Bassetlaw District Council

Bassetlaw Water Cycle Study

Scoping Study

Scoping Report
July 2009

Prepared for:

Revision Schedule

Bassetlaw Water Cycle Study Scoping Report
July 2009

Rev	Date	Details	Prepared by	Reviewed by	Approved by
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Acronyms

Abbreviation	Description
AMP	Asset Management Plan
AWS	Anglian Water Services
BAT	Best Available Technology
BATNEEC	Best Available Technology Not Entailing Excessive Cost
BDC	Bassetlaw District Council
BOD	Biochemical Oxygen Demand
CAMS	Catchment Abstraction Management Strategy
CFMP	Catchment Flood Management Plan
CSH	Code for Sustainable Homes
CSO	Combined Sewer Overflow
CLG	Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DO	Dissolved Oxygen/Deployable Output
DPD	Development Plan Document
DWF	Dry Weather Flow
EA	Environment Agency
EP	English Partnerships
FtFT	Flow to Full Treatment
GI	Green Infrastructure
GQA	General Quality Assessment
HPPE	High Performance Poly Ethylene (pipe)
IDB	Internal Drainage Board
l/c.d	Litres per capita per day (water consumption measurement)
LDF	Local Development Framework
LiDAR	Light Detection and Ranging
LPA	Local Planning Authority

Acronyms

Abbreviation	Description
MBR	Membrane Bioreactor
N	Nitrogen
NGP	New Growth Point
NE	Natural England
NVZ	Nitrate Vulnerable Zone
OFWAT	The Office of Water Services
P	Phosphorous
PE	Population Equivalent
PPS	Planning Policy Statement
RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
SAC	Special Area for Conservation
SEA	Strategic Environmental Assessment
SfG	Strategy for Growth
SFRA	Strategic Flood Risk Assessment
SIMCAT	EA mathematical River Water Quality Model
SPA	Special Protection Area
SPZ	Source Protection Zone
SRP	Soluble Reactive Phosphorus
SSSI	Site of Special Scientific Interest
ST	Severn Trent Water
SWMP	Surface Water Management Plan
SUDS	Sustainable Drainage Systems
TSFR	Treated Sewage Flow Recorder (flow meter)
TSS	Total Suspended Solids (in waste water)
UWWTD	Urban Wastewater Treatment Directive

Acronyms

Abbreviation	Description
WCS	Water Cycle Strategy/Water Cycle Study
WFD	Water Framework Directive
WRMP	Water Resources Management Plan
WRPZ	Water Resources Planning Zone
WRZ	Water Resources Zone
WSI	Water Services Infrastructure
WwTW	Waste Water Treatment Works

1 Executive Summary

The East Midland Regional Plan [1] identifies Worksop as a sub-regional centre, having the potential to accommodate sustainable growth and set targets to guide the scale and location of growth in Bassetlaw up to 2026. Bassetlaw is to provide 8,850 new homes within this time period.

As part of Bassetlaw District Council's (BDCs) overall strategy to meet future growth targets set out in the RSS in a sustainable way, a Water Cycle Study (WCS) has been commissioned. This will make up one of a number of strategic studies and plans which will form part of the evidence base supporting the production of BDCs Local Development Framework (LDF). Specifically, the WCS will form an important basis of the Bassetlaw Core Strategy making up part the LDF, as well as providing input to the development of Supplementary Planning Documents to assist in ensuring the delivery of water cycle management requirements at the local planning application level.

The Scoping Stage of the Bassetlaw WCS has been completed to inform and facilitate the undertaking of an Outline WCS and a Detailed WCS (where required), whilst building upon previous and on-going work undertaken in the area, providing a holistic and wider evidence-based approach to feed into the LDF.

The Scoping WCS has undertaken an initial review of available data and provided an overview of issues relating to clean water and wastewater infrastructure capacity, water resource availability, water quality and potential ecological impacts of development. The impacts of flood risk within Bassetlaw are being assessed within the Bassetlaw Strategic Flood Risk Assessment (SFRA) and the findings of this study will be reviewed during the next stage of the WCS.

Discussions with BDC, the Environment Agency (EA), Severn Trent Water (ST), Anglian Water Services (AWS) and Natural England (NE) were undertaken to identify key issues and constraints in relation to the proposed development within Bassetlaw and recommendations have been made for further investigation as part of the next stages of the WCS.

The key findings from the Scoping WCS include:

- The EA's view is that the AWS area in the east of the district, lies within an area of 'serious water stress', whilst the ST area in the west of the district, lies within an area of 'moderate water stress'[2],
- AWS and ST have re-assessed the supply / demand balance in their respective supply areas and both water companies appear to have surpluses (i.e. resources exceed demands) over the over the entire planning period[3] [4,]

[1] East Midlands Regional Plan, March 2009
[2] Environment Agency; 2007; Areas of Water Stress, Final Classification; Environment Agency
[3] Severn Trent Water Water Resource Management Plan – Statement of Response, 2009
[3] Anglian Water Water Resource Management Plan – Statement of Response, 2009

- Groundwater quality within its aquifers – ST forecast that by 2035 increasing nitrate concentrations will mean that many of its groundwater sources will no longer be suitable for water supplies[5]. Improved water use efficiency and improvements in their strategic treated water mains network may be required to overcome the challenge of dealing with nitrate, pollution, mainly from agricultural sources,
- There are no expected treatment capacity issues in terms of treating wastewater generated from the proposed development within Bassetlaw, though ST would like to see detailed development proposals before passing final judgement,
- The management of surface water has the potential to act as a constraint to development within Bassetlaw due to space requirements and the need to reduce runoff rates and volumes to limit discharges. Water quality impacts in main rivers and small watercourses, drains and ditches in Bassetlaw should also be managed,
- No detailed information on River Trent and River Idle water quality and the Water Framework Directive (WFD) requirements was available at the time of the Scoping WCS, but it is anticipated that some investment will be required to ensure no deterioration in the water quality standards under the WFD,
- Reduced water quality, due to increased volumes of treated sewage effluent being discharged into the watercourses and poorly managed urban runoff from new development areas could impact upon European, National and Locally important ecological sites, particularly those downstream of development sites.

The key recommendations for the Outline WCS include:

- Assessment of the water resource availability up to 2026 within Bassetlaw,
- Assessment of the flood risk to the proposed development sites and mitigation options. This will be undertaken in conjunction with the Bassetlaw SFRA,
- Assessment of the capacity of the existing wastewater and clean water network, both current and proposed, to identify the key constraints and required phasing of development to ensure that development does not outstrip capacity,
- Assessment of the likely surface water storage requirements and potential Sustainable Drainage Systems (SuDS) for proposed development within Bassetlaw,
- Environmental assessment of the impact of the proposed development within Bassetlaw upon watercourses and ecologically important sites. This includes the impacts on and requirements for increased discharges at wastewater treatment works (WwTW),
- Phasing of proposed development sites and key constraints for each of the major sites, with reference to the above assessments.

It is recommended that a Project Steering Group comprising BDC, EA, ST, AWS, NE and the local Internal Drainage Boards (IDBs) should be set-up upon finalisation of this Scoping WCS to guide, advise and agree on the findings of the Scoping, Outline and Detailed WCS (if required).

[5] Severn Trent Water Draft Water Resource Management Plan, 2008

2 Introduction

2.1 Terms of Reference

Scott Wilson Ltd (SW) was commissioned by BDC to undertake a Scoping, Baseline and Full Outline WCS for their administrative area in Northern Nottinghamshire. However, following a meeting with BDC on 17th April 2009 it was agreed that a standalone Baseline WCS is no longer required. It should be noted that through the undertaking of this Scoping WCS and the Outline WCS, all aspects that were proposed for the Baseline WCS will be covered.

WCSs are required to ensure that proposed growth does not adversely impact on the existing water cycle environment and that new Water Services Infrastructure (WSI) can be planned for and provided alongside new development in a sustainable and cost effective manner.

BDC requires a WCS to produce a 'sound' evidence base for their Core Strategy and Site Allocation Plan (Development Plan Documents (DPDs)). In so doing, it will also integrate with other related studies and reports, to jointly inform the overall LDF. It will also provide sufficient information for ST and AWS to allow for any additional WSI to be included in their draft Business Plan as part of the 2009 Price Review Process (PR09).

2.2 Background Overview

The East Midland Regional Plan (2009) identifies Worksop as a sub-regional centre, having the potential to accommodate sustainable growth. Worksop is likely to be the focus for much of the future development that will take place within Bassetlaw. The west of Bassetlaw, with clear links to Sheffield and access to the A1, is also being considered a focus for employment development.

2.3 Aims and Objectives

The objective of the Bassetlaw WCS is to identify any constraints on housing and employment growth planned for Bassetlaw up to 2026, that may be imposed by the water cycle and how these can be resolved (i.e. by ensuring that appropriate water infrastructure is provided to support the proposed development). Furthermore, it will provide a strategic approach to the management and use of water which ensures that the sustainability of the water environment in the region is not compromised.

The first stage of this study, the Scoping Report, has undertaken a review and provided an overview of the following specific items:

- Capacity issues with regards to water treatment works (WTWs), clean water network and water resources in Bassetlaw,
- Capacity issues with regards to wastewater network and treatment capacity in Bassetlaw,
- Potential impacts of future water abstraction and wastewater discharge near water dependent European Sites,

- Water quality issues with respect to the discharge of wastewater and surface water, groundwater quality and the management of gravity and pumped discharges.

The impacts of flood risk within Bassetlaw are being assessed within the update to the Strategic Flood Risk Assessment (SFRA) and the findings of this study will be reviewed and during the later stages of the WCS.

3 Bassetlaw Water Cycle Study

3.1 The Water Cycle

In its simplest form, the water cycle can be defined as:

> *'The process by which water is continually recycled between the earth's surface and the atmosphere'.*

Without considering human influences, it is simply the process by which rain falls, and either flows over the earth's surface or is stored (as groundwater, ice or lakes) and is then returned to the atmosphere (via evaporation from the sea, the ground, surface water or animal and plant life) ready for the whole process to repeat again.

In the context of this study, the 'water cycle' has a broader definition than the simple water or 'hydrological' cycle. The human influence on the water cycle introduces many new factors into the cycle through the need to abstract water from the natural environment, use it for numerous purposes and then return to the natural system (Figure 3-1). The development and introduction of technology such as pipes, pumps, drains, and chemical treatment processes has meant that human development has been able to manipulate the natural water cycle to suit its needs and to facilitate growth and development. 'Water Cycle' in this context is therefore defined as both the natural water related environment (such as rivers, wetland ecosystems, aquifers etc), and the water infrastructure (hard engineering focused elements such as: water treatment works, supply pipelines and pumping stations) which are used by human activity to manipulate the cycle.

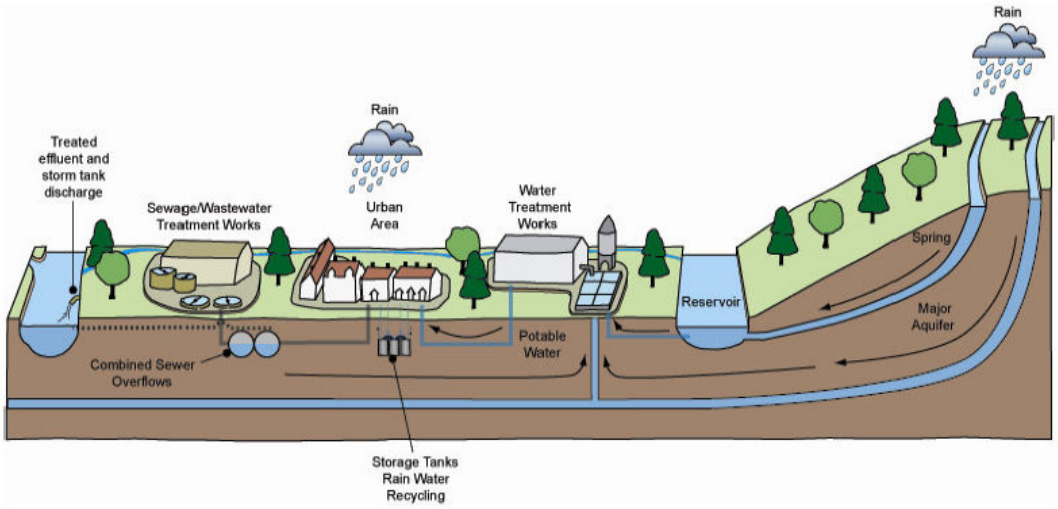


Figure 3-1 The Water Cycle Study (Source: Environment Agency[6])

[6] Water Cycle Study Guidance, Environment Agency, January 2009 (http://publications.environment-agency.gov.uk/pdf/GEHO0109BPFF-e-e.pdf)

3.2 Implications for Development

In directly manipulating elements of the water cycle, man effects many changes to the natural water cycle which can often be negative. To facilitate growth and development, there is a requirement for clean water supply which is taken from natural sources (often depleting groundwater stores or surface systems); the treatment of wastewater which has to be returned to the system (affecting the quality of receiving waters); and the alteration and management of natural surface water flow paths which has implications for flood risk. These impacts can indirectly affect ecology which can be dependent on the natural features of a water cycle. For example, wading birds and wetland habitat, or brown trout breeding in a Chalk stream which derives much of its flow from groundwater sources.

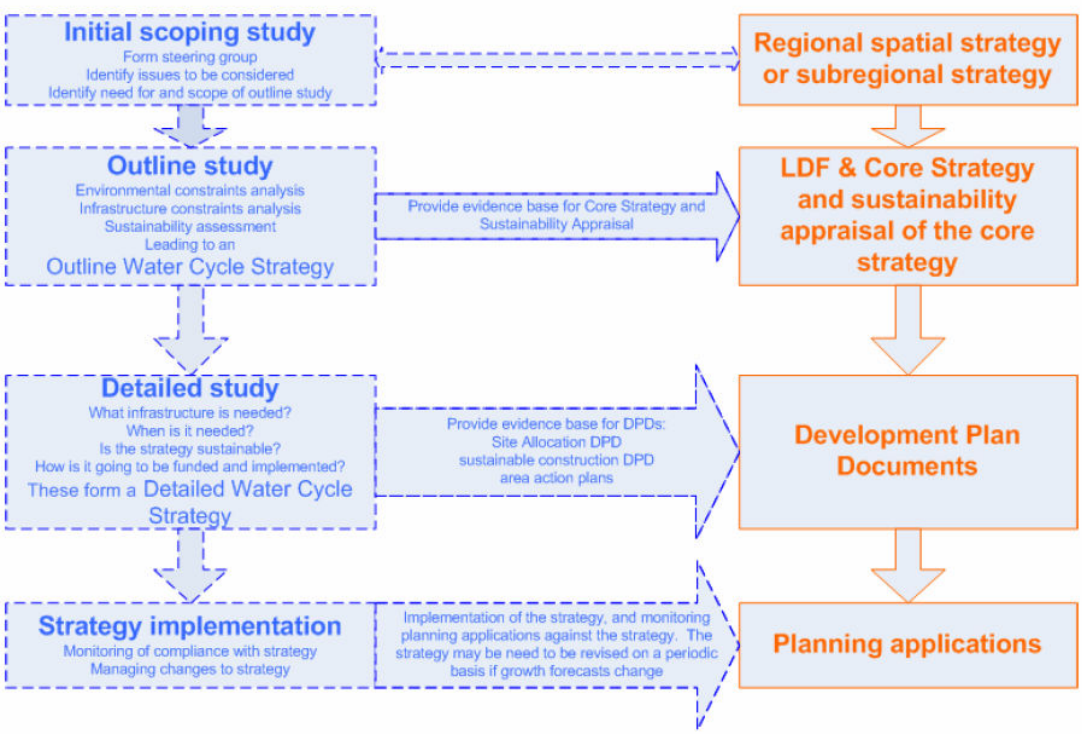
In many parts of the UK, some elements of the natural water cycle are considered to be at, or close to their limit in terms of how much more they can be manipulated. Further development will lead to an increase in demand for water supply and a commensurate increase in the requirement for waste water treatment; in addition, flood risk may increase if development is not planned for in a strategic manner. The sustainability of the natural elements of the water cycle are therefore at risk.

