

4. Water Resources and Public Water Supply

In developing a Water Cycle Study it is important to consider the regulatory system in which the water companies in England and Wales operate. Water resources are managed by the Environment Agency in England and Wales, in the form of granting (or refusing) abstraction licences to abstract water for various purposes. Once water has been abstracted from the environment the responsibility for public water supplies is transferred to the water undertakers who have a statutory duty to provide water supplies. There are two water undertakers who supply customers in the study area: Severn Trent Water and South Staffordshire Water.

Water resources can constrain development at two levels. At a strategic level, the overall balance between demand for water and the amount of water that is available for supply must be managed to ensure that existing and new homes can continue to be supplied. More locally, the extent and condition of the existing supply infrastructure affects the water companies' ability to distribute water more locally. Both of these issues are explored in this chapter in relation to the Derby HMA.

4.1 Water Resources Supply and Management

Information on public water supply in this area has been taken from the companies' draft Water Resource Management Plans (dWRMPs) and relevant changes made by the companies to these plans as part of the statutory consultation process that has occurred, as detailed in their respective Statements of Response. Additional data has also been made available specifically for the purpose of this study. Water supply infrastructure information was provided by both companies, including detail on the extent of the asset base and general information on existing supply pinch points.

4.1.1 Catchment Abstraction Management Strategies

The Environment Agency manages water resources within the environment, principally through the water resource abstraction licensing system. As part of this, the Environment Agency assesses water resource availability at a regional and local (catchment) level. The Environment Agency has developed Catchment Abstraction Management Strategies (CAMS) which set out how much water is available for additional abstraction taking into account the needs of the environment, and abstraction for public water supply and other uses. The results are used to inform future water abstraction licensing strategies and so provide a useful context in which to understand the environmental constraints affecting the water supply options available to Severn Trent Water and South Staffordshire Water. Section 4.3.2 sets out the implications of these strategies for water resource development relevant to the study area.



4.1.2 Water Resources in the Study Area

There are significant water resources in the area, from both groundwater and surface water sources. Groundwater is more readily useable than surface water as a source of public water supply because natural filtration processes result in higher quality of water thus requiring less treatment than raw water abstracted from rivers and reservoirs. The Derwent catchment is underlain by principal aquifers, with outcrops of Carboniferous Limestone in the North West and Sherwood Sandstone in the South West of the catchment.

The Derbyshire Derwent catchment is an important long-standing public water supply for the East Midlands and South Yorkshire. The major reservoirs in the Derwent and Dove valleys, augmented by a transfer from Rutland Reservoir (Anglian Water), and several river abstractions, provide the majority of water (620 megalitres per day, Ml/d) supplying the area occupied by the Derby HMA (East Midlands water resource zone, see below).

4.1.3 Resource Management

The people within the Derby HMA are supplied with water from two water resource zones: the East Midlands zone operated by Severn Trent Water, covering a large area; and South Staffordshire Water's single, company level water resource zone. Figure 4.1 illustrates these zones in relation to the study area. Public water supply is managed at a strategic rather than a local level. This means that a demand centre may be supplied with water from sources across the whole water resource zone, through an integrated zonal distribution network. An increase in demand from new development or from existing customers increases pressure on all the water resources in the zone, not specific local sources.

Approximately 80% of the study area lies within Severn Trent Water's East Midlands water resource zone, including the whole of Amber Valley and the City of Derby, and the majority of South Derbyshire. Due to the concentration of urban areas, the Company considers it supplies a greater proportion in terms of customer numbers. Two thirds of the water used to supply this area comes from surface water, predominantly from the reservoirs located in the Peak District. These sources are supported by groundwater abstractions from the aquifer underlying the area beneath Nottingham, Mansfield, Worksop, and Newark.

South Staffordshire Water supplies the parishes of Burnaston, Findern, Etwall, Hilton, Egginton, Willington, and Repton to the north and east of Burton upon Trent. A separate water cycle study covering Burton upon Trent has been completed for East Staffordshire Borough Council. South Staffordshire also supplies the areas between Walton on Trent, Short Heath, Netherseal, and Lullington in South Derbyshire. 55% of the water available to South Staffordshire Water is from surface water sources, primarily from the Blithfield Reservoir, located on the River Blithe, in the upper Trent catchment, and the Hampton Loade river abstraction from the River Severn. Water is also supplied from 27 groundwater sources, abstracting from the Sherwood Sandstone aquifer.

Both water companies recognise the drive from national Government to significantly increase the supply of new housing. Towns and cities in the East Midlands have been identified as growth points. Under current economic



situation and the housing market it is not certain how much of this will take place. Both companies say they will continue to monitor trends and develop flexible plans in response.

Severn Trent Water states that where there is reasonable certainty over the future growth plans of local government it will build infrastructure ahead of planned development to ensure that water from new resources may be deployed to the right place at the right time. In its Final Business Plan, Severn Trent Water has identified strategic reinforcements in areas where there is sufficient detail in the Local Development Framework housing growth numbers to enable the hydraulic impact to be assessed.

4.2 Strategic Water Resources

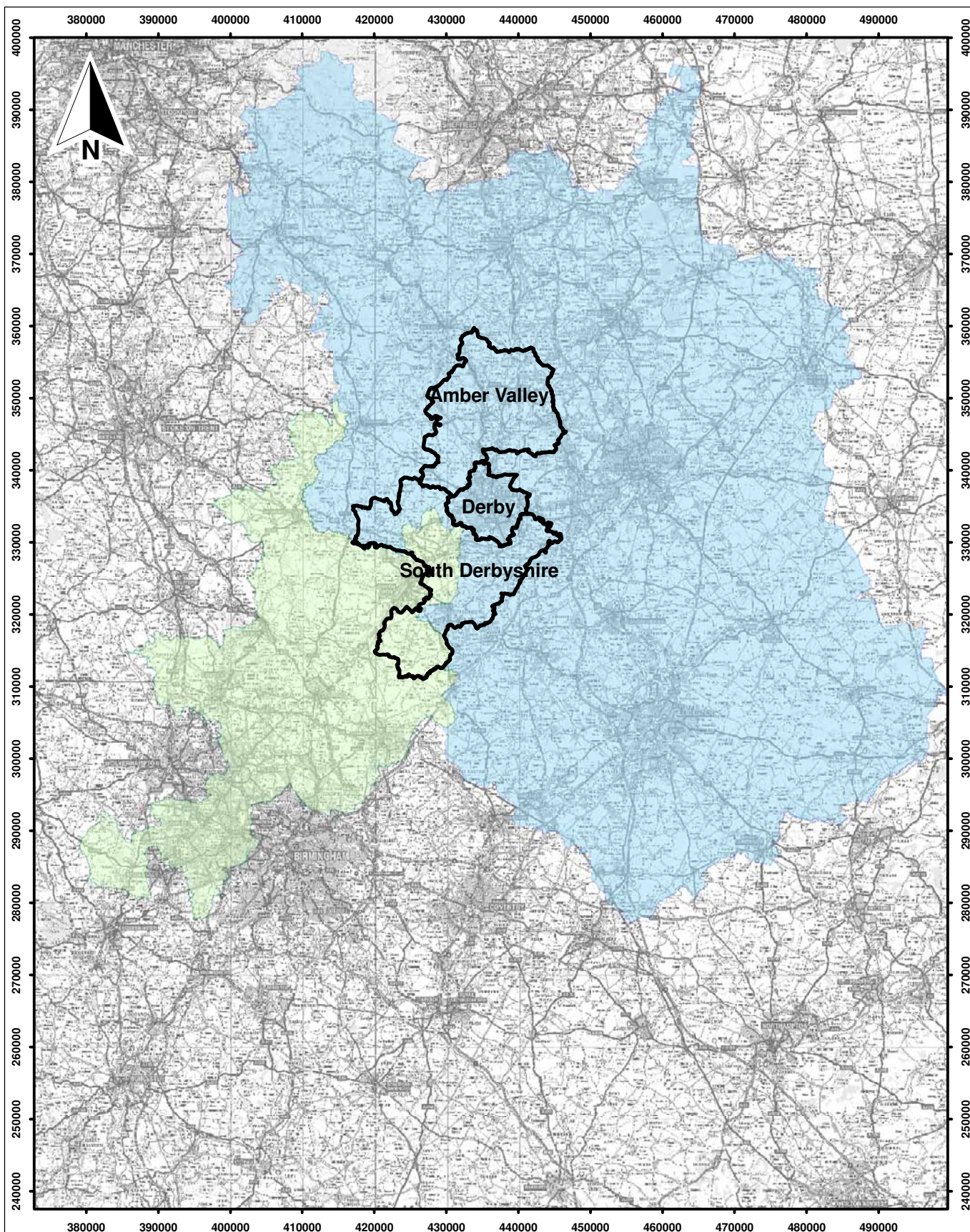
Water companies are required to produce Water Resources Management Plans (WRMP), under the Water Act 2003, which report long term planning related to the development of water resources over a period of 25 years. The Water Resource Management Plan identifies investment in water resources schemes to meet additional demand related to population growth and changes in per capita consumption of water. Draft WRMPs were prepared by Severn Trent Water and South Staffordshire Water and submitted to the Environment Agency and Defra for consultation in May 2008. Since submission of the draft plans, the water companies have prepared their Statement of Response, which sets out their responses to the representations on the draft Water Resource Management Plans made during the consultation period on how they will address comments and amend their final plan. Any other changes arising from changes in the economy for example are also included in their response. The Final WRMPs are currently being prepared but are not due to be published until December 2009, and are therefore not available for this study. More detailed information describing the water resource planning process, including the Ofwat periodic review of pricing is available in Appendix A.

4.2.1 Severn Trent Water Draft Water Resource Management Plan

The information presented in Severn Trent Water's draft WRMP and Statement of Response includes forecasts of how the balance between supply and demand will change in their East Midlands water resource zone over the 25 years from 2010 to 2035. These forecasts are based upon theoretical planning scenarios that all water companies use in their WRMPs which effectively consider the 'worst case' (dry year) situation. Companies first derive a 'baseline forecast' showing how supply and demand is expected to change without any intervention by the water company.

Severn Trent's baseline forecast in their draft WRMP indicated a deficit in supply: that is available supplies in the East Midlands WRZ would be 96 Ml/d less than demand in 2034/35. Since then, the company has reassessed its supply and demand forecasts and the forecast deficit has reduced to 60 Ml/d. In response to the potential deficit the company proposes a number of measures to limit increases in demand and to provide more supplies of water, so that in its final planning scenario, the Company forecasts a continual surplus in the East Midlands water resource zone for all of the next 25 years to 2034/35.





Key:

 Derby Housing Market Area

Water Resource Zone

 East Midlands Zone (Severn Trent Water)

 South Staffordshire Water

Derby HMA Scoping and Outline
Water Cycle Study

Figure 4.1
Water Resource Zones

Kilometers
0 10 20
Scale: 1:800,000 @ A4

H:\Projects\HM-255\25498 Derby Water Cycle Strategy\Drawings\GIS\MXD

October 2009
25498-b003 fiell

Entec

The key supply and demand facts and figures taken from the water company's draft WRMPs and updates from the Statement of Response are summarised below. Figures 4.2 and 4.3 illustrate the differences between Severn Trent's supply and demand forecast in the baseline and final planning scenarios.

Box 1 Severn Trent Water - East Midlands Water Resource Zone Key Facts

Total dry year supply (annual average deployable output) 2010 =889MI/d**

Groundwater sources = 25% of public water supply

Range of sources from across the zone; major reservoirs in the Derwent and Dove valleys; majority of groundwater abstracted from the Mansfield, Nottingham, and Worksop areas.

Population forecast to increase by 335,000 between 2006/07 and 2030/31*

Environmental pressures forecast to reduce supply: 39MI/d lost due to climate change by 2030/31 (surface water). The draft WRMP included no sustainability reductions for this zone, and this is confirmed in the Statement of Response.

A baseline surplus of 10 MI/d in 2007/08*

A baseline deficit of approximately 60MI/d by 2030/31**

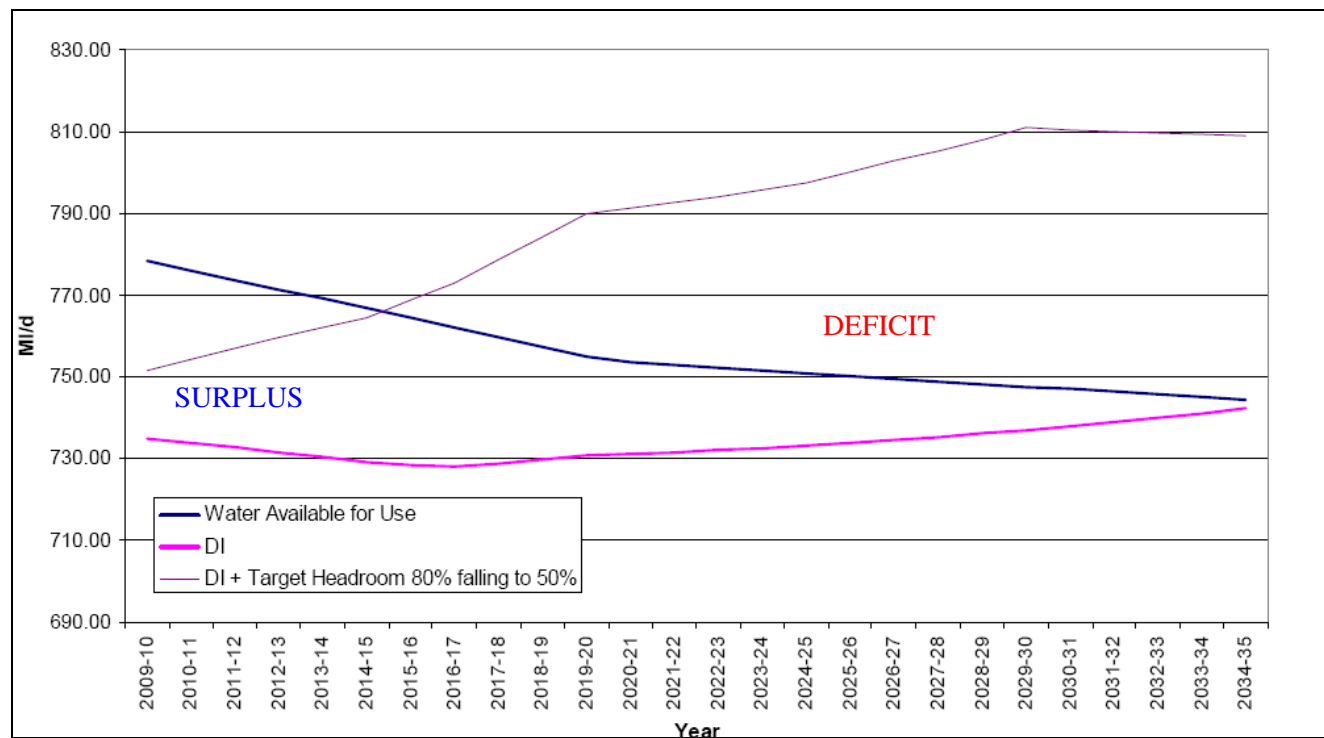
No deficit in final planning scenario** Takes account of measures to secure supply and manage demand

*based on draft WRMP. These data are subject to change in the Final WRMP

**based on STW latest assessment of supply demand balance and reported in the Statement of Response



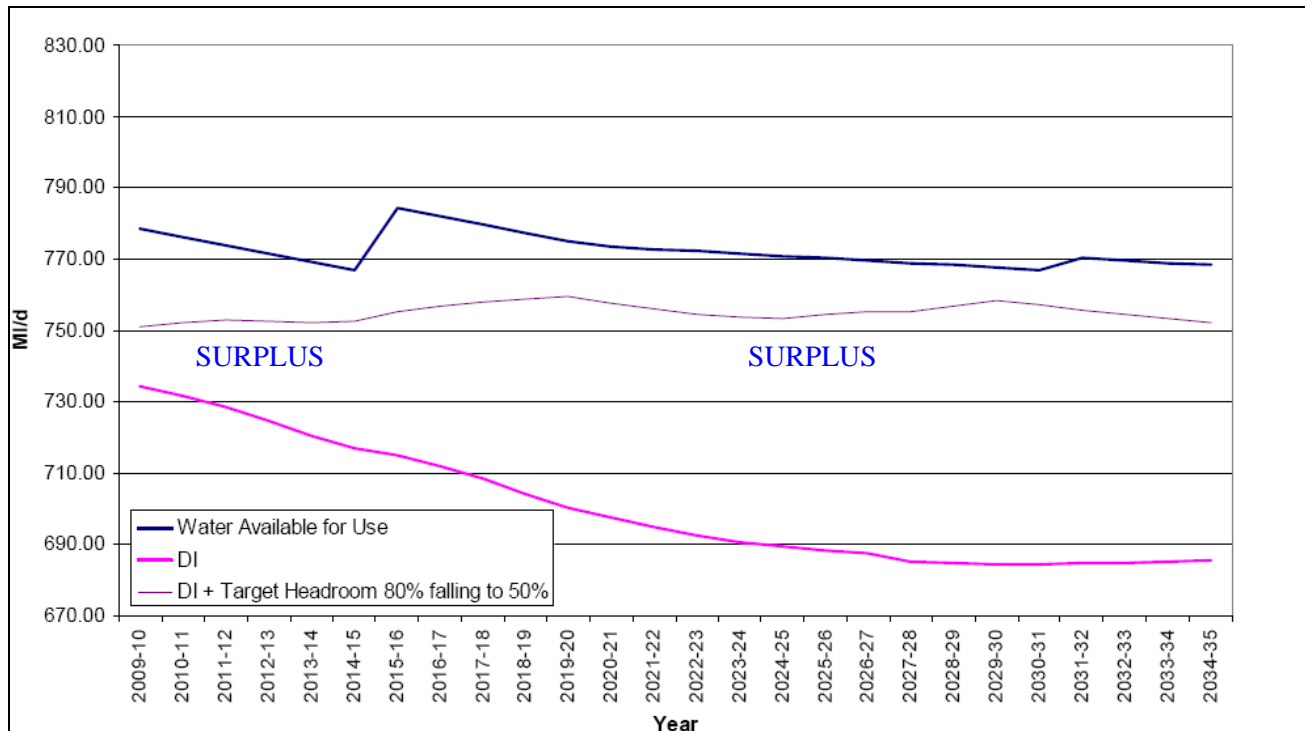
Figure 4.2 Severn Trent Water - Dry Year Baseline supply demand balance for the East Midlands Water Resource Zone



Source: Severn Trent Water Statement of Response (2009)



Figure 4.3 Severn Trent Water – Dry Year Final Plan supply demand balance for East Midlands Water Resource Zone



Source: Severn Trent Water Statement of Response (2009)

4.2.2 South Staffordshire Water Draft Water Resource Management Plan

South Staffordshire Water has forecast a surplus in its baseline planning scenario, and therefore expects to maintain secure supplies without the need for additional management options throughout its single water resource zone over the next 25 years.

The key supply and demand facts and figures taken from the water companies' draft WRMPs updated as appropriate from the Statement of Response are summarised below. Figures 4.4 and 4.5 illustrate the differences between South Staffordshire's supply and demand forecast in the baseline and final planning scenarios.



Box 2 South Staffordshire Water – Single Water Resource Zone Key Facts

Total dry year annual average deployable output 2007/08 = 398MI/d*

Surface water sources = 55% of public water supply

Bulk of surface water from Blithfield reservoir and River Severn. The Company also supplies water from 27 groundwater sources, abstracting from the Sherwood Sandstone aquifer.

Population forecast to increase by 73,000 between 2006/07 and 2030/31*

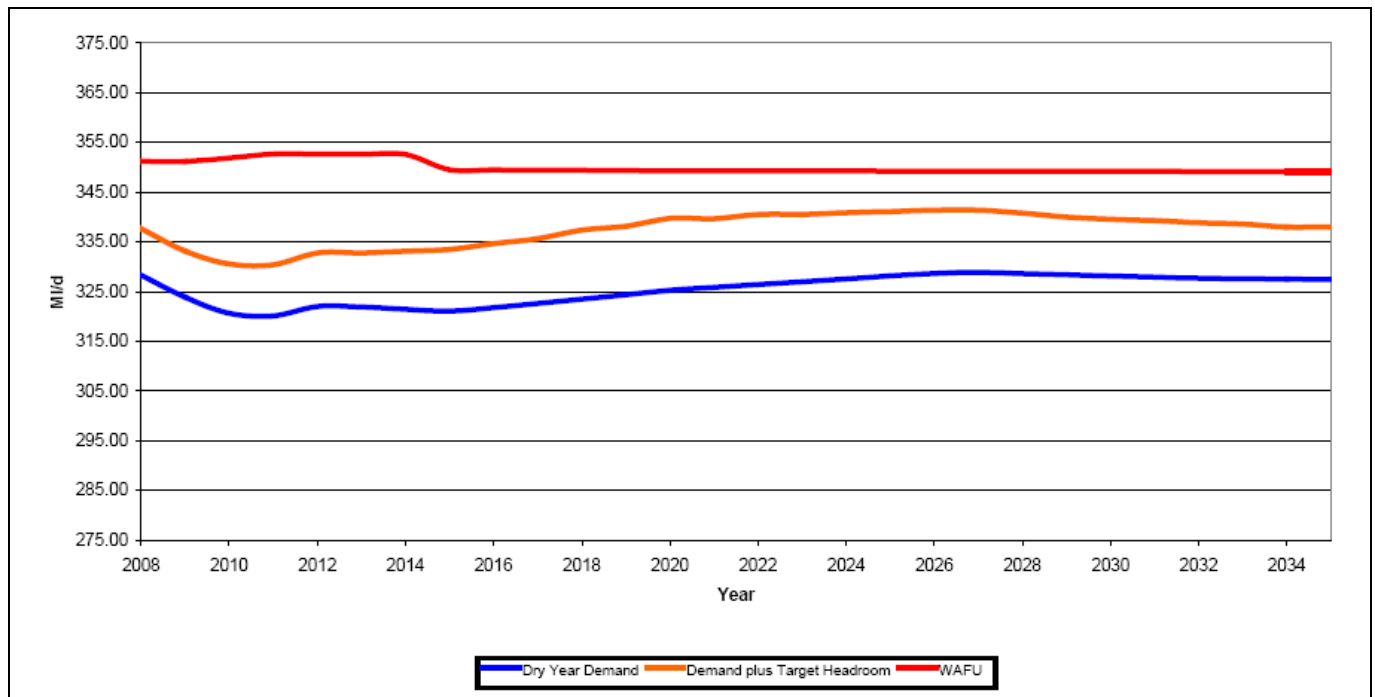
Environmental pressures forecast to reduce supply: 2 MI/d lost due to climate change by 2030/31

A surplus of approximately 15 MI/d in 2007/08*

No deficit forecast throughout the planning period (until 2034/35)*

*based on draft WRMP. These data are subject to change in the Final WRMP

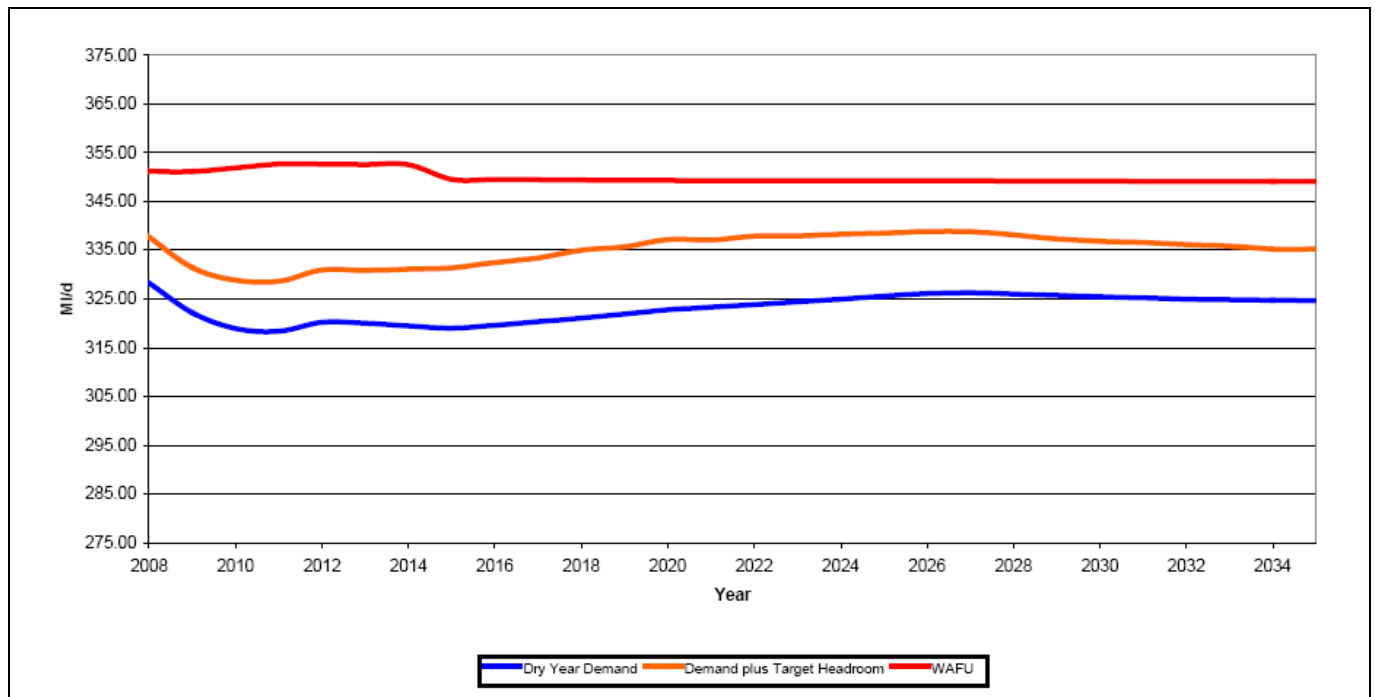
Figure 4.4 South Staffordshire Water – Dry Year Annual Average Supply Demand Balance (Baseline)



Source: South Staffordshire Water Response to Representations on the 2008 Draft Water Resources Management Plan, January 2009



Figure 4.5 South Staffordshire Water – Dry Year Annual Average Supply Demand Balance (Final)



Source: South Staffordshire Water Response to Representations on the 2008 Draft Water Resources Management Plan, January 2009

4.3 Constraints and Opportunities

The water companies are responsible for maintaining public water supply across a 25 year planning horizon. When faced with a present or forecast deficit in the theoretical planning scenarios used in the water industry, the water company is required to identify and select options to resolve it. In simple terms the options are; to increase the volume of water available to supply (either by developing new resources or making more effective use of the resources currently available); and/or to actively manage (reduce) demand to levels that can be met by existing resources. In practice the preferred solution usually consists of a mixture of options, led by demand management, but supported by resource development where justified, to guarantee secure supplies.

