Coventry City Council

Coventry Water Cycle Study

Final Report

3 November 2015

Amec Foster Wheeler Environment
& Infrastructure UK Limited

Report for

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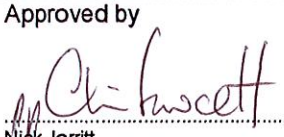

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Document revisions

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1	Draft	28/09/2015
2	Final	03/11/2015

Contents

Executive summary

Purpose of this report

This report has been produced for the purpose of helping Coventry City Council progress it's Local Plan and to establish the constraints to development from existing environmental and water infrastructure capacity. The purpose of this is to provide an informed platform for discussion between the Coventry City Council, the Environment Agency, and Severn Trent Water, plus other stakeholders. This report is aimed specifically for use by Coventry City Council but recognises that the information within it will also be of interest to neighbouring Local Authorities whilst they develop their own Local Plans.

Three phases were undertaken to complete this Water Cycle Study. A Baseline Assessment was completed to provide understanding of the existing capacity of the infrastructure and environment within the Coventry City Water Cycle (Phase 1). The proposed growth plans (2011 – 2031) within Coventry City are then summarised, with the subsequent phase (Phase 2) assessing the potential for the existing infrastructure and environment to accommodate these plans. Phase 3 recommends actions and considerations likely to be required to support the longer term growth proposals up to 2031.

Summary conclusions from the key disciplines that affect the water environment are:

- Water supply: water resources used to supply this area with drinking water are under pressure and whilst Severn Trent Water is able to undertake system improvements to augment resources and reduce leakage, managing demand remains a core part of the solution. This puts impetus on the Council to ensure that all new developments are built to conform to at least the basic levels of water efficiency. It is important that development is phased carefully and appropriately to ensure that water supply infrastructure is not a constraint. Any constraints should only be temporary as Severn Trent Water has a planned programme of water mains renewal to improve the quality and reliability of supplies to customers (to include mains upsizing). The company is in the early stages of assessing the investment needs for the study area and will confirm the detailed mains programme by 2020.
- Waste water and sewerage: there is generally capacity in the existing wastewater treatment and sewerage infrastructure to accommodate growth, but limitations exist in terms of phasing development with required (capacity or WFD initiated) upgrades. Severn Trent Water will provide the necessary sewerage and WwTW capacity in parallel with the development of the individual sites, in collaboration with developers and the planning authority, as part of the requirements of Section 94 of the Water Industry Act.
- Flood risk: there is generally capacity to accommodate growth. At individual sites fluvial flood risk is low or can be mitigated against. Whilst surface water flood risk is widespread across the city, for many of the potential development sites, development can be laid out sequentially to avoid areas of risk. Careful planning of developments will ensure minimal additional pressure put on existing systems by utilising natural attenuation and infiltration methods. Each development must be assessed independently for groundwater flood risk.

The information used in this study includes data and reports published by Coventry City Council, the Environment Agency, and Severn Trent Water, plus data and commentary submitted by the parties specifically to inform the study. It is assumed that all information and documents provided to Amec Foster Wheeler at the time of writing the report are accurate, complete and not misleading.

It is assumed that this report will be made publicly available. Third parties should be aware that this report is based on technical data and analyses but it is not intended to be a 'technical' document. Interested third parties should not use the content as an alternative to referencing the original data material and with regard to external parties' development plans it should be used as a starting point to support rather than bypass discussions with Coventry City Council.

1. Introduction

This introductory section of the report provides a background to the requirement for this Water Cycle Study which will form part of the evidence base for the Coventry City Council Local Plan. The specific aims of the study, and the guidance followed are summarised. A clear scope and approach to completion of the Water Cycle Study is provided.

Background and purpose

Coventry is now the UK's 13th largest city, but the influence of the city centre reaches wider than the city's boundary and covers a population in excess of half a million people[1]. The 2011 Census identified Coventry's population at 316,900 people, a growth of around 5% since the previous census in 2001. As a result, subsequent population projections have identified Coventry as having one of the fastest growing populations in the country[1] .

In September 2014, the strategic Housing Land Availability Assessment (SHLAA) for Coventry identified that Coventry needs to plan for a minimum of 23,600 homes (between 2011 and 2031), where possible and sustainable within its own boundary. A Local Plan is currently being prepared to set our how this objectively assessed development need will be delivered. Ensuring that this can be done in an appropriate and sustainable manner, within the capacity of both the environment and supporting infrastructure, is a key component of an effective Local Plan. Alongside this there must be sufficient flexibility to adapt to rapid change whilst consideration must also be given to adverse impacts and ensuring that they do not outweigh the benefits of development. This Water Cycle Study will provide the evidence base for the Local Plan with respect to the water-related environmental and infrastructure capacity to support development. Housing and employment numbers used considered derived from Coventry City Council sources and were accurate at the time they were made available (July 2015). The assessment in this report does not include any subsequent changes to these numbers.

Coventry City Council commissioned Amec Foster Wheeler to undertake a Water Cycle Study to support decisions on where and when housing growth should be targeted and to inform water related policies that may be included in the Local Plan.

1.1 Aims and objectives

The purpose of this study is to provide the Coventry City Council (and stakeholders) with a document that clearly demonstrates an appropriate level of consideration and investigation into the water issues that could constrain development and influence Local Plan policies.

The Water Cycle Study is a core pieces of evidence to support the Local Plan. The specific objectives are to:

- undertake a review of the existing water cycle processes and infrastructure capacity;
- assess the capacity of current water infrastructure to accommodate required growth without adversely affecting the environment by considering:
  - the availability of water resources and the supply network;
  - the capacity of existing wastewater infrastructure and the drainage network;
  - the environmental capacity of receiving watercourses to receive wastewater; and
  - the potential of development to increase flood risk.

[1] Coventry City Council, City Centre Area Action Plan The preferred approach (February 2015)

- Determine the potential impact of proposed development in the context of environmental legislation including the Water Framework Directive (WFD), Habitats Directive (HD), and any other relevant water or statutory planning policy;
- identify the infrastructure options necessary to achieve proposed growth within the constraints of the environment and legislation; and
- develop a strategy for a phased approach to development that allows key growth targets to be met whilst providing sufficient time for the identified infrastructure to be adopted.

1.2 How to use this report

This report incorporates a Baseline Assessment (Scoping) followed by a Capacity Assessment (Outline), with the various stages of a Water Cycle Study defined in Section 1.3. The Baseline Assessment looks to provide clarity on the current water cycle processes and infrastructure capacity within Coventry City. The Capacity Assessment considers the water cycle processes in the context of future growth plans and is supported by a development strategy which presents conclusions on the implications for growth and is intended to help Coventry City Council progress its Local Plan and facilitate timely interactions with the water utilities, Environment Agency, developers, and other stakeholders.

This report is aimed specifically for use by the Coventry City Council but recognises that the information within it will also be of use to other Local Authorities whilst they develop their own Local Plans. This study is designed to reflect the need for assessment in 2015 but also to continue to provide evidence as planning options and priorities continue to evolve.

- Chapter 1 sets out the rationale for this study and the approach and scope;
- Chapter 2 describes the water cycle and sets out the concepts of integrated water management and the relevant water management legislation;
- Chapter 3 presents the results of the Baseline Assessment: water resources and supply, wastewater treatment and sewerage, and the Strategic Flood Risk Assessment baseline flood characterisation;
- Chapter 4 presents the proposed housing and employment planned between 2011 and 2031 that form the basis of the Capacity Assessment;
- Chapter 5 presents the results of the Capacity Assessment: water resources and supply, wastewater treatment and sewerage, and the Strategic Flood Risk Assessment considering the future growth plans; and
- Chapter 6 recommends actions and considerations that are likely to be required to support the longer term growth proposals up to 2031.

A ‘traffic light’ system is used to visually present the constraints assessments in each topic area. The key for the traffic light system is as follows:

	Development ok, no constraints identified
	Development may be ok, some constraints identified, minor mitigation required to meet the proposed growth
	Constraints identified, development may be ok with major mitigation to meet growth targets
	Advise development site is not taken forward due to major constraint/ unsustainable solutions

1.3 National guidance on water cycle studies

The Environment Agency issued a National Guidance document to ensure that water cycle studies are carried out in a consistent way. This guidance outlines the required approach for the Scoping, Outline and Detailed phases of water cycle studies.

The National Guidance on Water Cycle Studies indicates that the assessment should be carried out in three phases:

- Scoping: The primary aim of the Scoping Assessment is to collate and review existing information (e.g. previous studies and monitoring data) on the water environment within the study area, identify development plans and engage with key stakeholders, including the Environment Agency, water companies and drainage authorities, to identify key issues that require consideration in the following stages of the work;
- Outline: The primary aim of the Outline Assessment is to identify potential environmental and water infrastructure constraints to development to provide an evidence base to support the Local Plan and identification of preferred sites for development. The Coventry City Council Strategic Housing and Land Availability Assessment (SHLAA) data is applied during this assessment. It is recommended that the study identify areas of uncertainty that may require further detailed studies if necessary;
- Detailed: The Detailed Assessment aims to resolve areas of uncertainty identified in the Outline Assessment through further more detailed studies. It identifies what water cycle management measures and infrastructure are needed, where and when they are needed, who is responsible for providing the systems, and by what deadline. This may involve an assessment of the costs and benefits of options. It also provides guidance to the local authorities to facilitate implementation and funding of the Strategy.

This report incorporates both a Baseline Assessment (Scoping Phase) and Capacity Assessment (Outline Phase). This study does not include a Detailed Assessment, the details and requirement of which would be based on the outcomes of the Outline Phase.

1.4 Local plans and water cycle studies

The need to examine existing water and environmental infrastructure in the Coventry City area is driven by a requirement to align growth with infrastructure provision and so the context in which this study is undertaken is framed by:

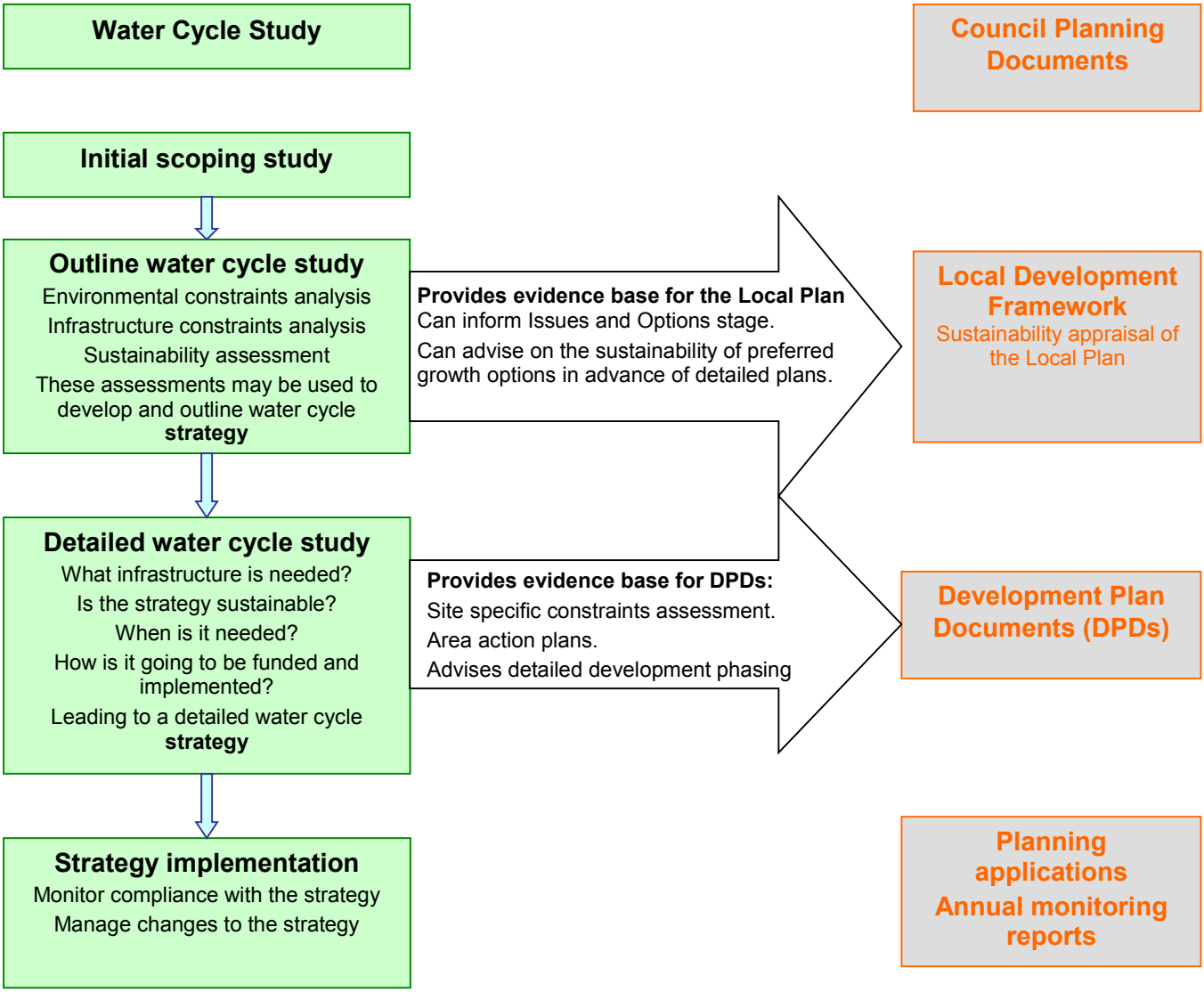
- The scale and distribution of growth to be provided;
- Relevant national and local planning policies; and
- The asset management plans of infrastructure providers.

Figure 1.1 summarises how the various stages of the Water Cycle Study relate to the Local Development Framework process.

In parallel to this Water Cycle Study the Strategic Flood Risk Assessment (SFRA) that was undertaken in 2008 is also being updated for Coventry City Council. This will provide further supporting evidence for the Council's Local Plan. Both the Water Cycle Study and the SFRA update will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management. The updated SFRA was not available for consideration at the time of writing this assessment but will provide a key source of information to complement this report[2].