A WCS is an ideal solution to address this problem. It will ensure that the sustainability of new development is considered with respect to the water cycle, and that new WSI introduced to facilitate growth is planned for in a strategic manner; in so doing, the WCS can ensure that provision of WSI is sufficient such that it maintains a sustainable level of manipulation of the natural water cycle.

3.3 Stages of a Water Cycle Study

Current Environment Agency (EA) guidance on WCS's[6] suggests that they should generally be undertaken in three stages, dependent on the status of the various Local Development Documents (LDDs), as part of the wider LDF, being prepared by Local Planning Authorities (LPAs) for submission. To coincide with Bassetlaw's timescales for responses and submissions the WCS is initially being undertaken in two stages: Scoping and Outline. These stages would be followed by a Detailed stage (if required).

Figure 3-2 illustrates the three stages of the WCS and how they inform planning decisions and documents, this study forms the initial Scoping WCS.



3.3.1

Figure 3-2 Stages of the Water Cycle Study Process (Source: Environment Agency)

Scoping Water Cycle Study

The Scoping WCS determines the key 'water-cycle' areas where development is likely to either impact on the water environment, or is likely to require significant investment in water infrastructure (i.e. pipes, or treatment) to service new development.

Its key purpose is to define whether there are significant constraints that would need further assessment to determine whether they affect either the locations of allocation options, or the amount of development that can be provided within an allocation site.

It is a high level assessment that looks at town-wide or area-wide issues. The level of assessment covered is dependent on whether:

- There is a potential for an area-wide negative supply and demand balance for potable water i.e. demand is likely to be greater than supply for the growth area,
- There are any ecologically sensitive sites that have a hydrological link to development i.e. an Scientific Advisory Committee (SAC) wetland site located on a river downstream of discharges from a wastewater treatment works,
- Local watercourses have water quality concerns which will be made worse if further discharge of wastewater from new development occurs.

A Scoping WCS therefore defines the study area, defines the key stakeholders required to input into the study and concludes what issues require further investigation and therefore, what

the scope of future stages of the WCS should be. A Scoping WCS includes preliminary data collection, collation and strategy inception.

Outline Water Cycle Study

The Outline WCS considers all of the ways in which new development will impact on the water environment or water infrastructure specific to where growth is most likely to be targeted. It is usually undertaken during consideration of allocation sites such that it can inform the decision process in terms of where development will be targeted for each authority by identifying the infrastructure required to meet the demands for growth.

The key aim of the Outline WCS is to provide LPAs with the evidence base which ensures that water issues have been taken into account when deciding the location and intensity of development within an authority's planning area as part of the development of the Core Strategy. It also aids in setting core policies related to water as part of the Development Control Policies Supplementary Planning Document (SPD).

Finally, it gives water companies an evidence base to its business plans which determine how much they can charge customers to invest in upgrades and the provision new infrastructure required to service proposed development. Methods for developer contributions to the capital costs of the proposed schemes should therefore be identified.

Detailed Water Cycle Study

Once the principles of the Outline WCS have been agreed by the stakeholders and identified as potential options, a Detailed WCS (if required) would then build upon this. A Detailed WCS can vary significantly in its scope and remit. However, its key purpose is to define what specific infrastructure and mitigation is required to facilitate development, once the decisions have been made on the location of allocations and the likely intensity and type of development within them. It would entail the development of a strategy and provide supporting evidence for the proposed development works and confirm the capital and operating costs associated with these.

Dependent on the findings of the Outline WCS, there could be the potential requirement to undertake detailed and complex studies in order to define exactly what infrastructure or mitigation is required. Furthermore, it would provide an in-depth assessment of developer contributions.

The Detailed WCS should be undertaken in conjunction with the development of DPDs such as Area Action Plans (AAP) and should provide the evidence base to site specific policies in SPDs.

3.4 Integration with the Planning System

As part of the LDF process, LPAs are required to produce evidence based studies which support the selection processes used in deciding on final growth targets and areas to be promoted for growth. The WCS is one such example of an evidence-based study which specifically addresses the impact of proposed growth on the 'water cycle'.

As part of BDC's overall strategy to meet future growth targets set out in the RSS in a sustainable way, the WCS will make up one of a number of strategic studies and plans which

will form part of the evidence base supporting the production of BDCs LDF. Specifically, the WCS will form an important basis for the Core Strategy making up part of the LDF evidence base, as well as providing input to the development of SPDs to assist in ensuring the delivery of water cycle management requirements at the local planning application level. There is a strong inter-relationship between the WCS and other components of the LDF evidence base and this interaction is discussed further in Section 4.

It is important that the findings of the WCS feed into and make use of the findings of other LDF studies that BDC are undertaking. The studies that are particularly relevant include the Bassetlaw SFRA, Harworth Scoping Study and the Strategic Housing Land Availability Assessment (SHLAA). Additionally, the findings of the WCS can be used by BDC in the preparation of its masterplans and design briefs for future development in Bassetlaw.

3.5 Data Availability

The undertaking of a WCS requires a large amount of data collection, much of which is reliant on the willingness of third parties to supply in order to allow the study to be progressed. In some cases, the availability of data with respect to water cycle infrastructure and future planning is not available within the time required to undertake the assessment and various assumptions have to be used to enable the study to continue. This Scoping WCS has collated available information within the project timeline, produced a catalogue of the data collected and further data required to complete the Outline WCS. It also identifies the data provider in each case.

A full list of the data requested is included in the data catalogue in Appendix A – Data Catalogue. This also includes the list of data required for the Outline WCS.

4 Development in Bassetlaw

4.1 Bassetlaw

The administrative area of Bassetlaw is illustrated in Figure 4-1 and covers an area of approximately 631 km2. Bassetlaw has a population of approximately 112,000, with over half of the population living in the towns of Worksop and Retford.

The area is endowed with good quality agricultural land, with the dominant rural land uses being intensive agriculture and the cultivation of protected crops.

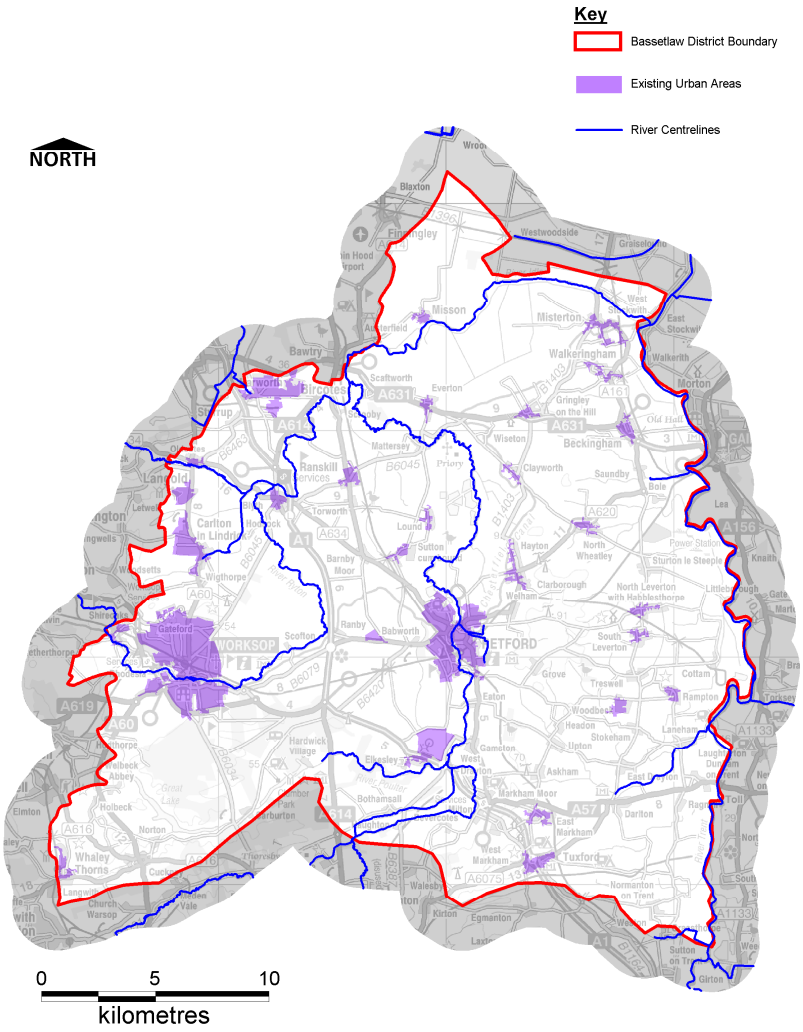


Figure 4-1: Bassetlaw District Area

4.2 Proposals

It is suggested that WCSs should be undertaken in partnership with the LPA, the local delivery vehicle (if applicable), the EA and the local water companies to ensure a sustainable and holistic approach is taken to development design. It is important at this stage to consider the planning timelines, both for BDC in terms of their LDF, but also Severn Trent Water (ST) and Anglian Water Services (AWS) in terms of the funding mechanisms for new water supply and wastewater network and wastewater treatment infrastructure.

4.3 National, Regional and Local Drivers and Policies

4.3.1 National Drivers and Policies

Growth within Bassetlaw is driven by regional planning policy, however any growth and changes to the environment will need to comply with the main EU Directives and UK legislation and guidance on water as provided in Table 4-1.

Table 4-1 EU Directives and UK Legislation and Guidance on Water

Directive/Legislation/ Guidance	Description
Bathing Waters Directive 76/160/EEC	To protect the health of bathers, and maintain the aesthetic quality of inland and coastal bathing waters. Sets standards for variables, and includes requirements for monitoring and control measures to comply with standards.
Code for Sustainable Homes	The Code for Sustainable Homes has been introduced to drive a step-change in sustainable home building practice, providing a standard for key elements of design and construction which affect the sustainability of a new home. It will become the single national standard for sustainable homes, used by home designers and builders as a guide to development, and by home-buyers to assist in their choice of home. It will form the basis for future developments of the Building Regulations in relation to carbon emissions from, and energy use in homes, therefore offering greater regulatory certainty to developers.
Environment Act 1995	Sets out the role and responsibility of the Environment Agency.
Environmental Protection Act, 1990	Integrated Pollution Control (IPC) system for emissions to air, land and water.
Future Water, February 2008	Sets out the Government's vision for water in England in 2030. The strategy sets out an integrated approach to the sustainable management of all aspects of the water cycle, from rainfall and drainage, through to treatment and discharge, focusing on practical ways to achieve the vision to ensure sustainable use of water. The aim is to ensure sustainable delivery of water supplies,

Directive/Legislation/ Guidance	Description
	and help improve the water environment for future generations.
Groundwater Directive 80/68/EEC	To protect groundwater against pollution by 'List 1 and 2' Dangerous Substances.
Making Space for Water, 2004	Outlines the Government strategy for the next 20 years to implement a more holistic approach to managing flood and coastal erosion risks in England. The policy aims to reduce the threat of flooding to people and property, and to deliver the greatest environmental, social and economic benefit.
Planning Policy Statements and Planning Policy Guidance	Planning policy in the UK is set by Planning Policy Statements (PPSs) They explain statutory guidelines and advise local authorities and others on planning policy and operation of the planning system. PPSs also explain the relationship between planning policies and other policies which have an important bearing on issues of development and land use. These must be taken into account in preparing development plans. A water cycle study helps to balance the requirements of the various planning policy documents, and ensure that land-use planning and water cycle infrastructure provision is sustainable. The most relevant PPSs to WCS are: PPS1 – Delivering Sustainable Development; PPS3 – Housing; PPS12 – Local Development Frameworks; PPS23 – Planning and Pollution Control; and PPS25 – Development and Flood Risk.
The Pollution Prevention and Control Act (PPCA), 1999	Implements the IPPC Directive. Replaces IPC with a Pollution Prevention and Control (PPC) system, which is similar but applies to a wider range of installations.
Water Act 2003	Implements changes to the water abstraction management system and to regulatory arrangements to make water use more sustainable.

Directive/Legislation/Guidance	Description
Water Framework Directive (WFD) 2000/60/EC	The WFD was passed into UK law in 2003. The overall requirement of the directive is that all river basins must achieve "good ecological status" by 2015 unless there are grounds for derogation. The WFD will, for the first time, combine water quantity and water quality issues together. An integrated approach to the management of all freshwater bodies, groundwaters, estuaries and coastal waters at the river basin level will be adopted. It will effectively supersede all water related legislation which drives the existing licensing and consenting framework in the UK. UKTAG[7], the advisory body responsible for the implementation of the WFD in the UK, has proposed water quality, ecology, water abstraction and river flow standards to be adopted in order to ensure that water bodies in the UK (including groundwater) meet the required status[8]. These are currently in draft form and will not be formalised until the final River Basin Management Plans are finalised in December 2009 (prior to EC sign off. The WCS is required to consider the longer term issues with respect to the water cycle and water environment and as such, an assessment of the impact of the interim WFD standards has been considered.
Water Resources Act, 1991	Protection of the quantity and quality of water resources and aquatic habitats.

4.3.2 Regional Drivers and Policies

The East Midlands Regional Spatial Strategy

The East Midland Regional Plan (2009) identifies Worksop as a sub-regional centre, having potential to accommodate sustainable growth.

Table 4-2 Water Related Policies in East Midlands RSS[9]

Policy	Description
Policy 33: Regional Priorities for Strategic River Corridors	Development Plans, future Local Development Frameworks, and other strategies of local authorities and other agencies should seek to protect and enhance the natural and cultural environment of the region's strategic river corridors of the Nene, Trent, Soar, Welland, Witham, Derwent and Dove, along with their tributaries, and rivers which contribute to river corridors of a strategic nature in adjoining regions. Actions of agencies and other bodies including those of adjoining regions should be

[7] The UKTAG (UK Technical Advisory Group) is a working group of experts drawn from environment and conservation agencies. It was formed to provide technical advice to the UK's government administrations and its own member agencies. The UKTAG also includes representatives from the Republic of Ireland.
[8] UK Environmental Standards and Conditions (Phase I) Final Report, April 2008. UK Technical Advisory Group on the Water Framework Directive.
[9] Regional Spatial Strategy for the East Midlands, East Midlands, Government Office for the East of England, March 2009.