Section 4.2 highlights that Severn Trent Water has a baseline deficit throughout the growth period. This section summarises the company's preferred options to secure supplies over the next 25 years, examining the constraints affecting the range of supply and demand options. Detailed information on the options appraisal and selection process is available in the Severn Trent Water's draft WRMP (www.stwater.co.uk).



4.3.1 Supply Constraints: Regional Water Resource Availability

The Environment Agency has recognized that future trends indicate a decline in water availability within the Humber River Basin District, in which the Derby HMA lies. There is no further surface water available for large-scale abstraction during periods of low flow in several areas. There are only limited water resources available for further large scale abstraction (Environment Agency 2007). Many important wildlife sites depend on a good supply of water and water management is vitally important for public water supply, agriculture and industry.

The Environment Agency (EA) is currently drafting the Humber River Basin Management Plan (see Sections 3.3.1 and Section 5.2) but has already pointed out that as there are ‘very limited water resources available for further large scale abstraction, water efficiency measures must be taken seriously in order to accommodate the expected demand growth in the district’. Additional abstraction in the wider area is unlikely to be an option to meet the water demand of the future population expected within the study area. The EA has stated that in order to accommodate sustainable growth more efficient use of water resources is needed including restoration of sustainable abstraction (as discussed in Appendix A).

Water resources in the area are forecast to decline due to climate change. Severn Trent Water has assessed the impact of climate change and predicts a loss of 38.8MI/d by 2034/35 compared to present day water availability. This is equivalent to 4.4% of the existing supply volume (deployable output). In its Strategic Direction Statement, Severn Trent Water states that climate change is one of the most significant uncertainties facing the Company over the next 25 years. South Staffordshire Water has forecast a loss of 2.3MI/d by 2030/31 due to climate change.

Table 4.1 Impact of Climate Change on Deployable Output (Supply)

Water Resource Zone	Deployable Output (MI/d) (2007/08)	Reduction in supply due to climate change (2034/35)	Reduction as percentage of Deployable Output 2007/08
East Midlands zone	892 MI/d	38.8 MI/d	4.4%
South Staffordshire Water	398 MI/d (excl export to STW)	2.3 MI/d	0.6%

Both water companies forecast the impacts on sources and customers’ consumption using the most recently available climate change projections. At the time the draft WRMPs were produced this was the UKCIP02 data. The impacts of climate change on supply and demand, and the uncertainty associated with climate change have been considered by the water companies using industry standard methods.



It should be noted that new climate change predictions have been issued in June 2009 by the UK Climate Change Impact Programme. These supersede the previous predictions that the water companies have used in their most recent water resource plans.

4.3.2 Supply Constraints: Catchment Water Resource Availability

A review of the Environment Agency's Catchment Abstraction Management Strategies (CAMS, see Section 4.1.1) assessments relevant to the supply zones shows that the vast majority have either no water available, are over licensed, or are even over abstracted. In these cases the Environment Agency's licensing strategy is to close the catchments to further abstraction at low flows, or seek to reduce licence volumes in over abstracted catchments. There are some exceptions applicable to both companies, where the CAMS resource assessment concludes that there is some water available:

- There is some water available in the Trent area of the Trent and Erewash catchment. The strategy for this Water Resource Management Unit is to stay at 'Water Available.' This means the EA would grant further abstraction licences subject to an appropriate flow condition and all new licences will have a time limit of 31 March 2015. The rest of the catchment has been assessed as having No Water Available, is Over-licensed, or Over-abstracted. The Wollaton groundwater management unit is part of the Sandstone Sherwood aquifer and is one of Severn Trent Water's main sources of supply. Currently, deployable output (supply) from these sources is less than the licensed volume. The CAMS assessment is based on licensed quantities;
- There is some water available in upper and lower Rother catchments. Abstraction in this area accounts for only a small amount of the total licensed volume in the catchment and most of this is for industrial use;
- The catchments available to Severn Trent Water within the Tame Goyt and Etherow (upper Mersey) house the headwaters and reservoirs of Kinder, Fernilee and Combs. Resource availability in this area has not been assessed.

In the Trent catchment, the Environment Agency's strategy is to maintain the Water Available status. To maintain this status, the Environment Agency will consider applications for new licenses in accordance with water resources legislation and standard licence determination practice.

In many of 'over licensed' and 'over abstracted' catchments, the Environment Agency's abstraction licensing strategy is to move towards 'no water available' in the next CAMS cycle. The Dove (and Churnet) CAMS which straddles both company zones has been assessed as over abstracted and one of the measures to move towards No Water Available is to renegotiate the conditions in the critical licence held by Severn Trent Water Ltd at Egginton. This is a large surface water source, licensed to abstract 236MI/d, approximately 15% of the total licensed quantity for the zone, or approximately 23% of total licensed surface water abstractions. Deployable output of this source is less than the full licensed quantity. Consequently, the impact of a reduction in this licence on the Company's ability to secure public water supply would depend on the size of the reduction, particularly if this is large enough to reduce its deployable output.



A large proportion of the groundwater units from which South Staffordshire Water abstracts are classified by the Environment Agency as over-licensed and over-abstracted and are at risk of requiring reductions in abstraction.

Low Flow Problems and Restoring Sustainable Abstraction (RSA)

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

South Staffordshire Water has included reductions in abstraction from groundwater sources in the vicinity of the River Mease (Habitats Directive designation) and Checkhill Bogs SSSI. These reductions total 3Ml/d. These figures are currently indicative and will continue to be reviewed and updated. South Staffordshire Water confirms that this is a significant area of uncertainty for the supply-demand balance. Further, the Environment Agency CAMS for the Staffordshire Trent Valley and Mease confirms that this catchment is a net importer of public water supply, which means water is supplied from elsewhere but discharged as river flow within the catchment from the wastewater treatment works. Therefore, any reductions in household demand for water would reduce pressure on external sources, but would reduce the volume of flow being discharged into the Mease.

In September 2008 the Environment Agency provided Severn Trent Water with indicative reductions to be included in the final WRMP. However, Severn Trent Water has not included any sustainability reductions in its draft WRMP as the sites are still under investigation and any reductions are still uncertain. No additional information is available from the Environment Agency to confirm the presence and volumes of any potential reductions in abstraction in order to comply with the Habitats Directive Review of Consents.

In conclusion, the resource situation in the East Midlands is significantly constrained. There is little opportunity to develop new water resource schemes; current licensed abstractions may be curtailed in order to protect the environment, and climate change is expected to reduce resource availability further. This situation reinforces the importance of managing demand in this area.

4.3.3 Local Water Supply Infrastructure

Severn Trent Water provided GIS shapefiles showing the spatial extent of its water supply network within the study area. This information is confidential and cannot be reproduced in this report. The distribution network extends to all existing developed sites, such that additional development within these areas should not require extensive new mains in order to connect to the network. However, additional mains enhancements may be required in areas close to hydraulic capacity. In summary, the Amber Valley area of the Derby HMA is principally supplied via the Severn Trent strategic main, referred to as the Derwent Valley Aqueduct. Supply to Derby City, and as far south as approximately the River Trent, is via the treatment works at Little Eaton, north of Derby. The remaining area of



South Derbyshire that isn't supplied via South Staffordshire Water principally encompasses the Melbourne area and again is supplied from both Severn Trent's strategic grid and in part from the treatment works at Melbourne.

South Staffordshire Water has a booster pumping station at Castleway, pumping supplies to the Hilton, Etwall, Findern, and Willington areas of the study area. The nearest surface water reservoir/storage tanks are at Winshill and Outwoods in Burton upon Trent, a neighbouring growth point. Planned growth in Burton upon Trent is likely to increase the pressure on these reservoirs. Any additional growth in the study area, to the north east of Burton upon Trent will also add to the demand for local storage and supply.

South Staffordshire Water has an integrated supply network and therefore the supply could be taken from a number of locations depending on the location of the proposal. South Staffordshire has stated that local pinchpoints, or 'hot spots' in the network would only be identified through detailed analysis examining specific growth plans and the relevant sections of the distribution mains. The Company has stated that it will be able to assess which trunk main and which surface water reservoir would be used to supply new developments once the size and location of future housing developments is confirmed. At this Outline stage there are no known infrastructure constraints within South Staffordshire's supply network.

Severn Trent Water has made provision within its Final Business Plan to improve the resilience of the supply network and to ensure security of supply to its customers both now and into the future. Although STW's strategic grid allows water to be moved around its supply area, the Company has highlighted the need to ensure protection of supplies over the next Business Plan period. The Company has reported increases in interruptions to supply, and has highlighted that operational improvements are required to existing mains to reduce current risks.

Water Companies have a legal requirement to prepare Water Resource Management Plans for Defra whereby they seek to demonstrate maintenance of a supply demand balance over a 25 year period. Where necessary mitigation measures, either to increase supply or to reduce demand, are proposed to protect this balance however funding for any mitigation is still sought via the Companies Final Business Plans to OFWAT, the Water Industry's economic regulator.

4.4 Capacity for New Development

4.4.1 Water Supply

Forecast demand is a critical component of the water companies' water resource management plans. The companies' plans to secure supplies are based on projections of population growth and per capita consumption (pcc). Both companies state that their demand forecasts the growth projections set out by the Regional Spatial Strategy. The pcc forecasts are based on the assumption that water efficiency policies and activities will successfully reduce individuals' demand for water. The Companies' pcc forecasts are available in Appendix A. This section sets out the water companies' strategies to control demand and explores the sensitivity of demand to alternative growth and pcc conditions.



Severn Trent Water has stated explicitly that its surplus in the final strategy supply-demand balance is dependent on successfully managing the demand of new and existing customers, and the Company considers that the Local Authorities to have a key role in supporting its demand management strategy.

A sensitivity analysis has been undertaken to test the implications of alternative growth scenarios and per capita consumption levels on household demand in the study area. The Local Authorities have supplied their projected growth rates and these have been totalled to produce a preferred growth rate for the study area. By agreement with the Local Authorities an upper and lower projection was calculated (20% above and below the preferred growth rate respectively). To each of these growth rates, nine alternative demand scenarios were applied. A suite of 27 results were produced covering a demand spectrum deviating from Severn Trent Water's forecast, as presented in Table 4.2 below. The sensitivity tests focus on the impact on total household demand as there is no data on which to develop alternative non household demand forecasts. The range of results are summarised on Figure 4.6, page 33.

Table 4.2 Summary of Water Efficiency Scenarios Used in Sensitivity Analysis

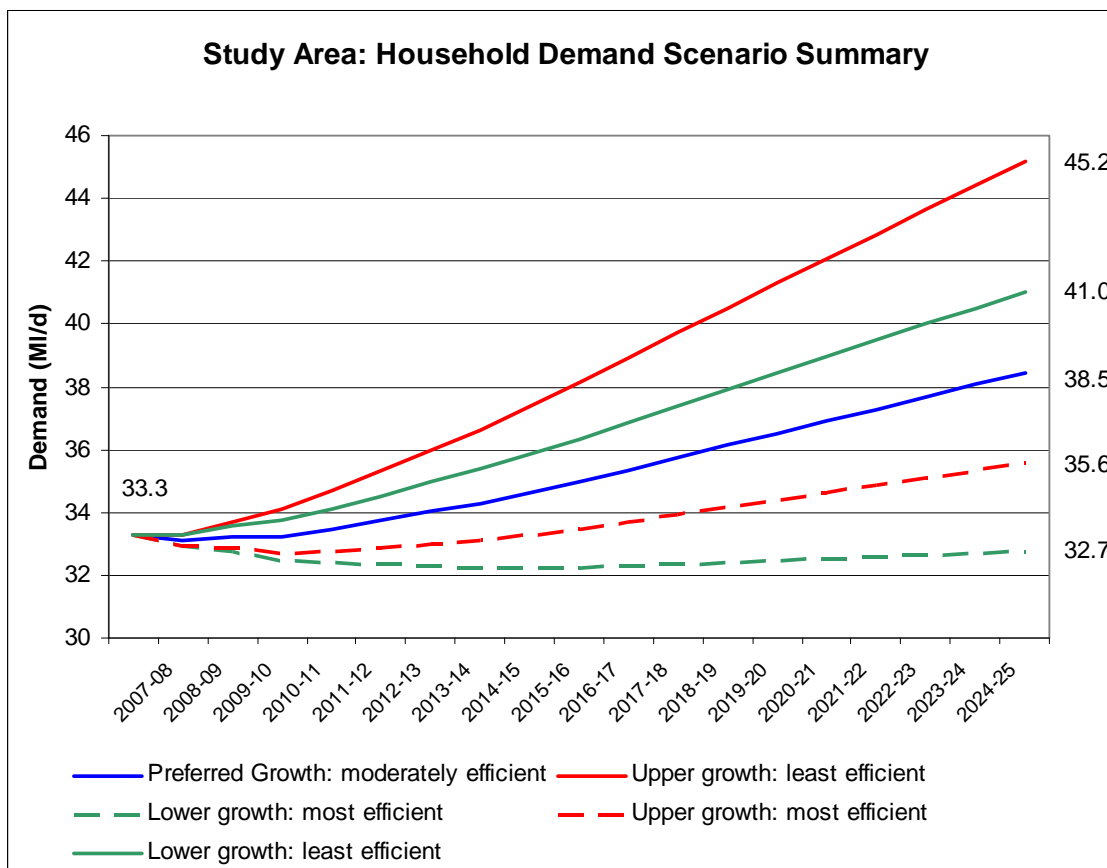
HIGHLY WATER EFFICIENT		
Existing household pcc is 10% below water company forecast*		
Forecast households:		
1a. 35% at 80 l/h/d	65% at 105 l/h/d	All new homes reach CSH level 4 as a minimum
1b. 35% at 105 l/h/d	65% at 120 l/h/d	A third of new homes reach CSH level 4
1c. 35% at 125 l/h/d	65% at 130 l/h/d	Demand in new homes misses CSH levels but demand is in line with Defra pcc target.
MODERATELY WATER EFFICIENT		
Existing households use water company pcc forecast*		
Forecast households:		
2a. 25% at 80 l/h/d	75% at 105 l/h/d	All new homes reach CSH level 4 as a minimum
2b. 25% at 105 l/h/d	75% at 120 l/h/d	A quarter of new homes reach CSH level 4
2c. 25% at 125 l/h/d	75% at 130 l/h/d	Demand in new homes misses CSH levels but demand is in line with Defra pcc target.
LEAST WATER EFFICIENT		
Existing household pcc is 10% above water company forecast*		
Forecast households:		
3a. 45% at 105 l/h/d	55% at 120 l/h/d	Over half of new homes only reach CSH level 1
3b. 45% at 120 l/h/d	55% at 125 l/h/d	Less than half of new homes only reach CSH level 1



3c. 45% at 130 l/h/d	55% at 150 l/h/d	pcc in new homes is significantly higher than the CSH levels, and Defra target
*See Appendix A l/h/d = litres per household per day		

Figure 4.6 illustrates a summary of the results. By applying the Company pcc forecasts to the population projections, demand in the study area is expected to increase from 33MI/d to 38MI/d. Higher growth combined with increasing pcc (i.e. unsuccessful demand management strategies) could increase this by 7MI/d, to 45MI/d. In contrast, lower growth combined with very effective demand management (that is pcc 10% less than forecast, and new homes reaching Code For Sustainable Homes level 3/4 and 5/6 for water consumption) could lead to household demand in 2025/26 equivalent to current levels.

Figure 4.6 Summary of Alternative Growth Rate and Demand Scenario Forecasts



4.4.2 Sustainable Development / Water Neutrality Assessment

Water neutrality is defined as the net demand for water in an area of significant development being the same after development is completed as it was before. Water neutrality may be achieved by making new homes and other



buildings water efficient, retrofitting water efficient devices into existing homes and buildings and increasing rates of metering. The relevance of water neutrality in any particular area is highly dependent on the water resource situation in the area; for example if water resources are seriously stressed and there are limited opportunities for further resource development. The feasibility of achieving water neutrality is dependent on a number of factors, including the number of new homes to be built relative to the numbers of existing homes in an area, the existing levels of per capita consumption in the area and whether the reduction required is realistically possible.

Although the 'baseline' forecast for supply and demand (the forecast that doesn't take account of additional measures to secure supplies) shows a deficit to supply, Severn Trent has revised their forecast to include demand management and maximising supply from existing sources where permitted by the EA. The final planning scenario therefore indicates that there are sufficient resources to meet existing and forecast demand up to 2034/35. Water demand management is already an integral part of the Company's strategy to secure supplies. The cost and social implications of additional demand management as required to achieve neutrality may not therefore be justifiable in this area.

Nevertheless, water efficiency measures should be promoted through planning policy and awareness campaigns led by the Councils, in order to support Severn Trent's forecast household consumption rates. Since the 1st May 2008 the department for Communities and Local Government (CLG) has required that all new homes are rated against the Code for Sustainable Homes (CSH). In terms of water consumption, homes which are designed to deliver per capita consumption between 120 to 80 litres/head/day are awarded between level 1 to 6 against the code, which will assist in meeting lower household demand. All new social housing funded through the Housing Corporation is required to be built to level 3 equivalent to 105l/h/d internal water use.

Since the publication of the CSH, the Government has committed to introduce a minimum regulatory standard for water consumption in all new homes. This has been set at 125 l/h/d (including external water use) and has been introduced through amendments to the Building Regulations in 2008 (CLG, 2007). The regulatory minimum is approximately equal to the CSH Level 1/2 standard, when an allowance for external use is included.

By implementing stricter water efficiency measures than those for most houses through the Building Regulations (equivalent to 125 l/h/d), the Councils will also support the Environment Agency's Catchment Management Strategies, which state that the majority of water management units have no water available or are over licensed or even over abstracted.

Local Authorities have an important role supporting the efforts of the water companies to raise awareness of the need to use water wisely, and for helping to distribute information to customers explaining how they can use water more efficiently and what the benefits are to them. The Environment Agency has highlighted that the planning authorities have a key role in managing water resources via spatial plans that contain policies promoting the efficient use of water resources.



Hampshire County Council and the local district and borough councils are a good example of how the Local Authorities can lead a partnership approach spreading a consistent message to save water. Information on the Local Government Association website explains,

“The 'Water in Hampshire' project was established in 1999. By forming a partnership of organisations from across the public, private and voluntary sectors, the project aims to raise the profile of water; gain a better understanding of the environmental, planning and management issues associated with the county's water environment; and to develop sustainable solutions. The project takes a holistic look at water issues, focuses predominantly on the county's freshwater resources, and appears to be the first of its kind in the UK.”¹

The key point to take forward in the Core Strategy is the need for the Local Authority to require all new homes to be water efficient. A recent study completed by Entec UK Ltd for the London Development Agency has demonstrated that basic water efficiency measures (6/4 litre dual flush toilets, standard rather than power showers, restrained flow bathroom taps etcetera) are feasible in terms of performance and customer satisfaction, and are sufficient to enable **all** types of new households to reach Level 3/4 of the Code for Sustainable Homes. It is recommended that the Councils include policies to recommend **all** new homes are built to Level 3/4 of the Code for Sustainable Homes, equivalent to 105 l/h/d.

4.4.3 Supply Infrastructure

OFWAT expects that water and waste undertakers growth assumptions are in-line with the regional and local planning process established under the 2004 Compulsory Purchase Act. In addition, under the Water Industry Act 1991, the water company has a duty to connect a property to the mains system if the property requires supply for domestic purposes. Whilst OFWAT can make provision for water companies to invest in growth driven investment via their Final Determinations, they will also require, where appropriate, that contributions are sought from developers to help fund new infrastructure requirements resulting from new development.

As the Water Companies Final Determinations will not be known until late November 2009 it isn't yet clear what degree of funding will be available to support the proposals as laid out in their Final Business Plans. South Staffordshire Water has not confirmed its position on this matter but it is expected that it too would require financial contributions.

Ofwat has recently issued its draft price determination and early indications from Severn Trent Water are that Ofwat will fund significantly less growth driven investment compared to that set out by the Company in its Final Business Plan. Ofwat's final determination is expected in November 2009. This means that Severn Trent Water will not be able fund network enhancements to its preferred level. The scale of this impact will be dependent on the nature of the infrastructure enhancements identified by the Company, and decisions on which particular enhancements may need to be postponed. It is important that the Local Authorities maintain dialogue with Severn

¹ <http://www.lga.gov.uk/lga/core/page.do?pageId=1132377>



Trent Water to discuss the likely development sites as the Local Development Framework plans are completed. In order to plan and prioritise its network enhancements the water company will need to examine its existing infrastructure, known issues, and areas of proposed development.

More detailed discussion with Severn Trent Water and South Staffordshire is required to confirm and identify specific water infrastructure issues regarding supply to the study area. This may be required if a Detailed study is undertaken.

4.4.4 Climate Change Allowance

The impact of climate change on water resources will vary depending on the nature of the sources in a particular supply area. It is generally considered that surface water sources will be more vulnerable than groundwater sources in the shorter term to changes in rainfall patterns. Surface water dominated resource systems may need to be modified to respond to more extreme weather events (for example prolonged dry periods or more winter rainfall).

As discussed in Section 4.3.1, the two water companies have forecast the impacts on sources and customers' consumption using the most recently available climate change projections using UKCIP02 data. It should be noted that new climate change predictions have been issued in June 2009 by the UK Climate Change Impact Programme. These supersede the previous predictions that the water companies have used in their most recent water resource plans.