[2] Coventry City Council, Level 1 and 2 Strategic Flood Risk Assessment Draft Report. Written and Prepared by JBA Consulting Ltd (September 2015)

Figure 1.1 Planning context of Water Cycle Studies



1.5 Scope and approach

Study area

Coventry City Council administrative boundary covers an area of 99km^2 located in central England, approximately 15km south east of Birmingham and approximately 10km north of Leamington Spa. It is predominantly urban, covering the areas of Tile Hill and Eastern Green to the west, Foleshill and Willenhall to the east, Holbooks to the north and Finham to the south. In the north-west the administrative boundary includes a rural expanse covering a number of small settlements including Pinkett's Booth, Pickford Green, Harvest Hill and Brownshill Green as well as smaller scattered dwellings and farms.

The study area is underlain by a bedrock geology of sandstones, mudstones and Siltstones, and an upper superficial geology of Alluvium, Bosworth Clays and Oadby Member. The majority of the area is flat or mildly undulating.

There are two main Rivers that flow south through the City, the River Sherbourne and the River Sowe (Figure 1.2). The upper reaches of the River Avon are located outside the south eastern boundary of Coventry City Council administrative area, which also flow south. These rivers join south of Coventry and continue to flow south through Warwick as the River Avon. Further west of Coventry is the River Blythe, which flows in a northerly direction between Coventry and Birmingham to join the River Tame near Sutton

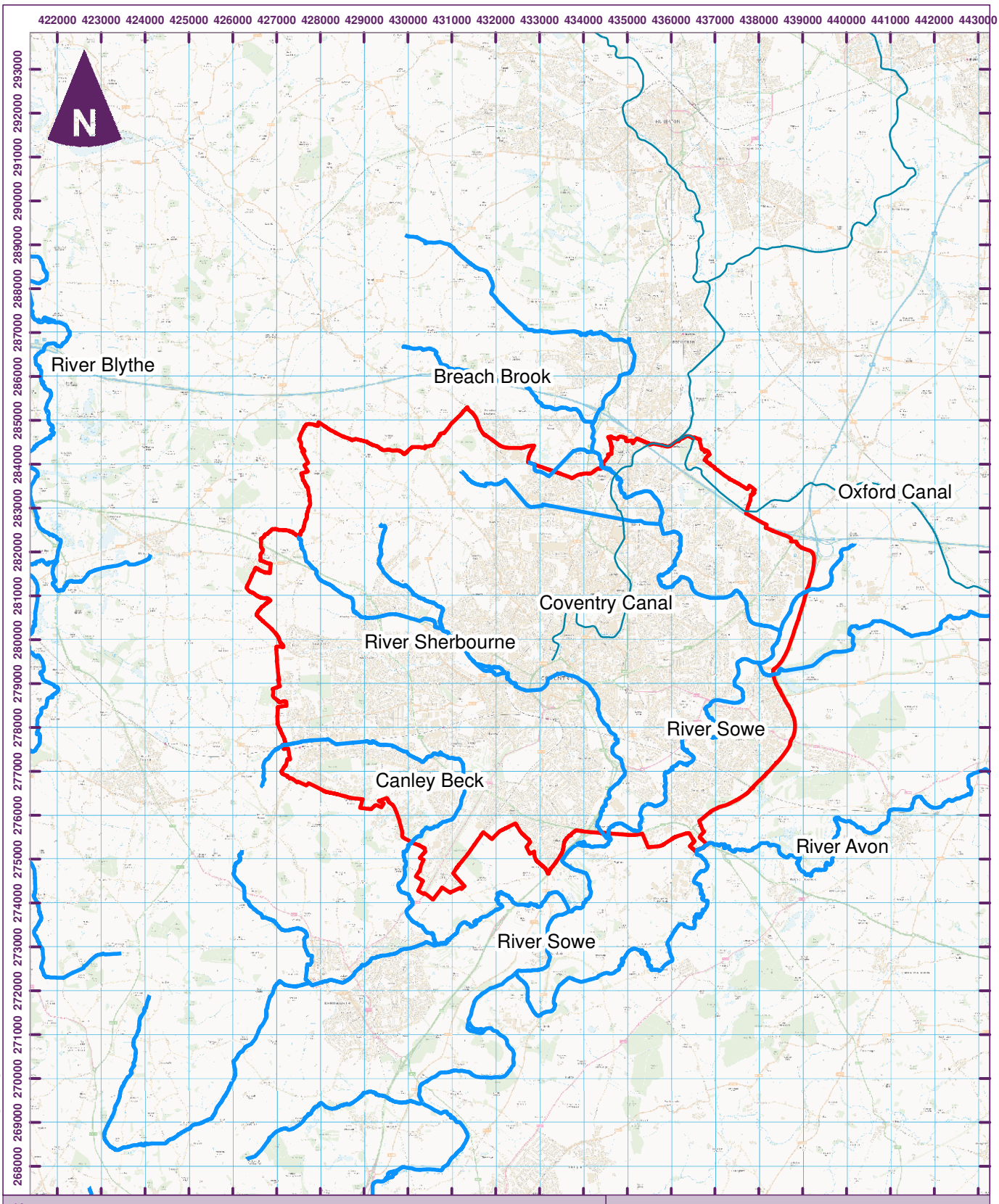
Coldfield. The Coventry Canal is located just north of Coventry City Centre and flows north, later joined by Oxford Canal, before forming part of the Ashby Canal north of Bedworth. The Canal and Rivers Trust confirm that this canal is not hydrologically connected to the River Sowe (the River Sowe being culverted under the Canal) with no weirs or sluices connecting the flows.

Based on the underlying bedrock geology the majority of the central and western part of the administrative area is underlain by Principal aquifer that provides high levels of water storage and can support water supply and/or river base flows on a strategic scale. The eastern part of the site is underlain by Secondary B aquifer which may store and supply limited amounts of water.

The City and its surrounding areas contain a number of designated sites of European, national, and local importance. Figure 1.3 illustrates the designated sites within the Coventry City Council administrative area and surrounding areas. SSSI sites are designated by Natural England under the Wildlife and Countryside Act 1981 to offer protection to the best sites for wildlife and geology in England. There are two SSSI sites within the Coventry City Council administrative Area, with others located in the surrounding areas. No SPA, SAC, Ramsar, AONBs or National Nature Reserves have been identified with the Coventry City Council administrative boundary or surrounding area. Designations can also be created by local authorities under the National Parks and Access to the Countryside Act 1949, identified as sites of local importance for nature conservation that are not legally protected. These designations include Local Nature Reserves (LNRs), places with wildlife or geological features that are of special interest locally. There are 16 Local Nature Reserves located within the Coventry City Council administrative boundary, and a number located in the surrounding area (Figure 1.3). There are also 64 designated Local Wildlife Sites (LWS) (680.29ha) within the Coventry City Council administrative area, and a further 20 potential Local Wildlife Sites[3] (Figure 1.3).

In this Water Cycle Study, only designated sites that are water dependant and located downstream of WwTWs are considered (Section 3.3), as these have the potential be affected by growth plans.

3 A site almost meets local criteria for LWS or is awaiting review for inclusion in the LWS list.



Key

- Canal
- Watercourse
- Coventry City Council Administrative Area

0 0.5 1 1.5 2 2.5 Kilometers

Scale at A4: 1:125,000

Coventry Water Cycle Study

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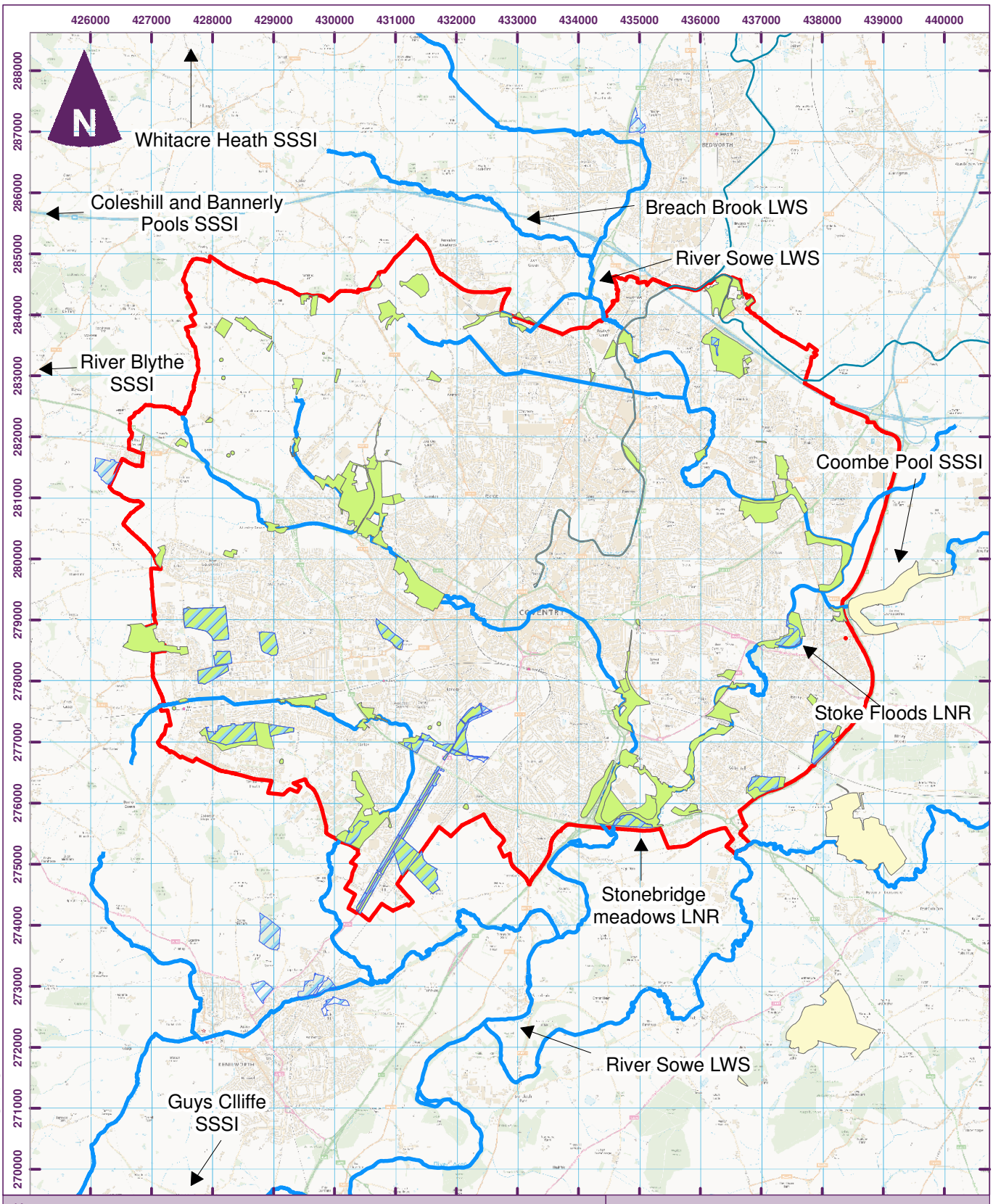
Figure 1.2
Coventry City Council Administrative Area



Key

- Canals
- Watercourses
- Existing and potential LWS
- Local Nature Reserves
- SSSI sites
- Coventry City Council Administrative Area

0 0.4 0.8 1.2 1.6 2 km

Scale at A4: 1:89,878

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Figure 1.3
Coventry City Council Designated Sites

Scope

The focus for development, and therefore the geographic scope of this assessment, is the main urban area of Coventry and the rural area to the north west of the City, all constituting the Coventry City Council Local Authority area. The study also includes wider 'spheres of influence' where it needs to be considered in the context of existing infrastructure across the Coventry City area. The study area is thus delineated as the Coventry City Council Local Authority area but relevant consideration is given to the catchment areas of the wastewater treatment works (WwTWs) that extend beyond the authority boundary and associated receiving waters (Section 3.3), and the water resource zones and catchments from which water is supplied to Coventry (Section 3.2).

The development horizon applied to this study is the period 2011 to 2031, although consideration is made of the fact that developments in the early years have already occurred. Both housing growth plans and commercial development are considered in this study.

Involvement of stakeholders

A Steering Group was formed to generate support and ownership across the core organisations whose operational and planning activities directly interact with those of Coventry City Council, in terms of the development proposals. The Steering Group is composed of representatives of the core organisations with responsibility for development planning, water infrastructure services, and environmental regulation:

The Steering Group was comprised of:

- Severn Trent Water: Data and information on water resources and supply; and wastewater and sewerage constraints and plans; and
- Environment Agency: Overarching interest that the study makes adequate assessment of the various water resource, water quality, groundwater, and the range of flood risk issues in the area and that the most robust information is used to support this.

A Stakeholder Assessment was undertaken and discussion with the Steering Group concluded to notify the following organisations about the Water Cycle Study being undertaken as an evidence base to support the Local Plan, and where relevant work with them to collate evidence to support the assessments:

- Warwickshire County Council: Lead Local Flood Authority (LLFA) responsible for a range of tasks required to prepare and maintain a strategy for local flood risk management;
- District Councils (North Warwickshire, Warwick and Stratford): Interested in wider scale issues that could be relevant to development and growth plans for which they remain responsible;
- Borough Councils (Rugby and Nuneaton and Bedworth): Interested in wider scale issues that could be relevant to development and growth plans for which they remain responsible;
- Solihull Metropolitan Borough Council: Lead Local Flood Authority (LLFA) responsible for a range of tasks required to prepare and maintain a strategy for local flood risk management;
- Coventry University: Significant research and knowledge on drainage and flooding within Coventry and interested in the findings of the Water Cycle Study
- Natural England: Concern that development plans recognise and take into consideration the requirements of designated sites;
- Warwickshire Wildlife Trust: Concern about the potential impact of large scale development on nature reserves and other sites important to the Wildlife Trusts; and
- Canal and Rivers Trust: Potential concern about the potential impact of large scale development on Coventry and Ashby Canals;

The stakeholder assessment also identified developers as a stakeholder group that ultimately will be interested in the study particularly if the constraints assessments and water infrastructure plans affect

decisions on the acceptability or timing of development sites to proceed. At this stage the development plans are not yet advanced to the point where specific developers have a recognised interest in specific sites.

