Bromsgrove District and Redditch Borough Water Cycle Strategy

Bromsgrove District Council and Redditch Borough Council

February 2009
Final Report Version 2
9T2337

A COMPANY OF

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Study Objectives

This Water Cycle Strategy (WCS) for the Bromsgrove District Council and Redditch Borough Council (the Councils) assesses the constraints and requirements that will arise from the scale of proposed growth on the water infrastructure of the Borough and District. It considers the following issues, addressing the constraints that they may pose to future development and discusses the improvements necessary to achieve the required level of development:

- Flood Risk;
- Water Resources and Water Supply;
- Waste Water Systems and Treatment; and
- Demand Management.

In addition, the WCS process also provides a benefit to the water companies by providing them with a more detailed indication of the potential development within the area. This will reduce the number of assumptions that are necessary in making decisions in relation to future planning of resource and infrastructure requirements.

Outputs

This report focuses upon the development sites, scenarios and options provided by the Councils. It considers trajectories of growth and land availability and assesses the flood risk, water supply and waste water systems for each proposed site, assigning a traffic-light colour code to indicate the ease of development in each case. In addition water supply, waste water treatment, river quality and demand management are discussed in more general terms. The report concludes with a discussion of the viability of each of the options and scenarios and the limitations in each case.

Data Sources

The data used within this WCS (and preceding Level 1 Strategic Flood Risk Assessment, SFRA) is documented within **Appendix B**. The results of the SFRA has been used as the basis for the flood risk section of this report. Additional data has been obtained from the Environment Agency, South Staffordshire Water and Severn Trent Water, including the water companies' Draft Water Resource Management Plans (dWRMPs) and Strategic Direction Statements. As the Regional Spatial Strategy figures and dWRMP are currently in draft form, it is recommended that this WCS be reviewed in light of any new findings released in these documents.

Co-operation

This WCS was carried out for the Council with the co-operation and support of the Environment Agency, Severn Trent Water, South Staffordshire Water, Highways Agency and British Waterways.

GLOSSARY

Area of Development Restraint	Sites identified by the Councils and reserved to meet future housing and employment needs.
Asset Management Plans	Asset Management Planning is the process by which the Office of Water Services (Ofwat) determined the programme of water infrastructure and environmental improvements that are to be funded over a five year period and the water bill price rises that have to be allowed to fund this.
Brownfield site	Any land or site that has been previously developed.
Catchment	The area contributing flow or *runoff* to a particular point on a watercourse.
Climate change	Long-term variations in global temperature and weather patterns both natural and as a result of human activity, primarily greenhouse gas emissions.
Culvert	Covered channel or pipe that forms a *watercourse* below ground level.
Development	The carrying out of building, engineering, mining or other operations in, on, over or under land or the making of any material change in the use of any buildings or other land.
Enmained	Watercourse designated as a *Main River*
Environment Agency	Government Agency charged with the protection of the environment
Exception Test	The final process of the PPS25 Sequential Test (TIERS 3 & 4). It is required for some developments (depending on their vulnerabilities as defined in Tables D.2 and D.3 of Planning Policy Statement (PPS) 25: Development and Flood Risk), when a development application is made for a site within Flood Zones 2 & 3 and no other site of lower flood risk is available.
Flood defence	Flood defence infrastructure, such as flood walls and embankments, intended to protect an area against flooding, to a specified *standard of protection*.
Flood event	A flooding incident characterised by its level or *flow hydrograph.*
Flood Hazard	The potential risk to life and potential damage to property resulting from flooding

Flood probability	The estimated likelihood of a flood of given magnitude occurring or being exceeded in any specified time period.
Flood risk	An expression of the combination of the *flood probability* and the magnitude of the potential consequences of the *flood event*.
Flood risk assessment	A study to assess the risk of a site or area flooding, and to assess the impact that any changes or development in the site or area will have on *flood risk*.
Flood Zones	Flood Zones are defined in Table D.1 of Planning Policy Statement (PPS) 25: Development and Flood Risk. They indicate land at risk by referring to the probability of flooding from river and sea, ignoring the presence of defences.
Floodplain	Area of land that borders a watercourse, an estuary or the sea, over which water flows in time of flood, or would flow but for the presence of flood defences where they exist.
Functional floodplain	Land where water has to flow or be stored in times of flood. It includes the land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes.
Greenfield	Previously undeveloped land
Groundwater	Water in the ground, usually referring to water in the saturated zone below the *water table*.
Groundwater flooding	Flooding caused by *groundwater* escaping from the ground when the *water table* rises to or above ground level.
Growth Points	The New Growth Points initiative was designed to provide support to local communities who wish to pursue large scale and sustainable growth, including new housing, through partnership with the Government. 29 areas were named New Growth Points and will share £40m in 2007-8 for a first round of infrastructure projects and to support growth related studies, master planning and capacity-building.
Housing Land Availability Assessments	Independent assessments of land availability which considers the options for meeting the Regional Spatial Strategy housing targets
Hydrograph	A graph that shows the variation with time of the level or discharge in a *watercourse*.

Local Development Documents	Documents that set out the spatial strategy for local planning authorities which comprise development plan documents.
Local Development Framework	Framework which forms part of the statutory development plan and supplementary planning documents which expand policies in a development plan document or provide additional detail.
Local planning authority	Body responsible for planning and controlling development, through the planning system.
Main River	A watercourse designated on a statutory map of Main rivers, maintained by Department for Environment, Food and Rural Affairs (DEFRA).
Major Urban Areas (MUAs)	Urban areas which are identified for the focus of Urban Renaissance which will underpin the Regional Spatial Strategy
Mitigation measure	A generic term used in this guide to refer to an element of *development* design which may be used to manage some *risk* to the *development*, or to avoid an increase in *risk* elsewhere.
Ofwat	The Water Services Regulation Authority, which is the economic regulator of the water and sewerage industry in England and Wales.
Ordinary watercourse	A watercourse which is not a private drain and is not designated a *Main river*.
Regional Spatial Strategy	A document produced as part of the national planning system with the main purpose to provide a long term land use and transport planning framework for the Region. It guides the preparation of local authority development plans and local transport plans.
Return period	A term sometimes used to express *flood probability*. It refers to the estimated average time gap between floods of a given magnitude, but as such floods are likely to occur very irregularly, an expression of the *annual flood probability* is preferred.
Runoff	Water flow over the ground surface to the drainage system.

Sequential test	The Sequential Test refers to the application of this approach by Local Planning Authorities (LPAs) in determining land uses that are compatible with the level of flood risk at each allocated development site within a Local Authority area. Development should be directed to Flood Zone 1 wherever possible, and then sequentially to Flood Zones 2 and 3, and to the areas of least flood risk within Flood Zones 2 and 3, as identified by the Strategic Flood Risk Assessments (SFRA) (see Table D.1 and Table D.2 of PPS25).
Settlement of Significant Development	Towns identified for the focus of growth beyond the Major Urban Area. These are identified as being capable of balanced and sustainable growth, with development primarily aimed at meeting the economic and social needs of the area rather than attracting out-migration from the Major Urban Areas.
Standard of protection	The estimated probability of a design event occurring, or being exceeded, in any year. Thus it is the estimated probability of an event occurring which is more severe than those against which an area is protected by flood defences.
Strategic flood risk assessment	A study to examine flood risk issues on a sub-regional scale, typically for a river catchment or local authority area during the preparation of a development plan.
Source Protection Zone (SPZ)	Defined areas showing he risk of contamination to selected groundwater sources used for public drinking water supply, from any activities that might cause pollution in the area.
Sustainable drainage systems (SUDS)	A sequence of management practices and control structures, often referred to as SUDS, designed to drain surface water in a more sustainable manner. Typically, these techniques are used to attenuate rates of runoff from development sites.
Urban Renaissance	The objective of addressing the challenges facing urban areas in the region and to maintain viable and sustainable urban communities.
Watercourse	Any natural or artificial channel that conveys surface water.
Water Cycle Strategy	Provides a plan and programme of Water Services Infrastructure implementation. It is determined through an assessment of the environment and infrastructure capacity for: water supply; sewage disposal; flood risk management; and surface water drainage.

ABBREVIATIONS

ADR	Area of Development Restraint
AMP	Asset Management Plan
CAMS	Catchment Abstraction Management Strategy
CDWF	Consented Dry Weather Flow
CIRIA	Construction Industry Research and Information Association
DCLG	Department of Communities and Local Government
dWRMP	draft Water Resources Management Plan
EA	Environment Agency
ELAA	Employment Land Availability Assessment
FRA	Flood Risk Assessment
FZ	Flood Zone
GIS	Geographical Information System
GQA	General Quality Assessment
HLAA	Housing Land Availability Assessment
JFLOW	A type of 2-Dimensional Hydraulic Model
LDF	Local Development Framework
LiDAR	Light Detection And Ranging
LPA	Local Planning Authority
LNR	Local Nature Reserve
MUA	Major Urban Area
NFCDD	National Flood and Coastal Defence Database
NGO	Non Government Organisation
OS	Ordnance Survey
PPS25	Planning Policy Statement 25 – Development and Flood Risk
RQO	River Quality Objective

RSS	Regional Spatial Strategy
SAC	Special Area of Conservation
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Sites of Special Scientific Interest
SSW	South Staffordshire Water
STW	Severn Trent Water
SUDS	Sustainable Drainage Systems
SWS	Special Wildlife Site
UWWTD	Urban Wastewater Treatment Directive
WCS	Water Cycle Strategy
WCSP	Worcestershire County Structure Plan
WMRSS	West Midlands Regional Spatial Strategy
WTW	Water Treatment Works
WYG	White Young Green Planning

1 INTRODUCTION

1.1 General Overview

In February 2008 Royal Haskoning was appointed by Bromsgrove District Council and Redditch Borough Council (hereafter "the Councils") to produce a Level 1 Strategic Flood Risk Assessment (SFRA) and Water Cycle Strategy (WCS). This report relates to the production of the WCS.

Although the WCS has been carried out jointly between two neighbouring Local Authority areas and this report covers both, the information has been separated, as far as is practical, into the Borough of Redditch and the District of Bromsgrove to allow ease of reference for the individual Councils.

1.2 Scope

The Councils are in the process of preparing their Local Development Frameworks (LDFs), as required by the Planning and Compulsory Purchase Act 2004. In particular, Bromsgrove District Council is looking to build up its evidence base to present its Preferred Option, whereas Redditch Borough Council is working on its Core Strategy. The growth targets, as presented in the Draft Phase Two Revision of the West Midlands Regional Spatial Strategy (WMRSS) for the two local authorities currently stand as follows:

- An additional 2,100 new homes in Bromsgrove District, plus up to an another 3,300 'overflow' from Redditch Borough, by 2026;
- An additional 3,300 new homes in Redditch Borough by 2026, with another 3,300 located across the Borough borders in Bromsgrove District and Stratford-on-Avon District;
- Development of 21ha of employment land in Bromsgrove District, plus up to an additional 24ha 'overflow' from Redditch by 2026; and
- Development of 27ha of employment land in Redditch Borough by 2026, with an additional 24ha located across the Borough borders in Bromsgrove District and Stratford-on-Avon District.

The two towns within the area, Bromsgrove and Redditch, are the focal points for growth in the region, although some of the larger villages within Bromsgrove District have also been sited for expansion. Although this area has not been identified as a potential New Growth Point by Central Government, Redditch has been sited as a 'Settlement of Significant Development' in the Draft Phase Two Revision of the WMRSS. As such, it is expected to accommodate a higher housing provision target than neighbouring areas in order to help meet the shortfall in land capacity of the Major Urban Areas (MUAs), such as Birmingham and Solihull. This has a knock-on effect within Bromsgrove District as it must therefore accommodate its own growth targets in addition to 'overflow' growth from the expansion of Redditch. Due to this concentrated growth and the rural nature of the area in general, locations identified for development have to be selected carefully with due consideration of all the elements of the water cycle.

The Councils need to be in a position to respond with technical studies, to the partial review of the Regional Spatial Strategy (RSS). The WCS is one such study, required in order to assess the constraints and requirements that will arise from the proposed growth on the water infrastructure of the Borough and District.

1.3 Objectives of the Water Cycle Strategy

The WCS considers the following issues, addressing the constraints that they may pose to future development and discusses the improvements necessary to achieve the required level of development:

- Flood Risk;
- Water Resources and Water Supply;
- Waste Water Systems and Treatment; and
- Demand Management.

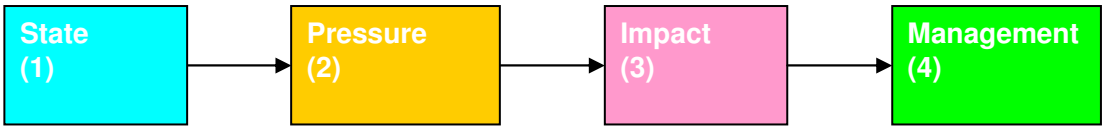
The WCS process also provides a benefit to the water companies by providing them with a more detailed indication of the potential development within the area. This will reduce the number of assumptions that are necessary in making decisions in relation to future planning of resource and infrastructure requirements.

This WCS has been produced in consultation with the Councils, the Council Drainage Engineers, the Environment Agency, Severn Trent Water, South Staffordshire Water, the Highways Agency and British Waterways.

2 DATA COLLECTION AND METHODOLOGY

2.1 Overview

A sequential approach was adopted within the production of this WCS and followed the high level model shown:



1. Firstly, the current status of the water management infrastructure was assessed in order to gain an insight into the current demands placed upon it as well as existing management strategies;
2. Secondly, using information available at the time of writing, the likely trends of future growth, environmental targets and possible external threats (e.g. climate change) were established.
3. Thirdly, the impact of the identified pressures on the existing water infrastructure and other environmental assets was assessed.
4. Finally, sustainable management strategies were proposed in order to manage the identified problems.

The information requested from each consultee was listed and requested at the inception meeting and subsequent meetings held jointly for the SFRA or solely for the WCS. The list of information received can be found in **Appendix B**. The limitations of this data are discussed further in Section 2.7.

2.2 Housing Growth and Trajectories

The Draft Phase Two WMRSS provides targets for housing development for the period 2006 – 2026, as follows:

- For Bromsgrove District, a net total of 2,100 dwellings, with an indicative annual average of 105 dwellings; and
- For Redditch Borough, a net total of 6,600 dwellings, with an indicative annual average of 330 dwellings. 3,300 of these dwellings will be located adjacent to Redditch town in Bromsgrove and/or Stratford-on-Avon Districts.

The Draft also provides targets for development for employment use:

- 21ha in Bromsgrove District, with a rolling five-year reservoir of 7ha;
- 51ha in Redditch Borough, with a rolling five-year reservoir of 17ha. 24ha from the 51ha total and 8ha of the 17ha reservoir will be provided within Bromsgrove and/or Stratford-on-Avon Districts.

Both Councils have provided GIS datasets of proposed development locations. Some of these have been identified for housing and/or employment use. Others have been identified as Strategic sites (within Redditch Borough) or Policy Reference sites (within Bromsgrove District), most of which have not yet been allocated a use. In addition, both Councils have identified sites classified as Areas of Development Restraint (ADRs) which are reserved to meet future employment or housing requirements. All the sites

provided were overlaid upon Ordnance Survey mapping for the Borough and District and used as a basis for discussion with the water companies and for the production of the Level 1 SFRA.

In addition to the housing targets outlined above, this WCS has considered two scenarios of higher development for the purposes of sensitivity testing, based upon estimates provided by the Councils and the higher Options provided in the Draft Phase Two WMRSS. The first sensitivity test was carried out using a 30% increase in the WMRSS figures quoted above and the second used figures in line with Option 3 provided in the WMRSS. Trajectories of growth were created using these targets, housing density targets provided in the Councils' Local Plan documents and the available land allocated within the proposed development sites. These trajectories provide an indication of the rate of development required to meet each target, whether sufficient land has been allocated to meet these targets and the type of land available (i.e. Brownfield or Greenfield).

2.3 Flood Risk

This WCS has been prepared in parallel with a Strategic Flood Risk Assessment (SFRA) for the Borough. The findings in relation to flood risk are therefore based on the Level 1[1] SFRA report. This WCS accounts for the 'Direct Flood Risk' from the Main Rivers and ordinary watercourses and the 'Additional Flood Risk' that a development will pose to existing development further downstream as a result of surface runoff.

2.4 Water Resources and Supply

Potable water within the whole of Redditch Borough and most of Bromsgrove District is provided by Severn Trent Water (STW). A small area to the north of Bromsgrove District, including the village of Romsley is supplied with potable water by South Staffordshire Water (SSW). All information included within this report has been collected through consultation with STW and SSW in addition to documentation from Ofwat and the Environment Agency (EA). Both the water companies published their Strategic Direction Statements in December 2007 and their Draft Water Resource Management Plans 2009 (dWRMP), covering the period 2010 – 2035, in the first half of 2008. All of these documents have been utilised in the production of this report, although it must be borne in mind that , although the dWRMPs have been completed, work is currently underway to produce the final Water Resource Management Plans. As a result this report may require reviewing to account for any changes.

2.5 Wastewater

Wastewater collection and treatment services are provided by STW for the entire of Bromsgrove District and Redditch Borough. Information regarding the standard, capacity and location of the infrastructure has been obtained through consultation with STW and the Councils' Drainage Engineers. In addition, information has also been obtained from the STW's dWRMP and Strategic Direction Statement, '*Focus on Water'*.

At the time of writing, no recent models of the sewage network within the area had been carried out or commissioned.

[1] Bromsgrove District and Redditch Borough SFRA – Level 1 Report, Royal Haskoning, August 2008.

STW have also provided comment regarding the condition and capacity of the main Sewage Treatment Works within the Borough and District,

2.6 Water Quality

The Environment Agency has provided the General Quality Assessment (GQA) grades and River Quality Objectives (RQO) for the main watercourses within Bromsgrove District and Redditch Borough, along with the Catchment Abstraction Management Strategies (CAMS) for the Warwickshire Avon, Worcestershire Middle Severn and the Tame, Anker and Mease. This data was used to provide an assessment of the water quality in the Borough and District.

Initial indications show that although river quality across Bromsgrove District is generally good, some watercourses are failing their RQO targets and scoring low GQA grades. River quality is generally better in Redditch Borough, where only one watercourse failed its RQO target. Levels of phosphates and nitrates in the rivers tend to be high across both Bromsgrove District and Redditch Borough, with a significant increase notable in the downstream sections of the assessed watercourses. Such effects have been attributed to the agricultural practices within the Borough and District and the high rate of surface runoff across this land into the watercourses.

2.7 Data Limitations

Although all stakeholders have been helpful with their provision of data and information provided, there are limitations to the analysis due to the level of detail available. For example, the schematics regarding water supply and sewer infrastructure, were not available at the Borough and District level, so have been adapted from regional reports and recommendations of the water companies. As such, the schematics are indicative only and cannot provide a true representation of the locations of the infrastructure and the distance of the developments from the key pipelines. Such analysis would also be aided with the construction of models to indicate pressure points within the infrastructure system. This was outside the scope of this WCS but, it is possible that STW may commission modelling of the sewer system at a later date which may increase the accuracy of the conclusions of this report.

In addition, it must be borne in mind that the WMRSS and dWRMP reports, which form the basis of this study, are both currently in Draft form. The conclusions may therefore require adjustment when the final reports are published.

3 BROMSGROVE AND REDDITCH WATER CYCLE CATCHMENT

3.1 Bromsgrove District and Redditch Borough

Bromsgrove District and Redditch Borough form the northeastern corner of the County of Worcestershire, south of the West Midlands conurbation.

The District of Bromsgrove lies to the north and northwest of the Borough of Redditch and covers an area of nearly 217km². In 2001, the population of the District totalled 87,837 (2001 census) with 27,633 living in Bromsgrove, the only town. With the exception of a small segment of the Birmingham suburb of Rubery spreading into the north, the rest of the District is rural, containing a few larger villages and numerous smaller settlements and hamlets. The larger villages include West Hagley, Romsley, Catshill, Marlbrook, Barnt Green, Alvechurch, Hollywood and Wythall. The largest concentration of settlements in the District is to the north and northeast of Bromsgrove town, located roughly along the M5 and M42 motorway corridors.

The Borough of Redditch is much smaller than Bromsgrove District, covering just 54.34km². However, it's population is not proportionally lower. In 2001 it's population was 78,813 (2001 census) with 93% living in Redditch town. The town covers the northern half of the Borough, leaving the southern half primarily rural, with only a few minor settlements, the largest of which is Astwood Bank. The two halves are split by a ridge of higher ground extending from the Birmingham plateau, along the route of the A448, although some of Redditch town is located to the south of this ridge.

Figure 1 shows the boundaries of Bromsgrove District and Redditch Borough and includes key features such as main towns, villages, watercourses, roads and railways.

3.2 Water Cycle Infrastructure

3.2.1 Water Supply

Potable water within the whole of Redditch Borough and most of Bromsgrove District is provided by Severn Trent Water (STW). A small area to the north of Bromsgrove District, including the village of Romsley is supplied with potable water by South Staffordshire Water (SSW). Most of the District of Bromsgrove and Borough of Redditch are therefore connected by a network of water supply mains. This is discussed in detail in Section 6 if this report.

The main water supply resource within the area is the Sherwood Sandstone Aquifer, located under the northwest and central area of Bromsgrove District. This groundwater supply provides most of the potable water supply for District and Borough, but besides its primary water supply function, the aquifer has significant environmental value and is vulnerable to overabstraction and pollution.

3.2.2 Wastewater

Wastewater collection and treatment within the Borough and District is the responsibility of STW. The wastewater produced within Bromsgrove District is treated at a number of sewage treatment works, located within and outside the District. The two main sewage treatment works within the District are Fringe Green, located on the River Salwarpe, southwest of Bromsgrove, and Alvechurch, on the River Arrow. Outside the borders,

wastewater is pumped to the northwest to Roundhill sewage treatment works (located to the west of Stourport and discharging into the River Severn), to the northeast to Minworth sewage treatment works (located on the River Tame to the east of Birmingham) and to the southwest to Droitwich/Ladywood sewage treatment works (which discharges into the River Salwarpe).

The wastewater produced from Redditch Borough is processed at Spernal sewage treatment works (located on the River Arrow, outside the Borough in Studley) and Priest Bridge sewage treatment works (located on Bow Brook, within the southwestern corner of the Borough boundary). The issues relating to wastewater collection and treatment are discussed in detail in Section 7 of this report.

3.2.3 Watercourses

The Main Rivers located within Bromsgrove District and Redditch Borough are shown on **Figure 1**.

Within Bromsgrove town the Battlefield Brook is enmained from the M42. As it passes through the town the name of the watercourse changes to the Spadesbourne Brook, the Sugar Brook and then finally the River Salwarpe, which leaves the District in the southwestern corner at Stoke Prior. The only other Main Rivers within Bromsgrove District are the Gallows Brook, which flows through West Hagley in the northwestern corner of the District, and the upstream extent of the River Arrow which is enmained from the village of Alvechurch and flows almost due south, crossing the Redditch Borough boundary.

Within Redditch, the River Arrow is enmained for its entire extent through the Borough, bisecting the town from north to south. The Borough also contains the Bow Brook, which at its upstream extremity is known as The Wharrage. It subsequently becomes the Wixon Brook, beyond Feckenham Road, Hunt End and joins the Swans Brook at old Yarr. Further downstream, northwest of Feckenham village, the Swans Brook is renamed as the Bow Brook, which flows due south to the Borough boundary before turning west and crossing the boundary at Priest Bridge.

In addition to these Main Rivers, there are numerous tributary streams and brooks (ordinary watercourses) draining the Birmingham Plateau, which forms the northern half of Bromsgrove District, and surrounding hills and fields. There are also two canals present, both located within Bromsgrove District. The Worcester and Birmingham canal bisects the District from the north to the southeast. This section of canal includes the Tardebigge lock flight, and is fed by the Lower and Upper Bittell and Tardebigge reservoirs. In addition, a very short section of the Stratford-on-Avon canal passes across the far northeastern corner of the District. Numerous pools, balancing ponds and storage areas are located within Redditch Borough and Bromsgrove District, but, other than the canal feeders, there are no water supply reservoirs within the boundaries. However, the Bartley Reservoir is located just beyond the northern boundary of the District, at Bartley Green.

4 GROWTH AND DEVELOPMENT WITHIN BROMSGROVE AND REDDITCH

4.1 Introduction

In order to assess the capacity of the water cycle infrastructure to meet the likely requirements of future development, it is necessary to assume development projection scenarios. However, the inherent difficulty in determining the location of potential development should be recognised, as the precise location of sites will be dependent upon an overall assessment of the findings of numerous individual studies, such as this WCS and the SFRA. It must also be noted that these trajectories represent a 'snap shot' in time and the site allocations and locations may change during the planning period. Some sites included within this report may also have been developed by the time of completion of this report. All of the trajectories presented within this Section should therefore be considered as guidance only. Although a change in an individual site from a housing allocation to employment or visa versa may have little effect on the conclusions of this WCS, large scale changes may require a review of this report. A number of development sites (both Greenfield and Brownfield) have been put forward for consideration within this study and are shown, along with the reference numbers which will be referred to within this report, in **Figure 2**. They have been retained in the groups in which they were provided or displayed in the Local Plan documents for ease of reference by the Councils.

4.2 Development Scenarios

4.2.1 Proposed Scenarios

The WCS has been produced based on development projections provided by the Councils. These figures match the preferred Option presented in the Draft Phase Two WMRSS, published in December 2007[2], and cover the period 2006-2026. The town of Redditch has been identified as a 'Settlement of Significant Development' within the Draft Phase Two WMRSS. It therefore has the potential to be allocated housing and employment targets beyond its own generated needs to meet the shortfall in land capacity of the Major Urban Areas (MUAs), such as Birmingham and Solihull. However, the targets currently provided for Redditch only meet the needs of the Borough and not the MUAs and the Council is currently questioning this issue in their response to the RSS. The Borough itself does not have the land capacity to meet the current requirement, regardless of the potential increase from the MUAs, resulting in the need for the neighbouring Districts of Bromsgrove and/or Stratford-on-Avon to accommodate approximately 50% of the allocated development along the borders of Redditch Borough.

The development projections provided by the Councils for the period 2006 – 2026 are as follows:

[2] West Midlands Regional Spatial Strategy, Phase Two Revision – Draft. Preferred Option December 2007

BROMSGROVE DISTRICT

Housing:

- 2,100 dwellings, with an indicative annual average of 105 per year.
- Up to an additional 3,300 dwellings 'overflow' from Redditch Borough, with an indicative annual average of approximately 165 per year, to be located in proximity to the Redditch Borough boundary.

Based on a housing density of 40 houses per hectare (the average Government guideline figure[3]), this gives a total housing requirement of 52.5 hectares for Bromsgrove's allocation and up to an additional 82.5 hectares to accommodate the overflow from Redditch Borough.

Employment:

- 21ha of employment land to meet the needs of the District.
- Up to an additional 24ha of 'overflow' from Redditch Borough, to be located in proximity to the Redditch Borough boundary.

REDDITCH BOROUGH

Housing:

- 3,300 dwellings, with an indicative annual average of approximately 165 per year.
- An additional 3,300 dwellings are to be located on the outskirts of Redditch, across the Borough boundary in Bromsgrove and/or Stratford-on-Avon Districts. These are to be located in proximity to the Redditch Borough boundary.

The Borough of Redditch Local Development Framework (LDF) states that residential development within or adjacent to Redditch, Astwood bank or Feckenham should be developed at densities of between 30 and 50 dwellings per hectare. Within Redditch's Town Centre or District Centres, densities of about 70 dwellings per hectare should be achieved. As relatively few development sites are located in the Town Centre or District Centres, this report will be based on the conservative approach of 40 dwellings per hectare. This gives a total housing land requirement of 82.5 hectares within the Borough boundaries.

Employment:

- 27ha of employment land within the Borough boundaries.
- An additional 24ha of employment land located on the outskirts of the town within Bromsgrove and/or Stratford-on-Avon Districts. These are to be located in proximity to the Redditch Borough boundary.

[3] Bromsgrove District Council, Issues and Options, June 2005

4.2.2 Scenarios for Sensitivity Testing

However, as the WRMSS has not yet been finalised and, as a result of the Baroness Andrews Intervention and resulting Nathaniel Lichfield[4] study, it is thought that the housing figures quoted in the Draft Phase Two report will increase. Unfortunately these figures will not be published during the time scale of this study. As a result we have considered two scenarios of higher development projections for the purposes of sensitivity testing, based upon estimates provided by the Councils and the Phase Two WMRSS Options, released for consultation in January 2007.

The Councils predict that the final WMRSS figures may increase by between 10% and 30%. The first sensitivity test will therefore be carried out using a 30% increase on the Preferred Option housing and employment figures. As the resulting figures from this 30% increase fall between the Options 1 and 2 figures quoted in the Phase Two WMRSS consultation paper, we have taken the extreme scenario of Option 3 as a high level sensitivity test. The employment figures for Option 3 have been calculated using the same ratio of increase shown between the Preferred Option and Option 3 housing figures. **Table 1** outlines these three sensitivity test scenarios:

Table 1: Housing and Employment Scenario figures for the purposes of sensitivity testing

	Scenario 1 ***(Preferred Option)***	**Scenario 2** ***(Preferred Option +30%)***	**Scenario 3** ***(WMRSS Phase Two Option 3)***
Bromsgrove			
Housing	2,100	2,730	7,200
Employment	21ha	27ha	72ha
Redditch*			
Housing	6,600 (3,300 + 3,300)	8,580 (4,290 + 4,290)	13,200 ((6,600 + 6,600)
Employment	51ha (27ha + 24ha)	66ha (35ha + 31ha)	99ha (54ha + 45ha)

* N.B. The employment and housing figures shown for Redditch are the total allocation for the Borough. The figures shown in brackets beneath shows this total allocation split into the total to be located within Redditch Borough (the first figure) and the total to be located on the outskirts of Redditch Borough in either Bromsgrove or Stratford-on-Avon Districts (the second figure).

[4] *Commissioned by the Government Office for the West Midlands to look at options for higher housing growth across the Region to meet the government's aspirations set out in the 2007 Housing Green Paper.*

4.2.3 Phasing of Development

BROMSGROVE DISTRICT

The Council has supplied a GIS of potential development sites, based upon their Local Plan 2004. The development sites were grouped in the GIS based on the following categorisations:

- Areas of Development Restraint (ADRs)
- Employment Zoning
- Shopping Regions
- Unzoned
- Village Envelopes
- Employment Policies
- Green Belt Zoning
- Open Space Policies
- Residential Policies
- Residential Zoning

To enable cross reference with the Local Plan, the last five of these categories have been grouped together under the heading 'Policy Reference' and, therefore throughout this report have Unique ID references starting with the letters 'PR'. Similarly, the ADRs have been assigned Unique ID references starting with the letter 'A', Employment Zoning the letter 'E', Shopping Regions 'Sh' and Unzoned sites 'UZ'. The Village Envelopes are referred to by name.

Sites identified for Residential Policies and Residential Zoning are destined for housing development and the Employment Zoning and Employment Polices for employment development. The ADRs are greenbelt sites which are reserved to fulfil future housing and employment needs, if necessary. The areas of these sites are therefore used within this report to calculate the land available for housing and employment development, if required. The sites identified for Green Belt Zoning, Open Space Policies and Unzoned sites have also been used to calculate the land availability for developments, prioritising the use of Brownfield land. Although the development in the Shopping Regions will probably be utilised for employment and the village envelopes assigned for housing, the development in these areas will be infill based. As a result the areas of these sites have not been included as part of the calculations of housing and employment land availability within this report. However these sites have been included within the evaluation of the water cycle as they may be utilised to fulfil the development quotas at a later date.

Land Availability Assessments

Bromsgrove District Council is in the process of undertaking a Strategic Housing Land Availability Assessment (SHLAA) which is not yet available for use within this study. However, in 2007 the Council published Land Availability assessments for both Housing and Employment, identifying the development position within the District as of April 2007. These studies identify the completions in development up to this date and compare the phasing of housing land release in relation to the original 2004 WMRSS development targets. **Table 2** and **Table 3** outline the completions, ongoing constructions and permissions between April 2006 and March 2007 for the housing and employment land developments.

Table 2: Summary of Housing Land Supply April 2006 – March 2007

	Completions	Under Construction	Outstanding (planning permission granted)
Bromsgrove Town*	192	28	126
Rest of District	84	64	186
TOTAL	276	92	312

*N.B. the figures for Bromsgrove Town include the village of Lickey End

Table 3: Summary of Employment Land Supply April 2006 – March 2007

	Completions	Under Construction	Outstanding (planning permission granted)
Bromsgrove District	2.6ha	5.1ha	20.3ha
Ravensbank Business Park *(Site E4)**	5ha	-	2.7ha
TOTAL	7.6ha	5.1ha	23ha

* N.B. Ravensbank Business Park is shown separately as it is being utilised to fulfil the employment needs of Redditch Borough

Proposed Development Sites

Table 4 summarises the land availability from the proposed development sites provided in the Council's GIS. The number of dwellings has been calculated using the average Government target of 40dwellings per hectare, as stated in the Bromsgrove District Council Issues and Options publication, 2005.

Table 4 – Proposed Development Sites, Land Availability

GIS Shapefile	Proposed Development Sites	Area	*Total*
Employment Zoning	E1 – E8	220.9ha	263.5ha
Employment Policies	PR1 – PR5	42.6ha	
Residential Policies	PR41 – PR43	45.5ha	147.7 ≈5,908 dwellings
Residential Zoning	PR34 – PR40	102.2ha	
Areas of Development Restraint (ADRs)	A1 – A13	169.0ha	
Green Belt Zoning	PR6 – PR19	58.8ha	
Unzoned	UZ1	8.7ha	
Open Space Policies	PR2 – PR33	22.8ha	
Shopping Regions	Sh1 – Sh10	12.1ha	

The Housing Land Availability assessment (HLAA) lists the developments completed between 1996 and 2007. A brief review of the larger sites (greater than 10 dwellings) that have been completed since the construction of the 2004 Local Plan shapefiles indicates that three of the development sites included in the table above have already been developed. All the area within development site PR1, 3.1ha, has been developed between 2005 and 2007 creating 124 new dwellings. Development site E8 overlaps with site PR1, resulting in a loss of 3.1ha from that area. In addition another 2.8ha of E8 has been developed, on which another 113 dwellings have been constructed. Clearly this indicates a switch in allocation from employment land to housing development for at

least part of this site. In addition site PR35, 0.4ha, has been developed into 21 dwellings.

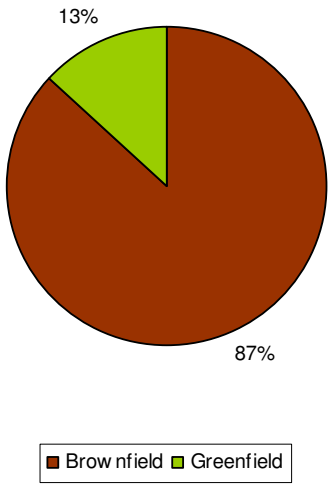
The Employment Land Availability assessment (ELAA) lists the employment sites developed since 2000/01 and 2007. Following a similar review as the housing sites above, it would appear that four of the proposed employment sites have already been developed since 2004. These include: E8, of which 6.96ha have been developed; 4ha of E6; 10.43ha of E4 and 3.12ha of PR2. In addition, the sites originally allocated for employment and now developed as housing must be deducted – 5.9ha of site E8 and 3.1ha from PR1.

Taking these adjustments into account, there is now a total of approximately 230ha of proposed employment land available for development and 147.3ha of housing land, which, at 40 houses per hectare, is equivalent to 5,892 dwellings. These adjusted values have been used in the rest of the analysis of land availability.

Land Type

The Worcestershire County Structure Plan (WCSP), 2001, states that 40% of housing development should be located on previously developed, Brownfield, land. However, it does not state a figure for employment development, although as much as possible should also be located on Brownfield land. **Figure 3**, below, shows that the completions between 2006 and 2007 are well above this target. The figures used in this figure were taken from the Housing Land Availability assessment.

Figure 3: Brownfield/Greenfield Housing Land Supply for Bromsgrove District April 2006–March 2007



The type of land on which the proposed development sites are located was not provided as part of the GIS. However, a brief review of the OS maps and Google Earth images reveal the following percentages of land type within the proposed site categories, shown in **Figure 4**. The 40% minimum stated within the WCSP is indicated by the red dashed line:

Figure 4 – Percentage of Brownfield and Greenfield Land Allocated Within Proposed Developments

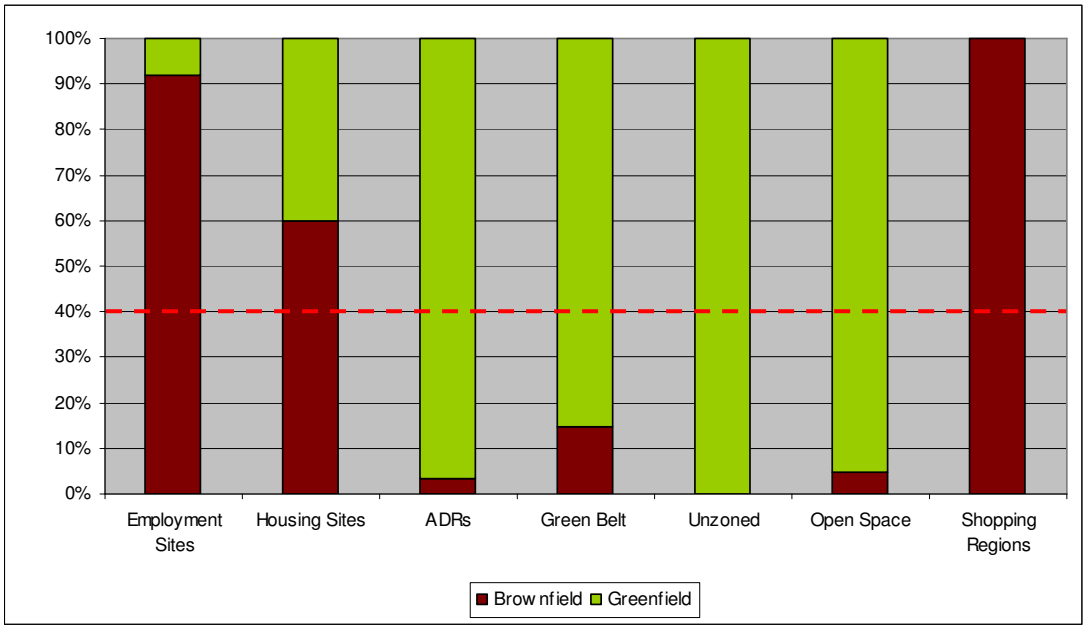


Figure 4 shows that, if the land identified for housing and employment development is sufficient to meet the development targets, then there is sufficient Brownfield land to be within the limits set by the WCSP. However, the high proportion of Greenfield land included within the ADR, Green Belt, Unzoned and Open Space categories indicates that inclusion of this land to meet the development targets will quickly decrease the percentage of Brownfield land utilised.

