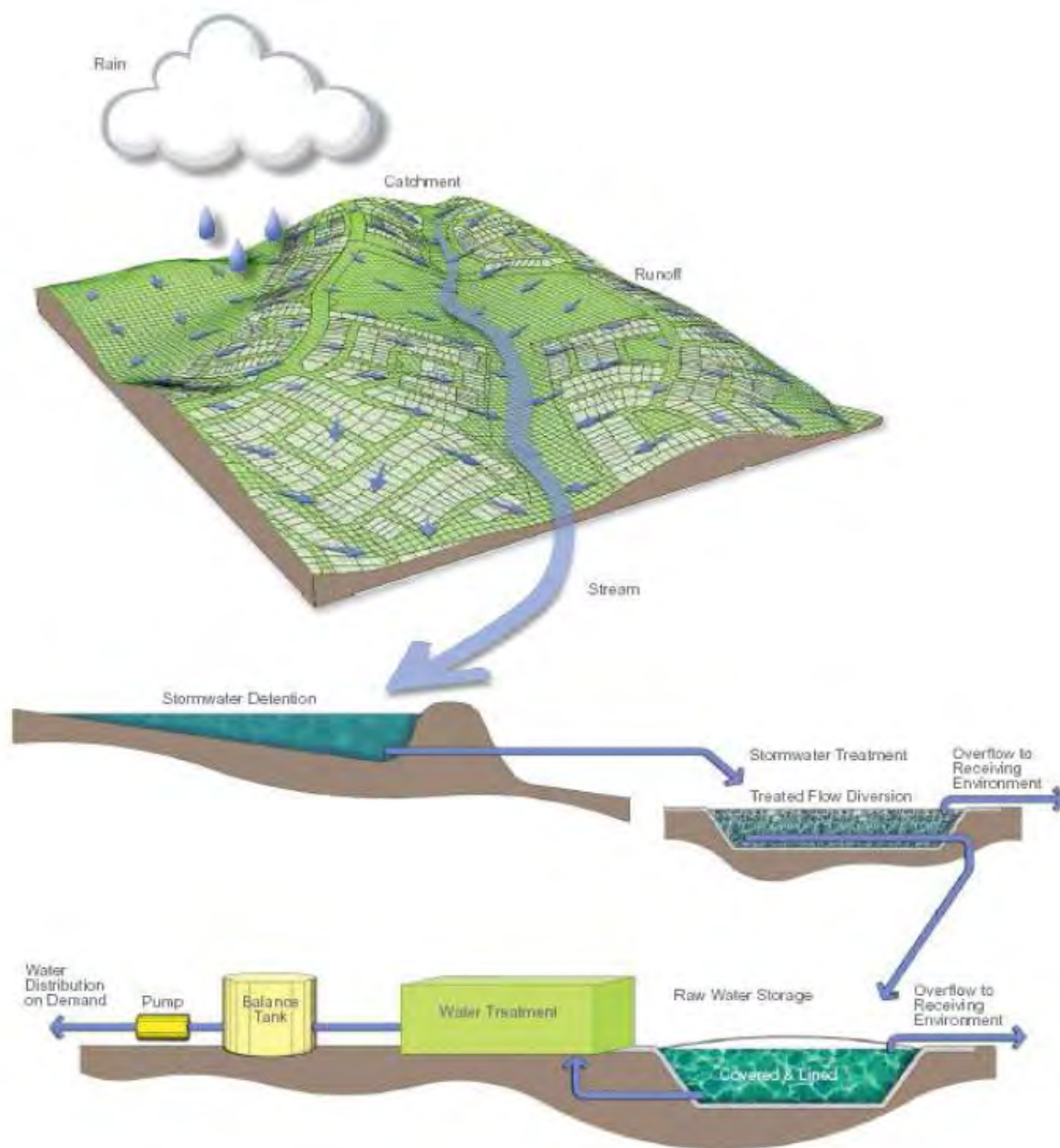


Figure C-3 Stormwater Harvesting

C1.5 Water Efficiency and Energy

Approximately 24% of domestic energy consumption in the UK goes to heating water (DTI 2002). This excludes space heating. Showering alone accounts for approximately 1% of total UK carbon emissions (MTP 2008). In addition, the treatment and distribution of water by water companies accounts for large amounts of energy consumption – e.g. Anglian Water is the largest single energy user in the East of England region, and recent estimates suggest that water companies consume more than 1% of the energy produced in the UK.



Energy prices are currently high and rising. In situations where more efficient hot water using fixtures and fittings, such as showers, baths and hot water taps are installed a major cost savings gained by the user will be through savings on the energy bill as well as the water bill.

The implementation of water efficiency measures not only reduce water demand and demand on water resources but produce associated savings in energy, financial costs and carbon emissions. Reductions in water demand can also reduce the need for additional infrastructure, resulting in further savings.

CL6 The Cost of Water Efficiency

A specification for indoor water use of 120 litres per person per day, as per Part G of the Building Regulations and Levels 1/2 of the Code can be achieved through installing a combination of standard and efficient fittings and fixtures. CLG estimate that this will not add any cost to a new home (CLG 2008).

Code Level 3/4 can be achieved by installation of efficient water using fixtures and fittings. CLG has estimated that under current supply-demand scenarios, achieving Code Level 3 specification for water consumption of 105 litres per person per day, will add £125 to the cost of a new home (CLG 2008). Developers Countryside Properties and Taylor Wimpey have estimated £400 and £280 respectively. The variation arises from different scales of business or assumptions on scales of business, dwelling type or assumptions on dwelling type and therefore style or desirability of fittings.

To achieve a specification of 80 litres per person per day required for Code Level 5/6, it is generally accepted that some form of water recycling is required. Inclusion of a rainwater or greywater recycling system is relatively costly. CLG estimate that achieving Code Level 5/6 would add £2650 to a new standard home. However, this is likely to be less per dwelling if communal water recycling systems are installed, and CLG (2008) estimate £800 for apartments.

The cost of meeting the Code will fall as demand increases. Bathroom manufacturer Grohe have estimated that, assuming bulk supply of the fittings and fixtures, the cost of meeting Code Level 3 /4 would drop to as little as £12.50 (Grohe 2008). The Governments stated intention is to kick-start the market transformation process by requiring the public housing sector to build to medium level Code specification. However, this means that the relatively higher costs of meeting the Code during the early stages of market transformation are borne by housing associations. The National Housing Federation is lobbying for private developers to be subject to the same Code implementation timetable. At least at this stage, achieving Code Level 3/4 specification for water consumption is one of the cheapest aspects of Code implementation.

The average unit price for a metered water customer in 2008 is approximately 0.3 pence per litre including waste water charges. Average per capita consumption is about 150 litres per person per day. Assuming that actual water use in the home meets the target specification, savings on water bills can be estimated.