Consultation and data sources

Implementation of the Coventry County Council Local Plan will affect local people and businesses and, as an important document consultation is core to its development. Coventry City Council has a consultation programme to ensure all stakeholders in the area are able to contribute to the plan. However, it is unfeasible to consult on every individual component of the evidence base. Whilst the steering group has been consulted on the technical content of this study and the Water Cycle Study may be made publicly available, it has been decided not to actively consult more widely on that technical content primarily because the vast majority of information used in the study is taken from data and plans provided by third parties which have already been subject to consultation on their own merits. Section 6 of this report sets out recommendations for the Coventry City Council to ensure that development in this area is sensitive to the local constraints and follows sustainability principles. Any further policy development, e.g. if water efficiency standards that deviate from national standards are to be implemented locally, this would be subject to consultation when the Local Plan is developed. Table 1.1 summarises the core sources of information used and consultation undertaken to complete this study.

To support the assessment of water resources Amec Foster Wheeler reviewed relevant content of a number of documents including the Water Act 2003; Water Industry Act 1991 and the Severn Trent Water Resource Management Plan (2014); and guidance on the Code for Sustainable Homes (Department for Communities and Local Government, 2010) for reference to water efficiency in new homes.

To support the assessment of wastewater treatment and water quality capacity Amec Foster Wheeler reviewed content of the Water Framework Directive and Habitats Directive with regard to objectives relevant to Coventry City Council; detailed information from Severn Trent Water on its discharge consents and existing capacity relevant to the study area plus discussions with Severn Trent Water regarding options for increasing capacity. The Environment Agency and Warwickshire Wildlife Trust were consulted on receiving water WFD objectives, and Local Wildlife Sites downstream of Waste Water Treatment Plants.

To complete the review of flood risk relevant to development in the study area, Coventry City Council, the Environment Agency, and Coventry University were consulted to discuss the issues picked up in the Scoping study and collate more up to date data and information. Full details of the sources of information used in the flood risk review are listed in Section 3.4.

Table 1.1 Aspects of the study and data source

Aspect of study	Data source
Potential development (locations, property type, numbers)	Strategic Housing Land Availability Assessment (SLAA), September 2014 GIS shape files and direct discussions with Coventry City Council Coventry, Warwickshire and South East Leicestershire Economic Prosperity Board meeting, Nov 2014 Consultation with North Warwickshire Borough Council Consultation with Solihull Metropolitan Borough Council and Solihull Local Plan, 2013
Biodiversity and designated sites	Geographic information available from Environment Agency Geostore Site Warwickshire Wildlife Trust
Water resources and supply	Water company 2014 Water Resource Management Plans (WRMPs). Catchment Abstraction Management Plans.
Wastewater treatment capacity	Water Framework Directive (Environment Agency Catchment Data explorer) Severn Trent Water
Sewerage	Severn Trent Water Environment Agency (CSO Design Criteria information)
Flood risk	Coventry City Council Strategic Flood Risk Assessments: Level 1 and Level 2 Coventry City Council Draft Surface Water Management Plan Coventry City Council Draft Flood Risk Management Strategy Coventry City Council Preliminary Flood Risk Assessment Environment Agency (2009) River Severn Catchment Flood Management Plan

2. Water cycle

This section provides an overview of the water cycle in advance of presenting the outcomes of the Baseline Assessment and Capacity Assessment in later sections. The water cycle describes the interconnectivity between the environment and water within the natural and urban environments. Specific elements of this cycle and the processes by which they connect are important to this study in the context of Coventry City.

2.1 Introduction

The water cycle describes the pathways and processes through which the water we use moves through the natural and built environment, as well as through the above and below ground infrastructure on which the domestic population and industry depend. Figure 2.1 illustrates the traditional image of the water cycle showing how water enters a river catchment, how it runs through and over the land, before returning to the river system and ultimately returning to the sea.

Figure 2.1 Traditional view of the water cycle without artificial influence

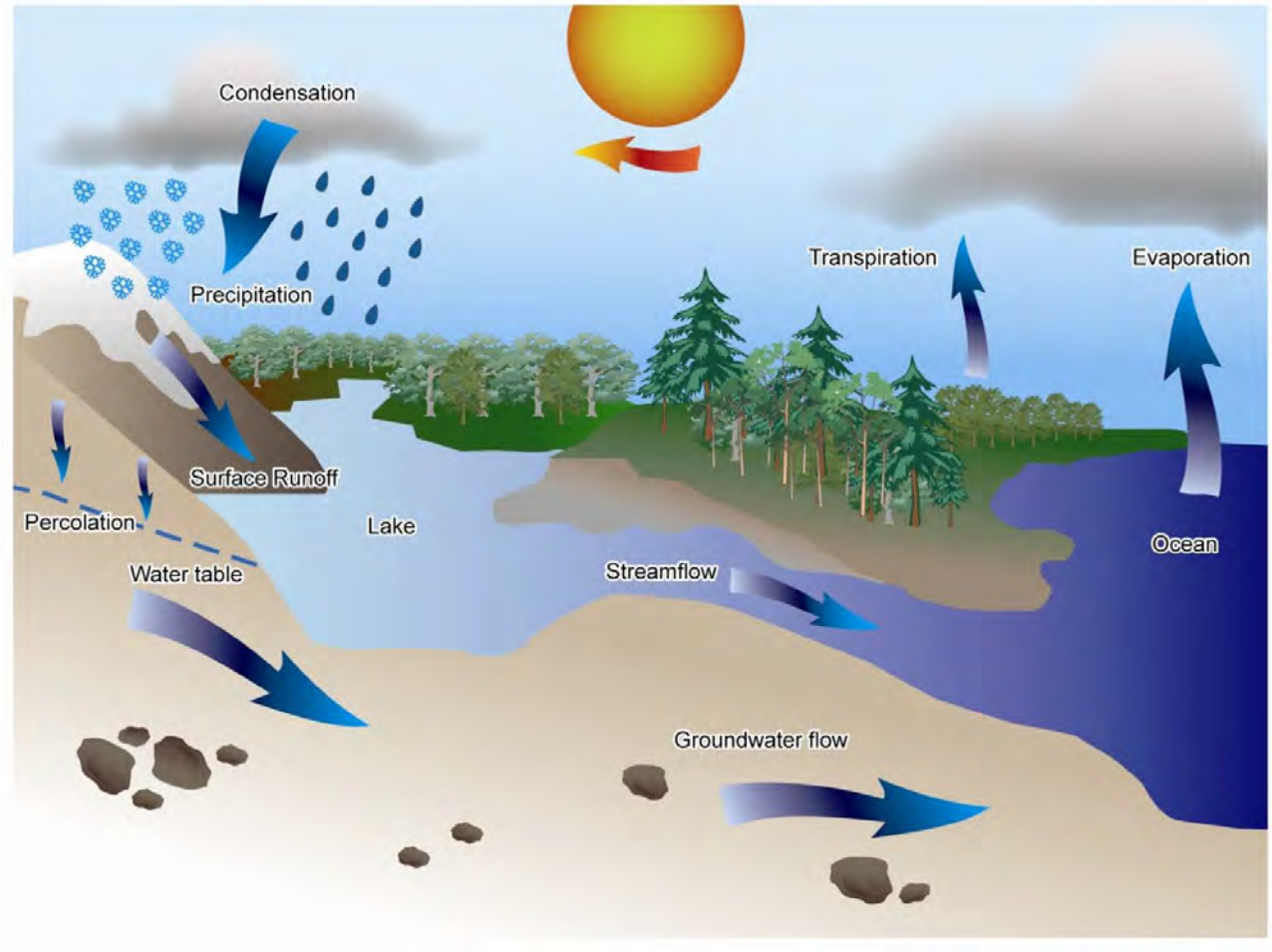
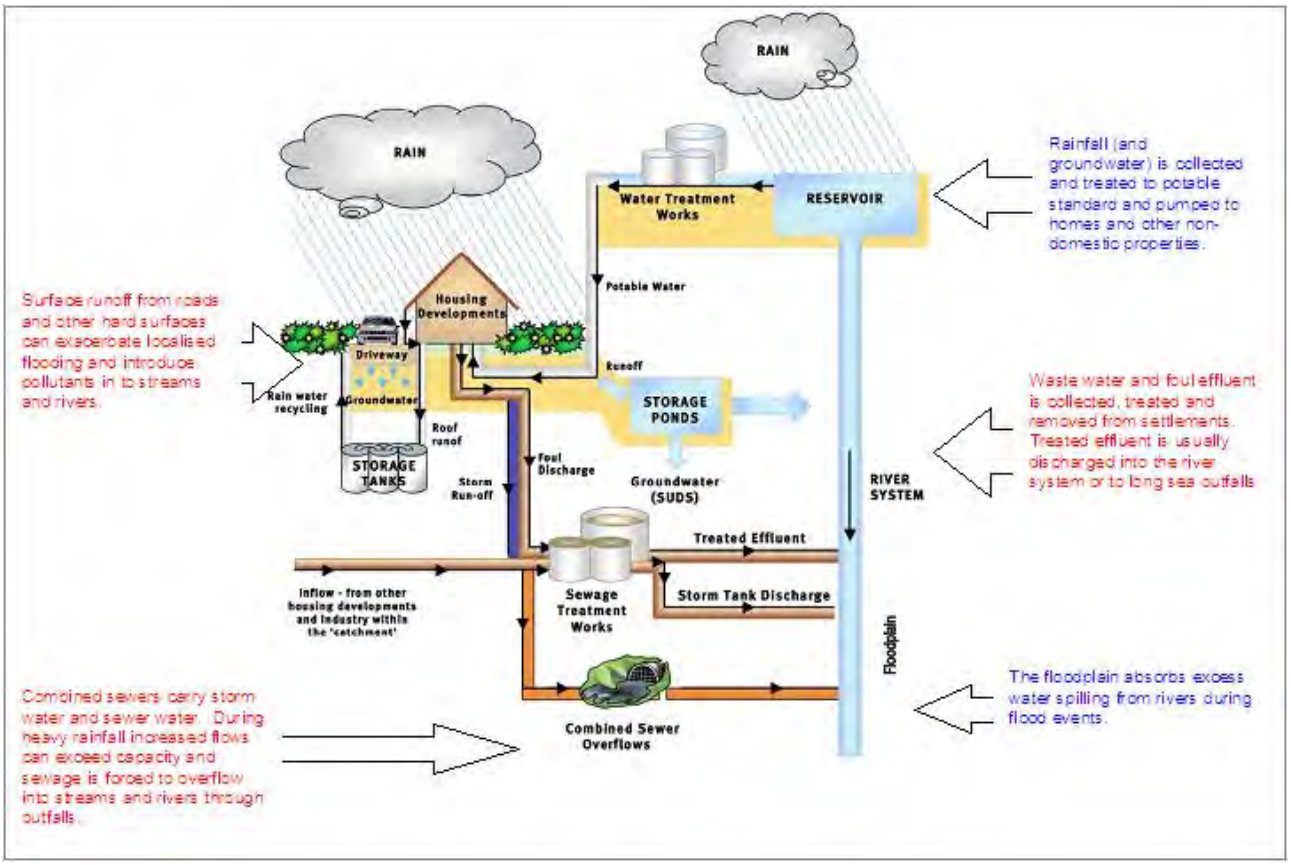


Figure 2.2 illustrates the added complexities within the urban water cycle (in schematic form) as a result of housing development and the infrastructure required to support it. The main differences between the natural and the urbanised water cycle relate to the rate of surface runoff (and infiltration) and overland stream flow. In the urbanised cycle, water is captured and stored for use, and this water only re-enters the river network once it has been used and then treated at wastewater treatment works. Hence, the timing and quality of water entering the river network can be significantly different in the urban version of the cycle.

Figure 2.2 Schematic of the urban water cycle based on current practice



The capacity of the water infrastructure needs to be sized appropriately to ensure the sufficient supply of clean water to homes and industry and to receive foul drainage, whilst preventing the discharge of polluted runoff and untreated foul drainage to protect the quality of the receiving water and any dependant habitats, whilst also reducing the risk of flooding.

2.2 Integrated catchment management

Integrated Catchment Management is an approach that is designed to identify various catchment issues and meet environmental objectives by considering the various land uses and catchment processes as components within an integrated system, and by examining issues, not in isolation but as a product of all activity within the catchment.

Environmental objectives take many forms but the most relevant in terms of this Water Cycle Study are the river water quality objectives including the impact of low and high flows. Understanding how water moves through a catchment is fundamental to managing low flows, increasing resilience to flood risks, and improving water quality.

It is important to understand the different scales at which the elements of the water cycle (water supply, sewerage and drainage) are managed, and the impacts this has on assessing constraints to growth. Water supply is managed strategically, as there is a high level of connectivity in the water supply network and water can be moved great distances from the raw water sources (rivers, reservoirs, or groundwater) to the point of delivery. Generally, new developments can be connected to the main system relatively easily. In contrast, wastewater treatment works have much smaller defined catchment areas and so the location of development relative to the capacity of the nearest treatment works and receiving water can be critical. Although drainage issues are specific to individual developments, the integration of drainage development across sites offers significant potential for green space/ habitat creation, in addition to reducing flood risk and potentially water demand.

Water quality objectives

The capacity of the receiving water environment, and thus development in the study area, is constrained by environmental quality objectives enforced by UK and European legislation. The Water Framework Directive (WFD) is European legislation that aims to consolidate existing legislation. It came into force in December 2000, and was transposed into UK law in 2003. It introduces new environmental standards that will help to improve the ecological health of inland waters to achieve 'Good Status'. Delivery of the WFD is managed at a 'River Basin' scale. There are eleven river basins covering England and Wales. Coventry City is within the Severn River Basin District.

The main aims of the WFD are to prevent deterioration and enhance the status of the water environment, including groundwater. This will be achieved within a framework of River Basin Planning by:

- reducing pollution;
- promoting sustainable water use; and
- contributing to mitigating the effects of floods and droughts.

The Baseline Assessment (Section 3) examines the existing and target WFD water quality objectives of the water receiving treated wastewater effluent and explores the parameters contributing to the quality assessments whilst the Capacity Assessment (Section 5) focuses on the relationship between these issues and the potential growth plans in the Coventry City area. This is specifically the impact of increased demand for wastewater treatment on activity at the treatment works and pressure on the receiving waters. Water quality issues often have multiple contributing factors and these are mentioned for reference, although where not directly related to housing growth in the local area, these are not examined in detail.

As well as discharges from treatment works the way that water moves through a catchment has significant impacts on water quality and the appearance of water bodies. Imposition of the urban water cycle (Figure 2.2) upon the natural environment alters the routes that water takes to move through the catchment, the quality of the water, and the speed with which it moves. The volume and speed of surface water run-off, and the nature of the land over which it runs, affects rates of diffuse pollution, from farmland and urban surfaces.