Policy	Description
	co-coordinated to maintain and enhance the multi-functional importance of strategic river corridors for wildlife, landscape and townscape, regeneration and economic diversification, education, recreation, the historic environment, including archaeology, and managing flood risk.
Policy 32: A Regional Approach to the Water Resources and Water Quality	*"Development Plans, future Local Development Frameworks, and policies of the Environment Agency and other agencies should be co-ordinated to:* *• take water related issues into account at an early stage in the process of identifying land for development;* • protect and improve water quality and reduce the risk of pollution especially to vulnerable groundwater, • manage supply and demand, require sustainable drainage where practicable and promote the efficient use of water, • reduce unsustainable abstraction from watercourses and aquifers to sustainable levels, • locate and phase development to take account of constraints on water resources, • plan rural areas to include winter storage reservoirs and lessen the impact of abstraction from rivers ."
Policy 35: A Regional Approach to Managing Flood Risk	"Development Plans, future Local Development Frameworks, and strategies of relevant agencies should: • be informed by the use of appropriate Strategic Flood Risk Assessments in order to evaluate actual flood risk and should include policies which prevent inappropriate development either in, or where there would be an adverse impact on, the coastal and fluvial floodplain areas; • deliver a programme of flood management schemes that also maximise biodiversity and other regeneration benefits; • require sustainable drainage in all new developments where practicable, • Development should not be permitted if, alone or in conjunction with other new development, it would: • be at unacceptable risk from flooding or create such an unacceptable risk elsewhere, • inhibit the capacity of the floodplain to store water, • impede the flow of floodwater, • have a detrimental impact upon ground water storage capacity, • otherwise unacceptably increase flood risk, • interfere with coastal processes. However, such development may be acceptable on the basis of conditions or agreements for adequate measures to mitigate the effects on the overall flooding

Policy	Description
	regime, including provision for the maintenance and enhancement (where appropriate) of biodiversity. Any such measures must accord with the flood management regime for that location. Strategic flood risk assessments should be carried out where appropriate to inform the implementation of this policy."

4.3.3 Local Drivers and Policies

Local Development Framework

The LDF for Bassetlaw is a statutory spatial development plan that comprises a portfolio of documents including the Core Strategy and the supporting Site Allocation DPDs. The LDF will set out the spatial strategy, policies and proposals to guide the future development and use of land in Bassetlaw up to the year 2026. BDC must ensure it coordinates and prepares LDF documents and policies, including preferred development locations, infrastructure and delivery plans that have had regard to the intent and steer from national policies, the RSS, as well as local aspirations, needs and demands

The Core Strategy is the overarching DPD that provides the strategic framework for the other DPDs and SPDs. In particular, the Site Specific Allocations and Policies DPD will set out the sites that will deliver the Core Strategy Spatial Strategy, policies and targets. All these Plans must conform to the Core Strategy and help to deliver its strategic objectives and policies. BDC will also produce SPDs that provide further guidance to support policies in the DPDs.

It is essential that these are all informed using the findings and advice from a sound evidence base that examines economic, social and environmental needs and constraints. This must include the comprehensive planning, phasing, delivery and management of water, sewerage, flooding and drainage infrastructure, whilst not adversely affecting environmental capacity. A critical element is therefore to consider in greater detail, the risks associated from all forms of flooding and the existing state, limitations and future requirements of the Bassetlaw water cycle system in the context of future growth.

The BDC LDF will set out the plan for directing development within the area. The choice of where to locate new development and new wastewater sites, will directly impact upon one another. Due to this, the findings of the WCS will be important in future alterations to the LDF – particularly the Core Strategy, Site Specific Allocations and Minerals and Waste DPDs.

The LDF process involves an extensive process of consultation. This overall planning process supports a staged strategy for the WCS, so that important considerations are not overlooked in between the production of the Scoping WCS, an Outline WCS (which informs the draft LDDs) and a Detailed WCS (if required), which will ensure that the final LDF has sufficient detail to ensure delivery of the WCS requirements. The WCS will also make recommendations on phasing for development.

Water Company Planning

It is important to consider the planning timelines, both for BDC in terms of the LDF, but also ST and AWS in terms of the funding mechanisms for new water supply and wastewater infrastructure.

There are two elements of Water Company Planning that are pertinent to the Bassetlaw WCS and specifically, with regard to integration with Spatial Planning timelines for LPAs and Regional Government.

Financial and Asset Planning

Water companies currently plan for Asset Management and the financial procurement required for this through the Asset Management Plan (AMP) process which runs in 5 year cycles. The Office of Water Services (OFWAT) is the economic regulator of the water and sewerage industry in England and Wales, and regulates this overall process.

In order to undertake maintenance of its existing assets and to enable the building of new assets (asset investment), water companies seek funding by charging customers according to the level of investment they need to make. The process of determining how much asset investment required is undertaken in conjunction with:

- Environment Agency (EA) as the regulator determining investment required to improve the environment,
- Drinking Water Inspectorate (DWI) who determine where investment is required to improve quality of drinking water,
- OFWAT who along with the EA require Water Companies to plan sufficiently to ensure security of supply (of potable water) to customers during dry and normal years.

The outcome is a Business Plan which is produced by each Water Company setting out the required asset investment over the next 5 year period, the justification for it and the price increases required to fund it.

Overall, the determination of how much a Water Company can charge its customers is undertaken by OFWAT. OFWAT will consider the views of the Water Company, the other regulators (EA and DWI) and consumer groups such as the Consumer Council for Water when determining the price limits it will allow a Water Company to set in order to enable future asset investment. This process is known as the Price Review (PR) and is undertaken in 5 year cycles. When OFWAT make a determination on a Water Company's business plan, the price limits are set for the proceeding five year period allowing the water company to raise the funds required to undertake the necessary investment which will also be undertaken in that 5 year planning period (the AMP period).

Both ST and AWS published their respective draft Business Plans (BP) for Price Review 2009 (PR09) in August 2008. OFWAT have responded to this plan, individually and in collective response published in October/November 2008. Both water companies have now submitted their final BPs which will seek funding for asset investment for the 5 year period covering 2010-2015 (known as AMP5). Both these companies final BPs were published in April 2009.

Ideally any new asset (or infrastructure) investment required to meet the requirements of the WCS should be incorporated into the final BPs. The timing of the Bassetlaw WCS will mean that only those infrastructure improvements which have been included in the final BPs will have a chance of being funded during the AMP5 period. In effect, this will mean that the outcome of this Scoping/Outline Study WCS will be mainly designed to inform the next Price Review, which comes towards the end of AMP5 and which would result in funding not being available until AMP6 running from 2015-2020.

The WCS is therefore essential for several reasons; it allows the discrepancies in the planning timeframes of ST, AWS and BDC to be reconciled through strategic planning as well as providing sufficient evidence base for BDC's statutory LDF process and robust evidence and justification for both ST's and AWS's Strategic Business Plans for investment required in AMP5 (2010-2015) and beyond.

Water Resource Planning

Water Companies are now required to produce Water Resource Management Plans (WRMP) on a statutory basis covering 25 year planning horizons. WRMPs set out how a water company plans to provide and invest in existing and new water resource schemes (e.g. reservoirs, desalination) to meet increases in demand for potable supply, as a result of new development, population growth and climate change over the next 25 year period. When complete, the new statutory WRMPs will be updated in 5 yearly cycles to coincide with the Price Review and AMP process.

Both ST and AWS submitted their respective draft WRMP to the EA in April 2008. These plans have been commented on by the EA in a response published on 11th August 2008. A statement of response to the consultation on the draft WRMP was published by both water companies in February 2009. Both companies have now submitted their final WRMPs for the next 25 year period (2010-35). Their final WRMPs are due to be published at the end of July 2009 (subject to approval by DEFRA). In effect, this will mean that only the findings from the draft WRMP and the statement of response have been incorporated into the Bassetlaw WCS Scoping Report. It may therefore be necessary to revisit the water resources aspects presented in this report, to incorporate the findings of the final WRMPs as part of the outline stage of this WCS.

It can therefore be seen that the WCS is crucial to bridging the gap between the LDF timeframe and the Water Company planning timeframe in terms of strategic planning for new water resources to meet development.

Additional Information

In addition to the legislation and guidance set out in Table 4-1 and above, the following studies and reports are relevant to and, where available, have been used within the Scoping WCS:

- Environment Agency's Trent Corridor Catchment Abstraction Management Strategy – June 2003 and [1] Idle and Thorne CAMS – March 2007,
- Bassetlaw Scoping Study for Harworth – ongoing,
- Bassetlaw Strategic Flood Risk Assessment – ongoing,
- Bassetlaw Housing Market Assessment – 2007,
- Bassetlaw Strategic Housing Land Availability Assessment – ongoing.

5 Water Cycle Environment and Infrastructure

5.1 Introduction

This section describes the baseline water resources assessment for the Bassetlaw WCS Scoping Study. The main sources of information used have been publicly available documents from the Water Company and EA websites. Further detailed information is expected to be published in April 2009 by the Water Companies in the form of their Final WRMPs and this information will be included in the next stage of reporting, the Outline WCS.

5.2 Water Resources and Supply

Climate

The average annual rainfall for the Bassetlaw area is 620mm[10,] less than the annual average rainfall for England of 897mm.

Geology and Groundwater

There are two Major Aquifers[11] underlying Bassetlaw; the Lower Magnesian Limestone (LML) and the Sherwood Sandstone (SS). The LML outcrops along the western flank of the district where it provides a baseflow contribution to various tributaries of the River Idle, including the Rivers Poutler and Ryton. The SS outcrops in a wide north/south strip though the district between Worksop and Retford. Further east, this strategically important groundwater resource becomes confined by mudstones which extend as far as the River Trent.

The change in geology from the more permeable formations (e.g. limestones and sandstones) in the west of the district to more impermeable formations (e.g. mudstones) in the east, will create marked differences in the groundwater vulnerability across Bassetlaw. An extract from the EA's Groundwater Vulnerability Maps is shown in Figure 5-1. This shows clearly the Major Aquifer in the west of Bassetlaw and the Non-Aquifer[12] in the east.

[10] Environment Agency; Idle and Thorne Catchment Abstraction Management Strategy – Final Document
[11] A Major Aquifer is Highly Permeable strata usually with a known or probable presence of significant fracturing
[12] A Non aquifer is a formation with negligible permeability that is generally considered as containing insignificant quantities of groundwater.

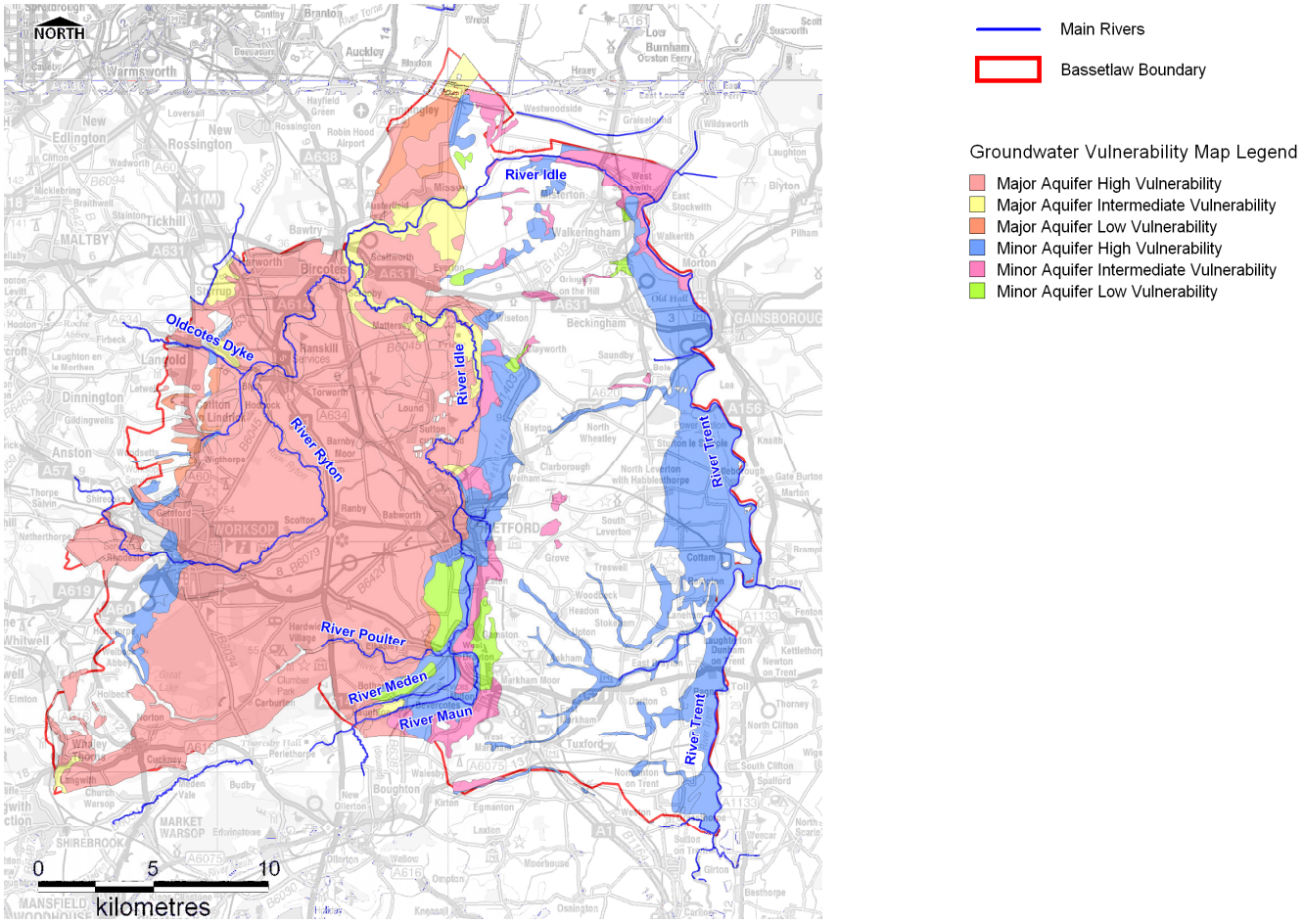


Figure 5-1: Bassetlaw Groundwater Vulnerability Classifications
(Source: Environment Agency)

Rivers

The main waterbodies in Bassetlaw include the River Trent, River Idle (and River Poulter), River Ryton and the Chesterfield Canal (Figure 5-2).

River Trent

The River Trent forms the eastern boundary of Bassetlaw, flowing generally northwards. The River Trent rises in the Staffordshire Moorlands and is joined by major tributaries in the upper catchment before flowing north east towards the Humber estuary. The River Trent catchment is predominantly impervious with the catchment consisting largely of glacial clay and Mercia Mudstone, but also with areas of sandstone and limestone. The tidal extent of the River Trent is at Cromwell Lock, downstream of Newark and therefore is tidal through Bassetlaw.