Average PCC	Target Specification	Savings (litres per day)	Unit cost of water (pence per litre)	Savings (pounds per person per year)	Savings per household per year (assuming 2.4 people)
150	120	30	0.3	£32.85	£98.55
150	105	45	0.3	£49.27	£147.82
150	80	70	0.3	£76.75	£229.95

Table C-2 Savings on water bills calculated from average UK metered water price and assuming specification targets are met in practice

For water bills, the payback time for specifications meeting Part G and Code Levels 1 through 4 ranges from immediately to a few years. If water recycling systems are added, the payback time is significantly longer – in the order of 10 years for systems supplying single homes. Savings on energy bills also need to be considered and in general these will at least match, and often exceed, the savings on metered water bills. Dwellings with water recycling systems will also save energy if efficient fittings are installed, but recycling systems will use energy for pumping and water treatment.

In conclusion, payback times for specifications involving efficient fittings and fixtures are reassuringly quick – a few years at most. Payback times for specifications that include recycling systems are significantly longer. Defra's water efficiency hierarchy illustrates this.

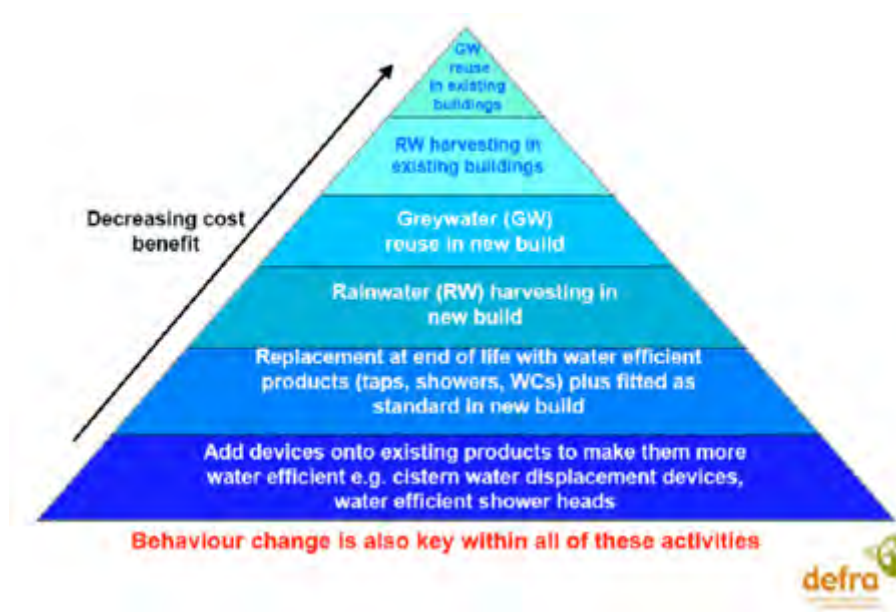


Figure C-4 Indicative illustration of cost-benefit of water efficiency strategies (Defra)



Appendix D. Technical analysis – Warwick DC

D1 Flood Risk Management

D1.1 Overview

The purpose of this section is to outline the findings from the flood risk and surface water management assessment for Warwick District Council.

There is a high level of flood risk in the District, with approximately 13% located within the combined Flood Zones 2 and 3. In particular, there are a number of properties at risk of flooding in the Leamington Spa area. The Main Rivers within Warwick District include the River Avon and its tributaries. Fluvial flooding from the River Avon has occurred on numerous occasions with the largest events recorded in January 1985 and April 1998, with several hundred properties affected along the River Avon and Leam. More recently, widespread flooding was experienced through the District in June and July 2007, with significant flooding experienced in the area of Cubbington from a number of sources including fluvial, surface water runoff and artificial drainage sources. The Level 1 SFRA also indicated that data from Severn Trent Water indicates a high risk of internal flooding within the Kenilworth and Leamington Spa areas.

The assessment has also indicated that there are a large number of defences throughout the District which provide a significant level of protection to both residential and commercial properties. A key recommendation is therefore that a Level 2 SFRA is undertaken for new developments proposed behind defences and development within high risk areas is avoided. In addition, a number of canals are located within the sub-region. Whilst the risk of breach or overtopping is generally considered low, for any development proposed adjacent to canals, a Level 2 SFRA must be undertaken to assess the residual risk of breach or overtopping. This will enable the new development to be appropriately informed, and appropriate emergency plans developed by the LPA.

D1.2 Potential Sites

The assessment has indicated that a number of the potential sites are at risk from fluvial flooding (Land at King's Hill, south of Green Lane, Finham, Warwickshire College, Warwick New Road, Leamington Spa, Land at South Sydenham and east of Whitnash, and Land at Lower Heathcote Farm, south of Harbury Lane). In general, the area located within Flood Zones 2 and 3 is low, being less than 5%. Warwickshire College, Warwick New Road, Leamington Spa, Land at South Sydenham and east of Whitnash and Land at Lower Heathcote Farm, south of Harbury Lane have a slightly greater area located within Flood Zones 2 and 3 (5.35%, 8.07% and 4.03% respectively).

An assessment of the density of housing that may be accommodated within the sites has indicated that in the majority of cases, there is sufficient developable land available. However, for Warwickshire College, Warwick New Road, Leamington Spa, the proposed development is 300 homes and based on our assessment only 184 homes can be accommodated within the site. Therefore, alternative sites in lower flood risk areas should be considered in preference to this site.

To the south west of Leamington Spa, there are four potential sites in the Heathcote area (Land at Lower Heathcote Farm, south of Harbury Lane – reference 1D, 1F, 2F and 3F). Sites 1D and 1F are at low fluvial flood risk, however, sites 2F and 3F are shown to be at significant risk. Given the size of the sites, the assessment has indicated that the proposed number of homes could be accommodated within the site. However,



at site 1F there is not enough developable land to accommodate the proposed 450 houses; this is principally because of the requirement for 15% open space, rather than due to flood risk.

It must be ensured that flood risk areas are left as open space and more vulnerable development is located towards low risk areas. A FRA should be undertaken to demonstrate that there will be no increase in flood risk from development within these area.

For two of the potential sites (Land at former Ford Foundry, Leamington and Land at Station Approach, Leamington), there may be a residual risk of flooding from breach or overtopping of the Grand Union Canal. Whilst the Level 1 SFRA did not identify incidents of breach or overtopping from the canal in these areas, there is a residual risk of breach or overtopping to both sites; which should be investigated further though a Level 2 SFRA prior to development within the sites.

Although there is no fluvial flood risk from the proposed development at the Land at Thickthorn (2G), there is concern about the potential increase in flood risk to the downstream village of Ashow from this development. In accordance with PPS25, surface water runoff rates and volumes should be managed to ensure they are no greater than current rates and volumes. In addition, there is opportunity from the development to reduce runoff rates and volumes from this site; hence having a positive impact on flood risk in Ashow. Warwick DC should promote reduced runoff rates and volumes from this development site.

Myton brook runs through the centre of the site West of Europa Way (1E). As this is a minor watercourse it has not been considered as part of the Environment Agency flood zones. In reality some flood risk will be posed from this site, which will need to be fully assessed as part of a developer led site specific FRA.