Further discussion of climate change on water resources is provided in Appendix G.

4.5 Water Company Preferred Strategy

Severn Trent Water has set out some potential options to resolve the baseline deficit, taking into account the constraints identified above. The details are expected in the Company's Final WRMP which is due to be published in December 2009, provided Defra does not wish to call in the plan for public inquiry. In its Business Plan it stated that there will be no new sources between 2010 and 2015, and that the strategy for AMP 6 is to maximise sustainable use of existing supplies to increase the amount of water available, to meet demand at the least cost to customers and the environment. This strategy will focus on making more sustainable use of existing supplies rather than developing new sources of water:

- **Production and Resource Development:** Extending production at the Church Wilne site on the River Trent and developing the Nottingham groundwater scheme in 2019/20 (combined deployable output of approximately 80MI/d). Severn Trent Water originally sought to increase its deployable output by 30MI/d from its Nottingham groundwater sources. However, following comments from the Environment Agency regarding water available in the Wollaton Groundwater Management Unit, Severn Trent Water has scaled down the potential deployable output gain of this scheme from 30MI/d to 10MI/d;
- **Distribution:** 20MI/d made available by improving water distribution;



- **Demand:** 7.7Ml/d saved in the East Midlands zone by 2034/35 via water efficiency activities and metering (reducing per capita consumption). STW plans to increase household metering. Currently only 33% of households in STW Company area are metered. In the draft WRMP STW forecast an increase to 42% by 2015, mostly by promoting the free meter option. At the Company level STW forecasts that its metering policies will increase the proportion of billed households with a meter to approximately 70% to 72% by 2034/35;
- **Demand:** Enhanced active leakage control. Reducing leakage is key element of STWs strategy. At the Company level current leakage is 496 Ml/d but the target is to reduce this to 453 Ml/d by 2014/15 based on achieving sustainable Economic Level of Leakage (ELL), through additional detection and repair, pressure management, and restructuring District Metered Areas (DMA) to target leakage more effectively. This will save 43 Ml/d across the company. Activities in the Final Business Plan have been reduced below those originally set out in the draft business plan, due to Ofwat's initial view on (CAPEX) allowance. In the East Midlands zone, Severn Trent Water plans to reduce leakage via mains replacement and pressure reduction;
- **Demand:** The situation may be eased in the short term by a significant reduction in non household demand as a result of the economic downturn. This is expected to be approximately 60Ml/d less than the draft forecast for 2035. Severn Trent Water has also suppressed its housing growth forecast to reflect the current economic situation but maintains that growth will reach planned levels by 2035.

As South Staffordshire Water forecasts that there will be no deficit in either dry year annual average, or peak demand conditions, the Company has not proposed additional options to secure supplies above those already in place in the baseline scenario. Water demand management is an integral part of SSWs baseline activity, including free issue of cistern displacement devices, metering policies targeting new houses and high users (sprinkler users) and optional take up. SSW intends to significantly increase the proportion of its customers who are metered from approximately 20% to 70% by 2025.

4.6 Summary and Recommended Policies / Development Strategy

The major reservoirs in the Derbyshire Derwent catchment (in the Derwent and Dove valleys), augmented by a transfer from Rutland Reservoir (Anglian Water), and several river abstractions, provide the majority of water supplying the area occupied by the Derby HMA.

The resource situation in the East Midlands is significantly constrained. The Environment Agency's Catchment Abstraction Management Strategies show that the vast majority of resource management units relevant to the study area have either no water available, are over licensed, or are even over abstracted. However, there are some exceptions applicable to both water companies, where the CAMS resource assessment concludes that there is some water available.

The study area is predominantly supplied by Severn Trent Water's East Midlands Water Resource Zone. A small percentage of South Derbyshire is supplied by South Staffordshire Water.



Climate change is expected to reduce resource availability further. Severn Trent Water predicts that by 2034/2035, the deployable output will reduce by 38.8 Ml/d. This is equivalent to a reduction of 4.4%.

Without additional measures, Severn Trent's draft WRMP forecasts a deficit in supply throughout the growth period. To rectify the deficit, their final planning scenario has allowed for certain measures that include a combination of demand management and increases in existing abstraction, where water is deemed available, so that in their Final WRMP, a surplus in supply and demand is forecast.

South Staffordshire Water's draft WRMP forecast a surplus in their baseline scenario. Their plan includes a reduction of 3Ml/d groundwater sources in the vicinity of the River Mease (Habitats Directive designation) and Checkhill Bogs SSSI to reduce the pressure on habitats protected under the Habitats Directive.

Severn Trent Water's demand forecast includes the assumption that consumption rate in new households will decline from the current level of 132 litres per head per day (l/h/d) to 129 l/h/d.

Water neutrality is unlikely to be an appropriate goal for the development area, as the concept needs to be applied at a resource zone scale and be driven by predicted deficits. With the forecast per capita consumption of 132 l/h/d together with demand management and review of existing licences, Severn Trent Water forecast a surplus in the supply and demand balance. Recommendation 1 below suggests all new homes are built to Code for Sustainable Homes Level 3/4 to reduce demand from new households. Recommendation 2 should be pursued so that the Councils can help reduce demand from existing development, alongside the water companies metering strategies and other water efficiency activities. There is limited potential to further reduce per capita consumption below that already forecast by the water companies.

To reduce the pressure on water resources in the region and to support the water company's management plans, it is key that the Local Authorities bring forward recommendations for all new homes to be water efficient in the Core Strategy. Basic water efficiency measures (6/4 litre dual flush toilets, standard rather than powershowers, restrained flow bathroom taps etcetera) have been found to be feasible in terms of performance and customer satisfaction, and are sufficient to enable all types of new households to reach Level 3/4 of the Code for Sustainable Homes.

Water Resources Recommendation 1

It is recommended that the Local Authorities Core Strategy require developers of private homes to build to Level 3/4 of the Code for Sustainable Homes (105 l/p/d).



Water Resources Recommendation 2

It is recommended that the Core Strategy includes policies to support the water companies' water efficiency activities for existing households.

Ongoing communication with the water companies will be essential to ensure that the Local Development Plans and WRMPs and operational plans are aligned. Housing growth figures are subject to regular change as development plans and applications are received and processed. The water companies are obliged to develop their forecasts in line with the best available information. Currently these plans are based on the target figures presented in the Regional Spatial Strategy. By providing regular development plan updates the Local Authorities can significantly help the water companies to refine and implement their plans more effectively.

A significant issue that Severn Trent Water is keen to address is the impact that the Derby HMA growth point status will have compared to historical growth patterns. The water company manages its supplies, and its infrastructure development policies based on assumptions that are equally applicable across the whole water resource zone. In this area housing growth has traditionally been fairly steady over space and time. The impact of the current economic climate on general housing development, combined with the emphasis of development in the growth point areas has the potential to create a step change in the way that resources, and particularly new infrastructure needs to be planned and delivered at a local level.

Water Resources Recommendation 3

It is recommended that a Detailed Water Cycle Study is undertaken to examine: the infrastructure constraints relative to local growth plans (allocated or under consideration) and set out an appropriate framework for the provision of improved and/or new infrastructure; feasible options for achieving level 3/4 of the CSH (water consumption); locally specific interactions between suppressed household consumption, sewerage, and discharge effluent volumes; cost/benefit analysis of development options; funding streams, including financial contributions from developers. The detailed study will continue the stakeholder engagement through regular steering group meetings and promote ongoing dialogue between the local authorities and the water companies for monitoring and assessing the impacts of growth on the water resources management in the study area.





5. Wastewater Treatment, Sewerage and Water Quality

This chapter uses all available information to assess the capacity of the existing wastewater infrastructure, owned and operated by Severn Trent Water (STW), to accommodate the proposed growth in terms of both the sewerage network and wastewater treatment assets. This is followed by an assessment of the capacity of the environment (in terms of water quality of rivers draining the study area and the underlying groundwater) to receive (potentially increased) effluent loads without detrimental effects, Water Framework Directive (WFD) failures or breach of other regulations. Presentation of the existing receiving water quality is followed by a prediction as to whether water quality targets (to 2026) will be met. Conclusions are drawn with regard to areas, specific water bodies or Wastewater Treatment Works (WwTWs) under pressure and recommendations are made in connection with the options available to address any potential issues identified.

5.1 Wastewater Treatment and Sewerage

This section presents the 'baseline' situation for wastewater treatment and sewerage in the study area. The information is based on the data provided by Severn Trent Water (STW) for the purposes of the Outline Water Cycle Study. Severn Trent Water is the sole provider of public wastewater services in the Derby HMA, while the Environment Agency regulates the quality of effluent discharges to help protect water quality, the environment and human health. This is done through issuing discharge consents which set the flow rates and water quality standards that must be achieved at the point of effluent discharge. Within the more rural areas there are likely to be some smaller private sewerage treatment systems that are not considered in this report.

Sewerage companies in England and Wales set out their long term requirements over a 25 year period for maintaining and enhancing their wastewater infrastructure in their Strategic Business Plans on a five yearly basis. The Strategic Business Plans form part of the Periodic Review (PR) process whereby Ofwat, in consultation with other organisations including Defra, the Environment Agency, Natural England and consumer organisations, determines the expenditure that the companies can make to maintain and enhance their infrastructure. The outcome of this determination is an Asset Management Plan (AMP) for the following five-year period.

The current (fourth) AMP period finishes in March 2010 and the water companies are currently in the process of preparing their Strategic Business Plans covering the next AMP Period (AMP5), setting out their funding requirements for the period from April 2010 to March 2015. The AMP5 reports and Long Term Wastewater Management Plans have not yet been made available to Entec for this study as they are not yet finalised.



5.1.1 Existing Wastewater Treatment Works

The location of discharge consents and WwTWs in the study area have been provided by both the EA and STW and are summarised below:

- There are 51 WwTWs operated by STW located within the study area and, on the boundary, some WwTWs also serve populations outside the study area;
- Derby City Council is served by one main treatment works; Derby WwTW;
- Amber Valley Borough is served by 23 WwTWs; and
- South Derbyshire District is served by 27 WwTWs.

Figure 5.1 presents the most significant WwTW locations and catchment areas. It can be seen that rural parts of the study area are outside the main sewered catchments and are served by cesspits and septic tanks.

The treatment capacity for WwTWs is a measure of the capacity of the treatment process to treat wastewater to comply with the consent standards. All water companies aim to treat effluents to exceed standards set out in the consent to reduce the risk of non-compliance. The difference between the actual effluent quality and that of the consent is termed headroom. However, headroom data has not been made available to this study and therefore treatment capacity has not been examined in this study.

A fundamental factor describing the hydraulic, or flow, capacity is a WwTW's 'Dry Weather Flow' (DWF), which is a measure of the incoming flow to a WwTW derived from human activity (both domestic and trade), but excluding any storm-induced flows. The method for determining DWF and further discussion is presented in Appendix B.

All sewage treatment works should now have certified flow monitoring equipment installed that enables effluent flows to be accurately monitored. The calculated DWF used for planning purposes is derived based on the 20th percentile flow from the monitored data (on the basis of 12 months daily data), that is the flow that is exceeded 80% of the time. The difference between measured wastewater flows and consented DWFs provides an estimate of the available capacity at a WwTW to receive additional inflows.

Wastewater flow data were provided by STW for most WwTWs in the study area. Measured and consented flows as well as the spare capacity are presented in Table 5.1. It can be seen that a number of the WwTWs are already operating over their consented discharge, so will have no capacity to accommodate any additional housing growth without additional investment (in red text). Derby and Clay Mills WwTWs have the largest amount of spare flow capacity, so are likely to be able to accommodate larger housing growth numbers.



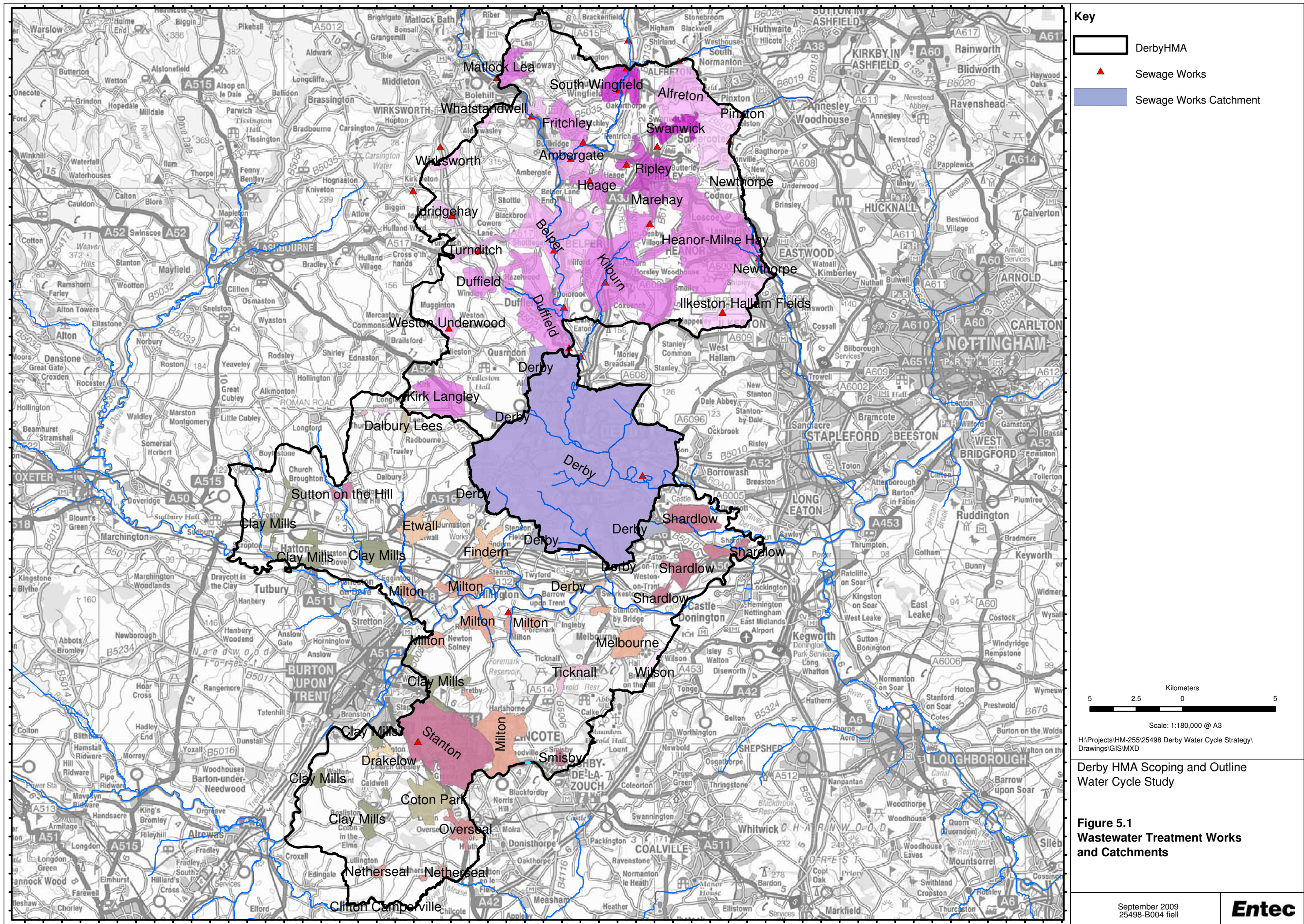


Table 5.1 Current Population and Consent Conditions for WwTWs Serving the Study Area

Council	Waste Water Treatment Works	Dry Weather Flow (m3/d)		
		Consented DWF	Measured DWF (2008)	Spare DWF (consented – measured)
Derby City	DERBY	91,500	81,940	9,560
S. Derbyshire	CLAYMILLS*	47,000	32,022	14,978
S. Derbyshire	Milton	2,500	3,100	-600
S. Derbyshire	STANTON	6,936	6,707	229
S. Derbyshire	SHARDLOW	1,900	1,639	261
S. Derbyshire	COTON PARK	1,054	1,168	-114
S. Derbyshire	FINDERN	584	929	-345
S. Derbyshire	MELBOURNE	950	876	74
S. Derbyshire	OVERSEAL	455	415	40
S. Derbyshire	ETWALL	900	413	487
S. Derbyshire	TICKNALL	100	167	-67
S. Derbyshire	NETHERSEAL	176	100	76
S. Derbyshire	SUTTON ON THE HILL	137	n/a	
S. Derbyshire	THURVASTON	81	n/a	
Amber Valley	ALFRETON	8,283	5,750	2,533
Amber Valley	KILBURN	3,248	3,161	87
Amber Valley	PINXTON**	3,907	2,263	1,644
Amber Valley	FRITCHLEY	800	1,668	-868
Amber Valley	RIPLEY	1,870	1,438	432
Amber Valley	DUFFIELD	726	1,397	-671
Amber Valley	HEAGE	1,470	808	662
Amber Valley	HEANOR-MILNE HAY	8,582	7,637	945



Table 5.1 (continued) Current Population and Consent Conditions for WwTWs Serving the Study Area

Council	Waste Water Treatment Works	Dry Weather Flow (m3/d)		
		Consented DWF	Measured DWF	Spare DWF ⁺ (consented – measured)
Amber Valley	SOUTH WINGFIELD	542	256	286
Amber Valley	BELPER	4,453	3,644	809
Amber Valley	AMBERGATE	485	n/a	

below 500m³/day or no additional housing are generally not considered further in this assessment

*also serves Burton upon Trent, outside study area

**also serves parts of Ashfield District Council

⁺This table purely shows consented and measured DWF and the difference between the two based on data provided by Severn Trent Water.

5.1.2 Existing Sewerage

The term sewerage within this report refers to the system of underground sewers or pipes used for the removal of wastewater. There is a known capacity issue with the sewerage in the Derby City area. Records of sewer flooding incidents were not made available for this study, however the SFRAs report on sewer flooding incidents in each of the local authority areas in the Derby HMA. There are a number Combined Sewer Overflows (CSO) in the Derby City area. Capacity issues are particularly pronounced to the south of the River Derwent in Derby City, where sewer flooding is known to have often occurred in the past. Some major enhancement works were carried out at Sinfen at the end of the AMP3 cycle (2005).

There are two issues with the sewerage in Derby City. South of the River Derwent, there are capacity issues in the existing network such that it will be difficult for Severn Trent Water to accommodate additional flows from any new development. Secondly, because the treatment works is located north of the river, it will also be difficult to connect any new infrastructure to the works, as crossing the River Derwent will incur extra costs and logistical issues; for example for new sewers.

The limited capacity of sewers in Derby City forms a potential source of flooding in many areas. To a lesser degree, backing up of the River Derwent in sewers during high river levels can also potentially lead to sewers overtopping (Derby City SFRA, 2009). Other areas in catchments of tributaries of the River Derwent, such as the Thulston, Wood, Boosemoor and Cuttle brooks, also face sewer flood risk issues due to limited capacity (see Chapter 6). Incidents of sewer flooding have been recorded in STW's internal register and presented in the SFRAs carried out within the study area. Sewer flooding has occurred in many parts of South Derbyshire, including Melbourne, with a particular clustering of events around Swadlincote. The Amber Valley SFRA indicates that



flooding from surface water sewers is a particular issue in the areas of Alfreton, Belper, Heanor, Ripley, Codnor, Somercotes and Langley Mill. In these areas many sewers and CSOs are already at capacity.

5.1.3 Sludge Management

Wastewater sludge is produced in the treatment of wastewater and also requires treatment and disposal in a sustainable manner. The planned growth in the Derby HMA will lead to increased sludge production and potentially affect future sludge management practices in the region. In the Final Business Plan for STW published on their website (<http://www.stwater.co.uk/upload/pdf/SVT - PR09 - FBP - A.pdf>) they anticipate by the end of AMP5 having an additional '22,000 tonnes of dried solids per year to deal with at our sludge treatment facilities, as a result of higher treatment standards and growth in demand' (Final Business Plan, Severn Trent Water, April 2009).

Severn Trent Water's sludge strategy seeks to mitigate risks associated with the sludge to land route, which is currently seen as environmentally the best route. Whilst there is currently a high level of demand for sludge from agriculture, the company recognises future trends and pressures may change the demand, therefore investigations into the sludge to energy capability are ongoing. Through increasing the electricity generation from sludge STW will look to reduce their carbon footprint also.

In their Final Business Plan, STW has a comprehensive sludge management strategy in place that this is not expected to hinder growth plans.

5.2 Water Quality

An overview of the study area hydrology is shown in Figure 3.3. Both the River Derwent and River Trent systems extend beyond the study area and are recipients of polluting inputs both upstream and downstream of the Derby HMA. Other important water bodies include the River Erewash and the Erewash Canal running along the eastern boundary of the Amber Valley area, the Trent and Mersey Canal bisecting South Derbyshire and the Foremark and Staunton Harold Reservoirs in South Derbyshire.

The quality of the water environment is an important indicator for the health and amenity of rivers, and for ecology and biodiversity. It is important to monitor quality in the rivers, especially those that receive discharges from wastewater treatment works, and agricultural discharge, so that land management practises can be improved. This section describes the existing water quality in the study area of the receiving watercourses, groundwater and designated sites, as a benchmark for assessing environmental capacity for growth.

The WFD is the principal legislative driver dictating the targets for surface and groundwater quality and under which actions to achieve compliance are implemented and monitored. Other EC Directives, such as the Habitats Directive, Nitrates Directive and the Urban Wastewater Treatment Directive also set objectives for specific designated waters, which contribute to the overall target of reaching good water body status and achieving WFD compliance by 2015.



5.2.1 Baseline Environment

Receiving Waters

The Environment Agency has been monitoring the health of all receiving waters for a number of years through the General Quality Assessment (GQA) scheme. The scheme provides a snapshot of receiving water quality based on chemistry, biology and nutrients.

A summary of the latest GQA data (2007) for key river reaches within the study area is presented in Appendix C. The Environment Agency's routine water quality monitoring programme changed at the beginning of 2007 to align with WFD requirements, with more risk-based sampling focused at fewer sites. Previous results from the GQA scheme are not directly comparable with the current regime being set for WFD. However, it is the WFD standards that drive future improvements to water quality and ecology of the receiving water and against which the existing and future capacity of the receiving water should be assessed.

The WFD standards for key watercourses in the Derby HMA have been provided by the Environment Agency and are also presented in Appendix C. These cannot be directly compared with those used under the GQA scheme, as the standards for parameters do not match the GQA thresholds. However for the purpose of this assessment we have assumed that the WFD standard of 0.12mg/l for phosphate approximately equates to GQA level 3 ('moderately low'), the standard of Biological Oxygen Demand (BOD) of 5mg/l equates to GQA grade B ('good') and the standards of ammonia of 0.3mg/l and DO of 75% are comparable to GQA grade A ('very good'). Based on this, Table 5.2 presents the current failures of WFD standards highlighted in red. The comparison illustrates that all river reaches are at risk of exceeding at least one of the WFD standards, with failures for phosphorus being the most likely for all rivers. The River Erewash and the smaller watercourses, such as the Bottle and Alfreton brooks, are currently failing WFD chemical targets. This may partly be attributable to the larger dilution afforded to polluting inputs in the larger watercourses.

The issue of nutrients is a well established water quality problem in the wider East Midlands region and a complex one to resolve as there is a variety of contributors, some of which are located in the upper catchments. For many rivers, a combination of measures that tackle both diffuse (both agricultural and urban runoff) and point sources will be required to meet the WFD standards.