Development Projections

To indicate whether there is enough development land proposed to accommodate the targets set by the three development scenarios outlined in Section 4.2.2 and in which year the land categories will become saturated, we have developed a set of development trajectories, shown in **Figures 5** and **6**. The graphs indicate the following:

- The blue lines indicate the Draft Phase Two WMRSS targets, increasing at the specified indicative average;
- The purple lines indicate the current position of development within the areas in terms of constructed developments and those under construction. Permissions have been disregarded as they may overlap with sites identified for development and it cannot be certified whether they will actually be constructed. The housing figures also include the oversupply from 2001-6 outlined in the Housing Land Availability Assessment;
- The pink arrow indicates where the Councils stand with this current position with reference to the WMRSS target;
- The yellow, orange and red dots show the targets of the three scenarios outlined in **Table 1** (Scenario 1 is shown in yellow, Scenario 2 in orange and Scenario 3 in red);
- The colour referenced dashed lines joining these dots to the 2007 position indicate the rate of development required to achieve the Scenario targets;

- The coloured arrows to the right of the charts indicate the increases required on each of the Scenario targets to fulfil the overflow quota from Redditch (see **Table 2**);
- The green lines on these arrows indicate the land available in the proposed development sites located on the borders of Redditch Borough to accept this overflow;
- The shading behind the graphs indicates the land availability in each category, divided into Brownfield and Greenfield. This shading initiates from the position at 2007 as the main sites developed or under construction between 2006 and 2007 have be en identified from the Land Availability Assessments and deducted from the proposed development site allocations (as outlined above). However, it must be noted that the sites developed between 2006-7 containing fewer than 10 dwellings have not been included in this deduction.

Housing

Figure 5 – Housing Trajectory for Bromsgrove District

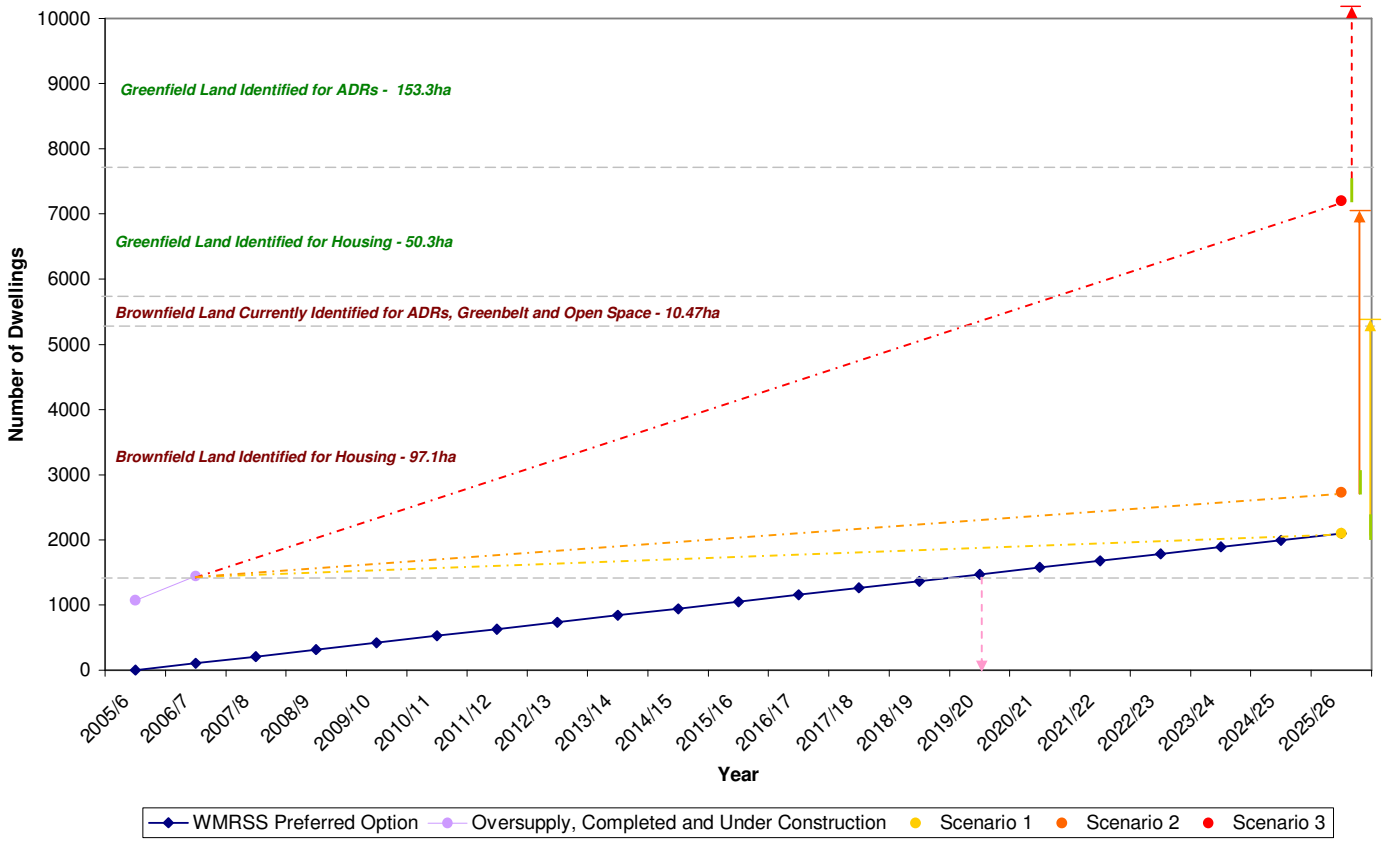


Figure 5 indicates that, at present, the Council is a well above the new WMRSS targets, with an oversupply of housing sufficient to meet the target set for the year 2020. Scenario 1 would require an increase from 2007 of approximately 35 dwellings per year, Scenario 2 would require an increase of approximately 68 dwellings per year, whereas Scenario 3 would require a rapid increase of just over 303 dwellings per year. It must be noted that the assumption of a constant growth rate to 2026, for this and all other trajectories in this WCS, was made as no other information was available. The actual

rates of growth will obviously affect the timings of any loss of capacities or required infrastructure improvements.

Figure 5 also indicates the type of land available for development. Development sites PR9 and A4 have been removed from this housing availability as they are located in proximity to the border of Redditch Borough and can therefore be utilised to fulfil the overflow quota. As shown in **Figure 5**, a large proportion of the land identified for housing development is Brownfield, totalling 97.1ha. This is more than sufficient to meet the requirements of Scenarios 1 and 2 and clearly fulfils the WCSP target stating 40% of new housing development should be located on Brownfield land. Scenario 3 requires a much larger area of land and exceeds the capacity of the Brownfield housing land allocation in 2019/20. Presuming the Council prioritises all Brownfield land development over Greenfield land development, the allocation of Brownfield Open Space, Green Belt and ADR land to housing will fulfil the housing land quota until 2021/22, after which Greenfield land will be required. There is sufficient Greenfield land allocated for Housing development to fulfil this Scenario target without the need for the Greenfield ADR land.

The accommodation of the overflow housing need from Redditch Borough increases the Scenario targets fairly dramatically. As development site E4 is required for accommodation of the employment overflow from Redditch (see below), only two sites, PR9 and A4 are available to accommodate the housing need, totalling an area of 10.3ha of Greenfield land, which will accommodate approximately 412 dwellings. The green markers on the arrows shown on **Figure 5** indicate that this is a very small proportion of the housing needs for all Scenarios. Extra land will therefore be required or the District of Stratford upon Avon will need to accommodate the bulk of the overflow.

Employment

Figure 6 – Employment Trajectory for Bromsgrove District

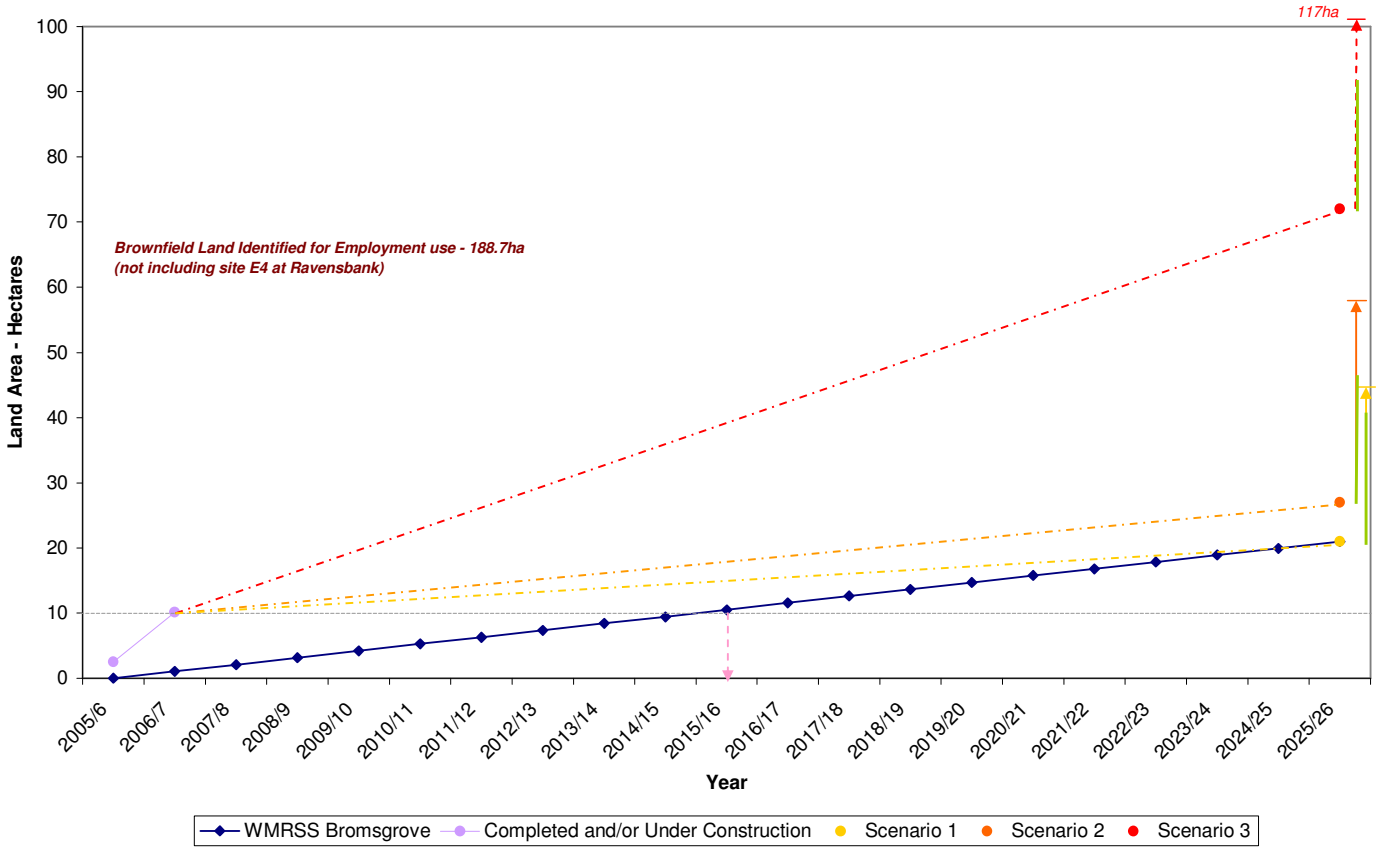


Figure 6 indicates that, at present, the Council has developed sufficient employment land to fulfil its WRMSS quota until 2015/16. However, in order to achieve the Scenario targets, it will need to develop 0.6ha of land per year for Scenario 1, 0.9ha of land per year for Scenario 2 and 3.3ha of land per year for Scenario 3. There is a total of 188.7ha of Brownfield land allocated for employment use which is more than sufficient to accommodate these needs.

The Greenfield site of Ravensbank Business Park, E4, has been identified on the border of Redditch Borough to accommodate Redditch's overflow growth. Between 2004 and 2006 5.4ha of this site were developed, resulting in an availability of land of 24.5ha. Between 2006 and 2007, 5ha of this land was developed, although as it was developed for the needs of Redditch, it has not been deducted from the land requirement or availability in **Figure 6**. The 24.5ha of land available between 2006 and 2026 is sufficient to accommodate a large proportion of the overflow from Redditch, totalling 100% of the requirement for Scenario 1, 79% of the requirement for Scenario 2 and 54.4% of the requirement for Scenario 3. With allocation of land within Stratford upon Avon this site E4 will be sufficient and the excess land could be used to accommodate some of the overflow housing quota.

REDDITCH BOROUGH

Redditch Council has also supplied a GIS of potential development sites, based upon their LDF. As they did not completely match the sites shown in the Local Plan No.3 (provided within the LDF), the development sites were grouped based on their headings within the GIS:

- Areas of Development Restraint (ADRs)
- Employment Sites
- Housing Sites
- Strategic Sites

The Unique ID references used within this report follow on from the ID numbers used for Bromsgrove District: ADRs have been assigned Unique ID references starting within the letter 'A'; Employment sites with the letter 'E'; Housing sites with the letter 'H' and Strategic Sites with the letters 'St'. Similarly to Bromsgrove, the ADRs are Greenfield sites reserved to fulfil future housing and employment needs, if necessary. The areas of these sites are therefore used within this report to calculate the land available for housing and employment development, if required. The Strategic Sites have a mixture of identified uses, as outlined in **Table 5** below:

Table 5 – Identified use for Strategic Sites in Redditch Borough

Site	Intended Use
St1	Mixed Use (District Centre)
St2	Mixed Use (District Centre)
St3	Mixed Use (District Centre)
St4	Mixed Use (District Centre)
St5	Extra Housing
St6	Employment
St7	Unidentified
St8	Employment
St9	Extra Housing
St10	Mixed Use

The Strategic Sites identified as having an Employment or Housing use will be included in the calculations of trajectories. The mixed use and unidentified sites will only be referred to if there is a shortfall in the available land. This conservative approach allows flexibility in the use of these sites.

Land Availability Assessments

Redditch Borough Council has undertaken a number of land availability assessments, including the '5 Year Housing Land Supply in Redditch Borough, 2007', 'Employment Commitments in Redditch Borough, 2007', 'Housing Commitments in Redditch Borough, 2008' and 'Housing Completions in Redditch Borough on Large and Small Sites, 2008' and identify the development positions of housing and employment within the Borough as of April 2007 or 2008. In addition White Young Green (WYG) produced a 'Joint Study into the Future Growth Implications of Redditch Town to 2026' in December 2007. However, this report was produced before the Revised Phase Two WMRSS figures were released, which are only referred to briefly within the Addendum and do not take

into account developments in 2007. **Tables 6** and **7** outline the completions, ongoing constructions and permissions between 2006 - 2007 for the housing land developments and 2006 – 2007 and 2007 – 2008 for the employment land developments.

Table 6: Summary of Housing Land Supply April 2006 – March 2008

	Completions		Under Construction 2007 - 2008	Outstanding (planning permission granted) 2007 - 2008
	2006 – 2007	2007 - 2008		
Brownfield	397	193	38	56
Greenfield	57	43	1	14
Redditch Borough TOTAL	454	236	39	70

Table 7: Summary of Employment Land Supply April 2006 – March 2007

	Completions	Commitments
Redditch Borough TOTAL	0.97ha	5.55ha

NB Completions do not include Ravensbank Business Park and Commitments do not include permissions as far as possible.

Proposed Development Sites

Table 8 summarises the land availability from the proposed development sites provided in the Council's GIS. The total number of dwellings has been calculated using the conservative average outlined in Section 4.2.1 of 40 dwellings per hectare[5].

Table 8 – Proposed Development Sites, Land Availability

GIS Shapefile	Proposed Development Sites	Area	*Total*
Housing	H1 – H13	13.9ha	16ha
Strategic Site Housing	St5, St9	2.1ha	≈640 dwellings
Employment	E9 – E27	21.3ha	23.8ha
Strategic Site Employment	St6, St8	2.5ha	
ADRs	A14 – A16	106.5ha	
Strategic Site Unidentified	St7	1.3ha	
Strategic Site Mixed Use	St1 – St4, St10	12.1ha	

As this WCS covers the period 2006 – 2026 and the LDF was produced in 2006, there should not be a problem with the inclusion of sites within the GIS which were developed before the initiation of the study period. It is therefore assumed that all the sites provided were still available for development at the start of 2006. As the Land Availability Assessments do not include any of the proposed development sites within the completions between 2006-7, it is assumed that the sites provided for analysis within this WCS have not been developed between 2006 and the present day and the total employment and housing land available remains as shown in **Table 8**.

[5] Note that the White Young Green report, 2007 uses densities of 35dewllings per hectare

Land Type

The Worcestershire County Structure Plan (WCSP), 2001, states that within Redditch Borough, 25% of housing development should be located on previously developed, Brownfield, land. However, it does not state a figure for employment development, although as much as possible should also be located on Brownfield land. **Figure 7**, below, shows that the completions between 2006 and 2007 and 2007 and 2008 are well above this target. The figures used in this figure were taken from the 'Housing Completions in Redditch Borough on Large and Small Sites, 2008' document.

Figure 7 - Brownfield/Greenfield Housing Land Supply for Redditch Borough April 2006–March 2007 and April 2007 – March 2008

The land type of the proposed development sites was not provided as part of the GIS. However, a brief review of the OS maps and Google Earth images reveal the following percentages of land type within the proposed site categories. The 25% minimum stated within the WCSP is indicated by the red dashed line:

Figure 8 – Percentage of Brownfield and Greenfield Land Allocated Within Proposed Developments

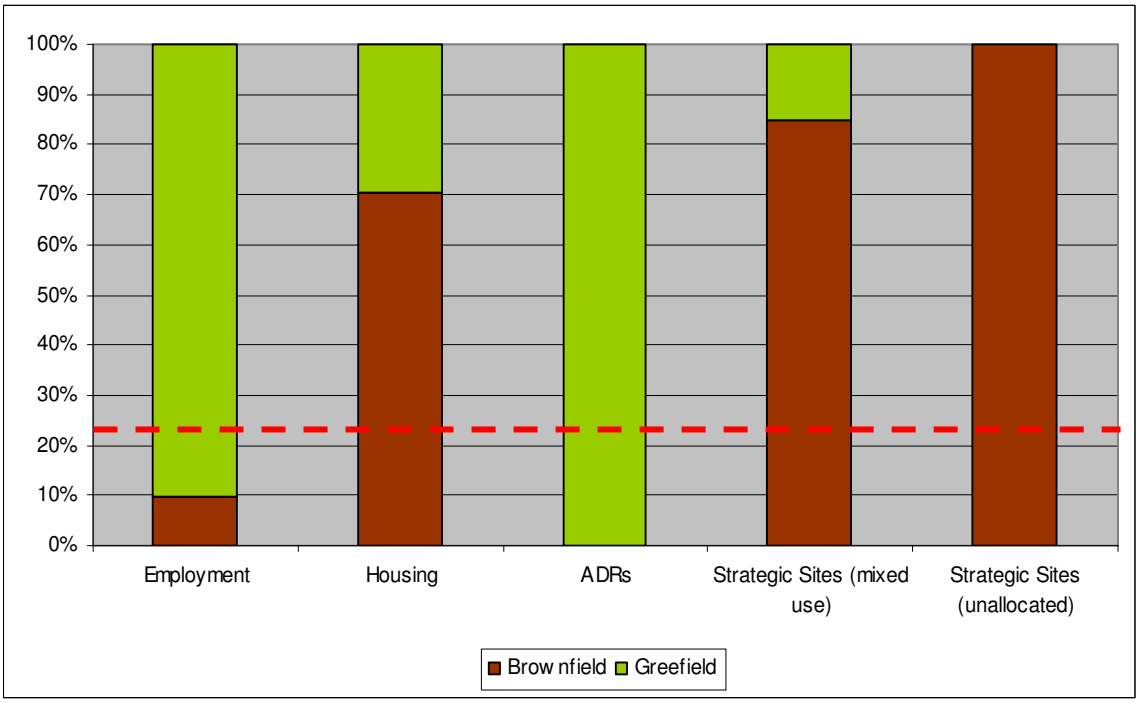


Figure 8 shows that, if the land identified for housing is sufficient to meet the development targets, then there is sufficient Brownfield land to be within the limits set by the WCSP. The allocated Employment land, however, falls below the target, although the incorporation of strategic site land, which includes a very high proportion of Brownfield land, may assist in sufficiently raising the allocation.

Development Projections

To indicate whether there is enough development land proposed to accommodate the targets set by the three development scenarios outlined in Section 4.2.2 and in which year the land categories will become saturated, we have developed a set of development trajectories, shown in **Figures 9** and **10**. The graphs use the same colour scheme as those shown for Bromsgrove above and indicate the following:

- The blue lines indicate the Draft Phase Two WMRSS targets, increasing at the specified indicative average;
- The purple lines indicate the current position of development within the areas in terms of constructed developments and those under construction. Permissions have been disregarded as they may overlap with sites identified for development and it cannot be certified whether they will actually be constructed.
- The pink arrow indicates where the Councils stand with this current position with reference to the WMRSS target;
- The yellow, orange and red dots show the targets of the three scenarios outlined in **Table 1** (Scenario 1 is shown in yellow, Scenario 2 in orange and Scenario 3 in red);
- The colour referenced dashed lines joining these dots to the 2007 position indicate the rate of development required to achieve the Scenario targets;
- The shading behind the graphs indicates the land availability in each category, divided into Brownfield and Greenfield. This shading initiates from the position

at 2007 as it is assumed that non of the development between 2006 and 2007 has taken place on the proposed development sites.

Housing

Figure 9 – Housing Trajectory for Redditch Borough

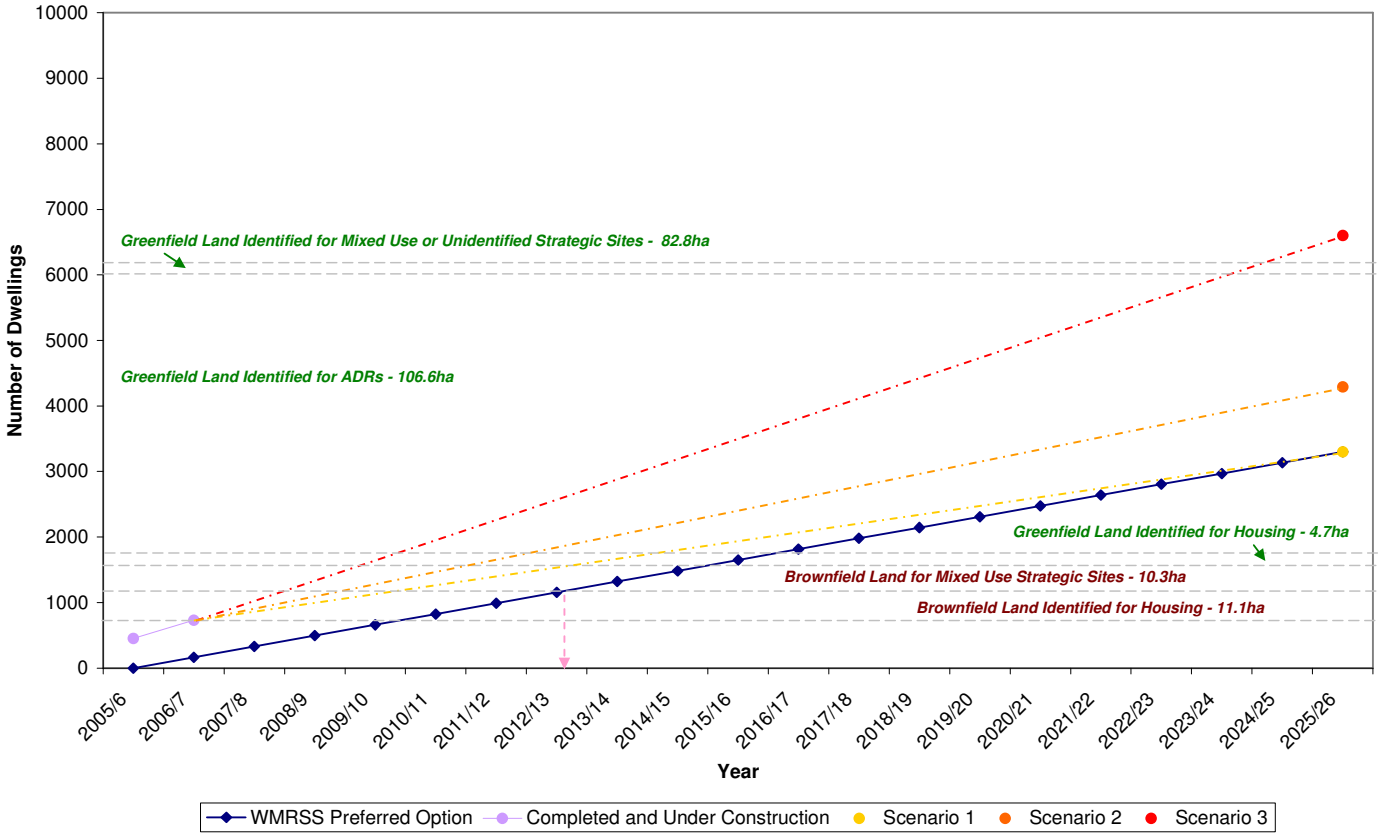


Figure 9 indicates that, at present, the Council is above the new WMRSS targets, with sufficient housing development to meet the target set 2010. Scenario 1 would require an increase from 2007 of approximately 135 dwellings per year, Scenario 2 would require an increase of approximately 187 dwellings per year, whereas Scenario 3 would require a rapid increase of 309 dwellings per year.

Figure 9 also indicates the type of land available for development. There is a fairly limited supply of land identified for housing development within Redditch, totalling just 15.8 ha (approximately 632 dwellings). Only 11.1ha of this land is Brownfield. **Figure 9** prioritises all the Brownfield land available, including the ADRs and Mixed Use Strategic Sites. Scenario 1 utilises all the Brownfield land available, in addition to all the Greenfield housing land and some of the Greenfield ADR land, with the Greenfield land requiring utilisation beyond 2021. There is also sufficient additional Greenfield ADR land to accommodate the increased development required for Scenario 2. However, there does not appear to be sufficient land in total to accommodate the growth target depicted in Scenario 3, even when all the housing, ADR and Strategic Site land is included (although excluding the employment site allocations). The shortfall is 443 dwellings (approximately 11ha).

However, there is sufficient Brownfield land in total (33%) to fulfil the WCSP target of 25% minimum Brownfield development for all Scenarios.

Employment

Figure 10 – Employment Trajectory for Redditch Borough

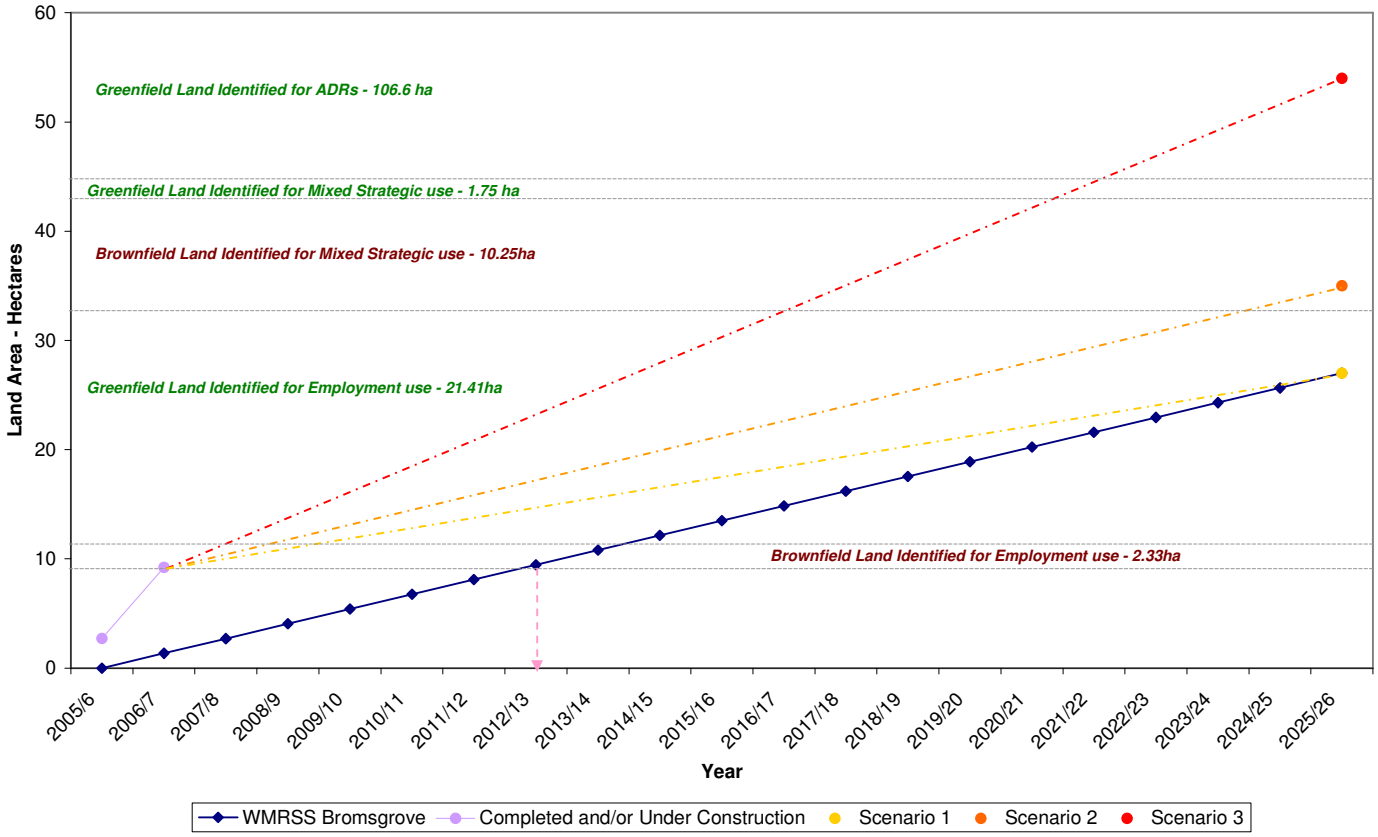


Figure 10 indicates that, at present, the Council has developed sufficient employment land to fulfil its WRMSS quota until 2012/13. However, in order to achieve the Scenario targets, it will need to develop 0.9ha of land per year for Scenario 1, 1.4ha of land per year for Scenario 2 and 2.4ha of land per year for Scenario 3. There is a total of 2.3ha of Brownfield land and 21.4ha of Greenfield land allocated for employment use. This is sufficient to meet Scenario 1 target, but additional land is required to meet Scenarios 2 and 3. Disregarding the additional land required for Housing, Scenario 2 would require some of the Brownfield land identified for Mixed Strategic use and Scenario 3 would require all the land identified for Mixed Strategic use and some of a large proportion of the Brownfield ADR land. There is sufficient land available to meet the housing and employment needs for Scenario 2 but not for Scenario 3. To meet this higher target additional land will be required.

5 FLOOD RISK

5.1 Introduction

PPS25 identifies flood risk as a material planning consideration, which should be addressed at all stages of the planning process. The issue of flood risk in respect to new development should be considered in terms of:

- Direct flood risk to the new development.
- Increased flood risk to other areas as a result of an increase in surface water runoff rate.

This section draws on the findings of the Level 1 Strategic Flood Risk Assessment and considers the potential development sites in terms of the impact of flood risk.

5.2 Bromsgrove and Redditch Flood Risk Assessment

This WCS has been prepared in parallel with a joint Strategic Flood Risk Assessment (SFRA) for the Borough and District. The findings in relation to flood risk are therefore based on the Level 1 SFRA report.

The SFRA was produced in accordance with PPS25 guidelines (Communities and Local Government, 2006, Planning Policy Statement 25: Development and Flood Risk) and Development and Flood Risk a Practice Guide, 2008.

The objectives of the SFRA are to provide a robust assessment of the extent and nature of the risk of flooding and its implications for land use planning. In addition, the SFRA sets the criteria for the submission of planning applications in the future and for guiding subsequent development control decisions.

5.2.1 Direct Flood Risk

The majority of proposed new development within the District and Borough are located within or around the towns of Bromsgrove and Redditch. The rest of the development sites are scattered around the larger villages in the rural areas.

Environment Agency Flood Zones

In accordance with PPS25, the location of new development should initially be based on the Flood Zones defined in the Environment Agency's Flood Map, which refer to the probability of sea and river flooding, ignoring the presence of any defences. **Table 9** below shows the Flood Risk Vulnerability and Flood Zone Compatibility (from PPS25).

Table 9 – Flood Risk Vulnerability and Flood Zone "Compatibility" (from PPS25)

Flood Zone	Definition	Flood Risk Vulnerability Classification				
		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	*Low Probability:* less than 1:1000 probability of river or sea flooding in any year (<0.1%)	✓	✓	✓	✓	✓
Zone 2	*Medium Probability:* 1%-0.1% probability of river flooding or 0.5%-0.1% probability of sea flooding in any year	✓	✓	Exception Test Required	✓	✓
Zone 3a	*High Probability:* >1% probability of river flooding or >0.5% probability of sea flooding in any year	Exception Test Required	✓	X	Exception Test Required	✓
Zone 3b	*Functional Floodplain:* annual probability of flooding of 1:20 years (5%) or greater, where flood water flows or is stored	Exception Test Required	✓	X	X	X

The Sequential and Exception Tests

The Sequential Test aims to steer all development to areas at the lowest probability of flooding. When land is allocated for development, the sequential test should be applied to demonstrate that all other sites reasonably available for development in areas at a lower probability of flooding have been considered first.

Following the application of the Sequential Test, there may be valid reasons for considering a development type which is not entirely compatible with the level of flood risk of that site. The Exception Test provides a method of managing flood risk whilst allowing necessary development to occur. However, this does tend to be in exceptional circumstances.

PPS25 states *"The Exception Test is only appropriate for use when there are large areas in Flood Zones 2 and 3, where the Sequential Test alone cannot deliver acceptable sites, but where some continuing development is necessary for wider sustainable development reasons*."

The Exception Test shows:

- if a proposed development provides wider sustainability benefits that outweigh the increased flood risk;
- that the development does not subsequently increase flood risk;
- that where possible the development will reduce flood risk; and
- most importantly that the development will be safe.

The development should also be on previously developed land.

Employment use, including shops, financial, professional an other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non residential institutions and assembly and leisure, are identified within PPS25 as being 'Less Vulnerable'. These are therefore permitted in Flood Zones 2 or 3a, following application of the Sequential Test. Residential use is generally classified as 'More Vulnerable', unless it consists of caravans, mobile homes or park homes intended for permanent use or includes basement dwellings, in which case it is classified as 'Highly Vulnerable'. Following application of the Sequential Test, application of the Exception

Test is required for More Vulnerable use development in Flood Zone 3a and Highly Vulnerable development in Flood Zone 2.

The EA will object to any development which does not accord with guidance contained within PPS25.

Figure 11 shows the EA Flood Zones 2 (100 - 1000 year) and 3a (<100 year) for the main watercourses within the Borough. In addition, the extent of Flood Zone 3b (Functional Floodplain), where available from existing modelling studies (25 year), is also shown. These indicate that a number of development sites within Bromsgrove District and Redditch Borough are at risk of flooding during these events. These Flood Zones do not take into account the presence of flood defence infrastructure and the protection they provide to the development sites, but, as discussed within the Level 1 SFRA, there are very few flood defence structures located within Bromsgrove District and Redditch Borough and, as a result, protection is provided to only one development site – E8, located to the south of Bromsgrove Town. The design standard of this defence was not available within the EA's National Flood Coastal Defence Database (NFCDD) catalogue. It was therefore not considered necessary to take the defences into account during the following analysis of direct flood risk.

Summary of Direct Flood Risk

Tables 10a – 10f and **11a – 11d** below summarise the direct flood risk to each of the proposed development sites within the Borough and District. These tables include the 100 year plus climate change flood risk, the outlines for which, where available, were included within the Level 1 SFRA report. They also take into account flood risk from the unmodelled 'ordinary watercourses' and historical surface and sewer flooding (identified and outlined within the Level 1 SFRA), stated within the 5th column. Where a site is at direct risk of fluvial flooding it is highlighted in red. Where a site is at partial risk of fluvial flooding, considered at risk from flooding of an ordinary watercourse or located in an area known to have experienced sewer of surface water flooding in the past, it is highlighted in orange.

BROMSGROVE DISTRICT

Flood Risk within Bromsgrove District is mainly associated with flash flooding of ordinary watercourses as a result of rapid response of its catchments to runoff. In many cases this has resulted in an overwhelming of the road, rail and canal networks and their associated drains and outflows. As identified in the SFRA, many of the ordinary watercourses flooding is attributable to a lack of maintenance resulting in blockages and reduced flow capacity. However, a degree of flooding has also been associated with the Main Rivers located within the District, most notably the River Salwarpe, the Sugar Brook, the Spadesbourne Brook and the Battlefield Brook, which have affected Bromsgrove Town. There are multiple occurrences of sewer and surface water flooding within the District with reports located in Bromsgrove town and nearly all of the larger villages.

Table 10a – Bromsgrove District Areas of Development Restraint

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
A1	West Hagley (Western Road)	No[1] (Gallows Brook)				History from Gallows Brook
A2	Willow Brook Road, Alvechurch	No	No	No	No	None[2]
A3	Birmingham Road, Alvechurch	No[1] (Unnamed ordinary watercourse)				Potentially from ordinary watercourse
A4	Ravensbank Business Park	No[1] (Unnamed ordinary watercourse, including Blacksoils Brook)				Potentially from ordinary watercourse
A5	Bleakhouse Farm, Grimes Farm	No[1] (Unnamed ordinary watercourse)				Potentially from ordinary watercourse
A6	Selsdon Close, Grimes Hill	No[1] (Unnamed ordinary watercourse)				Potentially from ordinary watercourse
A7	Birmingham Road, Alvechurch	No[1] (Unnamed ordinary watercourse)				Potentially from ordinary watercourse
A8	Rutherford Road, Bromsgrove	No model	Yes	Yes[3]	Yes	Ordinary watercourse
A9	Whitford Road, Bromsgrove	No	No	Yes	Yes	Battlefield Brook
A10	Egghill Lane, Rubery	No	No	No	No	None
A11	Perryfields Road, Bromsgrove	Yes	Yes	Yes	Yes	Battlefield Brook
A12	Church Road, Catshill	Yes	Yes	Yes	Yes	Battlefield Brook
A13	Birmingham Road, Bromsgrove	No	No	No	No	Surface flooding (repeatedly)

Notes

1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question

2 – Indicates the site is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000 year outline, it is assumed to be located within the 100 year plus climate change flood extent.

Table 10b – Bromsgrove District Employment Sites

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
E1	Factory Lane, Bromsgrove	Yes	Yes	Yes	Yes	Spadesbourne Brook
E2	Wythall Green Cricket Ground	No	No	No	No	None
E3	Depot Site, The Avenue, Rubery	No[1] (Callow Brook)				Sewer flooding & potentially Callow Brook
E4	Ravensbank Business Park,	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourses
E5	Ford Road, Bromsgrove	Yes	Yes	Yes	Yes	Spadesbourne Brook
E6	Saxon Business Park, Stoke Prior	No model	Yes	Yes[3]	Yes	Canal, Hen Brook & surface flooding (2000)
E7	Parsonage Drive, Cofton Hackett	No[1] (River Arrow)				Potentially River Arrow
E8	Bromsgrove Eastern By-Pass/Stoke Road	Yes	Yes	Yes	Yes	Sugar Brook, ordinary watercourse & sewer flooding

Notes

1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question

2 – Indicates the site is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000 year outline, it is assumed to be located within the 100 year plus climate change flood extent.