Traditionally piped drainage was designed to convey rainfall away from developments as quickly as possible; however this can lead to water entering rivers more quickly in urban areas compared to rural catchments and can result in flooding. Sustainable drainage systems (SuDS) is the name given to drainage techniques that aim to mimic natural processes, rather than using traditional piped urban systems. Sustainable drainage systems use grassed ditches and ponds, for example, instead of pipes to control rainfall. These allow some rainfall to soak back into the ground, and this slows down the movement of rainfall runoff in the catchment. Vegetation in these systems can also reduce the amount of urban pollutants entering watercourses and groundwater sources. The applicability of SuDS varies spatially, primarily due to local geology. The feasibility of SuDS in relation to the Coventry City is discussed in Section 6.

Pressure on water infrastructure and the water environment can also be decreased by reducing the volume of water used in homes and other buildings. In the UK, all water that is supplied to properties and business from water companies is treated to a standard suitable for drinking.

Water efficiency measures help to reduce the volume of water abstracted from rivers and groundwater sources, reducing the pressure on natural ecosystems and increasing the volume of water available for diluting both point source and diffuse pollution. Installing devices that reduce water use also reduces pressure on the sewerage network (notwithstanding blockages) and reduces the volume of wastewater that has to be treated at and then discharged from wastewater treatment works. There are also efficiencies gained from reduced energy consumption that would be required to pump, heat and treat this saved water.

The urban water cycle is complex and highly integrated with many feedback mechanisms. Advanced planning and appropriate management helps to ensure that the water cycle contributes to a safe, clean and healthy environment, rather than being a source of long term problems.

2.3 Legislation and guidance

Legislation, guidance and supporting evidence for water related issues, such as water quality, flood risk management and urban drainage, have a significant impact on the water cycle and are often the cause of changes in water infrastructure, as much as development pressures. Any adaptations to the water cycle must be compliant with such legislation and some are undertaken within the regulatory framework.

There is currently a significant level of change in the legislation and guidance for water related issues. Some of these changes are driven by European directives; others are in response to national pressures, from the 2007 summer floods for instance. These changes are either currently being implemented, soon to be applied or likely to change in next five to ten years. The timetable for the Water Framework Directive spans another 13 years until 2027. The first management cycle finishes in 2015 by which time the water companies and the Environment Agency expect to have carried out the majority of investigations to establish the necessary investment and achieve the WFD targets for many waterbodies. This cycle provides an opportunity to assess the improvements delivered through other quality investments. During the second management cycle (2015-2021) the River Basin Management Plans will be reviewed and action plans to improve water quality and 'Ecological Status' of more problematic waterbodies will continue to be implemented. The final cycle will take place between 2021 and 2027 at the end of which all waterbodies are expected to achieve 'Good Ecological Status' where possible.

The primary pieces of legislation which set the context relating to the water cycle are summarised in Table 2.1.

Table 2.1 Primary water related legislation

Water Framework Directive	The Water Framework Directive sets out a requirement to achieve Good Ecological Status in rivers, estuaries and coastal waters, together with Good Status of groundwater by at least 2027. It presents a unique opportunity for holistic environmental management for all users of the water environment. A cross-body Technical Advisory Group (UKTAG) has published environmental standards and thresholds. Whilst there is no certainty that these standards will become statutory in the current form, they form the best current knowledge of how the standards may change.
Habitats Directive	As people make increasing demands on the environment, wildlife habitats are coming under more and more pressure. The Habitats Directive recognises this and aims to protect the wild plants, animals, and habitats that make up our diverse natural environment. The European Directives created a network of protected areas of national and international importance. These are called 'Natura 2000' sites and include Habitats Directive Special Areas of Conservation (SACs). The Habitats Directive has been transposed into English law as the Conservation (Natural Habitats &c) Regulations 1994, now known as the Habitats Regulations. Existing and future water management has the potential to affect a number of these designations and the Environment Agency Review of Consents process has identified a series of amendments that will be required to existing abstraction licences and discharge consents if adverse effects on the European Sites are to be avoided.
Urban Wastewater Treatment Directive	The Urban Wastewater Treatment Directive (UWWTD) regulates the collection and treatment of wastewater from residential properties and industry. Under this Directive receiving waters can be designated as 'Sensitive' where additional levels of treatment are required at significant contributing discharges. These can either be direct discharges or those upstream of the designated reach/ water body that serve a population equivalent in excess of 10,000. One type of sensitive area is the "Sensitive Area [Eutrophic]", where elevated nutrient concentrations, mainly nitrogen or phosphorus, present a risk to the ecological status of the receiving water. In these areas, larger sewage discharges must be treated to reduce nutrient loads.
Nitrates Directive	Adopted by the European Union in 1991, this directive aims to reduce water pollution caused by nitrogen from agricultural sources and to prevent such pollution occurring in the future. The directive requires Defra and the Welsh Assembly Government to identify surface or groundwaters that are, or could be high in nitrate from agricultural sources. Nitrogen is one of the nutrients that can effect plant growth. Surface waters also have to be identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water.

	Once a water body has been identified, all land draining to that water is designated as a Nitrate Vulnerable Zone. Within these zones, farmers must observe an action programme of measures which include restricting the timing and application of fertilisers and manure, and keeping accurate records.
Freshwater Fish Directive	The EC Directive on Freshwater Fish is designed to protect and improve the quality of rivers and lakes to encourage healthy fish populations. It sets water quality standards and monitoring requirements for areas of water which are chosen, or 'designated' by Defra. These 'designated' areas of water are selected because they are significant bodies of water which are capable of supporting fish populations.
Floods Directive and Flood Risk Regulations 2009	The Floods Directive is designed to help Member States prevent and limit floods and their damaging effects on human health, the environment, infrastructure and property. The Floods Directive came into force on 26 November, 2007. The Directive requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU. The Flood Risk Regulations 2009 was published in December 2009 to transpose the directive into UK law.
Floods and Water Management Act	The Flood and Water Management Act received Royal Assent on 8 April 2010. It is designed to improve how the UK prepares for and responds to flood emergencies and better protect water quality and water supplies during drought. The Act will provide better, more comprehensive management of flood risk for people, homes and businesses. It will also help tackle bad debt in the water industry, improve the affordability of water bills for certain groups and individuals, and help ensure continuity of water supplies to the consumer. Implementation of the first parts of the Flood and Water Management Act 2010 begins on the 01 October 2010.
National Planning Policy Framework (NPPF) and associated Technical Guidance	This Technical Guidance to the NPPF gives guidance to local planning authorities to ensure the effective implementation of the planning policy set out in the NPPF on development in areas at risk of flooding. The guidance requires that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. The policy aims are set out as follows: **Flood Zone 1** (low probability of flooding) - In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems. **Flood Zone 2** (medium probability of flooding) - In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems. **Flood Zone 3a** – In this zone developers should seek opportunities to: • reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems; • relocate existing development to land in zones with a lower probability of flooding; and • create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage. **Flood Zone 3b** - In this zone, developers and local authorities should seek opportunities to: • reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems; and • relocate existing development to land with a lower probability of flooding.
Water Act 2003	The Water Act 2003 made significant changes to the water abstraction licensing system and water resource planning processes. It adopted a risk based approach and

	deregulated small abstractions (<20m^3/day), introduced all irrigation abstractions into the licensing system and introduced time limited licensing. It also made it a statutory requirement for all water companies to prepare and publicise drought plans and Water Resource Management Plans (which had until that point been voluntary).
Water Act 2014	The Water Act 2014 received Royal Assent on 14 May 2014. The purpose of this Act is to reform the water industry particularly introducing legislation to support competition in water supplies, enabling water trading, and reforming drought management requirements. It also introduces measures to restore the sustainable abstraction of water, to streamline the environmental permitting framework, and to encourage the use of Sustainable Drainage Systems (SuDS).

3. Baseline (Phase 1)

This section of the Water Cycle Study outlines the existing water cycle processes and infrastructure capacity across the Coventry City Council administrative area and identifies any major constraints to development in the study area prior to planned growth. This will provide the baseline against which future growth plans will be considered in Section 5.

3.1 Introduction

The purpose of this assessment is to review and summarise the existing water cycle processes and infrastructure across the Coventry City area. Infrastructure across Coventry City is in place to provide water supply, drainage and removal of waste waters from all existing development. Within the Baseline Assessment connections are made between this and the local hydrology, river flows, quality of watercourses and aquifers and the existing legislation and consent limits that exist to meet the needs of both the 'natural' and 'urban' water cycle.

Comprehensive detail and mapping is provided of the water cycle processes and infrastructure within the Coventry City, sub divided into the four key disciplines that affect the water environment:

- water resources and water supply;
- wastewater treatment;
- sewerage; and
- flood risk.

Due to the direct connectivity between wastewater treatment works and the sewerage network in providing wastewater disposal and treatment across Coventry City these two components are considered within the same section (Section 3.3).

3.2 Water resources and water supply infrastructure

Severn Trent Water supplies housing and commercial properties in Coventry with drinking water. There will also be some private water supply arrangements in the area and many industrial (and agricultural) users that have access to private abstractions (operated under licence to the Environment Agency).

In 2014 Severn Trent Water published its 2014 Water Resource Management Plan (WRMP), as mandated within the Water Act 2003. The plan forecasts supply and demand across a 25 year planning horizon, taking into account forecast changes in population and consumption behaviour, the impact of climate change on demand and water resource availability, and the impact of environmental constraints on the volume of water that Severn Trent Water is permitted to abstract from its network of surface and groundwater sources. At its core, the plan sets out the various options that are available to close any forecast supply deficits, and details the company's preferred solution with cost-benefit justification. In 2014 Ofwat completed its Price Determination governing customers' bills for the period 2015-2020 and essentially approving or rejecting the investments proposed by the water companies to secure supplies (and meet environmental objectives) in their plans. The outcome of the Price Determination for Severn Trent Water broadly supported the content of the company's plan with the exception of two proposed maintenance schemes which Severn Trent Water has announced it will undertake within its own expenditure plans (i.e. not funded by customer bills)[4]. This means that consideration of Severn Trent Water's 2014 WRMP will provide valid outcomes for this Water Cycle Study for Coventry City Council.

In 2017 the market for retail water and sewerage services to non-household customers will be opened (this is a change in law as set out in the Water Act 2014). This means that non-household customers will be able to switch to an alternative water retailer (if one is available), as is already the case in Scotland. However,

[4] Severn Trent Plc - Severn Trent Water response to Final Determination

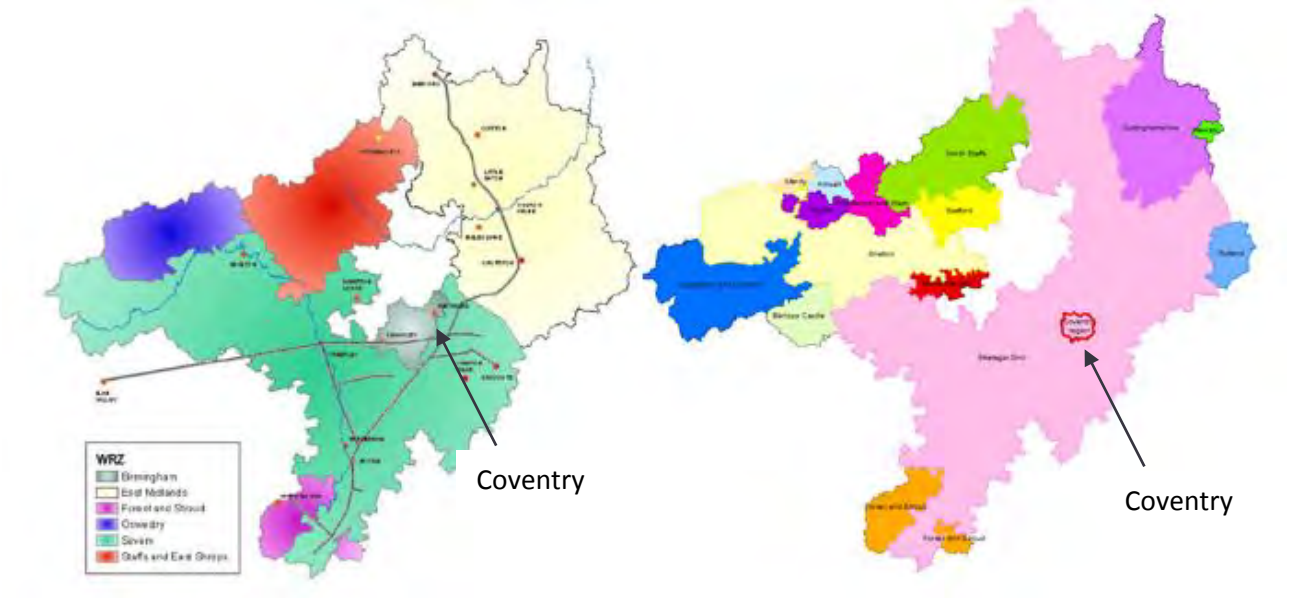
Severn Trent Water will still be the wholesale supplier with responsibility to plan and secure water supplies for all its ultimate customers.

This part of the study is primarily concerned with the water resource and water service infrastructure capacity available to Severn Trent Water to meet the mains supply needs of existing and future customers, including the distributing water to where it is needed (referred to as 'demand centres').

Water resource base

Since 2009 Severn Trent Water has re-configured how it manages its water resource system and has redefined its 'water resource zones'. Coventry was formerly located on the eastern edge of a zone previously referred to as the Severn Water Resource Zone. It is now located within the central part of a much larger zone called the 'Strategic Grid'. The change in layout of zones, and the position of Coventry is illustrated in Figure 3.1. This 2015 Water Cycle Study is based on the situation relevant to the Strategic Grid, within Severn Trent Water's 2014 WRMP.

Figure 3.1 Severn Trent Water's Water Resource Zones in 2009 and 2015



Strategic Grid – contextual information

It is evident from Figure 3.1 that Coventry is just a small component of the region supplied and managed within the Strategic Grid. According to the 2014 WRMP the total household population in 2012 (the company's base year for planning) in the Strategic Grid was just under 5 million (4,979,000) and the non-household population was 81,000. The non-household population is composed of people living in farms and communal establishments, for example, hospitals, prisons, educational establishments etc. According to census data available from the Office of National Statistics the population of Coventry (local authority area) in 2011 was 316,960 (just over 6 percent of the total for the zone). Figure 3.2 illustrates not just the spatial extent of the Strategic Grid but the range of towns and cities to which it supplies water and which therefore share the water resources that are available to it.