Where watercourses are located within the site, the proposed development should be set-back from the watercourse with a minimum 8m wide undeveloped buffer zone, to allow appropriate access for routine maintenance and emergency clearance. This is an Environment Agency requirement for Main Rivers. For sites adjacent to 'Ordinary Watercourses,' under the jurisdiction of the Local Authority, a similar buffer strip of 8m would be required and should be determined in conjunction with the Local Authority Land Drainage Officer.

Description	Ref	Type of Development	Total Site Area (ha)	Combined FZ2 and 3 Area (ha)	% development in Flood zone 2 & 3
Land at Thickthorn, between Kenilworth and A46	2G	Housing and Employment	39.65	0.00	0.00
Land west of Europa Way, Warwick	1E	Housing and Employment	63.49	0.00	0.00
Land at former Ford Foundry, Leamington	1A	Housing and Employment	5.08	0.00	0.00
Land at Station Approach, Leamington	1B	Housing Only	4.47	0.00	0.00
Warwickshire College, Warwick New Road, Leamington Spa	3H	Housing Only	5.78	0.31	5.35
Land at South Sydenham and east of Whitnash	1C	Housing Only	7.56	0.53	7.04
Land at Lower Heathcote Farm, south of Harbury Lane	1D	Housing Only	11.00	0.00	0.00

Land at Lower Heathcote Farm, south of Harbury Lane	1F	Housing and Employment	12.77	0.01	0.05
Land at Lower Heathcote Farm, south of Harbury Lane	2F	Housing and Employment	62.95	5.08	8.07
Land at Lower Heathcote Farm, south of Harbury Lane	3F	Housing and Employment	47.17	1.90	4.03

Table D-1 Developable land outside of flood zones 2 & 3 – Warwick DC

D1.3 Non-strategic development

In Warwick District the majority of non-strategic development is predicted to come forward from windfall development. There will always be uncertainty as to the location of these sites, and the specific locations of development cannot be predicted. For the non-strategic development the advice provided in section 6.5.1 should be adhered to.

D1.4 Alternative Option Sites

There are five locations which have been identified to accommodate the alternative option development in Warwick district. The key flood risk issues at these sites are discussed below:

- Site C06, King's Hill Road, Gibbet Hill, Green Lane – site affected by fluvial flood risk in southern part of site, and there are no reported incidents of surface water flooding in the site. There is sufficient land available for development, and flood risk is not considered to be a constraint at this site.
- Site L07, Land North of Milverton – the northern part of the site is affected by fluvial flood risk, and there has been one reported incidence of flooding from an unknown source in the north east of the site. There is sufficient land available within the remainder of the site to allow developed to occur.
- L23, Land at Red House Farm, Campion Hills – there are no flood risk issues identified at this site, and there were no reported incidents of flooding.
- Southcrest Farm – the site is located fully in Flood Zone 1. There are no minor watercourses within the site. The River Avon is located approximately 600m to the east of the site. The combined Flood Zone 2 and 3 for the River Avon do not extend into the site. There are no observed incidents of observed flooding from other sources within or adjacent to the site.

D1.5 Summary of flood risk issues

The flood risk analysis has identified where flood risk may present some constraint to development within the Borough. In the majority of proposed locations for development flood risk is not considered to represent a constraint to development. The key findings are summarised below.

- Fluvial flood risk does not represent a constraint to development for the majority of the proposed potential sites.



- The exception to this is Warwickshire College, Warwick New Road (Leamington Spa) where there is insufficient land available to for the 300 homes. The analysis has indicated that there is insufficient land available at Warwickshire College to accommodate 300 homes, based on the assumption of 40 houses per hectare and 15% open space. Based on these assumptions and the proposed size of the site, there is insufficient land, irrespective of flood risk issues; the fluvial flood risk issues will exacerbate the ability to meet the proposed growth. A detailed site-specific FRA is recommended for this site when the development comes forward to address these concerns.
- There are a number of proposed allocations where there is historical evidence of surface water flooding, and these must be adequately addressed through site-specific FRAs. The allocations affected by surface water flooding are:
 - Site 1D, 2F and 3F, Land at Lower Heathcote Farm, south of Harbury Lane - to east of the proposed development there are some recorded incidents of surface water flooding suggesting the site may drain to an area of existing surface water flood risk;
 - Land at Former Ford Foundry, Leamington - some recorded incidents of flooding to the north east of the site but the exact source of flooding is unknown, and;
 - Land at King's Hill, south of Green Lane, Finham - some recorded incidents to the east of the site. The exact source of flooding is unknown.
- The alternative option scenarios include four sites, all of which are considered to be at low risk from flooding. At these sites flood risk should be pose a constraint to development.

D2 Surface water management

D2.1 Potential sites

Table D-2 illustrates the findings of the surface water drainage assessment for the potential sites in Warwick district. It provides an indication of the total estimated storage required to store surface water. In all allocations the percentage of development which is likely to be taken up by storage of surface water is less than 10%; this does not indicate that the requirements to store surface water will present a constraint to development in these allocations.

The table also indicates the types of SUDS which may be appropriate at each potential site. In all of the sites some infiltration is feasible, but this would need to be confirmed in development proposals and supported by a groundwater risk assessment.



Description	Ref	Type of Development	Total Site Area (ha)	Total estimated storage required assuming no infiltration occurs assuming 1m depth of storage- worst case (ha)	Total maximum discharge rate from the developed site (l/s) – 100 year event	% of development site required by storage - assuming no infiltration	SUDS likely to be suitable
Land at Thickthorn, between Kenilworth and A46	2G	Housing and Employment	39.65	1.99	245	5-10%	Infiltration
Land west of Europa Way, Warwick	1E	Housing and Employment	63.49	3.20	450	5-10%	Combination
Land at former Ford Foundry, Leamington	1A	Housing and Employment	5.08	0.26	31	5-10%	Infiltration
Land at Station Approach, Leamington	1B	Housing Only	4.47	0.17	28	0-5%	Infiltration
Warwickshire College, Warwick New Road, Leamington Spa	3H	Housing Only	5.78	0.22	36	0-5%	Combination
Land at South Sydenham and east of Whitnash	1C	Housing Only	7.56	0.29	47	0-5%	Combination
Land at Lower Heathcote Farm, south of Harbury Lane	1D	Housing Only	11.00	0.43	68	0-5%	Combination
Land at Lower Heathcote Farm, south of Harbury Lane	1F	Housing and Employment	12.77	0.49	79	0-5%	Infiltration
Land at Lower Heathcote Farm, south of Harbury Lane	2F	Housing and Employment	62.95	3.17	447	5-10%	Combination
Land at Lower Heathcote Farm, south of Harbury Lane	3F	Housing and Employment	47.17	2.37	292	5-10%	Combination

Table D-2 Runoff rates and volumes for potential sites - Warwick DC



D2.2 Non-strategic development

As the majority of non-strategic development is likely to come forward from windfall developments, it is not possible to undertake an assessment of the surface water drainage required. However, when windfall developments do come forward surface water runoff should be managed using the hierarchy below:

- where possible, infiltrate runoff using infiltration SUDS;
- where this is not possible discharge to watercourse in close consultation with the Environment Agency, and;
- as a last resort connect to the public sewer system, in close consultation with Severn Trent Water.