Table 10c – Bromsgrove District Policy Reference Areas

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
PR1	Newton Road, Bromsgrove	No model	Yes	Yes[3]	Yes	Unnamed watercourse
PR2	Saxon Business Park, Stoke Prior	No model	Yes	Yes[3]	Yes	Canal, Hen Brook & surface flooding (2000)
PR3	Buntsford Drive, Bromsgrove	No	No	No	No	None
PR4	Bunstford Park Road/Buntsford Hill	No	No	No	No	(Potential from Sugar Brook)
PR5	Aston Road, Bromsgrove	No[1] (unnamed watercourse)		Yes[3]	Yes	Unnamed watercourse
PR6	Houndsfield Lane Caravan Site, Trueman's Heath	Yes	Yes	Yes[3]	Yes	River Cole
PR7	Sweet Pool, West Hagley	No Model	Yes	Yes[3]	Yes	Gallows Brook
PR8	Wilmore Lane, Silver Street	No	No	No	No	None
PR9	Church Hill, Beoley	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
PR10	Shirley Quarry	No Model	Yes	Yes[3]	Yes	River Cole and unnamed ordinary watercourse
PR11	Crown Meadow, Alvechurch	No	No	No	No	None[2]
PR12	Penmanor Road, Finstall	No	No	No	No	None
PR13	Heydon Road, Finstall	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
PR14	New Inns Lane, Rubery	No	No	No	No	Surface flooding and ditch
PR15	Transport Museum, Wythall Green	No	No	No	No	None
PR16	Dark Lane, Romsley	No	No	No	No	None
PR17	Wythall Park, Silver Street	No	No	No	No	None
PR18	Staple Flat Road, Lower Marlbrook	No	No	No	No	Sewer flooding
PR19	Redditch Road, Bromsgrove	No	No	No	No	None
PR20	Whitford Road, Bromsgrove	No	No	No	No	None
PR21	Indoor Bowls Centre, Stoke Road	No	Yes	Yes	Yes	Sugar Brook and sewer flooding
PR22	Grayshott Close, Bromsgrove	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
PR23	Granary Road, Bromsgrove	No	No	No	No	None
PR24	Byron Way, Catshill	No	No	No	No	None
PR25	Sycamore Drive, Hollywood	No	No	No	No	None
PR26	Falstaff Avenue, Hollywood	No	No	No	No	None
PR27	Beaudesert Road	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
PR28	Marlbrook Lane, Lower Marlbrook	No[1] (Battlefield Brook)				Battlefield Brook
PR29	Mayfield Close, Upper Catshill	No Model	Yes	Yes[3]	Yes	Battlefield Brook and surface flooding
PR30	Upland Grove, Lowes Hill	No	No	No	No	Surface flooding (repeatedly)
PR31	Staple Flat Road, Lower Marlbrook	No	No	No	No	Sewer Flooding
PR32	Worcester Road, Bromsgrove	Yes	Yes	Yes	Yes	Spadesbourne Brook
PR33	New Road, Bromsgrove	No[1] (Sugar Brook nearby)				Potentially from Sugar Brook
PR34	Tel Ex and Station, Barnt Green	No	No	No	No	Surface flooding (repeatedly)
PR35	Willow Road, Bromsgrove	No	No	No	No	None
PR36	Bromsgrove Station	No	No	No	No	None
PR37	Lickey Road, Rednal	No	No	No	No	None
PR38	School Lane, Alvechurch	No	No	No	No	None
PR39	(market) St John Street, Bromsgrove	No Model	Yes	Yes[3]	Yes	Spadesbourne Brook
PR40	Barnt Green	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse & sewer flooding
PR41	Whettybridge Road, Rubery	No	No	No	No	None
PR42	CheltenhamAvenue, Upper Catshill	No	No	No	No	Surface flooding (repeatedly)
PR43	Stoney Hill, Bromsgrove	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse

Notes: *1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question*

2 – Indicates the site is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000 year outline, it is assumed to be located within the 100 year plus climate change flood extent.

Table 10d – Bromsgrove District Shopping Sites

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
Sh1	Station Road, Grimes Hill	No	No	No	No	None
Sh2	Red Lion Street, Alvechurch	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
Sh3	Alcester Road, Hollywood	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
Sh4	Worcester Road, West Hagley	No	No	No	No	None
Sh5	Golden Cross Lane, Catshill	No[1] (Battlefield Brook)				Potentially from Battlefield Brook
Sh6	Bromsgrove Eastern By-Pass	Yes	Yes	Yes	Yes	Sugar Brook and Sewer flooding
Sh7	Stoke Road, Aston Fields, Bromsgrove	No	No	No	No	None
Sh8	May Lane, Hollywood	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse & surface flooding
Sh9	Hewell Road, Barnt Green	No	No	No	No	Surface flooding (repeatedly)
Sh10	New Road, Rubery	No[1] (Callow Brook)				Sewer & surface flooding and potentially from ordinary watercourse

Notes

1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question

2 – Indicates the site is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000 year outline, it is assumed to be located within the 100 year plus climate change flood extent.

Table 10e – Bromsgrove Unzoned Sites

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
UZ1	Cherry Hill Road, Barnt Green	No	No	No	No	Surface and sewer flooding

Notes

1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question

2 – Indicates the site is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000 year outline, it is assumed to be located within the 100 year plus climate change flood extent.

Table 10f – Bromsgrove Village Envelopes

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
Adams Hill	East of West Hagley	No	No	No	No	Sewer Flooding
Belbroughton	Southeast of West Hagley	No Model	Yes	Yes[3]	Yes	Hoo Brook
Bournheath	West of Catshill	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse & Sewer flooding
Burcot	Southeast of Lickey	No	No	No	No	None
Clent	East of West Hagley	No[1] (unnamed ordinary watercourse)				Sewer Flooding
Fairfield	Northwest of Catshill	No	No	No	No	None
Finstall	East of Bromsgrove	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
Holt End	Northeast of Redditch	No[1] (unnamed ordinary watercourse)				Surface flooding & potential from ordinary watercourse
Holy Cross	Southeast of West Hagley	No	No	No	No	None
Hopwood	North of Alvechurch	No	No	No	No	Surface flooding (repeatedly)
Lower Clent	East of West Hagley	No	No	No	No	Surface flooding (repeatedly)
Romsley	East of West Hagley	No	No	No	No	Sewer Flooding
Rowney Grn	Southeast of Alvechurch	No	No	No	No	None

Notes

1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question

2 – Indicates the site is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000 year outline, it is assumed to be located within the 100 year plus climate change flood extent.

REDDITCH BOROUGH

Flood Risk within Redditch Borough is mainly associated with rapid flash flooding as its numerous brooks and ordinary watercourses deliver storm water from the higher ground to the River Arrow. As the gradient suddenly reduces, the watercourses rapidly exceed their capacity and have a tendency to 'pool', flooding the surrounding area. This is most notable on the Batchley Brook, which flows into the northwestern corner of Redditch town. Similarly to Bromsgrove District, multiple accounts of sewer flooding have been reported within the Borough, although limited to Redditch town, Astwood Bank and the village of Feckenham.

Table 11a – Redditch Areas of Development Restraint

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
A14	A435, Redditch	No[1] (unnamed ordinary watercourse)		Yes[3]	Yes	River Arrow and potentially from ordinary watercourses
A15	Webheath, Redditch	No[1] (unnamed ordinary watercourse)				Surface flooding & potentially from ordinary watercourse
A16	Brockhill, Redditch	No[1] (Bordesley Brook)				Potentially from Bordesley Brook

Notes

1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question

2 – Indicates the site is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000 year outline, it is assumed to be located within the 100 year plus climate change flood extent.

Table 11b – Redditch Employment Sites

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
E9	Barn Close Farm, Love Lyne,Hunt End	No	No	No	No	None
E10	North of Red Ditch, Enfield	No[1] (Red Ditch)				Potentially from Red Ditch
E11	Green Lane, Wirehill	No[1] (unnamed ordinary watercourse)				Surface flooding (2007) & potentially from ordinary watercourse
E12	Enfield Industrial Estate, Redditch	No	No	No	No	None
E13	Palmers Road, Redditch	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
E14	Washford Industrial Estate, Redditch	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
E15	Merse Road, Moons Moat, Redditch	No	No	No	No	None
E16	Bartleet Road, Redditch	No	No	No	No	None
E17	Studley Road, Redditch	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
E18	Studley Road, Redditch	No[1] (Wharrington Brook)				Potentially from Wharrington Brook
E19	Fringe Meadow Road, Moons Moat	No[1] (unnamed ordinary watercourse)				Potentially from ordinary watercourse
E20	Old Forge Drive, Redditch	No[4]	Yes	Yes[3]	Yes	River Arrow
E21	Park Farm Industrial Estate, Redditch	No[4]	No[4]	Yes[3]	Partially[4]	River Arrow
E22	Shawbank Road, Redditch	No[4]	Yes[4]	Yes[3]	Yes[4]	River Arrow
E23	Upper Crossgate Road, Redditch	No[4]	No[4]	No[4]	No[4]	None
E24	Trescott Road, Smallwood,Redditch	No	No	No	No	None
E25	Old Forge Drive, Redditch	No[4]	No[4]	Yes[3]	Yes[4]	River Arrow
E26	Evesham Road, Astwood Bank	No	No	No	No	None
E27	Beoley Road West, StGeorge's,Redditch	No	No	No	No	None

Notes

1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question

2 – Indicates the site is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000 year outline, it is assumed to be located within the 100 year plus climate change flood extent.

4 - The River Arrow model has been identified as being inaccurate and is currently being remodelled. The extent of the flood outlines are therefore being updated and may cause these results to change.

Table 11c – Redditch Housing Sites

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
H1	Prospect Hill, Redditch	No	No	No	No	None
H2	Pheasant Lane, Oakenshaw,Redditch	No[1] (Wharrington Brook)				Potentially from Wharrington Brook
H3	(old school) Dilwyn Close, Redditch	No	No	No	No	None
H4	Harris Close, Redditch	No	No	No	No	None
H5	Greenlands Drive, Redditch	No	No	No	No	None
H6	Middlehouse Lane/ Alvechurch Highway	No Model	Yes	Yes[3]	Yes	Batchley Brook
H7	Enfield Industrial Estate, Redditch	*Misalignment – will be in flood zones*				Batchley Brook
H8	Easemore Road, Redditch	No	No	No	No	None
H9	Woodrow North, Redditch	No	No	No	No	None
H10	South Street, Redditch	No	No	No	No	None
H11	Grange Road, Redditch	No	No	No	No	None
H12	Walton Close, Redditch	No	No	No	No	None
H13	Rock Hill Farm, Feckenham	No[1] (Plack Brook)				Potentially from Plack Brook and surface flooding

Notes

1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question

2 – Indicates the site is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000 year outline, it is assumed to be located within the 100 year plus climate change flood extent.

4 - The River Arrow model has been identified as being inaccurate and is currently being remodelled. The extent of the flood outlines are therefore being updated and may cause these results to change.

Table 11d – Redditch Strategic Sites

Unique ID	Location	Functional Floodplain	100 year	100 year with climate change	1000 year	Source of Flood Risk
St1	Church Hill, Redditch	No	No	No	No	Surface and sewer flooding
St2	Winyates, Redditch	No	No	No	No	None
St3	Matchborough, Redditch	No	No	No	No	None
St4	Woodrow, Redditch	No	No	No	No	None
St5	Woodrow North, Redditch	No	No	No	No	None
St6	Green Lane, Wirehill	No[1] (unnamed ordinary watercourse)				Surface flooding (2007) & potentially from ordinary watercourse
St7	B4184, Redditch	No[1] (Red Ditch)				Potentially from Red Ditch
St8	Edward Street	No	No	No	No	None
St9	Prospect Hill, Redditch	No	No	No	No	None
St10	Town Centre, Northwest Quadrant	No	No	No	No	None

Notes

1 - Indicates the site is in close proximity to a watercourse – indicated in brackets – which has no flood zone definition for the return period in question

2 – Indicates the sites is in close proximity to the Worcester and Birmingham canal.

3 – Watercourse has not been modelled to show the 100 year plus climate change outline, but as site is located within the 1000year outline, it is assumed to be located within the 100 year plus climate change flood extent.

4 - The River Arrow model has been identified as being inaccurate and is currently being remodelled. The extent of the flood outlines are therefore being updated and may cause these results to change.

5.2.2 Additional Flood Risk

In addition to the risk from direct flooding, the increase in flood risk to the rest of Bromsgrove District and Redditch Borough, resulting from runoff attributed to the development of sites, must be considered. In line with the requirements of PPS25, the use of SUDS and, in particular source control measures should be optimised in new developments to minimise the impact of additional run-off. Most sites should be able to accommodate some form of SUDS depending on their characteristics (see Section 8.3 and **Appendix D** for more details). However, some sites will pose a much greater risk to other development than others.

Where it is considered that the total estimated additional runoff will pose an issue to existing development but can be potentially accommodated through the implementation of SUDS, the development sites are indicated in yellow in **Tables 12a – 12f** and **13a – 13d** below. This classification accounted for the land type and topography of the sites. Brownfield sites were disregarded as they are already contributing runoff to the local area. Therefore, if a site consisted of Greenfield land (even partially) and the topography (deduced from the LiDAR and OS maps) indicated that runoff would drain towards existing development it was highlighted in yellow.

Where there is a significant additional flood risk posed by the development and the existing drainage network is known to be already operating at capacity, a major upgrade to the system will be required. Some coordination between the SUDS schemes and major drainage upgrade is necessary to optimise the use of strategic SUDS systems in an integrated manner within the overall upgrade. These sites are indicated in orange within **Tables 12a – 12f** and **13a – 13d**. However, some SUDS methods, such as infiltration techniques, rely upon the permeability of the substrata. Therefore, where sites are located upon clays and silts, which suffer from reduced permeability, SUDS techniques that utilise infiltration will not be feasible and they are highlighted in red. However, as proven by the SUDS schemes implemented by Royal Haskoning in Cambourne, Cambridgeshire, also located on clay, alternative SUDS schemes can be implemented on soils with low or bad permeability through detention/retention techniques, although these will be restricted where groundwater or source protection zones exist. These issues are discussed later within this report. Therefore, although indicated as potentially problematic for the implementation of SUDS techniques, the sites highlighted in red within the following tables should not be immediately dismissed with regards to SUDS.

BROMSGROVE DISTRICT

Table 12a – Bromsgrove District Areas of Development Restraint

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
A1	West Hagley (Western Road)	Yes	Callows Brook	Yes	Yes
A2	Willow Brook Road, Alvechurch	Yes		Yes	Yes
A3	Birmingham Road, Alvechurch	Yes	Unnamed (drains to River Arrow)		Yes
A4	Ravensbank Business Park	Yes	Blacksoils Brook	Yes	Yes
A5	Bleakhouse Farm, Grimes Farm	Yes	Unnamed ordinary watercourse	Yes	Yes
A6	Selsdon Close, Grimes Hill	Yes	Unnamed (drains to River Cole)		Yes
A7	Birmingham Road, Alvechurch	Yes	Unnamed (drains to River Arrow)		Yes
A8	Rutherford Road, Bromsgrove	Yes	Unnamed ordinary watercourse	Yes	Yes
A9	Whitford Road, Bromsgrove	Yes	Battlefield Brook	Yes	Yes
A10	Egghill Lane, Rubery	Yes			Yes
A11	Perryfields Road, Bromsgrove	Yes	Battlefield Brook & unnamed	Yes	Yes
A12	Church Road, Catshill	Yes	Battlefield Brook	Yes	Yes
A13	Birmingham Road, Bromsgrove	Yes	Spadesbourne Brook Yes	Yes	Yes

Table 12b – Bromsgrove District Employment Sites

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
E1	Factory Lane, Bromsgrove	No	Spadesbourne Brook		Yes
E2	Wythall Green Cricket Ground	Partially	Unnamed ordinary watercourse		Yes
E3	Depot Site, The Avenue, Rubery	No	Callows Brook		Yes
E4	Ravensbank Business Park,	No	Blacksoils Brook		Yes
E5	Ford Road, Bromsgrove	No	Spadesbourne Brook		Yes
E6	Saxon Business Park, Stoke Prior	No	Hen Brook		Yes
E7	Parsonage Drive, Cofton Hackett	No	River Arrow		
E8	Bromsgrove Eastern By-Pass/Stoke Road	Partially	Sugar Brook & unnamed	Yes	Yes

Table 12c – Bromsgrove District Policy Reference Areas

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
PR1	Newton Road, Bromsgrove	No	Unnamed ordinary watercourse		Yes
PR2	Saxon Business Park, Stoke Prior	No	Hen Brook		Yes
PR3	Buntsford Drive, Bromsgrove	No	Sugar Brook		Yes
PR4	Bunstford Park Road/Buntsford Hill	No	Sugar Brook		Yes
PR5	Aston Road, Bromsgrove	No	Unnamed ordinary watercourse		Yes
PR6	Houndsfield Lane Caravan Site, Trueman's Heath	Yes	River Cole		Yes
PR7	Sweet Pool, West Hagley	Yes	Gallows Brook		
PR8	Wilmore Lane, Silver Street	Yes	Unnamed ordinary watercourse	Yes	Yes
PR9	Church Hill, Beoley	Yes	Churchill Brook	Yes	Yes
PR10	Shirley Quarry	Yes	River Cole		Yes
PR11	Crown Meadow, Alvechurch	Yes	Worcester & Birmingham Canal	Yes	Yes
PR12	Penmanor Road, Finstall	Yes		Yes	
PR13	Heydon Road, Finstall	Yes		Yes	
PR14	New Inns Lane, Rubery	Yes		Yes	Yes
PR15	Transport Museum, Wythall Green	No	Unnamed ordinary watercourse		Yes
PR16	Dark Lane, Romsley	Yes		Yes	
PR17	Wythall Park, Silver Street	Yes	Unnamed ordinary watercourse	Yes	Yes
PR18	Staple Flat Road, Lower Marlbrook	Yes		Yes	Yes
PR19	Redditch Road, Bromsgrove	No			Yes
PR20	Whitford Road, Bromsgrove	Yes		Yes	
PR21	Indoor Bowls Centre, Stoke Road	Yes	Sugar Brook	Yes	Yes
PR22	Grayshott Close, Bromsgrove	Yes		Yes	Yes
PR23	Granary Road, Bromsgrove	Yes		Yes	Yes

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
PR24	Byron Way, Catshill	Yes		Yes	Yes
PR25	Sycamore Drive, Hollywood	Yes		Yes	Yes
PR26	Falstaff Avenue, Hollywood	Yes	Unnamed ordinary watercourse	Yes	Yes
PR27	Beaudesert Road	Partially	Unnamed ordinary watercourse	Yes	Yes
PR28	Marlbrook Lane, Lower Marlbrook	Yes	Battlefield Brook	Yes	Yes
PR29	Mayfield Close, Upper Catshill	Yes	Battlefield Brook	Yes	Yes
PR30	Upland Grove, Lowes Hill	Yes		Yes	Yes
PR31	Staple Flat Road, Lower Marlbrook	Yes		Yes	Yes
PR32	Worcester Road, Bromsgrove	Yes	Spadesbourne Brook	Yes	Yes
PR33	New Road, Bromsgrove	Yes	Sugar Brook	Yes	
PR34	Tel Ex and Station, Barnt Green	No			Yes
PR35	Willow Road, Bromsgrove	No			Yes
PR36	Bromsgrove Station	No	Unnamed ordinary watercourse		Yes
PR37	Lickey Road, Rednal	Partially	Drains to River Arrow	Yes	
PR38	School Lane, Alvechurch	Partially	River Arrow	Yes	Yes
PR39	(market) St John Street, Bromsgrove	No	Spadesbourne Brook		Yes
PR40	Barnt Green	Partially	Spadesbourne Brook	Yes	Yes
PR41	Whettybridge Road, Rubery	Yes		Yes	Yes
PR42	CheltenhamAvenue, Upper Catshill	No	Battlefield Brook		Yes
PR43	Stoney Hill, Bromsgrove	No			

Table 12d – Bromsgrove District Shopping Sites

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
Sh1	Station Road, Grimes Hill	No			Yes
Sh2	Red Lion Street, Alvechurch	No	River Arrow		Yes
Sh3	Alcester Road, Hollywood	No			Yes
Sh4	Worcester Road, West Hagley	No	Gallows Brook		Yes
Sh5	Golden Cross Lane, Catshill	No	Battlefield Brook		Yes
Sh6	Bromsgrove Eastern By-Pass	No	Sugar Brook		Yes
Sh7	Stoke Road, Aston Fields, Bromsgrove	No			Yes
Sh8	May Lane, Hollywood	No			Yes
Sh9	Hewell Road, Barnt Green	No			Yes
Sh10	New Road, Rubery	No	Callow Brook		Yes

Table 12e – Bromsgrove Unzoned Sites

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
UZ1	Cherry Hill Road, Barnt Green	Yes		Yes	

Table 12f – Bromsgrove Village Envelopes

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
Adams Hill	East of West Hagley	Partially			
Belbroughton	Southeast of West Hagley	Partially	Hoo Brook		
Bournheath	West of Catshill	Partially			Yes
Burcot	Southeast of Lickey	Partially	Unnamed ordinary watercourse		
Clent	East of West Hagley	Partially	Unnamed ordinary watercourse		Yes
Fairfield	Northwest of Catshill	Partially			
Finstall	East of Bromsgrove	Partially			
Holt End	Northeast of Redditch	Partially	Churchill Brook		Yes
Holy Cross	Southeast of West Hagley	Partially			
Hopwood	North of Alvechurch	Partially			Yes
Lower Clent	East of West Hagley	Partially			
Romsley	East of West Hagley	Partially			Yes
Rowney Grn	Southeast of Alvechurch	Partially	Drains to Dagnell Brook		Yes

REDDITCH BOROUGH

Table 13a – Redditch Areas of Development Restraint

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
A14	A435, Redditch	Yes	Ipsley Brook, River Arrow & Unnamed	Yes	Yes
A15	Webheath, Redditch	Yes	Unnamed, drains to Swans Brook	Yes	Yes
A16	Brockhill Redditch	Yes	Bordesley Brook and River Arrow*		Yes

**** land to the west of the railway line, which bisects site A16, will potentially impact the Bordesley Brook, whereas land to the east will potentially impact the River Arrow.***

Table 13b – Redditch Employment Sites

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
E9	Barn Close Farm, Love Lyne,Hunt End	Partially			Yes
E10	North of Red Ditch, Enfield	Yes	Red Ditch	Yes	Yes
E11	Green Lane, Wirehill	Yes	Unnamed ordinary watercourse	Yes	Yes
E12	Enfield Industrial Estate, Redditch	Partially	Batchley Brook	Yes	Yes
E13	Palmers Road, Redditch	Yes	Blacksoils Brook	Yes	Yes
E14	Washford Industrial Estate, Redditch	Partially	Unnamed ordinary watercourse	Yes	Yes
E15	Merse Road, Moons Moat, Redditch	Yes		Yes	Yes
E16	Bartleet Road, Redditch	Yes		Yes	Yes
E17	Studley Road, Redditch	Partially	Unnamed ordinary watercourse	Yes	Yes
E18	Studley Road, Redditch	Partially	Wharrington Brook	Yes	Yes
E19	Fringe Meadow Road, Moons Moat	Yes		Yes	Yes
E20	Old Forge Drive, Redditch	Yes	Broadground Ditch	Yes	Yes
E21	Park Farm Industrial Estate, Redditch	Yes	River Arrow	Yes	Yes
E22	Shawbank Road, Redditch	Yes	Park Brook	Yes	Yes
E23	Upper Crossgate Road, Redditch	Partially			Yes
E24	Trescott Road, Smallwood,Redditch	No			Yes
E25	Old Forge Drive, Redditch	No	River Arrow		Yes
E26	Evesham Road, Astwood Bank	No			Yes
E27	Beoley Road West, StGeorge's,Redditch	No			Yes

Table 13c – Redditch Housing Sites

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
H1	Prospect Hill, Redditch	No			Yes
H2	Pheasant Lane, Oakenshaw,Redditch	Yes	Wharrington Brook	Yes	Yes
H3	(old school) Dilwyn Close, Redditch	No			Yes
H4	Harris Close, Redditch	Yes		Yes	Yes
H5	Greenlands Drive, Redditch	Yes		Yes	Yes
H6	Middlehouse Lane/ Alvechurch Highway	Partially	Batchley Brook		
H7	Enfield Industrial Estate, Redditch	No	Batchley Brook		Yes
H8	Easemore Road, Redditch	Yes		Yes	Yes
H9	Woodrow North, Redditch	Partially	Wharrington Brook	Yes	Yes
H10	South Street, Redditch	Yes		Yes	Yes
H11	Grange Road, Redditch	No			Yes
H12	Alton Close, Redditch	No			Yes
H13	Rock Hill Farm, Feckenham	Yes	Plack Brook	Yes	Yes

NB Site H6 has been classified as posing no additional flood risk due to confirmation from an FRA, carried out in accordance with PPS25, which confirms it neither poses an issue to existing development nor is a major drainage system upgrade required. However, due to its location within Flood Zone 3, the 'overall flood risk' classification for this site has not changed.

Table 13d – Redditch Strategic Sites

Unique ID	Location	Greenfield?	Watercourse	Additional runoff poses an issue to existing development	Major upgrade to existing drainage system required
St1	Church Hill, Redditch	Partially		Yes	Yes
St2	Winyates, Redditch	Partially		Yes	Yes
St3	Matchborough, Redditch	Partially	Ipsley Brook	Yes	Yes
St4	Woodrow, Redditch	Partially		Yes	Yes
St5	Woodrow North, Redditch	Partially	Wharrington Brook	Yes	Yes
St6	Green Lane, Wirehill	Yes		Yes	Yes
St7	B4184, Redditch	No	Batchley Brook		Yes
St8	Edward Street	No			Yes
St9	Prospect Hill, Redditch	No			Yes
St10	Town Centre, Northwest Quadrant	No			Yes

5.2.3 Overall Flood Risk

By combining the results from the analysis of direct flood risk and additional flood risk mentioned in Sections 5.2.1 and 5.2.2 above, a traffic light colour code system of overall flood risk has been constructed for all the development sites.

Green

- Low Flood Risk
  (*no direct flood risk cited in section 5.2.1*)
- Fits with existing drainage system
  (*Not highlighted in orange or red in section 5.2.2*)
- Minimal SUDS requirement
  (*Not highlighted in yellow in section 5.2.2*)

Yellow

- Medium Flood Risk
  (*direct flood risk >100 year with climate change or identified as being having the potential to be flooded from ordinary watercourses or has experience sewer or surface flooding in the past*)
- Mitigation of additional flood risk is potentially achievable with SUDS to accommodate all the additional runoff. Upgrade of existing drainage network may be required in addition to SUDS.
  (*highlighted in yellow or orange in section 5.2.2 but not red)*

Red

- Significant Flood Risk
  (*direct flood risk ≤100 year with climate change*)
- Underlying geology results in limitation to SUDS techniques available. Upgrade of existing drainage network may be required in addition to SUDS.
  (highlighted in red in section 5.2.2)

Tables 14a – 14f and **15a – 15d** show the traffic light colour with regard to flood risk assigned to each of the development sites within the Borough and the District. The flood risk is summarised in **Figures 12, 13** and **14**.

BROMSGROVE DISTRICT

Table 14a – Bromsgrove District Areas of Development Restraint

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
A1	22.6	G (mostly)	West Hagley (Kidderminster, Western & Stourbridge Roads)	
A2	1.3	G	Willow Brook Road, Alvechurch	
A3	2.8	G	Birmingham Road, Alvechurch	
A4	10.0	G	Ravensbank Business Park	
A5	6.3	G (mostly)	Bleakhouse Farm, Grimes Farm	
A6	3.1	G	Selsdon Close, Grimes Hill	
A7	1.1	G	Birmingham Road, Alvechurch	
A8	7.6	G	Rutherford Road, Bromsgrove	
A9	24.4	G	Whitford Road, Bromsgrove	
A10	6.4	G	Egghill Lane, Rubery	
A11	65.7	G	Perryfields Road, Bromsgrove	
A12	5.9	G	Church Road, Catshill	
A13	11.9	G	Birmingham Road, Bromsgrove	

Table 14b – Bromsgrove District Employment Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
E1	2.5	B	Factory Lane, Bromsgrove	
E2	17.3	B & G	Wythall Green Cricket Ground	
E3	3.4	B	Depot Site, The Avenue, Rubery	
E4	29.9	B	Ravensbank Business Park,	
E5	0.6	B	Ford Road, Bromsgrove	
E6	50.3	B	Saxon Business Park, Stoke Prior	
E7	38.0	B	Parsonage Drive, Cofton Hackett	
E8	78.9	B (mostly)	Bromsgrove Eastern By-Pass/Stoke Road, Bromsgrove	

Table 14c – Bromsgrove District Policy Reference Areas

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
PR1	3.1	B	Newton Road, Bromsgrove	
PR2	26.6	B	Saxon Business Park, Stoke Prior	
PR3	9.2	B	Buntsford Drive, Bromsgrove	
PR4	2.3	B	Bunstford Park Road/Buntsford Hill	
PR5	1.4	B	Aston Road, Bromsgrove	
PR6	1.4	G	Houndsfield Lane Caravan Site, Trueman's Heath	
PR7	1.8	G	Sweet Pool, West Hagley	
PR8	0.7	G	Wilmore Lane, Silver Street	
PR9	0.3	G	Church Hill, Beoley	
PR10	13.4	G	Shirley Quarry	
PR11	1.2	G	Crown Meadow, Alvechurch	
PR12	0.8	G	(playground) Penmanor Road, Finstall	
PR13	1.2	G	Heydon Road, Finstall	
PR14	3.3	G	Recreation Ground, New Inns Lane, Rubery	
PR15	1.5	B	Transport Museum, Wythall Green	
PR16	1.3	G	Dark Lane, Romsley	
PR17	16.1	G	Wythall Park, Silver Street	
PR18	8.9	G	Staple Flat Road, Lower Marlbrook	
PR19	7.1	B	Museum of Buildings, Redditch Road, Bromsgrove	
PR20	0.5	G	Whitford Road, Bromsgrove	
PR21	3.5	G (mostly)	Indoor Bowls Centre, Stoke Road, Bromsgrove	
PR22	0.2	G	Grayshott Close, Bromsgrove	
PR23	0.8	G	Granary Road, Bromsgrove	
PR24	0.2	G	Byron Way, Catshill	
PR25	1.3	G	Sycamore Drive, Hollywood	
PR26	0.2	G	Falstaff Avenue, Hollywood	
PR27	0.7	B & G	Beaudesert Road	
PR28	1.6	G	Marlbrook Lane, Lower Marlbrook	
PR29	3.3	G	Mayfield Close, Upper Catshill	
PR30	0.5	G	Upland Grove, Lowes Hill	
PR31	8.9	G	Staple Flat Road, Lower Marlbrook	
PR32	0.9	G	Worcester Road, Bromsgrove	
PR33	0.1	G (mostly)	New Road, Bromsgrove	
PR34	0.5	B	Tel Ex and Station, Barnt Green	
PR35	0.4	B	Willow Road, Bromsgrove	
PR36	0.2	B	Bromsgrove Station	
PR37	3.4	B & G	Lickey Road, Rednal	
PR38	8.6	B & G	School Lane, Alvechurch	
PR39	0.7	B	(market) St John Street, Bromsgrove	
PR40	88.4	B & G	Barnt Green	
PR41	0.1	G	Whettybridge Road, Rubery	
PR42	8.0	B	Cheltenham Avenue, Upper Catshill	
PR43	37.5	B	Stoney Hill, Bromsgrove	

Table 14d – Bromsgrove District Shopping Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
Sh1	0.2	B	Station Road, Grimes Hill	
Sh2	0.8	B	Red Lion Street, Alvechurch	
Sh3	0.3	B	Alcester Road, Hollywood	
Sh4	2.0	B	Worcester Road, West Hagley	
Sh5	0.9	B	Golden Cross Lane, Catshill	
Sh6	2.6	B	(superstore) Bromsgrove Eastern By-Pass, Bromsgrove	
Sh7	0.8	B	Stoke Road, Aston Fields, Bromsgrove	
Sh8	0.4	B	May Lane, Hollywood	
Sh9	0.7	B	Hewell Road, Barnt Green	
Sh10	3.5	B	New Road, Rubery	

Table 14e – Bromsgrove Unzoned Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
UZ1	8.7	G	Cherry Hill Road, Barnt Green	

Table 14f – Bromsgrove Village Envelopes

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
Adams Hill	4.5	B & G	East of West Hagley	
Belbroughton	18.5	B & G	Southeast of West Hagley	
Bournheath	7.6	B & G	West of Catshill	
Burcot	4.3	B & G	Southeast of Lickey	
Clent	2.8	B & G	East of West Hagley	
Fairfield	4.4	B & G	Northwest of Catshill	
Finstall	12.1	B & G	East of Bromsgrove	
Holt End	6.5	B & G	Northeast of Redditch	
Holy Cross	11.6	B & G	Southeast of West Hagley	
Hopwood	5.1	B & G	North of Alvechurch	
Lower Clent	2.3	B & G	East of West Hagley	
Romsley	26.2	B & G	East of West Hagley	
Rowney Grn	15.2	B & G	Southeast of Alvechurch	

REDDITCH BOROUGH

Table 15a – Redditch Areas of Development Restraint

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
A14	33.4	G	A435, Redditch,	
A15	47.7	G	Webheath, Redditch	
A16	25.5	G	Brockhill, Redditch	

Table 15b – Redditch Employment Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
E9	0.2	B & G	Barn Close Farm, Love Lyne, Hunt End	
E10	11	G	North of Red Ditch, Enfield	
E11	2.0	G	Green Lane, Wirehill	
E12	0.9	B & G	Enfield Industrial Estate, Redditch	
E13	0.3	G	Palmers Road, Redditch	
E14	0.2	G (mostly)	Washford Industrial Estate, Redditch	
E15	0.7	G	Merse Road, Moons Moat, Redditch	
E16	0.6	G	Bartleet Road, Redditch	
E17	0.4	G (mostly)	Studley Road, Redditch	
E18	0.4	B & G	Studley Road, Redditch	
E19	0.1	G	Fringe Meadow Road, Moons Moat, Redditch	
E20	1.3	G	Old Forge Drive, Redditch	
E21	1.1	G	Park Farm Industrial Estate, Redditch	
E22	1.0	G	Shawbank Road, Redditch	
E23	0.4	B (mostly)	Upper Crossgate Road, Redditch	
E24	0.2	B	Trescott Road, Smallwood, Redditch	
E25	0.4	B	Old Forge Drive, Redditch	
E26	0.02	B	Evesham Road, Astwood Bank	
E27	0.01	B	Beoley Road West, St George's, Redditch	

Table 15c – Redditch Housing Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
H1	1.5	B	Prospect Hill, Redditch	
H2	0.5	G	Pheasant Lane, Oakenshaw, Redditch	
H3	0.7	B	(old school) Dilwyn Close, Redditch	
H4	0.9	G	Harris Close, Redditch	
H5	1.0	G	Greenlands Drive, Redditch	
H6	1.0	B & G	Middlehouse Lane/ Alvechurch Highway	
H7	5.7	B	Enfield Industrial Estate, Redditch	
H8	0.4	G	Easemore Road, Redditch	
H9	0.7	B & G	Woodrow North, Redditch	
H10	0.3	G	South Street, Redditch	
H11	0.2	B	Grange Road, Redditch	
H12	0.4	B	Alton Close, Redditch	
H13	0.4	G	Rock Hill Farm, Feckenham	

Table 15d – Redditch Strategic Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Overall Flood Risk
St1	2.3	B (mostly)	Church Hill, Redditch	
St2	2.5	B (mostly)	Winyates, Redditch	
St3	0.9	B & G	Matchborough, Redditch	
St4	1.7	B (mostly)	Woodrow, Redditch	
St5	0.7	B & G	Woodrow North, Redditch	
St6	2.0	G	Green Lane, Wirehill	
St7	1.3	B	B4184, Redditch	
St8	0.5	B	Edward Street	
St9	1.4	B	Prospect Hill, Redditch	
St10	4.6	B	Town Centre, Northwest Quadrant	

5.2.4 Flood Risk Management Options

There are a number of options available for consideration in order to manage the risk of flooding. The most effective approach will be to avoid the risk by zoning as much new development as possible away from Flood Zones or other areas known to be at high probabilities of flooding. It is recognised however that the overall sustainability of the growth in terms of existing communities and other targets requiring priority use of Brownfield sites will make complete avoidance impractical. However, opportunities should be taken where possible as this will provide the best long term solution in terms of flood risk.

Where avoidance is not possible, preference should be given to flood risk management measures which work with the natural processes and have more opportunities for enhancement of the environment and social wellbeing, such as SUDs and flood storage. Flood Defences are historically a conventional way of managing flood risk, although their implementation and upkeep can be costly. Due to their nature, they usually include interventions that work against the natural processes. As compared with avoidance measures, flood defences only increase the standard of protection and measures still need to be in place to forecast and manage extreme events above this standard, including safe evacuation when necessary. Reducing the amount of surface water running off development sites can also reduce and hence manage the risk of flooding. The monitoring of flows, along with better forecasting and flood warning methods could be employed on land already developed and identified as being at risk of flooding.

Ground raising is also proposed as a possible flood risk mitigation option for some of the sites. However, ground raising can potentially increase flood risk elsewhere and therefore may not in fact be an appropriate mitigation measure. This will need further careful consideration on a site by site basis.

5.3 Conclusions

Due to the location of Bromsgrove District and Redditch Borough in the headwaters of catchments, there is very little direct flood risk from the Main Rivers and, as a result, there are very few flood defences located along theses watercourses. However, as summarised in the tables in Section 5.2.1, there are a number of sites within Bromsgrove and Redditch which are located within areas identified as included within the EA's Flood Zones. These must be reviewed with reference to the EA guidance shown in **Table 9** in relation to their intended use, especially where they fall within Flood Zones 3a and 3b, in addition to compliance with the Sequential and Exception Tests required by PPS25. Sewer and surface water flooding is a more common source of direct flood risk to the potential developments, also outlined in Section 5.2.1, especially within the towns of Bromsgrove and Redditch. However, the District and Borough contain a high number of ordinary watercourses which have not been modelled. Development sites located in proximity to these watercourses have been highlighted within this section as being 'potentially' at risk from direct flooding from these watercourses. This should be taken as a guide only as these risks need to be clarified with further modelling or site specific FRAs. This is also true of the River Arrow model, which is currently being updated and the watercourses modelled with JFLOW, especially where affected by misalignments.

The greatest risk of flooding within Bromsgrove District and Redditch Borough is from rapid rainfall runoff resulting in high flows on poorly maintained ordinary watercourses

which are constrained by development and subsequently overtop. It is therefore imperative that any new development takes this into account and minimises the volume of runoff produced through the implementation of SUDS, especially where located on Greenfield sites. Ideally the aim for the volume of runoff should be in line with the Greenfield runoff rates present from that site before development takes place. This has also been highlighted by the drainage engineers and the EA, especially where large development areas have been identified upstream from current development in proximity to ordinary watercourses identified within the SFRA as suffering from a lack of capacity. The requirement and viability of SUDS required on each site in terms of the risk to existing development, proximity to constrained ordinary watercourses and the limitations of viable SUDS techniques has been outlined in **Tables 12a – 12f** and **13a – 13d**. Over the whole of Redditch Borough and most of Bromsgrove District, the underlying geology is silt or clay which is impermeable and will therefore render infiltration techniques impractical. Coupled with the restrictions on most of the watercourses and the location of the proposed developments upstream of existing developments, every new development will require the inclusion of SUDS and most will require the collected surface runoff to be disposed of on site (e.g. through water reuse or evaporation), but not using methods which require infiltration techniques. It will therefore be desirable to utilise techniques to recycle the collected water into the existing developments. This is explained in more detail in Section 8.

Tables 14a - 14f and **15a – 15d** summarise the risk of direct flooding and additional flood risk posed to existing development into the three tier traffic light system. This indicates that almost every site suffers from some degree of flood risk. However, as they combine the two types of flood risk, they should be referred to in combination with **Tables 10 – 13**, which outline the risk to individual sites in greater detail.

6 WATER RESOURCES AND WATER SUPPLY

6.1 Introduction

Severn Trent Water (STW) is responsible for providing potable water to the whole of the Borough of Redditch and most of the District of Bromsgrove. South Staffordshire Water (SSW) is responsible for providing potable water to a small area in the north of Bromsgrove District, including the village of Romsley. The assessment of water resources and water supply included in this WCS has therefore been primarily based on consultation with and data provided by STW and SSW, together with documentation produced by Ofwat and the Environment Agency.