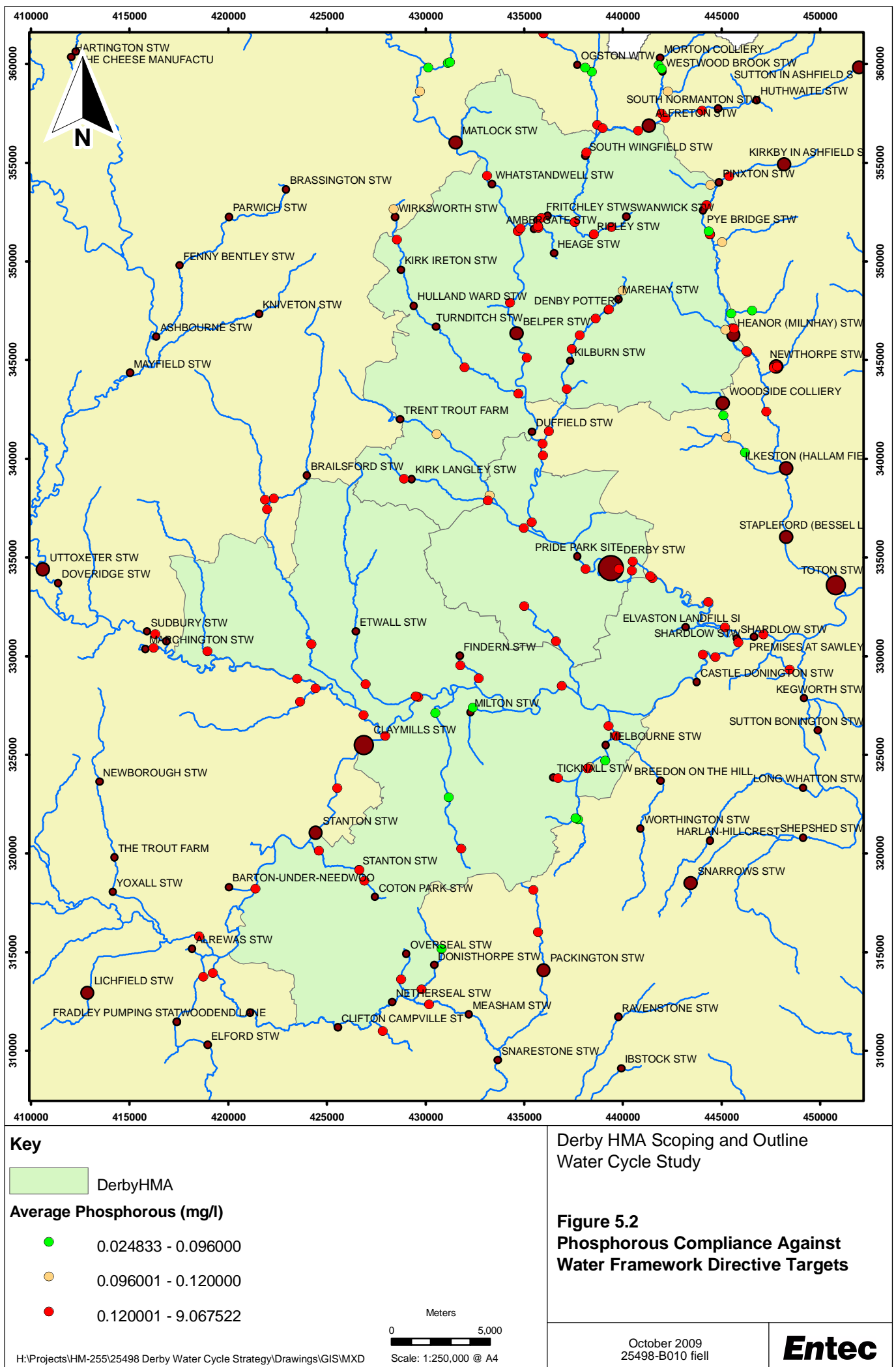
Table 5.2 Assumed compliance with WFD targets, based on GQA measurements

STWs	Receiving Water	Upstream		Downstream	
		Chem	P	Chem	P
Belper, Duffield, Derby	River Derwent	A	4	B	5
South Wingfield, Ambergate, Fritchley	River Amber	B	6	B	6
Netherseal, (Measham, Overseal)	River Mease	B	6	A	5
(Kirkby, Pinxton), Pye Bridge, Heanor, (Ilkeston-Hallam Fields)	River Erewash	C	5	C	5
(Claymills), Swandlincote	River Trent	B	6	A	6
(Wirksworth), Ildridgehay, Turnditch	River Ecclesborne	B	3	B	5
Alfreton	Alfreton Brook	C	6	C	6
Kilburn, Marehay, Little Eaton	Bottle Brook	C	3	B*	6

* due to GQA class B for DO (i.e. <70% 10-percentile) being lower than WFD target of 75% for DO (10 percentile)

Figure 5.2 presents the compliance of water quality in receiving watercourses at discharge points and WwTW (shown as STW – sewage treatment works) locations with regard to phosphorous, based on the average annual mean for data from 2000 – 2004. The figure shows that the majority of locations are already above the WFD standard for Good Status (i.e. > 0.12mg/l).





The WFD will be implemented through River Basin Management Plans (RBMP). The Humber draft RBMP states that 27% of all surface waters in the Derwent catchment are currently in good status and this is predicted to rise to 39% by 2015. In the Dove catchment 24% of all surface waters in are currently in good status and this is predicted to rise to 28% by 2015. By contrast, only 5% of surface water bodies are meeting good status in the Lower Trent and Erewash, and 0% of surface water bodies are meeting good status the Tame, Anker and Mease catchment. Good compliance status is also achieved for both major groundwaters (Sherwood Sandstone and Carboniferous Limestone).

According to the Humber draft RBMP, a number of studies are planned, or already underway, to better understand the effects of abstractions and discharges on sensitive waters in or near the study area. An investigation into the impact of abstraction on the River Mease is to be completed by 2010. One modification to abstraction licence is to be imposed in the Derbyshire Derwent catchment, with another two modifications planned in the Tame, Anker and Mease catchment, all relating to SSSIs, while a further modification relates to a Natura 2000 site in the Tame, Anker and Mease catchment.

A number of AMP4 schemes are nearing completion and further AMP5 studies are to be carried out by STW. The planned works in the AMP5 period (2010 to 2015) include maintenance and growth investment at Kilburn works. Severn Trent Water has been unable to comment on any other planned investments on works investments, with the exception of those works undergoing tightening of quality consents. Works affected by quality drivers include Belper, Fritchley, Cotton Park, Milton, Netherseal, Overseal and Stanton.

Designated Sites

The legislative drivers for the water quality are presented in Table 2.1, which includes European legislation to protect receiving waters and their dependant habitats that are considered particularly sensitive. The sites present in the study area are presented in Figure 5.3, page 42, with tables of their designations in Appendix B.

The River Mease is a designated Special Area of Conservation (SAC) and a Site of Specific Scientific Interest (SSSI) on account of its vegetation and freshwater fish communities. The Tame, Anker and Mease CAMS states that a Habitats Directive review is under way which will assess the effect of abstraction (and other regulated activities including WwTW discharges) and determine management options by 2010 for the River Mease. River water quality has improved over recent years as a result of WwTW improvements and a reduction in the number of CSOs, as well as tighter regulations on discharges.

The Habitats Regulations Assessment (HRA) of the East Midlands Regional Spatial Strategy found no adverse effects on the integrity of Ensor's Pool SAC. The River Mease SAC is a site for which potential effects were identified in the HRA due to increasing demand for water resources and for which water neutrality (or other action) was suggested to ensure adequate capacity for abstraction and treatment would be available. Indeed, the Environment Agency is keen for water neutrality to be explored whenever possible. The Water Cycle Study has confirmed that the South Staffordshire Water public water supply abstractions on the River Mease have been subject to sustainability reductions (reduced abstraction to resolve low flow issues).



Section 4.1.3 of the water resources section of this report clarifies that increased demand for water from new developments would increase the pressure on all sources in the zone, not specifically those sources that may be in the local vicinity. Water neutrality is therefore a concept that should be applied on a water resource zone scale. The water resources section has confirmed that all new housing developments should aim to meet level 3/4 of the Code for Sustainable Homes (water consumption) but that there is limited potential to further reduce per capita consumption below that already forecast by the water companies (average per capita consumption forecast to be 132 l/h/d by 2025/26). Further reductions in demand from existing customers are possible and should be encouraged where effective, cost efficient activities are identified. However, due to the limited potential to reduce per capita consumption even further, water neutrality is unlikely to be a realistic, cost effective objective. Section 4.3.2 highlights the issue that water neutrality/reduced demand could have on river flows where these are supported by discharges from wastewater treatment works. In particular, it points out that the Mease catchment is a net importer of public water supply, and so further reductions in demand could result in reduced water discharge, which could be detrimental to the River Mease.

Water quality related mitigation was also found to be required for the River Mease. Recommendations included the use of sustainable drainage techniques wherever practical to help mitigate diffuse pollution and support groundwater recharge. If improvements are necessary they should be delivered before the delivery of housing so that the quality of effluent discharged is not compromised; this can be addressed in a Detailed WCS.

The Environment Agency is currently working on the following projects along the River Mease:-

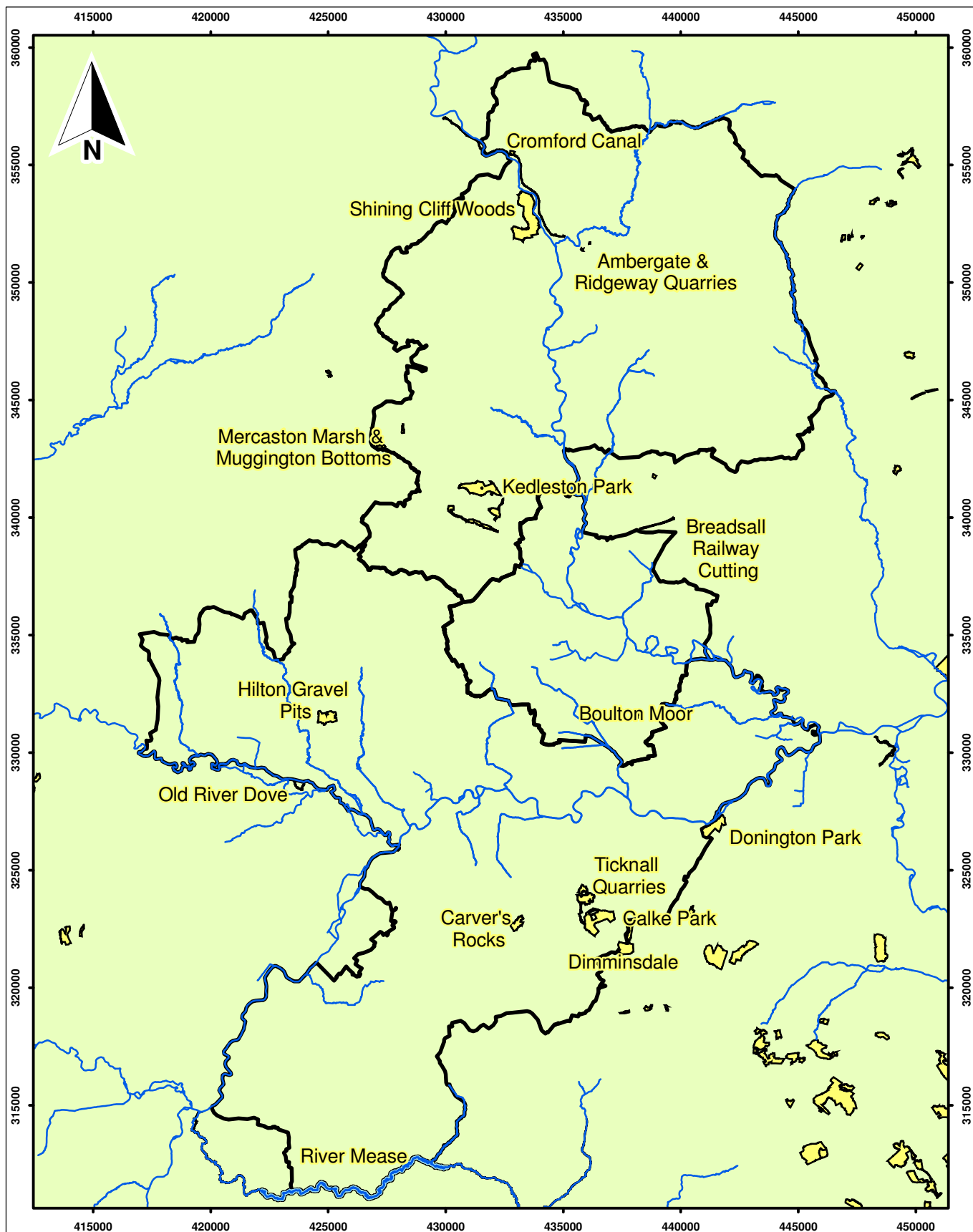
- A programme of pollution prevention visits to farms within the catchment;
- As part of the Upper Trent Catchment Sensitive Farming Initiative (also included Tame and Anker, Blyth) – 2006-2008 - a number of events were carried out including one to one farm visits, on-farm demonstrations and resource management workshops;
- Targeting data collection and sampling within the catchment and tie in with WFD pollution investigations; and
- Developing a water quality management plan (WQMP) for the River Mease SAC catchment. This will also highlight the fact that in order to tackle diffuse pollution it will not be solely the remit of the EA. Other competent authorities (e.g. National Farming Union, Farming and Wildlife Advisory Group, Natural England, Local Authorities, Local Interest Groups etc) will also need to play their part in order to reduce diffuse pollution as this will fall under WFD and not Habitats Directive Review of Consents.

The outcome of South Derbyshire's Appropriate Assessment Screening Report (South Derbyshire District Council, October 2008, www.south-derbys.gov.uk) suggests that the proposals in the District's Core Strategy are likely to affect the Mease due to drainage and water quality inputs, including agricultural runoff and point and diffuse source pollution. It is recommended that new developments within the River Mease catchment are subject to a Level 2 Appropriate Assessment. The assessment must determine whether the development plan would adversely affect the integrity of the site in terms of its nature conservation objectives.



The Derby HMA is in a nitrate vulnerable zone (NVZ) in its entirety. The Nitrates Directive requires all known areas of land which drain into polluted waters (nitrate concentrations greater than 50 mg/l) to be designated as NVZs. The rivers Trent, Derwent, Amber and Mease, the Westwood and Alfreton brooks, the River Erewash and Erewash Canal and Staunton Harold Reservoir are all designated Sensitive Areas [Eutrophic] under the Urban Wastewater Treatment Directive. If the population equivalent at a WwTW discharging either directly or upstream of a designated Sensitive Area [Eutrophic] exceeds the 10,000 threshold due to growth, then phosphorus-stripping would be required at the WwTW to control nutrient inputs to the water environment. This is currently provided at the Derby, Belper, Heanor, Kilburn, Alfreton WwTWs within the study area. It is also provided at Kirkby in Ashfield, Pinxton, Westwood Brook and Matlock WwTWs in upstream areas neighbouring Amber Valley Borough.





Key

- DerbyHMA
- Main River
- SAC
- SSSI

Meters
0 5,000

H:\Projects\HM-255\25498 Derby Water Cycle Strategy\Drawings\GIS\MXD Scale: 1:300000 @ A4

Derby HMA Scoping and Outline
Water Cycle Study

Figure 5.3
Designated Sites

October 2009
25498-b005 fiell

Entec

5.3 Constraints and Opportunities

5.3.1 Environmental Constraints

The water quality records of the rivers and watercourses in the study area indicate that many rivers are failing to meet WFD targets, with particular reference to nutrient levels. Due to the sparse nature of summary data examined and the sampling frequency of the monitoring on which this summary data is derived, it is not clear whether this is caused primarily by WwTW discharges. Nutrients are elevated in upper and middle reaches of rivers, as well as the lower reaches, suggesting other sources are present; the entire Derby HMA is in a NVZ, which means that farmers must comply with a number of rules to promote best practice in the use and storage of fertiliser and manure, and build on the guidelines set out in the Code for Good Agricultural Practice for the Protection of Water. In some cases (rivers Trent and Mease) chemical water quality improves through the Derby HMA.

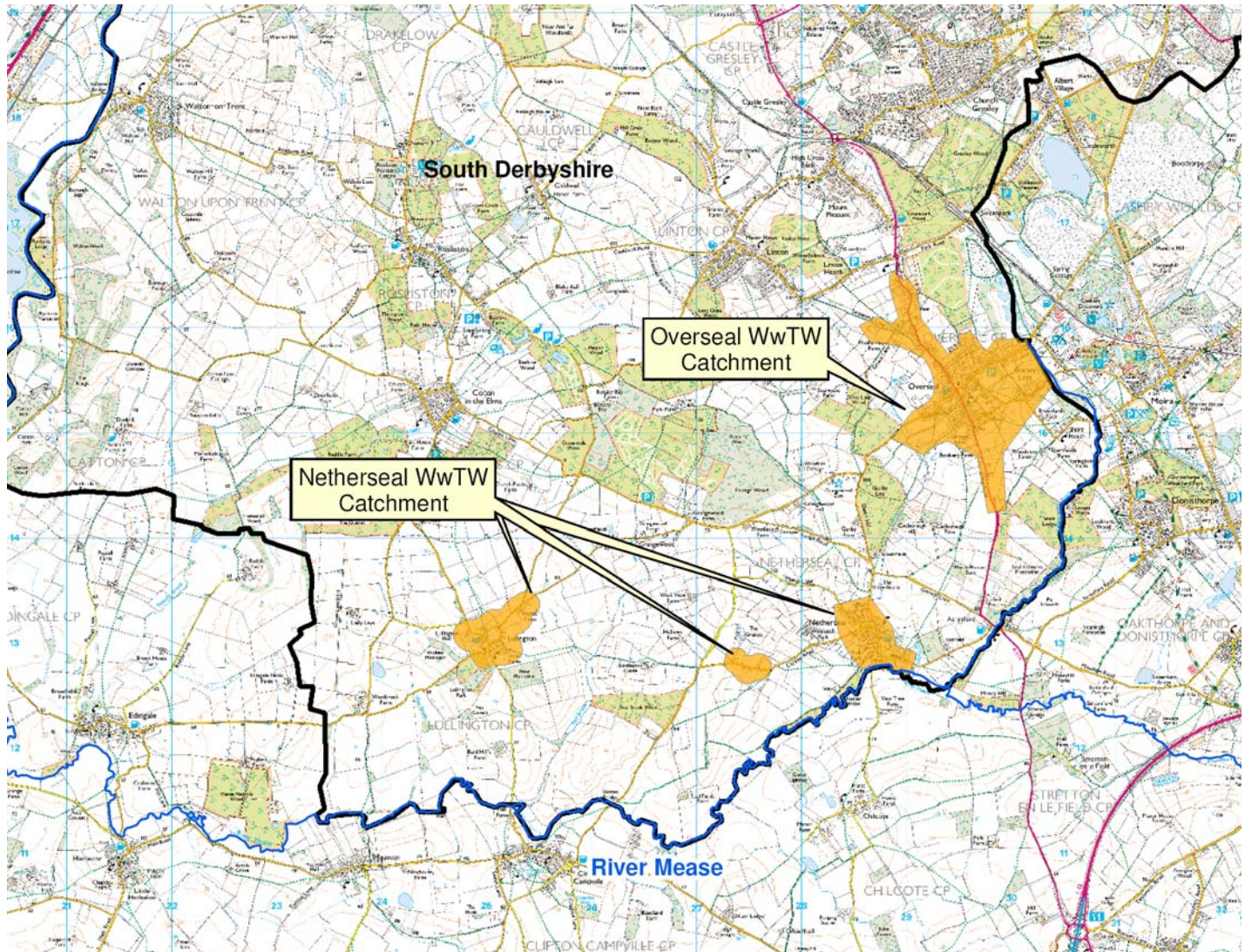
The excessively high levels of phosphates and nitrates, coupled with chemistry WFD failures in some watercourses (Erewash, Alferton and Bottle Brooks), illustrate the limited environmental capacity of most receiving waters to assimilate any additional pollution load. As treatment capacity of the WwTWs has not been assessed in this study where information has not been made available, the impact of growth on discharge quality cannot be determined. However, the Environment Agency will continue to monitor and set the discharge limits from WwTWs with regard to quality, to ensure that water quality does not deteriorate further. The potential impact of stricter discharge consents would be on the amount of investment required by STW to update treatment works, if required. The impacts of growth on water quality are mainly discussed below with regard to the River Mease. Investigating the impacts and potential mitigation measures would fall under the remit of a Detailed Water Cycle Study.

In terms of the significant improvements required in nutrient status in most rivers, a twin approach of improving wastewater discharges and controlling diffuse sources is likely to be pursued by the Environment Agency. Phosphorus removal at WwTWs is one measure used to reduce high nutrient levels; AMP5 schemes are planned for Belper, Fritchley, Coton Park, Milton, Netherseal, Overseal and Stanton WwTWs.

The River Mease SAC presents the biggest constraint in the study area, which is considered to be at saturation point for receiving effluent flows. The EA's position statement on River Mease is to refuse planning permission 'unless it can be demonstrated by the applicant when submitting a planning application that the additional effluent from the proposed development will not cause deterioration of the quality of the receiving water course and/or a breach of the sewage works discharge consent.' At the time of publication of this study, the EA's position is being tested at appeal but the outcome will not be available in time for this study. Their position may potentially impact growth or new developments in the southern area of South Derbyshire District: Netherseal, Overseal and Lullington – Netherseal WwTW discharges directly into the River Mease, whilst the Overseal WwTW discharges into Overseal Brook, a tributary of the River Mease. These catchments are shown in amber in Figure 5.4 to represent potential constraints to development in those catchments. The full position statement is presented in Appendix C, with a plan showing the extent of the Mease catchment provided by the Environment Agency.



Figure 5.4 Wastewater Treatment Catchments in the River Mease Catchment



© Crown copyright. All rights reserved 100023251 2009

One option potentially being considered is to divert additional effluent flow from new developments out of the River Mease catchment. This issue in relation to treatment works capacities is discussed below in Section 5.3.2. It is important to note that the existing effluent flows into the River Mease help to support flow volumes, therefore the transfer of existing effluent out of the catchment would not be seen as favourable in case of reducing flow volumes in the river.

A formal EA comment on sewerage in Derby was requested following previous EA recommendations (received as part of a previous project for emda) to discourage development to the south of the River Derwent until adequate sewerage infrastructure is in place. In their response (email 17th August, 2009) the EA commented that they



perceived there would be *unsatisfactory deterioration or significant investment predicted if the growth points are badly planned* in the following stretches of river:

- River Derwent (from River Wye to River Derwent);
- River Derwent (Bottle Brook to River Trent);
- Milton Brook; and
- Bentley Brook.

The EA's no deterioration policy is expected to apply to all future discharges in the area. The policy is not only about maintaining existing water quality standards but is also about striving for improvements. As a minimum requirement where proposed growth will cause a breach in the current consent conditions the EA will require an overall standstill in the load to prevent deterioration in the receiving water quality. The implications are that where flow, through growth, is allowed to exceed the consented flow (through renegotiation of revised flow consents), a pro-rata improvement in the effluent quality will be expected. Improvements in specific water quality parameters, such as nutrients, are still expected to be required for many wastewater discharges, regardless of any proposed changes to the flow element of discharge consents.

This section highlights that there are environmental constraints present in the Derby HMA due to elevated nutrient concentrations and failing WFD targets in the study area's watercourses. Effective measures are required to improve the quality of the watercourses, which are likely to include improvements to WWTWs and the implementation of more catchment sensitive farming techniques to deliver reductions in diffuse pollution. These improvements would be needed prior to growth being delivered. Continued communication between the Derby HMA local authorities and Severn Trent Water is required to ensure that appropriate improvements can be made in wastewater infrastructure to improve the quality of discharged effluent/CSO discharges within the required timescales that is often in advance of new housing connecting to the sewer network) and that these enhancements can be planned, funded and implemented within the AMP programmes operated by STW.

Whilst not related to the targeted growth in the study area, the management of runoff from agricultural land can be improved by promoting best practice in agricultural activities and will contribute to improving water quality. Pollution prevention campaigns across England, such as the Catchment Sensitive Farming (CSF) programme promote good farming measures to reduce pollution. Within the study area there are no CSF priority catchments, however the Peak District CSF catchment is located upstream on the Upper Derwent, and will contribute to improving water quality in the Derwent catchment and thus in time lead to an increase in the dilutive capacity downstream. However, the effectiveness of catchment based management is uncertain, difficult to measure and it is also likely to take a long time, i.e. decades, to realise a measurable improvement.