It is important to note that *a groundwater risk assessment will be required for any site where infiltration SuDS are proposed*. The Environment Agency should be consulted regarding the risks to groundwater at an early stage, as it is likely that more detailed risk assessments would be required for those sites located in, or near to, source protection zones, or where groundwater is found at shallow depths.

The type of SuDS permitted will depend on the sensitivity of and depth to groundwater, the source of the discharge and the ability of the system to remove pollutants. For example, runoff from a car park may not be suitable for direct discharge via a soakaway without prior treatment, whereas rainfall from a roof collection system would present a very low risk to groundwater. It is therefore essential that a groundwater risk assessment is undertaken prior to the design of any surface water drainage systems.

Because of their potential to increase aquifer recharge volumes, the use of infiltration systems can also increase the risk of groundwater flooding. In areas where there is a history of groundwater flooding, or the water table is found at shallow depths, the risk of groundwater flooding should also be assessed.

Brownfield development offers the opportunity to reduce the rate and volume of surface water runoff, and every effort should be sought to reduce both rate and volume, where possible.

In Kenilworth, Leamington and Warwick windfall development sites may be suitable for infiltration SUDS in certain locations, although this would be confirmed on a site by site basis. Within the District, there are areas in the north and west classified as a groundwater source protection zone (GSPZ) by the Environment Agency. These are located to the north of all three of the settlements affected by growth. As part of the design process, any boreholes, water wells or other extraction points should be identified and taken into account in the design process. Any development proposed within the GSPZ will require attenuation storage of runoff to prevent infiltration and contamination.

D2.3 Alternative option sites

A high level assessment of surface water runoff and SUDS suitability has been undertaken for the alternative option sites. A full assessment of runoff rates and volumes would be required should the alternative option scenario be realised.



The assessment has indicated that a combination of SUDS would be suitable at Land at Red House Farm (Campion Hills), and attenuation SUDS would be more appropriate at Kings Hill Farm and the Land North of Milverton. In addition the latter two sites are influenced by GSPZ to the north. The site at Southcrest Farm is likely to be suitable for infiltration approaches to surface water drainage.

D3 Wastewater infrastructure analysis

D3.1 Overview

The WwTW affected by proposed growth are illustrated in Table D-3. For the wastewater capacity assessment the proposed developments have been analysed by drainage regions (i.e. WwTW boundaries).

Analysis and comments on development sites have been based on high level assessments and not detailed evaluation. Further detailed assessments will be required to ensure final development proposals do not result in service deterioration.

With regards to the sewerage system Severn Trent would not usually envisage particular problems on the foul water system provided that surface water is managed in a sustainable manner and is not connected to the foul system. It is expected that surface water would be dealt with through SUDS or discharge to a suitable watercourse.

WwTW	Potential sites which drain to WwTW	Alternative option scenario which drains to WwTW	Non-strategic development settlements
Warwick-Longbridge	Land west of Europa Way, Warwick Land at former Fords' Foundry, Leamington Land at station approach, Leamington Warwickshire college, Leamington Land at S. Syndeham and E of Whitnash Land at lower Heathcote Farm	Land north of Milverton Land at Red House Farm, Campion Hills	Leamington Warwick Whitnash
Finham (Coventry)	Land at Thickthorn, between Kenilworth and A46	Land at King's Hill Road, Gibbet Hill, Green Lane Southcrest Farm	Kenilworth

Table D-3 WwTW affected by growth - Warwick DC

Due to the number of proposed development site and settlements assessed as part of the outline WCS, the discussion is split into two sections; one on WwTW infrastructure capacity, and one on network capacity for each proposed development site and settlement.

D3.2 WwTW analysis

Warwick-Longbridge WwTW

The vast majority of the proposed strategic development within the entire Warwick District Council area is located within Warwick and Leamington Spa. The sewerage from Warwick and Leamington Spa drains to Longbridge WWTW located in the south west of Warwick.



Based on the development figures provided, Longbridge WWTW is required to accept between 4,725 (strategic) and 9,350 (total strategic and non strategic) additional properties. Severn Trent has commented that the upper figure, including all possible development, amounts to approximately a 20% increase in flows to the treatment works. The WwTW has ZERO spare capacity and will not be able to accommodate dwellings proposed in the catchment. Project feasibility has already started to identify additional capacity options and so early confirmation of development proposals would be required to ensure sufficient time to provide the required additional capacity at Warwick-Longbridge WwTW

Finham WwTW

The remainder of development in Warwick District Council is likely to drain to Finham WwTW, which serves Coventry City. Coventry City is forecast to receive an additional 33,500 new homes up to 2026 (of which approximately 7,000 homes may be required as overspill), and therefore the assessment of Finham has included the growth from Coventry city.

Comparison of current measured dry weather flow against the consented dry weather flow consent indicates that there is ZERO spare hydraulic capacity at this treatment works and limited capacity from a quality performance perspective. In addition to the development being proposed outside Coventry, Finham sewage works is also expected to take 33,500 dwellings from Coventry City Council's RSS allocation. Significant capacity improvements are therefore required at Finham WwTW to accommodate future growth and to meet the expected tightening of the quality discharge consent. In view of the potential treatment capacity shortfall STW request early sight of final development proposals for the catchment to allow sufficient lead time to allow additional capacity to be provided.

D3.3 Wastewater network analysis

A summary of the findings from the outline WCS for wastewater networks affected by the potential and alternative option sites are shown in Table D-4 and D-5.

With regards to other areas for development, four areas are to be considered to accommodate an additional 2,575 properties – Warwick, Leamington Spa, Whitnash and Kenilworth. Whitnash is located towards the south of Leamington Spa. Warwick is the preferred from the wastewater perspective. This is because these three regions drain to the same treatment works. However, as the works is in Warwick, development in that region is more proximate to the works and therefore has less impact on the sewer network. The more proximate the development can be to the works the less impact it is likely to have on the sewerage system, particularly with regards to existing flooding or ancillary performance (though the impact on the works discussed earlier will remain the same).