STW is one of the largest water companies in England and supplies a population of 7.4million people with around 1,900 million liters of potable water over an area of 21,000 square kilometers in the Midlands and mid-Wales. SSW covers a much smaller area of just 1,490 square kilometers and a population of 1.24million. Their supply area is located in the centre of the STW supply zone and stretches from the edge of Ashbourne in the North, to Halesowen in the South, and from Burton on Trent in the East to Kinver in the West.

6.2 Water Resources Plans

Water companies have a duty to maintain the security of their supplies. In order to help achieve this, water companies produce Water Resource Management Plans. These plans set out forecasts of supply and demand over a twenty-five year horizon and address how they intend to provide sufficient water to meet the needs of the customer whilst protecting the environment.

Both STW and SSW produced their latest Draft Water Resource Management Plans (dWRMP) in May 2008, which are currently under public consultation with the final Drafts due for release in April 2009. These latest releases have been produced using the water resources planning guideline that the EA produced in 2007. They cover the period 2010 – 2035, although it must be appreciated that they are updated on a five year cycle, and have been produced in line with the Companies' 2010-2035 Strategic Direction Statements produced for Ofwat in December 2007.

In addition to Water Resource Plans, water companies produce Asset Management Plans (AMPs) covering five year periods. These plans identify what the company intends to deliver over that period and what impact this will have on their customers' bills. Currently water companies are operating under AMP4, which covers the period 2005-2010. AMP5 will cover 2010-2015, AMP6 2015-2020 etc.

6.3 Water Resources

6.3.1 Water Resource Zone

A Water Resource Zone (WRZ) is the largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers experience the same risk of supply failure from a resource failure[6].

STW's supply area consists of six WRZs, originally derived for use in their 2004 Water Resources Plan (WRP04). Bromsgrove District and Redditch Borough are located within the same STW water resource zone – WRS3, 'Severn'. This is the largest of the WRZs and covers most of the southern half of STWs supply area, including Warwickshire, Worcestershire, parts of Gloucestershire, Wolverhampton, parts of Shropshire and Powys, with a population of 2.3 million. However, following EA concerns regarding the size of these zones, STW are currently in the process of setting up a network of 40 to 50 water accountability zones which will provide leakage and water production management information at a sub WRZ level. They plan to have these accountability zones set up and metered by March 2009.

SSW has a different set up to STW and is unusual in that its entire supply area is derived from just one WRZ.

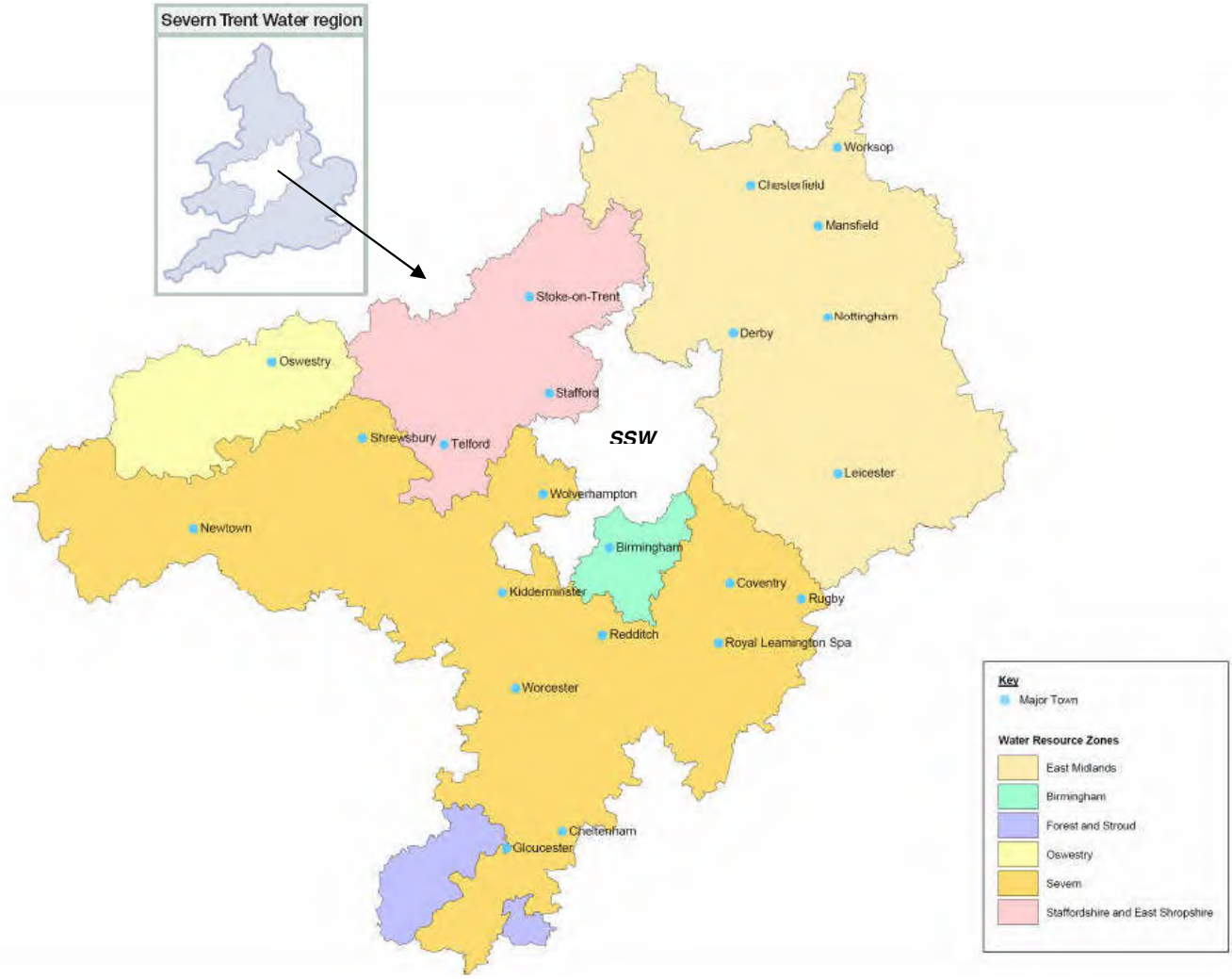
Figure 15 shows the area supplied by STW divided into the six WRZs with Severn shown in orange. The area covered by SSW is shown in white and is located in the centre of the STW supply area.

Due to the size of these zones it is difficult to obtain detailed information at the District and Borough scale. However, it does imply that, when reviewed on a zonal level, the precise location of development is not important in terms of water supply. Location in terms of water supply is therefore not important over most of the study area, with the exception of the small area supplied by SSW to the north, which must be considered separately. With access to more detailed information, however, this assertion may change.

The information used in this Section has been obtained from consultation with the water companies and their dWRMP's.

[6] West Midlands Regional Spatial Strategy (RSS 11) – The Impact of Housing Growth on Public Water Supplies, Environment Agency, June 2007

Figure 15 – Water Resource Zones of Severn Trent Water and South Staffordshire Water



(Adapted from STW publications – Focus on Water, 2007 and DWRMP SEA, Technical Summary, 2008)

6.3.2 Water Sources

Severn Trent Water

Over its entire supply area STW obtains 40% of its water from river abstraction. The other 60% is split equally between groundwater and reservoirs. In total STW operates 17 major surface water abstraction and raw water treatment works, around 180 groundwater abstraction sources and 15 reservoirs, most of which are naturally filled by gravity. The groundwater sources draw mainly from the Triassic Sandstone Aquifers in the English Midlands (which underlay much of this study area) but also smaller aquifers in Nottinghamshire and the Cotswolds. Triassic sandstone has large water storage capacity within the structure of the strata and it does not tend to react rapidly to periods of low rainfall. Therefore, it gives a relatively reliable and constant supply of water.

In addition to the indigenous supplies, STW imports water from neighbouring water undertakers, principally SSW and Dwr Cymru (Welsh Water). The Welsh transfer is supplied via the Elan Aqueduct under gravity from Powys to Frankley, located just across the Bromsgrove District Boundary in Birmingham. . It constitutes approximately 14% of STW's total water supply and is stored in the Bartley Reservoir, supplementing

the city's supply. A small quantity of this water is transferred from the Birmingham Zone into the Severn Zone.

Within the Severn Zone, 53% of Worcestershire, and most of Bromsgrove and Redditch, is supplied by groundwater from the Triassic Sandstone aquifer, underlying much of Bromsgrove District. The majority of the rest of the water supply for the area is extracted from a number of sources on the River Severn. The regulation of the River Severn is controlled and operated by the Environment Agency who monitor and report on the situation regularly.

The dWRMP also states that Worcestershire, Warwickshire, Gloucestershire and South Shropshire make up the largest supply system within the Severn Zone. Within this area there are some limitations on the capacity of linkages, although the system can be supported by imports from the Birmingham WRZ and the East Midlands WRZ.

South Staffordshire Water

SSW obtains its water resources from three sources: Blithfield Reservoir, the River Severn and groundwater from 25 sites across the Company's area of supply. Approximately 40% of the total water available to the Company is taken from groundwater sources and the remaining 60% from the two surface water sources.

Groundwater is abstracted from around 62 boreholes in the Triassic Sandstone aquifer. On average there are three boreholes at each groundwater site.

Blithfield Reservoir is an impoundment reservoir with a capacity of approximately 18,224 megalitres of water. It was formed in 1953 by the construction of a dam across the River Blithe. The raw water is taken out of the reservoir by pipeline to the treatment works at Seedy Mill near Lichfield before going into the distribution network.

The River Severn is a regulated river i.e. flows in the river are augmented by inputs from both groundwater and reservoirs at its head at times of low flows. SSW takes water from the River Severn at Hampton Loade where it is stored in Chelmarsh Reservoir before being treated and distributed. Some of the abstraction from Hampton Loade is exported to STW at Trimpley.

6.3.3 Current and Future Water Availability

Severn Trent Water

Table 16 is taken from the STW dWRMP and outlines the supply demand balance within each of STW's Water Resource Zones. However, it must be noted that these are baseline figures and do not include any mitigation measures proposed by STW. The Severn WRZ is outlined in red:

Table 16 – Projected "baseline" supply/demand balance

Zone	Year when supply demand balance becomes negative	Baseline supply-demand balance position at the end of successive AMP periods				
		Supply-demand balance in 2014/15 (Ml/d)	Supply-demand balance in 2019/20 (Ml/d)	Supply-demand balance in 2024/25 (Ml/d)	Supply-demand balance in 2029/30 (Ml/d)	Supply-demand balance in 2034/35 (Ml/d)
East Midlands	2011/12	-29.30	-76.86	-88.73	-104.92	-112.43
Staffs and East Shropshire	2006/07	-16.63	-22.85	-32.29	-39.10	-43.55
Severn	2006/07	-56.03	-71.67	-80.85	-86.79	-96.61
Forest and Stroud	2006/07	-0.10	0.96	1.88	2.53	2.59
Birmingham	2018/19	5.41	-1.90	-2.01	2.66	2.71
Oswestry	N/A	1.93	1.15	1.00	0.84	0.50

Note: A negative value indicates a risk of shortfall (deficit) of resources to meet demand. A positive value indicates surplus of resources over demand. All values refer to the balance of supply and demand averaged over the year as a whole, under the "baseline" planning condition of the continuation of present policies and the inclusion of climate change impacts, but without any further measures ("interventions") to bring supply and demand into balance .

Table 16 shows that the Severn WRZ has a negative supply demand balance from 2006/7 and this balance remains negative throughout the planning period of this WCS and beyond, becoming increasingly negative over time. Close to the end of the planning period covered by this WCS, 2024/5, the shortfall in this WRZ is over 80Ml/d. It should also be noted that these deficits are the final planning scenarios (with mitigation measures included) and that housing/population growth is just one of the contributing factors (for example, Climate Change is another big factor which requires consideration).

The dWRMP also states that it is the Worcestershire, Warwickshire, Gloucestershire and South Shropshire area of this WRZ which has a predicted supply-demand balance deficit under annual average and peak demand period. This shortfall was identified in WRP04 and solutions were funded in this AMP period. The main scheme included a new river intake and water treatment works at Ombersley, which would have supplied an additional 30 million liters of water a day to support the Severn WRZ through the strategic water grid. The aim of this strategy was to achieve a supply/demand balance at the 80% confidence level by 2010. However, due to problems gaining the appropriate planning permissions and justification of the additional abstraction license, this has been delayed, resulting in the continued shortfall of water supply for this area of the WRZ. STW have delayed the need for the works through the use of other solutions, providing the time required to obtain planning permission

Consultation with STW identified that the projected housing growth in the Draft WMRSS would put water supply in the Severn Trent region as a *whole* into deficit between 2011-16 and 2019-24. Although the operational area of STW includes other RSS areas in addition to the West Midlands, such as the East Midlands and South West, correspondence with STW referred solely to the effect of the WMRSS on the water supply.

To overcome these shortfalls, STWs strategy for the Severn zone now includes:

- Importing up to 20 megalitres per day from the East Midlands zone via the existing eat/west strategic link;
- Increasing the capacity of the Derwent Valley Aqueduct in order to give the capability to deploy more water from treatment works along the River Derwent to the south of the East Midlands zone and to provide further support to the east/west link;
- Provision of a new Granular Activated Carbon (GAC) treatment at the Frankley water treatment works. This involves the transfer of raw Severn water from the Trimpley works to Frankley for treatment and allows provision of additional

supply resilience benefits through a more integrated strategic grid. This is due for completion in 2009-10 and will benefit the deployable output in both the Birmingham and Severn zones. The additional deployable output will allow 20 million liters a day of treated water to be available for transfer to the Severn zone via a strategic link main to Meriden by the end of AMP4;

- Reduction of leakage, increasing metering and increasing water conservation activities, as outlined in WRP04 will continue in this zone;

- Promotion of water efficiency measures and design in both new and existing developments;

- Due to concerns that some abstraction of water could be contributing to environmental damage of rivers and wetlands, the EA have constructed a programme called 'Restoring Sustainable Abstraction' (RSA), which may result in abstraction reductions being identified. This area of the Severn Zone has been impacted by such reductions, one of which is located on Battlefield Brook, which will be reviewed and updated before the final WRMP 2009; and

- The Ombersley treatment works still forms part of the strategy but has been deferred until later in the planning period (AMP6, starting in 2015).

However, the scenario post 2010 is dependent upon the investment STW are able to make during AMP5 and AMP6.

South Staffordshire Water

The extract below is taken from SSW's website and comments on their (the Company's) assessment of current water resource availability as of December 2008:

> *Throughout the autumn months and into December, the Company has had no concerns over the resource position, given the relatively wet autumn, and wet December. Details of the current resource position and recent rainfall are included below. However, in general, the water resource situation for South Staffordshire Water remains very healthy and at the moment the Company has no concerns over the supply situation.*
>
> *<u>Reservoir Levels</u>*
> *The Company uses the level in Blithfield Reservoir as the main indicator of resource availability. Regular analysis of refill scenarios for Blithfield Reservoir are routinely undertaken during the refill season and the levels are monitored continuously. Blithfield reservoir is currently at 100%, this is above average for the time of year.*
>
> *<u>River Severn</u>*
> *The surface water reservoirs used to support flows in the River Severn (Clywedog and Vyrnwy) are also close to full and therefore there are no concerns over availability of resources for river support*
>
> *<u>Groundwater</u>*
> *Groundwater levels in the Sherwood Sandstone aquifer do not tend to react rapidly to short periods of high rainfall. However after several months of above average rainfall in the summer groundwater levels are rising. In general the reliable yield of the Companies groundwater sources is*

unaffected by groundwater levels, and therefore the Company does not use groundwater levels as a means of assessing the water resources situation.

Rainfall
Rainfall totals for the period August-November 2008 were 120% above the long term average, with August, September, and November well above average.

This is an important assessment as it shows that SSW is in a good position, with regards to its supply situation at the moment, to fulfil the targets set within its dWRMP.

SSW states in its dWRMP that it has no deficit in its supply demand balance for either the dry year annual average or peak week critical period scenarios throughout the plan period.

Canal Network

One option for boosting water supply to a WRZ experiencing a supply demand deficit is to bulk import additional water from other areas which are experiencing a surplus. One of the methods for achieving this is to utilise the existing canal network as a transfer resource. This is briefly discussed by both STW and SSW as a water resource option in their dWRMPs but is not included as a viable option within their plans for the study area in the near future. The source of the water pumped into this system may be a reservoir, river or groundwater, but, as identified by SSW in their dWRMP, the scheme would require the transfer of water of a suitable quality and to a suitable location, where a new treatment works would be required to process the water before it entered the supply network.

6.4 Water Supply Infrastructure and Impact of Development

The capacity of the infrastructure used to pipe water to existing and new development, both residential and commercial, could potentially have a significant impact on the timing of development. For example, in order to serve a significant increase in population it may be necessary to undertake significant improvements to the existing infrastructure. This is especially true for large development in primarily rural areas which may not have sufficient, or even any, infrastructure present. Similarly, the type of employment land intended for development is also an important consideration as the water supply requirements for a brewery or food processing plant are much greater than for an office block, which again may result in a requirement for significant improvements to be made to the existing infrastructure. The lead in time necessary to make these improvements would of course impact on the delivery of the new development.

For the purposes of the WCS, STW and SSW provided information about the current water supply infrastructure. However, they do state that all the information provided is for indicative purposes only as it is not feasible at this stage to undertake detailed analysis in order to determine more accurately the infrastructure requirements and associated capital costs, especially due to the long term phasing of developments and uncertainty at this time.

For clarification purposes the information has been simplified so as to only show the significant features of the network. **Appendix C** contains schematic diagrams of STW and SSW's strategic water grids. In addition, SSW provided a schematic of their Hayley Green supply zone, which covers their area of supply within Bromsgrove District. This schematic is also provided in **Appendix C**.

Both water companies were consulted and plans of the development scenarios for Bromsgrove District and Redditch Borough were explained. Copies of the plans were provided for comment on issues relating to water supply and the potential need for improvements to the existing infrastructure

The rest of this section discusses the water resources, environmental considerations, agricultural impacts, impact of non residential water use.

6.4.1 Water Resources

Severn Trent Water

Consultation with STW identifies that, with the improvements to water supply listed in Section 6.3.3, water supply should not be a problem in Bromsgrove and Redditch as there is sufficient headroom in the system. They also stated that it is unlikely that the timing of development will prove a restriction on water supply and that the size and duration of the deficits would be substantially reduced through water efficiency measures and design in both new and existing development, point 5 in Section 6.3.3.

However, it is a concern that the system is already shown as being in deficit within this area of the WRZ and is reliant upon the improvements mentioned in such a short time scale. In addition, STW did indicate that if development targets were increased dramatically beyond those stated in the Draft WMRSS, shortfalls of water supply may become much more problematic, although it was the location of the higher development

predictions that were most limiting. This could, for example highlight potential issues in relation to the highest sensitivity test used in this WCS, Scenario 3.

South Staffordshire Water

The only development site located in SSW supply zone is PR16 to the south of Romsley village. The area of this site and its potential uses were supplied to SSW for comment. It was deemed to not cause any issues or problems in terms of water supply.

6.4.2 Environmental Considerations

The Councils have asked for comment regarding the influence that increasing demands on water resources may have on sites of national and international importance.

Figure 16 shows the Conservation areas, Landscape Protection areas and Sites of Special Scientific Interest (SSSIs) located within Bromsgrove District and the SSSIs, Special Wildlife Sites (SWS) and Local Nature Reserves (LNR) located within Redditch Borough. The Figure shows both the SSSI allocations provided by the Councils and the SSSI allocations provided by Natural England. There are no National Nature Reserves, Special Protection Areas (SPAs) or Special Areas of Conservation (SAC) within the Borough or District boundaries. A number of the sites shown are reliant upon water availability and are protected under a range of environmental legislation and designations. Protection of these sites is dependent upon a number of stakeholders, most notably the water companies and the EA.

Severn Trent Water

Within their dWRMP, STW identify SSSIs, water related SSSIs and Special Areas of Conservation (SACs) across their supply area. For the Severn WRZ they state that there are 13 Natura 2000 sites (land designated by the UK and EU governments as having the most seriously threatened habitats and species across Europe) and 171 water dependent SSSIs. None of the Natura 2000 sites are located within Bromsgrove or Redditch. However, a number of SSSIs are located within the Borough and District and are dependent upon receiving water from the Triassic Sandstone aquifer or the watercourses. Where these water supplies are under pressure, from over abstraction or low flows, special care must be taken not to let the natural water supply fall below critical thresholds. This may become especially problematic with the extra demands on water supply from increased development.

South Staffordshire Water

SSW identify three SSSI sites which have been identified as being under pressure due to water abstraction. None of these are located within Bromsgrove or Redditch, but one, Hurcott and Podmore Pools, located on Blakedown Brook in Worcestershire, has been identified as being dependent upon the groundwater stored in the Triassic Sandstone aquifer. The abstraction from two SSW's sources have been identified as impacting on groundwater levels beneath this SSSI, located at Hagley and Churchill. Both of these sources supply water to the Hayley Green zone which includes Romsley village in Bromsgrove District. Modelling is being undertaken to determine the scale of the

reduction required to sufficiently raise the groundwater levels beneath the SSSI to achieve groundwater discharge and hydroecological improvements. At present the only satisfactory increase from the modelling runs is achieved from complete cessation of abstraction at these two locations, although this will depend on further study. In the meantime no reductions in deployable output have been included within the draft plan for this site. As the SSW supply zone is considered as one WRZ, loss of abstraction in this area can be supplemented by supply from elsewhere in the region. However, complete cessation at both Hagley and Churchill abstraction points would result in a supply/demand deficit and would require some action by SSW to meet the shortfall.

Environment Agency

The EA have produced a number of Catchment Abstraction Management Strategies (CAMS) in consultation with a range of key stakeholders, which explain how they will manage the water resources. There are three CAMS studies relevant to the area covered by Bromsgrove District and Redditch Borough:

- The Worcestershire Middle Severn CAMS, which covers the main rivers in Bromsgrove District;
- The Warwickshire Avon CAMS, which covers most of Redditch Borough and part of Bromsgrove District; and
- The Tame, Anker and Mease CAMS, which covers the River Cole in the far northeast corner of Bromsgrove District.

These studies outline where water is available for abstraction, where there is a need to reduce current rates of abstraction, outline their policy on time-limited licences and renewal of licences and provide an indication of the reliability of a potential abstraction licence. In addition they highlight the water management units within each area and the water related SSSIs, SACs and Special Protection Areas (SPAs).

<u>BROMSGROVE DISTRICT</u>

The area of Bromsgrove District located within the Worcestershire Middle Seven CAMS area is located within one Water Resource Management Unit (WRMU) and a majority of its area is located within a Groundwater Management Unit (GMU). The River Salwarpe, The Battlefield Brook, the Spadesbourne Brook, the enmained section of Sugar Brook and the headwaters of Elmley Brook and the River Stour are highlighted within the study. All these rivers and the GMU are noted as being Over-abstracted, due to loss of base flow from the underlying groundwater.

The 2018 target for this WRMU is to remain Over-abstracted as it is not considered economic to reduce this in the time limit. However, licenses for new abstractions up to 5 Ml/d will be considered on the River Salwarpe during times of medium to high flows. The EA defines the status of 'over abstracted' as:

> *"Existing abstraction is causing unacceptable damage to the environment at low flows. Water may still be available at high flows, with appropriate restrictions".*

The CAMS identifies a number of SSSIs which may affect water availability in the area. Two of these are located within Bromsgrove District – Romsley Manor Farm and Feckenham Forest – and two others are located just downstream of the District boundaries – Illey Pastures and Upton Warren Pools – and are thus partially dependent upon the use of water within the District.

The 2018 target for the GMU is also to remain Over-abstracted. The CAMS study states that the current strategy it to prevent the current situation for worsening and regain as much licensed water as possible. There is therefore no further water available for abstraction and licences due for renewal will be reduced as far as possible. This reinforces the statement regarding groundwater abstraction at Hagley and Churchill mentioned in SSW's dWRMP (above). STW also notes within its dWRMP that the Triassic Sandstone Aquifer is under pressure. Reductions in groundwater levels will impact any of the water dependent sites of national and international importance located above and, potentially, any of the sites located downstream on watercourses fed from a groundwater source.
The Tame, Anker and Mease CAMS identifies the River Cole as having water available for use, including at low flow (although restrictions may apply). However, it is identified that pressure will be put on increasing abstraction, so the 2019 target is No Water Available (no water is available for licensing at low flows, although water may be available at high flows with appropriate restrictions). A small section of one of the GMUs included within this study extends into the northeastern corner of Bromsgrove District. This is also identified as having water available and has a target of No Water Available for 2019.

The Warwickshire Avon CAMS locates the central eastern part of Bromsgrove District, including the villages of Alvechurch and Barnt Green as being in the Offenham – Badsey Brook catchment WRMU, which also includes the Bittell Reservoirs and Hopwood Dingle SSSIs. This WRMU is identified as having No Water Available and has a 2011 target to remain at this level. It identifies the River Arrow within Bromsgrove District as having No Water Available.

These studies indicate that the whole of Bromsgrove District is under pressure with regards to water availability. Due to its location in the headwaters of catchments and containing the large aquifer, problems with water availability within Bromsgrove District extent far beyond its borders and can have negative impacts on sites much further downstream. It is therefore essential that appropriate measures are taken not to over abstract the sources groundwater and surface water sources within its administrative area

<u>REDDITCH BOROUGH</u>

Due to its location downstream from the main aquifer and the headwaters of many of its watercourses, many of the sites of national and international importance within Redditch are dependent upon the regulation of water availability in Bromsgrove.

The Warwickshire Avon CAMs includes the Bow Brook and River Arrow. The River Arrow and Redditch Town are located in the Broome WRMU, which, within Redditch Borough, also contains the Rough Hill and Wirehill Woods SSSI and Ipsley Alders Marsh SSSI. The River Arrow through Redditch is identified as having Water Available, but this has been overridden by the status ' No Water Available' to maintain current flow levels in the River Severn and the Estuary. The EA defines this status as:

> *"No water is available for further licensing at low flows. Water may be available at higher flows with appropriate restrictions."*

The Bow Brook is located within the Besford Bridge WRMU and is identified as Over-Abstracted. This is defined within Bromsgrove section above. Its target for 2011 and 2018 is No Water Available by closing the catchment to further abstraction. It also states that STW is carrying out a compensation scheme on the Bow Brook to improve the resource availability status.

The CAMS study identifies the Wylde Moor Feckenham SSSI, Rookery Cottage Meadows SSSI and Trickses Hole SSSI as being located within the Besford Bridge WRMU in Redditch Borough. These are therefore highly dependent upon water resource management within the Borough.

This brief analysis shows that there are many sites of national importance located both within and outside Bromsgrove District and Redditch Borough which are highly dependent upon water resources which are already highly stressed. Development within the region must therefore take account of the requirements of these sites and not further exacerbate the problems with increased water abstraction. The EA and water companies are already working together to help solve these problems. The large WRZ used by the water companies will assist in this as water does not need to be sourced locally.

In addition to water availability, many of these sites are also sensitive to the quality of the water they receive in terms of chemical input, eutrophication, acidification, sediment inputs and urban debris. These water quality issues will be discussed in Section 7.4 of this WCS.

6.4.3 Agricultural Impact

Agricultural practices have a high demand for water supply, mainly to fulfil irrigation requirements. This supply is often gained from river or groundwater abstractions which therefore require a licence from the EA. As outlined in the CAMS above, this may become very restricted within the Borough and District and increasingly pressurised due to development and climate change. The following tables summarise the future strategy for water abstraction licences within Bromsgrove District and Redditch Borough. However, it must be appreciated that the CAMS status is at low flows only.

BROMSGROVE DISTRICT

Table 17 – Impact of Water Availability on Abstraction Licences in Bromsgrove District

Water Source	Status	New Licences	Existing Licences
River Salwarpe and River Stour	Over-abstracted	HOF* No low flow licences Encouragement of winter storage reservoirs and water efficient measures Restrictive daily pumping capacity	No increase in low flow HOF* Reductions on volumes Daily pumping capacity of 0.5Ml/d Reservoirs and efficiency measures
Triassic Sandstone Aquifer	Over-abstracted	No further water available	No additional water Renewal licences only approved through stringent testing Reduction to maximum usage of all licences due for renewal
River Cole	Water Available (No Water Available in 2019)	HOF of 29.7Ml/d at Coleshill Time limit of March 2014	No Impact Further water may be available Local considerations and renewal criteria will apply
Birmingham groundwater management unit	Water Available (No Water Available in 2019)	Water available for abstraction Time limit 31 March 2014	No impact Further water may be available Local considerations and renewal criteria will apply

*HOF refers to Hands Off Flow – water can only be abstracted at times of higher flow

For most of the Borough, including the north east and southern areas, there will be increasing restrictions on the abstraction licences. The reduction in water abstraction from the Triassic Sandstone Aquifer is particularly severe and will undoubtedly affect agricultural practices in the region. More water is currently available in the north west of the District, around the Hollywood and Wythall villages. However, the restrictions will increase towards the end of the planning period as the River Cole and Birmingham groundwater management units head towards a status of No Water Available.

As development and climate change predictions are set to increase the pressure on water availability, it is essential that measures, such as winter storage of water for agricultural use and the provision of storage lakes are adopted sooner rather than later.

REDDITCH BOROUGH

Table 18 – Impact of Water Availability on Abstraction Licences in Redditch Borough

Water Source	Status	New Licences	Existing Licences
River Arrow	No Water Available	No consumptive licences at low flow HOF conditions on surface water licences Minor tributaries may be subject to different conditions Time limit of 31 March 2013 Groundwater licences from minor aquifers on a case by case basis	HOF* condition Renewal criteria and local considerations Encouragement of water efficient practices
Bow Brook	Over-abstracted (No Water Available 2011)	Closed to any further licensing until No Water Available status is reached No surface water or minor aquifer licences	Presumption of renewal time limited licences subject to other renewal criteria and local considerations Encouragement of water efficient practices

*HOF refers to Hands Off Flow – water can only be abstracted at times of higher flow

As the two main watercourses within the Borough are under pressure, there will be increasing restrictions on abstraction licences. The Warwickshire Avon CAMS in particular identifies the River Arrow as being under pressure from agricultural abstraction and highlights the need for farmers to meet their summer irrigation needs by abstracting and storing water during the winter. To encourage this, the EA has set the cost of a winter licence at 10% of the cost of a summer licence.

As development and climate change predictions are set to increase the pressure on water availability, it is essential that measures, such as winter storage of water for agricultural use and the provision of storage lakes, are adopted sooner rather than later.

6.4.4 Non Residential Water Use

Some non-residential water use has a much higher demand for water supply than typical housing or employment development, for example the food processing or brewing industries. If these are proposed for development within a region then it is vital to inform the water company as they will need to structure this into their forecasts within their asset management and business plans. For WRZ such as Severn, where the supply-demand balance is already in deficit, this could be a major concern. No such industry has been identified within Bromsgrove District and Redditch Borough so this is not a requirement for consideration. However, the situation would need to be reviewed if a new site is proposed. As the water supply has already been identified as under pressure within Bromsgrove District and Redditch Borough, the introduction of a high water use industry may create significant problems for development within the area, especially in the short term before the improvements suggested by STW are in operation.

Conversely, typical office based employment development has a much lower water supply requirement per land area than residential use and therefore will have less impact in areas such as Severn, with a negative supply-demand balance.

6.4.5 Water Infrastructure

The infrastructure necessary to supply water throughout the Borough and District has the potential to influence the timing of development depending on the location. However, as the precise locations and phasing of development is not known, it is not feasible for the water companies to provide detailed costs for necessary improvements for hypothetical scenarios.

SSW and STW were provided with figures and locations for growth based upon the current Phase Two Preferred Option (Scenario 1) and the Local Plan and LDF development locations. Neither expressed concern regarding the capacity of the current water infrastructure for the proposed increase. However, as extension to the water supply network will be required for Greenfield sites and adjustments to the network for Brownfield sites, the exact locations, timing and size of development would need to be submitted to the water companies as soon as possible to allow them to factor any costs into their next AMP submissions to Ofwat. In addition, if the higher development Scenarios, most notably Scenario 3, were implemented instead of Scenario 1 then it is likely that the capacity of the current infrastructure will be exceeded.

SSW explained the process by which such improvements would be introduced. Firstly, they would wish to be consulted at the LDF stage, to give an early indication of future development and when it would be delivered. They would not undertake calculations and design until approached by a developer, who would be required to pay an infrastructure charge. SSW would then undertake the necessary upgrade in infrastructure.

Figures 17, 18 and **19** show the existing supply system and the proposed developments across the District of Bromsgrove and Borough of Redditch. SSW was able to provide schematics for the supply zone relevant to their supply area within Bromsgrove District. Unfortunately STW, could not provide any additional schematics to those available within their dWRMP. As far as possible these have been accumulated onto one map. Locations of water supply infrastructure are for indicative purposes only and are not accurate.

As there is only one development site located within the SSW supply area and the rest of the sites are located within one STW WRZ, across which water can be exported and imported depending upon demand and regardless of location within the WRZ, **Tables 19a – 19f** and **20a – 20d** summarises the capacity of the water supply network solely in terms of:

- proximity to the major supply mains, as shown in **Figures 17, 18** and **19**;
- type of site (Brownfield or Greenfield); and
- remoteness of the site

However, it must also be noted that the movement of water within a WRZ is reliant upon existing infrastructure, such as pump capacities and pipe size, which may act as a limiting factor.

Green	• Little or no infrastructure upgrade required ⇨ Located in proximity to major supply main ⇨ Brownfield site so some existing infrastructure should be present ⇨ Easily accommodated within the existing system as located close to developed area
Yellow	• Minor infrastructure upgrade required ⇨ Satisfies one or two of the three criteria required for 'green' classification
Red	• Major infrastructure upgrade required ⇨ Satisfies none of the criteria required for 'green' classification

BROMSGROVE DISTRICT

Table 19a – Bromsgrove District Areas of Development Restraint

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
A1	22.6	G (mostly)	West Hagley (Kidderminster, Western & Stourbridge Roads)	
A2	1.3	G	Willow Brook Road, Alvechurch	
A3	2.8	G	Birmingham Road, Alvechurch	
A4	10.0	G	Ravensbank Business Park	
A5	6.3	G (mostly)	Bleakhouse Farm, Grimes Farm	
A6	3.1	G	Selsdon Close, Grimes Hill	
A7	1.1	G	Birmingham Road, Alvechurch	
A8	7.6	G	Rutherford Road, Bromsgrove	
A9	24.4	G	Whitford Road, Bromsgrove	
A10	6.4	G	Egghill Lane, Rubery	
A11	65.7	G	Perryfields Road, Bromsgrove	
A12	5.9	G	Church Road, Catshill	
A13	11.9	G	Birmingham Road, Bromsgrove	

Table 19b – Bromsgrove District Employment Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
E1	2.5	B	Factory Lane, Bromsgrove	
E2	17.3	B & G	Wythall Green Cricket Ground	
E3	3.4	B	Depot Site, The Avenue, Rubery	
E4	29.9	B	Ravensbank Business Park,	
E5	0.6	B	Ford Road, Bromsgrove	
E6	50.3	B	Saxon Business Park, Stoke Prior	
E7	38.0	B	Parsonage Drive, Cofton Hackett	
E8	78.9	B (mostly)	Bromsgrove Eastern By-Pass/Stoke Road, Bromsgrove	

Table 19c – Bromsgrove District Policy Reference Areas

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
PR1	3.1	B	Newton Road, Bromsgrove	
PR2	26.6	B	Saxon Business Park, Stoke Prior	
PR3	9.2	B	Buntsford Drive, Bromsgrove	
PR4	2.3	B	Bunstford Park Road/Buntsford Hill	
PR5	1.4	B	Aston Road, Bromsgrove	
PR6	1.4	G	Houndsfield Lane Caravan Site, Trueman's Heath	
PR7	1.8	G	Sweet Pool, West Hagley	
PR8	0.7	G	Wilmore Lane, Silver Street	
PR9	0.3	G	Church Hill, Beoley	
PR10	13.4	G	Shirley Quarry	
PR11	1.2	G	Crown Meadow, Alvechurch	
PR12	0.8	G	(playground) Penmanor Road, Finstall	
PR13	1.2	G	Heydon Road, Finstall	
PR14	3.3	G	Recreation Ground, New Inns Lane, Rubery	
PR15	1.5	B	Transport Museum, Wythall Green	
PR16	1.3	G	Dark Lane, Romsley	
PR17	16.1	G	Wythall Park, Silver Street	
PR18	8.9	G	Staple Flat Road, Lower Marlbrook	
PR19	7.1	B	Museum of Buildings, Redditch Road, Bromsgrove	
PR20	0.5	G	Whitford Road, Bromsgrove	
PR21	3.5	G (mostly)	Indoor Bowls Centre, Stoke Road, Bromsgrove	
PR22	0.2	G	Grayshott Close, Bromsgrove	
PR23	0.8	G	Granary Road, Bromsgrove	
PR24	0.2	G	Byron Way, Catshill	
PR25	1.3	G	Sycamore Drive, Hollywood	
PR26	0.2	G	Falstaff Avenue, Hollywood	
PR27	0.7	B & G	Beaudesert Road	
PR28	1.6	G	Marlbrook Lane, Lower Marlbrook	
PR29	3.3	G	Mayfield Close, Upper Catshill	
PR30	0.5	G	Upland Grove, Lowes Hill	
PR31	8.9	G	Staple Flat Road, Lower Marlbrook	
PR32	0.9	G	Worcester Road, Bromsgrove	
PR33	0.1	G (mostly)	New Road, Bromsgrove	
PR34	0.5	B	Tel Ex and Station, Barnt Green	
PR35	0.4	B	Willow Road, Bromsgrove	
PR36	0.2	B	Bromsgrove Station	
PR37	3.4	B & G	Lickey Road, Rednal	
PR38	8.6	B & G	School Lane, Alvechurch	
PR39	0.7	B	(market) St John Street, Bromsgrove	
PR40	88.4	B & G	Barnt Green	
PR41	0.1	G	Whettybridge Road, Rubery	
PR42	8.0	B	Cheltenham Avenue, Upper Catshill	
PR43	37.5	B	Stoney Hill, Bromsgrove	

Table 19d – Bromsgrove District Shopping Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
Sh1	0.2	B	Station Road, Grimes Hill	
Sh2	0.8	B	Red Lion Street, Alvechurch	
Sh3	0.3	B	Alcester Road, Hollywood	
Sh4	2.0	B	Worcester Road, West Hagley	
Sh5	0.9	B	Golden Cross Lane, Catshill	
Sh6	2.6	B	(superstore) Bromsgrove Eastern By-Pass, Bromsgrove	
Sh7	0.8	B	Stoke Road, Aston Fields, Bromsgrove	
Sh8	0.4	B	May Lane, Hollywood	
Sh9	0.7	B	Hewell Road, Barnt Green	
Sh10	3.5	B	New Road, Rubery	

Table 19e – Bromsgrove Unzoned Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
UZ1	8.7	G	Cherry Hill Road, Barnt Green	

Table 19f – Bromsgrove Village Envelopes

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
Adams Hill	4.5	B & G	East of West Hagley	
Belbroughton	18.5	B & G	Southeast of West Hagley	
Bournheath	7.6	B & G	West of Catshill	
Burcot	4.3	B & G	Southeast of Lickey	
Clent	2.8	B & G	East of West Hagley	
Fairfield	4.4	B & G	Northwest of Catshill	
Finstall	12.1	B & G	East of Bromsgrove	
Holt End	6.5	B & G	Northeast of Redditch	
Holy Cross	11.6	B & G	Southeast of West Hagley	
Hopwood	5.1	B & G	North of Alvechurch	
Lower Clent	2.3	B & G	East of West Hagley	
Romsley	26.2	B & G	East of West Hagley	
Rowney Grn	15.2	B & G	Southeast of Alvechurch	

REDDITCH BOROUGH

Table 20a – Redditch Areas of Development Restraint

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
A14	33.4	G	A435, Redditch	
A15	47.7	G	Webheath, Redditch	
A16	25.5	G	Brockhill, Redditch	

Table 20b – Redditch Employment Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
E9	0.2	B & G	Barn Close Farm, Love Lyne, Hunt End	
E10	11	G	North of Red Ditch, Enfield	
E11	2.0	G	Green Lane, Wirehill	
E12	0.9	B & G	Enfield Industrial Estate, Redditch	
E13	0.3	G	Palmers Road, Redditch	
E14	0.2	G (mostly)	Washford Industrial Estate, Redditch	
E15	0.7	G	Merse Road, Moons Moat, Redditch	
E16	0.6	G	Bartleet Road, Redditch	
E17	0.4	G (mostly)	Studley Road, Redditch	
E18	0.4	B & G	Studley Road, Redditch	
E19	0.1	G	Fringe Meadow Road, Moons Moat, Redditch	
E20	1.3	G	Old Forge Drive, Redditch	
E21	1.1	G	Park Farm Industrial Estate, Redditch	
E22	1.0	G	Shawbank Road, Redditch	
E23	0.4	B (mostly)	Upper Crossgate Road, Redditch	
E24	0.2	B	Trescott Road, Smallwood, Redditch	
E25	0.4	B	Old Forge Drive, Redditch	
E26	0.02	B	Evesham Road, Astwood Bank	
E27	0.01	B	Beoley Road West, St George's, Redditch	

Table 20c – Redditch Housing Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
H1	1.5	B	Prospect Hill, Redditch	
H2	0.5	G	Pheasant Lane, Oakenshaw, Redditch	
H3	0.7	B	(old school) Dilwyn Close, Redditch	
H4	0.9	G	Harris Close, Redditch	
H5	1.0	G	Greenlands Drive, Redditch	
H6	1.0	B & G	Middlehouse Lane/ Alvechurch Highway	
H7	5.7	B	Enfield Industrial Estate, Redditch	
H8	0.4	G	Easemore Road, Redditch	
H9	0.7	B & G	Woodrow North, Redditch	
H10	0.3	G	South Street, Redditch	
H11	0.2	B	Grange Road, Redditch	
H12	0.4	B	Walton Close, Redditch	
H13	0.4	G	Rock Hill Farm, Feckenham	

Table 20d – Redditch Strategic Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Water Supply Infrastructure
St1	2.3	B (mostly)	Church Hill, Redditch	
St2	2.5	B (mostly)	Winyates, Redditch	
St3	0.9	B & G	Matchborough, Redditch	
St4	1.7	B (mostly)	Woodrow, Redditch	
St5	0.7	B & G	Woodrow North, Redditch	
St6	2.0	G	Green Lane, Wirehill	
St7	1.3	B	B4184, Redditch	
St8	0.5	B	Edward Street	
St9	1.4	B	Prospect Hill, Redditch	
St10	4.6	B	Town Centre, Northwest Quadrant	

Water Infrastructure Summary

Both STW and SSW have commented that they do not envisage a problem with water supply or infrastructure with Bromsgrove District or Redditch Borough.