Figure 3.2 Competing demand centres (towns and cities) in the Strategic Grid

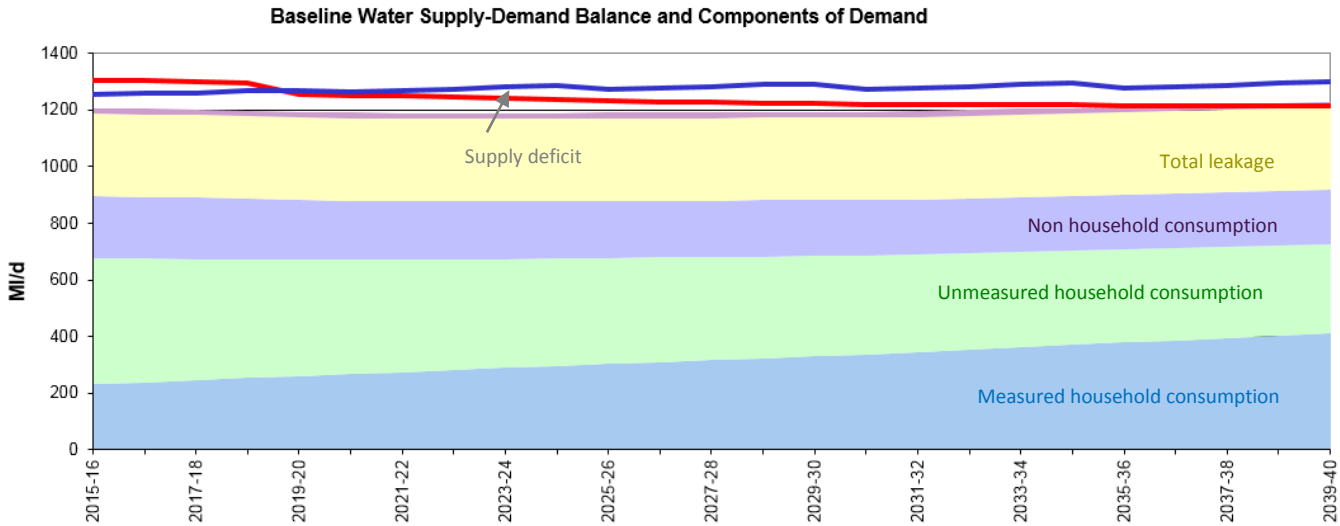
When examining the potential water constraints (and pressure that new development and population increase can exert on water resources) it is necessary to consider the wider area from which resources are drawn. In the case of Coventry theoretically it shares resources with other places from within the Strategic Grid and surface water and groundwater sources used to provide public water supply (PWS) are distributed across the area. Figure 3.2 shows the other demand centres (towns and cities) within the Strategic Grid that share resources with Coventry.

The water situation in the Strategic Grid

Severn Trent Water forecast 'baseline' demand and supply in the Strategic Grid for the period 2015 to 2040. The baseline forecast is developed excluding any policies or other interventions beyond what the company is already doing or has already committed to. Figure 3.3 shows Severn Trent Water's baseline forecast of the supply-demand balance for the Strategic Grid zone (and the components of demand). The red line is the supply forecast and this includes all water that is available for use, including water imported from other zones. The blue line is the forecast demand, including a buffer (headroom) to allow for and increase resilience to any uncertainties in the forecasts. It shows that whilst a small supply surplus is forecast until 2019 a drop in the supply base combined with increasing demand will generate a forecast deficit under dry year annual average conditions.

In the short term, the single biggest challenge to Severn Trent Water's ability to maintain supplies is the impact of the Natural Resource Wales' Review of Consents on the River Wye, as required under the Habitats Directive. The decision has been made that the Severn Trent Water abstraction is causing unacceptable impacts on the water environment in the River Wye and the habitats supported by it. Consequently, the regulator (NRW) requires Severn Trent Water to reduce its abstractions from the Wye by 40Ml/d. This reduction is due to commence in 2019/20. In the longer term environmental concerns are expected to result in a further reduction of 5Ml/d. Water resources for both the environment and supply are expected to be impacted by ongoing changes in the climate reducing overall rainfall volumes.

Figure 3.3 Baseline forecast supply-demand balance for the Strategic Grid



The drop in supply creates a deficit of 14Ml/d starting in 2019/20 which unless interventions are made is forecast to increase to 86Ml/d by 2039/40. The consequences of not taking action to close the deficit mean that in the event of a dry year condition materialising customers may be at risk of supply interruptions. In order to resolve this Severn Trent Water has identified the various options that are technically and financially feasible to deliver and invest in. This report is based on the content of Severn Trent Water's Water Resources Management Plan which was published in 2014.

Understanding sources of supply

Severn Trent Water abstracts water from within the Strategic Grid zone, receives a large import of raw water from Dŵr Cymru Welsh Water (via the Elan Valley Aqueduct), imports potable water from its own Nottinghamshire, and Forest and Stroud zones, and receives an import of potable water from Anglian Water. However, the company also exports raw water to Yorkshire Water and potable water back to the Nottingham zone. Within its own supply area the Derwent Valley Aqueduct (DVA) is a critical element of the water supply infrastructure. The DVA provides raw and treated water into the Strategic Grid and the Company's investment plans include strengthening sections of the aqueduct, to help move water more flexibly around the region.

Transfers reflect the importance of moving water flexibly around a large area and working in conjunction with neighbouring companies to make better use of resources, and are subject to fixed agreements. The net volume imported is 190 Ml/d (total in 352Ml/d, total out 162Ml/d). It is the import from Welsh Water that is affected by the decisions to reduce abstraction on the River Wye and subsequent changes to the operation of the Elan reservoir.

Plan for Strategic Grid

The Strategic Grid and Nottinghamshire zones are both at risk of large supply deficits (baseline forecasts) unless investment is made to continue decreasing demand (including leakage), to augment resources, and improve the efficiency of water production. Severn Trent Water has prepared a plan to resolve the situation.

As well as reducing abstraction from unsustainable sources, and reducing demand, the Company also intends to increase the flexibility and capacity of the Strategic Grid to cope with future supply uncertainties such as climate change and usage projections. It is anticipated that by improving the flexibility of the system operation, creating new strategic links and providing new sources of water supply the deployable output (output of sources once a range of environmental and infrastructure constraints are taken into account) of the Strategic Grid will improve. Table 3.1 summarises the strategy to secure supplies in the Strategic Grid

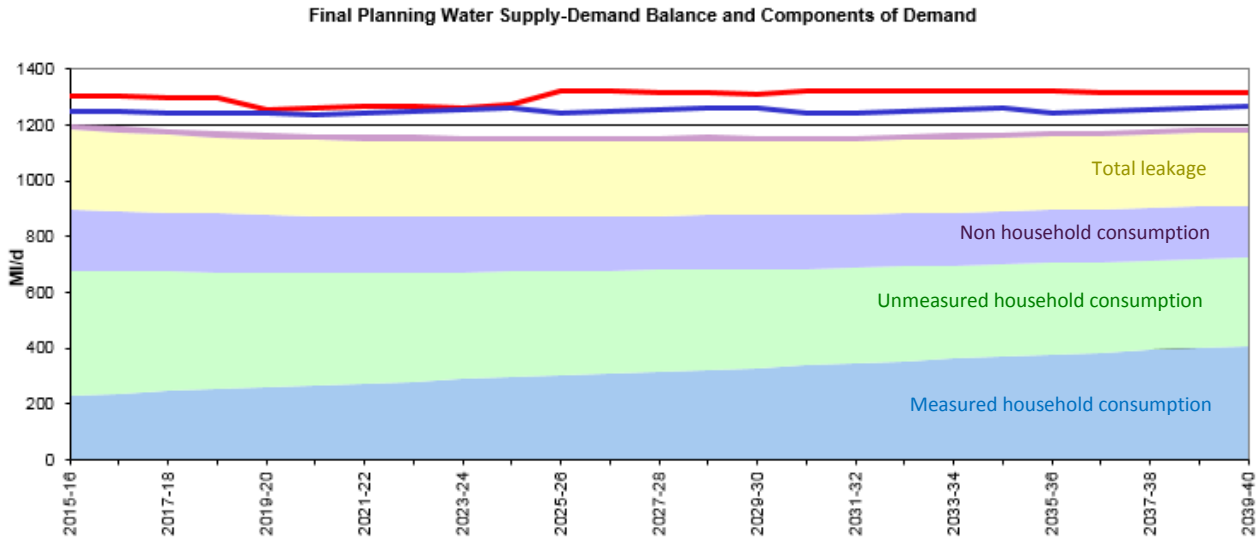
from 2015 to 2040 and Figure 3.4 illustrates the impact of this strategy on the forecast supply-demand balance.

Table 3.1 Summary of Strategic Grid strategy

	Scheme description	Assumed benefit
AMP6	Reduce Leakage by 19Ml/d.	19Ml/d
2015 – 2020	Reduce demand by 5Ml/d.	5Ml/d
	Increase Uckington output in the Shelton zone to facilitate Upper Worfe flow augmentation which will be re-abstracted into the Strategic Grid zone from the River Severn.	Maintain service levels
AMP7	Reduce leakage by 3Ml/d.	3Ml/d
2020 – 2025	Trimpley-Worcestershire groundwater conjunctive use.	15Ml/d
	Whitacre aquifer storage and recovery, Phase 2.	10Ml/d
	Draycote reservoir 6% expansion.	7.5Ml/d
	Bromsgrove groundwater licence transfer.	17Ml/d
	Upper and Lower Worfe flow augmentation	30Ml/d
AMP8	Reduce leakage by 1.9Ml/d	1.9Ml/d
2025 – 2030		
AMP9	Reduce leakage by 3.7Ml/d	3.7Ml/d
2030 – 2035		
AMP10	Reduce leakage by 0.3Ml/d	0.3Ml/d
2035 – 2040		

AMP: Asset Management Plan (6 refers to the sixth 5 year AMP period since 1990).

Figure 3.4 Final planning forecast supply-demand balance for the Strategic Grid



The strategy is forecast to mitigate the immediate impact of the loss of 40Ml/d from Welsh Water and then the combined impact of interventions in 2025/26 will create a surplus over the longer time. Key investments will include the Upper and Lower Worfe flow augmentation, the Bromsgrove groundwater licence transfer, the Trimpley-Worcestershire groundwater conjunctive use, and the Whitacre aquifer storage and recovery scheme. These will support the longer term continuous investments to reduce leakage and reduce demand. Within the next five years (2015-2020) it is intended to reduce demand by 24Ml/d.

Summary descriptions of the main elements of the strategy for the Strategic Grid:

- schemes to reduce demand:
  - AMP6 – AMP10 Leakage Reduction – Reducing the volume of water that leaks from the distribution network is a major part of Severn Trent Water's plan to secure water supplies in the zone. Leakage levels are already at the lowest levels recorded but the Company intends to continue driving it down. Inevitably, it the harder to solve leaks that remain and therefore require more expensive activity. The bulk of the future leakage savings will be achieved through a continuation of the company's active find and fix policy (increasing the level of analysis to detect leaks, improving techniques to fix leaks, and investing to fix leaks more quickly). The company will also increase investment in mains renewal.
  - AMP6 Water Efficiency Programme - water efficiency measures could equate to around 7Ml/d of additional benefit. The overall programme includes a range of services that Severn Trent Water will provide for free to help customers use water more efficiently, and others which may incur a fee. Free services include providing advice on best practice, as well as providing information to customers on how to understand how much water they use, how to measure it, and advice on how to reduce how much they use. The Company will also direct customers to free resources such as downloadable self-audit guides, billing and tariff explanation and options and case studies and benchmarking.

Where there are significant opportunities to reduce water consumption for larger commercial, corporate and public section customer, the Company will provide water audits for a fee. Investment or remedial works such as retrofit programmes or process improvements may be provided as follow up actions. Currently, the proposed method for paying for these changes is a "pay as you save" approach whereby the customer repays upfront capital via water bill savings, although this scheme would have to be capped, most of the work is expected to occur in AMP6. As part of the paid services programme in non-household properties, it is anticipated that education of water efficiency measures to staff, site visitors, and children may improve water efficiency going forwards.

- schemes to increase supply:

- Whitacre Aquifer Storage and Recovery – injection of treated water into a confined aquifer for re-abstraction when required, such as during drought periods. After significant feasibility trials, a site has been selected at the Whitacre treatment works, it is anticipated that this scheme will contribute up to an additional 10Ml/d.
- Upper Worfe Flow Augmentation – historic groundwater abstraction from the underlying aquifer has impacted this river at low flows, causing a status of less than good ecological status. In order to restore the river to good ecological status (GES) the scheme would require a reduction in long term abstraction rates to improve natural baseflow discharge, and additional river flow of up to 25Ml/d support during very dry summers. It is likely that this additional flow would involve capital works at existing potable water abstraction sites at Lizard Mill, Sherrifhales and Shifnal. The additional water, minus losses, would then be re-abstracted downstream at Trimpley to supply additional raw water to Frankley water treatment works in Birmingham. This scheme is dependent on delivering an alternative supply scheme to customers in Telford.
- Lower Worfe Flow Augmentation – plans to utilise three boreholes that have not been used for several years (Stableford, Rindleford and Roughton) for river augmentation to supply an additional 15Ml/d during dry summers for re-abstraction on the River Severn at Trimpley to supply additional raw water to Frankley water treatment works in Birmingham to both increase deployable output and dry river flows in the River Worfe.
- Trimpley and Worcestershire Groundwater Conjunctive Use – proposes increasing peak capacity of two existing borehole sites in North Worcestershire by constructing new boreholes at each site, enabling them to be run at higher outputs during dry year summer/ autumn periods. In addition, each site will have a minor treatment works upgrade to achieve an extra 15ml/d of treated water peak output.
- Draycote Reservoir Minor Water Level Raise – minor modifications to the Draycote Reservoir allowing an additional 60cm to the water level, which will provide an additional 6% raw water storage capacity.
- Bromsgrove Groundwater Licence Transfer – transfer of 17Ml/d of peak abstraction quantity from three groundwater sources at the top of the catchment (Wildmoor, Washingstocks and Whitford) to an expanded Sugarbrook borehole site to improve the flow in the Battlefield Brook as part of the Restoring Sustainable Abstraction Scheme.