Within the Humber draft RBMP, there are a number of actions that are already underway to help improve run-off and water quality from agricultural land, such as proactive targeted farmer education on nitrate control. A list of the relevant actions to improve water quality from agricultural land is presented in Appendix D.



5.3.2 Infrastructure Constraints

A risk assessment of WwTWs in the East Midlands was undertaken in 2006 by Arup on behalf of the EA. This broad assessment examined areas of proposed growth and WwTW characteristics (including discharge consent conditions) to highlight works that could potentially come under pressure when growth becomes connected. The study found that the Milton and Heanor Milnhay WwTWs were found to be at high risk on account of low available capacity and potential for failing water quality consents respectively. Most other works within the Derby HMA area were at medium risk.

The emda study (Entec, 2008) highlighted a number of works that may face capacity issues as they are already operating within 75% of their design capacity. From those works serving Derby HMA, Belper WwTW was mentioned as operating at greater than 75% capacity, while Milton WwTWs was believed to have no available capacity. It should be noted that this is not a direct indicator of WwTW performance, as a works operating close to capacity may still be producing high quality effluent, compliant to discharge consents. It is more an indicator of potential inability to receive additional wastewater flows from new growth areas.

A high level comparison of the consented and measured DWF for the main WwTWs in the study area (Table 5.1) indicates that the following works are already over capacity in terms of hydraulic/flow capacity: Coton Park; Findern; Ticknall; Fritchley; Milton and Duffield.

The capacity of the sewer system serving Derby City is very limited and thought to be unlikely to be able to support the levels of proposed growth without modifications or enhancements. A number of options are being examined by STW to enhance sewerage capacity and support the development proposals around Derby City. Normally all wastewater from the urban Derby area would arrive at Derby WwTW. Diverting wastewater from development in the south/southwest of the City to Findern WwTW and substantially expanding this small works is an option available to STW. Diverting wastewater further away to the large works at Burton upon Trent (Claymills WwTW) is another option; this would involve pumping and gravity sewers. This constraint is an important issue that will concern the strategic housing sites.

The benefit of diverting flows away from Derby City is that capacity will be freed up at Derby WwTW to receive wastewater from any development that occurs in the north and west of the City. Further options are likely to be available to STW. This may include consideration of the Etwall WwTW in South Derbyshire and Duffield WwTW in Amber Valley depending on available capacity and the need for pumping. It is recommended that options are assessed in a Phase 2 WCS, which should focus on the trade off between the environmental benefits in terms of improved river water quality and the wider sustainability implications associated with increased energy use and carbon costs.

In order to prevent further deterioration in the River Mease from increased effluent discharges, one option that may be considered would be to divert new effluent flow out of the Mease catchment to treatment works that discharge into other river catchments in South Derbyshire. An appeal in North West Leicestershire is currently underway at the time of publication over additional development in the Mease catchment. Should STW consider transferring



additional effluent out of the Mease catchment (away from Packington, Netherseal and Overseal WwTW), this may potentially affect the capacity of treatment works in South Derbyshire. A Phase 2 WCS should consider the impacts of growth in adjoining districts when assessing capacity of WwTWs in the study area.

For example, Ashby-de-la-Zouch is one of the settlements where housing growth is being considered as part of NW Leicestershire's Core Strategy. The WwTW that serves this settlement is Packington Nook that discharges into a tributary of the Mease, however, this works is operating at flow capacity. There may be a need to look to alternative WwTW to deliver development around Ashby.

A summary of the constraints attached to the WwTWs, displayed in traffic light outputs, is provided in Appendix B.

5.4 Capacity for New Development

Of all the WwTWs within the Derby area, only the WwTWs whose catchments contain predicted housing growth, and with a measured DWF greater than 500m³/day will be looked at in any further detail in this chapter.

The Planned Growth in Housing Stock for Derby HMA, presented in Chapter 2, is taken from the forecast housing provided by each of the Councils and through discussions with each Council to project the RSS targets across the growth period. The housing data up to 2015 is detailed enough to be mapped to individual WwTW catchments. The total number of houses per catchment has therefore been used to determine the likely effluent flow from the works by 2015. A wastewater consumption rate of 135 l/day per person, an occupancy rate of 2.1 and a fixed infiltration rate of 25% have been assumed based on the average figures expected for the growth period. Since the current capacity of WwTWs is known, calculations were carried out to predict the additional wastewater DWFs (incoming) at each WwTW between 2009 and 2015. It has been assumed that 100% of the water supply is returned to the sewer (Worst-case scenario), and no allowance is made for changes in trade effluent and non-household contributions. The number of houses and resulting DWF are presented in Table 5.3 below, and comparisons between the consented, measured and predicted DWF are displayed graphically in Figure 5.5.

Table 5.3 Housing Growth and Future DWF to 2015

Council	Treatment Works	DWF (m3/d)		2009 - 2015	
		Consented DWF	NEF(80%) ALL (measured DWF)	Additional houses	Future DWF
Derby City	DERBY	91500	81940	4999	83711
S. Derbyshire	CLAYMILLS	47000	32022	424	32172



Table 5.3 (continued) Housing Growth and Future DWF to 2015

Council	Treatment Works	DWF (m3/d)		2009 - 2015	
		Consented DWF	NEF(80%) ALL (measured DWF, 2008)	Additional houses	Future DWF
S. Derbyshire	MILTON	2100	3500	1009	3458
S. Derbyshire	STANTON	6936	6707	1376	7195
S. Derbyshire	SHARDLOW	1900	1639	126	1684
S. Derbyshire	COTON PARK	1054	1168	97	1202
S. Derbyshire	FINDERN	584	929	24	938
S. Derbyshire	MELBOURNE	950	876	672	1114
S. Derbyshire	ETWALL	900	413	58	434
S. Derbyshire	OVERSEAL	455	415	52	433
Amber Valley	HEANOR-MILNE HAY	8582	7637	404	7780
Amber Valley	ALFRETON	8283	5750	122	5793
Amber Valley	BELPER	4453	3644	275	3741
Amber Valley	KILBURN	3248	3161	486	3333
Amber Valley	PINXTON	3907	2263	269	2358
Amber Valley	FRITCHLEY	800	1668	25	1677
Amber Valley	RIPLEY	1870	1438	273	1535
Amber Valley	DUFFIELD	726	1397	37	1410
Amber Valley	HEAGE	1470	808	12	812

below 400m³/day or no additional housing are ignored



Figure 5.5 Wastewater Treatment Works DWF with additional housing to 2015

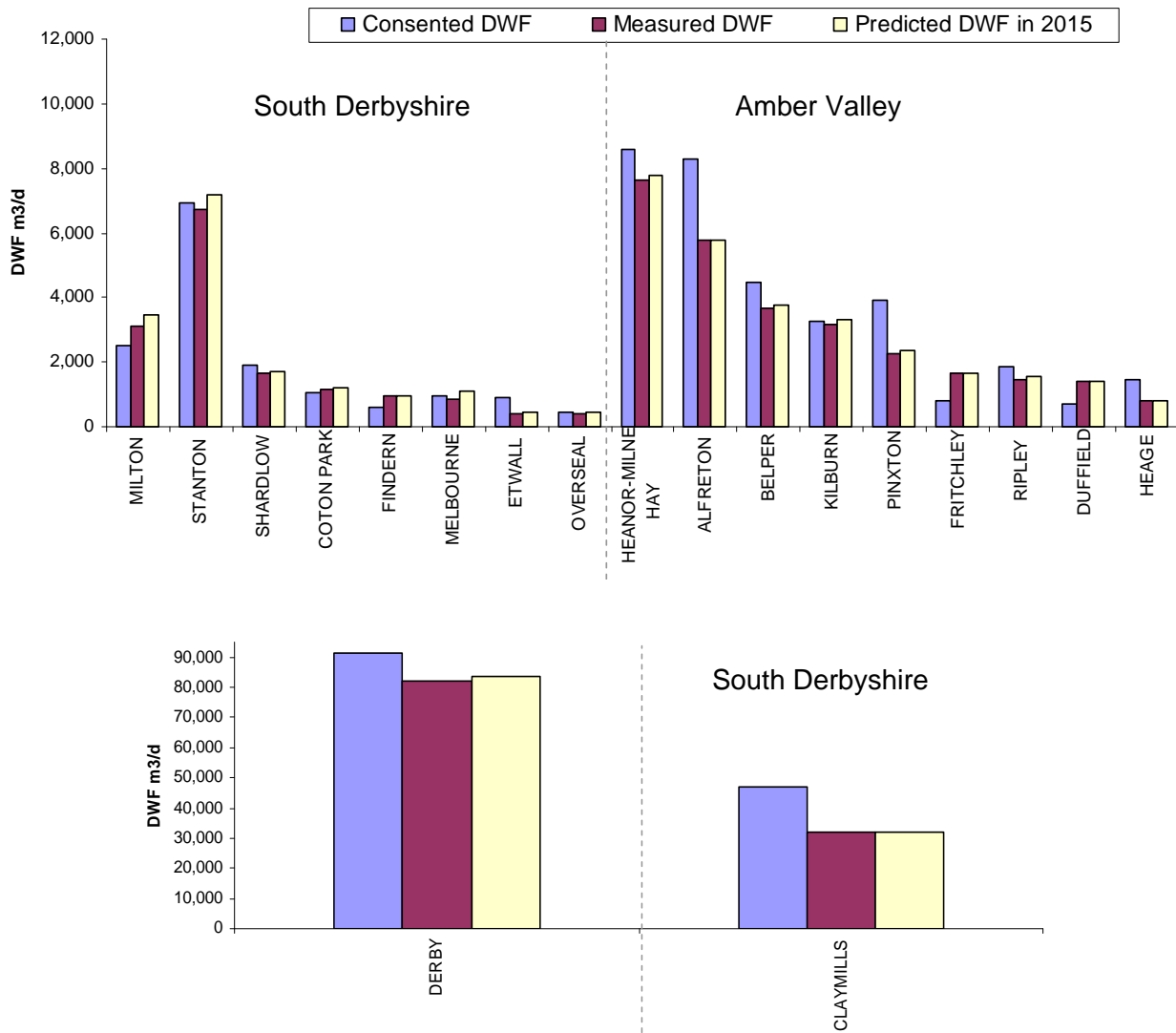


Figure 5.5 shows the potential growth in DWF of 19 WwTWs due to potential planned housing growth in the WwTW catchments to 2015. Five of these already exceed the consented DWF prior to additional housing growth (Fritchley, Duffield, Coton Park, Milton and Findern WwTWs), and an additional three WwTWs exceed their consents with planned growth to 2015 (Stanton, Kilburn and Melbourne WwTWs). There are other WwTWs that with the housing growth plans to 2015 will be close to exceeding their consents. The assessment for Clay Mills WwTW does not take account of the growth in Burton upon Trent, which will also affect this works.

These results indicate which works should be the immediate focus of Severn Trent Water for future investment and / or consent variation requests with the EA. It should be noted that this assessment is very high level, and does not include headroom, which the sewerage companies use to allow for uncertainties in their planning. The assessment has not included future plans for upgrading of works, as this information has not been made available. Therefore,



even though the high level assessment indicates hydraulic capacity at the works may be reached by 2015, Severn Trent Water may already have plans to mitigate the impacts of growth. Information available from the EA's National Environment Programme does indicate that an increase in the discharge consent for DWF is likely to occur at Findern and Ambergate WwTWs.

Although housing growth figures between 2015 and 2025 are known, there is no clarification over their locations and hence associated WwTW catchments. A best estimate was made based on discussions with the individual Councils over the likely locations of development during this period, and using the RSS growth targets.

Table 5.4 Estimated Housing Numbers to 2026 at WwTWs most Affected by Growth

South Derbyshire RSS Growth Target 2010 - 2026 = 10387			
Location of growth	WwTW affected	growth to 2015	extra growth 2015 - 2026
Swadlincote	Stanton	1376	800
Swadlincote	Milton	1009	820
Derby PUA	Shardlow	125	175
Derby PUA	Derby	155	6400
		Sub Total 2009 - 2026	10860
		Remainder of district	400
		Total 2009 - 2026	11260
Amber Valley RSS Growth Target 2010 - 2026 = 8300			
Location of growth	WwTW affected	growth to 2015	extra growth 2015 - 2026
Belper	Belper	275	800
Kilburn	Kilburn	486	1000
Heanor	Heanor-Milne Hay	400	1000
Derby PUA	Derby	179	3190
		Sub Total 2009 - 2026	7330
		Remainder of district	1106



Table 5.4 (continued) Estimated Housing Numbers to 2026 at WwTWs most Affected by Growth

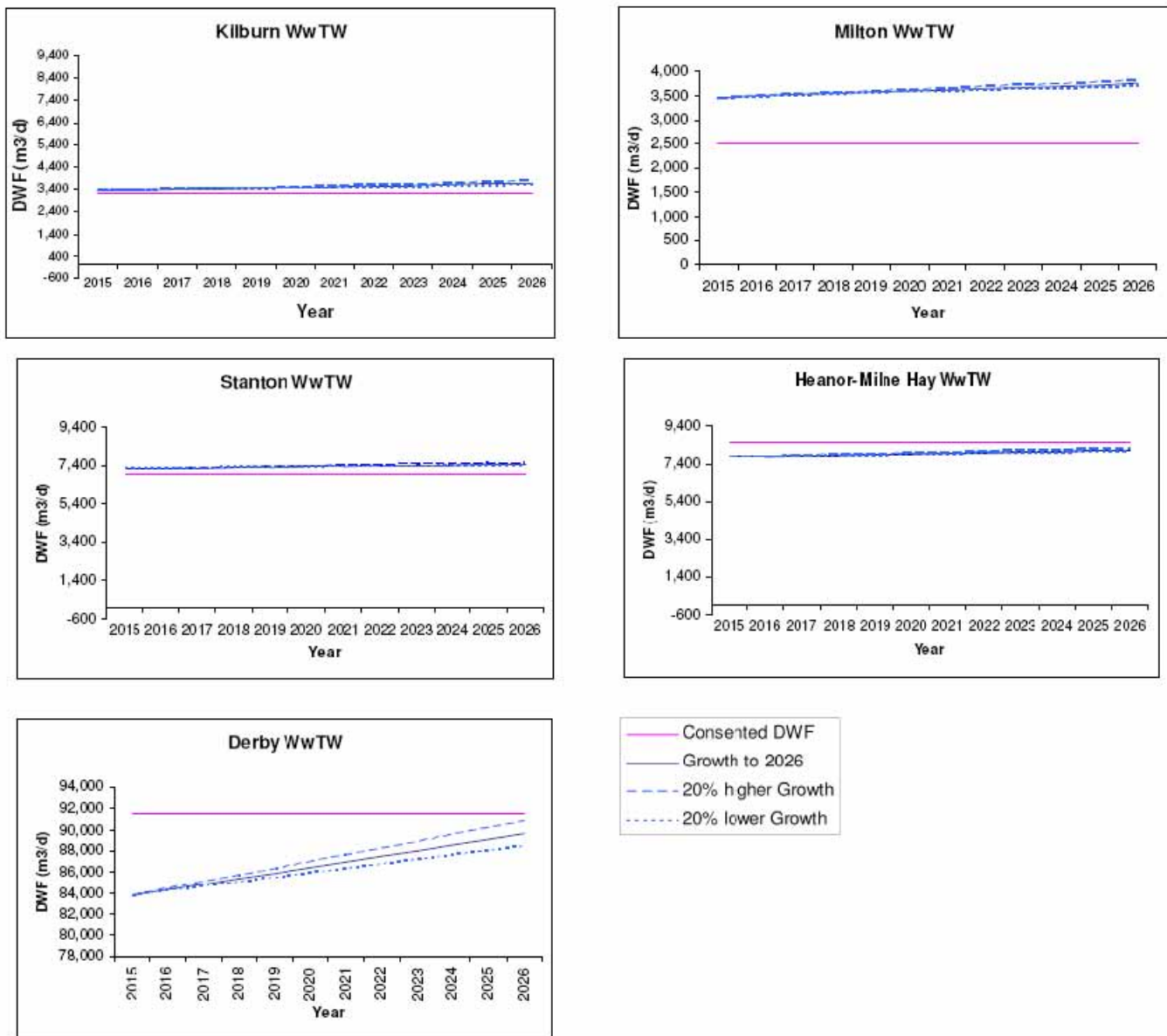
Derby City RSS Growth Target 2010 - 2026 = 11000			
Location of growth	WwTW affected	growth to 2015	extra growth 2015 - 2026
Derby City		Total 2009 - 2026	8436
		4665	7200
		Total 2009 - 2026	11865
		Additional from SDDC and AVBC	9590
		Total	21455

Figure 5.6 shows a timeseries of how capacity is likely to be eroded at the largest WwTWs that may be affected by future growth. A sensitivity of +/- 20% on the numbers in Table 5.3 has been applied.

Continued work with Severn Trent Water and the local authorities is needed, to ensure that the water company plans for the correct growth numbers, and to progress these assessments to a more detailed level.



Figure 5.6 Potential Impact of Growth on Effluent Flow at Major WwTWs 2015 to 2026



5.4.1 Climate Change Allowance

There are a number of uncertainties relating to predictions of the effect of climate change on the capacity of wastewater infrastructure and the environment to accommodate new growth. Climate change is expected to increase the frequency of flooding and also the magnitude and duration of flooding events. Waterlogging of areas is also a concern as local drainage systems and overflows may not perform satisfactorily during wet weather when the watercourse channels are already full. Incidents of surcharging of gullies and drains and sewer flooding are



likely to be more frequent as the amount of impermeable surfaces and runoff increase. However, the above can be off-set by employing SuDS and water efficiency measures.

Climate change effects may exacerbate summer low flows and flood flows in rivers, which means that the dilution capacity to pollution entering rivers will vary from very low levels in summer dry conditions to significant dilution in storm conditions. At the same time the operation of CSOs may be affected, as an increase in sediment deposition in pipes can be expected in dry weather (particularly under water efficiency measures) and more extreme ‘first-flush’ effects could be seen in wet weather, particularly during summer storms with larger sediment loads discharged into rivers faster, in advance of peak river flows.

Potential climate change effects on WwTW operation include the requirement for greater storm tank capacity, as more wastewater is expected to arrive under storm conditions, and the ability of the treatment techniques and infrastructure to cope with wider variability in both the quantity and quality of incoming wastewater, as less wastewater of higher strength would be generated in drought conditions and more wastewater of lower strength would be expected in wet weather.

5.5 Summary and Recommended Policies / Development Strategy

The public sewerage is provided by Severn Trent Water in the study area, who operates 51 wastewater treatment works and the associated foul sewers and pumping stations. Some private sewerage systems will also operate in the study area, although these have not been considered in this study, as they are unlikely to be affected by the proposed growth.

A high level assessment of the flow capacity of the study area’s WwTWs has highlighted that there is likely to be capacity issues within the growth period. The treatment works at Fritchley, Duffield, Coton Park, Ticknall, Milton and Findern WwTWs have been found to be already at capacity. Severn Trent Water has advised that the Dry Weather Flow consent at Findern works will be increased in the next AMP period (2010 – 2015).

The treatment works at Stanton, Kilburn and Melbourne will potentially exceed their consented flow by 2015 based on the predicted growth used in this study based on the RSS targets. Maintenance and growth improvement works are included in the company’s investment plans at Kilburn works. It is recommended that STW concentrate their assessments of growth and investment at Stanton and Melbourne works also.

Wastewater, Sewerage and Water Quality Recommendation 1

It is recommended that the works at Fritchley, Duffield, Coton Park, Findern, Stanton, Kilburn, Milton and Melbourne should be assessed by STW for their capacity to receive growth in the immediate term, so that potential capacity issues to 2015 are dealt with as early as possible.



The capacity of the sewerage (foul sewer network) has been highlighted as a constraint to development, particularly within Derby City. The EA and STW are aware of this issue, and STW has included plans in their long term strategy to achieve a long term vision to:

- Deal with existing hydraulic inadequacies in our sewerage system;
- Progressively remove surface water drainage connections to foul combined systems. to the extent that it is practicable; and
- As necessary, reinforce the capacity of our sewerage system to prevent future flooding problems.

Wastewater, Sewerage and Water Quality Recommendation 2

It is recommended that STW continues communication with the Derby HMA to determine where and when growth will occur in the Derby WwTW catchment, to identify the preferred option to alleviate pressures on the sewerage system.

The Scoping and Outline Study has identified a number of issues regarding limited capacity at a number of wastewater treatment works and in the sewerage network. A Detailed Study would be able to investigate these issues further to provide more definitive answers on the number of houses that could be accommodated by the existing works, and work with Severn Trent Water as they confirm their investment plans.

Wastewater, Sewerage and Water Quality Recommendation 3

It is recommended that a Detailed WCS is undertaken, to provide further clarification on the location and annual rate of growth, to determine exactly the pressures on the hydraulic and treatment capacity of WwTWs, the capacity of sewerage, and the likely impacts of the WFD and discharge criteria on required investment.

Water quality within the study area's rivers has been found to be a potential issue, as a result of elevated nutrient levels. These are likely to be a result of a combination of sources, including agricultural / urban run-off as well as sewage discharge.

A number of designated sites are present in the study area, including the River Mease Special Area of Conservation in South Derbyshire. The River Mease also has an issue with elevated nutrients and is currently failing to meet its Water Framework Directive objectives. At the time of writing the Environment Agency's current position on the River Mease is to object to any new development that will discharge surface run-off or effluent into the Mease, relevant to the Netherseal and Overseal areas. This is being tested at public inquiry and further work is required between the EA, the Councils and STW to discuss potential options.



Increases in the controls on quality of discharge consents within the study area maybe required as a result of the WFD, with particular regard to phosphorous levels. This may require further investment from STW and also potentially from developer contributions. New developments will also need to assess the impact and quality of surface run-off within the River Mease catchment.

Wastewater, Sewerage and Water Quality Recommendation 4

The WCS recommends that South Derbyshire's Core Strategy includes policies that restrict market housing development in the Netherseal and Overseal catchments to reduce the pressures on the River Mease.

Improvements to water quality can also be achieved through measures aimed at reducing flood risk, such as Sustainable Drainage Measures. These are discussed further in Chapter 6, but include actions from the Trent CFMP such as identifying BAP habitats and increasing green corridors in urban areas.

There are multiple benefits from SuDS, which provide more storage of rainwater, reducing pressures on the drainage system, and provide amenity and environmental benefits. These are considered particularly important in the study area, to alleviate the existing issues with sewerage capacity and to contribute to the improvement of river water quality.

Wastewater, Sewerage and Water Quality Recommendation 5

The WCS recommends that each Council's Core Strategy includes policies that promote sustainable drainage techniques (SuDS) that mimic natural drainage, rather than using traditional piped systems in all new developments

Agricultural sources are also partly responsible for the high nutrient levels in the areas watercourses. Actions have already been identified in the Humber River Basin Management Plan to help improve run-off and water quality from agricultural land. It is recommended that the Core Strategy supports these actions.

A summary of the findings of infrastructure requirements, against the projected growth, is presented in Chapter 7.





6. Flood Risk and Drainage

6.1 Flood Risk Management

Flood risk to people and property can arise from various different sources, including fluvial (from rivers), tidal, surface water run-off (or pluvial), sewers & drains, culverted watercourses, groundwater, as well as through breaching/overtopping of flood defences and from artificial sources such as canals and reservoirs. The risk of flooding can never be totally removed, however through good planning, management and use of sustainable flood mitigation and drainage approaches, the risk and consequences of flooding in many areas can be reduced.

All sources of flood risk are considered to be a material planning consideration. Planning Policy Statement 25: Development and Flood Risk (PPS25) is the overarching planning guidance for taking account of flood risk in development. It promotes 'positive planning at all levels to deliver appropriate sustainable development in the right places, taking full account of flood risk'. The key message is to avoid inappropriate development and to locate development away from flood risk through the Sequential Test. The policies within PPS25 should inform both Regional Spatial Strategies and local authorities' local development documents, so that flood risk is taken into account at all stages throughout the planning process.