From the schematics it is clear that there is a substantial network of water mains through the village of Romsey which will serve the only development site in the SSW area, PR16. SSW have also commented directly that this site does not pose a problem in terms of water supply.

However, only a very general schematic of water supply infrastructure was available for use in this study from STW. **Figures 17, 18** and **19** and the summary **Tables 19a – 19f** and **20a – 20d** are therefore based solely on the general schematic and are thus considered to provide a conservative view as a much wider network of water mains will be present to serve the existing developments. Only sites located within 500m of the main water supply pipes were considered 'in proximity'. The distance of 500m is an arbitrary figure that was chosen purely to create distinction between the sites based upon distance. It should therefore be used as a guidance tool and not considered a strict divisional distance between the sites. The sites allocated as requiring 'little or no infrastructure upgrade' are therefore Brownfield locations in Bromsgrove and Redditch close to the one main STW pipe which bisects the study area. The sites identified as requiring 'major infrastructure upgrade' are generally located on Greenfield sites to the rural northeastern corner of Bromsgrove District.

Due to the general nature of this analysis, many of the sites have been placed in the middle 'yellow' classification and thus require 'minor infrastructure upgrade'. However, for many located on Brownfield sites this assumes the previous development was connected to the water supply network and this network still remains. If it does not, they will require a major upgrade and should be classified in **Tables 19a – 19f** and **20a – 20d** as red. Similarly, it is assumed that sites located within, or on the margins of, current settlements will be able to connect to the current water supply network. This may be proved impractical due to the location of the sites and thus they may require a more extensive infrastructure upgrade than shown within this report. This table should thus be used as a general guide only.

6.5 Conclusions

The assessment of water resources and water supply is limited by the availability and detail of information provided by STW and has been based upon the dWRMP report. When released in the summer of 2009, the final WRMPs may supersede some of the conclusions of this report, although it is unlikely that any changes will be major.

SSW have confirmed that they do not have any problems with water supply or infrastructure to serve development site PR16 in Romsley. Their dWRMP confirms this as it states there is no deficit in water resources within the SSW supply zone throughout the plan period.

Consultation with STW has concluded that they have no concerns regarding water resource supply or infrastructure capacity within Bromsgrove as they have "sufficient headroom within the system". However, their dWRMP indicates that the Severn WRZ is already in supply-demand deficit, which will become increasingly negative throughout the plan period, although Severn Trent as a whole will not become negative until 2011-

2016 or 2019-2024. It is assumed that transfer of water between the WRZs, most notably from the Birmingham and East Midlands WRZs will balance out the negativity. The delay in building of the Ombersley Water Treatment Works has had a severe impact on these projections, but, if and when it is eventually passed, it will provide an extra boost of water to the system and, in addition to the other improvements specified, it will stop the supply-demand balance from becoming increasingly negative. Although Ombersley Water Treatment Works should have been built in the current AMP cycle, STW have delayed the need for the works through the use of other solutions, providing the time required to obtain planning permission. STW do note that the implementation of water efficiency measures into development is essential and that the situation post 2010 is dependent upon investment made in AMP 5 and AMP6.

However, following the issue of the draft version of this WCS report, the Environment Agency have notified us that the deficits in the final planning scenario of the dWRMP are caused by a 'quirk' of the model used by STW. Apparently these have been corrected and in the final plan the company will not have any deficits once the management strategies have been put in place. There is therefore a requirement for a review of this WCS once the final WRMPs have been published.

In addition to the predictions made by the water companies, it is essential to take into account the decrease in abstraction licences noted in the CAMS reports as this may affect the type of development that is viable. The abstraction restriction place on many of the watercourses within the Borough and District may pose a limiting factor for growth. Although it is unlikely that water supply will impact housing development as water can be brought into the area from elsewhere, the time of industry may be limited if mains water cannot be provided or is too expensive, especially with regards to factory based manufacture.

Even if there were an unlimited supply of water "bottle-necks" in the water supply infrastructure could limit growth. Large scale developments on the margins of the existing supply network would require significant investment in infrastructure upgrade. Given the lead in time associated with the design and construction of infrastructure improvements it is essential that the timing of infrastructure upgrade be factored into the planning of new development allocations. For example, it may not be feasible to plan for immediate development in the more marginal Greenfield sites where significant upgrade would be necessary.

It must also be borne in mind that any development application will require a formal submission to the water companies outlining the water usage requirements in order that the application can be assessed in detail to identify the potential impact upon the water distribution system and any upgrades that may be required. As mentioned in Section 6.4 above, the water requirements are extremely sensitive to the type of employment land intended for development, details of which have not been provided or reviewed within this WCS.

7 WASTE WATER COLLECTION, TREATMENT AND RIVER WATER QUALITY

7.1 Introduction

Wastewater collection and treatment within the whole of Redditch Borough and Bromsgrove District is undertaken and managed by Severn Trent Water. The assessment of the wastewater infrastructure, as presented in this WCS, has been based on consultation with Severn Trent Water together with information produced by Ofwat and the Environment Agency.

This section will address the capacity of the existing wastewater infrastructure to deal with the increase in flow as a result of the proposed increase in population, both in terms of pipe network and in the capacity of the sewage treatment works. This section also addresses the environmental quality of the receiving watercourses and the potential limiting impact of this due to legislation relating to water quality.

7.2 Waste Water Collection

The main network of sewers between developed areas and sewage treatment works are considered 'public' sewers and are the responsibility of STW. However, for houses built after 1 October 1937 all pipework serving more than one property will be a 'private' sewer until they join the public sewer, normally under the road. Maintenance of private sewers is the responsibility of all the house owners using it. It is the capacity and location of the main public sewers that will be discussed within this report.

However, there are two types of public sewer: foul and surface. The foul sewers remove dirty waste water that cannot be discharged into the environment (although much is 'clean' water discharge from taps and baths etc) and carry it to sewage treatment works. Surface water sewers transmit runoff from housing (i.e. roofs, driveways etc.) and discharge it into ditches and rivers. Although new developments generally connect road gullies to housing estate mains, highway drainage is usually owned and operated by highways authorities, especially on main routes and water companies have no legal requirement to take highway drainage. However, there are also locations within the study area where there is only one combined sewer, which is a much older system and transmits both foul and surface water. Although the proportion of 'dirty' water containing sewage is much less in these systems, the inclusion of foul water results in the need to treat all the discharge from these sewers at the sewage treatment works.

Figure 20 shows the main public sewers located within Bromsgrove District and Redditch Borough.

It is understood that STW have commissioned Jacobs Babtie (Jacobs) to construct hydraulic sewer models for many of the New Growth areas within their service area. At present no models are available for Bromsgrove or Redditch, although they may constructed in the future. The analysis of waste water collection has therefore been undertaken through consultation with STW and the Council Drainage Engineers. The rest of this section summarises the main features of the waste water collection systems and the main concerns of these systems with regards to increased development obtained through this consultation. Information provided by Severn Trent Water was minimal and non-specific. A higher level of detail was provided by the Council Drainage Engineers and constitutes the bulk of this analysis.

BROMSGROVE DISTRICT

The Bromsgrove Council Drainage Engineer has summarised the main waste water collection features for each of the areas of the District, as shown on **Figure 20**.

Hagley

The sewage system in Hagley also receives the waste water from Lower Clent. The pre-war properties have partially combined sewer systems, but there are no public storm sewers for most of the area. The infiltration of storm water into the system currently causes flooding problems at the site of the old sewage treatment works within West Hagley, which has now been converted into a pumping station to transmit the sewage to the Roundhill sewage treatment works in Stourport.

Holy Cross and Belbroughton

Similarly to the Hagley area, the pre-war properties have partially combined sewers and there are no public storm sewers. The wastewater from Clent and Holy Cross is transmitted to a pump in Hossil Lane and subsequently transmitted to Yew Tree Avenue, just north of Belbroughton. This pump struggles to control the storm water. From here the sewers pick up the wastewater from Belbroughton village and feed it to the Drayton Road pump transmits it to a small sewage treatment works southwest of the village (located just inside the District boundary.

Romsley and Hunnington

The system here is designed to take into account storm infiltration with separate storm and foul sewers. Part of the scheme to accommodate the surface water was the installation of a weir by the factories at Hunnington. However, this weir was designed in the 1960s to accommodate considerable storm infiltrate from Romsley Village and Upper Hunnington. It is know to become obstructed and results in foul water pollution to the stream. As a result it is considered critical that the problem is resolved. Flooding of the surface water sewers has also caused problems along St Kenelms Road/Dark Lane in Romsley. The public storm sewer eventually outfalls to Dudley Metropolitan Borough Council and the foul water also feeds to the Dudley sewage treatment works (Lower Gornal).

Rubery

In this area there are separate storm and foul systems, although there are problems with cross contamination between the two as they use the same manhole chambers. These sewers outfall to Minworth sewage treatment works.

Bromsgrove

The Bromsgrove sewers take wastewater from the villages of Fairfield, Bournheath, Catshill, Upper Marlbrook, Lickey End, Linthurst, Burcot and Finstall. The original town sewers were constructed in 1887 as a combined system. This was extended in the mid 1930s to take in Sidemoor (the western area of Bromsgrove town), Catshill, Marlbrook and Aston Fields and it is these systems that struggle with storm infiltration. As a result there are off-line balancing systems located at Washingstocks, at Catshill and the Strand, in Bromsgrove town centre. The sewer systems in Fairfield, Bournheath,

Linthurst and Burcot were constructed in the 1970s-1990s and therefore should be free of storm infiltration, however the Bournheath sewers, dating from 1972, tend to suffer from flooding off the field systems. Storm sewers do exist in the town area, but the sewage treatment works cannot cope with the storm water from high intensity rainfall.

Stoke Works

This system takes the wastewater from part of Stoke Heath, Stoke Prior and Foley Gardens, to the south of Bromsgrove. There is only public foul sewer in this area, although there is a new public storm sewer from Stoke Heath. The sewage works struggle to cope in this area.

Alvechurch

The Alvechurch sewers take wastewater from part of Lickey, Rednal, Cofton Hackett, Barnt Green and Rowney Green Lane in Hopwood. No problems have been experienced at the Alvechurch sewage treatment works. Apart from Alvechurch village (the old part of the system), the storm water should be separated from the foul, although storm inflows have repeatedly caused problems in Barnt Green and within Alvechurch (most notably at Birches Lane, which has problems with storm water culverting). There is on-line balancing at Ross hill, Rednall, Ten Ashes Lane and two at Plymouth Road, to attenuate the infiltration which mainly occurs at the head of the system. There are no public storm sewers.

Bordesley

Bordesley is served by a 1980s system and is pumped to Redditch. There are no storm sewers.

Holt End

This village is served by a 1970s system which is partially pumped to Redditch and partially drains by gravity to Spernal STW. Again, there are no storm sewers present.

Wythall and Hollywood

This system includes the area of Inkford, which was included in the 1970s. It contains separate storm and foul sewers, due to the clay substrata, with formal private outfalls. The system is balance off line in Lea Green Lane. Majors Green was formally part of Stratford RDC and, on the Council mapping, has the storm sewers shown as public sewers, as they are ex-highway drains. The foul water system for this area outfalls at Minworth.

Walkers Heath

This area has separate storm and foul public sewers. It is part of the Birmingham overspill and outfalls to Minworth.

As a whole, the main problems associated with the sewer systems in Bromsgrove District are due to the influx of unattenuated storm water into the foul sewers, resulting in an exceedance of capacity within the system. At present this is particularly problematic in West Hagley and the new development in Finstall as the foul sewers are not designed

to carry the volumes of storm water flow delivered from development and road networks. This situation is not helped by a lack of maintenance of both sewers themselves and the watercourses which they outfall in to. Attenuation of all surface water from new development is therefore key to stopping the problem from worsening. Severn Trent Water has stated that the water table is well below the surface in the District so excess water tends to drain rapidly away through the underlying sandstone geology.

REDDITCH BOROUGH

Redditch Borough has a much simpler wastewater treatment system than Bromsgrove District as it is served by two sewage treatment works and one Water Reclamation Works (WRW), all of which are located within or just outside the Borough boundaries. There are two main catchments, divided by a ridge of higher ground which runs from northwest to south through Redditch town, depicted by the line of Birchfield and Evesham road, depicted by the brown dashed line on **Figure 20**. All the development located north of this ridge, most of Redditch town, is located within the Spernal sewage treatment works catchment area, whereas the area to the south of the ridge drains to the Priest Bridge sewage treatment works. However, the village of Astwood Bank, located within the Priest Bridge catchment area, is served by a small WRW on Dark Lane.

Due to the height of the development above these sewage treatment works, most of the sewers within Redditch Borough are gravity systems. However, there are a number of pumping stations located in the northwestern corner of the Priest Bridge catchment which pump foul water from parts of the Webheath and Headless Cross areas of the town over the ridge to the Spernal gravity sewers. The Church Road pumping station serves the former Webheath WRW drainage catchment, the Foxlydiate Lane pump serves developments around Foxlydiate Lane and Grazing Lane and the Norgrove pump serves the development sites off Great Hockings Lane (pumping with a real-time link and additional storage). These all outfall to the Windsor Road Trunk Sewer via Batchley. The Plymouth Close pump serves the Plymouth Close development site and also pumps to the Spernal gravity sewers. There is an additional pump on Crumpfields Lane which replaces the former WRW at the same site and pumps to the Priest Bridge gravity sewers. **Figure 20** shows a very rough indication of the locations of the main foul sewers within Redditch Borough. It must be noted that these are for indicative purposes only and are not a true representation of the complex system. The dashed lines represent the pumped sewers, whereas the solid lines indicate the gravity systems.

In terms of the proposed developments, most are located within the gravity fed Spernal catchment. This includes the sites located within the Holt End and Ravensbank areas of Bromsgrove District. Very few sites are located within the Priest Bridge catchment. The Redditch Council Drainage Engineer has commented that sites E9 and H13 may be able to drain to the gravity sewers of the Priest Bridge system, dependent upon capacity. Site E26 would be served by the Dark Lane WRW. The large ADR site, A15 would either require additional pumping stations to pump wastewater over the ridge to the Spernal gravity sewers or, as part of sewerage rationalisation, require a new scheme to pump wastewater into the Spernal system across the ridge further south at Hunt End.

There are two systems of main foul sewers (old and new) forming the backbone of the Spernal network through Redditch and both are operating at capacity, which is exceeded during storm events, such as occurred in 2007. The lack of capacity is especially critical for a length of 3-4km between Batchley and Ipsley Church Lane (highlighted in red on **Figure 20**). A suggestion has therefore been made by the

Redditch Council Drainage Engineer to create a 'bypass' system to divert a large portion of the wastewater within the Priest Bridge system to the Spernal sewage treatment works. This scheme involves the installation of a pump at Dunlop Road in Hunt End to pump this water over the ridge which would communicate with the Spernal Trunk Outfall Sewer, downstream of all known vulnerable locations. This would allow the pumping stations at Crumpfields Lane, Church Road, Norgrove and possibly Foxlydiate Lane to be abandoned, following an extension of the Western Areas Trunk Foul (gravity) Sewer. In addition, it may also be possible to provide reserve capacity within the Priest Bridge catchment to accommodate limited, further development.

There are extensive surface water sewerage systems within the Redditch area, principally within the New Town Areas. A number of the older settlements within the Borough, namely the Town Centre, Webheath, Headless Cross, Crabbs Cross, Astwood Bank, Feckenham and ribbon development along the 'original' main roads, are substantially drained by combination sewers. All sewers downstream of these areas are therefore affected by unattenuated runoff from development. If the Hunt End strategy is adopted, the Redditch Council Drainage Engineer suggests that a significant proportion of the combined wastewater currently draining to Priest Bridge sewage treatment works could also be diverted to Spernal. Due to capacity problems within the sewers and Priest Bridge sewage treatment works (discussed below), a volume of 'wet' Dry Weather Flow (DWF) could be diverted to Spernal and replaced with an equivalent volume of 'dry' DWF.

A number of balancing areas exist throughout the Borough and are discussed in the SFRA. However a number are on-line balancing pools which attenuate surface water sewer flow, such at Batchley Pools. This is a new scheme that is operating well but does not offer any additional capacity. Increasing the capacity would involve carrying out some form of measured improvement strategy, requiring the consent of the EA, Redditch Borough Council and STW. Concern has also been raised regarding the influx of unattenuated flow from development sites upstream in Bromsgrove District.

In summary therefore, there is no capacity within the sewage system of Redditch Borough (both combined and separate) for any surface water flow. It is therefore important for any development to incorporate suitable SUDS systems to attenuate and balance any surface water runoff. However, infiltration systems are likely to be ineffective over much of the area due to the predominantly heavy, impervious underlying sub-soils (marl). Open storage, where practicable, is therefore preferred, although at certain sites, such as A16, this would be problematic due to topography and current land drainage issues. Due to the elevation of the most of the developed areas of the Borough above the sewage treatment works, in places as much as 90metres, most development sites would be able to connect to the gravity fed foul water sewers. The Drainage Engineer recommends a blanket refusal of all sites which require either foul and/or surface water pumping. However, there are restrictions within the wastewater infrastructure, most notably the northern section of the main Western Areas and also Spernal Trunk Foul sewers. Any new development will therefore struggle to connect to this system unless a by-pass scheme, such as that suggested for Hunt End is adopted.

7.3 Waste Water Treatment

All waste water transmitted in the combined or foul sewer networks, either by gravity systems or pumps, is taken to a Sewage Treatment Works to be cleansed and subsequently released back into the river network. The number of Sewage Treatment Works is decreasing due to a preference for the utilisation of fewer larger works. The locations of these are shown on **Figure 20**. Two main sewage treatment works remain in Bromsgrove District – Fringe Green and Alvechurch. Two smaller works are also located within the District boundaries, at Stoke Prior and Belbroughton. However, the remainder of the sewage within the Borough is pumped beyond its borders and treated at Roundhill (for the Hagley area), Lower Gornal (treats the Romsley area), Minworth, (which takes all the sewage from the Rubery, Hollywood and Wythall areas) and Spernal (which serves the Bordesley and Holt End areas). All sewage within Redditch is treated at two main sewage treatment works – Priest Bridge, which is just inside the Borough boundary and Spernal, which is beyond the southeast Borough boundary.

The capacity of these systems is an important consideration when planning new development. This is judged in terms of the ability of the sewage treatment works to receive more flow and the quality of the watercourse into which it discharges. For a STW to increase its capacity, it has the potential to require an increase in Consented Dry Weather Flow (CDWF). If the quality of the rivers in question is already marginal or poor, it may prove to be a barrier to the increase in CDWF due to the enhanced influence an increase in treated effluent will have upon the aquatic ecosystem. However, should consent be granted, the conditions will undoubtedly be stringent and require additional capital investment by Severn Trent Water in order to meet the higher require effluent standard, particularly with regards to the level of phosphates discharged[7]. 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 the size of the treatment works and the sensitivity of the receiving watercourse. As populations grow, some sewage treatment works may exceed the UWWTD threshold that requires nutrient removal[8]. In locations where households cannot be connected to existing sewers, particularly of concern in the rural areas of the Borough and District, this may result in additional septic tank discharges to water bodies in which levels of phosphates and nitrates are already very high. Under the Water Resources Act a 'consent to discharge' must be obtained from the EA before any polluting material is legally discharged into a watercourse. The consents are based upon the quality and volume of the waste water and the quality and capacity of the receiving watercourse. If a sewage treatment works needs to expand due to new development with it may be necessary for a new consent for increased flow to be applied for. The RSS states that although the EA may grant this it is likely to set tighter limits on the pollutant concentrations to ensure overall loading is unaltered. When the initial RSS targets were released, the Environment Agency carried out a study to assess the impact of housing growth on water quality and waste water infrastructure[8]. However, SUDS can be implemented as part of new developments with the resulting effect of improving water quality and reducing additional rate and volume of surface water run off.

[7] West Midlands Regional Spatial Strategy (RSS 11) The Impact of Housing Growth on Water Quality and Waste Water Infrastructure, 2007

Table 21 and **22** summarise the current and future problems for each of the sewage treatment works as well as the results of the EA risk assessment and the water quality of the rivers into which they discharge (river quality is assessed in greater detail in Section 7.4).

BROMSGROVE DISTRICT

Table 21 – Sewage Treatment Works Serving Bromsgrove District

Sewage Treatment Works	Watercourse	Council Opinion *- current problems*	STW Opinion *- future problems*	EA Risk Assessment (Overall Risk)	River Quality Objective
Fringe Green, Bromsgrove	Sugar Brook	Cannot cope with high intensity rainfall	High risk of putting pressure on sewage treatment infrastructure if new development occurs. Plans to upgrade[8]	High	Compliant
'Stoke Prior'	Hen Brook	Struggle to cope	-	-	Significant Failure
Alvechurch	River Arrow	No Problems	High risk of putting pressure on sewage treatment infrastructure if new development occurs	Medium	Compliant
'Belbroughton'	Hoo Brook	Hossil Lane pump struggles with storm water	-	-	Compliant
Roundhill, Stourbridge	River Stour	Hagley pump struggles with storm water	Improvement plans to upgrade[8]	High	Compliant
Minworth	River Tame	-	Improvement plans to upgrade[9] AMP4 2005-2010	High	-
Lower Gornal, Dudley	-	-	-	Medium	-

*N.B. Spernal Sewage Treatment Works receives some of the sewage from Bromsgrove District and is included within **Table 22** below.*

STW have already identified the need for Improvement works at Fringe Green, Alvechurch, Roundhill and Minworth sewage treatment works within their AMP4 submission, all of which were identified as High or Medium Risk within the EA risk assessment report, based upon water quality and flow risk. If additional improvements are required based upon the updated DWMRSS figures, they will incorporate this need into their AMP5, PR09 submission this year. The most concerning sewage treatment works within Bromsgrove District is the Fringe Green site, which receives all the sewage from Bromsgrove town and the villages to the north. This has been identified by the EA as being at high risk and STW states that it will be under pressure if new development were to occur. The other main sewage treatment works for the District is Alvechurch,

[8] 'Bills to fund wave of investment', Severn Trent Water, 19th February 2007

which is also identified by STW as being under pressure. Stoke Prior, which is another area identified for development south of Bromsgrove town has also been identified as struggling to cope at present and has significantly failed its RQO. These three sewage treatment works therefore require assessment and potential upgrade before development takes place within their catchments. Although Roundhill and Minworth were identified as being at high risk within the EA report, they have been identified by STW and plans have already been put forward to upgrade the systems.

REDDITCH BOROUGH

Table 22 – Sewage Treatment Works Serving Redditch Borough

Sewage Treatment Works	Watercourse	Council Opinion *- current problems*	STW Opinion *- future problems*	EA Risk Assessment (Overall Risk)	River Quality Risk
Spernal, Redditch	River Arrow	No known problems Scope for improvement and increased capacity	No known problems	Low	Compliant
Priest Bridge	Bow Brook	Flows are at capacity and cannot be increased or decreased due to fragile water environment	High risk of putting pressure on sewage treatment infrastructure if new development occurs Plans to upgrade[9]	Medium	Compliant
Dark Lane WRW*	Doe Bank Brook	Recently improved. No early replacement or abandonment envisaged	-	-	-

** Water Reclamation Works*

There are no known problems regarding capacity or river quality at the Spernal sewage treatment works. No concerns have been raised regarding the works although the Council Drainage Engineer has stated that that this site may have scope for improvements and the capacity to increase. Dark Lane WRW has also been sited as recently improved so should not be affected by a minor increase in capacity. However, no river quality or EA assessments are available for Doe Brook so comment cannot be made regarding the water quality. It must be noted that Doe Bank Brook outfalls into the Bow Brook which has been identified having low flows by the Drainage Engineer and high nutrient levels (see Section 7.4.1). Although Priest Bridge is compliant with its RQO and has only been identified by the EA as being at Medium Risk, comment has been made regarding its lack of capacity by STW and flow and river quality by the Council Drainage Engineer. It is therefore unlikely that this catchment can receive increased wastewater from new development.

7.4 River Water Quality

7.4.1 Current River Water Quality

As outlined in Section 7.3, river quality is highly dependent upon the quality of the discharge from the sewage treatment works. This section analyses the quality of the main watercourses within Bromsgrove District and Redditch Borough and discusses the effect on waste water treatment within the area.

The Environment Agency has provided the 2006 General Quality Assessment (GQA) grades and River Quality Objectives (RQO) for a number of watercourses within the Borough and District, along with the Catchment Abstraction Management Strategy's (CAMS) for the Worcestershire Middle Severn, Warwickshire Avon and the Rivers Tame, Anker and Mease. This data was used to provide an assessment of the water quality in the Borough.

RQOs are targets which were agreed by the Government for 40,000km of river length in England and Wales when the water industry was privatised in 1989. The targets specify the water quality needed in rivers if we are to be able to rely on them for water supplies, recreation and conservation and centre on ensuring the rivers support fish. They are based on chemical quality, and the Government believes that they represent the best available reference point to establish progress in maintaining and improving river quality. The targets, as shown on the EA website, are given in **Table 23**.

Table 23 - RQO Targets

RE1	very good quality (suitable for all fish species)
RE2	good quality (suitable for all fish species)
RE3	fairly good quality (suitable for high-class coarse fisheries)
RE4	fair quality (suitable for course fisheries)
RE5	poor quality (likely to limit fish populations)

Compliance with an RQO is assessed on the basis of data gathered by the EA over a complete calendar year. It is this data which is displayed in **Figure 21**. If a stretch of river fails to meet the standards the EA takes action to remedy the situation, firstly discovered the cause of the failure.

As they are based on chemical quality, the RQO does not monitor or assess compliance for all substances that may exert an impact on ecological water quality, such as phosphates, nitrates or biological quality. This data is provided by the EA in the GQA database. Chemical quality is an indicator of organic pollution in general, Biological quality is an indicator of the overall 'health' of rivers and Nitrate and Phosphate levels indicate diffuse pollution, most notably from agricultural practices. Elevated levels of these nutrients are of concern because they can cause eutrophication, which harms the water environment. In addition, excess nitrate has to be removed before water can be supplied to consumers, increasing supply costs.

These four main quality indicators are assessed on by the EA on a common six point scale, shown in **Table 24**:

Table 24 – GQA assessment scale

Grade	Standard	Explanation
A	Very Good	The quality is similar to (or better than) that expected for an average, unpolluted river of this size, type and location.
B	Good	The quality shows minor differences from Grade 'a' and falls a little short of that expected for an unpolluted river of this size, type and location.
C	Fairly Good	The quality is worse than that expected for an unpolluted river of this size, type and location.
D	Fair	The quality shows considerable differences from that expected for an unpolluted river of this size, type and location
E	Poor	The quality is much worse than expected for an unpolluted river of this size.
F	Bad	The quality is so bad that, in terms of biology, there may be little or no life present in the river

A summary of the GQA and RQO compliance data is presented graphically for each available stretch of river in **Figure 21**.

BROMSGROVE DISTRICT

Data was provided for all the Main Rivers within the District, with the exception of Gallows Brook. Data was also provided for the upstream section of the River Arrow, and the downstream reaches (within the District Boundary) of the Hen Brook, Spadesbourne Brook, Battlefield Brook, Hoo Brook, River Stour, Illey Brook, River Cole, Batchley Brook and Swans Brook. In addition, data was included for the Worcester and Birmingham and the Stratford-on-Avon Canals.

Figure 21 indicates that, although the majority of rivers sections within Bromsgrove District are compliant with their assigned RQO, a number are marginally or significantly failing their targets. The significant failures are the downstream section of the River Cole, the upstream section of the River Arrow (north of the M42), all section of the Hen Brook and the entire length of the Worcester and Birmingham canal. These are shown in red on **Figure 21**. The Stratford-on-Avon Canal was classified as a marginal failure. All development must contain surface water attenuation which includes measures to reduce, or eliminate, the level of pollution reaching the watercourses, but sites within the catchments of these watercourses must take extra precautionary measures.

In terms of the chemistry and biology within the GQA, the watercourses within the District score fairly highly with most sections being classified as Fairly Good to Very Good. However, there are a few watercourses which have been rated much lower. The most notable of these are the two canals. The Worcester and Birmingham Canal has a 'Poor' chemistry quality along its entire length through the District and, in its northern section, it also scores a 'Poor' biology score, although this improves slightly to 'Fair' along its southern extent. The Stratford-on-Avon canal has a 'Poor' Chemistry and 'Bad' Biology, the latter of which indicates there may be no life present within the watercourse. To a certain degree, the pollution within the canal systems originated outside the District boundary, most notably within the urban Birmingham conurbation to the north.

However, although **Figure 21** does not show this to be the case, it is important that practices within the Borough do not increase the pollution The Sugar Brook is also a concern as its Biology quality decreases to 'Poor' as it passes through Bromsgrove but this increases again to 'Fairly Good' by the time the River Salwarpe leaves the District. The River Cole also demonstrates a decrease in Biology in its downstream reaches, dropping to 'Fair'. This could be a concern for development site PR10, located on its left bank.

In terms of Chemistry quality, the other concerning watercourse is the Hen Brook. Although it is classified as 'Fairly Good' in its upstream section and its Biology Quality actually increased to 'Good' in its downstream reaches, the Chemistry Quality drops to 'Poor' in sections He2 and He3. This may indicate mixing of the Brook water with the poor quality water from the Worcester and Birmingham canal or chemical pollution entering the brook from the Saxon Business and Industrial parks. This is a concern for development sites PR2 and E6 which are located on the banks of this section of the Hen Brook.

Phosphate and Nitrate levels are concerning across much of the District, with levels of both tending to increase on the downstream extents of all watercourses. In terms of Nitrates, the southeastern corner of the Borough, including the River Salwarpe and the Hen Brook are the worst, scoring quality levels of 'Bad'. With the exception of the Worcester and Birmingham Canal, levels of phosphates are high across the District, with quality scores of Fair to Bad. The worst affected watercourses are the River Arrow and the Sugar Brook/River Salwarpe with quality scores of 'Bad', although the Hen Brook is also classified as 'Poor' along all its sections. These will be partially due to the agricultural practices in the upstream rural parts of the District and, as mentioned above, cause concern for eutrophication and water supply.

The CAMS reports, outlined in Section 6.4.2, identified that the Rivers Salwarpe and Stour are Over-abstracted and the River Cole has No Water Available (until 2019). This means that there is no water available for further licensing at low flows on the River Cole and that existing abstraction is causing unacceptable damage to the environment at low flows on the Rivers Salwarpe and Stour. However, on all these rivers water may still be available at high flows with appropriate restrictions. These restrictions must be taken into account when considering the new employment sites, especially with regards to factory based manufacture.

REDDITCH BOROUGH

Figure 21 indicates that almost all of the assessed watercourses within Redditch Borough are compliant with their RQO targets. There is only one, the Brandon Brook, which marginally fails.

As a whole, the watercourses in Redditch Borough score higher on their GQA checks than those located in Bromsgrove District, although there are only 3 watercourses – the River Arrow, the Brandon Brook and the Swans/Bow Brook – that have been assessed in full. None of the smaller Ordinary watercourses which drain Redditch town (with the exception of a Biology GQA of Batchley Brook) have been included within the RQO or GQA assessments. The Wharrage and the Wixon Brook, which are both Main Rivers have also not been assessed.

In terms of Chemical and Biological Quality, all the watercourses score 'Fairly Good' or higher. With the exception of Brandon Brook and the downstream sections of Bow Brook, the nitrate levels are also fairly acceptable with all the other watercourses scoring 'Fairly Good'. In the Brandon Brook and section B2 of the bow Brook, the nitrate levels are classified as 'Fair'. However, further downstream, beyond the confluence of these two brooks, the levels increase further with the classification dropping to 'Poor'.

Phosphate levels are the most concerning river quality index within Redditch Borough. On every assessed watercourse, it is classified as 'Poor' or 'Bad', indicating high levels of pollution and has a tendency to worsen further downstream. As mentioned by Defra, above, agricultural practices influence the phosphate levels to a high degree and this is exemplified by the River Arrow, which indicates a decrease in phosphate levels as it passes through Redditch, presumably due to the addition of urban watercourses, which do not contain such high levels of phosphate, diluting the main watercourse.

The Council has mentioned that eutrophication problems exist within the Borough boundaries and these assessments indicate that this is due to high phosphate, and in some areas, high nitrate levels within the watercourses. Section 7.4.2 discusses this matter in more detail, but it is important that these levels do not increase any further, and are reduced in the Brandon and Bow Brooks, to stop the problem from worsening and reduce the need for additional cleansing of the water supply within the Borough.

The CAMS reports, outlined in Section 6.4.2 identified that the River Arrow has No Water Available and the Bow Brook is Overabstracted. This means that there is no water available for further licensing at low flows on the River Arrow and that existing abstraction is causing unacceptable damage to the environment at low flows on the Bow Brook. However, on all these rivers water may still be available at high flows with appropriate restrictions. These restrictions must be taken into account when considering the new employment sites, especially with regards to factory based manufacture.

7.4.2 Effect of Agricultural Practices on Water Quality

As mentioned previously in this section, agriculture is a major source of diffuse pollution. Diffuse pollution cannot be attributed to a precise point or incident, but is the cumulative effect of day to day activities over a large area, including agriculture, forestry, mining, construction and urban life. The main agricultural sources of diffuse pollution include silt from soil erosion, nutrients from the application of fertiliser or spreading of manure and pesticides from the handling and application of the chemicals. In addition to this pollution entering surface water sources, it can be carried within infiltrating rain water and pollute groundwater sources. On their website, Defra states the following statistics[9]:

- around 60% of nitrate and 25% of phosphates in English waters originate from agricultural land;
- Agricultural practices contribute between 25-50% of pathogen loadings which affect England's bathing waters;
- Up to 75% of the sediment input into rivers can be attributed to agriculture, reducing water clarity and causing serious problems for fish, plants and insects; and

[9] http://www.defra.gov.uk/Environment/water/quality/nitrate/intro.htm

- Pesticides are contaminating drinking water sources, requiring expensive treatment at water works.

Defra considers that the improved control of the application of manures and fertilisers to land is essential to improve the diffuse water pollution from agriculture. Studies to achieve this are ongoing, but the three currently recommended methods are:

- Promoting the Codes of Good Agricultural Practice
- Encouraging Catchment Sensitive Farming
- Implementing the EC Nitrates Directive

Codes of Good Agricultural Practice

These codes currently consist of Water, Air and Soil codes, which were introduced in the early 1990s and outline practical steps for preventing environmental pollution from farming activities. However, they are currently under review, with the aim to consolidate them into one code. The consultation phase was closed in November 2007.

One of the aims of the code is to helps farmers achieve the standards which will be required by the integrated approach to managing water quality and quantity across whole river catchments by 2015 as part of the Water Framework Directive. It does this by explaining the environmental impacts of farming practices and suggests methods of minimise these impacts with regards to management plans, use of farm buildings and structures, field work, specialised horticulture, wastes and water supplies to the farm. The full draft document can be found at on the Defra website at the following address:

http://www.defra.gov.uk/corporate/consult/cogap-rev/consultation.pdf

Catchment Sensitive Farming

Catchment Sensitive Farming is land management that keeps diffuse emissions of pollutants to levels consistent with the ecological sensitivity and uses of rivers, groundwaters and other aquatic habitats, both in the immediate catchment and further downstream. It includes managing appropriately the use of fertilisers, manures and pesticides; promoting good soil structure and rain infiltration to avoid run-off and erosion; protecting watercourses from faecal contamination, sedimentation and pesticides; reducing stocking density; managing stock on farms to avoid compaction and poaching of land; and separating clean and dirty water on farms.

At present the advice element of the programme is being delivered through the England Catchment Sensitive Farming Delivery Initiative (ECSFDI) across 40 Priority Catchments in England alongside some limited capital grants. At present neither Bromsgrove District or Redditch Borough is located within these 40 Priority catchments, although the west of Worcestershire is. However, the catchments are currently under review with another 10 planned. Further information regarding this scheme can be found on the Defra website at the following address:

http://www.defra.gov.uk/farm/environment/water/csf/

EC Nitrates Directive

This is an environmental measure designed to reduce water pollution by nitrate from agricultural sources to prevent such pollution from occurring in the future. The Directive requires Member States to:

- designate as Nitrate Vulnerable Zones (NVZs) all land draining to waters that are affected by nitrate pollution;
- establish a voluntary code of good agricultural practice to be followed by all farmers throughout the country (outlined above);
- establish an Action Programme of measures for the purposes of tackling nitrate loss from agriculture. The Action Programme should be applied either within NVZs or throughout the whole country; and
- review the extent of their NVZs and the effectiveness of their Action Programmes at least every four years and to make amendments if necessary.