Water supply network affecting Coventry

Information on the capacity of the local water supply network to support demand for water across the Coventry area is a key issue for local planners. Under the article 37 (section 1) of the Water Industry Act 1991 every water undertaker (such as Severn Trent Water) has a duty to provide “supplies of water to premises [in that area] and for making such supplies available to persons who demand them” in addition they have a duty to maintain, improve, and extend [their own] water mains and other pipes.

Water companies typically respond to concerns regarding supply network capacity by referring to this duty. However, it must be recognised that where there are constraints and upgrades required to fulfil this duty timescales to implement the improvement may not necessarily support Councils’ and/or developers preferred rate of growth. Improvements are typically funded through the five-yearly Asset Management Plan (AMP) cycle. Investment plans take into account planned developments notified to the water company which are then funded through the price determination process. Developments which come on-line outside of this planning process can face delays as funding issues have to be resolved. In certain cases the water company may seek developer contributions to fund supply network improvements specific to developments that have not been planned for.

The Council, developers, and Severn Trent Water will seek to avoid this type of situation and this Water Cycle Study provides the basis for understanding the potential implications of large scale development in the area on water supply services. Site specific assessments of potential demand for water are examined in Phase 2 of this study, together with information on the existing supply infrastructure capacity and planned improvements. At this Phase 1 stage it is possible to confirm that the total development numbers now being

considered by Coventry Council exceed those assumed by Severn Trent Water in the lead up to publication of the Water Resource Management Plan 2014 and the wider business plan.

Potential to accommodate growth

It is clear from the forecast supply-demand balance and the main Water Resources Management Plan that the resource situation in this area is constrained by environmental water availability, and that with growth forecast, if there were no interventions security of supply would be at risk.

The forecast takes into account that over 176,000 new properties will be built in this resource zone by 2029/30 (of which 114,000 are expected by 2024/25). At 23,000 Coventry represents 13 percent of the total. Phase 2 examines in more detail if that 23,000 has been fully taken into account by Severn Trent Water and the implications of and for growth as constrained by water resources and supply availability if it is not. At this stage, it is sufficient to note that whilst Severn Trent Water has identified a supply-deficit it has also identified its strategy to resolve that whilst supporting significant growth in the zone. The impact of Coventry specific growth on the Strategic Grid supply-demand balance is examined further in Phase 2 (Section 5.1).

3.3 Wastewater treatment, water quality and sewerage

Waste Water Treatment Works (WwTWs) provide the infrastructure to process and treat waste water primarily from residential and commercial sites. A variety of treatment processes are used to remove contaminants from the water and produce environmentally safe water to return to the water cycle. The connectivity between buildings and the WwTW is provided by the 'sewerage network' infrastructure that is maintained and operated by a water company. Storm waters (urban runoff) can also be conveyed through the sewerage network.

'Clean' waters from the WwTW are usually discharged to nearby watercourses. These receiving waters are important to both people and wildlife and the water quality of which can be influenced by discharges from WwTWs and other activities. All watercourses fall under the Water Framework Directive, an operational tool, identifying current water qualities and setting the objectives for water protection for the future.

This section of the Baseline Assessment examines the current existing wastewater and sewerage infrastructure across the Coventry City Area, and the quality of receiving waters. Any potential constraints to future growth plans are identified.

Due to the location and extent of existing infrastructure across the City the assessment focuses on two distinct areas; the extensive urban areas that cover the majority of the Coventry City administrative area, and the more rural area to the north-west of the City (Figure 1.2).

Waste water treatment works

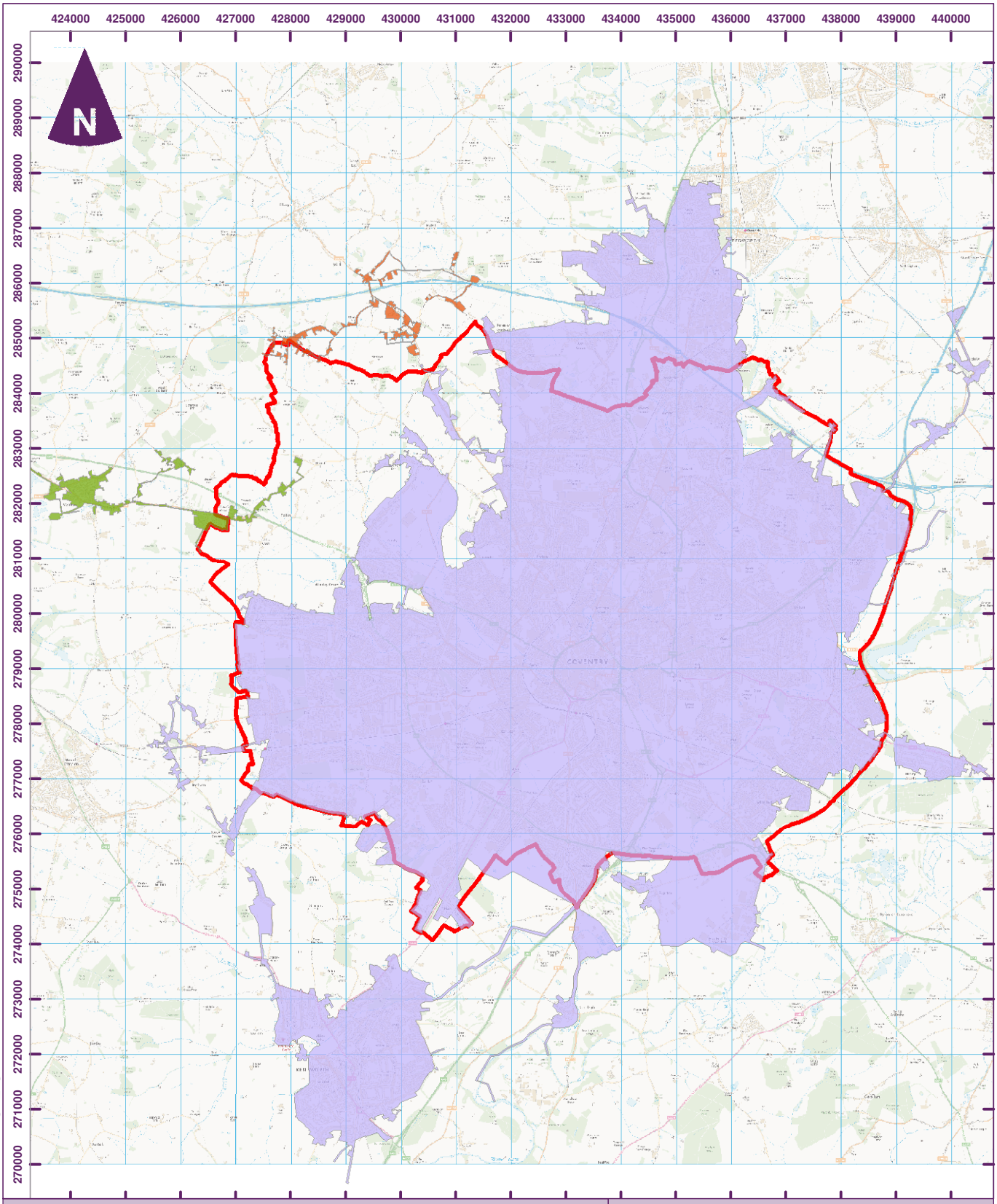
WwTWs serving the Coventry City area

The Coventry City Council area is served by three WwTWs all operated by Severn Trent Water (Figure 3.5). Finham WwTW has a large catchment area that serves the majority of Coventry City administrative area, with infrastructure to serve a population (population equivalent) of approximately 420,000. The catchment extends out beyond the study area boundary and includes other smaller urban centres such as Bedworth and Kenilworth. This WwTW is likely to accommodate future growth plans both inside and outside the study area.

Two additional WwTW catchments cross the north-western part of the Coventry City Council administrative area (Corley and Meriden WwTWs). Both these WwTWs have much small catchments that server smaller settlements such as Corley and Meriden. The population equivalents served are approximately 900 and 3,000 respectively. The largest proportion of both WwTW catchments are located outside the Coventry City administrative area, and therefore have the potential requirement to accommodate future growth plans inside and outside the study area.

There are some small settlements and single farms within the more rural area in the north west of the Coventry administrative area. It is anticipated that these settlements are likely to be served by septic tanks or small package plants. Growth plans within these settlements are likely to be very limited and therefore unlikely to contribute towards the demand placed on WwTWs. In cases were a large development is planned it is likely to require connection to the nearest sewerage network.

There are other treatment works located approximately 2km or more from the Coventry City Council administrative area. While these WwTWs have potential to offer alternative options to accommodate growth plans within the wider catchment of the three main WwTWs, the distance from any growth specific to the Coventry City Council administrative boundary indicates that they will not offer specific sewage treatment alternatives. While consideration may be made of these WwTW in the Water Cycle Study as a wider context of alternatives to alleviate capacity constraints at the three main WwTWs, detailed assessment of the capacity and receiving waters of these WwTWs falls outside the scope of this assessment.



Key

Watewater Treatment Work Catchments

- Corley WwTW
- Meriden WwTW
- Finham WwTW
- Coventry City Council Administrative Area

0 0.4 0.8 1.2 1.6 2 km

Scale at A4: 1:100,000

Coventry Water Cycle Study

amec foster wheeler

Figure 3.5
Severn Trent Water WwTW Catchments

Waste water Treatment Works capacity

In the UK WwTWs are issued with environmental permits to limit pollution of the watercourses receiving treated effluent (receiving waters). This permit includes a flow limit based on Dry Weather Flow[5] (DWF) and quality parameter limits. The rationale behind the flow limit is that in dry weather the flow volume of the receiving water is at its lowest, resulting in reduced dilution of effluent. In dry weather, the effluent volume is expected to be the product of domestic and industrial sewage flows, without additional flows from surface runoff. Exceedances of the DWF limits would result in further investigation by the consent holder and may result in a required increase to the discharge consent flow limit (where suitable). Table 3.2 provides the current DWF consent limit for the three WwTWs within Coventry City administrative area.

WwTWs are also operated to a level sufficient to maintain compliance with discharge permits in relation to biological treatment and associated quality parameter limits (e.g. BOD, Phosphate, Ammonia). Exceedance of these limits may require further treatment (e.g. phosphate removal) to be put in place at WwTWs.

Severn Trent Water have provided information on the current capacity of the WwTWs that intersect Coventry City Council administrative area that would serve future developments. Capacity to accommodate future growth is indicated by WwTW compliance with the DWF and water quality limits. During Amp 6 Severn Trent Water have projects identified to alter existing limits and infrastructure (including phosphate removal and capital maintenance) at two of the WwTWs which will influence the future capacity of WwTWs to accommodate future growth. A summary of WwTW compliance and Amp 6 plans are also provided in Table 3.2, and the influence on growth plans is described further below.

Table 3.2 Current capacity of WwTWs that serve Coventry City administrative area

WwTW	Consented DWF limit (m3/d)	Total Population Equivalent (PE) limit	DWF compliance*	Biological treatment capacity RAG (current performance)**	Notes
Finham	115000	420,862	Exceedance (2014)***	TBC by Severn Trent Water following further investigation	AMP6 quality project - phosphate removal + secondary treatment capital maintenance to be completed by 2020.
Corley	660	894	Compliant	TBC by Severn Trent Water following further investigation	Considering a reduction in pDWF (extent unknown at present) and AMP6 quality project - phosphate removal by 2020.
Meriden	752	2,723	Compliant	Limited	

* Compliance is assessed based on approach set out in Severn Trent Water Discharge permits where numeric value of DWF (Q90 over 12 month period) shall not exceed the consented DWF
** Biological treatment capacity RAG (Red, Amber Green) assessment based on current performance completed by Severn Trent Water. Green = increase of up to 50% on current PE. Amber = 25%. Red = no more than 10%
*** Severn Trent Water identify that the 2013/14 data may not be a true representation of actual DWF.

Potential to accommodate growth

Growth across the main urban areas of Coventry:

- served by Finham WwTW:
  - According to DWF monitoring Finham WwTW was very close to exceeding the DWF consent limit during 2013, and does exceed it during 2014. However Severn Trent Water identify uncertainty over these flow estimates (possible overestimates) due to a possible issue with the new flow meter installed during 2013. This exceedance should therefore be treated with caution in any assessment. Severn Trent Water do not anticipate a change to the current

[5] DWF is currently defined in UK practice as the total daily flow value that is exceeded by 80% of the total daily flow values in any period of twelve months.

DWF consent but this will not be confirmed until the accuracy over the DWF flow data is resolved.

- Severn Trent Water identify that the treatment capacity of Finham WwTW is uncertain, with plans for Phosphate removal and secondary treatment capital maintenance to be operational by 2020. The WwTW already had Phosphate removal in place but further treatment is needed to meet WFD objectives. The Population Equivalent designed to be treated by this upgrade work is unconfirmed and the scope of maintenance work is still being determined. Seven Trent Water confirm that this will not affect the ability to cater for new development.
- Severn Trent Water have an obligation under Section 94 of the Water industry Act 1991 to provide capacity as required to cater for development. To ensure capacity to accommodate further growth at Finham WwTW, understanding the scale of growth, and the timescales and requirements for current and future upgrades will be critical. Communication will need to be maintained between the Coventry City Council, developers and Severn Trent Water to ensure that upgrades and infrastructure changes required to accommodate growth plans are phased appropriately to be operational in advance of significant development construction.