Site Ref	Site Name	No. dwellings	Sewerage Comment	Potential impact on sewerage infrastructure
1D	Lower Heathcote Farm, south of Harbury Lane	250	This site is likely to drain to Grove Farm sewage pumping station located to the south of the development. This then pumps flows back across site 3F to the main 675mm dia outfall sewer serving the south of Leamington. There are no known sewer flooding problems downstream of this development but hydraulic modelling will be required to confirm the extent of any capacity improvement works and to confirm capacity at Grove Farm SPS.	Low (subject to hydraulic modelling confirmation)
1F	Lower Heathcote Farm, south of Harbury Lane	450	These two sites are located adjacent to the main 675mm dia outfall sewer serving the south of Leamington. There are no known sewer flooding problems downstream of these two developments but hydraulic modelling will be required to confirm the extent of any capacity improvement works.	Low (subject to hydraulic modelling confirmation)
2F	Lower Heathcote Farm, south of Harbury Lane	1050		
3F	Lower Heathcote Farm, south of Harbury Lane	1000	Most of this site is likely to drain to Grove Farm sewage pumping station located to the east of the development. This then pumps flows back across the site to the main 675mm dia outfall sewer serving the south of Leamington. There are no known sewer flooding problems downstream of this development but hydraulic modelling will be required to confirm the extent of any capacity improvement works and to confirm capacity at Grove Farm SPS.	Low (subject to hydraulic modelling confirmation)
1E	West of Europa Way, Warwick	1250	This site is located north of the main 675mm dia outfall sewer serving the south of Leamington and is crossed by a 450mm dia sewer serving the Europa Way industrial estate. There are no known sewer flooding problems downstream of this development but hydraulic modelling will be required to confirm the extent of any capacity improvement works.	Low (subject to hydraulic modelling confirmation)





3H	Warwickshire College, Warwick New Road	300	There are no known sewer flooding problems downstream of this site although the hydraulic modelling will be required to assess sewer capacity and performance on a downstream combined sewer overflow.	Low (subject to hydraulic modelling confirmation)
1B	Station Approach, Leamington	150	There are no known sewer flooding problems downstream of this site although the hydraulic modelling will be required to assess sewer capacity and performance on a downstream combined sewer overflow.	Low (subject to hydraulic modelling confirmation)
1A	Ford Foundry, Leamington	75	There is known highway sewer flooding affecting the Price's Drive in the vicinity of the railway. Further detailed hydraulic modelling will be required but as this is re-development it is not expected that this site will have any significant capacity issues.	Low (subject to hydraulic modelling confirmation)
1C	South Sydenham and east of Whitnash	200	This development is likely to require pumping but is located upstream of a sub-catchment with known sewer flooding problems. Capacity improvements to alleviate this flooding problem are currently being appraised as part of Severn Trent's sewer flooding investment programme. Further hydraulic analysis will be required to assess the impact of this development on sewer capacity.	High - Known flooding downstream
2G	Thickthorn, between Kenilworth and A46	800	There are isolated known sewer flooding problems downstream of this development, some of these are currently being appraised as part of Severn Trent's sewer flooding investment programme. Further hydraulic analysis will be required to assess the impact of this development on sewer capacity.	Medium - Known isolated flooding downstream

Table D-4 Wastewater network summary for potential sites - Warwick DC





Site Ref	Site Name	No. dwellings	Sewerage Comment	Potential impact on sewerage infrastructure
C06	King's Hill Road, Gibbet Hill, Green Lane	3500	This site is located immediately upstream of Finham sewage treatment works and is crossed by the 1350mm dia Coventry southern interceptor sewer. Subject to detailed hydraulic modelling capacity problems are not envisaged but as a worst case a new dedicated outfall could be provided direct to Finham STW.	Low (subject to hydraulic modelling confirmation)
L07	Land North of Milverton	1500	This is a significant development proposal located upstream of significant known sewer flooding problems. Capacity improvements to alleviate this flooding problem are currently being appraised as part of Severn Trent's sewer flooding investment programme. Further hydraulic analysis will be required to assess the impact of this development on sewer capacity.	High - Known flooding downstream
L23	Land at Red House Farm, Campion Hills	200	This development is located immediately adjacent to significant known sewer flooding problems. Capacity improvements to alleviate this flooding problem are currently being appraised as part of Severn Trent's sewer flooding investment programme. Further hydraulic analysis will be required to assess the impact of this development on sewer capacity.	High - Known flooding downstream
	Southcrest Farm	450	At the time of writing the final report, Halcrow had requested additional information from Severn Trent Water. This information will need to be added to the report at a later date, when the information is supplied by Severn Trent Water	

Table D-5 Wastewater network summary for alternative sites - Warwick DC





D3.4 Wastewater summary

The suitability of proposed strategic and non strategic development sites within Warwick District Council has been reviewed. The key findings from the wastewater summary are shown below.

- Existing capacity issues have been identified at Longbridge and Finham treatment works and STW has indicated there is no hydraulic capacity at either WwTW to accept proposed growth. Urgent, further work needs to be carried out by STW to identify whether capacity can be built at these WwTW's and when capacity might be able to be provided. The phasing of development will need to reflect the provision of adequate WwTW infrastructure to accommodate the growth.
- The majority of non-strategic development will occur via windfall development. The wastewater infrastructure assessment indicates that the preferred location for windfall development is in Warwick because of its proximity to Warwick-Longbridge WwTW. Leamington Spa and Whitnash are not preferable because of the long flow pathways required to Warwick WwTW and existing flooding issues within the catchment.
- Development at South Syndeham and East of Whitnash (1C) are upstream of a location which suffers from significant network capacity issues (sewer flooding problems). As part of their capital investment programme STW are appraising options to resolve these flooding problems.
- In terms of the alternative option scenarios the sites North of Milverton, and Land at Red House Farm (Campion Hills) are remote from the WwTW and there are existing flooding issues downstream of these sites. However, Severn Trent are currently investing in sewer flooding projects, and further modelling would be required to assess whether the sewer upgrades could accommodate the proposed development.
- King's Hill Farm lies in close proximity to Finham WwTW which makes it a preferable location from a wastewater network capacity perspective. However, Finham WwTW would also need to be upgraded to accept these flows, as discussed.

D4 Water quality

D4.1 Current WFD status

The WFD states that all water bodies must achieve good ecological status by 2027 at the latest. It is important that housing growth does not cause detrimental environmental impacts that will hinder the ability of a water body to meet WFD. As illustrated in Table D-6 the water bodies which have WwTWs affected by growth do not currently achieve good ecological status. All of the water bodies currently achieve moderate ecological status.



Water Framework Directive Classification Status of Waterbody							
Relevant WwTW	Waterbody Name	Water Body ID	Overall Physiochemical Status (EcoGen)	Overall Biological Status (EcoBio)	Overall HM Status (EcoHM)	Overall Ecological Status (EcoClass)	Ecological Status Objective (EcoObj)
Warwick - Longbridge (STW)	Gog Bk - source to conf R Avon	GB109054043800					Good Ecological Status by 2027
Coventry - Finham (STW)	Finham Bk - conf Canley Bk to conf R Sowe	GB109054044480					Good Ecological Status by 2027

Table D-6 Current WFD classification for water bodies in Rugby BC

D4.2 Initial assessment of impact of growth

As shown in Table D-7 both Finham and Longbridge WwTWs will breach their DWF consent due to growth. Two scenarios have been examined for Longbridge WwTW; one including purely the potential sites, and the other including all potential growth to the WwTW (including the alternative option development and SHLAA). Both Finham (Coventry) and Warwick-Longbridge WwTW are already shown to be breaching their DWF consent and will therefore require a new DWF and discharge consent from the Environment Agency.