66 Nitrate Vulnerable Zones (NVZs), 8% England, were designated in 1996 to protect drinking waters from nitrate pollution. A further 47% of England was designated as an NVZ in October 2002 to include all surface and groundwaters. This includes all of Bromsgrove District and Redditch Borough.

A consultation was launched on 21August 2007 to discuss proposals fro revised Action Programme measures to control pollution caused by nitrogen from agricultural sources and whether to apply these measures within discrete NVZs or throughout the whole of England.

Further information on this Directive can be found at:

http://www.defra.gov.uk/ENVIRONMENT/water/quality/nitrate/directive.htm

Improvements to the nitrate and phosphate levels from agricultural sources within Redditch Borough and Bromsgrove District can therefore be made through:

- ⇨ promotion of the Codes of Good Agricultural Practice, especially the updated version when it is released;
- ⇨ Participation in the Catchment Sensitive Farming Initiative, if the study area is included within the Priority Catchments list in the future; and
- ⇨ Recognition of their location within a NVZ and application of the updated EC Nitrates Directive Action Programme.

7.4.3 Effect of Sewage Treatment Works on Water Quality

Untreated sewage discharges can have a significant impact on the environment. The inappropriate collection and treatment of sewage, and disposal of the sewage sludge (generated as a by-product of sewage treatment), have detrimental effects on river quality, mainly due to overloading of phosphates and nitrates resulting in eutrophication. Defra has identified nitrate and eutrophic sensitive areas in the UK which are being adversely affected by sewage discharges. The list of eutrophic sensitive areas includes:

- the Bow Brook
- the River Arrow
- the River Salwarpe (identified in 2007)

This affects both Redditch Borough and Bromsgrove District and ties with the findings of the GQA assessments. As a result the Alvechurch, Spernal and Priest Bridge sewage treatment works have been identified as Eutrophic Tertiary Treatment Works, which provide a final treatment stage to raise the effluent quality before its release into the stream. At present the Fringe Green sewage treatment works has not been upgraded.

There are several European Union Directives that influence sewage treatment levels, including the Urban Waste Water Treatment Directive[10]. Development which requires the utilisation of these works may be restricted by the environmental constraints on the discharge.

7.5 Conclusions

The treatment of wastewater is dependent upon three main criteria – infrastructure location and capacity, sewage treatment work capacity and the ability of the watercourse to cope with the discharge from the works in terms of quality and flow. This section has shown that the treatment of wastewater is a major concern for development within Redditch Borough and Bromsgrove District. Although waste water infrastructure is present within most of the developed areas, it is generally already operating at capacity and will struggle to cope with increased flow. This is especially problematic with regards to the infiltration of storm water flow into the foul water systems, which must be reduced through attenuation in both existing and proposed development sites.

Many of the sewage treatment works are also operating at capacity and will struggle to cope with increased discharge. STW has identified three of the main sewage treatment works (Fringe Green, Alvechurch and Priest Bridge) serving the District and Borough as at high risk of putting pressure on the sewage infrastructure if development were to take place. It has also identified two others (Minworth and Roundhill) as requiring upgrade work.

In terms of water quality, although many of the rivers in the area comply with their RQOs, some are suffering from eutrophication due to nutrient enrichment from both agricultural practices and discharge from sewage treatment works, including the Rivers Arrow and Salwarpe and the Bow Brook, affecting Alvechurch, Priest Bridge, Spernal and Fringe Green sewage treatment works.

Assessment of the ability of the wastewater infrastructure to cope with the proposed development has been carried out using a traffic light scale, based on a three point check list as follows. This is summed up in **Figures 22, 23** and **24** and **Tables 25a – 25f** and **26a – 26d**.

[10] *See the Defra web page* http://www.defra.gov.uk/environment/water/quality/uwwtd/default.htm

Green	• Little or no infrastructure upgrade required ⇨ Connection required to a major supply main which has capacity and no previous capacity problems within vicinity of the site ⇨ Brownfield site so some existing infrastructure should be present ⇨ Located in the catchment area of a sewage treatment works that has not been identified as suffering from a lack of capacity and poor river quality*
Yellow	• Minor infrastructure upgrade required ⇨ Satisfies one or two of the three criteria required for 'green' classification
Red	• Major infrastructure upgrade required ⇨ Satisfies none of the criteria required for 'green' classification

**i.e. is not served by Priest Bridge, Fringe Green, Alvechurch or Stoke Prior sewage treatment works. Spernal has been identified as Eutrophic Tertiary Treatment Works, with high nutrient levels in the River Arrow, but measures are being taken to reduce this and it has not been identified as having any problems with capacity so has not been included within this list. However, consideration must be given to the negative effect on discharge caused by increased utilisation and increase in pollution reduction measures may be required for the scale of proposed development within its catchment.*

BROMSGROVE DISTRICT

Table 25a – Bromsgrove District Areas of Development Restraint

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
A1	22.6	G (mostly)	West Hagley (Kidderminster, Western & Stourbridge Roads)	
A2	1.3	G	Willow Brook Road, Alvechurch	
A3	2.8	G	Birmingham Road, Alvechurch	
A4	10.0	G	Ravensbank Business Park	
A5	6.3	G (mostly)	Bleakhouse Farm, Grimes Farm	
A6	3.1	G	Selsdon Close, Grimes Hill	
A7	1.1	G	Birmingham Road, Alvechurch	
A8	7.6	G	Rutherford Road, Bromsgrove	
A9	24.4	G	Whitford Road, Bromsgrove	
A10	6.4	G	Egghill Lane, Rubery	
A11	65.7	G	Perryfields Road, Bromsgrove	
A12	5.9	G	Church Road, Catshill	
A13	11.9	G	Birmingham Road, Bromsgrove	

Table 25b – Bromsgrove District Employment Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
E1	2.5	B	Factory Lane, Bromsgrove	
E2	17.3	B & G	Wythall Green Cricket Ground	
E3	3.4	B	Depot Site, The Avenue, Rubery	
E4	29.9	B	Ravensbank Business Park,	
E5	0.6	B	Ford Road, Bromsgrove	
E6	50.3	B	Saxon Business Park, Stoke Prior	
E7	38.0	B	Parsonage Drive, Cofton Hackett	
E8	78.9	B (mostly)	Bromsgrove Eastern By-Pass/Stoke Road, Bromsgrove	

Table 25c – Bromsgrove District Policy Reference Areas

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
PR1	3.1	B	Newton Road, Bromsgrove	
PR2	26.6	B	Saxon Business Park, Stoke Prior	
PR3	9.2	B	Buntsford Drive, Bromsgrove	
PR4	2.3	B	Bunstford Park Road/Buntsford Hill	
PR5	1.4	B	Aston Road, Bromsgrove	
PR6	1.4	G	Houndsfield Lane Caravan Site, Trueman's Heath	
PR7	1.8	G	Sweet Pool, West Hagley	
PR8	0.7	G	Wilmore Lane, Silver Street	
PR9	0.3	G	Church Hill, Beoley	
PR10	13.4	G	Shirley Quarry	
PR11	1.2	G	Crown Meadow, Alvechurch	
PR12	0.8	G	(playground) Penmanor Road, Finstall	
PR13	1.2	G	Heydon Road, Finstall	
PR14	3.3	G	Recreation Ground, New Inns Lane, Rubery	
PR15	1.5	B	Transport Museum, Wythall Green	
PR16	1.3	G	Dark Lane, Romsley	
PR17	16.1	G	Wythall Park, Silver Street	
PR18	8.9	G	Staple Flat Road, Lower Marlbrook	
PR19	7.1	B	Museum of Buildings, Redditch Road, Bromsgrove	
PR20	0.5	G	Whitford Road, Bromsgrove	
PR21	3.5	G (mostly)	Indoor Bowls Centre, Stoke Road, Bromsgrove	
PR22	0.2	G	Grayshott Close, Bromsgrove	
PR23	0.8	G	Granary Road, Bromsgrove	
PR24	0.2	G	Byron Way, Catshill	
PR25	1.3	G	Sycamore Drive, Hollywood	
PR26	0.2	G	Falstaff Avenue, Hollywood	
PR27	0.7	B & G	Beaudesert Road	
PR28	1.6	G	Marlbrook Lane, Lower Marlbrook	
PR29	3.3	G	Mayfield Close, Upper Catshill	
PR30	0.5	G	Upland Grove, Lowes Hill	
PR31	8.9	G	Staple Flat Road, Lower Marlbrook	
PR32	0.9	G	Worcester Road, Bromsgrove	
PR33	0.1	G (mostly)	New Road, Bromsgrove	
PR34	0.5	B	Tel Ex and Station, Barnt Green	
PR35	0.4	B	Willow Road, Bromsgrove	
PR36	0.2	B	Bromsgrove Station	
PR37	3.4	B & G	Lickey Road, Rednal	
PR38	8.6	B & G	School Lane, Alvechurch	
PR39	0.7	B	(market) St John Street, Bromsgrove	
PR40	88.4	B & G	Barnt Green	
PR41	0.1	G	Whettybridge Road, Rubery	
PR42	8.0	B	Cheltenham Avenue, Upper Catshill	
PR43	37.5	B	Stoney Hill, Bromsgrove	

Table 25d – Bromsgrove District Shopping Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
Sh1	0.2	B	Station Road, Grimes Hill	
Sh2	0.8	B	Red Lion Street, Alvechurch	
Sh3	0.3	B	Alcester Road, Hollywood	
Sh4	2.0	B	Worcester Road, West Hagley	
Sh5	0.9	B	Golden Cross Lane, Catshill	
Sh6	2.6	B	(superstore) Bromsgrove Eastern By-Pass, Bromsgrove	
Sh7	0.8	B	Stoke Road, Aston Fields, Bromsgrove	
Sh8	0.4	B	May Lane, Hollywood	
Sh9	0.7	B	Hewell Road, Barnt Green	
Sh10	3.5	B	New Road, Rubery	

Table 25e – Bromsgrove Unzoned Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
UZ1	8.7	G	Cherry Hill Road, Barnt Green	

Table 25f – Bromsgrove Village Envelopes

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
Adams Hill	4.5	B & G	East of West Hagley	
Belbroughton	18.5	B & G	Southeast of West Hagley	
Bournheath	7.6	B & G	West of Catshill	
Burcot	4.3	B & G	Southeast of Lickey	
Clent	2.8	B & G	East of West Hagley	
Fairfield	4.4	B & G	Northwest of Catshill	
Finstall	12.1	B & G	East of Bromsgrove	
Holt End	6.5	B & G	Northeast of Redditch	
Holy Cross	11.6	B & G	Southeast of West Hagley	
Hopwood	5.1	B & G	North of Alvechurch	
Lower Clent	2.3	B & G	East of West Hagley	
Romsley	26.2	B & G	East of West Hagley	
Rowney Grn	15.2	B & G	Southeast of Alvechurch	

REDDITCH BOROUGH

Table 26a – Redditch Areas of Development Restraint

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
A14	33.4	G	A435, Redditch,	
A15	47.7	G	Webheath, Redditch	
A16	25.5	G	Brockhill, Redditch	

Table 26b – Redditch Employment Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
E9	0.2	B & G	Barn Close Farm, Love Lyne, Hunt End	
E10	11	G	North of Red Ditch, Enfield	
E11	2.0	G	Green Lane, Wirehill	
E12	0.9	B & G	Enfield Industrial Estate, Redditch	
E13	0.3	G	Palmers Road, Redditch	
E14	0.2	G (mostly)	Washford Industrial Estate, Redditch	
E15	0.7	G	Merse Road, Moons Moat, Redditch	
E16	0.6	G	Bartleet Road, Redditch	
E17	0.4	G (mostly)	Studley Road, Redditch	
E18	0.4	B & G	Studley Road, Redditch	
E19	0.1	G	Fringe Meadow Road, Moons Moat, Redditch	
E20	1.3	G	Old Forge Drive, Redditch	
E21	1.1	G	Park Farm Industrial Estate, Redditch	
E22	1.0	G	Shawbank Road, Redditch	
E23	0.4	B (mostly)	Upper Crossgate Road, Redditch	
E24	0.2	B	Trescott Road, Smallwood, Redditch	
E25	0.4	B	Old Forge Drive, Redditch	
E26	0.02	B	Evesham Road, Astwood Bank	
E27	0.01	B	Beoley Road West, St George's, Redditch	

Table 26c – Redditch Housing Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
H1	1.5	B	Prospect Hill, Redditch	
H2	0.5	G	Pheasant Lane, Oakenshaw, Redditch	
H3	0.7	B	(old school) Dilwyn Close, Redditch	
H4	0.9	G	Harris Close, Redditch	
H5	1.0	G	Greenlands Drive, Redditch	
H6	1.0	B & G	Middlehouse Lane/ Alvechurch Highway	
H7	5.7	B	Enfield Industrial Estate, Redditch	
H8	0.4	G	Easemore Road, Redditch	
H9	0.7	B & G	Woodrow North, Redditch	
H10	0.3	G	South Street, Redditch	
H11	0.2	B	Grange Road, Redditch	
H12	0.4	B	Alton Close, Redditch	
H13	0.4	G	Rock Hill Farm, Feckenham	

Table 26d – Redditch Strategic Sites

Unique ID	Area	Brownfield/ Greenfield	Location	Capacity of Waste Water Infrastructure
St1	2.3	B (mostly)	Church Hill, Redditch	
St2	2.5	B (mostly)	Winyates, Redditch	
St3	0.9	B & G	Matchborough, Redditch	
St4	1.7	B (mostly)	Woodrow, Redditch	
St5	0.7	B & G	Woodrow North, Redditch	
St6	2.0	G	Green Lane, Wirehill	
St7	1.3	B	B4184, Redditch	
St8	0.5	B	Edward Street	
St9	1.4	B	Prospect Hill, Redditch	
St10	4.6	B	Town Centre, Northwest Quadrant	

Following this review, Redditch Borough Council is concerned that, as a result of the lack of response from STW, the conclusions shown above may not accurately reflect the severity of the foul sewerage flooding problem within the Borough. They believe that, in the absence of a more rational approach, recognised and co-ordinated by STW with the approval of both EA and RBC, there is likely to be significant additional impact from foul flooding during inclement weather to any site which drains either to the old town trunk sewer, particularly between: -

- Hewell Road and Ravensmere Road/Watery Land, and
- Millrace Road and Ipsley Church Lane

These problems are receiving the attention of the Leader of the Council, other Elected Members and Resident Groups and additional assistance, and recognition, from STW to help solve the problems are essential. As a result of this the Council feels that there is a strong risk that 'good' sites may otherwise be discounted and 'poor' or 'bad' sites may, from a sewage flooding or drainage perspective, be erroneously viewed in a more favourable light. This section will therefore require reviewing if, and when, additional data or modelling results are published by STW.

8 DEMAND MANAGEMENT

8.1 General

National government policy for sustainable development in general includes efficient resource use. PPS11 and PPS12 emphasise the need for water efficiency as part of sustainable development. In addition the Department of Communities and Local Government (DCLG) requirements for the sustainable communities' plan include higher standards of water efficiency and 25% savings. Government has stated a greater need for higher regional standards of water efficiency in response to the regional water resources position and the Water Act 2003 requirements place a duty on undertakers to achieve further water conservation and on public authorities to take into account the desirability of conserving water supplied to premises[11].

Development will increase the water requirement within the Bromsgrove District and Redditch Borough, but through managed water usage, wastage can be reduced and the developments made more sustainable in the long term to meet the Government requirements outlined above.

8.2 Water Usage

The three main methods used to promote sustainable water usage are metering (to encourage conservative usage in the home) leakage control (to reduce loss through the pipelines) and sustainable housing (to increase the efficiency of water usage). All three of these methods have been referred to in detail within both STW and SSW's dWRMPs. These are discussed below.

8.2.1 Metering

As stated in the RSS report[12], in general water users who are not metered use more water on average than metered customers. Metering helps to give users a signal and incentive to manage their own demand for water and, on average, water savings are reported within a range of 5-15% compared to unmetered use. All new properties are metered and further savings can be expected as more existing customers are metered and, in the long run, through the introduction of smart meters and changes to tariffs. Such changes can be promoted by both the water companies and the Council, but will have to be made alongside protection of vulnerable customers. Only water companies in areas of 'High Water Stress' can implement compulsory metering. As the Environment Agency classifies this area of the West Midlands as an area of 'Moderate Water Stress' STW and SSW can only implement metering on change of occupier. However, they can also encourage existing customers to have a meter installed through improvement of education/information and use of more favourable pricing and reward structures.

The following outlines the comments and targets made by the water companies within their dWRMPs:

SSW

[11] West Midlands Regional Spatial Strategy (RSS 11) The Impact of Housing Growth on Public Water Supplies, 2007

Within their dWRMP, SSW forecasts a significant increase in domestic meter penetration through the following metering policies:

- Continued implementation of the policy to meter domestic customers on change of occupation;
- Continuation of the policy to meter domestic customers using unattended garden watering devices (sprinkler metering);
- Continuation of the policy to compulsorily meter all new households and non-household properties. Phased implementation of change of occupier metering is to commence in April 2008;
- Continuation of the free meter option policy for domestic and commercial customers.

STW

By 2006-7 28% of households within STW's region were metered, which was slightly ahead of the meter penetration they had projected in WRP04. Their dWRMP assumes that as a minimum, the current levels of uptake of free water meters will continue through the planning period and that the minimum level of water penetration reached by 2035 will be 66% of the total housing stock. Although they are proposing to implement a policy of metering households on change of occupier in their Staffordshire and East Shropshire WRZs for the 2010 – 2015 period, they do not plan to implement such a scheme within the Severn WRZ until they have ascertained that it is appropriate, possibly within the next planning period, 2015-2020.

8.2.2 Leakage Control

Water companies have to meet leakage targets set by Ofwat related to economic level of leakage. The EA expectation is that companies will continue to strive for higher standards and use new technology to drive leakage down further in future, especially where water resources are scarce. Government states that it does not expect water companies to allow leakage to rise. As stated in the RSS report[12], it is the view of the water companies that higher capital investment will be needed to achieve significant further reductions in leakage. Given that about 25% of all water supply is lost to leakage across the UK, more effort at a strategic scale by the water companies at property level scale through education would be of benefit.

The following outlines the comments and targets made by the water companies within their dWRMPs:

SSW

The economic level of leakage (ELL), the point at which the costs of detecting and repairing leaks would be greater than the value of water lost, has been reassessed as for 2008/9 as 73.9Ml/d. The Company will work hard to maintain leakage at the ELL throughout the plan period although they note that this will be difficult as there will be more mains in the ground, more connections and an ageing mains network. The main approach used to maintain this situation will be the operating cost solution of find and fix supported as appropriate and justified on economic terms by the more capital intensive expenditure solution of mains and service pipe replacement.

Their policy on free supply pipe repairs remains unchanged and continues to be supported by the Company's freephone leakline based upon the following criteria:

- Private domestic customers only (Local Authorities, Housing Associations and other tenanted properties are excluded);
- External underground leaks only (internal leaks or leaks under a building or other permanent structure are excluded);
- First repairs only.

STW

At present an estimated 27% of treated water within STWs supply zone is currently unaccounted for and therefore classed as leakage. Within their dWRMP they state that:

> *"Our AMP4 strategy has been to drive leakage down by 17Ml/d through a combination of measures, including:*
>
> - *Improving our processes of proactive and reactive leakage control;*
> - *Implementing our Accountability Zones (AZs) programme to enable improved leakage reporting and targeting in trunk mains outside of DMAs;*
> - *Replacing around 300km of water mains per annum;*
> - *Installing continuous pressure monitoring at around 4000 critical pressure points within our network;*
> - *Offering a free or subsidised customer owned supply pipe repair and replacement service;*
> - *Working with contractors and academics to improve leak detecting technology "*

Their policy is to continue to achieve and maintain the economic level of leakage during AMP5 and over the longer term. Their assessment of the preferred long term strategy considers leakage reduction options alongside water resource investment options and demand management options, and seeks to achieve the *"overall least whole life cost mix of the different types of investment"*.

8.2.3 Sustainable Housing

It was recommended within the West Midlands RSS[12] that a revision should be made to the RSS to include a policy on water efficiency. This would require that all new houses are to meet Level 3 of the Code of Sustainable Homes, requiring good water efficiency to be achieved. In terms of water usage level 3 requires that:

The home will have to be designed to use no more than about 105 litres of water per person per day. This could be achieved by fitting a number of items such as:

- 6/4 Dual Flush WC;
- Flow Reducing/Aerating taps throughout;
- 6-9 litres per minute shower (note that an average electric shower is about 6/7 litres per minute);
- a smaller, shaped bath – still long enough to lie down in, but less water required to fill it to a level consistent with personal comfort;
- 18ltr maximum volume dishwasher;
- 60ltr maximum volume washing machine.

Other minimum requirements are required for:

- Surface water management – this may mean the provision of soakaways , where feasible, and areas of porous paving;

(Code for Sustainable Homes: A step-change in sustainable home building practice, DCLG, 2006)

This code was published by Waterwise (waterwise.org.uk), a NGO focussing on decreasing water consumption in the UK, in December 2006. Initially it was compulsory for all homes receiving government funding, and restricts water use to 105 litres per capita per day. Since April 2007 a developer of any new home can be assessed against this code. From May 1st 2008 this assessment will be mandatory. The code uses a points system to identify the most efficient homes, with higher points being awarded for the most efficient. Points are awarded for internal potable water consumption, (i.e. reduced toilet cistern sizes) external potable water consumption (i.e. water butts, grey water recycling and rainwater harvesting discussed below), surface water run off (specifically the use of SUDS) and flood risk, which is generally based on development location and the types of measures one can use.

The following outlines the comments and targets made by the water companies regarding water efficiency within their dWRMPs:

Greywater Recycling

There are two types of greywater recycling systems. A water diversion system diverts greywater directly to the subsoil in the garden and a water recycling system with purification for the reuse of water in the home. The water for the water recycling system is collected from bath, shower and sink waste. The system then consists of a cleaning tank to remove any solids and then 'treat' the water, with the additional of disinfection tablets. This water is then collected in a tank ready for use, but provision must be made to discharge the water if it is stored too long, as it may become hazardous. The water can then be reused for toilet flushing. However, although this technique works well at the community scale, it is not always appropriate for individual properties or small scale developments.

Rainwater Harvesting

Rainwater harvesting is also a growing sector of water recycling. This is where rainwater from the roof area of the property is collected, and then reused to flush toilets,

supply washing machines and outside tap use. Systems that combine the collection of rainwater and the reuse of greywater are also in use.

SSW

The current range of water efficiency activities carried out by SSW will continue and includes:

- Provision of cistern devices on request to customers;
- Promotion of water butts;
- Provision of household self-audit information;
- Provision of non-household self-audit information;
- Provision of water efficiency advice during Water Regulations inspections;
- Water saving tips and information on the Company website;
- Promotion and enforcement of sprinkler metering policy;
- Water efficiency information advertised in appropriate press; and
- Targeted water efficiency projects, such as occurred in summer 2007.

STW

STWs main areas of activity during AMP4 were:

- Distribution of Save-a-flush cistern displacement devices to organisations and businesses who are installing them to customer and business premises;
- Discounted water butts and the opportunities for customers to purchase a discounted rain saver kit;
- Extension of their domestic product promotion to include additional product such as water efficient shower heads, shower timers and internal leak alarms since February 2008;
- Setting up of a partnership with Envirowise to target their top 250 water users with the aim to raise awareness of the importance of water efficiency and to give advice on the implementation of water efficiency measures;
- To undertake trials to investigate the use of retrofit water efficient devices in domestic properties and schools;
- Education programmes through education centres, provision of educational material and their 'Be Smart' initiative.
- Development of options for their future water efficiency strategy developed through 2007, using their involvement with Waterwise and other industry trials.

8.3 Sustainable Drainage Systems

Within new developments, the incorporation of a suitably designed drainage system will be necessary in order to mitigate the risk of surface water and overland flooding as well as the risk posed by the overloading of local sewers and watercourses. Such a system should ideally be based upon Sustainable Drainage principles aimed at simulating natural processes and mitigating the impact of polluted surface water runoff upon the environment. Within the design of these systems, appropriate consideration of safe exceedence flows must be made, for example, to account for the predicted impact of climate change and possible blockages. Moreover, full advantage should be made of the opportunities for environmental enhancement posed by the utilisation of these systems. Proposed SUDS schemes should also consider operation and maintenance issues. The system should be robust in design in order to prevent blockages, allow ease

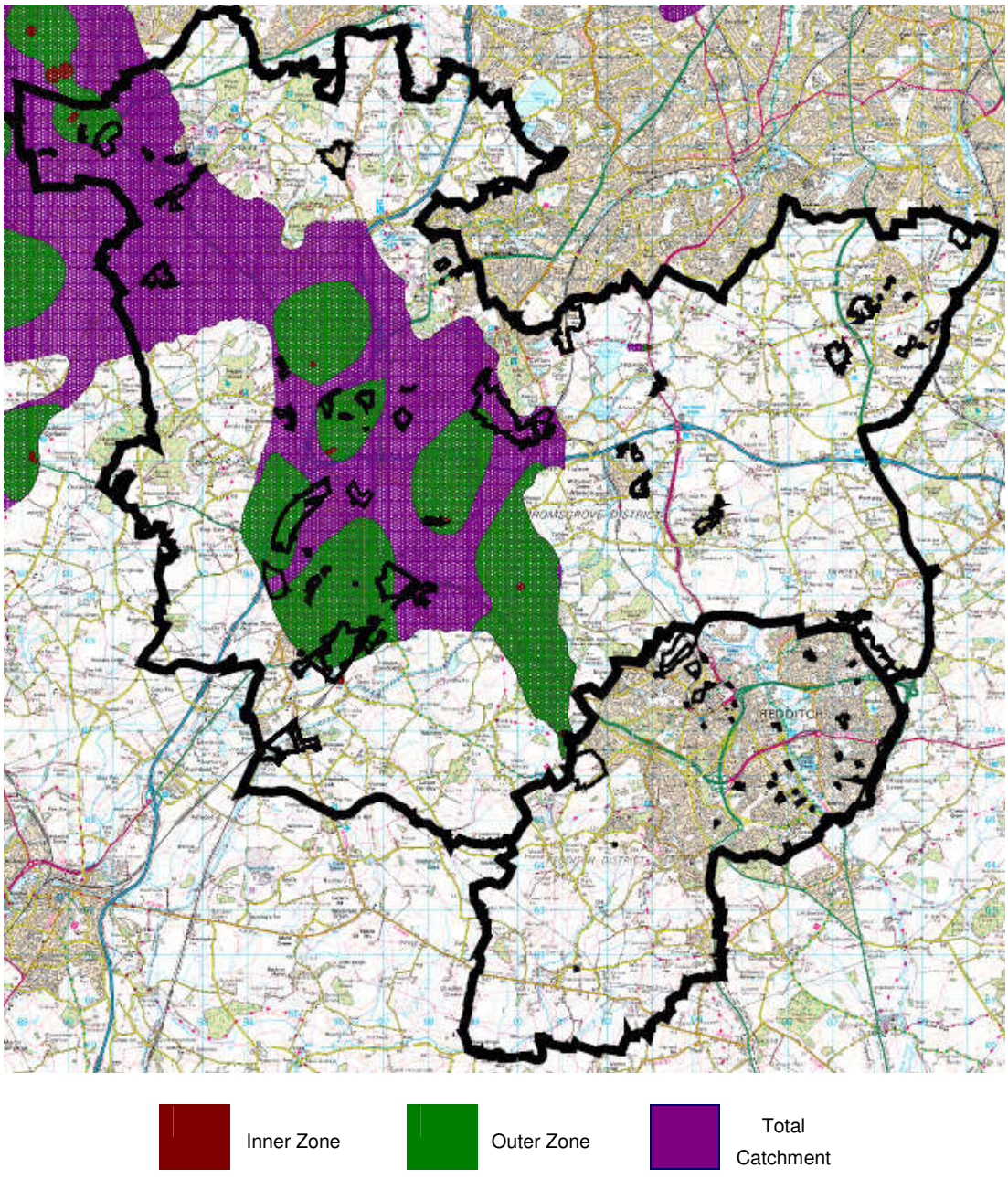
of maintenance and reduce long term maintenance costs. Moreover, a suitable maintenance scheme should be proposed although the operation of the system should not be overly reliant upon maintenance being carried out.

It is essential to consider source control within the surface water drainage proposals; techniques which aim to manage the surface water at or close to the receiving surface should be utilised as widely as possible. For example, paved surfaces (e.g. car parks and access roads) should be of permeable construction allowing water to be stored prior to discharge. Other areas should ideally be drained using a network of grassed swales which will serve to improve the quality of the surface water and reduce the flow rate, whilst directing it to the attenuation area or discharge point. Furthermore, it is recommended that rainwater re-use schemes be utilised, such as, rainwater harvesting for domestic use, such as toilet flushing, as well as the encouragement of the use of water butts and rainwater storage tanks. Further source control techniques would include the installation of green roofs where practical. Incorporation of such measures would serve to greatly reduce the volume of surface water requiring discharge, reduce water demand, and would also further satisfy the Code for Sustainable Homes.

Interactive soils maps are available to view on the National Soils Research Institute website: *www.landis.org.uk/soilscapes/*, which provides information regarding the soil type, drainage, fertility, texture, landcover and habitats. These indicate that the majority of the area possesses a variable to negligible permeability. The permeability of the subsoil beneath a proposed development site influences the range of applicable techniques; permeable soils lend themselves to the application of infiltration based SUDS whilst the application of a SUDS system to a site with a soil of low permeability will necessitate the presence of a watercourse in which to discharge attenuated flows. However, in the absence of a watercourse, an agreement could be possible with the surface water regulating authority to discharge attenuated flows into a nearby surface water drain. Within an assessment of the feasibility of SUDS for a development site, it is recommended that an infiltration test be conducted.

Depending upon the proposed catchment and estimated surface water runoff pollutant load, the application of SUDS, especially those based upon infiltration, must be done so with care within areas designated by the EA as Source Protection Zones (SPZ). These define the locations of groundwater sources, such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. **Figure 25**, below, shows the SPZs located beneath Bromsgrove District and Redditch Borough. SUDS schemes serving these catchments must fully integrate the management train concept and be lined in the upper stages (i.e. where the pollutant load is likely to be at its highest) in order to minimise the potential for pollutant laden surface water to infiltrate the ground. However, in addition to consideration of the actual pollutant loading of the surface water to be attenuated, attention must also be given to the ground which the surface water soaks through (i.e. the contaminated status of the site). The Environment Agency will object to enhanced infiltration through contaminated land where not accompanied by an appropriate risk assessment, leachate test, and/or associated soil remedial plan to show it would not cause increased pollution of groundwater.

Figure 25 – Source Protection Zones within Bromsgrove District and Redditch Borough



The shape and size of the zones depends upon the condition of the ground, how the groundwater is removed and other environmental factors. The three zones are defined as below:

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.

(Environment Agency website)

Depending upon the proposed catchment and estimated surface water runoff pollutant load, the application of SUDS, especially those based upon infiltration, must be done so with care within areas designated as Source Protection Zones (SPZ). SUDS schemes serving these catchments must fully integrate the management train concept and be lined in the upper stages (i.e. where the pollutant load is likely to be at its highest) in order to minimise the potential for pollutant laden surface water to infiltrate the ground.

Additional information on the planning, design, construction and operation of SUDS can be found in the CIRIA publication C697, *The SUDS Manual,* and the associated site handbook C698, both of which can be downloaded from the CIRIA website: www.ciria.org.uk/downloads.htm

The Adoption of SUDS

The maintenance of SUDS systems has been subject to a great deal of discussion over the last few years. At present there is no precedent for the adoption of SUDS – that is no authority or statutory undertaker take ownership of them as a matter of course. This often means that SUDS systems are not maintained by an appropriate authority. Without proper maintenance, their effectiveness diminishes.

There are already a number of good practice case examples where relevant organisations including local authorities, developers and water companies have developed acceptable adoption solutions for developments or development areas. Defra is currently working with its partners to develop an agreed national adoption system for SUDS. Some options for these were tested within the recent Defra Integrated Urban drainage pilots. The Floods and Water Bill currently being developed for England is expected to include clearer policy and responsibilities for adoption of SUDS. In the meantime it is good practice for the relevant key stakeholders including developers, water companies, Local Councils and County Council (Highways) to develop agreed bespoke adoption agreements for development areas to enable whole life management of SUDS. The Construction Industry Research and Information Association (CIRIA) has already published guidance that enable maintenance and adoption agreements to be set-up[12].

Section 106 of the Town and Country Planning Act 1990 allows Planning Authorities to enter into legally binding agreements with the local unitary authority in order to offset the cost of the development. This may be the form of a fee, say as a contribution to a new

[12] Interim Code of Practice for Sustainable Drainage Systems, July 2004 (http://www.ciria.org/suds/icop.htm)

school, or it could be an agreement, such as a section of the development site is developed as an amenity area and handed to the Local Authority.

The use of the Section 106 agreement has been considered as a method of collecting a financial contribution from developers in order to fund the future maintenance of SUDS schemes. An alternative method of collection could be through the Water Authorities infrastructure Charge, which is paid in relation to all new properties.

However, before the collection of this money is considered, the following points would need determining:

- Who will 'adopt' the SUDS schemes?
- What will happen to developments that are not suitable for SUDS?
- How will the level of fees be set?
- If SUDS are not constructed on a suitable development should the developer be penalised?

These items will require further consideration as SUDS become more commonplace.

A summary guidance sheet outlining the SUDS and the different types of SUDS measures available is provided in **Appendix D**.

8.4 Summary

A tap left running for just 15 minutes, the time it takes to brush your teeth 7 times, could use the same amount of water an efficient house uses in a day. By educating water users, a significant reduction in water demand could easily be made.

Demand management could be seen as an alternative to the sourcing of new water supplies. By reducing the current demand by 25% on 1000 dwellings, 250 new dwellings could be supplied without increasing the quantity of water required. Therefore the impact of the management of existing demand should not be underestimated as a method for accommodating future growth.

9 CONCLUSIONS

9.1 Introduction

This study shows that, at present, within Bromsgrove District and Redditch Borough water is overabstracted and demand outweighs supply, the sewage treatment works are generally at or approaching capacity and in many places flooding from lack of sewer capacity is seen. This is indicated by the high proportion of yellow and red site categorisations as opposed to green within the tables included within the report above and summarised in **Tables 27a – 27f** and **28a – 28d** below. However, as indicated by the high proportion of yellow classifications, many of theses issues are not complete 'show stoppers' to development and can often be rectified on a local scale to allow development to take place. Investment will be needed to enable the area to accommodate the predicted growth, but, as outlined in this WCS, many of these problems are already being addressed by SSW, STW and the Environment Agency. Resolving these issues will, however, have an effect on the timing of growth, especially with regards to flood risk mitigation measures and will require close liaison with the stakeholders concerned to allow the development targets to be met.

9.2 Constraints Matrix

Tables 27a – 27f and **28a – 28d** below summarise the constraints found for all the specified development sites within Bromsgrove District and Redditch Borough.

Green

- Clear to develop

Yellow

- Will require minor infrastructure improvement

Red

- Will require major infrastructure improvement

BROMSGROVE DISTRICT

Table 27a – Bromsgrove District Areas of Development Restraint

Development Site	Location	Flood Risk	Water Supply	Waste Water
A1	West Hagley (Kidderminster, Road)			
A2	Willow Brook Road, Alvechurch			
A3	Birmingham Road, Alvechurch			
A4	Ravensbank Business Park			
A5	Bleakhouse Farm, Grimes Farm			
A6	Selsdon Close, Grimes Hill			
A7	Birmingham Road, Alvechurch			
A8	Rutherford Road, Bromsgrove			
A9	Whitford Road, Bromsgrove			
A10	Egghill Lane, Rubery			
A11	Perryfields Road, Bromsgrove			
A12	Church Road, Catshill			
A13	Birmingham Road, Bromsgrove			

Table 27b – Bromsgrove District Employment Sites

Development Site	Location	Flood Risk	Water Supply	Waste Water
E1	Factory Lane, Bromsgrove			
E2	Wythall Green Cricket Ground			
E3	Depot Site, The Avenue, Rubery			
E4	Ravensbank Business Park,			
E5	Ford Road, Bromsgrove			
E6	Saxon Business Park, Stoke Prior			
E7	Parsonage Drive, Cofton Hackett			
E8	Bromsgrove Eastern By-Pass/Stoke Road,			

Table 27c – Bromsgrove District Policy Reference Areas

Development Site	Location	Flood Risk	Water Supply	Waste Water
PR1	Newton Road, Bromsgrove			
PR2	Saxon Business Park, Stoke Prior			
PR3	Buntsford Drive, Bromsgrove			
PR4	Bunstford Park Road/Buntsford Hill			
PR5	Aston Road, Bromsgrove			
PR6	Houndsfield Lane, Trueman's Heath			
PR7	Sweet Pool, West Hagley			
PR8	Wilmore Lane, Silver Street			
PR9	Church Hill, Beoley			
PR10	Shirley Quarry			
PR11	Crown Meadow, Alvechurch			
PR12	(playground) Penmanor Road, Finstall			
PR13	Heydon Road, Finstall			
PR14	Recreation Ground, New Inns Lane, Rubery			
PR15	Transport Museum, Wythall Green			
PR16	Dark Lane, Romsley			
PR17	Wythall Park, Silver Street			
PR18	Staple Flat Road, Lower Marlbrook			
PR19	Museum of Buildings, Redditch Rd, Bromsgrove			
PR20	Whitford Road, Bromsgrove			
PR21	Indoor Bowls Centre, Stoke Road, Bromsgrove			
PR22	Grayshott Close, Bromsgrove			
PR23	Granary Road, Bromsgrove			
PR24	Byron Way, Catshill			
PR25	Sycamore Drive, Hollywood			
PR26	Falstaff Avenue, Hollywood			
PR27	Beaudesert Road			
PR28	Marlbrook Lane, Lower Marlbrook			
PR29	Mayfield Close, Upper Catshill			
PR30	Upland Grove, Lowes Hill			
PR31	Staple Flat Road, Lower Marlbrook			
PR32	Worcester Road, Bromsgrove			
PR33	New Road, Bromsgrove			
PR34	Tel Ex and Station, Barnt Green			
PR35	Willow Road, Bromsgrove			
PR36	Bromsgrove Station			
PR37	Lickey Road, Rednal			
PR38	School Lane, Alvechurch			
PR39	(market) St John Street, Bromsgrove			
PR40	Barnt Green			
PR41	Whettybridge Road, Rubery			
PR42	Cheltenham Avenue, Upper Catshill			
PR43	Stoney Hill, Bromsgrove			

Table 27d – Bromsgrove District Shopping Sites

Development Site	Location	Flood Risk	Water Supply	Waste Water
Sh1	Station Road, Grimes Hill			
Sh2	Red Lion Street, Alvechurch			
Sh3	Alcester Road, Hollywood			
Sh4	Worcester Road, West Hagley			
Sh5	Golden Cross Lane, Catshill			
Sh6	(superstore) Bromsgrove Eastern By-Pass			
Sh7	Stoke Road, Aston Fields, Bromsgrove			
Sh8	May Lane, Hollywood			
Sh9	Hewell Road, Barnt Green			
Sh10	New Road, Rubery			

Table 27e – Bromsgrove Unzoned Sites

Development Site	Location	Flood Risk	Water Supply	Waste Water
UZ1	Cherry Hill Road, Barnt Green			

Table 27f – Bromsgrove Village Envelopes

Development Site	Location	Flood Risk	Water Supply	Waste Water
Adams Hill	East of West Hagley			
Belbroughton	Southeast of West Hagley			
Bournheath	West of Catshill			
Burcot	Southeast of Lickey			
Clent	East of West Hagley			
Fairfield	Northwest of Catshill			
Finstall	East of Bromsgrove			
Holt End	Northeast of Redditch			
Holy Cross	Southeast of West Hagley			
Hopwood	North of Alvechurch			
Lower Clent	East of West Hagley			
Romsley	East of West Hagley			
Rowney Grn	Southeast of Alvechurch			

REDDITCH BOROUGH

Table 28a – Redditch Areas of Development Restraint

Development Site	Location	Flood Risk	Water Supply	Waste Water
A14	A435, Redditch			
A15	Webheath, Redditch			
A16	Brockhill, Redditch			

Table 28b – Redditch Employment Sites

Development Site	Location	Flood Risk	Water Supply	Waste Water
E9	Barn Close Farm, Love Lyne, Hunt End			
E10	North of Red Ditch, Enfield			
E11	Green Lane, Wirehill			
E12	Enfield Industrial Estate, Redditch			
E13	Palmers Road, Redditch			
E14	Washford Industrial Estate, Redditch			
E15	Merse Road, Moons Moat, Redditch			
E16	Bartleet Road, Redditch			
E17	Studley Road, Redditch			
E18	Studley Road, Redditch			
E19	Fringe Meadow Road, Moons Moat, Redditch			
E20	Old Forge Drive, Redditch			
E21	Park Farm Industrial Estate, Redditch			
E22	Shawbank Road, Redditch			
E23	Upper Crossgate Road, Redditch			
E24	Trescott Road, Smallwood, Redditch			
E25	Old Forge Drive, Redditch			
E26	Evesham Road, Astwood Bank			
E27	Beoley Road West, St George's, Redditch			

Table 28c – Redditch Housing Sites

Development Site	Location	Flood Risk	Water Supply	Waste Water
H1	Prospect Hill, Redditch			
H2	Pheasant Lane, Oakenshaw, Redditch			
H3	(old school) Dilwyn Close, Redditch			
H4	Harris Close, Redditch			
H5	Greenlands Drive, Redditch			
H6	Middlehouse Lane/ Alvechurch Highway			
H7	Enfield Industrial Estate, Redditch			
H8	Easemore Road, Redditch			
H9	Woodrow North, Redditch			
H10	South Street, Redditch			
H11	Grange Road, Redditch			
H12	Alton Close, Redditch			
H13	Rock Hill Farm, Feckenham			

Table 28d – Redditch Strategic Sites

Development Site	Location	Flood Risk	Water Supply	Waste Water
St1	Church Hill, Redditch			
St2	Winyates, Redditch			
St3	Matchborough, Redditch			
St4	Woodrow, Redditch			
St5	Woodrow North, Redditch			
St6	Green Lane, Wirehill			
St7	B4184, Redditch			
St8	Edward Street			
St9	Prospect Hill, Redditch			
St10	Town Centre, Northwest Quadrant			

These summary tables indicate that flood risk is the biggest problem for development within Bromsgrove District and Redditch Borough. However, this is mostly attributable to the limitations for accommodating increased surface water drainage within the existing watercourses and substrata rather than direct flood risk from the rivers and can mostly be overcome with the implementation of SUDS, although the loss of developable area to accommodate such systems must be borne in mind. The additional problems of sewer and surface water flooding may also be reduced through the reduction in runoff from the developments and from improvements to the existing drainage network.