Through Bassetlaw, the River Trent catchment is very flat and rural, with a generally very wide and meandering channel and associated wide floodplain.

River Idle

The River Idle is a main tributary of the River Trent. It flows from south to north through the centre of Bassetlaw, passing though Retford to its confluence with the River Ryton at Bircotes. The river then continues to flow in a north easterly / easterly direction to its confluence with the River Trent at West Stockwith.

The River Idle has a total catchment area of 896 km^2 and is formed at the confluence of the River Maun and River Meden near Markham Moor in South Yorkshire. The catchment is low lying, in particular downstream of Bawtry where the catchment comprises very low-lying, heavily drained farmland with numerous sand and gravel pits. Parts of the upper catchment drain permeable Sherwood Sandstone and as a result parts of the catchment are spring-fed with a considerable contribution to flows from groundwater. To help drainage from the low-lying parts of the River Idle catchment, the river is pumped into the River Trent during high tidal levels (on the River Trent).

Tributaries of the River Idle upstream of Bassetlaw rise on Magnesian Limestone and then traverse an outcrop of Sherwood Sandstone.

River Maun

The River Maun rises near Sutton-in-Ashfield and from there it flows north east through Mansfield, Edwinstowe and Ollerton. The River Maun is known as Whitewater near the village of Walesby and temporarily converges with the River Meden where the Robin Hood Way crosses them. They then split near Bothamsall and converge again near Markham Moor, forming the River Idle. The River Maun's main tributaries are Rainworth Water and Vicar Water.

River Meden

The River Meden rises just north of Huthwaite, near the Nottinghamshire / Derbyshire border and from there it flows north east through Pleasley and Warsop before converging with the River Maun, before splitting and merging again near Markham Moor to form the River Idle.

River Poulter

The River Poulter flows from west to east from Welbeck Abbey, Carburton and Elkesley to its confluence with the River Idle. The river has been dammed to form ornamental lakes for the Dukeries Estates of Welbeck Abbey (Shrubbery Lake, Great Lake, Carburton Forge Lake, and Carburton Dam) and Clumber Park (Clumber Lake). The River Poulter rises on magnesian limestone before crossing onto the Sherwood Sandstone outcrop to join the River Idle close to the A1.

River Ryton

The River Ryton rises at Anston, north west of Worksop and flows south eastwards towards Shireoaks. At Rhodesia, the River Ryton flows eastwards through Worksop, before typically meandering in a north easterly direction through Scotton. From here the river redirects northwards through Hodsock and Blyth to its confluence with the River Idle near Bawtry. The River Ryton rises on Magnesian Limestone before crossing onto the Sherwood Sandstone outcrop to join the River Idle at Scaftworth. There are flood defences on the River Ryton at Worksop.

Other watercourses

In addition to the main river systems, there are several smaller watercourses, ditches and drains within Bassetlaw including Retford Brook. Any run-off from future development within the locality of these watercourses will require attenuation, to be agreed with the EA, ST, AWS and IDBs, prior to discharge to the watercourse network (surface water or treated effluent).

Chesterfield Canal

The Chesterfield Canal lies on a south west to north east orientation through Bassetlaw. The canal links Gainsborough to the north and Chesterfield to the south west. It passes through Worksop, Ranby and Retford, running due north between Retford and the A631 (between Everton and Wiseton) and then north east to Walkeringham. Restoration of the Chesterfield Canal was completed in 2006 following a nine year restoration project. BDC formed part of the canal restoration consortium and it is now navigable for 31 km from the River Trent at West Stockwith to the Norwood Tunnel at Kiveton Park. A further 5 km isolated section is available for trailboats between Chesterfield and Staveley.

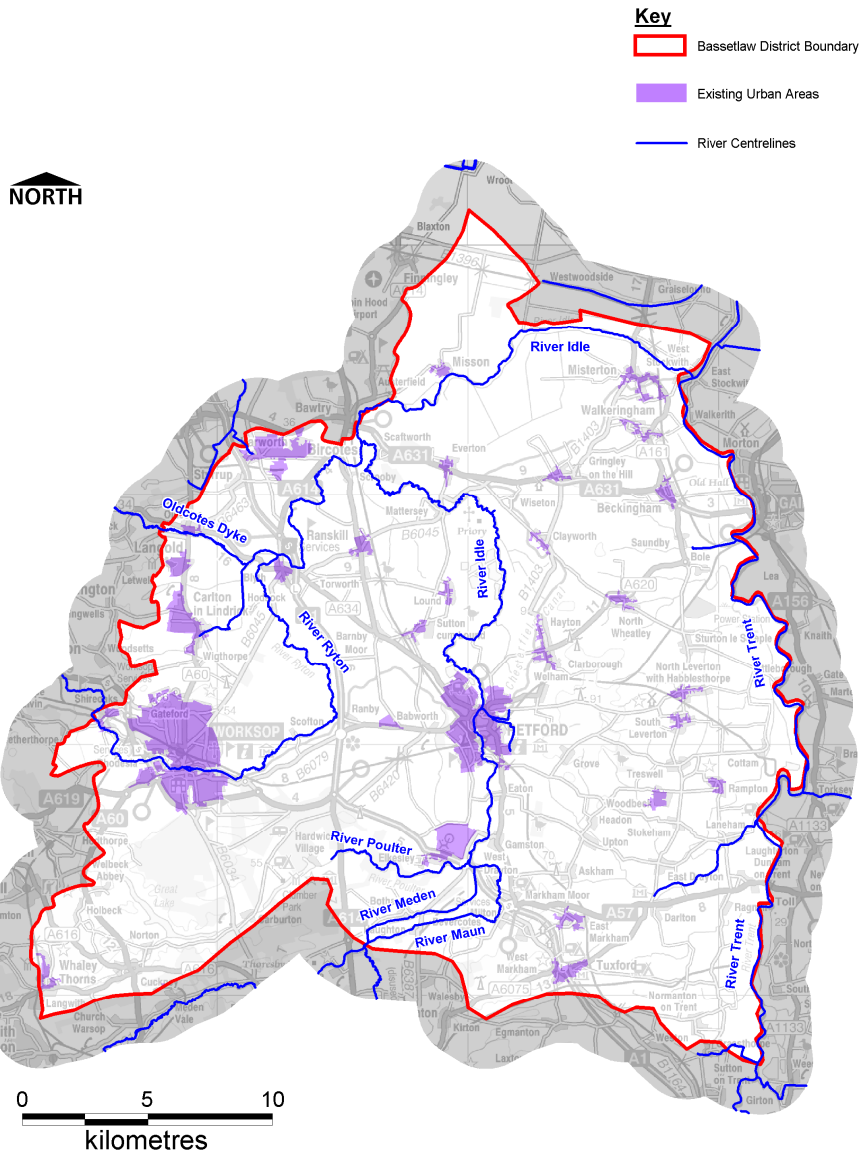


Figure 5-2 Watercourses in Bassetlaw
(Source: Environment Agency)

5.2.1 Types of Abstractions

Groundwater Abstractions

There are several major groundwater supply abstractions within Bassetlaw. Figure 5-3 shows the Source Protection Zones (SPZ) around these major Public Water Supply abstraction sources. These zones help to monitor the risk of contamination from any activities that might cause pollution in the area. There are four zones:

Zone 1 (Inner protection zone)

Any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being inside zone 1. This applies at and below the water table. This zone also has a minimum 50 metre protection radius around the borehole. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.

Zone 2 (Outer protection zone)

The outer zone covers pollution that takes up to 400 days to travel to the borehole, or 25% of the total catchment area – whichever area is the biggest. This travel time is the minimum amount of time that we think pollutants need to be diluted, reduced in strength or delayed by the time they reach the borehole.

Zone 3 (Total catchment)

The total catchment is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

Zone of special interest

Sometimes a fourth zone is identified. This is usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment area.

The presence of SPZs means that there is the potential for discharges from development areas in the west of the district in particular to affect the underlying Major aquifer.

Development within the east of the district is likely to have less impact on groundwater, as there are no abstractions to the east of north-south line running through the town of Retford. Retford is also the location of Grove WTW (AWS) which is fed by four boreholes abstracting water from the Sherwood Sandstone aquifer. In addition to this site, AWS also operates another twelve boreholes at three other sites across Bassetlaw. It is understood that the Grove WTW currently exports much of its output out of Bassetlaw to feed other demand centres within AWS operational area.

ST also operates a number of groundwater fed WTWs both locally within Bassetlaw and in the surrounding districts. ST currently operates eighteen borehole sources within Bassetlaw. Although the actual amounts of water abstracted are understood to be much less than the licensed quantity, mainly due to water quality problems at a number of these sources (Section 5.2.7).

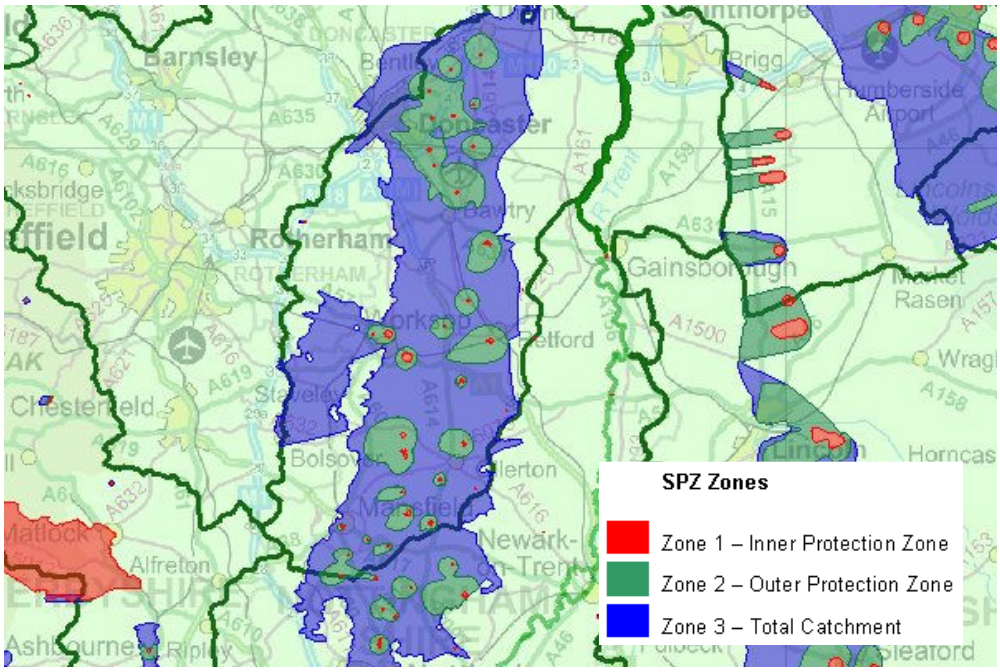


Figure 5-3: Source Protection Zones around Bassetlaw
(Source: Environment Agency)

Surface Water Abstractions

There are no major public water abstractions from surface water within Bassetlaw. Surface water abstractions take place from reservoirs and river systems in adjoining areas and some of this water may be brought into Bassetlaw via the strategic treated water mains network at times of high demand (Section 5.2.6).

5.2.2 Water Resources Management

The EA manages water resources at the local level through the use of Catchment Abstraction Management Strategies (CAMS) and Bassetlaw lies within the Idle and Thorne CAMS[13].

Within the CAMS, the EA's assessment of the availability of water resources is based on a classification system that gives a resource availability status and indicates:

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

The categories of resource availability status are shown in Table 5-1. The classification is based on an assessment of a river system's ecological sensitivity to abstraction-related flow reduction. This classification can then be used to assess the potential for additional water resource abstractions.

[13] Idle and Thorne CAMS, Environment Agency, 2007

Table 5-1: CAMS resource availability status categories

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

The Idle and Thorne CAMS catchments are split into five Water Resource Management Units (WRMUs). Bassetlaw falls within two WRMUs:

- WRMU4 - Rivers Idle,
- WRMU2 – River Upper Poulter.

WRMU2 has 'Water Available' at present, although it is predicted that there will be 'No Water Available' by 2010. Whilst, WRMU4 has been assessed as 'Over Abstracted', the CAMS plans being to reduce this status to 'Over Licensed' status by 2010.

The EAs view is that the AWS area (in the east of district) lies within an area of 'serious water stress', whilst the ST area (in the west) lies within an area of 'moderate water stress'[14]. This definition is based on the above CAMS resource assessments and the water demand situation, both for current and forecast growth[15].

Future growth cannot therefore rely on new local resources being developed and instead will have to rely on greater efficiency in water use from either existing local sources or regional resource schemes in neighbouring supply zones.

5.2.3 Water Supply

Bassetlaw is supplied by two water companies, the west of the district is served by ST and the east by AWS.

[14] Environment Agency; 2007; Areas of Water Stress, Final Classification; Environment Agency
[15] Environment Agency; 2007; Areas of Water Stress, Final Classification; Environment Agency

The ST[16] supply zone for Bassetlaw is the East Midlands Water Resource Zone (WRZ6). The main sources of supply are from groundwater around Worksop and Mansfield. There are no surface water sources used locally. The main ST WTW is located to the southwest of Mansfield and the treated water from this works is exported into the west of Bassetlaw. The large deficits originally forecast for this WRZ in the draft WRMP[17], have now been revised in STs Statement of Response (SoR) to the consultation on the draft WRMP[18.] The SoR is now showing that WRZ6 to be in surplus (i.e. resources exceeding demands) over the entire planning period through to 2035/36. It is understood that the changes since the publication of the draft WRMP are due to revisions of the effects of climate change impacts on resources and also updated demand forecasts in the light of the recent economic circumstances. The effect of these changes will mean that STs investment plans, at least in the short to medium term (AMP5 to AMP8, 2010-30) will be mainly focused on demand management, plus some improvements in their strategic treated water mains network (Figure 5-4).

The AWS[19] supply zone for Bassetlaw is in the Lincoln Water Resources Zone (WRZ2). WRZ2 is split into two planning zones (PZ):

- East Retford (PZ10),
- Everton (PZ11).

The draft WRMP[20] stated that PZ10 and PZ11 were both forecast to be in slight deficits of 1.78 Ml/d and 0.46 Ml/d respectively by 2035/36. In AWS SoR[18] to the consultation of the draft WRMP21, these two PZs have surpluses in the baseline forecast case. No details are given about the situation through the rest of the planning period to 2035. The list of schemes included in the SoR makes reference to a new Lincoln WTW to be built within AMP5 (2010-15) and which lies within WRZ2. The 20 Ml/d of extra water from this works could therefore potentially be available to support development within the east of Bassetlaw. Until AWS final WRMP is due to be published 2009, full details about the investment plans within the district will not be known for certain.