Relevant WwTW	Current BOD 95%ile consent	Current Amm 95%ile consent	Current P consent (mean)	Measured DWF	Consented DWF	Dwelling Forecast to Test (to 2026)	2026 DWF	Consented available capacity (dwellings)	When will capacity be exceeded?
Warwick – Longbridge*	20	5	2 (UWWTD)	33,750	29,849	4725	35,576	-10,095	Existing
Warwick – Longbridge**	20	5	2 (UWWTD)	33,750	29,849	9350	37,363	-10,095	Existing
Coventry - Finham	15	3	1 (UWWTD)	104,236	100,000	33500	117,180	-10,962	Existing

Table D-7 Initial environmental capacity assessment - Warwick DC

NB: Growth to Warwick-Longbridge WwTW with potential sites only, ** all proposed growth to Warwick-Longbridge WwTW



The initial assessment has also undertaken an assessment of the available dilution of effluent in receiving watercourses. The available dilution measures how much river flows there is to dilute the effluent, at the point when the WwTW discharges to the receiving watercourse. Watercourses which have a higher dilution (therefore lower percentage of effluent compared to river flows) are less likely to be impacted by effluent from the WwTW, and vice versa. The purpose of this assessment is to identify which watercourses have greater dilutive capacity and are therefore less influenced by effluent from WwTW. It is worth noting that a low dilutive capacity should not be seen as a barrier to growth, but it is likely that these WwTW would require tighter discharge consents to help meet the requirements of the WFD.

Relevant WwTW	Receiving Water	Effluent flow as a % total flow d/s of WwTW (Mean)	Effluent flow as a % total flow d/s of WwTW (Q95)
WARWICK - LONGBRIDGE	Gog Bk - source to conf R Avon	5.99	11.63
COVENTRY -FINHAM	Finham Bk - conf Canley Bk to conf R Sowe	45.38	66.48

Table D-8 Current effluent flow as a percentage of flow downstream of the WwTW

As shown in Table D-8 there is very low dilutive capacity downstream of Coventry-Finham WwTW, with nearly 50% of mean flow coming from final effluent flow. There is a significantly higher dilutive capacity downstream of Warwick-Longbridge WwTW, and therefore effluent is likely to play a lesser role in affecting water quality in the watercourse.

D4.3 Load standstill

Load standstill calculates the load (where load = flow * concentration) from the WwTW which is required to ensure that the load discharged from the works is the same as the current consented load for BOD and ammonia (current consented DWF and current consented discharge). The load standstill calculations are illustrated in Table D-9.

WwTW	Current consent			2026 load standstill		
	DWF (m3/day)	BOD 95%ile (mg/l)	Amm 95%ile (mg/l)	2026 DWF (m3/day)	BOD 95%ile (mg/l)	Amm 95%ile (mg/l)
Warwick – Longbridge*	29,849	20	5	35,576	17	4
Warwick – Longbridge**	29,849	20	5	37,363	16	4
Coventry - Finham	100,000	15	3	117,180	13	3

Table D-9 Load standstill - Warwick DC



NB: *Growth to Warwick-Longbridge WwTW with potential sites only, ** all proposed growth to Warwick-Longbridge WwTW

For phosphate an assessment has been carried out to identify what phosphate consents would be needed to ensure no deterioration of class downstream of the WwTW. The nearest sampling point downstream of the three WwTW has been assessed to identify what the current phosphate level is, and hence the current WFD classification for phosphate. Downstream of both WwTW the nearest downstream sample point is currently in 'poor' status. For both WwTW, to achieve no deterioration of 'poor' status would not require any tightening of phosphate discharge consents.

D4.4 Consents to achieve 'good' status

This assessment has identified the consents that would be needed at the WwTW to meet 'good' status, assuming that all upstream sources of pollution have been addressed. At Finham WwTW the ammonia consent to meet good WFD status would be at the limit of Best Available Technology (BAT). The phosphate consent at both Finham and Warwick-Longbridge WwTW would need to be set well beyond currently accepted BAT to achieve good status for phosphate. The Environment Agency need to confirm whether a discharge consent would be granted at these WwTW, despite the findings suggesting good status will not be achievable without setting consents beyond BAT¹⁵.

WwTW	WFD good status target			Consents with 2026 flows and upstream sources of pollution addressed		
	BOD (90%ile)	Amm (90%ile)	P (mean)	BOD consent required (95%ile)	Amm consent required (95%ile)	P consent required (mean)
Finham-Coventry	5	0.6	0.12	8	1	0.14
Warwick-Longbridge	5	0.6	0.12	Greater than current consent	Greater than current consent	0.4

Table D-10 Good status assessment

D4.5 Water quality summary

Warwick-Longbridge WwTW

The current DWF at Warwick-Longbridge WwTW breaches its consented DWF and therefore under both of the scenarios examined, the flow consent will be breached. The WwTW discharges to Gog Brook which is currently moderate physico-chemical and ecological class and good biological class. The WwTW has BOD, ammonia and phosphate consents of 20 mg/l, 5 mg/l and 2 mg/l, respectively. The load standstill calculations for BOD and ammonia indicate that to maintain load from the WwTW will require

¹⁵ The Environment Agency may need to undertake further assessment of the consents needed to achieve good WFD status, with and without growth.



a tightening of discharge consents. The no deterioration assessment of phosphate indicates that phosphate would not need to be tightened to ensure no deterioration of current phosphate class. However, to meet WFD good status would require a phosphate consent beyond BAT, and the EA need to confirm whether a new discharge consent would be granted at Warwick-Longbridge WwTW, prior to development.

Coventry-Finham WwTW

Coventry-Finham WwTW is due to receive growth of 33500 new dwellings as outlined in the Coventry City RSS. However, this works is already exceeding its current consented DWF and will require a new DWF and discharge consent. The load standstill calculations indicate that for BOD and ammonia the consents can be tightened and still remain within current Best Available Technology (BAT). However, as the phosphate consent at Coventry-Finham WwTW is already 1 mg/l (current BAT), and whilst the phosphate consent would not need to be tightened to achieve no deterioration, it would need to be tightened well beyond BAT to achieve good phosphate status. Prior to development being approved, the Environment Agency need to confirm whether a new discharge consent would be granted at Warwick-Longbridge WwTW.

D5 Water supply

At the time of writing the draft final report we have received no information from Severn Trent Water with regards to water supply infrastructure. Therefore it has not been possible to undertake an assessment of the implications of growth for water supply infrastructure.