There is little differentiation between the development sites in terms of connection to the water supply network. However, limitations in water resources may pose a problem dependent upon the type of development and the density of development, especially with regards to Scenario 3 or high water use industries. These problems with water resources and overabstraction issues within the Borough highlight the necessity for storage of water for agricultural use, especially during the winter months.

The most problematic areas in terms of wastewater treatment are located in, or around, the currently developed areas. This highlights restrictions within the existing sewage systems, most notably due to the infiltration of storm water into the foul sewers. Improvements to the surface water drainage system would therefore decrease the restrictions to development associated with flood risk and wastewater removal. Some sewage treatment works pose capacity problems, most notably due to the quality of the river water into which they discharge. Many measures are already being undertaken by STW and factored into their AMP5 submission, although they may deem additional measures necessary once the proposed sites are finalised. However, should the level of development increase dramatically, notification should be given to STW so additional improvements are extensions to the works can be factored into their following AMP submissions.

Although some development sites will require some degree of investment to make them feasible, no major show stoppers have been identified and no sites have been classified as ‘red’ in all three categories (very few have been classified with two ‘reds’). Due to the close proximity of many of the sites within the District and Borough it will be possible to increase the feasibility of many sites with one strategic infrastructure improvement. For example, decreasing the infiltration of surface water into the foul water mains within Redditch town, through the implementation of SUDS techniques or construction of additional balancing ponds and lakes, will decrease the pressure on the foul water main and potentially increase the capacity for additional foul sewage, although such techniques will require further discussion with STW and the Council Drainage Engineers. It is also be advisable to ensure that all future sewerage systems are separate and to work towards a programme of separation of combined sewers, in particular in the critical areas to reduce the stress on the sewage treatment works, although this will require detailed discussion with STW.

For all sites a high level of implementation of demand management techniques will be a necessity, including SUDS, water metering, rain water harvesting and grey water recycling etc to accommodate the increasing demands and effects of climate change.

Reference to the development trajectories must be considered when reviewing the results in **Tables 27a – 27f** and **28a – 28d** above, as this may limit the level of choice available between the proposed development sites. For example, should the WMRSS development requirements increase towards Scenarios 2 or 3, the area of land available

to develop becomes increasingly restricted. For example, there is a limited supply of land within Bromsgrove District to accommodate the overflow from Redditch Borough and the only option to accommodate this development may be to carry out all the necessary improvements rather than identify additional developable land. Should it be deemed necessary to identify additional land to accommodate increased development, the findings of this report can be used to provide general guidance regarding the most feasible locations in terms of flood risk, water supply and wastewater treatment.

It must be noted that there are limitations to all the results which are discussed throughout the body of this report. Improvements, such as increased modelling of the ordinary watercourses and sewer and water supply networks may provide an increased level of detail.

9.3 High Level Cost Estimation

Detailed costings of the required improvements cannot be provided within this report the water companies will not provide cost estimates until they are approached by a developer and are aware of the situation at that time. However, the traffic light colours used in the summary tables within this report relate to a high level cost estimation. Development sites shown in red will require a high degree of investment, whereas those highlighted in green will require a very low level of investment. The potential costs to be considered are:

- Implementation of new water supply pipe lines to connect the new development sites to the existing trunk mains.
- Upgrading or installation of booster stations necessary for transmitting the water to the development sites located on the edge of Redditch and Bromsgrove towns or in the rural areas of the Borough and District.
- Installation of new WTWs or upgrading the capacity of current WTWs.
- Increasing capacity of the sewage treatment works (although this has been incorporated to some degree in the dWRMPs)
- Increasing the water quality of the treated effluent to comply with water quality standards.
- Increasing capacity and connections of the surface water sewage networks.
- Implementation of SUDS schemes.
- Upgrading and increased maintenance of the watercourse channels, including replacing damaged or insufficient culverts.

10 RECOMMENDATIONS

It is recommended that this study is reviewed once the final WRMPs and WMRSS figures, and the WFD River Basin Management Plans, are published. If possible, it is also recommended that additional models of the ordinary watercourses, sewer networks and water supply systems are carried out to increase the accuracy of the results. This will allow finalisation of the constraints matrix and inclusion of more accurate high level costings, which may create greater divides between the development sites than could be presented here. For many of the sites, however, this will still provide a 'broad-scale' analysis and viability of development may not be concluded upon until detailed site-specific FRAs and infrastructure upgrade analyses are carried out. With regards to the Flood Risk analysis, this report should be read in conjunction with the Level 1 SRFA and updated with the findings of a Level 2 SFRA if one is subsequently commissioned.

10.1 LDF Policies and Development Control Policies

This WCS provides information regarding all elements of the Water Cycle to support appropriate land use allocations within the Borough and District. The site allocations within the Core Strategy Local Development Document should reflect the Councils' strategic planning policies and should address all the issues and limitations regarding water supply, wastewater treatment and flood risk identified within this report.

Suggested local policies for the LDF relating to the finding of this WCS are as follows (all recommendations relating to flood risk presume that reference is made to the Level 1 SFRA and PPS25 and the Exception and Sequential Tests are followed):

- Location and phasing of development should ensure that infrastructure is provided in the right place and at the right time;
- The location of development sites should be allocated according to the capacity of the wastewater network, water supply network and the guidance set out in PPS25, as identified in this WCS and the associated Level 1 SFRA;
- It should be assured that the development of any new site does not detrimentally impact any existing development in terms of wastewater disposal, water supply or flood risk;
- As far as possible Brownfield and should be chosen for development above Greenfield land, where it is appropriate and practical in terms of water supply, wastewater treatment and flood risk;
- All new development should adopt appropriate SUDS, grey water recycling and/or rainwater harvesting methods as appropriate to deal with the surface water runoff produced on that site;
- The suggested recommendations and policies in the SFRA, with regards to flood risk, should be noted;
- Appropriate consideration must be given to the guidance provided in PPS25, and the Sequential and Exception Tests followed, for any development identified as being either wholly or partially located in Flood Zones 2 or 3. Further information and policies regarding flood risk are provided in the Level 1 SFRA;
- FRAs should be undertaken where identified as necessary within this WCS or the Level 1 SFRA;
- Due to the nature of the Borough and the District every new development will require the inclusion of SUDS and most will require the collected surface water to be disposed of on site;

- No new development should be connected to the surface water sewer network as it is already operating above capacity and is resulting in foul water flooding;
- The development of any new site should not have a negative impact on water quality, either directly through pollution of surface or ground water or indirectly through overloading of sewage treatment works;
- Until upgrade or improvement works are carried out no development should take place in areas served by sewage treatment works or sewer networks that have been identified as currently operating at, or above, current capacity;
- All necessary measures should be adopted to reduce water supply demand and through efficiency measures, both in new developments and through retrofitting of old development; and
- Formal submission to the appropriate water company will be required for any new development, outlining the water usage requirements for the site.

REFERENCES

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3. West Midlands Regional Spatial Strategy (WRMSS) Phase Two Revision Draft: West Midlands Regional Assembly, 2008
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22. West Midlands Regional Spatial Strategy (RSS 11): The Impact of Housing Growth on Water Quality and Waste Water Infrastructure, Environment Agency, 2007

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25. Housing Commitments in Redditch Borough 1 April 1996 – 31 March 2007, 2007

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28. Joint Study into the Future Growth Implications of Redditch Town to 2026: Prepared for Worcestershire County Council, Redditch Borough Council, Bromsgrove District Council and Stratford-on-Avon District Council, White Young Green, 2007

ROYAL HASKONING

APPENDICES

Appendix A
Figures

N

BROMSGROVE DISTRICT

REDDITCH DISTRICT

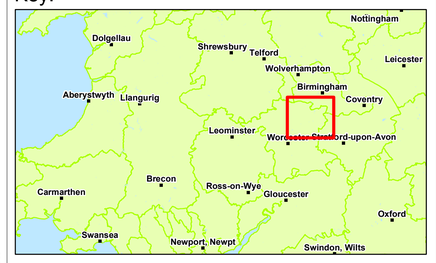
West Hagley
Lower Clent
Adam's Hill
Clent
Holy Cross
Romsley
Belbroughton
Rubery
Fairfield
Bournheath
Catshill
Upper Marlbrook
Lower Marlbrook
Cofton Hackett
Barnt Green
Walker's Heath
Hollywood
Major's Green
Wythall
Alvechurch
Rowney Green
Lickey End
Linthurst
Burcot
Bromsgrove
Finstall
Stoke Prior
Holt End
Redditch
Astwood Bank
Feckenham

Gallows Brook
River Stour
Valley Brook
Fenn Brook
Callow Brook
Roo Brook
Hockley Brook
Battlefield Brook
Spadesbourne Brook
Sugar Brook
Battlefield Brook
River Salwarpe
Hen Brook
Cofton Hackett Reservoir
Upper Bittell Reservoir
Lower Bittell Reservoir
River Arrow
River Cole
Chinn Brook
Stratford-upon-Avon Canal
Worcester & Birmingham Canal
Tardebigge Reservoir
The Lake
Bordesley Brook
Red Ditch
Batchley Brook
Batchley Pool
Arrow Valley Lake
Blacksoils Brook
Church Hill Brook
Park Brook
Ipsley Brook
Broadground Ditch
Wharrington Brook
The Wharrage
Alders Brook
Swans Brook
Spring Brook
Thickwithey Brook
Wixon Brook
Black Brook
Doe Bank Brook
The Valley Hole
Bow Brook
Brandon Brook
River Alne
Dagnell Brook
River Cole

HOLLYWOOD
ASTWOOD BANK

0 1,000 2,000 3,000 4,000 5,000 Metres

Key:



- Reservoirs, Lakes and Pools
- Balancing Ponds
- Ordinary Watercourses
- Bromsgrove and Redditch Boundaries
- Canals
- Main Rivers

Title:
Bromsgrove District and Redditch Borough Boundaries and Key Watercourses

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

Scale:
1:45,000 @ A1

Figure:
1

ROYAL HASKONING

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385000 390000 395000 400000 405000 410000

280000 275000 270000 265000 260000

BROMSGROVE DISTRICT

REDDITCH DISTRICT

West Hagley
Lower Clent
Adams Hill
Clent
Holy Cross
Belbroughton
Romsley
Rubery
Fairfield
Cofton Hackett
Upper Marlbrook
Lower Marlbrook
Catshill
Bournheath
Barnt Green
Hopwood
Walker's Heath
Hollywood
Major's Green
Wythall
Alvechurch
Lickey End
Linthurst
Burcot
Bromsgrove
Rowney Green
Finstall
Holt End
Stoke Prior
Redditch
Astwood Bank
Feckenham

Gallows Brook
River Stour
Fenn Brook
Callow Brook
Hoo Brook
Battlefield Brook
Spadesbourne Brook
Sugar Brook
River Salwarpe
Worcester & Birmingham Canal
River Arrow
River Cole
Hewell Brook
Shaw Brook
Chinn Brook
Stratford Upon Avon Canal
Dagnell Brook
Red Ditch
Batchley Brook
Blacksoils Brook
Church Hill Brook
Park Brook
Ipsley Brook
Broadground Ditch
Alders Brook
Swans Brook
Spring Brook
Thickthorn Brook
Wharrington Brook
The Wharrage
Whitford Brook
Black Brook
Doe Bank Brook
Brandon Brook
Bow Brook

A1 A10 A11 A12 A13 A15 A16 A2 A3 A4 A5 A6 A7 A8 A9
B4091 B4101 B4120 B4184 B4497 B4551

Sh1 Sh2 Sh3 Sh4 Sh5 Sh6 Sh7 Sh8 Sh9 Sh10

PR1 PR2 PR3 PR4 PR5 PR6 PR7 PR8 PR9 PR10 PR11 PR12 PR13 PR14 PR15 PR16 PR17 PR18 PR19 PR20 PR21 PR22 PR23 PR24 PR25 PR26 PR27 PR28 PR29 PR30 PR31 PR32 PR33 PR34 PR35 PR36 PR37 PR38 PR39 PR40 PR41 PR42 PR43

E1 E2 E3 E4 E5 E6 E7 E8 E9 E10 E11 E12 E13 E14 E15 E16 E17 E18 E19 E20 E21 E22 E23 E24 E25 E26 E27

H1 H2 H3 H4 H5 H6 H7 H8 H9 H10 H11 H12 H13

St1 St2 St3 St4 St5 St6 St7 St8 St9 St10

UZ1

Key:

- Village Envelopes
- Policy Reference
- Shopping
- Unzoned
- Strategic Sites
- Housing Sites
- Employment Sites
- ADR
- Reservoirs, Lakes and Pools
- Balancing Ponds
- Ordinary Watercourses
- Bromsgrove and Redditch Boundaries
- **Development Site**
- Canals
- Main Rivers

0 1,000 2,000 3,000 4,000 5,000 Metres

Title:
Development Sites

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

Scale:
1:45,000 @ A1

Figure:
2

ROYAL HASKONING

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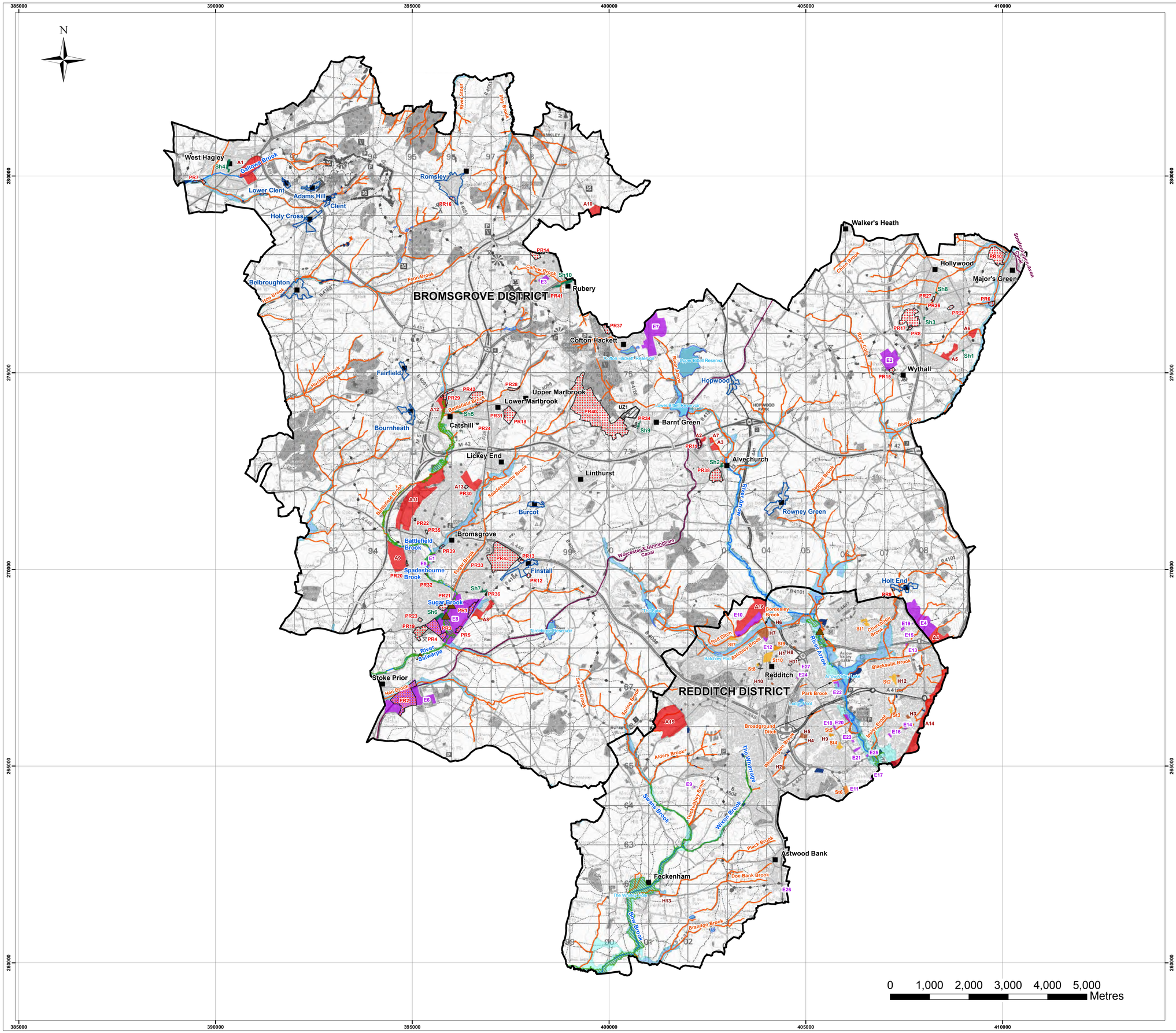

Key:

Flood Zone Misalignments

- Bromsgrove and Redditch Boundaries
- NFCDD Raised Defences
- Flood Zone 3b (Functional Floodplain)
- Reservoirs, Lakes and Pools
- Balancing Ponds
- Ordinary Watercourses
- Canals
- Main Rivers
- Flood Zone 3a
- Flood Zone 2

Development Sites

- Village Envelopes
- Policy Reference
- Strategic Sites
- Housing Sites
- Employment Sites
- ADR
- Shopping
- Unzoned

Title:

Flood Zones and Potential Development Sites

Project:

Bromsgrove District and Redditch Borough WCS

Client:

Bromsgrove District and Redditch Borough Councils

Date:

January 2009

Scale:

1:45,000 @ A1

Figure:

11

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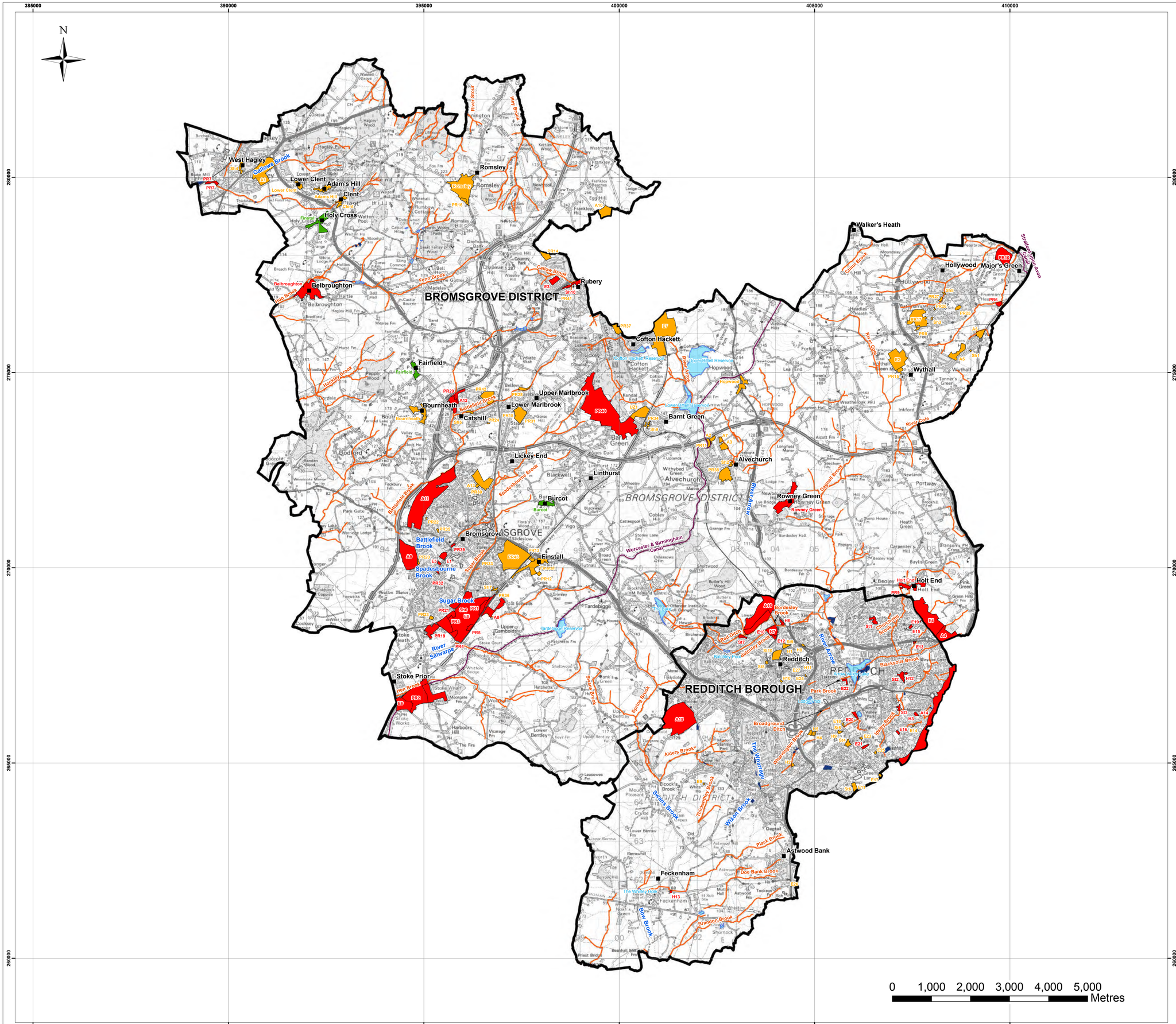

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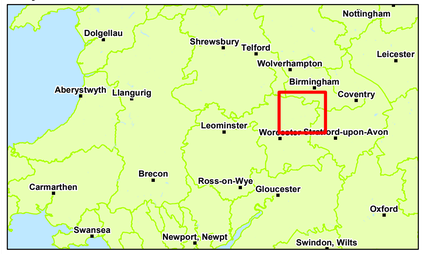

Development Sites

- Low flood risk, will fit in existing drainage system with minimum SUDS requirement
- Medium flood risk, SUDS and upgrade to existing drainage network may be required
- Significant flood risk, underlying geology limits SUDS techniques and upgrade to existing drainage network will be required.
- Bromsgrove and Redditch Boundaries
- Main Rivers
- Ordinary Watercourses
- Canals
- Reservoirs, Lakes and Pools
- Balancing Ponds

Title:
Overall Flood Risk to Development Sites

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

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12

ROYAL HASKONING

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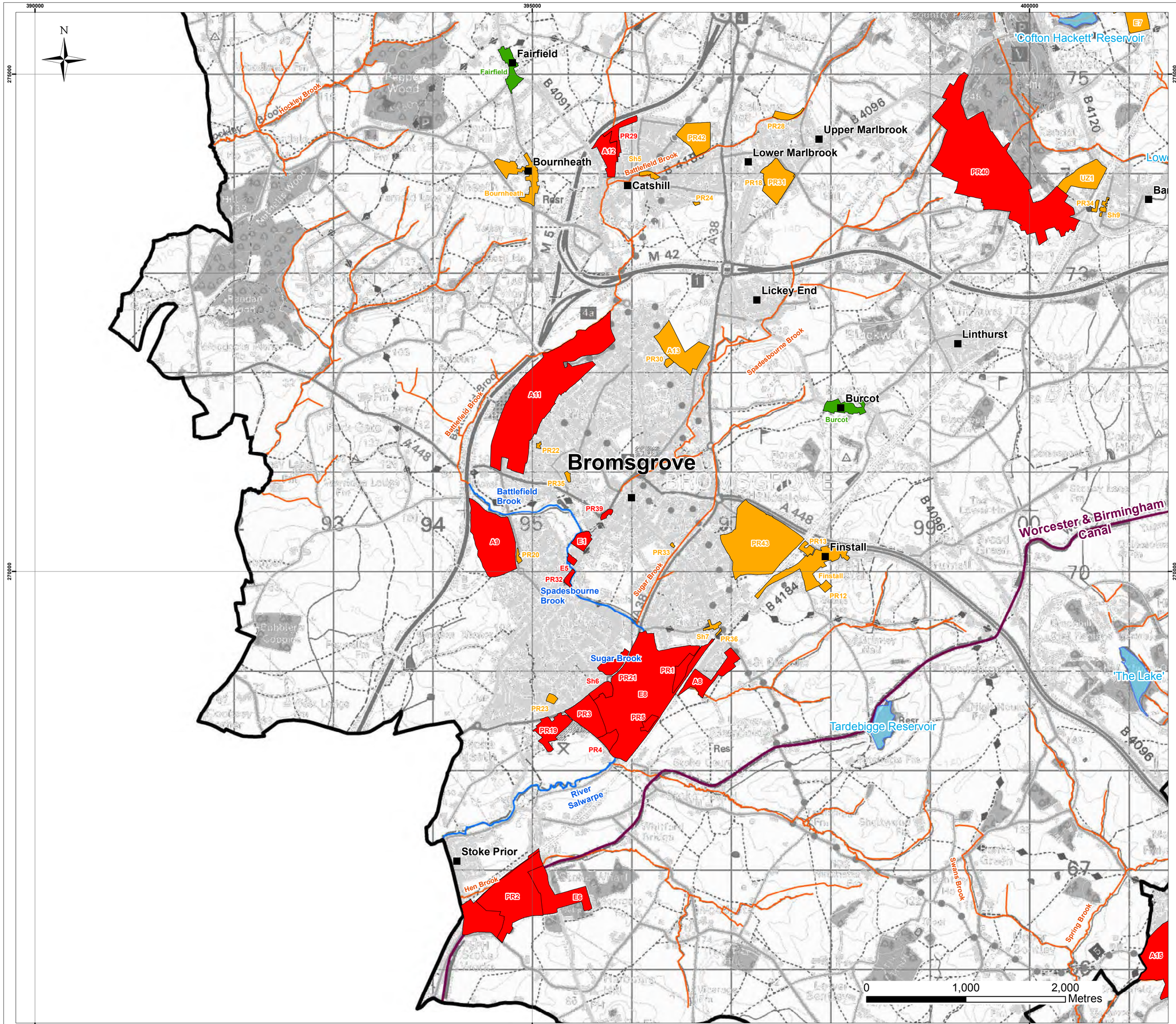

Key:

Development Sites

- Low flood risk, will fit in existing drainage system with minimum SUDS requirement
- Medium flood risk, SUDS and upgrade to existing drainage network may be required
- Significant flood risk, underlying geology limits SUDS techniques and upgrade to existing drainage network will be required.

- Bromsgrove and Redditch Boundaries
- Main Rivers
- Ordinary Watercourses
- Canals
- Reservoirs, Lakes and Pools
- Balancing Ponds

Title:
Overall Flood Risk to Development Sites - Bromsgrove Town

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:	Scale:
January 2009	1:25,000 @ A1

Figure:
13

ROYAL HASKONING

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400000
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265000
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'The Lake'
Batchley Pool
Arrow Valley Lake
Lodge Pool
Holt End
Astwood Bank

Redditch
REDDITCH DISTRICT

A16 E10 H6 H7 E12 St7 St9 H1 H8 St10 St8 H11 E27 E24 H10 E22 Park Brook
A15
E20 E18 St5 H9 St4 E23 E21 E25 H5 H4 Broadground Ditch
H2 Wharrington Brook
E17 E11 St6
E9
St1 E19 E4 A4 E15 E13 Church Hill Brook
PR9 Holt End
St2 H12 Blacksoils Brook
St3 H3 E14 E16 Ipsley Brook A14
Bordesley Brook
Red Ditch
River Arrow
Spring Brook
Alders Brook
The Wharrage
Swans Brook
Thickwithey Brook
Wixon Brook
Plack Brook

B4101
B4497
B4096
A448
A4189
A441
B4504
B4497

0 1,000 2,000 Metres

Key:

Development Sites

- Low flood risk, will fit in existing drainage system with minimum SUDS requirement
- Medium flood risk, SUDS and upgrade to existing drainage network may be required
- Significant flood risk, underlying geology limits SUDS techniques and upgrade to existing drainage network will be required.
- Bromsgrove and Redditch Boundaries
- Main Rivers
- Ordinary Watercourses
- Canals
- Reservoirs, Lakes and Pools
- Balancing Ponds

Title:
Overall Flood Risk to Development Sites - Redditch Town

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

Scale:
1:20,000 @ A1

Figure:
14

ROYAL HASKONING

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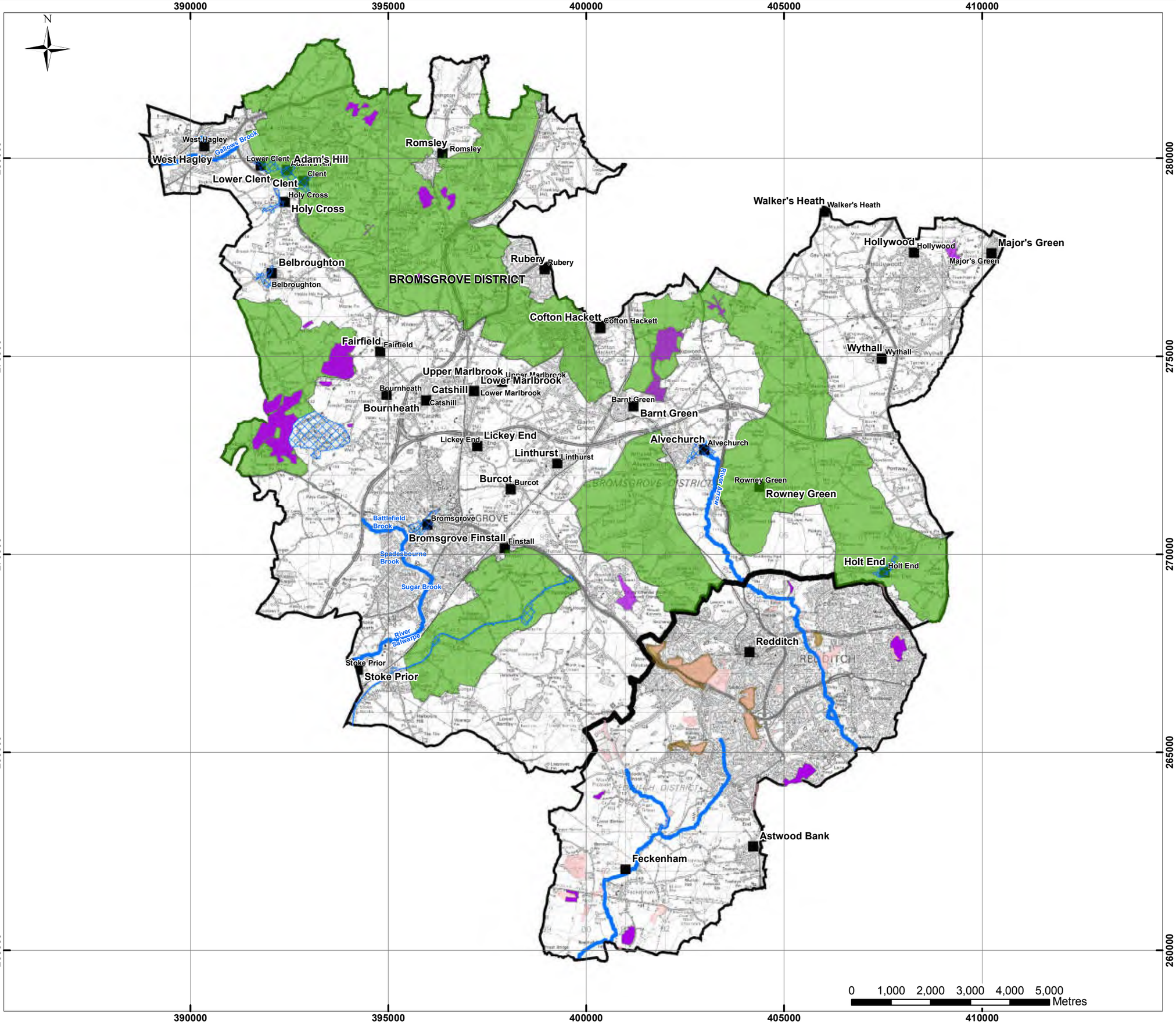

Key:

- Conservation Areas
- Sites of Special Scientific Interest
- Landscape Protection Areas
- Main Rivers
- BROMSGROVE DISTRICT
- Special Wildlife Sites
- Local Nature Reserves

Title:
Conservation areas, Landscape Protection areas and Sites of Special Scientific Interest

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

Scale:
1:90,000 @ A3

Figure:
16

ROYAL HASKONING

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NOTE: The Infrastrucuture locations shown on this map are for guidance purposes only and do not portray the exact locations. The schematics are not to scale.

BROMSGROVE DISTRICT

REDDITCH BOROUGH

Low Pressure

Key:

Development Sites

- Easily accomodated within the existing system with little or no infrastructure upgrade
- Requiring minor infrastructure upgrade
- Requiring major infrastructure upgrade

Water Supply Infrastructure

- Borehole
- Pumping Station
- Raw Water Storage
- Reservoir
- WTW

Water Mains

- Elan Valley Aqueduct
- SSW Large Supply Main
- SSW Small Supply Main
- STW Existing Water Main
- Main Rivers

Title:

Bromsgrove District and Redditch Borough Water Supply Infrastructure

Project:

Bromsgrove District and Redditch Borough WCS

Client:

Bromsgrove District and Redditch Borough Councils

Date:	Scale:
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Figure:

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ROYAL HASKONING

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275000
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Low Pressure

Fairfield
Bournheath
Catshill
Upper Marlbrook
Lower Marlbrook
Barnt Green
Lickey End
Linthurst
Burcot
Bromsgrove
Finstall
Sugarbrook
Stoke Prior

Battlefield Brook
Spadesbourne Brook
Sugar Brook
River Salwarpe

PR20 PR21 PR22 PR23 PR24 PR28 PR29 PR30 PR31 PR32 PR33 PR34 PR35 PR36 PR39 PR40 PR42 PR43 PR1 PR2 PR3 PR4 PR5 PR12 PR13 PR18 PR19
A8 A9 A11 A12 A13 E1 E5 E6 E7 Sh5 Sh6 Sh7 Sh9 UZ1

NOTE: The Infrastrucuture locations shown on this map are for guidance purposes only and do not portray the exact locations. The schematics are not to scale.

0 1,000 2,000 Metres

Key:

Development Sites

- Easily accomodated within the existing system with little or no infrastructure upgrade
- Requiring minor infrastructure upgrade
- Requiring major infrastructure upgrade

Water Supply Infrastructure

- Borehole
- Pumping Station
- Raw Water Storage
- Reservoir
- WTW

Water Mains

- Elan Valley Aqueduct
- SSW Large Supply Main
- SSW Small Supply Main
- STW Existing Water Main

Main Rivers

Title:
Bromsgrove District and Redditch Borough Water Supply Infrastructure

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:	Scale:
January 2009	1:25,000 @ A2

Figure:
18

ROYAL HASKONING

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405000

270000

265000

Key:

Development Sites

- Easily accomodated within the existing system with little or no infrastructure upgrade
- Requiring minor infrastructure upgrade
- Requiring major infrastructure upgrade

Water Supply Infrastructure

- Borehole
- Pumping Station
- Raw Water Storage
- Reservoir
- WTW

Water Mains

- Elan Valley Aqueduct
- SSW Large Supply Main
- SSW Small Supply Main
- STW Existing Water Main

Main Rivers

Title:
Bromsgrove District and Redditch Borough Water Supply Infrastructure - Redditch Town

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

Scale:
1:20,000 @ A2

Figure:
19

NOTE: The Infrastrucuture locations shown on this map are for guidance purposes only and do not portray the exact locations. The schematics are not to scale.