[16] Severn Trent Water Draft Water Resource Management Plan, 2008
[17] Severn Trent Water Draft Water Resource Management Plan, 2008
[18] Severn Trent Water Water Resource Management Plan – Statement of Response, 2009
[19] Anglian Water Draft Water Resource Management Plan, 2008
[20] Anglian Water Draft Water Resource Management Plan, 2008
[21] Anglian Water Water Resource Management Plan – Statement of Response, 2009

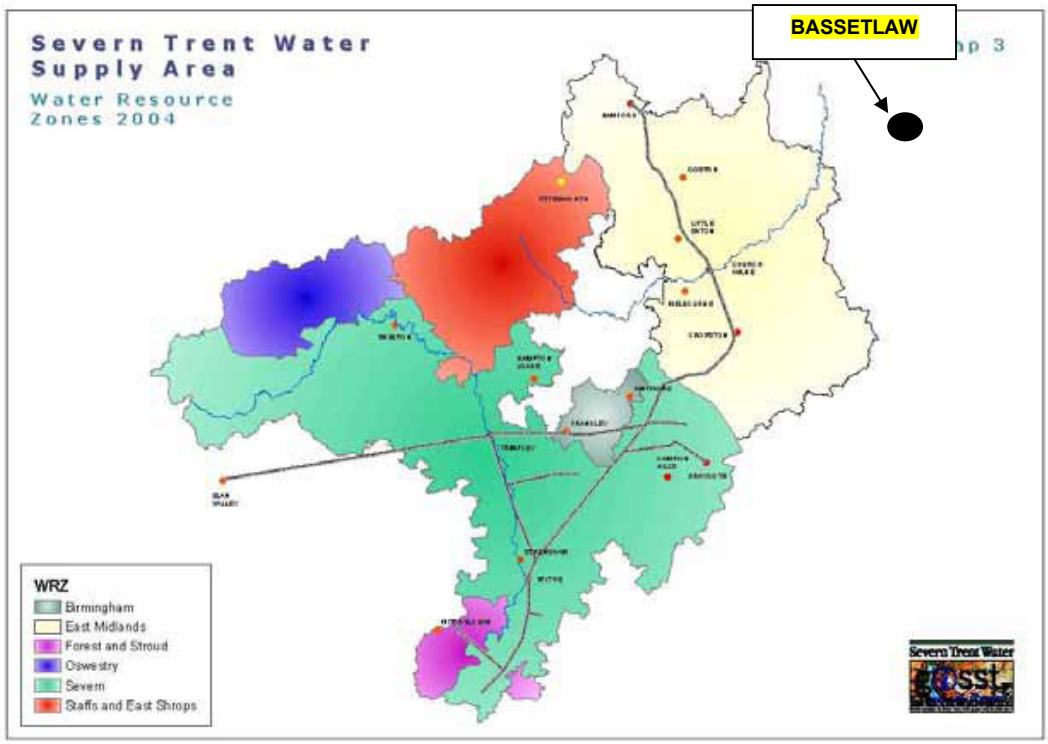


Figure 5-4: ST WRZs and Strategic Treated Water Transfer Grid

5.2.4 Potential Risks to Supply

The potential risks to both ST and AWS supplies may come from a number of areas, including:

- Groundwater quality within its aquifers – ST forecast that by 2035 increasing nitrate concentrations will mean that many of its groundwater sources will no longer suitable for water supplies22. The main source of nitrate is from agricultural inputs, which may or may not change in the future,
- Climate change – this principally affects surface water systems, which represent a relatively small part of the total supply to Bassetlaw. However climate change may also affect demand and whilst Water Companies can forecast patterns, the unexpected may happen,
- Review of Consents process – being undertaken by the Environment Agency is looking at the effects of both abstractions and discharges on nationally designated sites e.g. SSSI's SACs etc…The ST draft WRMP[23] mentioned that the aquifer in Nottinghamshire is under pressure from abstractions and that two 'top-up' schemes for local rivers had been introduced to compensate for impacts. It is not known what the final outcome of the RoC process has been and whether further investigations will be required at either of these sites,
- Water Framework Directive (WFD) – The ST draft Business Plan[24] contains details of catchment solutions, to be implemented instead of and in parallel to treatment solutions, for

[22] Severn Trent Water Draft Water Resource Management Plan, 2008
[23] Severn Trent Water Draft Water Resource Management Plan, 2008
[24] Severn Trent Water Draft Business Plan, 2008

both nitrate and other water quality problems. The work proposed for 2010-15 should help influence and will inform how ST implements the WFD River Basin Management Plan Cycles.

5.2.5 Next Stage – Outline WCS

The next stage of the WCS will include:

- A full assessment of what the additional (regional) demand from the new growth (both from the extra homes and jobs) will be,
- A review of the spare licence quantities available from sources within the Bassetlaw District and surrounding areas,
- A review of the options for meeting the extra water supply demand required, including in the area of demand management,
- A review of the options for meeting the extra wastewater management demands.

5.3 Flood Risk

A review of flood risk in the WCS is essential to ensure that the risk of flooding to new development is managed and mitigated in accordance with PPS25 and that new development is steered away from high risk areas (EA Flood Zone 2 and Flood Zone 3[25]). It will also ensure that any flood mitigation measures are planned in a strategic manner. It is also essential that there is no deterioration to existing neighbouring communities' standards of protection, or subsequent increases in flood risk.

5.3.1 Local Hydrology and Flood Zones

As stated in Section 0, the main waterbodies in Bassetlaw include the River Trent, River Idle, River Maun, River Meden, River Poulter, River Ryton and the Chesterfield Canal. The East Midlands Regional Flood Risk Assessment (RFRA) states that Bassetlaw has more than 10% of its area in Flood Zone 3.

River Trent

Severe flooding can occur in this reach of the River Trent, during times of high flows in the channel coinciding with high tides in the Humber Estuary preventing free discharge. The effects are exacerbated by low-lying land, which is easily inundated and difficult to drain.

Flow in the River Trent along the reach through Bassetlaw is influenced by public water supply abstraction, groundwater abstraction, recharge and effluent returns.

There are extensive areas of Flood Zone 2 and Flood Zone 3 extending out from the left bank within the eastern fringe of the district, covering areas including northwards through Rampton, Ragnall, Cottam, Littleborough, North Leverton, Habblesthorpe and West Stockwith. However, much of the River Trent floodplain is agricultural in nature and predominantly isolated properties are at risk of flooding.

[25] Environment Agency Flood Zones, www.environment-agency.gov.uk

Numerous further tributaries of the River Trent flow generally eastwards through the eastern area of Bassetlaw. The general extent of inundation from these watercourses in relation to settlements in these areas are minimal; however parts of Flood Zone 2 and Flood Zone 3 associated with some of these tributaries coincide with the villages of Treswell, North Leverton with Habblesthorpe, North Wheatley and Saundby in particular having a greater risk.

There are also washlands in operation to the west of Gainsborough to attenuate flood flows and store water in times of flood.

River Maun and River Meden

The River Maun and River Meden flow generally parallel in the south of Bassetlaw. The floodplain associated with these watercourses is constrained and primarily affects agricultural land and woodland. However, some isolated properties are at risk of flooding in the villages of Haughton, Bevercotes, Milton and West Drayton.

River Poulter

The predominantly rural floodplain of the River Poulter is generally constrained by the valley topography and therefore, minimal areas of Carburton, Hardwick Village and Elkesley are at risk from inundation by Flood Zone 2 and Flood Zone 3.

River Ryton

There are areas within the predominantly rural floodplain of the River Ryton at risk from Flood Zone 2 and Flood Zone 3. The greatest risk is posed to the centre of Worksop and the B4065 and A634 roads near Blyth. There are flood defences on the River Ryton at Worksop.

River Idle

There are extensive areas within Flood Zone 2 and Flood Zone 3 of the River Idle between Gamston and its confluence with the River Trent. There are significant areas of flood risk in Retford town centre and the village of Misson, with large swathes of rural land and isolated properties also at risk of flooding. There are flood defences on the River Idle at Retford in the Thrumpton Lane area and washlands in operation to the south of Misson.

Oldcotes Dyke

There areas at risk from inundation by Flood Zone 2 and Flood Zone 3 of Oldcotes Dyke are those to the south of the A634 and the southern boundary of Oldcotes village; however the extent of this area is minimal.

Chesterfield Canal

The Chesterfield Canal lies on a south west to north east orientation through Bassetlaw. The canal links Gainsborough to the north and Chesterfield to the south west. There are no recorded instances of flooding associated with the canal.

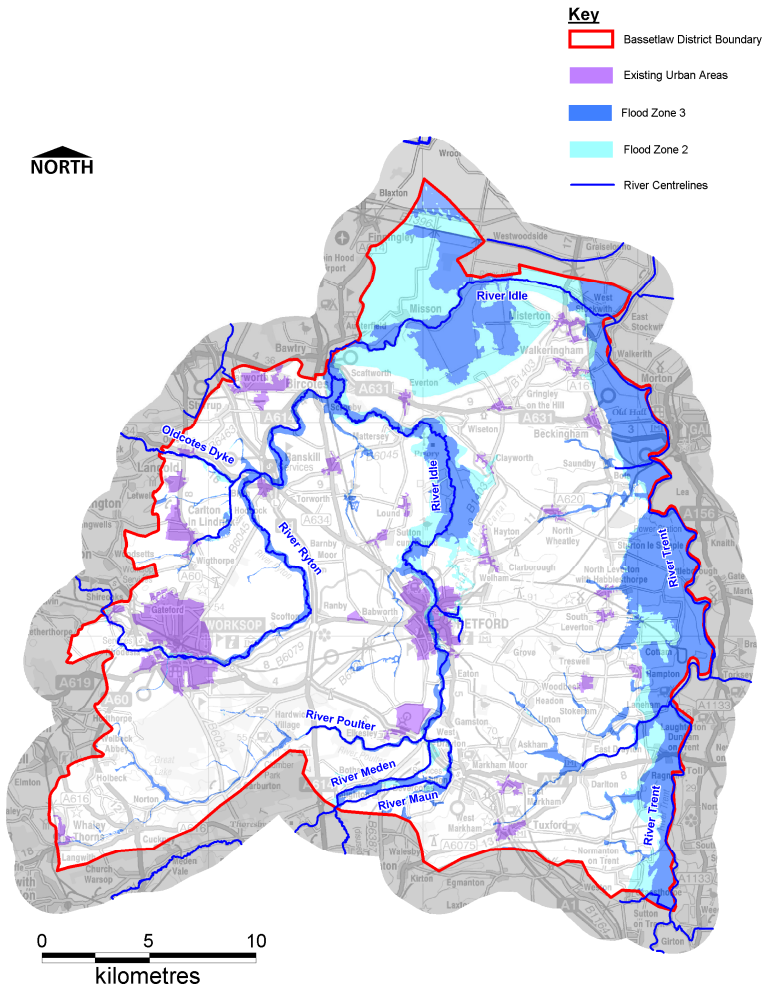


Figure 5-5- Flood Risk Zones
(Source: Environment Agency)

BDC are currently finalising their SFRA and this will provide more detailed information on flood risk in the district from fluvial, tidal, surface water, groundwater and artificial sources to aid BDC in their application of the Sequential Test and inform the Sustainability Appraisal (SA) and subsequent planning policies. Until completed, it is not at this stage possible to report fully on the flood risk baseline within Bassetlaw; however, once published the SFRA will be reviewed and considered in more detail in the later stages of the WCS.

5.4 Wastewater Treatment and Collection

ST are solely responsible for operation and maintenance of the existing foul sewerage system and surface water drainage within Bassetlaw. ST is not responsible for the operation or maintenance of soakaways, land drainage, highways drainage, SuDS or septic systems.

The principal WwTWs serving Bassetlaw are Retford, Worksop, Lound, Ranskill, Mattersey, Thorpe, Walkeringham, East Stockwith, North Wheatley, Rampton, East Markham, Elkesley, Gamston plus a few smaller facilities (Figure 5-6).

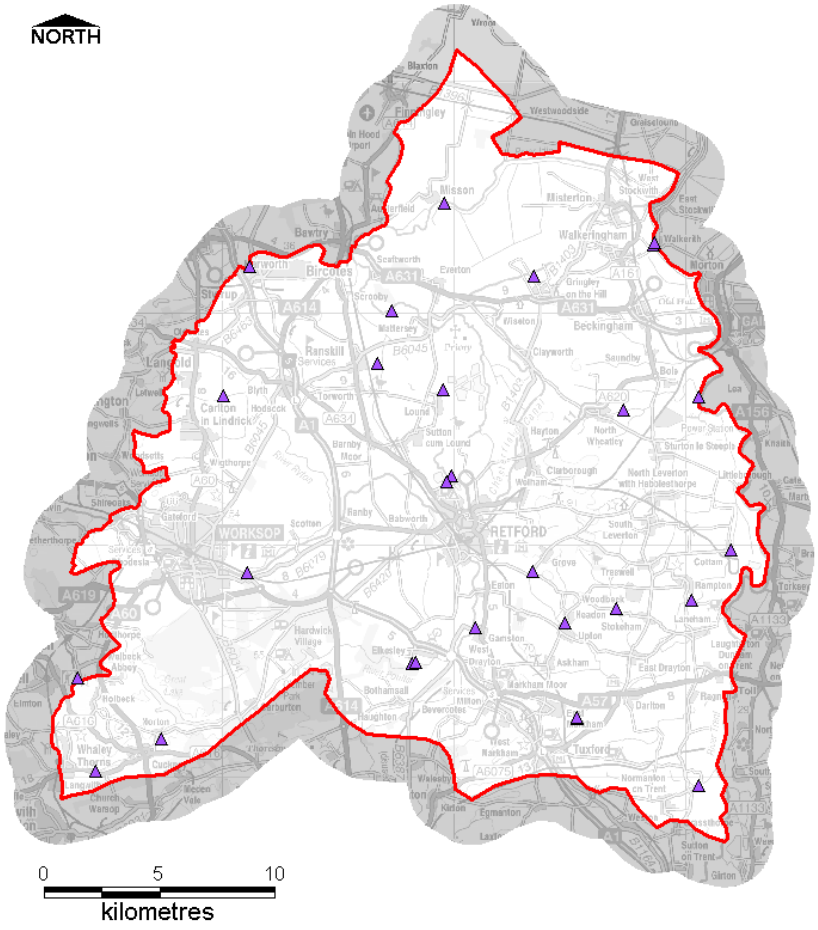


Figure 5-6- Wastewater Treatment Works
(Source: Environment Agency)

It is clearly useful to identify areas where new development could put pressure on the sewage treatment infrastructure and where there is a particular problem with nutrient enrichment. Nitrates and phosphates come from a range of sources, principally agriculture and treated sewage effluent. If some WwTWs increase in size they may be required to significantly reduce the amount of phosphate they discharge. Key to assessing water and wastewater capacity is not just the location of proposed development, but the type and the timing (start, duration, phasing etc.). At that point any additional investment can be identified and then the critical path identified from when the assets are required and how long they will take to deliver.

As part of future stages of the WCS, it will be important to fully assess existing water supply and wastewater infrastructure and also determine any spare capacity of local WwTWs.