Appendix E. List of acronyms

AMP – Asset Management Plan

BAT – Best Available Technology (also called limit of conventional treatment)

BOD – Biochemical Oxygen Demand

CFMP – Catchment Flood Management Plan

CSH – Code for Sustainable Homes

CSO – Combined Sewer Overflow

DO – Deployable Output

DWF – Dry Weather Flow

dWRMP – draft Water Resource Management Plan

FRA – Flood Risk Assessment

GOWM – Government Office West Midlands

GSPZ – Groundwater Source Protection Zone

HRA – Habitats Regulations Assessment

LDF – Local Development Framework

LPA – Local Planning Authority

LSOA – Lower Super Outputs Area

NEP – National Environment Programme

NHPAU – National Housing and Planning Advice Unit

NLP – Nathaniel Lichfield & Partners

NVZ – Nitrate Vulnerable Zone





ONS – Office of National Statistics

PCC – Per Capita Consumption

PE – Population Equivalent

PPS1 – Planning Policy Statement 1: Delivering Sustainable Development

PPS25 – Planning Policy Statement 25: Development and Flood Risk

RFRA – Regional Flood Risk Appraisal

RNC – River Needs Consent

RQP – River Quality Planning (Toolkit)

RSA – Restoring Sustainable Abstraction

SFRA – Strategic Flood Risk Assessment

SoR – Statement of Response

STW – Severn Trent Water

SUDS – Sustainable Urban Drainage Systems

TSS – Total Suspended Solids

UPM – Urban Pollution Management

WAFU – Water Available for Use

WCS – Water Cycle Study

WFD – Water Framework Directive

WRZ – Water Resource Zone

WTW – Water Treatment Works

WwTW – Wastewater Treatment Works





Appendix F. Glossary of terms

Annual Monitoring Report (AMR) - Assesses the implementation of the Local Development Scheme and the extent to which policies in Local Development Documents are being successfully implemented.

Appropriate Assessment – Required by the Habitats Directive (92/43/EEC) for all plans or projects which, either alone or in combination with other plans or projects, would be likely to have a significant effect on a European classified conservation site, and are not directly connected with the management of the site for nature conservation. Its purpose is to assess the implications of a proposal in respect to the site's conservation objectives. The assessment process is not specified by the regulations but is usually an iterative process at a level dependent on the location, size and significance of the proposed plan or project. English Nature can advise on whether a plan or project is likely to have a significant effect and thus require assessment.

Area Action Plans – Development Plan Documents that provide a planning framework for areas of change and areas of conservation.

Areas of Outstanding Natural Beauty (AONB) - Were brought into being by the same legislation as National Parks - the National Parks and Access to the Countryside Act of 1949. They are fine landscapes, of great variety in character and extent. The criteria for designation is their outstanding natural beauty. Many AONBs also fulfil a recreational role but, unlike national parks, this is not a designation criteria. The Countryside Agency and the Countryside Council for Wales are responsible for designating AONBs and advising Government on policies for their protection.

Asset Management Plan (AMP) - a plan for managing an water companies' infrastructure and other assets in order to deliver an agreed standard of service. The Asset Management Plans are submitted to Ofwat every 5 years and forms the basis by which water rates are set. These plans identify the timescales and levels of investment required to maintain and upgrade the serviceability of the assets.

Biodiversity Action Plans (BAPs) – The UK initiative, in response to the Rio Summit in 1992, to conserve and enhance biodiversity. The plan combines new and existing conservation initiatives with the emphasis on a partnership approach and seeks to promote public awareness.

BREEAM - The Building Research Establishment Environmental Assessment Method. A method for assessing the environmental sustainability of a new building. The BREEAM has been superseded by the Code for Sustainable homes for residential developments, but is still in common usage for non-residential developments.

Catchment Abstraction Management Strategy (CAMS) – a strategy to assess how much water can be abstracted to meet its many economic uses – agriculture, industry, and drinking water supply – while leaving sufficient water in the environment to meet ecological needs.



Catchment Flood Management Plan (CFMP) – A strategic planning tool through which the Environment Agency seeks to work with other key decision-makers within a river catchment, to identify and agree policies for sustainable flood risk management.

Code for Sustainable Homes – the Code for Sustainable Homes - a new national standard for sustainable design and construction of new homes—was launched in December 2006. The code measures the sustainability of a new home against a range of sustainability criteria. The code sets minimum standards for energy and water use in new properties, and gives homebuyers more information about the environmental impact of their new home.

Combined Sewer Overflow (CSO) - Combined sewer overflow is the discharge of untreated wastewater from a sewer system that carries both sewage and storm water (a combined sewerage system) during a rainfall event. The increased flow caused by the storm water runoff exceeds the sewerage system's capacity and the sewage is forced to overflow into streams and rivers through CSO outfalls.

Communities and Local Government (CLG) - Communities and Local Government is the government department responsible for policy on local government, housing, urban regeneration, planning and fire and rescue. They have responsibility for all race equality and community cohesion related issues in England and for building regulations, fire safety and some housing issues in England and Wales. The rest of their work applies only to England.
(<http://www.communities.gov.uk/corporate/about/>)

Core Strategy - The Development Plan Document which sets the long-term spatial planning vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.

Development Plan - As set out in Section 38(6) of the Planning and Compulsory Purchase Act (2004), an authority's development plan consists of the relevant Regional Spatial Strategy (or the Spatial Development Strategy in London) and the Development Plan Documents contained within its Local Development Framework.

Development Plan Documents (DPDs) - Spatial planning documents within the Council's Local Development Framework which set out policies for development and the use of land. Together with the Regional Spatial Strategy they form the development plan for the area. They are subject to independent examination. They are required to include a core strategy and a site allocations document, and may include area action plans if required; other DPDs may also be included, e.g. development control policies.

DEFRA - Department of Environment, Food and Rural Affairs Development

Environment Agency - The leading public body for protecting and improving the environment in England and Wales. Flood management and defence are a statutory responsibility of the Environment Agency; it is consulted by local planning authorities on applications for development in flood risk areas,



and also provides advice and support to those proposing developments and undertaking Flood Risk Assessments. The Environment Agency reports to DEFRA.

Environment Agency Flood Zones - Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency.

Flood Estimation Handbook - The latest hydrological approach for the estimate of flood flows in the UK.

Flood Risk Assessment – A site specific investigation usually carried out by the site developers to be submitted as part of their planning applications. It assesses both current flood risk to the site and the impact of development of the site to flood risk in the area.

Freshwater Fish Directive - The EC Directive on Freshwater Fish is designed to protect and improve the quality of rivers and lakes to encourage healthy fish populations. In 2013, this directive will be repealed. Waters currently designated as Fish Directive waters will become protected areas under the Water Framework Directive.

Future Water - The Government's new water strategy for England, Future Water was published 7 February 2008. This strategy sets out the Government's long-term vision for water and the framework for water management in England. (<http://www.defra.gov.uk/Environment/water/strategy/index.htm>)

Habitats Regulation Assessment - An assessment of the potential effects of planning policies on European nature conservation sites, which lie within and outside the Borough

Infrastructure – The basic physical systems of a community's population, including roads, utilities, water, sewage, etc. These systems are considered essential for enabling productivity in the economy. Developing infrastructure often requires large initial investment, but the economies of scale tend to be significant. Water services infrastructure refers to infrastructure that provides clean water, urban drainage and wastewater services.

Inset appointment - An inset appointment is made when an existing water and/or sewerage undertaker is replaced by another as the supplier of water and/or sewerage services for one or more customers within a specified geographical area.