0 1,000 2,000 Metres

ROYAL HASKONING

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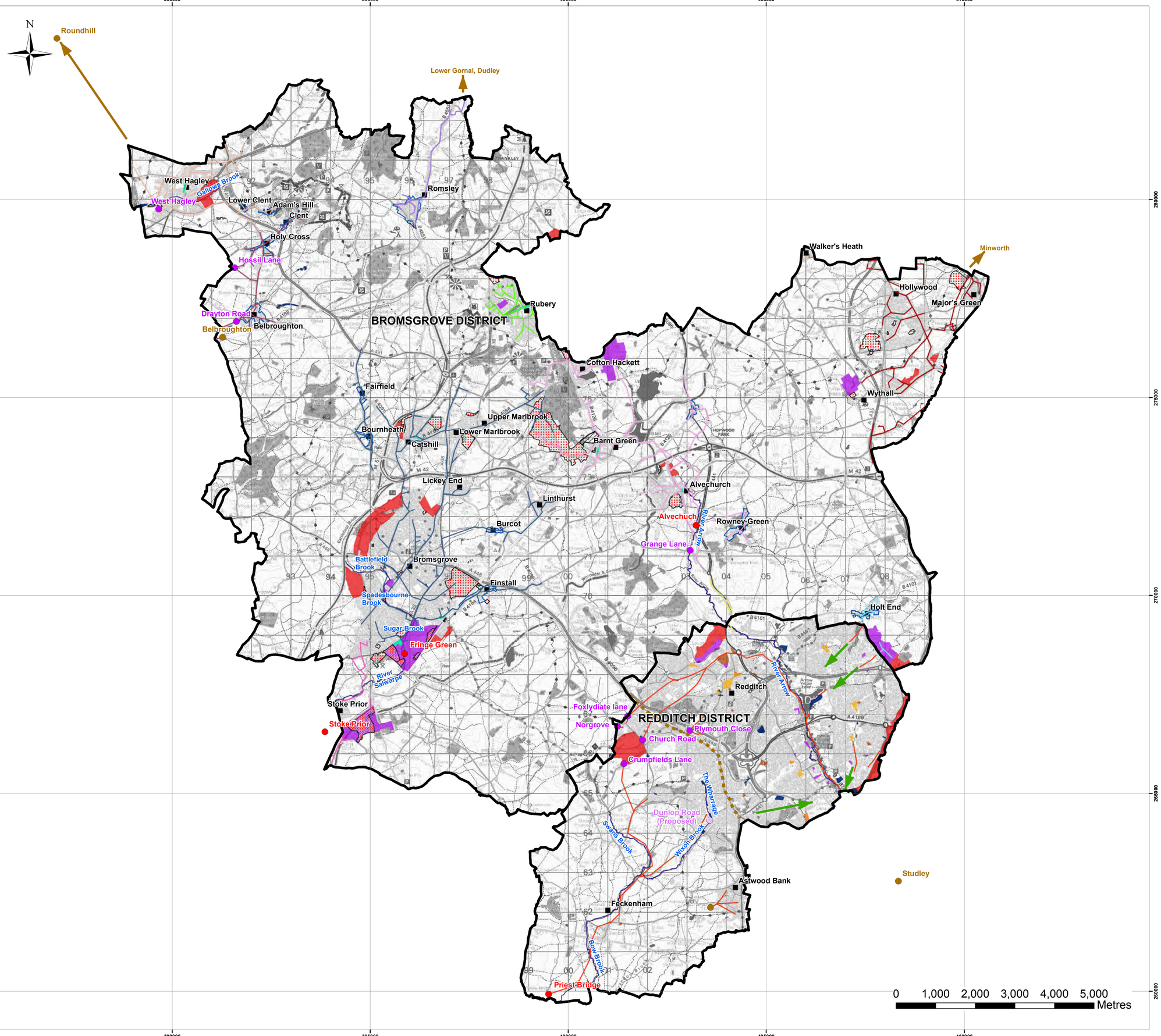

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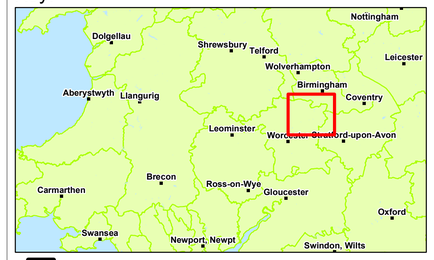

- Bromsgrove and Redditch Boundaries
- Sewage Treatment Works
- Sewage Treatment Works Under Pressure
- Highground Ridge
- Pumping Stations
- Poposed Pumping Stations
- Main Rivers
- Balancing Ponds
- Redditch Sewers
- Redditch Pumped Sewers
- Redditch Sewers Under Pressure
- Alvechurch Sewers
- Alvechurch Pumped Sewers
- Bordesley Sewers
- Bromsgrove Sewers
- Bromsgrove Pumped Sewers
- Hagley Sewers
- Hagley Pumped Sewers
- Hollywood/Wythall Sewers
- Hollywood/Wythall Pumped Sewers
- Holt End Sewers
- Holy Cross/Belbroughton
- Holy Cross/Belbroughton Sewers
- Romsley Sewers
- Rubery Sewers
- Walkers Heath Sewers
- Stoke Prior Sewers

Development Site

- Village Envelopes
- Policy Reference
- Strategic Sites
- Housing Sites
- Employment Sites
- ADR
- Shopping
- Unzoned

Title:
Bromsgrove District and Redditch Borough Wastewater Infrastructure

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

Scale:
1:45,000 @ A1

Figure:
20

ROYAL HASKONING

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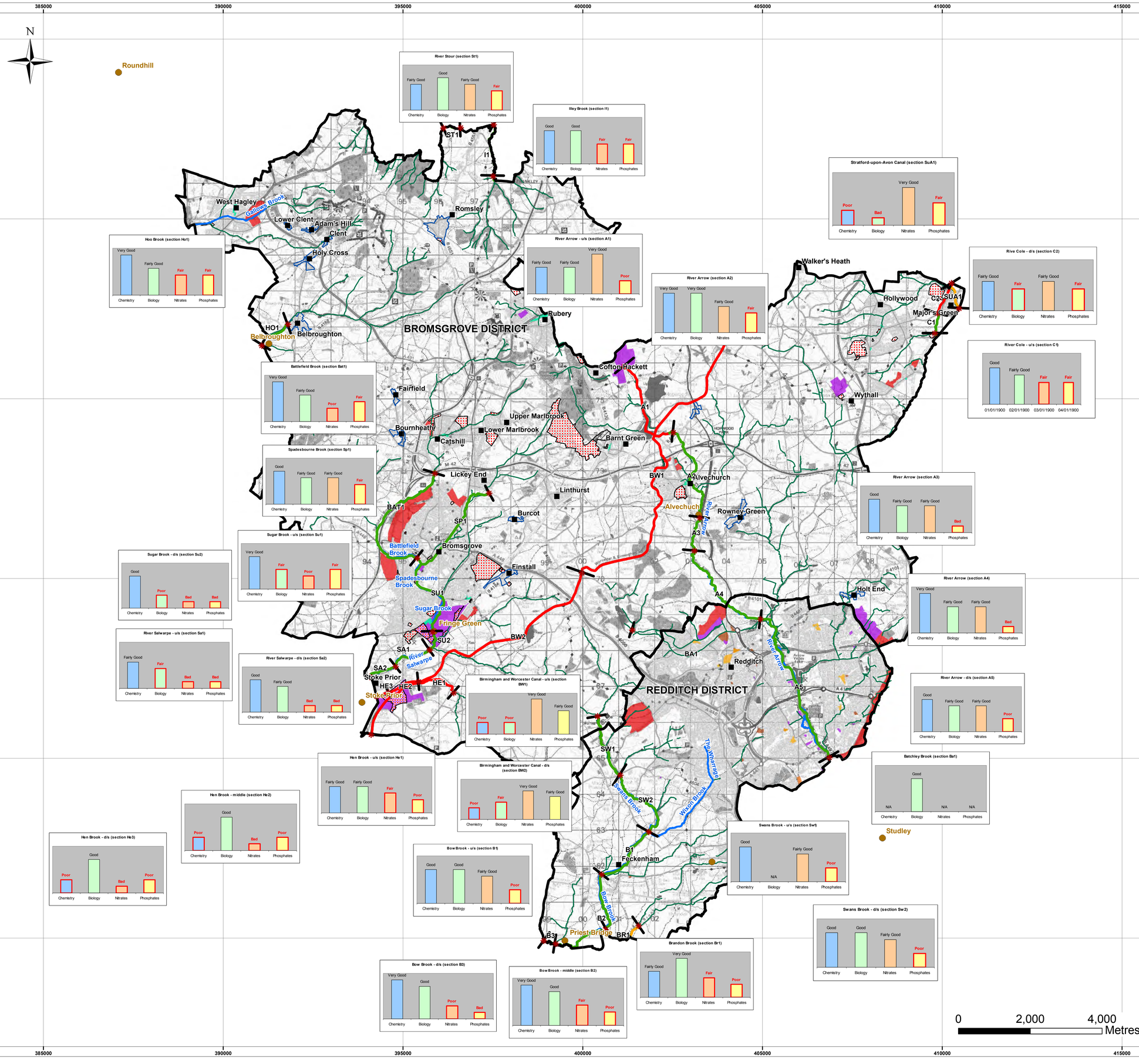

Key:

- Bromsgrove and Redditch Boundaries
- Sewage Treatment Works
- River Segments
- BW1 *(Unique IDs for River Segments)*
- Main Rivers
- Ordinary Watercourses
- Canals

River Quality Objectives (RQO)

- Compliant
- Marginal
- Significant Failure

General Quality Assessment (GQA)

(Unique IDs refer to the River Segments)

Development Site

- Village Envelopes
- Policy Reference
- Strategic Sites
- Housing Sites
- Employment Sites
- ADR
- Shopping
- Unzoned

Title:
Bromsgrove District and Redditch Borough - River Water Quality

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

Scale:
1:50,000 @ A1

Figure:
21

ROYAL HASKONING

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385000 390000 395000 400000 405000 410000

280000 275000 270000 265000 260000

BROMSGROVE DISTRICT

REDDITCH BOROUGH

West Hagley
Gallows Brook
Lower Clent
Adam's Hill
Clent
Holy Cross
Romsley
Belbroughton
Rubery
Fairfield
Bournheath
Catshill
Upper Marlbrook
Lower Marlbrook
Cofton Hackett
Walker's Heath
Hollywood
Major's Green
Wythall
Barnt Green
Lickey End
Linthurst
Burcot
Alvechurch
Rowney Green
Holt End
Bromsgrove
Battlefield Brook
Finstall
Spadesbourne Brook
Sugar Brook
Fringe Green
River Salwarpe
Stoke Prior
Redditch
River Arrow
The Wharrage
Swans Brook
Wixon Brook
Astwood Bank
Feckenham
Bow Brook
Priest Bridge

0 1,000 2,000 3,000 4,000 5,000 Metres

Key:

- Bromsgrove and Redditch Boundaries
- Sewage Treatment Works Under Pressure
- Sewers
- Pumped Sewers
- Sewers Under Pressure

Development Sites

- Easily accomodated within the existing system with little or no infrastructure upgrade
- Requiring minor infrastructure upgrade
- Requiring major infrastructure upgrade
- Main Rivers

Title:
Bromsgrove District and Redditch Borough Waste Water Drainage

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

Scale:
1:45,000 @ A1

Figure:
22

ROYAL HASKONING

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390000 395000 400000

275000 270000

N

Fairfield
Bournheath
Catshill
Upper Marlbrook
Lower Marlbrook
Barnt Gr
Lickey End
Linthurst
Burcot
Bromsgrove
Finstall
Fringe Green
Stoke Prior

B4091 B4096 B4120 B4184 A38 M5 M42 A448 A4

Battlefield Brook
Spadesbourne Brook
Sugar Brook
River Salwarpe

PR1 PR2 PR3 PR4 PR5 PR12 PR13 PR18 PR19 PR20 PR21 PR22 PR23 PR24 PR28 PR29 PR30 PR31 PR32 PR33 PR34 PR35 PR36 PR39 PR40 PR42 PR43
E1 E5 E6 E7
A8 A9 A11 A12 A13
Sh5 Sh6 Sh7 Sh9
UZ1

0 1,000 2,000 Metres

Key:

- Bromsgrove and Redditch Boundaries
- Sewage Treatment Works Under Pressure
- Approximate location of Sewers

Development Sites

- Easily accomodated within the existing system with little or no infrastructure upgrade
- Requiring minor infrastructure upgrade
- Requiring major infrastructure upgrade
- Main Rivers

Title:
Bromsgrove District and Redditch Borough Waste Water Drainage - Bromsgrove Town

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:
January 2009

Scale:
1:25,000 @ A2

Figure:
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REDDITCH BOROUGH
REDDITCH DISTRICT
Redditch
Holt End
Astwood Bank
River Arrow
The Wharrage
Swans Brook
Wixon Brook

0 1,000 2,000 Metres

Key:

- Bromsgrove and Redditch Boundaries
- Sewage Treatment Works Under Pressure
- Approximate location of Sewers
- Approximate location of Pumped Sewers
- Sewers Under Pressure

Development Sites

- Easily accomodated within the existing system with little or no infrastructure upgrade
- Requiring minor infrastructure upgrade
- Requiring major infrastructure upgrade
- Main Rivers

Title:
Bromsgrove District and Redditch Borough Waste Water Drainage - Redditch Town

Project:
Bromsgrove District and Redditch Borough WCS

Client:
Bromsgrove District and Redditch Borough Councils

Date:	Scale:
January 2009	1:20,000 @ A1

Figure:
24

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ROYAL HASKONING

Appendix B
Data Register

Appendix B – Data Register

Description	When Requested	Media	Source	When Received
Water Vole Survey (including channel descriptions)	04/03/2008	Report	Hayley Pankhurst q(Bromsgrove DC)	04/03/2008
Bromsgrove LDF Core Strategy	04/03/2008	Brochure	Rosemary Williams (Bromsgrove DC)	04/03/2008
Bromsgrove Planning and Environment Services Issues and Options	04/03/2008	Brochure	Rosemary Williams (Bromsgrove DC)	04/03/2008
Bromsgrove District Local Plan, 2004	04/03/2008	Brochure and Report	Rosemary Williams (Bromsgrove DC)	04/03/2008
Bromsgrove Local Plan Proposals Map	04/03/2008	Brochure/Report	Rosemary Williams (Bromsgrove DC)	04/03/2008
Redditch Borough LDF	04/03/2008	Folder	Emma Baker (Redditch BC)	08/03/2008
10K and 50K background mapping	31/03/2008	TIFF Tiles	Katrina Woodger (Redditch BC)	01/04/2008
Outstanding 50K background mapping for Redditch	31/03/2008	TIFF Tiles	Rosemary Williams	18/08/2008
Mastermap Data – Worcestershire	31/03/2008	ESRI	Katrina Woodger (Redditch BC)	04/04/2008
Development Sites - Bromsgrove	28/03/2008 (01 April 2008) (04 April 2008) (08 April 2008)	Shapefiles	John Knott (Bromsgrove DC) Hayley Pankhurst (Bromsgrove DC) Rosemary Williams (Bromsgrove DC)	30/04/2008
Development Sites – Redditch	08/04/2008	Shapefiles	Alexa Williams (Redditch BC) Alison Grimmett (Redditch BC, GIS)	'Strategic' - 07/05/2008 ADRs – 23/04/2008
250K Maps - Worcestershire	01/0/4/2008	TIFF Tiles	Katrina Woodger (Redditch BC)	01/04/2008
Streetmap of Bromsgrove	01/0/4/2008 09/04/2008	TIFF Tiles	John Knott (Bromsgrove DC) Shirley Atkins (Bromsgrove DC)	30/04/2008
Flood Zones	01/0/4/2008	Shapefile	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
LiDAR data	01/0/4/2008	ASCII Tiles	EA enquiries (Tewkesbury External Relations) Mike Plant	08/05/2008

Description	When Requested	Media	Source	When Received
SAR Data	01/0/4/2008	-	EA enquiries (Tewkesbury External Relations)	- *Probably not necessary*
Hydrometric Gauge Data	01/0/4/2008	.all files	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
List of available survey data	01/0/4/2008	Email	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
Hydraulic Models	01/0/4/2008	Email	EA enquiries (Tewkesbury External Relations) Matthew Weston	List of available: 07/05/2008
NFCDD data	01/0/4/2008	Shapefiles	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
Flood Event data	01/0/4/2008	Email	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
SFRAs from neighbouring authorities	01/0/4/2008	-	EA enquiries (Tewkesbury External Relations)	- (Wyre Forest, RH)
ABDs	01/0/4/2008	-	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008 (none exist)
Historic Flood Outlines	01/0/4/2008	Shapefiles	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
Modelled Flood Outlines	01/0/4/2008	Shapefile	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
Groundwater Levels	01/0/4/2008	Shapefiles	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
Groundwater Vulnerability Maps	01/0/4/2008	Shapefiles	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008

Description	When Requested	Media	Source	When Received
Groundwater Source Protection Zones	01/0/4/2008	Shapefiles	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
River Quality Data (GQA and RQO)	01/0/4/2008	Shapefile	EA enquiries (Tewkesbury External Relations) Matthew Weston	07/05/2008
CFMPs River Severn	01/0/4/2008	PDF	Internet – EA Website	01/04/2008
CAMS Warwickshire Avon CAMS Worcestershire Middle Severn CAMS Tame, Anker and Mease CAMS	01/0/4/2008	PDF	Internet – EA Website	01/04/2008
Watercourse and Flooding Data – Redditch	04/04/2008	Excel Spreadsheet, MS Word Document & PDF	Clive Wilson	14/04/2008
Highways Flooding Records	04/04/2008	Excel Spreadsheet	David Aitchison (Area 9) Amey Mouchel - email	17/04/2008
Worcestershire County Plan	07/04/2008	PDF Document	Online	07/04/2008
Making Space for Water, The Role of Land Use and Land Management in Delivering Flood Risk Management, Jan 2008	07/04/2008	PDF Document	Online	07/04/2008
Sewer Flooding Records	08/04/2008	Excel Spreadsheet	Andrew Marsh & Martin Young (Severn Trent Water)	25/06/2008
Background Information about Bromsgrove Drainage	09/04/2008	Conversation	John Bailey (Bromsgrove DC Land Drainage)	09/04/2008
Canal Flooding Records	10/04/2008	Letter	Sally Phipps (British Waterways) - letter	25/04/2008
Bromsgrove Housing Capacity Study, 2004	10/04/2008	PDF Document	Online	10/04/2008
Worcestershire County Emergency Flood Plan	16/04/2008	PDF Document	Online	16/04/2008
5 year housing land supply in Redditch Borough	18/04/2008	PDF Document	Online	18/04/2008
Appendix 2, Worcestershire RSS	18/04/2008	PDF Document	Online	18/04/2008
Shell Brook Survey Data, 2002	07/05/2008	CD	EA – Matthew Weston (received from EA Barnaby Ellis)	04/06/2008

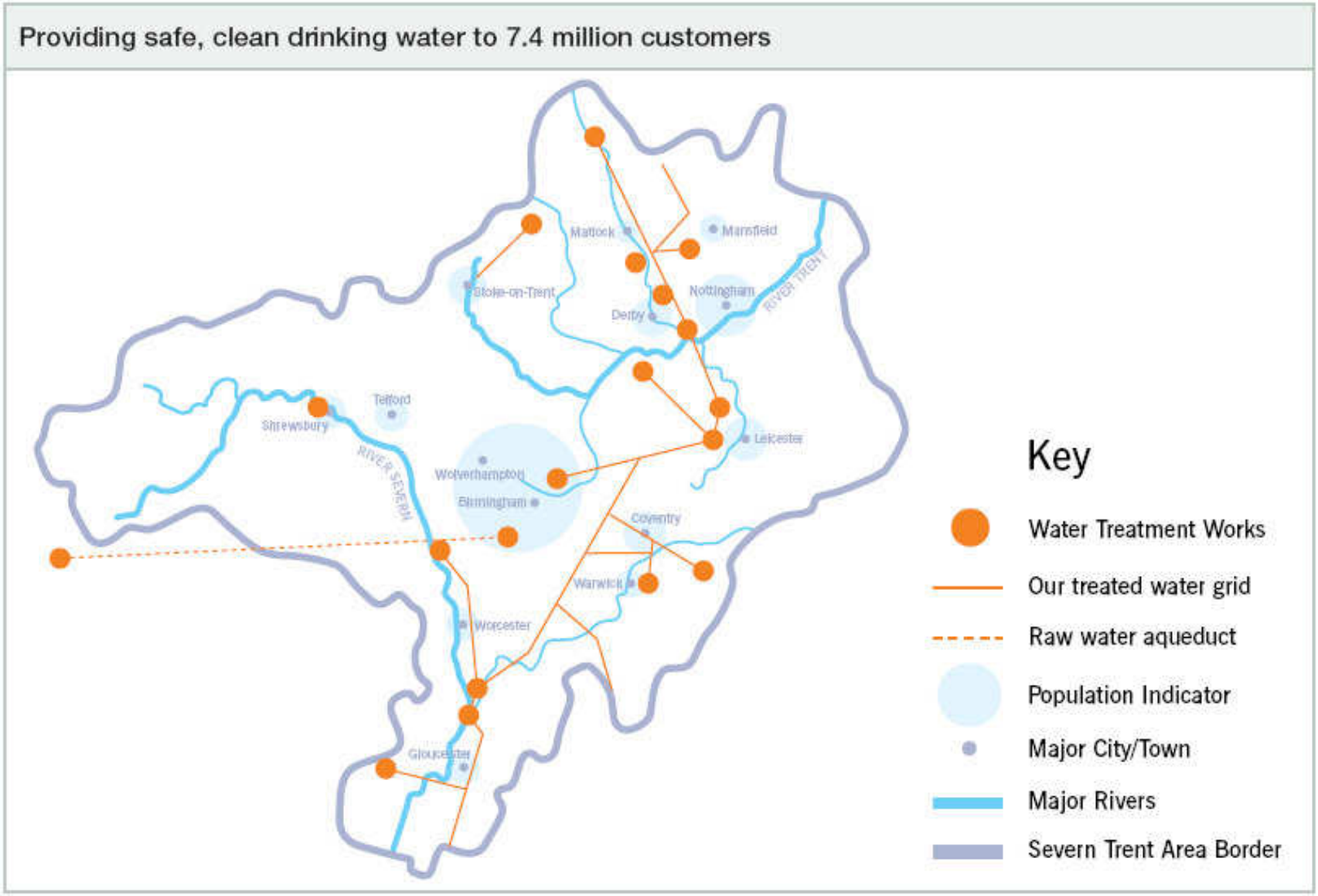
Description	When Requested	Media	Source	When Received
Bow Brook Survey Data and Report, 2002	07/05/2008	CD	EA – Matthew Weston (received from EA Barnaby Ellis)	04/06/2008
Elcocks Brook Survey Data, 2002	07/05/2008	CD	EA – Matthew Weston (received from EA Barnaby Ellis)	04/06/2008
NATCON 257 – Bow/Shell & Elcocks Brook Models, 2004	07/05/2008	CD	EA – Matthew Weston (received from EA Barnaby Ellis)	04/06/2008
Arrow Alne Section 105, FRM Study – Annex 3, Digital Deliverables, 2003	07/05/2008	CD	EA – Matthew Weston (received from EA Barnaby Ellis)	04/06/2008
Copy of River Arrow and Alne iSIS test model, 2005	07/05/2008	CD	EA – Matthew Weston (received from EA Barnaby Ellis)	04/06/2008
Arrow and Alne Flood Risk Mapping Investigation, 2003	07/05/2008	CD	EA – Matthew Weston (received from EA Barnaby Ellis)	04/06/2008
Flood Resilience Analysis, Redditch	02/06/2008	Document	RBC – Clive Wilson	02/06/2008
Watercourse Names	02/06/2008	Hardcopy map	RBC – Clive Wilson	02/06/2008
Culvert locations, inspection times and STW balancing ponds	02/06/2008	Excel spreadsheet and hardcopy map	RBC – Clive Wilson	02/06/2008
Batchley Brook Flood Outline 2007	02/06/2008	Hardcopy with photos	RBC – Clive Wilson	02/06/2008
Catchment outlines – Redditch	02/06/2008	Hardcopy Map	RBC – Clive Wilson	02/06/2008
Historical Flooding Records from BHS Chronology of British Hydrological Events	04/06/2008	Electronic	Internet	04/06/2008
Redditch Borough Council Policy Statement on Flood Defence, Dec 2005	10/06/2008	PDF	Internet	10/06/2008
Environment Agency High Level Target 3: Emergency Exercises and Emergency Plans' Report to DEFRA April 2005	10/05/2008	PDF	Internet	10/05/2008
CEH National River Flow Archive Data http://www.ceh.ac.uk/data/nrfa/catchment_spatial_information.html River Arrow, River Salwarpe, River Cole and Bow Brook	10/05/2008	Electronic figures and text	Internet	10/05/2008

Description	When Requested	Media	Source	When Received
West Midlands Regional Spatial Strategy (RSS 11) The Impact of Housing Growth on Water Quality and Waste Water Infrastructure	10/05/2008	PDF Report	Internet	10/05/2008
South Staffordshire Water, Water Resource Management Plan and Non-Technical Summary	12/05/2008	PDF Report	Internet	12/05/2008
Severn Trent Water, Water Resource Management Plan and Non-Technical Summary	12/05/2008	PDF Report	Internet	12/05/2008
South Staffordshire Water, Strategic Direction Statement	12/05/2008	PDF Report	Internet	12/05/2008
Severn Trent Water, Strategic Direction Statement	12/05/2008	PDF Report	Internet	12/05/2008
South Staffordshire Water SEA Report	12/05/2008	PDF Document	South Staffordshire Water Website	12/05/2008
Focus on Water, Dec 2007	12/05/2008	PDF Document	Severn Trent Water Website	12/05/2008
Schematics and Information regarding sewer networks, water supply networks, sewage treatment works capacity etc from Severn Trent Water.	13/06/2008	Partial (Email)	Andrew Marsh Severn Trent Water	04/07/2008
Schematics of water supply network from South Staffordshire Water	13/06/2008	Excel Spreadsheet	Dave Martin South Staffordshire Water	02/07/2008
Bromsgrove District Council, Land Availability Housing and Employment Surveys	19/06/2008	Hard Copy Report	Rosemary Williams, Bromsgrove DC	24/06/2008
River Salwarpe Model	11/07/2008	CD	Sue Munns (via Sumi Lai)	18/07/2008
Information regarding groundwater flooding	17/07/2008	Telephone conversation	Alistair Brodey (Fradley) re Redditch Tony Jenkins (Shrewsbury) re Bromsgrove	17/07/2008 22/07/2008
Flood Watch Areas – West Warwickshire (Redditch)	19/06/2008	GIS Shapefile	EA (Wendy Rees)	16/07/2008
Statement regarding standard and condition of flood defences through Redditch	19/06/2008	Email	[Peter Clarke via Tina Scott]	15/08/2008
Statement on viability of rainfall warnings in Redditch	19/06/2008	Email	[Peter Coxhill via Tina Scott]	15/08/2008
Corrections to JFLOW flood zones	19/06/2008		[Niall Hall via Tina Scott]	Not Available
River Salwarpe FRA (JBA)	10/07/2008		Paul Flynn	Not Available

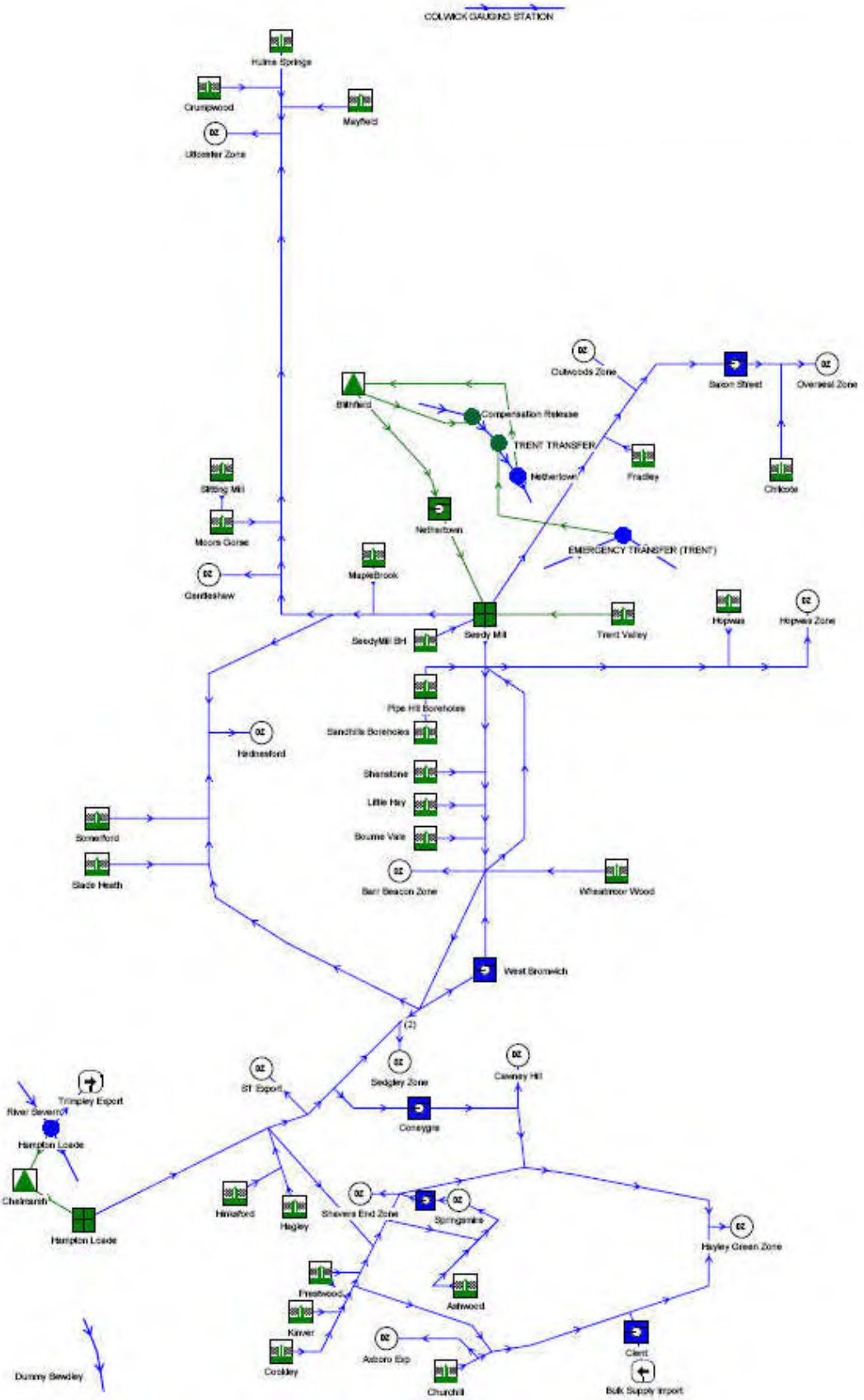
Description	When Requested	Media	Source	When Received
Gallows Brook FRAs	10/07/2008		Paul Flynn	Not Available
Bromsgrove models and/or surveys	10/07/2008		Paul Flynn	Not Available
SAR data	10/07/2008		Paul Flynn	Not Available
Flood Watch Shapefile - Bromsgrove	10/07/2008		Paul Flynn	24/07/2008
Flood Outlines for 25yr and 100yr +CC for River Salwarpe	23/07/2008	Email GIS outlines	(Sue Munns) Peter Restorick	20/08/2008
Historical Flooding Information		Map and Text	John Bailey	05/08/2008
Sewer Locations and problems in Bromsgrove	05/08/2008	Map and Text	John Bailey	12/08/2008
Sewer Locations and problems in Redditch	12/08/2008	Map and Email	Clive Wilson	14/08/2008

Appendix C
Water Supply Schematics

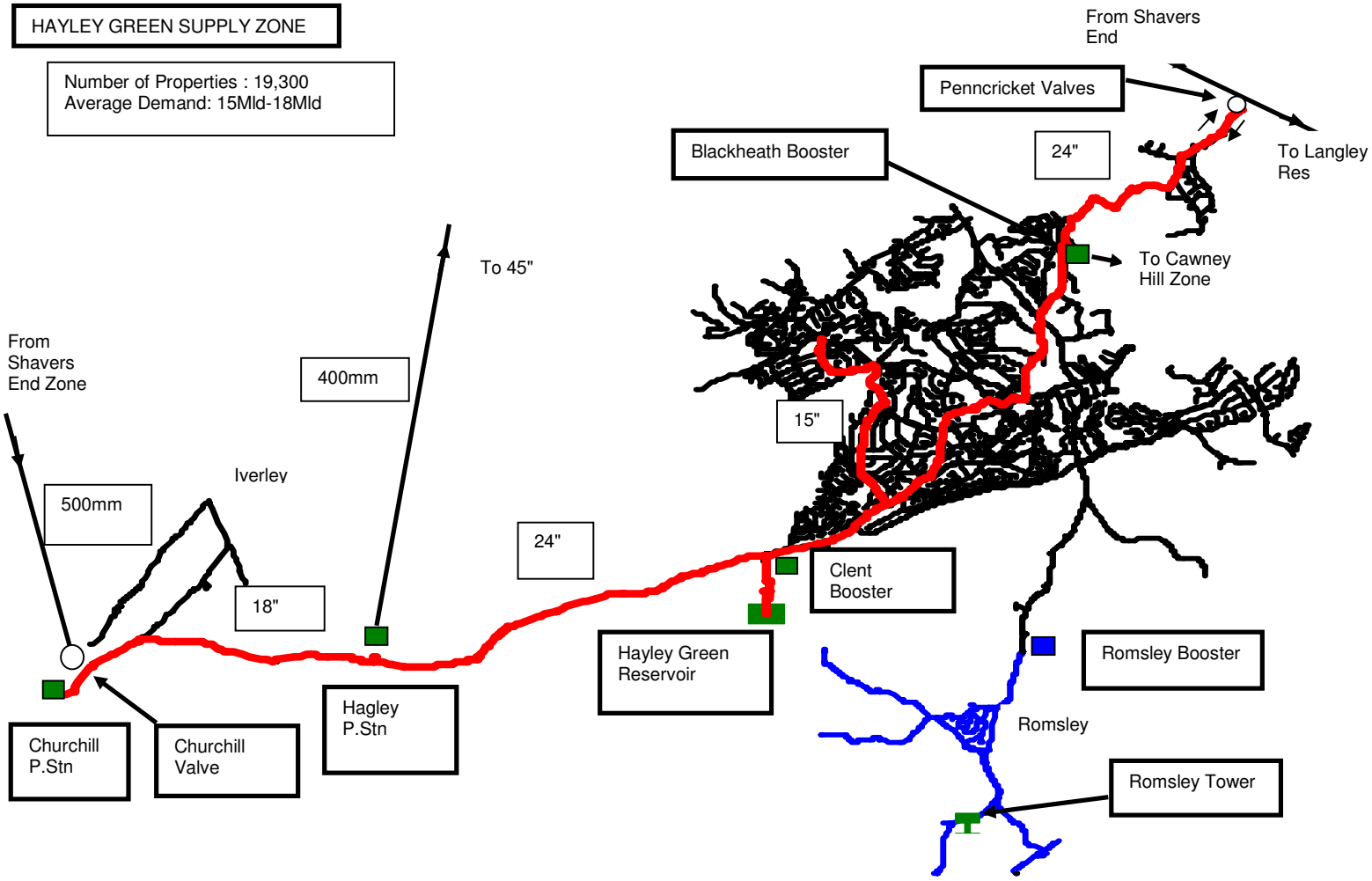
Severn Trent Water – Strategic Treated Water Grid



South Staffordshire Water, Schematic of Water Supply Network



South Staffordshire Water, Hayley Green Supply Zone Schematic



N.B. Although trunk mains between Churchill and Hagley, the only place supplied is Iverley. Principally area of supply commences at/near Hayley reservoir/Clent booster and extends to north and east, including Romsley.

Appendix D
Guidance

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GUIDANCE NOTE:
DEALING WITH SURFACE WATER

1. Requirements of PPS25 regarding surface water management

Urban developments can have a big effect on the quantity and speed of surface water runoff. By replacing vegetated ground with buildings and paved areas the amount of water being absorbed into the ground is severely reduced, therefore increasing the amount of surface water present. This additional surface water increases the demand on drainage systems in built up areas. Traditional drainage systems are designed to get rid of the water as quickly as possible to prevent flooding in the built up area. This can cause problems, particularly downstream, by altering the natural flow patterns of the catchment. In addition, water quality can be affected due to pollutants from the built up areas being washed into the watercourse due to the lack of treatment of the water. One technique which can reduce this problem is the use of Sustainable Drainage Systems (SUDS).

2. What are SUDS?

Sustainable Drainage Systems (SUDS) are techniques designed to control surface water runoff before it enters the watercourse. They are designed to mimic natural drainage processes, along with treating the water to reduce the amount of pollutants getting into the watercourse. They can be located as close as possible to where the rainwater falls and provide varying degrees of treatment for the surface water, using the natural processes of sedimentation, filtration, adsorption and biological degradation.

3. The Purpose of SUDS

SUDS are more sustainable than traditional methods because they can:

- Manage the speed of the runoff
- Protect or enhance the water quality
- Reduce the environmental impact of developments
- Provide a habitat for wildlife
- Encourage natural groundwater recharge.

In addition, they can be used to create more imaginative and attractive developments and are designed so that less damage is done, than conventional systems, if their capacity is exceeded.

4. Places where are SUDS appropriate

Surface water management using SUDS can be implemented at all scales and in most urban settings, ranging from hard-surfaced areas to soft landscaped features, even if there is limited space. Most techniques use infiltration but even if the area has little or no infiltration SUDS can still be used in the form of green roofs, permeable surfaces, swales and ponds.

5. The different types of measures

SUDS are made up of one or more structures built to manage surface water runoff, and used in conjunction with good site management. There are five general methods, listed below. These are shown

in hierarchial order in terms of the 'management train', described in the CIRIA SUDS Manual, 2007 (Prevention ➔ Source Control ➔ Site Control ➔ Regional Control). The techniques that are higher in the hierarchy are preferred to those further down so that prevention and control of water at source should always be considered before site or regional controls, such as balancing ponds and wetlands.

i. **Prevention** – this can involve minimizing paved areas, replacing tarmac with gravel, rainwater recycling, cleaning and sweeping, careful disposal of pollutants, and general maintenance.

ii. **Filter strips and swales** – these are vegetated surface features that drain water evenly off impermeable areas. Swales (figure 1) are long shallow channels whilst filter strips (figure 2) are gently sloping areas of ground. Both of these mimic natural drainage by allowing rainwater to run in sheets through vegetation, slowing and filtering the flow.

Figure 1 - Cross-section of a Swale

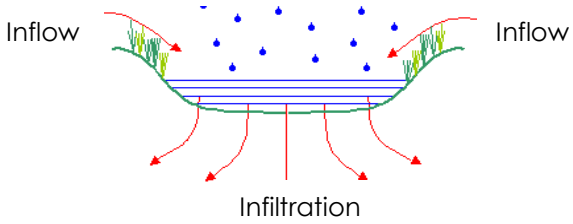
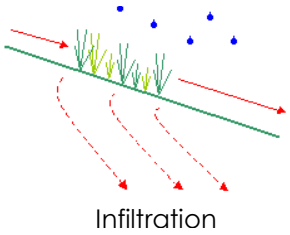


Figure 2 - Cross-section of a Filter Strip



iii. **Permeable surfaces and filter drains** – these are devices that have a volume of permeable material below ground to store surface water. Runoff flows to this storage area via a permeable surface.

iv. **Infiltration devices** – these enhance the natural capacity of the ground to store and drain water. They include soakaways, infiltration trenches and infiltration basins. See figure 3.

v. **Basins and ponds** – these are areas for storage of surface runoff e.g. floodplains, wetlands, and flood storage reservoirs. They can be designed to control flows by storing water then releasing it slowly once the risk of flooding has passed. See figure 4.

Figure 3 Cross-section through an Infiltration Basin

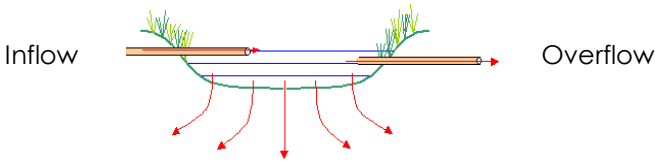
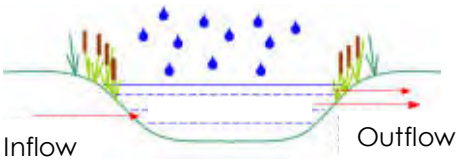


Figure 4 - Cross-section of a Pond



Water level varies in the pond

6. References

Information taken from:

- *Planning Policy Statement 25 – Development and Flood Risk*, December 2006
- www.ciria.org/suds
- The SUDS Manual, 2007 (CIRIA C697)