At this stage, the following comment has been made by ST regarding wastewater capacity in Bassetlaw:

> *"In general terms we do not anticipate any particular issues with the wastewater systems however the key to future performance is the effective management of surface water run-off. We would expect surface water on new developments to be managed in a sustainable manner in line with the Government's new Water Strategy, Future Water, which sets out a vision for more effective management of surface water to deal with the dual pressures of climate change and housing development. We would not expect surface water to be conveyed to the foul or combined sewerage system and where practicable we support the removal of surface water already connected to foul or combined sewer."*

This would be required as a sound starting point for more detailed work as it is preferable to maximise the use of existing facilities where feasible and also develop strategic upgrade solutions. By maximising existing infrastructure costs may be minimised, and potentially the most sustainable options would be encouraged (e.g. minimising initial carbon footprint of new development). Adopting such an approach may also reduce impact on existing neighbouring communities and allow the early phasing of some new development, which would not have to rely on longer lead in times associated with securing funding for new infrastructure through the statutory water company planning process.

BDC are currently undertaking a scoping study for Harworth. They have appointed consultants to undertake a spatial analysis of the area and identify growth opportunities for Harworth engaging statutory consultees, infrastructure providers and key community groups as part of this process. The report is in its initial stages but it is hoped that findings of this report will be available to incorporate into the next stage of the WCS.

There are several pieces of legislation which are relevant to WwTWs, of these the Urban Waste Water Treatment Directive (UWWTD) and Freshwater Fish Directive (FFD).

Urban Waste Water Treatment Directive

The Urban Wastewater Treatment Directive (UWWTD) is designed to make sure all wastewater in the EU is treated to the appropriate standard. An essential element of the Directive is that quality standards for effluent fall into categories depending on size of the treatment works and the sensitivity of the receiving water. As populations grow in each sewerage catchment, some sewage treatment works may exceed the UWWTD threshold that requires nutrient removal.

For works discharging into a Sensitive Area (Eutrophic) a population equivalent exceeding 10,000 will require phosphate removal to a standard of 2mg/l (as an annual average). If however the population equivalent is increased to exceed 100,000, then a tighter standard of 1 mg/l (as an annual average) phosphorous is required. It is clear that growth in some areas could result in tighter limits on the quality of the effluent and this could have implications for investment in new wastewater treatment infrastructure.

Fresh Water Fish Directive

The Fresh Water Fish Directive (FWFD) is designed to protect fish from harmful chemicals such as ammonia. The East Midlands has a significant number of rivers designated under this Directive. Many WwTWs on rivers such as the Trent have already had major investment in order to meet the tight ammonia standards required in the FWFD. Any new discharges into

these rivers must also meet the FWFD standards. There are implications for the capacity of current works and the cost of investment in new works.

5.5 Water Quality

Discharge of new, or additional treated wastewater from proposed growth could have a detrimental impact on the water quality of receiving waters. A review of water quality in the WCS is therefore essential to ensure that:

- The water related environment has the capacity to absorb further discharges to the receiving watercourse,
- There is no unacceptable deterioration in the quality of the water related environment as a result of the development,
- Any water quality mitigation measures are planned in a strategic manner.

The aim of assessing the current and potential water quality of watercourses within and surrounding the development site is to identify the current water quality situation and the potential impacts the development may have on this and the surrounding water environment.

5.5.1 Water Quality Standards and Water Framework Directive

In England and Wales, one of the key tasks of the EA is to protect the quality of fresh, coastal marine, surface water and groundwater. A variety of standards, targets and guidelines are used to guide actions and investment to protect and improve water quality by calculating the potential impacts of industry, point sources and more recently, agriculture. Most of the standards (for example those concerning bathing waters, habitats, shellfish and freshwater fish) support the requirements of European Directives transposed to England and Wales. Others, such as River Quality Objectives (RQOs), stem from past regulation in England and Wales, but are nevertheless a particularly useful measure, and a good historical record. These chemical and biological grades and standards are currently in a state of change with the introduction of new methods as part of the WFD. However, given these standards are only very recently changed (and will still be used to describe water quality before 2009) a brief description is provided, before describing WFD standards.

River Quality Objectives

In recent decades, the principal non-statutory RQO system has been the River Ecosystem (RE) Classification scheme which comprised five hierarchical classes in order of decreasing quality. Each stretch of river was given a RE target such that if the river achieves this target it means that the river was of adequate quality to support the required ecosystem.

General Quality Assessment Scheme

Whereas the EA used RQOs for planning purposes (i.e. for setting water quality targets and assessing compliance with those targets), the General Quality Assessment (GQA) scheme was designed to provide an assessment of the general state of water quality and changes through time. The GQA scheme comprised several separate aspects of water quality, falling under chemical (including nutrients) and biological monitoring and assessment.

Chemistry

The chemical grading gave an indication of river water quality primarily in respect to organic pollution. River reaches were sampled a minimum of twelve times a year for the parameters shown in Table 5-3, and data collected over three years are used in order to give the required precision to assign grades. River reaches were assessed against all three parameters and a GQA grade was assigned based on the lowest-graded parameter. The locations for sampling were usually up and downstream of point sources such as sewage treatment work discharges to help assess compliance with consents.

Biology

The biological grading compared macro invertebrates in the river with the likely assemblage which would be expected to be found if the river was not impacted. Flow and morphology were taken into account in this assessment.

Nutrients

As well as the chemical and biological quality, river systems were also sampled to determine the concentration of nutrients in given reaches. Excessive nutrients (especially phosphorus) can allow eutrophication if other factors are not limiting. This allows nuisance species such as algae to proliferate at an undesirable level and at the expense of other aquatic life which rely on the system (fish and aquatic plants); the overall effect is to reduce biodiversity. The two most important nutrients in terms of eutrophication are nitrogen and phosphorus and these were each assessed using a separate GQA grade.

A grade from 1 to 6 was derived for both phosphate and nitrate based on the average concentration over the previous three years. There are no 'good' or 'bad' concentrations for nutrients in rivers in the way that is used to describe chemical and biological quality. Rivers in different parts of the country have naturally different concentrations of nutrients. 'Very low' nutrient concentrations, for example, are not necessarily good or bad; the classifications merely state that concentrations in this river are very low relative to other rivers.

Table 5-1 Environment Agency chemical GQA grades in watercourses

GQA Grade	Dissolved Oxygen	BOD	Ammonia
	(% saturation)	mg/l	mg-N/l
	10 percentile	90 percentile	90 percentile
A	80	2.5	0.25
B	70	4	0.6
C	60	6	1.3
D	50	8	2.5
E	20	15	9.0
F	<20	>15	>9.0

The WFD passed into UK law in 2003. The competent authority responsible for its implementation is the EA in England and Wales. The overall requirement of the WFD is that all waterbodies in the UK must achieve "good ecological status" (GES) by 2015 unless there are grounds for derogation. Standards in England and Wales have been significantly changed, but these standards are being applied in tandem with the GQA/RQO scheme from 2007 to 2009.

The WFD will improve the integration of water issues. The directive combines (or in some cases, repeals) previous water legislation and in certain areas strengthens existing legislation. An integrated approach to the management of all freshwater, groundwater, estuaries and coastal waters at the river basin level has been adopted.

This legislation has several well-defined objectives to:

- Prevent further deterioration, to protect and enhance the status of water resources,
- Promote sustainable water use,
- Enhance protection and improvement of the aquatic environment through specific measures for the progressive reduction of discharges,
- Ensure the progressive reduction of pollution of groundwater and prevents its further pollution,
- Contribute to mitigating the effects of floods and droughts.

The ultimate objective is for all waterbodies to achieve at least 'good ecological status' by 2015. The status is based on biological (phytoplankton, macroalgae, benthos and fishes), hydromorphological and physio-chemical quality elements, with the biological elements being especially important. 'Good ecological status' is defined as slight deviation from natural conditions that has no or very low human pressure.

All waterbodies in the UK have been designated a status based on their ecological, and chemical quality. The status ranges from 'poor' to 'very good'. In addition, the risks to each water body have been assessed and graded from point sources (e.g. WwTW discharges; factory discharges); diffuse sources (e.g. agriculture; road runoff); morphology and flow (e.g. over abstraction; weirs and culverts) and others (e.g. recreation; channel modification). The WFD requires risks to the environment caused by anthropogenic pressures, to be managed in addition to their impacts; there is a fundamental difference in terms of the management approach required to meet these needs. Managing impact is 'reactive' and is typical of the way we have managed the environment to date. Managing risk is 'proactive' requiring the ability to identify where an impact might occur (or is occurring) and prevent it from happening in the future.

In response to these aspects, the EA has drafted River Basin Management Plans (RBMPs) for the 11 River Basins of the UK. The draft RBMPs were published on 22nd December 2008 and these comprehensive documents contain status, risks, and objectives for each waterbody, together with a Programme of Measures (POMs) which are actions required for each waterbody to meet GES. These are categorised actions by sectors including Central Government; EA; Water Industry; Agriculture; Industry; and specifically in relation to this study – Local Government. The key waterbody data and relevant RBMP draft information are presented in Section 5.5.2.

It should be noted that both the proposed WFD standards and catchment characterisation are preliminary and may change before being used for reporting purposes.

5.5.2 Draft Humber River Basin Management Plan & Waterbody Classification

Under the WFD, Bassetlaw falls within the Humber River Basin District (RBD). The draft Humber RBMP (published on 22nd December 2008) sets out detailed proposals for the next six

years and beyond, to be refined as an iterative response model. Amongst the components of the draft Humber RBMP is to 'lower the impact of transport and built environments'.

The main causes of the problem have been linked to:

- Flood defences – for example with artificial river embankments,
- Housing growth, leading to pressures on water quality and water resources,
- Leaks from sewerage systems and private sewage treatment works,
- Discharge of industrial waste containing organic matter,
- Using fertilisers and pesticides in parks and gardens,
- Run-off from roads, driveways, car parks, car washing, contaminated land.

The draft Humber RBMP also notes that:

> *"The main responsibility for implementing measures that will contribute to lowering the impact of transport and the built environment will fall on a number of different sectors including urban and transport, the water industry and the construction industry. A significant lead will have to be provided by Local Government, particularly LPAs. The Regional Planning Body (RPB) will have a significant role to play in ensuring that the RSS and proposed Integrated Regional Strategy actively seek to endorse the requirements of the WFD and promote sustainable development across the River Basin District." (Environment Agency, 2008)*

Classification of the River Idle and River Ryton

Under the draft Humber RBMP, Bassetlaw falls largely within the River Idle and River Torne catchment and a general description of the catchment is provided in Box 5-1. It should be noted that 99% of surface waterbodies are currently failing to meet either good or potentially good status.

The Upper River Ryton (to Aniston Brook), is classified as moderate ecological status and is considered to have a 'good' grade for phosphorus. Aniston Brook is considered to be at poor ecological status and has a bad grade for phosphorus, while flow conditions are considered to be complicating factors.

The River Idle from the River Maun / River Poulter confluence to the River Ryton is considered to be at moderate ecological status. The main parameters of concern are phosphorus and also the quantity and dynamics of flow.

The concentration of nitrate is 'very high' in River Ryton and River Idle and it will be important to assess the sources of nitrate in a similar manner to phosphorus. Although in these catchments it is strongly suspected that the main sources are agricultural in origin.

Box 5-1 Description of the Idle and Torne catchment from the draft Humber RBMP

"The Idle and Torne catchment stretches from central Nottinghamshire to southern Yorkshire. It covers an area of approximately 1,300km^2, the landscape varying from Sherwood Forest in the south to the exposed Hatfield and Thorne Moors and valuable agricultural land of the Isle of Axholme in the north.

The Rivers Idle and Torne both flow in a general north easterly direction. The Idle is formed by the Rivers Meden, Maun and Poulter which meet near Gamston. The Idle joins the River Trent at West Stockwith and lower downstream the Torne joins the Trent at Keadby where it is tidal. The confluences with the Idle and Torne are artificially managed with water either pumped out of the tributaries at high tides or released by gravity at low tide.

Both rivers rise and flow through heavily urbanised areas including Mansfield, Sutton in Ashfield, Worksop, East Retford and the south-eastern outskirts of Doncaster. Heavy industry is present in the catchment but many collieries have closed in recent years due to the decline in coal mining which means that minewaters need to be carefully managed. Peat has historically been extracted in the north, at Hatfield Moors. The practice has now ceased and work is underway to encourage re-generation of this important habitat.

Major growth proposed in the catchment of 17,000 up to 2021 (23,000 to 2026). There is high pressure from the cumulative impacts of planned development and measures will be required to achieve good ecological status and prevent deterioration in any water bodies.

The dominant land use is arable agriculture. Large areas of land in the north of the catchment have a comprehensive system of land drainage to maintain their agricultural quality. Due to their low-lying situation these areas are also protected from the River Trent by extensive flood defences.

Currently 1% of surface waterbodies in this catchment are achieving either good or potentially good status. We are proposing that by 2015, 7% compliance will be achieved, and this will have improved to 51% by 2027. To date 4%".

Source: Environment Agency, 2008

Table 5-2: Summary of WFD Status Rivers Ryton and Idle

River & Reach	Waterbody code	Current ecological quality	Biological Quality				General Physico Chemical Quality					Specific Pollutants Quality					
			Overall biological quality	Diatoms	Fish	Macro-inverts	Overall phys-chem quality	NH_4	DO	pH	P	NO_3	Overall specific pollutant quality	NH_3	As	Cu	Zn
Ryton (Aniston Brook to River Idle)	GB1040280 58100	Poor potential	Poor	Poor	Good	Mod	Mod	High	High	High	Poor	V High[1]	High	High	High	High	High
Idle (Maun / Poulter confluence to River Ryton)	GB1040280 58090	Mod	Good	Not assessed	Good	Good	Mod	High	High	High	Poor	V High[1]	High	High	High	High	High

1. Nitrate is not directly assessed under the WFD. This data is an annual average grade for 2007 from the national EA nutrient monitoring; 'Very High' is >40 mg NO_3 L^{-1}

5.6 Ecology and Biodiversity

The major issues that could have an adverse effect on the water environment that could arise due to new development are:

- Potential reductions in watercourse flow rates and levels, to such a degree that damage is caused to downstream designated sites,
- Potential increases in watercourse flow rates and levels in downstream sites, which would be most notable at low flows as a result of the potential additional wastewater volumes entering the river,
- Potential increases in nutrient load (and potentially concentration) at downstream sites, coupled with an increase in total oxidised nitrogen, potential lowering of dissolved oxygen and an increase in biological oxygen demand.

A Habitats Regulation Assessment (HRA) as required under the Habitats Directive will need to be undertaken as part of the planning approval process. Until development design and area is agreed in detail following review of all planning considerations, it is not possible to complete a full Appropriate Assessment (AA) as part of this Scoping WCS to determine the full impact on designated European Sites. This will be a requirement of any follow on stages of the WCS, but as part of this study, an initial ecological review of the area has been undertaken to ascertain whether there are any ecological constraints to the proposed development.