Local Authority or Local Planning Authority (LA or LPA) – the local authority or council that is empowered by law to exercise planning functions. Often the local borough or district council. National parks and the Broads authority are also considered to be local planning authorities. County councils are the authority for waste and minerals matters.

Local Development Documents (LDDs) – the collective term for Development Plan Documents and Supplementary Planning Documents.



Local Development Framework (LDF) - The name for the portfolio of Local Development Documents. It consists of the Local Development Scheme, a Statement of Community Involvement, Development Plan Documents, Supplementary Planning Documents, and the Annual Monitoring Report.

Local Development Scheme (LDS) - Sets out the programme for preparing Local Development Documents. All authorities must submit a Scheme to the Secretary of State for approval within six months of commencement of the 2004 Act (thus all authorities should now have submitted an LDS). LDSs are subject to review.

'Making Space for Water' (DEFRA 2004) - The Government's new evolving strategy to manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches, so as to: a) reduce the threat to people and their property; b) deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles, and c) secure efficient and reliable funding mechanisms that deliver the levels of investment required.

National Environment Programme - The NEP is a list of environmental improvement schemes that ensure that water companies meet European and national targets related to water. The NEP is produced by the Environment Agency after consultation with the water industry and a number of other organisations. Companies incorporate these requirements into their proposed business plans, which inform Ofwat's decision on prices.

Ofwat - The Water Services Regulation Authority (Ofwat) is the body responsible for economic regulation of the privatised water and sewerage industry in England and Wales. Ofwat is primarily responsible for setting limits on the prices charged for water and sewerage services, taking into account proposed capital investment schemes (such as building new wastewater treatment works) and expected operational efficiency gains.

Planning Policy Statements (PPS) - The Government has updated its planning advice contained within Planning Policy Guidance Notes (PPGs) with the publication of new style Planning Policy Statements (PPSs), which set out its policy for a range of topics.

Pollutants - A substance or condition that contaminates air, water, or soil. Pollutants can be artificial substances, such as pesticides and PCBs, or naturally occurring substances, such as oil or carbon dioxide, that occur in harmful concentrations in a given environment

Previously Developed (Brownfield) Land - Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example a house and its garden would be considered to be previously developed land. Land used for mineral working and not subject to restoration proposals can also be regarded as Brownfield land.

QMED - The median annual maximum flood flow.



Regional Spatial Strategy (RSS) - Sets out the region's policies in relation to the development and use of land and forms part of the development plan for local planning authorities.

River Basin Management Plan (RBMP) – A strategic tool introduced by the Water Framework Directive (2000/60/EC) which integrates the management of land and water within a river basin (river catchment or group of catchments). The river basin may cover several political areas.

River Quality Objective (RQO) – agreed by Government as targets for all rivers in England and Wales when the water industry was privatised in 1989. The targets specify the water quality needed in rivers if we are to be able to rely on them for water supplies, recreation and conservation.

Sites of Importance for Nature Conservation (SINCs) - is a designation used in many parts of the United Kingdom to protect areas of importance for wildlife at a county.

Site of Special Scientific Interest (SSSI) – 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).

Source Protection Zones (SPZs) – The Environment Agency has defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest, which is occasionally applied to a groundwater source. (http://www.environment-agency.gov.uk/maps/info/groundwater/?version=1&lang=_e)

Statement of Community Involvement (SCI) - Sets out the standards which authorities will achieve with regard to involving local communities in the preparation of local development documents and development control decisions. It is subject to independent examination.

Strategic Environmental Assessment (SEA) - A generic term used to describe environmental assessment as applied to policies, plans and programmes. The European 'SEA Directive' (2001/42/EC) requires a formal 'environmental assessment of certain plans and programmes, including those in the field of planning and land use'.

Strategic Flood Risk Assessment (SFRA) – a Level 1 SFRA is a district-wide assessment of flood risk, usually carried out by a local authority to inform the preparation of its Local Development Documents (LDDs) and to provide the information necessary for applying the Sequential Test in planning development. A Level 2 SFRA is a more detailed assessment produced where the Exception Test is required for a potential development site, or to assist in evaluating windfall planning applications.



Strategic Housing Land Availability Assessment (SHLAA) - A SHLAA is an assessment of the potential of a borough to accommodate housing development over a period of 15 years from the date of adoption of the LDF Core Strategy. The SHLAA forms part of the evidence base for the emerging Local Development Framework (LDF), and inform the identification of potential new housing sites to be allocated in the LDF.

Super Output Areas (SOA) – a new national geography created by the Office for National Statistics (ONS) for collecting, aggregating and reporting statistics.

Supplementary Planning Documents (SPDs) - Provide supplementary information in respect of the policies in Development Plan Documents. They do not form part of the Development Plan and are not subject to independent statutory examination, but are normally subject to public consultation.

Sustainability Appraisal (SA) - Tool for appraising policies to ensure they reflect sustainable development objectives (i.e. social, environmental and economic factors) and required in the 2004 Act to be undertaken for all local development documents. It incorporates Strategic Environmental Assessment.

Sustainable Development – “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (The World Commission on Environment and Development, 1987).

Sustainable Drainage Systems (SUDS) – Surface water drainage systems which manage runoff in a more sustainable way than conventional drainage, through improved methods of managing flow rates, protecting or enhancing water quality and encouraging groundwater recharge. A variety of types are available and can be chosen as appropriate for the location and needs of the development, and many have added benefits such as enhancement of the environmental setting, provision of habitat for wildlife and amenity value for the community.

The Sequential Test - Informed by a Strategic Flood Risk Assessment, a planning authority applies the Sequential Test to demonstrate that there are no reasonably available sites in areas with less risk of flooding that would be appropriate to the type of development or land use proposed.

Water Framework Directive (WFD) – a European Union directive which commits member states to making all water bodies (surface, estuarine and groundwater) of good qualitative and quantitative status by 2015.

Water neutrality - If a development is to be ‘water neutral’ then the total demand for water should be the same after the new development is built, as it was before. That is, the new demand for water should be offset in the existing community by making existing homes and buildings in the area more water efficient. (<http://www.environment-agency.gov.uk/research/library/publications/40737.aspx>)



Water stress - Water stress occurs when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use. Water stress causes deterioration of freshwater resources in terms of quantity (e.g. aquifer overexploitation or dry rivers) and quality (eutrophication, organic matter pollution, and saline intrusion).

Water resource zone – a geographical area defined by the water supply/demand balance in the region such that all customers within it receive the same level of service in terms of reliability of water supply.

Water Resource Management Plans (WRMP) - Water companies in England and Wales have a statutory duty to prepare, consult, publish and maintain a water resources management plan under new sections of the Water Industry Act 1991, brought in by the Water Act of 2003. Water resource management plans show how the water companies intend to supply your water over the next 25 years. In doing so, they need to take into account population changes, climate change and protecting the environment from unnecessary damage caused by taking too much water for use.

Water resource zone – a geographical area defined by the water supply/demand balance in the region such that all customers within it receive the same level of service in terms of reliability of water supply.