Growth in north western Coventry:

- Corley Moor (served by Corley WwTW):
  - The current DWF at Corley WwTW is compliant with the Permitted DWF, (annual DWF information indicating that the Q90 is approximately 50% of the permitted DWF) and therefore there is capacity within the existing DWF limit to accommodate further growth plans. Based on a high level assumption that PE can be directly comparable to the DWF capacity this would indicate a potential capacity at this works to accommodate future growth plans in the region of 400 people. However Severn Trent Water are considering accepting a reduction in permitted DWF (between 2015 and 2020) as part of a quality improvement project. The extent of any reduction is currently unknown and will be determined by demand projections and phosphate removal requirements.
  - Severn Trent Water identify that the treatment capacity of Corley WwTW is uncertain. During Amp 6 Severn Trent Water is considering the option of phosphate removal, to be operational by March 2020. There is also a known atypical load of Ammonia reaching the WwTW from a local motorway service station which, while not currently an issue, provides an added complication when calculating how much additional load could be treated.
  - A reduction in the DWF consent limit at this WwTW will reduce the available headroom to accommodate future growth. The phosphate removal will allow future growth to be accommodated while ensuring the WFD requirements of the receiving waters are still met or improved. There are no significant constraints to receiving growth within and around Corley, although the amount of growth could be limited.
- Millisons Wood, Pinketts Booth and surrounding areas (served by Meriden WwTW):
  - The current DWF at this WwTW is currently compliant with the existing DWF consent limit (operating at approximately 75% of the limit based on 2014 flow data), and therefore has capacity to accommodate future growth to some level. Based on a high level assumption that PE can be directly comparable to the DWF capacity this would indicate a potential capacity at this works to accommodate future growth plans in the region of 600 people.
  - Severn Trent Waters Biological Treatment Capacity assessment identified that Meriden WwTW has limited available capacity within existing water quality limits with an available capacity of only 25% on the current PE. There are no current plans in place for WwTW upgrades or maintenance.
  - There are no constraints to some low levels of growth within Meriden and the surrounding area, which will remain within current DWF and quality consents. Any significant growth plans within WwTW catchment would have to be carefully phased with any required upgrades. These upgrades would be anticipated to occur within AMP 7 (2020 onwards) to tie in with the next set of water company business plans.

The catchments of the three WwTWs that serve Coventry City Council administrative area also include urban areas outside the study area which will also contribute to the existing capacity of the WwTWs (Figure 3.5). Therefore additional growth plans set out by the adjoining councils (Nuneaton and Bedworth Borough Council, Warwick District Council, North Warwickshire Borough Council and Solihull Metropolitan Borough Council) will also be important in fully understanding availability at the WwTW. Growth plans within and outside the Coventry City Council administrative area are considered within the Capacity Assessment (Section 5).

Receiving waters

The receiving watercourses for the three WwTWs identified in Figure 1.2 are:

- the River Sowe, which flows through the Coventry City Council administrative boundary (Finham WwTW);
- Breach Brook, a tributary of the River Sowe, located north of the Coventry City Council administrative area (Corley WwTW). The tributary joins the River Sowe south west of Bedworth, before the river flows south through the Coventry City Council administrative area; and
- Horn Brook, a tributary of the River Blythe, which is located to the west of Coventry (Meriden WwTW). The River Blythe flows north to join the River Tame near Birmingham.

WFD requirements

The European Water Framework Directive (WFD) is driving improvements in river water quality. As a minimum the WFD sets a mandatory target of 'no deterioration' in the water quality of receiving waters (into which wastewater treatment works discharge treated effluent) below current conditions. Secondly, it sets a target for river water to meet 'Good Ecological Status' (as defined by numerous water quality parameters) by 2015 (unless the water quality status was classified as 'Bad' in the first round of RBMPs in 2009 and for which the target to meet Good Status has been deferred from 2015 to 2027). In cases where investigations conclude that achieving Good Status will not be achievable, or if the work to achieve it will be technically unfeasible or disproportionately expensive the second cycle of RBMPs *may* adjust the objective (e.g. to moderate status) to reflect something achievable by the specific river waterbody. However, they may also retain the deferred timescale to meet Good Status.

There are multiple factors contributing to the failure of watercourses to achieve Good Status: point source discharges from treatment works, diffuse source pollution from agriculture, water abstraction, plus the implications of physical modifications to the waterbody [6]. The Good Status (or potential) requirement is derogated (removed) if the factors causing the failure to meet Good Status are considered essential on their own terms, e.g. flood protection and essential drinking water supply (these are overriding policy objectives). In such cases all appropriate mitigation measures must still be applied [7]. If the cause of the failure is due to some other important activity (e.g. power generation) then the requirement may also be derogated but only if it passes three tests: the alternatives are technically impossible, that they are prohibitively expensive, or they produce a worse overall environmental result.

As part of the WFD (section 2.3) individual watercourses are split into numerous waterbodies to enable classification to be provided at points down a watercourse and reasons for classifications to be more easily identified. Some waterbody catchments can incorporate local small tributaries under the same waterbody ID and therefore take on the classification of the watercourse into which it flows. WFD classification of the receiving waters above are provided on a waterbody basis.

In 2009, in the first cycle of the River Basin Management Plan process, the Environment Agency examined the quality of the water courses including those within the study area. Those watercourses within the study area are classified as Moderate or Poor Ecological Status[8]. Only Coventry and Ashby Canal is identified to be of Good Ecological Status[8].

[6] Environment Agency (2009), River Basin Management Plan Severn Basin District
[7] http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm
[8] http://maps.environment-agency.gov.uk/wiyby/

In the first cycle of River Basin Management Planning the receiving waters for Finham and Corley WwTWs were classified as Poor status, while Meriden WwTW receiving water was classified as Moderate status. Now in the early stages of Cycle 2 of the River Basin Management Plan process the Environment Agency has updated the quality of these watercourses to reflect 2014 data and the results of any investigation and improvement made during Cycle 1. Based on the current Cycle 2 (2014) WFD classifications the waterbodies into which Finham WwTW and Corley WwTW discharge have improved to Moderate status, while the waterbody of Meriden WwTW receiving water has been classified as Poor Ecological status (Table 3.3). Specific Water Quality elements that result in the failure to meet good ecological status are shown in Table 3.3 as well as their possible sources.

There are no measures or actions identified within the Cycle 2 information to achieve the most recent Cycle 2 objectives. These are currently under consideration by the Environment Agency and will be ready in time for the start of 2016 (personal comms, EA, August 2015). It is appropriate to assume for this assessment that where a source of failure in Table 3.3 is identified to potentially relate to sewage discharge then there are likely to be actions within the Cycle 2 WFD to improve WwTW discharge quality.

Table 3.3 Cycle 2 WFD classification of Receiving Waters, including reasons and possible sources of failure

WwTW	Receiving Water (waterbody name)	WFD current ecological waterbody status (and reason for failure)	Potential source of failure and status objective
Finham WwTW	River Sowe (Sowe - conf Withy Bk to conf R Avon)	Moderate (Macrophytes and Phytobenthos Combined, Phosphate, Triclosan)	**Probable:** Sewage discharge **Suspected:** Agriculture and rural land management **Objective**: to reach/maintain Moderate ecological status due to an unfavourable balance of costs and benefits (actions to reach Good status being disproportionately expensive)
Corley	Breach Brook (Breach Bk - source to conf R Sowe)	Moderate (Invertebrates, macrophytes)	**Probable**: Agriculture and rural land management, mixed drainage (urban and transport) **Objective**: to reach/maintain Moderate ecological status
Meriden	Horn Brook	Poor (Macrophytes and Phytobenthos Combined, phosphate (poor))	**Probable**: Sewage discharge , Agriculture and rural land management **Objective**: to reach Good ecological status

Water dependant protected areas

In addition to water quality improvements afforded by the requirements of the WFD for WwTW receiving waters, there are requirements to maintain (and in some cases improve) other sites of environmental importance (Section 1.5). Water dependant designated sites have the potential to be affected by changes in WwTW receiving watercourse quality as a result of WwTWs accommodating increased growth. Where this is the case tighter consents at the WwTW may be required.

There are a number of SSSI sites and sites of local importance within and surrounding Coventry City (Figure 1.3). For the purpose of this study only those designated sites that are water dependant and located downstream of the WwTW discharges are considered. Water dependant SSSI sites and Local Nature Reserves and their propensity to be affected by future growth plans are highlighted in Table 3.4.

A large number of the Local Wildlife Sites (LWS) within the Coventry City Council area are located adjacent to the watercourses (Figure 1.3), also evident in the wider area. A number of existing or potential LWS sites are located in the receiving waters (and downstream) of the WwTW discharges considered in this study. These locally important sites have the potential to be affected by water quality changes associated with wastewater discharge from growth plans. Two of the LWS located on the receiving waters of WwTW discharges are given in Table 3.4 but others located downstream are also considered in the assessment.

Table 3.4 Water dependent designated sites downstream of WwTWs

Water dependant designated	Reason for designation	Current conditions	Potential to be affected by Future Growth at WwTWs
Coombe Pool SSSI	One of the most important ornithological sites in Warwickshire for herons, breeding birds and wintering wildfowl	Unfavourable – Recovering Reasons: - Excessive weed growth - Tree replanting required	Located on a tributary of the River Sowe upstream of Finham WwTW, and downstream of Corley WwTW. This site will not be affected by water quality changes of the River Sowe or upstream influences (Corley WwTW).
Guys Cliffe SSSI	Good exposure sandstones which have yielded the finest specimens of an important amphibian species	Favourable condition	Located north of Warwick, alongside the River Avon, downstream of its confluence with the River Sowe. Located more than 12km downstream of Finham WwTW, any effects from Finham WwTW are anticipated to be minimal due to dilution afforded by the confluence of the River Sowe and the River Avon.
River Blythe SSSI (39km stretch from Spring Brook to the confluent of the River Blythe with the River Tame)	Increasingly rare (in Lowland Britain) wide ranging natural structural features (such as riffles and pools) accompanied by wide ranging plant communities making the river one of the most botanically rich in lowland Britain with important habitats for invertebrates.	Unfavourable - no change. Reasons: - Inappropriate weirs, dams and other structures - Invasive freshwater species - Water abstraction - Water pollution – Agriculture/runoff	Meriden WwTW is located on Horn Brook that flows into the River Blythe within this designated stretch. Therefore any growth plans within this WwTW have the potential to affect the water quality of this important watercourse.
Coleshill and Bannerly Pools SSSI	Two pools and adjoining bog area that together form the only valley mire system in Warwickshire. These contain nationally restricted habitats and flora that are rare across the county.	Unfavourable – Recovering Reasons: - Work needed to remove birch scrub. - Need for Rhododendron removal.	Located approximately 500m west of the River Blythe near Birmingham. Water from these pools is anticipated to flow under gravity east within the drains and channels to join the River Blythe therefore will not be affected by water quality changes within the River Blythe itself.
Whitacre Heath SSSI	One of a chain of water bodies created by gravel extraction along the valley that are now important for their bird life. Whitacre Heath is notified for its wetland breeding birds.	Favourable	Located more than 12km downstream of the Horn Brook, any effects from Meriden WwTW on water quality are anticipated to be minimal due to dilution afforded by the confluence of the River Blythe with the River Cole and the River Tame upstream of the SSSI.
Stoke Floods Local Nature Reserve	The reserve has a large lake, reedbeds and scrub next to the River Sowe. The lake supports many wetland plants, while	No information available	The site is located more than 10km downstream of the Breach Brook, alongside the River Sowe in the east of Coventry. There are a number of small

Water dependant designated	Reason for designation	Current conditions	Potential to be affected by Future Growth at WwTWs
	bird life is varied. The reserve is one of the most important wetland sites in Coventry and is a wildlife oasis in an area of high intensity housing.		tributaries that join the River Sowe downstream of Breach Brook that will afford some dilution to any water quality changes due to growth at Corley WwTW. Impacts are anticipated to be minimal.
Stonebridge meadows Local Nature Reserve	Unimproved meadow and pasture with a small alder woodland alongside the River Sowe. Variable grasslands and notable plant species and a good range of birds and invertebrates.	No information available	Located more than 3km upstream of Finham WwTW therefore not affected by Growth Plans. Located more than 10 km downstream of Corley WwTW There are a number of small tributaries that join the River Sowe downstream of Breach Brook that will afford some dilution to any water quality changes due to growth at Corley WwTW. Impacts are anticipated to be minimal.
River Sowe LWS (Potential site)	No information available	No information available	Located on the River Sowe, a stretch of approximately 5km of watercourse including the area adjacent to Finham WwTW. Has potential to be affected by future growth plans at Finham WwTW.
Breach Brook (Potential site)	No information available	No information available	A stretch of approximately 5km of Breach Brook, located in close proximity to Corley WwTW. Has potential to be affected by future growth plans at Corley WwTW.

Potential to accommodate growth

To support future development plans there is the potential that wastewater treatment capacity will need to be increased at Finham, Corley and Meriden WwTWs, which may require amended permits, or permit limits need to be tightened to improve downstream water quality. The Environment Agency reviews and grants permits with consents that are designed to either maintain, or enable an improvement in water quality as part of the requirement of the WFD (section 2.3).

Where the WwTW receiving water waterbody status is less than good under WFD (and it can be shown that it is the WwTW that is driving the failure), or there is a downstream protected area, there is a risk to growth plans. The WwTW will be required to serve growth (potentially requiring a permit amendment) whilst also conforming to the requirements of the WFD and any downstream protected sites. It is likely that the Environment Agency, from a WFD perspective, could possibly support growth in catchments where the levels of constraint are low but would have concerns where a development could prevent the watercourses from reaching good status.

Table 3.5 summarises the potential across Coventry City administrative area to accommodate future growth based on the requirements of the WFD and designated sites. Further description is provided in the bullet points below.

Table 3.5 Summary of constraint to growth plans

Growth areas	Summary of constraint to growth plans
Main Urban area	Further monitoring, modelling and investigations required to provide more certainty on the WwTW as a source contributing to the WFD failure and investigate further mitigation measure requirements. Guys Cliffe SSSI and Local Wildlife sites are unlikely to pose a constraint to current growth, pressure to prevent deterioration in water quality at these designated sites may constrain future development plans (where water quality changes could be attributable to upstream WwTWs).
Corley Moor	WwTW discharge is not identified as a source of the failure indicated within the WFD. Growth within the Corley Moor area is unlikely to be constrained by the Local Nature Reserves or LWS.
Millisons Wood, Pinketts Booth and surrounding areas	Further monitoring, modelling and investigations required to provide more certainty on the WwTW as a source contributing to the WFD failure and investigate any further mitigation measure requirements. Meriden WwTW is unlikely to be currently having an impact on the water quality of SSSI or LWS sites. However there is the potential that future requirements may be placed on this (and any other upstream WwTWs) to ensure water quality complies with the standards in the SSSI.