The East Midlands Plan RSS includes policies that outline a regional approach to managing flood risk and regional priorities for strategic river corridors, whilst each of the local planning authorities within the Derby HMA have recently completed Level 1 Strategic Flood Risk Assessments (SFRAs). The web links for the SFRAs are listed below:

Table 6.1 References for the Councils' Strategic Flood Risk Assessments

South Derbyshire SFRA	http://www.south-derbys.gov.uk/planning_and_building_control/planning_policy/local_development_framework/evidence_base/flood_risk_assessment/default.asp
Amber Valley SFRA	http://www.ambervalley.gov.uk/services/environment/landandpremises/planningtownandcountry/structureplans/localdevelopmentplans/Flood+Risk+Assessment.htm
Derby City SFRA	http://www.derby.gov.uk/Environment/Planning/LandUsePlanning/Evidencebase.htm

A Sustainable Development Framework has also been produced for the East Midlands to provide a strategic vision with regards to quality of life and sustainable communities. It outlines the regional approach to flood risk management. The relevant regional and local policies for the Derby HMA are summarised in Chapter 2.

Catchment Flood Management Plans (CFMP) are planning documents the EA are developing with other key decision makers within a river catchment for sustainable flood risk management on a catchment basis rather than



documents that just looking at specific issues. The Derby HMA lies within the River Trent CFMP, which has six different policy options to inform investment decisions and provide a steer to the planning system on the most effective course of action for dealing with flood risk issues for the next five to ten years. These are discussed in more detail in Section 6.4.1.

In response to widespread and severe flooding in the UK during the summer of 2007, the Government commissioned an independent review on the lessons to be learned. The Pitt Review was comprehensive and considered all stages of flooding - preparedness, response and recovery - as well as the coordination, responsibilities, and legislation necessary to ensure the United Kingdom can advance in the area of flood risk management. A total of 92 recommendations were made. Amongst other recommendations the Review emphasised the need to consider surface water flooding in more detail, and recommended that local authorities should take the lead in managing local flood risk. The basis for this should be through a Surface Water Management Plan, for which Derby City has recently been selected by DEFRA to receive funding.

A draft Floods and Water Bill, currently in preparation following consultation, sets out the Governments proposals to improve flood risk management and ensure water supplies are more secure. This is also an important part of the Government's response to the Pitt Review, and gives local authorities a local leadership role, including taking the lead in managing risk from a number of sources including surface water and groundwater.

An important theme in government planning policy is the need to achieve sustainable development which includes dealing with Climate Change. PPS1 'Delivering Sustainable Development' (2005) and the December 2006 supplements to it on: 'Climate Change', 'Zero Carbon Development' and the 'Code for Sustainable Homes' have now been incorporated in a Planning and Climate Change Bill. Climate change will have a profound effect on rainfall and hence flood risk, and PPS25 acknowledges that the future risks of flooding are likely to be more frequent and of greater magnitude than they have been in the past.

6.2 Sources of Flooding

This section summarises all sources of flooding present in the study area. Much of this work is a summary of the work already undertaken through SFRAs undertaken by the individual councils. WCSs and SFRAs include a significant overlap in the assessment of flood risk and sustainable flood risk management. To avoid duplication this report only summarises the main flooding issues and directs readers to the individual SFRAs for more detailed information on flood risk in each of the three Council areas.

6.2.1 Fluvial Flooding

An overview of the hydrology in the study area is presented in Figure 3.3. The draft Trent Catchment Flood Management Plan (CFMP), Amber Valley Borough Council SFRA, Derby City SFRA and South Derbyshire District Council (SDDC) SFRA report numerous historical fluvial flood events in the study area and indicate that flooding from rivers is the most likely source of flooding and is also likely to cause the most widespread damage.



The main sources of fluvial flooding in the study area are the River Trent and its tributaries: the River Dove and River Mease, in South Derbyshire; the River Derwent and the Trent in Derby City; and the River Derwent (and its tributaries the Rivers Amber and Ecclesbourne) and the River Erewash in Amber Valley Borough. Fluvial flooding events are predicted to become more frequent and more widespread as a result of increased storminess due to climate change. The fluvial sources in the Derby HMA are summarised below.

River Trent

The River Trent catchment is a vast river basin by UK standards, and although much of the catchment is rural, it does contain large urban areas, which have mostly grown up around or along river corridors and are at some risk from river flooding. Within the Derby HMA area the River Trent poses most risk to South Derbyshire, although much of the area at risk of flooding is rural. The main settlements include Willington, Repton, Barrow-on-Trent and Swarkestone. The tributaries of the River Mease and River Dove (see below) also form some risk to the District.

The Trent CFMP also indicates that culverts and the blockage of trash screens in culverts are significant factors affecting localised flooding in the catchment.

Dove Catchment

The River Dove is located along the southern border of South Derbyshire District. It is relatively fast flowing compared to the slower flowing River Trent and hence in the lower reaches and particularly at their confluence there tends to be rapid sediment deposition, particularly of gravel around Monks Bridge, which can lead to flow blockage and flooding, as documented in a number of references (including the draft Trent CFMP). Flooding has been a particular problem in Scropton, Hatton and Egginton.

Derwent Catchment

The River Derwent poses the main source of fluvial flooding in Amber Valley and Derby City. The River Amber and River Ecclesbourne are two of the major tributaries of the River Derwent. The River Amber poses a risk of flooding to Amber Valley Borough in the Alfreton area, whilst and the River Ecclesbourne potentially affects the Duffield area. The Markeaton and Mackworth Brooks, tributaries of the River Derwent, also pose a risk of flooding to parts of Amber Valley and Derby City. Other tributaries of the derwent in Derby City with a high flood risk include Hell, Cuttle, Cotton, Bramble, Littleover and Chaddesden brooks.

The lower Derwent, downstream of Derby City has large areas of washlands which help alleviate flooding to some extent in the areas downstream of the city. The draft Trent CFMP suggests that flooding in the lower reaches of the River Derwent may have been exacerbated by aggregate extractions which have contributed to the problem of sedimentation and blockage.



There are estimated to be nearly 50,000 properties in the floodplain within the Derwent catchment as a whole – most of these lie within the more heavily built-up areas of the lower Derwent and are protected from flooding by some form of defence (see Section 6.2.3). The most recent serious flooding event in Derby due to the River Derwent was in 1965 during which a large part of the City was flooded particularly around the Chester Green, Mansfield Road and Eastgate areas. This flooding occurred before the construction of the flood defences that exist today.

To monitor and mitigate flooding, the EA have prepared a Lower Derwent Strategy, which includes a ‘Blue Corridor Vision’ which aims to address the ageing flood defences and make the river an integral part of the urban environment, providing greater capacity in the floodplain and high amenity value for recreation and leisure. This is described in more detail in Section 6.5.

6.2.2 Surface Water Flooding

Overland Flow

Surface water flooding, resulting from heavy rainfall flowing and accumulating over impermeable surfaces, either on its own or as a contributing factor in other types of flooding, is relatively frequent in the River Trent catchment where it is associated with 20% of reported flooding incidents. The scale of the disruption or damage caused is less certain, and there are few records of significant losses resulting from surface water flooding. One of the main issues with surface water flooding is that in areas with no history of flooding, relatively small changes to hard surfacing and surface gradients can cause flooding (i.e. garden loss and reuse of brownfield sites). As a result, continuing development can mean that pluvial/surface water flooding becomes more frequent and although not on the same scale as fluvial flooding, it can still cause significant disruption.

The South Derbyshire SFRA indicates that much of the flooding experienced in 2000 in the River Dove, River Trent and River Derwent catchments and summer month flooding can be attributed to pluvial/surface water flooding following prolonged intense rainstorms. Away from the river corridor, where soils are reasonably free-draining (sands and gravels), the underlying soils in the Derwent catchment are generally quite ‘heavy²’ and tend to become saturated in the winter months. Ground conditions found within South Derbyshire District Council area range from poorly drained to moderately drained.

The Derby City SFRA provides an inventory of a number of small watercourses that are prone to flooding for a variety of reasons, including augmented overland flow where catchments have been developed and faster concentration of flood water due to rapid flow through the sewer network in steep catchments. Other causes of flooding include waterlogging of the lower parts of catchments due to saturated ground.

² Heavy soils are impermeable clayey or loamy soils



The Amber Valley SFRA indicates that surface water flooding associated with run-off from large impermeable areas is a potential risk where urban areas are at the bottom of steep hillslopes. However, a high level review of this source of flooding indicated that the risk from this source in the urban areas was low. Site specific flood risk assessments should review this particular issue in more detail.

The Environment Agency has very recently produced indicative maps at a national scale to highlight areas potentially susceptible to flooding from surface water run-off, following recommendations from the Pitt Review of the summer 2007 flooding. It recommended that the Environment Agency, supported by local authorities and water companies should urgently identify the areas that are at highest risk from surface water flooding.

The map shows areas that are susceptible to surface water flooding, produced using a simplified method that excludes: underground sewerage and drainage systems, and smaller over ground drainage systems; and buildings. It uses a single rainfall event. Therefore, it only provides a general indication of areas which may be more likely to suffer from surface water flooding. The map provides three bandings, indicating 'less' to 'more' susceptible to surface water flooding. The maps should not be used to identify individual properties susceptible to surface water flooding.

In Amber Valley, the areas most susceptible are generally along the river paths, with some areas identified in Belper and Duffield.

South Derbyshire shows areas most susceptible to be located around Dalbury on the Bottelsford Beck, Sutton on the Hill near the Sutton Brook, Findern and between Swadlincote and Burton-on-Trent along the A444.

Derby City has numerous areas that are considered to be more susceptible to surface water flooding, particularly in the wards of Chaddesden and Sinfin that also contain areas with intermediate susceptibility. The strategic housing sites identified in the Derby HMA Growth Point Programme of Delivery at Wilmorton College and Boulton Moor are shown to contain areas at risk of surface water flooding.

Sewer Flooding

Sewer flooding was identified in the South Derbyshire District Council SFRA using historical records from the STW sewer flooding DG5 database detailing the total number of flood events that affected both internal and external property. Whilst not presented graphically in the report, the SFRA notes that approximately 90% of the study area has experienced sewer flooding. This is considered to be a high estimate, potentially as a result of the postcode format in which the sewer flooding records are provided. Sewer flooding will generally be higher within the existing urban areas of the District.

There are many areas of Derby City at risk from flooding due to this source as the discussed in Section 5.1.2, as the capacity if the sewer network is very limited. Sewer flooding could also occur during intense rainfall events when there is also already a high river level in the River Derwent. This is because the surface water outfalls may be submerged and therefore unable to operate effectively. In this instance the sewers would be likely to flood lower



lying areas. A secondary risk is the route offered by sewers for floodwater from the River Derwent to flood lower-lying areas if the flap-valves on the outfall headwalls fail to operate properly.

The Amber Valley SFRA indicates that flooding from surface water sewers is a particular issue in the areas of Alfreton, Belper, Heanor, Ripley, Codnor, Somercotes and Langley Mill. In these areas many sewers and Combined Sewer Overflows (CSOs) are already at capacity. The SFRA includes maps of sewer flooding records provided by STW. The report also recognises that the areas of Cowhill, Duffield, Ironville, Langley Mill and Heanor are at risk from the combined fluvial and trunk sewer flooding.

Culverts

Watercourses through urban areas have often historically been culverted to allow development to progress. These pose risks of flooding when they reach capacity, or if they become blocked. The Derby City SFRA lists a number of small watercourses, which have the potential to inundate significant numbers of properties in the city, for instance the Littleover, Markeaton and Chaddesden brooks in the Derwent catchment and the Hell and Cuttle brooks in the Trent catchment. The reduction in capacity due for instance to undersized culverts or mature vegetation, neglect from riparian owners, vandalism and fly tipping, all lead to a reduced flow area and/or blockages of debris screens and in culverts and increased flood risk. Locations of culverted watercourses provided by Derby City Council are presented in Figure 6.1 (page 74). The Amber Valley SFRA notes that there is a risk of flooding from culverts in the main urban areas of Alfreton, Belper, Heanor and Ripley, and it supports the EA policy against the culverting of watercourses. South Derbyshire is also likely to have culverted watercourses.

6.2.3 Flooding from Infrastructure

Reservoirs

There are several large raw water storage reservoirs in the study area including: Foremark Reservoir and Staunton Harold Reservoir plus three water supply reservoirs at the head of the Derwent valley upstream of the study area, namely the Howden, Derwent and Ladybower reservoirs. Generally risk of dam failure on reservoirs is considered extremely low but failure could have major consequences, including loss of life. The Water Act 2003 introduced amendments to the Reservoirs Act 1975 which require the undertakers of large reservoirs to produce reservoir flood plans where directed by the Secretary of State (in England), where large reservoirs are those holding over 25,000 cubic metres of water above natural ground level. Reservoir flood plans have become a legal requirement in 2009 and will need to include a map identifying the extent and severity of flooding resulting from an uncontrolled release of water. Therefore with ongoing flood assessments and statutory management plans prepared by the reservoir undertaker, the probability of a flood or breach event is very small. Any flood risk that exists from reservoir failure is therefore considered to be a residual risk. Due to the sensitive nature of the information contained within such risk assessments and the potential security issues however, they are treated as highly confidential and are currently unavailable for public use although this is likely to change under the new draft Flood & Water Management Bill.



Canals

The Trent and Mersey Canal runs parallel to the River Trent through the centre of the study area. The South Derbyshire District Council SFRA reports that there was one instance of flooding documented in February 2000, just east of Shardlow at the confluence of the canal, River Trent and River Derwent. The canal towpath was noted to be under several feet of water.

Parts of the Cromford Canal and Erewash Canal run through Amber Valley Borough. Documented in their SFRA is confirmation from British Waterways that there is no history of flooding along the stretches of these canals, for which British Waterways are the responsible body.

Flood Defences

The Trent CFMP indicates that land drainage and flood defences have altered the way sediment is carried and deposited in the Dove catchment by changing the characteristics of the flows in the river and often by changing the channel form itself. This has resulted in less deposition and erosion within the channels where the changes have taken place, however by increasing conveyance through flood risk locations, there is a tendency for sediment deposition to increase in other downstream locations.

Flood defences were constructed during the middle and end of the last century to provide protection up to a 1% Annual Exceedance Probability (AEP) flood event – that is the flood that is likely to occur in any one year with a probability of 1%. However recent studies have shown that the standard of protection is generally much lower than previously thought and is around a 2% AEP flood event. There are currently some flood risk management schemes and flood defences in operation along the River Dove, at Egginton, Scropton, Willington and Ambaston. The standards of protection for these are 1 in 25 years (4% AEP) at Egginton and 1 in 100 years (1% AEP) at Scropton (with some areas at 1 in 50 years / 2% AEP).

The urban stretches of river through Derby in particular have extensive defences built in the 1930s. The standard of defence provided varies however and is generally well below a 1% AEP flood event. Around Derby, there are a number of structures and weirs within the River Derwent which increase water levels and reduce channel capacity. Despite the flood defences a high number of properties are expected to flood during a 1% AEP flood event in Derby because the defences provide insufficient protection against flooding from an event of this severity or greater. Although generally protected from the smaller more frequent flood events, the overall flood risk is assessed as high because of the large number of properties at risk during a severe flood event.

The data on flood defences for this report has been taken from the SFRAs for each Council. Please refer to Table 6.1 for the references to these documents.



6.2.4 Other Sources

The River Trent is considered tidal only downstream of Newark and therefore there is no risk of tidal flooding in the study area. The River Trent CFMP indicates that groundwater flooding is not generally a significant problem in the catchment. This is due to the low permeability of the underlying geology, resulting in a generally low water table compared to ground levels.

6.3 Constraints to Development

The main constraints to development identified in the study are fall into two categories: environmental constraints and infrastructure constraints. These are discussed below.

6.3.1 Environmental Constraints and Future Capacity

The flood zones identified in the individual council SFRAs form the main constraints to development in the Derby HMA. The SFRA flood zones have been provided in GIS format for the WCS and are presented in Figure 6.1. These have not necessarily been updated on the Environment Agency's flood zone map. The SFRAs' Flood Zone 3 is highlighted in Orange, indicating that limited development should occur in this zone. According to PPS25, only Water Compatible and Less Vulnerable development types should be permitted within this zone. These categories include shops, restaurants, cafes, waste treatment, mineral workings, water and sewage works.

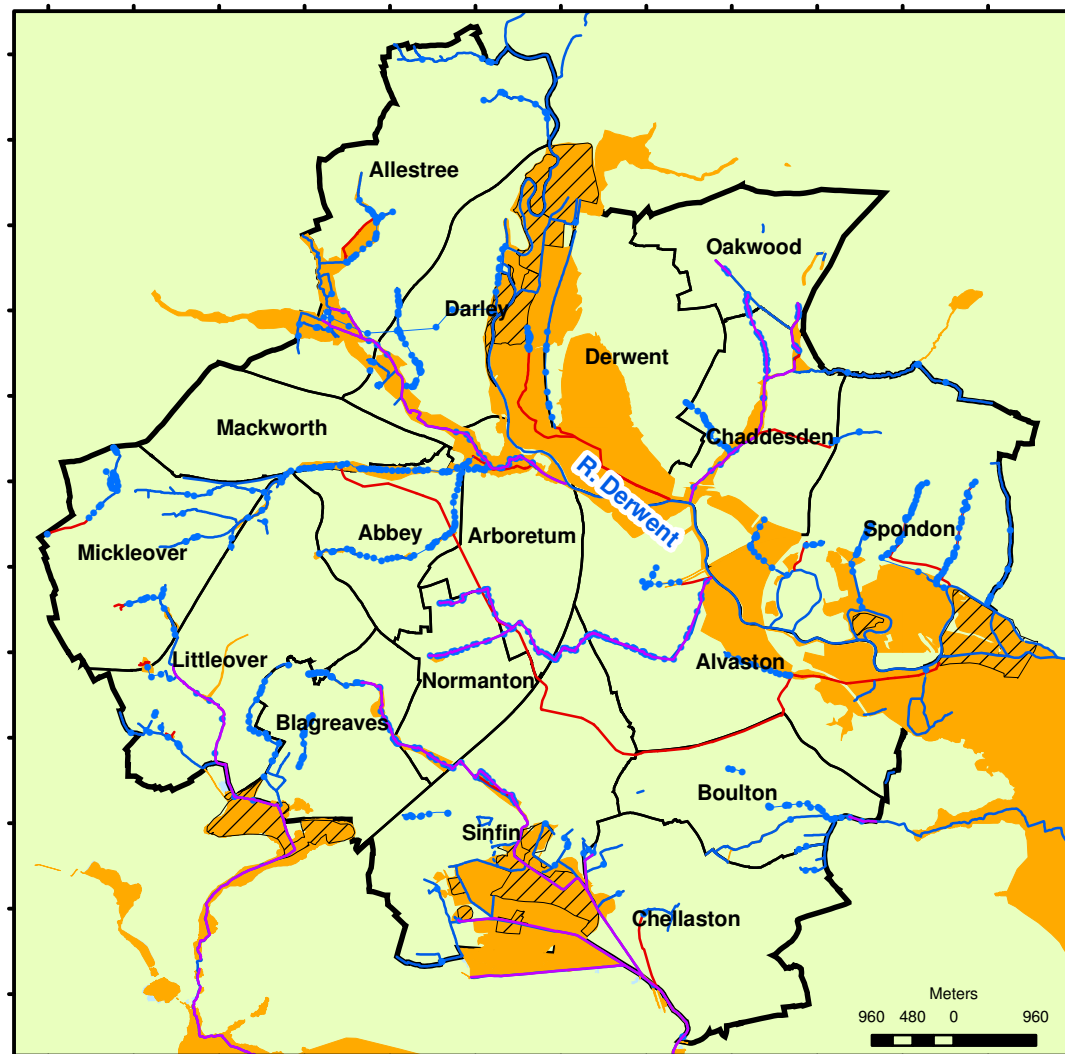
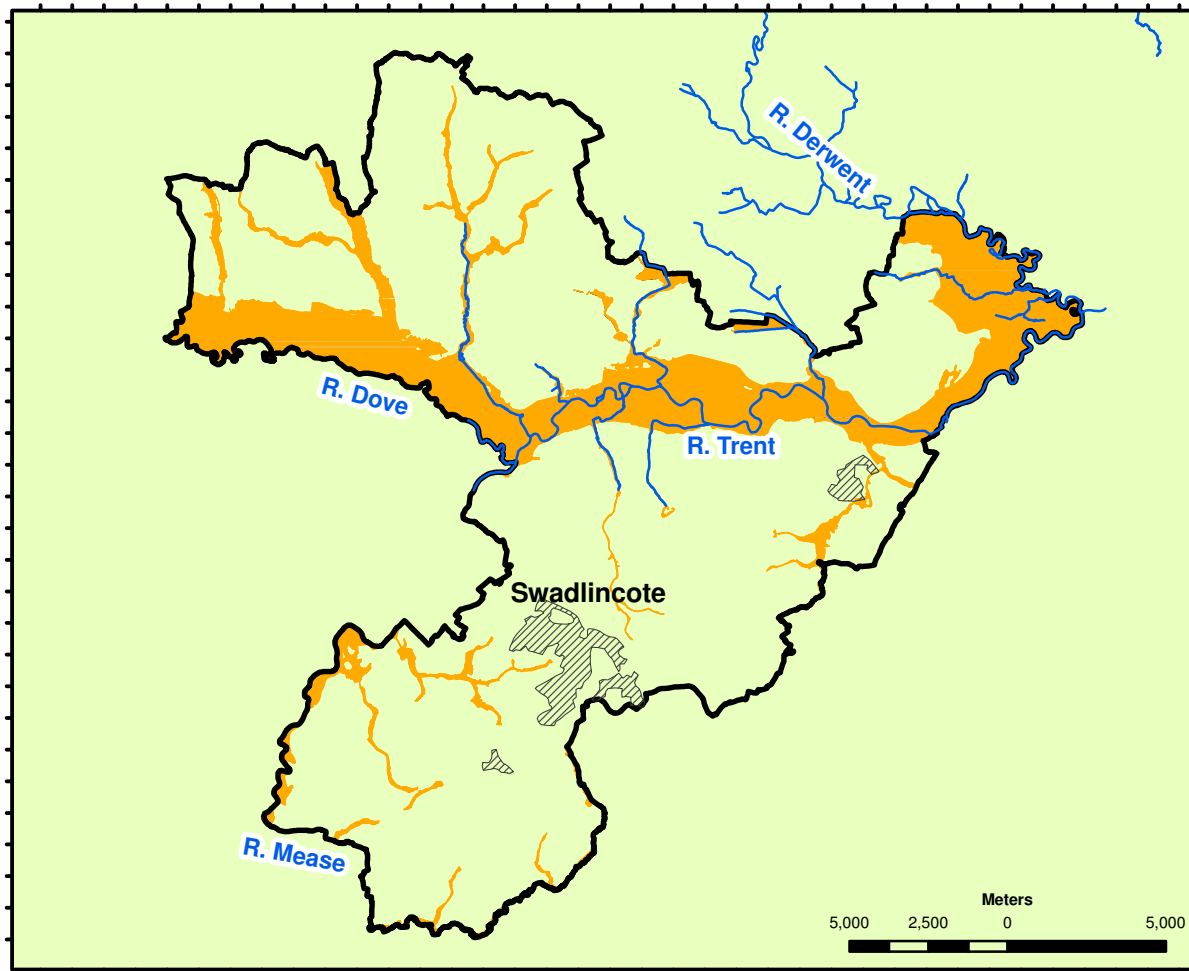
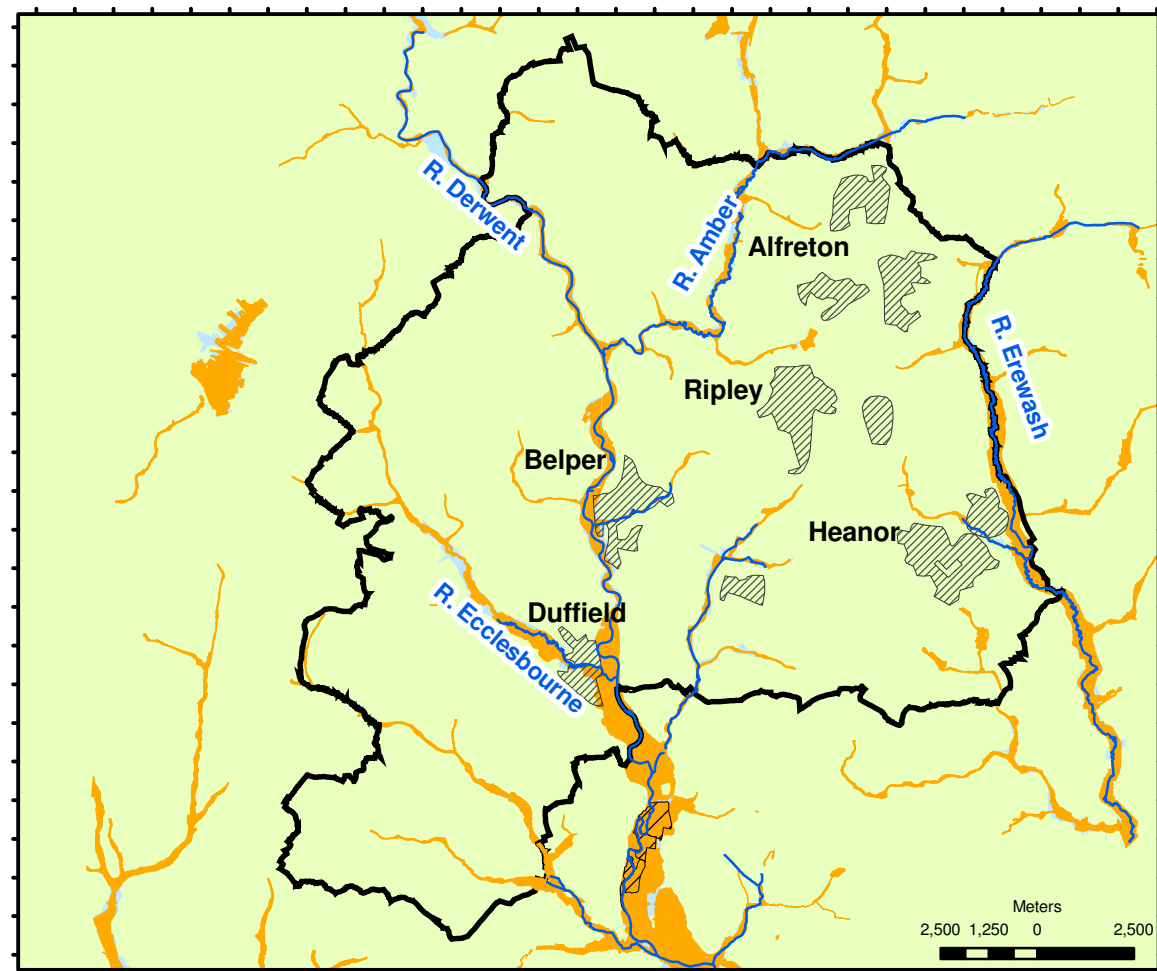
Residential development is classified as More Vulnerable therefore to comply with the Sequential Test this type of development should not be permitted in Flood Zone 3, unless it can pass the Exception Test. To pass the Exception Test, developments should demonstrate that:

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

A list of the PPS25 vulnerability classifications is provided in Appendix E.