In practice, HRA of projects can be broken down into three discrete stages, each of which effectively culminates in a test. The stages are sequential and it is only necessary to progress to the following stage if a test is failed. The stages are:

Stage 1 – Likely Significant Effect Test - This is essentially a risk assessment, typically utilising existing data, records and specialist knowledge. The purpose of the test is to decide whether 'full' AA is required. The essential question is:

> *"is the project, either alone or in combination with other relevant projects and plans, likely to result in a significant adverse effect upon European Sites"?*

If it can be demonstrated that significant effects are unlikely, no further assessment is required.

Stage 2 – Appropriate Assessment - If it cannot be satisfactorily demonstrated that significant effects are unlikely, a full AA will be required. In many ways this is analogous to an Ecological Impact Assessment (EIA), but is focussed entirely upon the designated interest features of the European Sites in question. Bespoke survey work and original modelling and data collation are usually required. The essential question here is:

> *"will the project, either alone or in combination with other relevant projects and plans, actually result in a significant adverse effect upon European Sites, without mitigation"?*

If it is concluded that significant adverse effects will occur, measures will be required to either avoid the impact in the first place, or to mitigate the ecological effect to such an extent that it is no longer significant. Note that, unlike a standard EIA, compensation for significant adverse effects (i.e. creation of alternative habitat) is not permitted at the AA stage.

Stage 3 – Imperative Reasons of Overriding Public Interest (IROPI) Test - If a project will have a significant adverse effect upon a European Site and this effect cannot be either avoided or mitigated, the project cannot proceed unless it passes the IROPI test. In order to pass the test it must be objectively concluded that no alternative solutions exist. The project must be referred to Secretary of State on the grounds that there are IROPI as to why the plan should nonetheless proceed. The case will ultimately be decided by the European Commission.

Habitat Areas in Bassetlaw

BDC is a signatory to the Nottinghamshire Biodiversity Action Plan (BAP), which contains action plans for a range of habitats and species that require conservation action.

Bassetlaw contains a number of the priority habitats identified in the Nottinghamshire BAP. It is important that any future development does not impact priority habitats and again, this should be considered throughout the WCS. The BAP habitats located within Bassetlaw, which may be affected are:

- Lowland Heath,
- Coastal Floodplain Grazing Marsh,
- Lowland Mixed Deciduous Woodland,
- Lowland Dry Acidic Grassland,
- Wet Woodland.

Sites of Special Scientific Interest

Bassetlaw contains around twenty Sites of Special Scientific Interest (SSSI), including the River Idle Washlands SSSI, Clumber Park SSSI and Misson Training Area SSSI. It is important that any future development does not impact designated sites and again, this should be considered for hydrologically linked sites throughout the WCS.

The SSSIs that are potentially at risk from development and therefore require more detailed consideration in the WCS are those that are downstream of the likely development areas (primarily Worksop and Retford), these being:

- River Idle Washlands SSSI,
- Misson Line Bank SSSI,
- Misson Training Area SSSI,
- Sutton and Lound Gravel Pits.

Table 5-5 contains descriptions of the SSSIs noted above. Figure 5-7 shows the locations of SSSIs in Bassetlaw and its immediate environs.

Table 5-5: Water Dependent Conservation Sites in Bassetlaw

Site	Description
River Idle Washlands SSSI[26]	The site combines the best remaining washland grasslands along the River Idle floodplain. Characteristically the grassland swards are dominated by marsh foxtail Alopecurus geniculatus in a community which contains such wet meadow herbs as la smock Cardamine pratensis and great burnet Sanguisorba officinalis. In wetter areas the vegetation is dominated by stands of reed sweet-grass Glyceria maxima which has also colonised the internal drains although, locally, a more varied wetland plant community occurs which includes such plant species as meadow rue Thalictrum flavum. The washlands are important as feeding and roosting sites for populations of wintering and passage waterfowl including Bewick's, whooper and mute swans, wigeon, teal, pochard, snipe and a variety of other wildfowl and wading birds. Additional interest is provided by the breeding bird community which includes snipe and redshank
Misson Line Bank SSSI[26]	Misson Line Bank contains fine examples of wetland plant communities of unusual diversity and species richness developed in association with a series of old borrow pits. In the centre of the site occur a series of water-filled borrow pits excavated from Keuper Marl. Areas of marsh at the water's edge are characterised by common spike rush Eleocharis palustris, grey club rush Scirpus tabernaemontani and soft rush J. effusus, and contain such plants as tufted forget-me-not Myosotis caespitosa. In deeper water the marsh is replaced, locally, by reedswamp dominated by common reed Phragmites australis, lesser bulrush Typha angustifolia or bulrush T. latifolia. The aquatic community of the larger pools contain abundant broad-leaved pondweed Potamogeton natans, fennel pondweed P. pectinatus, Canadian water weed Elodea canadensis, alternate water milfoil Myriophyllum alterniflorum, lesser marshwort Apium inundatum, and the liverwort
Misson Training Area SSSI[26]	Misson Training Area is a redundant military bombing range, forming one of the largest remaining tracts of fenland formerly typical of the Misson/Idle Levels of north Nottinghamshire and Lincolnshire. It supports a diverse range of semi-natural habitats, including standing open water, tall-herb fen,unimproved neutral and acidic grassland, dry oak woodland and nationally restricted wet woodland types. The breeding bird community associated with birch and willow scrub is notable, whilst the site is recognised as supporting a rich invertebrate fauna, in particular its assemblage of moths. Wet woodland occupies much of the site on thin fen peats overlying Triassic Sherwood Sandstones. Downy birch Betula pubescens and grey willow Salix cinerea, together with occasional pedunculate oak Quercus robur and

[26] Natural England (http://www.english-nature.org.uk)

Site	Description
	aspen Populus tremula.
Sutton and Lound Gravel Pits	Sutton and Lound Gravel Pits contains extensive areas of open water and margins which support an exceptionally rich assemblage of breeding wetland birds and a nationally important population of wintering gadwall. The site supports an exceptional diversity of breeding, wintering and passage birds. A series of flooded lagoons occur in association with a wide range of associated naturally-colonising habitat which includes sparsely- vegetated gravel islands and shorelines, and a diverse suite of marginal vegetation communities dominated by species such as reedmace Typha latifolia and rushes Juncus spp. In places common reed Phragmites communis forms substantial strands. A variety of aquatic plants of interest occur within the lagoons including broad-leaved pondweed Potamogeton natans, fennel pondweed P. pectinatus and lesser bearded stonewort Chara curta, a charophyte with a restricted distribution across England. Around the margins of the lagoons are areas of dry open grassland, acidic scrub and wet willow-dominated woodland which add to the diversity of habitat present.

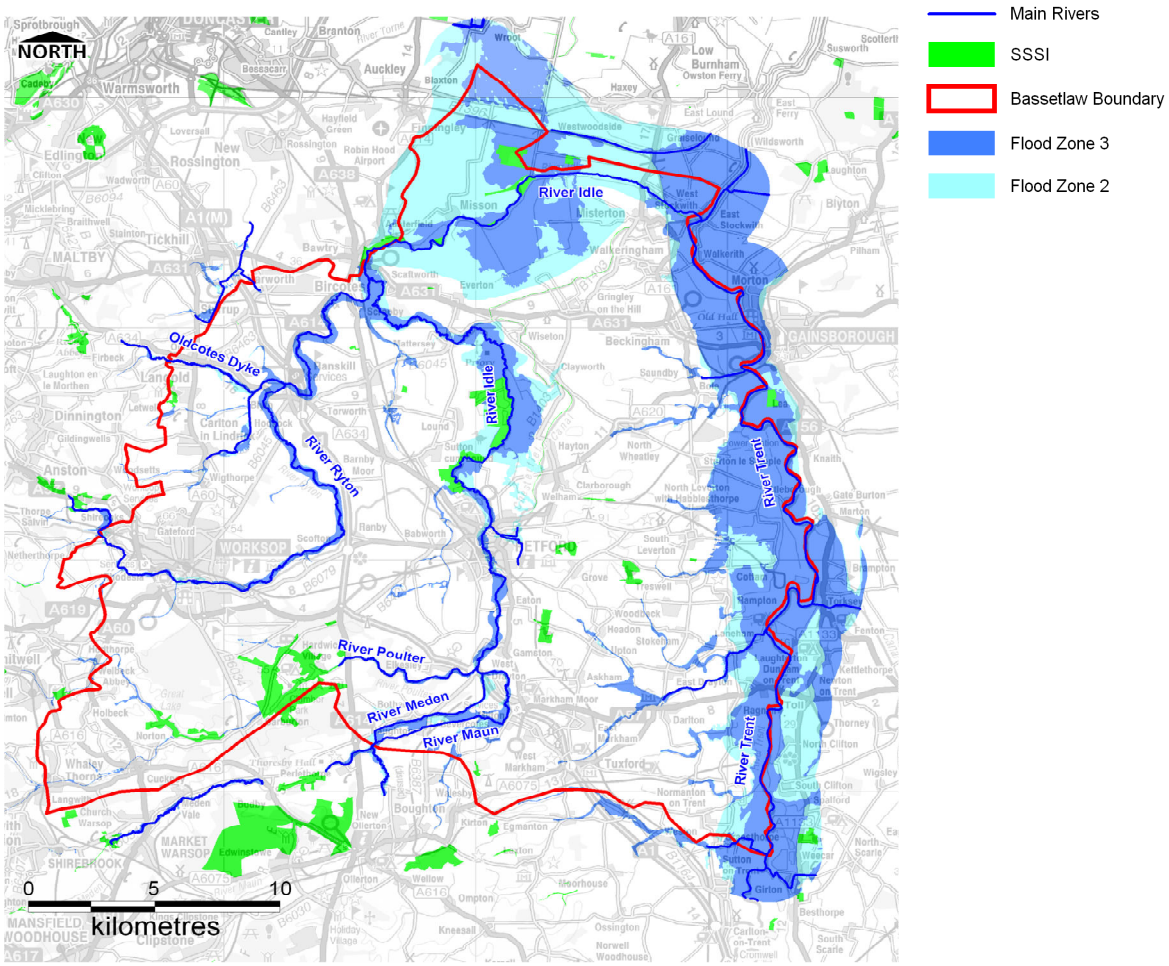


Figure 5-7 Sites of Special Scientific Interest within Bassetlaw
(Source: Environment Agency and Natural England)

6 Preliminary Findings, Constraints and Recommendations

6.1 Water Resources and Supply

The average annual rainfall for the Bassetlaw area is 620mm[27], less than the annual average rainfall for England of 897mm.

There are two Major Aquifers[28] underlying the Bassetlaw District; the Lower Magnesian Limestone (LML) and the Sherwood Sandstone (SS). The LML, outcrops along the western flank of the district and where it provides a baseflow contribution to various tributaries of the River Idle, including the Rivers Poutler and Ryton

There are several major groundwater supply abstractions within Bassetlaw, with SPZs around these major Public Water Supply abstraction sources. The presence of SPZs means that there is the potential for discharges from development areas in the west of the district in particular to affect the underlying Major aquifer.

In terms of water resources, the Idle and Thorne CAMS assessment has indicated that parts of catchment are already 'Over-abstracted' (see section 5.2.5). Future growth cannot therefore rely on new local resources being developed and instead will have to rely on greater efficiency in water use from either existing local sources or regional resource schemes in neighbouring supply zones.

AWS and ST have both re-assessed the supply / demand balance in their respective draft WRMPs[29] [30] and SoR[31] to the consultation on the draft WRMP. The latest findings are that both water company's currently have surpluses (i.e. resources exceed demands) over the entire planning period through to 2035/36. However until both AWS and ST have published their final WRMP and OFWAT final determinations (due at the end of 2009), it cannot be known for certain what the investment plans will be for the Bassetlaw District.

The following outstanding issues within Bassetlaw in relation to future development and water resources and supply have been identified and should be reviewed and further investigated as part of the Outline WCS in conjunction with ST and AWS: These include a:

- Review of potential water resources within neighbouring WRZs and their spare capacity,
- Review of demand management measures which could be taken to improve water usage rates within the Bassetlaw District,
- Investigation of the threat to existing sources of supply of pollution, principally nitrate from agricultural inputs,

[27] Environment Agency; Idle and Thorne Catchment Abstraction Management Strategy – Final Document
[28] A Major Aquifer is Highly Permeable strata usually with a known or probable presence of significant fracturing
[29] Severn Trent Water Draft Water Resource Management Plan, 2008
[30] Anglian Water Draft Water Resource Management Plan, 2008
[31] Severn Trent Water Water Resource Management Plan – Statement of Response, 2009
[31] Anglian Water Water Resource Management Plan – Statement of Response, 2009

- Assessment of the impact of climate change on water resources, both local and in the surrounding WRZs,
- Incorporation of Review of Consent – Stage 4 findings, if available, which may reduce the DO from existing sources,
- Incorporation of the WFD River Basin Management consultation and ST's implementation plans for the WFD River Management Plan Cycles, if available, where these plans will directly or indirectly affect future water supply plans within the Bassetlaw District. .

6.2 Flood Risk and Surface Water Management

6.2.1 Overview

The aim of identifying the potential sources of flood risk to the study area is to assess the risk of all forms of flooding to and from development, in order to identify any potential development constraints with respect to flood risk. PPS25 emphasises the need for a risk-based approach to be adopted by LPAs through the application of the Source-Pathway-Receptor model.

The model firstly identifies the Sources of flooding to and from development. The identification is based on a review of local conditions and consideration of the effects of climate change. The nature and likely extent of flooding arising from any one source is considered, e.g. whether such flooding is likely to be localised or widespread. The presence of a flood source does not always infer a risk.

The exposure Pathway or 'flooding mechanism' determines the risk to the receptor and the effective consequence of exposure, e.g. sewer flooding does not necessarily increase the risk of flooding unless the sewer is local to the site and ground levels encourage surcharged water to accumulate.

The varying effect of flooding on the Receptors depends largely on the sensitivity of the target. Receptors include any people or buildings within the range of the flood source, which are connected to the source by a pathway.

In order for there to be a flood risk, all the elements of the model must be present. Furthermore effective mitigation can be provided by removing one element of the model, e.g. by removing the pathway or receptor. In the case of Bassetlaw, the general consensus is the receptor (i.e. the new development) is removed from the exposure pathway to a flood source. With regard to fluvial flood risk, the most robust way to achieve this is by moving the proposed development wholly into Flood Zone 1.

The other major potential source of flooding is surface water flooding, which can occur as a result of a number of factors. During periods of prolonged rainfall events and intense downpours, overland flow from adjacent higher ground may 'pond' in low-lying areas of land without draining into watercourses, surface water drainage systems or the ground. In general, surface water drainage systems are only required to be designed to contain a 1 in 30 year rainfall event (as a maximum). During higher intensity events, surface water drainage systems become overwhelmed often resulting in surface water flooding.

One of the main issues with surface water flooding is that in areas with no history, relatively small changes to hard surfacing and surface gradients can cause flooding (garden loss and reuse of brownfield sites). As a result, continuing development could mean that surface water flooding can become more frequent and although not on the same scale as fluvial flooding, it can still cause significant disruption. The utilisation of sustainable drainage systems (SuDS) can mitigate against surface water flooding.

6.2.2 Flood Risk

Bassetlaw's SFRA is currently being finalised. This will provide detailed information on the flood risk from fluvial, tidal, surface water, groundwater and artificial water sources to aid BDC in their application of the Sequential Test and to inform their SA and subsequent planning policies. Once available, this information should be incorporated into the next stage of the WCS and assessed in relation to the proposed development site allocations to ensure that:

- The risk of flooding to the potential development areas is quantified and the development is steered away from high risk areas (Flood Zone 2 and Flood Zone 3),
- Any flood mitigation measures are planned in a strategic manner,
- There is no deterioration to existing communities' standard of protection.

The aim of identifying the potential sources of flood risk to potential development areas is to assess the risks of all forms of flooding to and from a development in order to identify any potential development constraints with respect to flood risk.

Preliminary findings of this scoping study are that there are significant areas of fluvial flood risk within the District associated with the River Idle and River Trent. Smaller areas of flood risk have been identified along the River Ryton and Retford Beck.

Surface water flooding has also been identified as having previously affected parts of the District, most notably during the summer 2007 floods in Retford and Worksop.

6.2.3 Surface Water Management

Surface Water Management is a key consideration when assessing development within large areas. PPS25 requires that new development does not increase the risk of flooding elsewhere by managing surface water runoff generated as a result developing land. Altering large areas of land by urbanising it fundamentally alters the way in which rainfall drains to watercourses and has the potential to increase the rate and amount of water that enters watercourses causing an increase in flood risk. In many cases, the management of surface water is achieved via a requirement to restrict runoff from developed sites to that which occurs from the pre-development site usage and this is achieved by incorporating a range of SuDS which aim to maximise the amount of rainwater which is returned to the ground (infiltration) and then to hold back (attenuate) excess surface water. Incorporating SuDS often requires a large amount of space and for large developments often requires the consideration of large scale strategic features such as balancing ponds which can attenuate and store large volumes of water generated during very heavy rainstorms to prevent flood risk downstream.

The management of surface water has the potential to act as a constraint to development within Bassetlaw, not just because of space requirements, but because the reduction in runoff

rates and volumes is likely to be onerous. Additionally, several of the smaller watercourses, ditches and drains in Bassetlaw are identified as low-flow channels with no additional capacity to accept surface water runoff and will require attenuation of surface water generated by new development. These issues will be further investigated as part of the Outline WCS and potentially any required Detailed WCS, to ensure that the appropriate strategic level constraints and mitigation measures are identified and that guidance is given to the development of a Surface Water Management Plan (SWMP) for Bassetlaw as recommended by the Pitt Report. The WCS and SWMP will also help to ensure that developers address the required surface water management issues during preparations of site specific Flood Risk Assessments (FRA).

6.3 Wastewater Treatment and Collection

The principal WwTWs in the Bassetlaw area are Worksop WwTW and Hodsock WwTW, which discharge to the River Ryton and Retford WwTW which discharges to the River Idle.

Preliminary discussions with ST have confirmed that there are no major issues anticipated with wastewater capacity in accommodating growth in Bassetlaw. The key issue is the management of surface water runoff. ST would not expect surface water to be conveyed to the foul or combined sewerage system and where practicable would support the removal of surface water already connected to foul or combined sewer.

However, initial discussions with representatives from BDC have confirmed that they consider that there may be issues within the District. In particular potential issues at Harworth, Retford and Worksop should be considered as part of the later stages of the WCS.

6.3.1 Harworth

Major development is being considered for Harworth and it is unlikely to come forward without reinforcements to the wastewater network, draining to Harworth WwTW. At present it is understood that there is likely to be a planning application coming forward for the redevelopment of the former colliery site in Harworth. The effects of the redevelopment of the site are being considered in a separate drainage study[32], which is examining surface water and foul water aspects of the site, as without any upgrades it has been shown that the current networks would not be able to cope with increases in flows.

Later stages of the WCS should consider the implications of the colliery redevelopment and any other potential development within Harworth, both upon the wastewater network (sewers and pumping stations) and also the capacity at Harworth WwTW (volumetric and process).

It was also noted in discussions with BDC[31] that older parts of Harworth (south west) flood regularly and it is understood that this may be caused by the old (shallow) sewers in this area.

6.3.2 Retford

At this stage it is understood that lesser levels of development are likely within Retford. From discussions with BDC[31] it was noted that in general Retford is flat and as such there is very little

[32] Harworth Drainage Study, BWB Consulting

gravity drainage. As a consequence, the main wastewater drainage issue is believed to be associated with the capacity of Bollom Lane Pumping Station.

It is also understood that ST are due to produce a drainage area plan for Retford in late June. Given the timescales, it is likely that this will be available to feed into later stages of the WCS.

6.3.3 Worksop

Worksop suffered from flooding during the summer 2007 floods. From discussions with BDC[31] it was noted that the whole of the Town Centre was flooded for several days and this is believed to have being caused by sewers backing up, as flood levels in the River Ryton were high.

The main outfall sewer runs through the centre of Worksop to the new WwTW at Manton. It is believed to be a 1200nn diameter combined sewer, with screw pumps.

6.3.4 Next Steps

Key to assessing water and wastewater capacity is not just the location of proposed development, but the type and the timing (start, duration, phasing etc.). At that point any additional investment can be identified and then the critical path identified from when the assets are required and how long they will take to deliver.

The Outline WCS should corroborate the findings of the Scoping WCS and assess in more detail the capacity of the wastewater network and WwTW to accommodate growth. Through these steps the Outline WCS will provide:

- The baseline with respect to wastewater / sewer network and whether there is capacity to accommodate growth in the existing network system[33] prior to upgrades being required,
- The baseline with respect to treatment of wastewater and how much 'spare' capacity is available in existing wastewater treatment facilities,
- The phasing requirements for development to ensure that any planned growth is commensurate with planned upgrades to the existing network / facilities.

6.4 Water Quality

6.4.1 Potential Impact on Water Quality

There are three main ways that development can impact water quality, in this case primarily on surface water, but groundwater should also be considered:

- Over abstraction of water, which can reduce water flow, affecting hydromorphology and chemistry of watercourses for aquatic and riparian habitats, and impacting available seasonal dilution of pollutants,

[33] the network of pipes and pumping stations which are used to transmit wastewater from buildings to treatment facilities

- Alterations to timing and magnitude of runoff from impervious surfaces (usually managed by attenuation features such as SuDS). Potential increased sources and transport of pollutants from sources such as roads and gardens,
- Increases in treated wastewater effluent, and potential discharges from storm discharges.

The Scoping WCS has identified specific water quality and hydromorphological issues that should be examined further in the Outline WCS. The sensitivity of receiving waters has been reviewed in conjunction with data from the EA and Natural England. Data from the EA Statutory GQA Monitoring Scheme and draft Humber RBMP indicated that the concentrations of nutrients in watercourses are generally high. However, the sources (point and diffuse) of these nutrients should be investigated further.

It is also important to note that revised water quality monitoring and associated standards are currently being implemented. Since WCSs are primarily tools to guide development and associated water infrastructure in the short and medium term, we consider it important that, wherever possible, the draft new water quality and ecological standards published in the draft RBMPs will be used in the WCS water quality assessment. This will allow an indication of possible changes to water quality status compared to existing standards and hence any changes in water infrastructure that might be appropriate.

Since the concentration of a substance is a function of dilution, it will be important to review flow of watercourses; historical, current and projected. The EA CAMS document will be reviewed to indicate pressures on flow from water resources abstraction.

By contrast to phosphorus, concentrations of nitrogen in inland waterbodies, in the form of nitrate, are directly affected by legislation. The EC Nitrates Directive 91/676/EEC aims to reduce nitrate pollution from agriculture and there is legislation to regulate the amount of nitrate emissions to water from point sources, such as WwTWs.

6.5 Ecology and Biodiversity

Bassetlaw contains several areas / sites of ecological importance, including the Misson Line Bank, Misson Training Area, Sutton and Lound Gravel Pits SSSIs, all of which have the potential to be affected by development within the Bassetlaw region.

It is not possible to screen out impacts to the ecologically designated sites within Bassetlaw as a result of development at this stage. However it can be noted that the following impacts may be possible as a result of development:

- Reduced water quality, due to increased volumes of treated sewage effluent being discharged into the watercourses as a result of development in Bassetlaw, could impact upon the aforementioned SSSIs,
- Poorly managed urban runoff from new development areas could impact upon ecological sites within Bassetlaw, hence strategic level SuDS will need to be planned for and policy drivers provided in the WCS to ensure these do not present a constraint.

These findings will need to be reviewed and further investigated as part of the Outline WCS and Detailed WCS (if required), in conjunction with NE.

A HRA as required under the Habitats Directive will need to be undertaken as part of the planning approval process. Until development design and areas are agreed in detail, following review of all planning considerations, it is not possible to complete a full AA as part of the Scoping WCS. This will be a requirement of any follow on stages of the WCS, but as part of this study, an initial ecological review of the area has been undertaken to ascertain whether there are any ecological constraints to the proposed development.

7 Progression of Water Cycle Study

7.1 Outline Water Cycle Study

Following on from BDCs work on their Core Strategy, the Outline WCS will consider all ways in which new development will impact on the water environment or water infrastructure, specific to where growth is most likely to be targeted. It will be undertaken during consideration of allocation sites such that it can inform the decision process in terms of where development will be targeted. The key aim of the Outline WCS is to provide BDC, as the LPA, with the evidence base which ensures that water issues have been taken into account when finalising the location and intensity of development within the District. It will also give ST and AWS an evidence base to use in their business plans, which determine how much they can charge customers to invest in upgrades and the provision new infrastructure required to service proposed development.

7.2 Detailed Water Cycle Study

If significant new infrastructure is required, or an impact on the water environment cannot be ruled out as significant, a Detailed WCS will need to be undertaken for site-specific allocations, or for Bassetlaw as a whole.

7.3 Project Steering Group of Stakeholders

A Project Steering Group is required to be created to inform the project. The Steering Group will oversee the management and direction of the project, but that a lead contact for the project will be nominated by BDC. The Steering Group will be made up of representatives of some, or all of the following organisations:

- Bassetlaw District Council as the planning authority,
- The Environment Agency – as the statutory planning and flood risk consultee as well as regulator for water quality,
- Severn Trent Water – as provider of wastewater infrastructure and water supply infrastructure to the western area of Bassetlaw,
- Anglian Water Services – as provider of water supply infrastructure for the eastern area of Bassetlaw,
- Internal Drainage Boards – as statutory consultee,
- Natural England – as a statutory environmental consultee,
- Nathaniel Lichfield and Partners – as they are undertaking an infrastructure study at Harworth.

As well as close liaison with the Steering Group members, consultation has been and will be sought from the following other organisations:

- Highways Agency (HA),

- Key Landowners,
- Authors of various FRAs and SFRAs.

Having due regard to the planning timeframes there will need to be stakeholder agreement on what infrastructure will be required (as recommended by the WCS) as well as when it will be required and how it will be funded. The best way to achieve this is to ensure that the key stakeholders are involved at an early stage of the WCS.

As such a Project Steering Group should be set-up upon finalisation of this Scoping WCS to advise and agree on the findings of the Scoping WCS, proposals for the Outline WCS and help with the determination of the requirements of any required Detailed WCS. Should any issues arise at the Project Steering Group Meeting, these will be addressed as part of the Outline WCS.

Appendix A – Data Catalogue

Data Type	Stakeholder source
PLANNING AND BACKGROUND	
Master Plan Layout Drawing to enable ID of wastewater drainage & water supply areas;	Council
OS Base Mapping;	Council
Emerging Local Development Frameworks	Council
Local Plans	Council
Development Plan Documents	Council
Other relevant planning documentation relating to development i.e. SPDs	Council
FLOODING	
Drainage Problem areas	Council
Records of surface water flooding	Council
Topographic data (river surveys etc)	EA
Remote Topographic Data (LiDAR and/or SAR data) for the study area	EA
Existing Hydrometric Monitoring locations for potentially affected watercourses	EA
Information on Existing Hydraulic Models - coverage and return periods run	EA
Identification of Main River, Critical Ordinary Watercourses	EA
Location of flood defences or alleviation schemes	EA
Design standards of flood defences	EA
Condition of existing defences	EA
Flood Zone outlines - 2, 3a, and 3b and flood levels	EA
Historical flooding records (from rivers and groundwater)	EA
Details of Improvements Programme top flood defences / schemes	EA
Areas benefiting from flood warning procedures and management strategies	EA
WATER QUALITY / ENVIRONMENTAL	
General Quality Assessment (GQA) data – water quality	EA
WFD status	EA
Ecological monitoring data for the two main Rivers	EA
Location and details of abstractions (groundwater and surface) in the study area	EA
Location and details of discharges to ground and to local watercourses	EA
Geology for the area	EA
Groundwater level records	EA
Areas of protected or designated status (SSSI, SAC, SPA) - boundaries and reasons for designations	EA
Areas of national or local conservation / interest (SNCI, NNR, LNR)	EA
WASTEWATER	
Location of current STWs, their consent details, treatment type and spare capacity details (both hydrualic and process capacity)	ST
Any known problem locations for the existing sewer network	ST
Data from sewerage and treated water capacity assessment studies in support of the development of Business Plans for Price Review 09.	ST
Sewerage Network layout, pipe diameter, capacities, pumping stations and CSOs, (Combined Sewer Overflows) and coverage of network models	ST
Discharge locations and consent details for consented discharges for Bassetlaw	ST
WATER RESOURCES (SUPPLY)	
Data and information from Water Resource Plans draft (2009) and interim 2006	ST, AWS
Information pertaining to relevant water resource schemes proposed for the development of draft Business Plans 09.	ST, AWS
Existing Water Volumes being supplied (i.e. current and also projected), including:	ST, AWS
Water Consumption per capita/property or per property/day assumed in planning	ST, AWS
water treatment works current and projected outputs (capacities), location (layout drawings and location maps), treatment levels (chemical, power consumptions, etc rough cost of treatment/m3)	ST, AWS
Distribution supply Network layout, (trunk mains, pipe diameters and capacities) and confirmation of coverage of network models	ST, AWS
locations of service reservoirs	ST, AWS
Raw Water Abstraction License and limits including Locations	ST, AWS
Pumping Stations locations (clean water)	ST, AWS
Existing water consumption control measures assumed in planning	ST, AWS
Coverage of clean water network models	ST, AWS
The latest demand forecasts – Dry Year Annual Average unrestricted daily demand and Average Day Demand in Peak Week. Do these include the latest growth forecasts contained in the East of England RSS Plan?	ST, AWS
Details of any water quality issues affecting outputs from the WTWs supplying Bassetlaw	ST, AWS
Pressure information in water distribution system	ST, AWS