The study area comprises significant areas, identified in the main growth centres, that are in the lower flood risk zones and these should be used in preference for new development wherever possible. The effect of climate change should also be taken into consideration when making planning decisions, which is likely to increase the extent of the flood zones, to understand the flood risk throughout the development lifetime.





Key

- Local Authority Boundary
- Ward Boundary
- Flood Zone 3a*
- Flood Zone 2
- Main River
- Ordinary Watercourse
- Culverted
- STW Adopted Watercourse
- Enmained, pipe
- Enmained, open

*Derby City and South Derbyshire Flood Zone 3 extent includes an allowance for climate change

H:\Projects\HM-255\25498 Derby Water Cycle Strategy\Drawings\GIS\MXD

Derby HMA Water Cycle Study

Figure 6.1
Flood Zones from Strategic
Flood Risk Assessments

September 2009
25498-B007 fiell

Entec

6.3.2 Infrastructure Constraints and Future Capacity

The risk of flooding from surface water run-off, sewers and culverted watercourses is relatively high in the urban areas of the Derby HMA, particularly in Derby City. There is therefore a constraint on new development due to inadequate drainage, as the existing drainage and sewerage is nearing or at capacity. Increased urbanisation combined with the impacts of climate change on increased rainfall intensity is likely to exacerbate this source of flooding.

Whilst this issue suggests there is limited capacity for growth, the promotion of Sustainable Drainage Systems (SuDS) through national, regional and local planning policy will help to alleviate the potential constraint on growth due to lack of surface water drainage capacity. Each of the SFRAs for the study area advocate the use of SuDS, recommending that policies are included in the LDF to ensure new developments apply SuDS and aim to replicate natural runoff, or better, reduce run-off rates compared to existing rates. Furthermore, the wastewater and sewerage assessment (Chapter 5) has indicated that STW are considering a number of options to divert effluent flow from the Derby WwTW catchment to other works such as Findern, Etwall or Clay Mills. The driver for this change is to relieve the pressure on the sewerage system in Derby City. With proper planning and appropriate controls on drainage from new developments together with the change in wastewater catchments, additional capacity may be created for the sewerage and drainage in Derby City.

New development in the remaining urban areas in the Derby HMA should also aim for the optimum use of SuDS to alleviate pressures on the drainage and sewerage capacities, and where possible retrofitting SuDS into existing developments, for example introducing green corridors where appropriate. These measures are discussed in more detail in the following sections.

6.4 Sustainable Flood Risk Management

A number of reports and policies are already in place to encourage sustainable flood risk management both nationally and specific to the study area. The aims are to ensure that existing and future generations can live sustainably alongside the inevitable risk of flooding. This section summarises the recommended approaches from these documents for flood risk management, and makes further recommendations for the Derby HMA based on the assessment of flood risk.

6.4.1 Trent Catchment Flood Management Plan

The main sources of flooding in the study area have been identified above as being from rivers (fluvial) and surface water run-off (pluvial). The EA's draft Trent CFMP main objectives are to set policies across the whole catchment which will achieve long-term sustainable flood risk management. The Plan covers the whole catchment of the Trent and all its tributaries, fully encompassing the Derby HMA.



To set policies and objectives, the catchment is divided into ten Policy Units, of which the Derby HMA mainly lies in Policy Unit 5: Burton, Derby and Nottingham. The selected policy for this unit is Policy 5 – Take further action to reduce flood risk (now and / or in the future). A number of actions are associated with this Policy Unit to meet the selected policy and ensure sustainable flood risk management, and they are listed fully in Appendix F. A summary is provided in Table 6.2 below.

Smaller parts of the study area lie within the CFMPs Policy Units 3 and 6: Peaks and Moorland; and Mid Staffs and Lower Tame.

The selected policy for these two units is Policy 6 - *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.*

The actions for their policies are also presented in Appendix F.

Table 6.2 Summary of Main CFMP Actions for LPAs in Burton, Derby and Nottingham (Policy Unit 5)

Action	Principal Organisation	Timescale	Objectives
Increase green corridors through urban areas, particularly on the River Erewash through strategic planning and building partnerships with local authorities, to help ensure appropriate development controls are applied.	Environment Agency, local authorities, Natural England	2014 - 2029	Return watercourses to a more natural state, increasing biodiversity and opening up green river corridors through Derby and the towns of Langley Mill, Ilkeston, Sandiacre and Long Eaton.
Identify locations within the urban areas where BAP habitats may be created, expanded or improved through links with other flood risk management schemes or initiatives.	Environment Agency, local authorities, Natural England	2010-02015	Sustain and increase the amount of BAP habitat in the catchment by opening up green spaces within the built environment.
Identify locations and opportunities where we can work with the aggregate extraction companies to improve planning for and restoration of gravel workings, - particularly in relation to providing additional flood storage.	Environment Agency, aggregates companies, Natural England	2011 - 2015	Return watercourses to a more natural state, increasing biodiversity and opening up green river corridors through Derby and the towns of Langley Mill, Ilkeston, Sandiacre and Long Eaton.



Table 6.2 (continued) Summary of Main CFMP Actions for LPAs in Burton, Derby and Nottingham (Policy Unit 5)

Action	Principal Organisation	Timescale	Objectives
Produce an integrated urban drainage strategy, for principal urban areas within the policy unit.	Local Authorities, Environment Agency, Severn Trent Water Ltd, IDBs	2009 - 2012	Support and encourage land and drainage management that will protect and improve water quality, particularly from disused mines and derelict areas as well as heavily urbanised areas.
Implement Integrated Urban Drainage strategies – priority for principal urban areas, to reduce the incidence of surface water and foul water flooding through greater involvement of Severn Trent Water Ltd in flood risk management.	Local Authorities, Environment Agency, Severn Trent Water Ltd, IDBs	2012 - 2020	
Develop a surface water management plan that will ensure an appropriate approach is adopted to surface water drainage.	Local Authorities, Environment Agency, Land owners, IDBs.	2009 - 2012	Reduce the cost of flood damage where it is high and economically viable to do so.

6.4.2 Lower Derwent Strategy

Consultation documents have been produced for the Lower Derwent Flood Risk Management Strategy by the EA in order to monitor and mitigate flood risk. The cornerstone of the strategy is the EA's 'Blue Corridor Vision' which aims to make the river an integral part of the urban environment, providing greater capacity in the floodplain and high amenity value for recreation and leisure. The key aims are Sustainability, Maximising Environment Benefit, Developing Safe Schemes and Securing Value for Money. The Strategy looks into four main areas along the Lower Derwent, starting from the most upstream location they are: Duffield and Little Eaton, Darley Abbey and Derby City, and South Derbyshire. The preferred strategy for each of these areas are summarised in Table 6.3 below:



Table 6.3 Preferred Strategies from the Lower Derwent Strategy Document (Environment Agency, 2008)

Area	Recommended Strategy
Duffield (River Ecclesbourne / Derwent / Bottle Brook)	Continued flood warning Advice on flood resistance Maintaining defences Improve floodplain capacity of agricultural land
Derby City	Realign defences through the city, creating recreational and environmental improvements – Blue Corridor Increase flow beneath Railway Junction Bridge Continued flood warning / resilience advice and maintaining defences for Darley Abbey
Derby South	Derby South Flood Alleviation Scheme (1991) included new defences Continued maintenance of defences Increase capacity of floodplain at gravel pits
South Derbyshire (Derwent / Trent)	Raise existing banks at Shardlow and some smaller villages

6.4.3 Sustainable Drainage Systems (SuDS)

In order to minimise flooding resulting from heavy rainfall and drainage constraints, development plans must consider the potential runoff and discharge rates from potential development sites, as well as consulting with the sewerage undertaker to determine existing capacity of the drainage network. PPS25 states that all developments greater than one hectare must provide a Flood Risk Assessment which considers surface water management for the development to prevent increased flood risk from surface drainage.

Regional planning statements and the Environment Agency promote the use of Sustainable Drainage Systems (SuDS). SuDS are designed to reduce the potential impact of new and existing developments with respect to surface water drainage discharges by making more use of natural processes to convey surface water away from development. They aim to:

- Control runoff at source;
- Improve water quality by treating runoff and removing pollutants prior to discharge off site;
- Enhance the amenity value of a development;



- Encourage groundwater recharge; and
- Integrate with the environmental surroundings.

SuDS are the name given to a drainage approach, rather than any particular drainage type, and are often described in terms of a “management train”, a series of progressively larger scale practices to manage runoff and control water quality. The management train is:

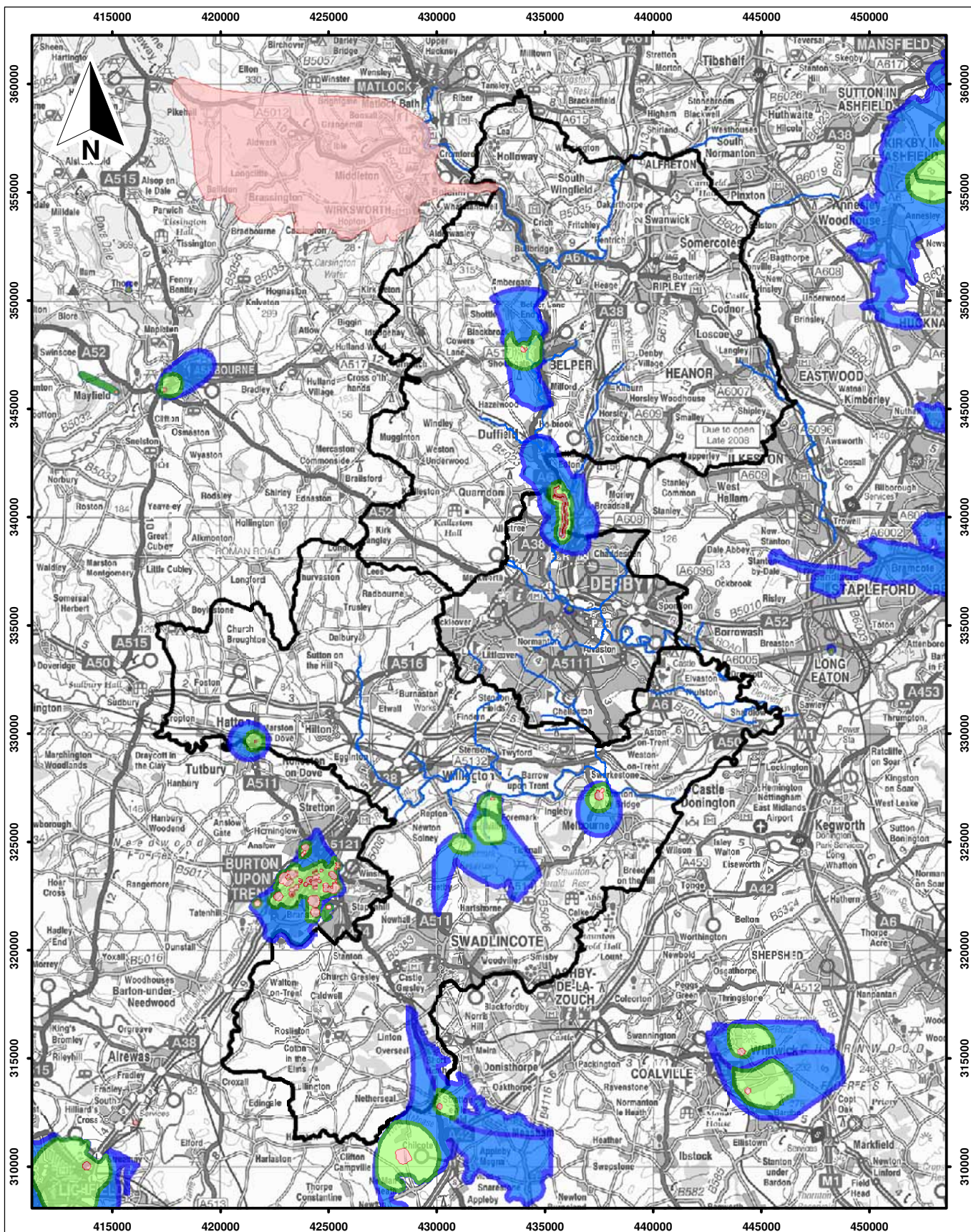
- **Prevention**, Application at individual sites, e.g. use of rainwater harvesting, management to prevent accumulation of pollutants;
- **Source Control**, Control of runoff at or very near to its source e.g. through permeable pavements, green roofs etc;
- **Site Control**, Management of water in a local area or site e.g. by routing water from building roofs and car parks to large soakaways or infiltration/detention basins;
- **Regional Control**, Management of runoff from a site or number of sites, typically in a balancing pond or wetland.

The preferred method of SuDS is infiltration. In most cases any pollutant particles are absorbed and dissipated by vegetation. Infiltration SuDS are best suited to areas overlain by permeable soils, drift and geology. Examples of these drainage techniques are permeable paving, soakaways, infiltration trenches, infiltration basins and swales. In most parts of the study area, the soils and geology are of low permeability and may be unsuitable for infiltration techniques. Due to the variability of soils and geology however, site specific infiltration tests should be carried out to confirm the feasibility of infiltration drainage. Figure 3.4 shows the solid and drift geology across the study area, and areas in South Derbyshire covered by higher permeability formations which may be more suited to infiltration.

Furthermore, where infiltration is into an aquifer the risk of contamination should be assessed and minimised, particularly where the groundwater is a source of public water supply. Additional measures, such as oil interceptors, may be required. Source Protection Zones (SPZs) are used to protect groundwater resources from pollutants. In areas designated as SPZs, the location and type of discharges into the water environment are closely controlled. The level of control is most stringent close to the point of abstraction. Figure 6.2 shows the location and definition of the SPZs relevant to the study area.

The SuDS approach is not wholly dependent on infiltration, but also includes attenuation techniques such as ponds, wetlands, green roofs and water recycling schemes which hold back run-off volumes and rates and allow water re-use. Recommended options for the Derby HMA also include the opening up of culverted watercourses where possible to provide green corridors within the urban areas, in line with the CFMP actions. Such schemes would have multiple benefits, not only in reducing flood risk by providing space for storing flood waters, but also through providing environmental corridors with high amenity and biodiversity value.





Key

- DerbyHMA
- Zone I - Inner Protection Zone
- Zone II - Outer Protection Zone
- Zone III - Total Catchment
- Zone of Special Interest
- Main River

Derby HMA Scoping and Outline Water Cycle Study

Figure 6.2 Groundwater Source Protection Zones

Meters
0 5,000
Scale: 1:250,000 @ A4

October 2009
25498-B010 fiell

Entec

Developers should be encouraged to consider the land take required for SuDS at the earliest opportunity, as typically SuDS need a greater footprint than traditional piped drainage systems. As mentioned above, all new developments greater than 1 hectare, or within Flood Zone 2 or 3 should be accompanied by a Flood Risk Assessment to consider the site's drainage strategy and feasibility of SuDS. A drainage strategy flow diagram is presented in Chapter 7. This refers to surface water drainage, which should be kept separate from foul drainage to reduce pressures on the sewerage capacity in the study area.

6.4.4 Land Management

Land management as a tool for sustainable flood risk management includes the recommendations for the Blue Corridor through Derby and use of SuDS and natural drainage systems in new developments. Other initiatives underway include the Mercaston and Markeaton Brooks Project. This is a catchment based land management initiative. The overall aim is to protect the soil, water, landscape and biodiversity of the Mercaston and Markeaton Brooks catchment and reduce the risk of flooding in Derby through improved natural resource management.

Whilst not within the study area, the Peak District National Park plays an important role in helping to alleviate flood risk in the River Derwent. The Moors for the Future programme (<http://www.moorsforthefuture.org.uk/mftf/main/Home.htm>) is a partnership project that aims to restore large parts of the internationally important Peak District moors. Through actions such as moorland restoration, afforestation, wetland creation and de-intensifying agriculture, land management practices can help to store flood water in the upper catchment thereby lowering the risk of flooding in the downstream catchment. These measures should also be encouraged where possible within other rural areas of the Derby HMA to contribute to sustainable flood risk management.

The effect of increasing the amount of 'green spaces' such as tree planting and habitat creation within the National Forest, or the incorporation of parks and open spaces within development on attenuating the timing and levels of peak river flows is discussed in the South Derbyshire SFRA. These effects, such as increased interception of rainfall and evapotranspiration by vegetation, and also the increase of more permeable land, may be maximised by strategically linking such green spaces into corridors or areas. The 6C's Growth Point is in the process of preparing its Green Infrastructure Strategy which will look to identify the most appropriate locations for satisfying the provision of green open space. It is recommended that the Councils also look to opening up of culverts where feasible to improve the storage capacity of these watercourses and also provide additional land for green infrastructure.

6.4.5 Climate Change Allowance

Climate change is predicted to have a profound effect on rainfall and hence flood risk, and PPS25 acknowledges that the future risks of flooding are likely to be more frequent and of greater magnitude than they have been in the past.



It is noted in the Derby City SFRA that development sites within the River Derwent corridor are non-residential and therefore would be permitted under the Sequential Test. However, it notes that the effect of climate change however will mean that the risk of inundation and flooding frequency to these sites will become greater in the future. It is a requirement of Derby City Council that 100 year (plus climate change allowance) rainfall volumes and flows are retained on the site and must not flow onto other 3rd party land (Derby City SFRA January 2009, based on recommendations from the Pitt Review and PPS25).

In the Amber Valley SFRA, sensitivity testing of the Environment Agency's Flood Map was undertaken, using the 20% allowance for the increase in peak flows from 2025 to 2115, as suggested in Table B2 of PPS25. The results indicated that changes in the extent of inundation are negligible in well-defined floodplains, but can be significant in flatter areas with less well defined floodplains. There are currently no hydraulic modelling results available for watercourses within Amber Valley that allow for the effects of climate change and hence it has not been possible to produce accurate future flood category envelopes for the "with climate change" scenario. When considering the effects of climate change on future developments, the current envelope for Flood Category 2 should therefore be taken as the future "with climate change" envelope for Category 3. It is recommended that the Level 2 SFRA undertakes climate change scenarios on the Environment Agency's Flood Zone 3.

To account for climate change in South Derbyshire, the SFRA acquired modelled flood outlines for Flood Zone 3a including the effects of climate change from the EA for several watercourses. Where no modelled climate change results were available, the Flood Zone 2 outlines were used as a proxy to estimate of the impacts of climate change. This is based on the assumption that the depth and extents of flooding would increase to somewhere between the 1 in 100 year (1% AEP) and 1 in 1000 year (0.1% AEP) outlines. This is a conservative approach designed to help strategic planners identify where increased detail and resolution in the flood outlines is needed at either the Level 2 SFRA or Site Specific FRAs.

6.5 Recommended Policies / Development Strategy

The main sources of flood risk in the study area have been identified as fluvial and surface water run-off. Level 1 SFRAs have been prepared for all three Council areas, and the findings of these are summarised in this Chapter.

Flood Risk & Drainage Recommendation 1: Actions

It is recommended that Level 2 SFRAs are undertaken to apply the Sequential Test to each Council's strategic allocations in support of the Core Strategy. These will cover all forms of flooding.

It may be advisable to prepare a Level 2 SFRA for the Derby Principal Urban Area encompassing the proposed developments on the outskirts of the Derby City Boundary, rather than individual reports for each authority. The majority of proposed development sites in Amber Valley and South Derbyshire, outside of the PUA, are located in Flood Zone 1.



It is recommended that the policies in each of the SFRAs are taken into account in spatial planning. Developments should, where possible, be located in the lowest flood risk zone based on the SFRA mapping.

The Outline WCS supports the proposed actions from both the Trent CFMP and the Lower Derwent Strategy to reduce flood risk. The Blue Corridor vision will help to control the flooding through Derby, and should this should be put into action as soon as possible.

Surface water flooding, as a result of heavy rainfall events, urbanisation and insufficient drainage capacity is a problem in the study area, with particular reference to Derby City and urban areas. The recommended actions to alleviate this source of flooding are presented in the box below.

Flood Risk & Drainage Recommendation 2: Actions

It is recommended that the Core Strategy for each Council should encourage culverted watercourses to be opened up to natural channels where feasible. These will create green corridors in urban areas, providing benefits to flood alleviation, amenity, recreation and water quality.

Land management techniques should be applied and encouraged where possible in rural areas to alleviate flooding. Examples include wetland creation and afforestation.

The opening up of culverted watercourses could provide required green corridors for the urban areas where there are deficiencies for open space. The Trent CFMP also recommends that the EA and LPAs identify locations within the urban areas where BAP habitats may be created. This is already underway as part of the Green Infrastructure Strategy for the 6C's Growth Point.

Defra has recently announced the top 77 Councils in the UK that are to receive funding to undertake Surface Water Management Plans (SWMPs). Derby City is listed and it is recommended that the SWMP is started as soon as possible, to review the areas within the City most at risk of surface water flooding, to contribute to future development planning, the Core Strategy, and Severn Trent's investment plans. Defra also has a further fund available to Councils not listed in the top 77 and it is recommended that Amber Valley Borough and South Derbyshire District review the merits of applying for additional funding to assess surface water flooding in their administrative areas.

Flood Risk & Drainage Recommendation 3: Actions

It is recommended a Surface Water Management Plan is undertaken for Derby City in line with a Detailed WCS, in order to identify the highest risk areas of the city and provide mitigation to surface water flooding.



The flood risk and drainage recommendations above are for actions and plans, some of which are already underway and regulated by other partners. In line with the Wastewater and SFRA recommendations, the WCS recommends the following policies for inclusion in the Core Strategy for each Council.

Flood Risk & Drainage Recommendation 4: Policies

The WCS recommends that each Council's Core Strategy includes policies that promote sustainable drainage techniques (SuDS) that mimic natural drainage, rather than using traditional piped systems in all new developments.

The WCS recommended that each Council provide a limit on run-off from new developments to reduce the risk of surface water flooding.



7. Integrated Recommendations and Guidance

The combined Scoping and Outline WCS for the Derby HMA has reviewed the existing environment with regard to the natural and urban water cycle, falling into the three technical disciplines of water resources, wastewater / sewerage / water quality and flood risk and drainage. This 'baseline' data has informed where there are likely to be constraints to development from both the environment and infrastructure. These constraints have been identified where there is a risk that the LPAs will fail to meet one or more of the following three aims:

- To aspire toward water neutrality;
- To meet EU Water Framework Directive targets on water quality; and
- To ensure sustainable flood risk management over the longer term.

Using the most available data on predicted growth provided by the individual Councils, the study has identified some potential phasing and capacity issues, and some technical areas that require further assessment. Given that elements of managing water in the urban environment are inter-related between the three technical disciplines, there are some areas of cross-over from the recommendations. This section summarises the overall constraints and capacity issues and provides integrated recommendations for the Council's Core Strategies.

7.1 The Water Environment

Water resources supplying the Derby HMA are mainly sourced from surface water, predominantly from the reservoirs located in the Peak District. The Environment Agency has indicated that there are 'very limited water resources available for further large scale abstraction and water efficiency measures must be taken seriously in order to accommodate the expected demand growth in the district'. The area is deemed to be at moderate water stress as demand from households for water is high in the study area.

The water companies are responsible for securing public water supply across a 25 year planning horizon and are currently preparing their final Water Resource Management Plans for the period to 2034/35. STW predict that there will be no deficit to supply in their final planning scenario (up to 2034/35), based on implementation of a number of supply-side schemes and demand management measures. SSW has forecast a surplus in its baseline scenario, and therefore expects to maintain secure supplies without the need for additional management options.

The water quality records of the rivers and watercourses in the study area indicate that many rivers are failing to meet WFD targets, with particular reference to nutrient levels. Nutrients are elevated in upper and middle reaches of rivers, as well as the lower reaches, suggesting sources other than sewage discharge are present. The River Mease SAC presents the biggest constraint in the study area, which is considered to be at saturation point for receiving effluent flows. This may potentially restrict growth or new developments in the southern area of South



Derbyshire District: Netherseal, Overseal and Lullington. It is not recommended that existing effluent be diverted from the catchment to prevent deterioration of flow volumes in the river.

Appropriate improvements will be required in wastewater treatment to improve the quality of discharged effluent/CSO discharges within the required timescales (i.e. often in advance of new housing connecting to the sewer network) so that these enhancements can be planned, funded and implemented within the AMP programmes operated by STW. Land management measures required under the draft Humber RBMP will need to be implemented to ensure that the other sources of nutrients are controlled to help improve water quality.

The main sources of flood risk in the study area have been identified as fluvial, from the rivers Derwent and Trent and their tributaries and from surface water run-off. Development in the highest flood risk zones should only be permitted if they are at the appropriate level of vulnerability in accordance with PPS25. As the preferred sites for development across much of the study area have not yet been confirmed, it has not been possible to confirm the implications of flood risk to future development in detail.

The key recommendations of the WCS as a result of reviewing the existing environment presented in Table 7.1 below.

7.2 Water and Sewerage Infrastructure

The distribution network for drinking water supply in the study area has been provided by both water companies. The network extends to all existing developed sites, such that additional development in these areas should not require extensive new mains in order to connect to the network. However, additional mains enhancements may be required in areas close to hydraulic capacity.

Severn Trent Water has indicated in its Final Business Plan that improving the resilience of the supply network is a priority as there is a need for large scale investment in this area. However, in its recent draft price determination, Ofwat has indicated that there will be a significant reduction in the amount of investment originally set out by the Company in its draft WRMP. Ofwat's final determination is expected in December 2009. STW has confirmed that it will fund mains diversions but it expects contributions from developers and new connection charges to fund the cost of increasing distribution capacity to new developments. The company is planning changes in infrastructure networks and treatment works capacity to respond to housing growth plans. SSW has an integrated supply network and therefore the supply could be taken from a number of locations depending on the location of the proposal.

More detailed discussion with both companies is required to confirm and identify specific water infrastructure issues regarding supply to the study area in a Detailed Study. This should be taken forward once specific development plans have been identified, to enable meaningful discussions to take place.

The locations of sewerage infrastructure and wastewater treatment works has been provided by STW for this study. A high level comparison of the consented and measured effluent flow (DWF) for the main WwTWs in the study area indicates that the works at Coton Park, Findern, Ticknall, Fritchley, Milton and Duffield are already over



capacity in terms of hydraulic/flow capacity. The assessment also indicates that further works will potentially reach capacity by 2015, indicating that STW should concentrate further assessments and potentially investment in those works at Stanton, Melbourne and Kilburn. The Detailed Study's assessment of works' capacities should take account of growth in neighbouring districts, particularly with regard to growth in North West Leicestershire in case options to divert additional effluent flow out of the Mease catchment into WwTWs in South Derbyshire are considered.

The capacity of the sewer system serving Derby City (in the catchment of the Derby WwTW) is very limited and thought to be unlikely to be able to support the levels of proposed growth without modifications or enhancements. A number of options are being examined by STW to enhance sewerage capacity, which includes diverting wastewater from development in the south/southwest of the City to Findern WwTW and substantially expanding this small works. Diverting wastewater further away to the large works at Burton upon Trent (Claymills WwTW) is another option; this would involve pumping and gravity sewers.

Further options may include consideration of the Etwall WwTW in South Derbyshire and Duffield WwTW in Amber Valley depending on available capacity and the need for pumping. It is recommended that options are assessed in a Detailed WCS, which should focus on the trade off between the environmental benefits in terms of improved river water quality and the wider sustainability implications associated with increased energy use and carbon costs.

The limitation on the sewerage in Derby City is also a source of flooding. Similar issues have been identified in the SFRAs suggesting that sewer flooding is a risk to the study area's urban settlements. The benefit of diverting flows away from Derby City is that capacity will be freed up at Derby WwTW to receive wastewater from new development in the north and west of the City, but also there is potential to reduce flood risk with combined improvements to the drainage.

Flood defences protect parts of Derby City from the River Derwent flooding; however, these defences are reaching the end of their lifetime and provide an insufficient level of protection. A high number of properties are likely to be affected by flooding during a 1% AEP event. The Blue Corridor vision presented in the EA's Lower Derwent Strategy seeks to set back the flood defences from the river, to increase the storage capacity of the floodplain.

The key recommendations for policy and future work to assess the infrastructure requirements for the study area are presented in Table 7.1 below.

7.3 Integrated Recommendations

This section presents a range of integrated recommendations that the Authorities and developers should comply with to achieve sustainable development in the Derby HMA.

Table 7.1 provides a list of recommended policies to be included in the Councils' Core Strategies to ensure where possible water efficiency, water quality and sustainable flood risk management targets are met.



Table 7.2 provides a list of recommended actions to be implemented by the Councils, the water companies and the Environment Agency to support the requirements for water efficiency and improvements to water quality.

Figure 7.1 provides recommended actions throughout the growth period for the relevant stakeholders to ensure that the predicted growth for the New Growth Point and the RSS does not have a detrimental impact on the water environment or water infrastructure.

Figure 7.2 provides a checklist for developers to comply with the proposed strategy and policies.

Table 7.1 Policy Recommendations to Achieve Sustainable Development Relating to the Water Cycle

Policy Recommendation	Discipline Area	Justification
Local Authorities should require developers of private homes to design new homes to meet the minimum water use standard in Level 3/4 of the Code for Sustainable Homes (105 l/p/d)	Water Resources	All new social housing funded through the Housing Corporation is required to be built to level 3 of the Code For Sustainable homes, 105l/p/d. Councils' should support a high level of water efficiency in remaining homes to ensure that the water companies plans for demand management and water supply can be met in the growth period
The Core Strategy for each Council should include policies to support the water companies' water efficiency activities as set out in the WRMPs, particularly the drive for increased water efficiency activities in existing households.	Water Resources	Councils' should support a high level of water efficiency in existing development (residential and non-residential) to ensure that the water companies plans for demand management and water supply can be met in the growth period
The WCS recommends that each Council's Core Strategy includes policies that promote sustainable drainage techniques (SuDS) that mimic natural drainage, rather than using traditional piped systems in all new developments.	Water Quality / Flood Risk	To support the requirements of PPS25, the Trent CFMP, the Pitt Review and the forthcoming Floods and Water Management Bill, the Council's should encourage all new development to use SuDS to reduce flood risk from both fluvial and surface water run-off. SuDS will also provide a level of treatment, improving water quality and contributing to meeting WFD targets.



Table 7.1 (continued)

**Policy Recommendations to Achieve Sustainable Development
Relating to the Water Cycle**

Policy Recommendation	Discipline Area	Justification
The Core Strategy for each Council should encourage culverted watercourses to be opened up to natural channels where feasible	Water Quality / Flood Risk	<p>To provide green corridors within existing urban areas, contributing to sustainable flood risk management whilst also creating recreational areas, in line with national and regional policy, and the requirements of the Trent CFMP and Humber RBMP.</p> <p>These will also offer up green corridors within urban areas, in line with the Green Infrastructure requirements</p>

Table 7.2 Recommended Actions

Recommended Action	Discipline Area	Justification
It is recommended that a Detailed Water Cycle Study is undertaken,	All	<p>To review the water companies final investment and management plans.</p> <p>To continue the stakeholder engagement and promote ongoing dialogue between the local authorities and the water companies for monitoring and assessing the impacts of growth on the water resources management in the study area.</p> <p>To provide further clarification on the location and annual rate of growth, to determine exactly the pressures on the hydraulic and treatment capacity of WwTWs, the capacity of sewerage, and the likely impacts of the WFD and discharge criteria on required investment.</p> <p>To take account of growth in neighbouring areas that may contribute to wastewater treatment works in the Derby HMA.</p>



Table 7.2 (continued) Recommended Actions

Recommended Action	Discipline Area	Justification
The works at Fritchley, Duffield, Coton Park, Findern, Milton, Stanton, Kilburn and Melbourne should be assessed by STW	Wastewater	To assess their capacity to receive growth in the immediate term, so that potential capacity issues to 2015 are dealt with as early as possible.
It is recommended that STW continues communication with the Derby HMA	Wastewater	To determine where and when growth will occur in the Derby WwTW catchment, to identify the preferred option to alleviate pressures on the sewerage system.
To prepare a Level 2 SFRA for the Derby Principal Urban Area	Flood Risk and Drainage	to apply the Sequential Test to each Council's strategic allocations in support of the Core Strategy. These will cover all forms of flooding.
It is recommended a Surface Water Management Plan is undertaken for Derby City in line with a Detailed WCS	Flood Risk and Drainage	to identify the highest risk areas of the city and provide mitigation to surface water flooding.
The Core Strategy for each Council should encourage culverted watercourses to be opened up to natural channels where feasible.	Flood Risk and Drainage	These will create green corridors in urban areas, providing benefits to flood alleviation, amenity, recreation and water quality.
Land management techniques should be applied and encouraged where possible in rural areas to alleviate flooding. Examples include wetland creation and afforestation		



Figure 7.1 Development Strategy for the Derby HMA

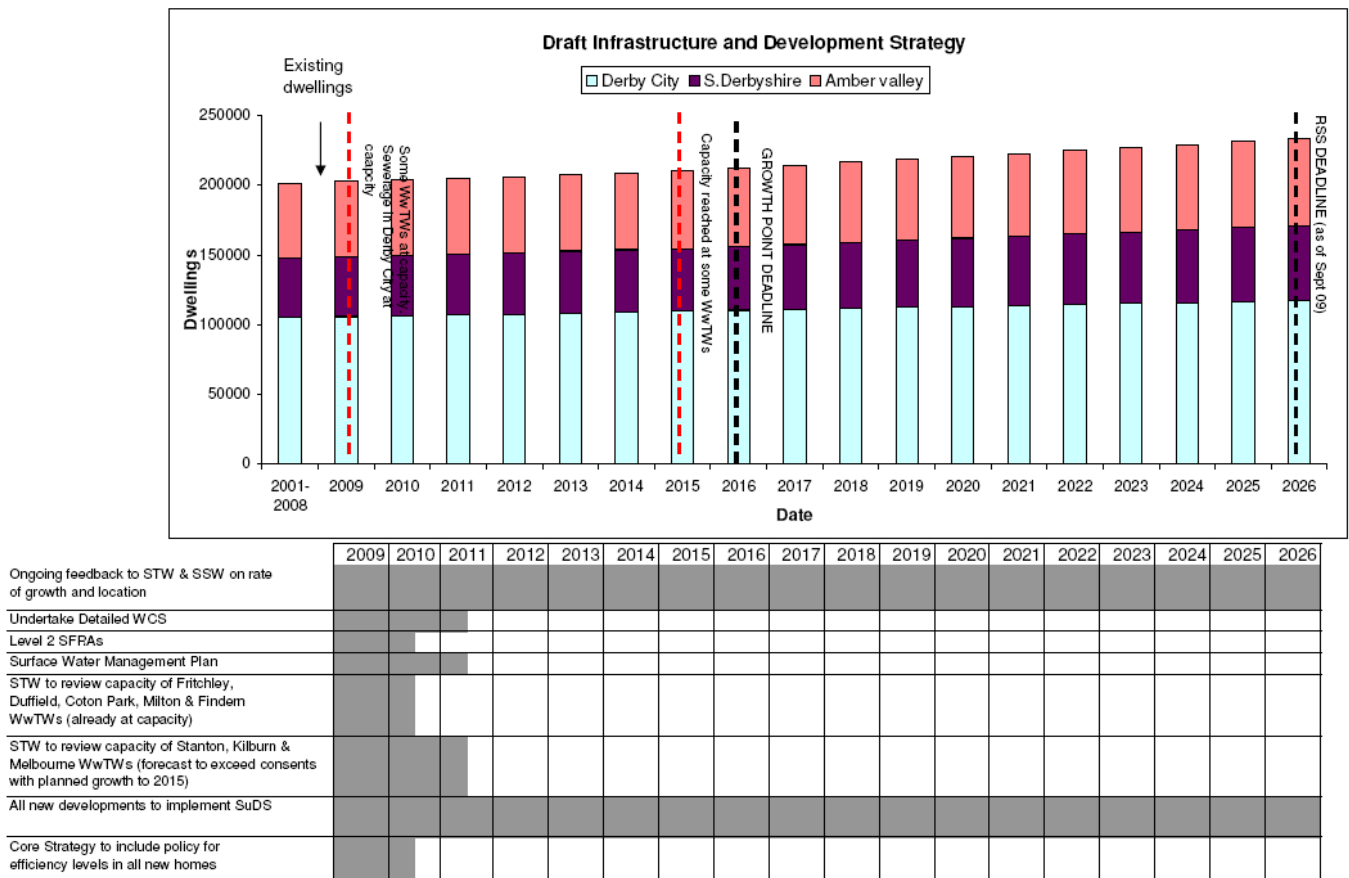
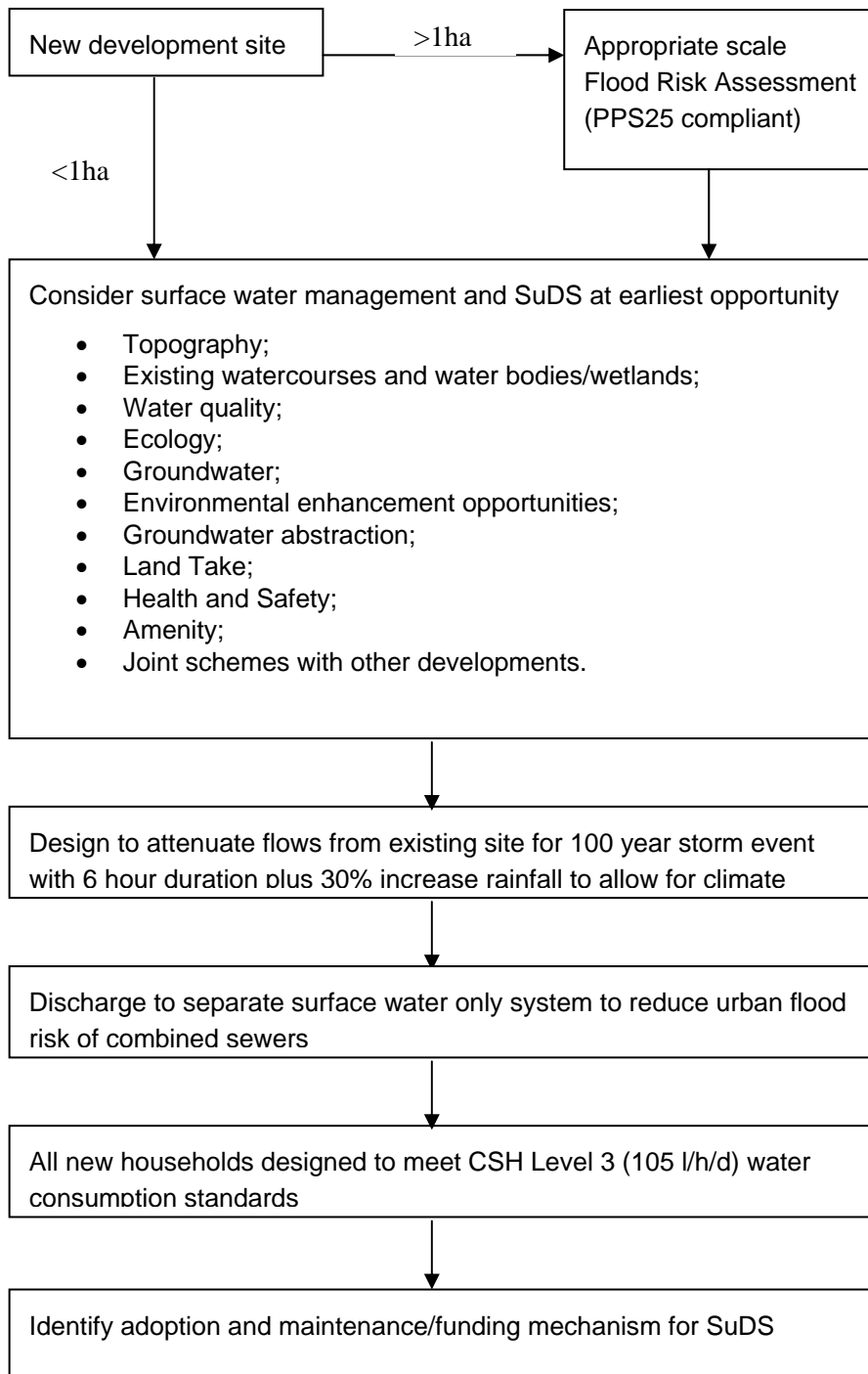


Figure 7.2 Strategy for Developers



Recommendations for Future Work

This study has collated available information at a strategic level to determine potential constraints to development targets in the Derby HMA. The study has highlighted some areas that require further analysis. In order to further assist in meeting the development targets and improving the sustainable use and treatment of water, the following recommendations for a Detailed WCS are proposed.

- It will be important to continue communication between the water companies, particularly STW that serves the majority of customers in the study area, and the Authorities to monitor growth rates. This is especially relevant to monitor how the impact of the economy, the Growth Point deadline and the RSS deadline affect development rates. By continuing the WCS in a Detailed Study, the steering group provides the platform for this ongoing communication and stakeholder engagement;
- With policy recommendations in place for water efficiency measures complying with CSH Level 3/4 as a minimum, local authorities will be supporting efforts to manage the future demand for water. In the Detailed study, more detailed site specific recommendations can be made for implementing and maintaining water efficiency measures, for example through combined site rainwater harvesting and grey water re-use systems;
- Where sewerage infrastructure is identified as presenting a constraint to development, additional analysis and modelling is likely to be required to review options. Sewer modelling is undertaken by STW and by their preferred consultants, but the outputs may be made available to the Authorities for the Detailed WCS to fully review the capacity of key assets in the sewerage network (i.e. pumping stations and CSOs). Where insufficient capacity leads to an increase in the spill frequency of CSOs, a parallel assessment on the impact on the receiving water should also be undertaken;
- A number of options are available to STW to relieve the pressure on the sewerage infrastructure within the catchment of the Derby WwTW. Some of these may involve pumping of effluent into other catchments, which have the potential to increase the company's carbon footprint. A sustainability assessment and carbon counting of the available options is recommended;
- As the location of development is not yet confirmed, the exact impact on infrastructure and the costing has not been included in this study. The Detailed Study would be in line with the Authorities decision on development locations, so that scheme options, costs and sustainability can be assessed;
- The potential for the implementation of SuDS across the District has been identified within the Outline study. In the Detailed Study, assessments of areas that require integrated surface water management can be achieved, with the aim of aligning outputs with the surface water management plans for the preferred site allocations, as recommended in the Pitt Report.





8. References

Communities and Local Government (2008). The Code for Sustainable Homes. Setting the standard in sustainability for new homes.

Derby City Council (January 2009) Level 1 Strategic Flood Risk Assessment for the City of Derby

Environment Agency (2003). Don and Rother Catchment Abstraction Management Strategy. Leeds.

Environment Agency (2004). Tame, Goyt and Etherow Catchment Abstraction Management Strategy. Warrington.

Environment Agency (2008). Don and Rother Catchment Abstraction Management Strategy Update. Leeds.

Environment Agency (2006). Derbyshire Derwent Catchment Abstraction Management Strategy. Solihull.

Environment Agency (2006). Dove Catchment Abstraction Management Strategy. Lichfield.

Environment Agency (2006). Soar Catchment Abstraction Management Strategy. Solihull.

Environment Agency (2006). Warwickshire Avon Catchment Abstraction Management Strategy. Solihull.

Environment Agency (2006). Worcestershire Middle Severn Catchment Abstraction Management Strategy. Shrewsbury.

Environment Agency (2007). Idle and Torne Catchment Abstraction Management Strategy. Solihull.

Environment Agency (2007). Staffordshire Trent Valley Catchment Abstraction Management Strategy. Lichfield.

Environment Agency (2007). Water for life and livelihoods. River basin planning: summary of significant water management issues Humber River Basin District.

Environment Agency (2007). Welland Catchment Abstraction Management Strategy. Bristol.

Environment Agency (2008). Idle and Torne Catchment Abstraction Management Strategy Update. Solihull.

Environment Agency (2008). Lower Trent and Erewash Catchment Abstraction Management Strategy. Solihull.

Environment Agency (2008). Tame, Anker and Mease Catchment Abstraction Management Strategy. Lichfield.

Environment Agency (February 2009) A consultation on the draft River Basin Management Plan. Humber River Basin District



Environment Agency (October 2007) River Trent Catchment Flood Management Plan, Draft Report

Faber Maunsell-Aecom, (June 2009). Amber Valley Borough Council Level 1 Strategic Flood Risk Assessment

Opsi Water Industry Act 1991. Accessed online: [http://www.opsi.gov.uk/acts/acts1991/ukpga_19910056_en_1].

Scott Wilson Ltd (November 2008). South Derbyshire District Council Strategic Flood Risk Assessment

Severn Trent Water (2008). Draft Water Resource Management Plan.

Severn Trent Water (2009). Final Business Plan. Part A Company Strategy.

Severn Trent Water (2009). Statement of Response.

South Staffordshire Water (2008). Draft Water Resource Management Plan.

South Staffordshire Water (2009). Statement of Response.