Growth across the main urban areas of Coventry:

- The River Sowe based on the 2014 WFD status is currently not achieving Good status, and is identified to remain with a 'Moderate' objective due to an unfavourable balance between costs and benefits (Table 3.3). It is deemed disproportionately expensive to achieve good status for Phosphate and Macrophytes and Phytobenthos. However there will still remain the objective to ensure no deterioration from the existing quality. The increased phosphate removal at this WwTW will enable further development to be accommodated while ensuring that Phosphate levels within the receiving water do not deteriorate. It is probable that the discharge from Finham WwTW is a significant contributing factor to failing the WFD objective, although it is important to note that any other WwTWs discharging within the upstream reaches and tributaries of the River Sowe (e.g. Corley WwTW) may also be contributing to this failure. Further monitoring, modelling and investigations may be undertaken to provide more certainty on the WwTW as a source contributing to the failure and investigate any further mitigation measures. It is quite possible that agricultural land-use could also be significantly contributing to the water quality status (Table 3.3). It will be important to determine the relative contributions of wastewater treatment discharge and agricultural runoff before assessing whether the further outputs from the treatment works will be constrained because of Water Framework Directive objectives.
- There is one national site of environmental importance located downstream of Finham WwTW, that has the potential to be affected by growth (Guys Cliffe SSSI). This SSSI site is currently of favourable condition (Table 3.4). There are no water quality problems currently indicated at the site, and impacts directly related to Finham WwTW are anticipated to be minimal. Any discharge from Finham WwTW will be subject to dilution from the confluence of the River Avon and the River Sowe before reaching the SSSI. There is also a Potential LWS located in the receiving waters of Finham WwTW (Figure 1.3). While pressure to prevent deterioration in water quality at these designated sites may constrain future development plans (where water quality changes could be attributable to upstream WwTWs), the upstream WFD requirements (ensuring no deterioration from current status of waterbodies) are most likely to constrain current growth plans within the catchment of Finham WwTW.
- Phosphate removal to be operational by 2020 at Finham WwTW will minimise the constraint posed to growth in Coventry City and improve the water quality of the receiving waterbody (even though the objective is not to reach good status). Guys Cliffe SSSI is unlikely to pose a constraint to growth.

Growth in north western Coventry:

- Corley Moor:
  - The Breach Brook WFD Waterbody is classified as 'Moderate' Status (Table 3.3) based on the current (2014) WFD status. Under this classification the waterbody objective is to remain at 'Moderate' status (Table 3.3), due to an unfavourable cost benefit balance and requirements for ecological recovery time. The objectives for all currently failing parameters is to achieve good status with the exception of Phosphate. Although not classified during the Cycle 2 (2014) information this parameter was classified as 'Bad' during Cycle 1. The 2014 objective identifies that it is disproportionately expensive to achieve good status for phosphate. Probable sources contributing to the failure of this waterbody relate to agriculture, rural land management and mixed drainage (urban and transport) (Table 3.3).
  - There are two water-dependent Local Nature Reserves and a number of potential Local Wildlife sites (sites of environmental importance – Section 1.5) located downstream of Corley that have the potential to be affected by water quality changes brought about by growth plans (Figure 1.3). Stoke Floods Local Nature Reserve and Stonebridge Meadows Local Nature Reserve are both located more than 10km downstream of Corley WwTW. Breach Brook, into which the Corley WwTW discharges, and the River Sowe further downstream, are currently identified as a potential LWS sites. No information is available on the water quality of these sites.
  - The failure to meet the 'Good' WFD status for the Breach Brook Waterbody is not identified to be due to WwTW discharge, and phosphate removal is already identified within Severn Trent Waters AMP6 plans to be operational by 2020. Growth within the Corley Moor area is unlikely to be constrained by the Local Nature Reserves or LWS due to WFD requirements in the upstream waterbodies.
- Millisons Wood, Pinketts Booth and surrounding areas (served by Meriden WwTW):
  - The waterbody within which Horn Brook resides is classified as 'Poor' Status (Table 3.3) based on the current (2014) WFD status. Under this classification the waterbody is predicted to achieve 'good' status, (anticipated to be by 2027) (Table 3.3), allowing for ecological recovery time. A probable source contributing to the failure is identified to be WwTW discharge. It is possible that Meriden WwTW contributes towards this failure, however any WwTWs whose discharges reach the River Blythe upstream of Horn Brook are also likely to be contributing to the failure. It is quite possible that agricultural land-use could also be significantly contributing to the water quality status (Table 3.3). It will therefore be important to determine the relative contributions of wastewater treatment discharge and agricultural runoff before assessing whether the further outputs from the treatment works will be constrained because of Water Framework Directive objectives. If clarification is provided on the contribution of WwTW discharges to the current WFD failure then Meriden WwTW (as well as any upstream WwTWs) may be required to provide phosphate removal. This may pose a constraint to further growth within the north-west of Coventry that drains to Meriden WwTW.
  - There are two water-dependent nationally protected areas (sites of environmental importance – Section 1.5) located downstream of Meriden WwTW that have the potential to be affected by water quality changes brought about by growth; River Blythe and Whitacre Heath SSSIs. River Blythe SSSI is classified as unfavourable for a number of reasons including water pollution (Table 3.4), related to agriculture/ run off. Whitacre SSSI is classified as favourable (Table 3.4). While this indicates that Meriden WwTW is unlikely to be currently having an impact on the water quality of these SSSI sites there is the potential that future requirements may be placed on this (and any other upstream WwTWs) to ensure water quality complies with the standards in the SSSI. There are also a number of downstream LWS sites (Figure 1.3), although no water quality information is available for these.
  - WwTW discharge is contributing to the failure of the waterbody, however further clarification will be required on the relative contribution from Meriden WwTW. It is possible that tighter

consents at the WwTW may be required as part of water quality improvement projects aimed at improving the designated sites.

Sewerage

Sewerage services, providing the connection between development and the WwTWs that treat the waste, are also provided by a Water Company. The company have a responsibility to manage these sewer systems, providing, improving and extending them where required to ensure an effective management. Severn Trent Water is responsible for providing this management service across the Coventry City Council area.

Sewer flooding is an indicator that the sewer network in the area is constrained and struggles to operate effectively with current waste volumes flowing through it. Sewer flood risks usually arise from[9] :

- rainfall events of a severity that exceeds the design performance criteria;
- older sewer systems that do not meet the performance requirements;
- blockages and damage that may occur to a sewer system; or
- high water levels in watercourses preventing outfalls from functioning correctly with consequent flooding in the upstream sewer system.

Water companies such as Severn Trent Water record incidents of sewer flooding on a register referred to as the "DG5", that can provide indications of where a sewerage network is currently constrained. This register is not in the public domain due to the confidential data held within it but provides an ever changing register of current known flooding issues[9] . For the purpose of this assessment Severn Trent Water have provided a summary of the current position within the sewerage systems within the catchments of the three WwTWs considered in this study.

Potential to accommodate growth

Any new developments within the Coventry City area will require sewerage services, which have the potential to be constrained in two ways, the capacity of the existing network to transfer the volume of sewerage to the WwTWs (indicated by sewer flooding) and the proximity of any development to the existing sewerage network.

Any upgrade or new infrastructure required to provide sewerage connection must meet minimum design criteria. These are location specific and are based calculations of projected flows that allow for increased population, anticipated levels of groundwater infiltration and anticipated increases in trade effluents. This will need to be considered in any upgrades undertaken by Severn Trent Water.

In the same way that supply networks are managed in response to planning information from the Local Authorities (Section 3.2), sewerage upgrades are also planned and delivered in the same way. Under the water industry Act Severn Trent Water have an obligation to provide such additional capacity as may be required to treat additional flows and loads arising from new domestic development. Therefore upgrade and improvement works within the sewerage network can be undertaken while providing the increased capacity to accommodate growth. Therefore while the sewerage network is unlikely to ever be a 'showstopper' to growth it is important that phasing is considered and discussions are ongoing between Severn Trent Water and Coventry City Council to ensure the most effective way to accommodate development is identified.

Growth across the main urban areas of Coventry:

- The majority of Coventry City is served by Finham WwTW (Figure 3.5) and the associated existing sewerage network. This network includes areas outside the Coventry City Council administrative area, including pumped flows from Kenilworth to the south. Severn Trent Water indicate that there is generally good sewer capacity across the network, although there are some known localised capacity constraints. Some constraint relates to the location of Finham WwTW itself, particularly when considering increased volumes due to future growth. Finham

[9] Coventry City Council (2008) Strategic Flood Risk Assessment

WwTW is located to the south east of Coventry, and any significant development proposals in the north-west of the city are likely to encounter capacity issues as flows from these areas would need to drain through existing local networks before reaching the WwTW.

- There are a number of combined sewers that drain older parts of the city which incorporate combined sewer overflows (CSO). During intense rainfall events these release into watercourses to relieve pressure on the network and reduce the risk of foul effluent flooding onto highways and into properties. There are approximately 37 combined sewer overflows within Coventry which can pose a pollution risk to watercourses that receive the excess effluent during a storm event[10] . Ensuring adequate capacity within the sewerage network will reduce the frequency with which these overflows are required to operate.

Growth in north western Coventry:

- The north west of Coventry is more rural with less existing WwTW catchment (Section 1.5) and therefore sewerage network coverage. The scale of any growth within the areas not served by a WwTW would need to be carefully considered. Large scale developments would potentially require a connection to a nearby sewer system. Phasing of this development would be critical to ensure infrastructure is in place in advance of the development.
- Generally there is good current performance across the sewerage system serving Corley WwTW, but constraints on the existing network relate to the diameter and therefore volumes of sewerage that the network can accommodate. The network serves Chorley, Chorley Moor, Chorley Ash, Fillongley, New Arley, Old Arley and Devitts Green. Severn Trent Water indicate that "*there will be limited capacity to accommodate minor infill development but any larger development proposals are expected to require capacity improvements."* (Severn Trent Water). These capacity improvements would have an influence on the phasing of any larger scale development proposals.
- The area in and around Meriden is also served by a sewerage network that has a generally good performance. However there are known capacity issues relating to the diameter of sewerage pipe to the east of the village. Development proposals to the east of Meriden (mainly located within the Coventry City Council administrative boundary) would therefore need to be discussed with Severn Trent Water to ensure they can be accommodated within the network without exacerbating the existing flood risk or capacity improvements can be completed before the development is complete.

Summary

The main wastewater treatment and sewerage infrastructure across Coventry City Council administrative area has been identified and assessed in terms of any major constraints and the potential implications this will have for future growth plans. Statutory water quality objectives and designations that protect the receiving water quality has also been considered in terms of their constraints to increasing the capacity of WwTWs. The Baseline Assessment has been sub divided to the two distinct areas of the Coventry City Council administrative area based on the infrastructure. A summary of the Baseline Assessment findings are:

Main area of Coventry

- Severn Trent Water have Phosphate removal plans and capital maintenance that will be completed by 2020 that will provide capacity for the WwTW to accommodate some growth. However the extent of the upgrades and the available capacity of the DWF consent are currently uncertain. Any future growth plans will need to be phased carefully to allow completion of upgrades.
- The sewerage capacity across Coventry City is generally good, with a few localised capacity constraints. It is anticipated that development will be constrained within the north west of the

[10] Coventry City Council (2008) Strategic Flood Risk Assessment

City where flows will need to travel through extensive local networks before reaching the WwTW. This will be considered further in Section 5 for individual development sites.

- Phosphate removal to be operational by 2020 at Finham WwTW will minimise the constraint posed to growth in Coventry City and improve the water quality of the receiving waterbody (even though the objective is not to reach good status). Downstream Guys Cliffe SSSI is unlikely to pose a constraint to growth.

North western Coventry

- Limited growth could be accommodated within the existing WwTW and sewerage infrastructure in north western Coventry (inc. Corley Moor and Millisons Wood).
- Large scale development plans would need to be phased carefully to ensure infrastructure upgrades or permit changes have been implemented in advance of site construction. Upgrades would be anticipated to occur within AMP 7 (2020 onwards) to tie in with the next set of water company business plans.
- Current WFD objectives within the receiving waterbody of Corley WwTW do not relate to point source from WwTW and therefore objectives to improve the Water quality are unlikely to require tighter water quality consents. Phosphate removal is already planned at this WwTW to be operational by 2020. Constraints posed by the downstream LNRs are anticipated to be minimal due to the distance and dilution afforded between the discharge point and the sites.
- Current WFD objectives within the receiving waterbody of Meriden WwTW may be related to discharges from WwTWs, although the relative contribution compared to other sources (Agriculture) are unknown. Further clarification will be required on the relative contribution from Meriden WwTW (and any other upstream WwTWs) to the waterbody. It is possible that tighter consents at the WwTW may be required as part of water quality improvement projects aimed at improving the designated sites that may constrain levels of future growth.

3.4 Flood risk

Introduction

This section reviews the range of flood risks affecting development sites across Coventry City Council administrative area. Previous studies have concluded that the most significant issue in the area is surface water drainage and the flooding that can occur when the existing drainage system is subject to intense rainfall events. The content of this section of the Water Cycle Study is based on review of pre-existing information and no new technical analyses or modelling has been undertaken. However, analysis of existing data and information has identified the specific surface water, fluvial and groundwater flooding issues associated with the development sites are presented in Phase 2.

Sources of information

A review of national, regional and local policies, plans, strategies and investment programmes relating to the flood risk affecting development in Coventry has been completed. The Environment Agency, Coventry City Council, and Severn Trent Water were consulted to obtain flood risk information and to confirm our understanding of the degree of flood risk across the study area.

The context of this review was undertaken incorporating knowledge of:

- the Flood and Water Management Act 2010;
- the Flood Risk Regulations 2009;
- Defra (2005) Making Space for Water;

- the outcomes from the Pitt Review, 'Learning lessons from the 2007 floods - Full Report' (2008); and
- Technical Guidance to the National Planning Policy Framework (NPPF).

Specifically, local flood risk information was gathered from the following documents:

- Coventry City Council (2008) Strategic Flood Risk Assessment: Level 1;
- Coventry City Council (2008) Strategic Flood Risk Assessment: Level 2;
- Coventry City Council (2011) Preliminary Flood Risk Assessment;
- Environment Agency (2009) River Severn Catchment Flood Management Plan;
- Coventry City Council (2014) Draft Surface Water Management Plan; and
- Coventry City Council (2015) Draft Flood Risk Management Strategy.

The draft Surface Water Management Plan (2014), and draft Flood Risk Management Strategy when finalised will provide a comprehensive understanding of flood risks in Coventry.

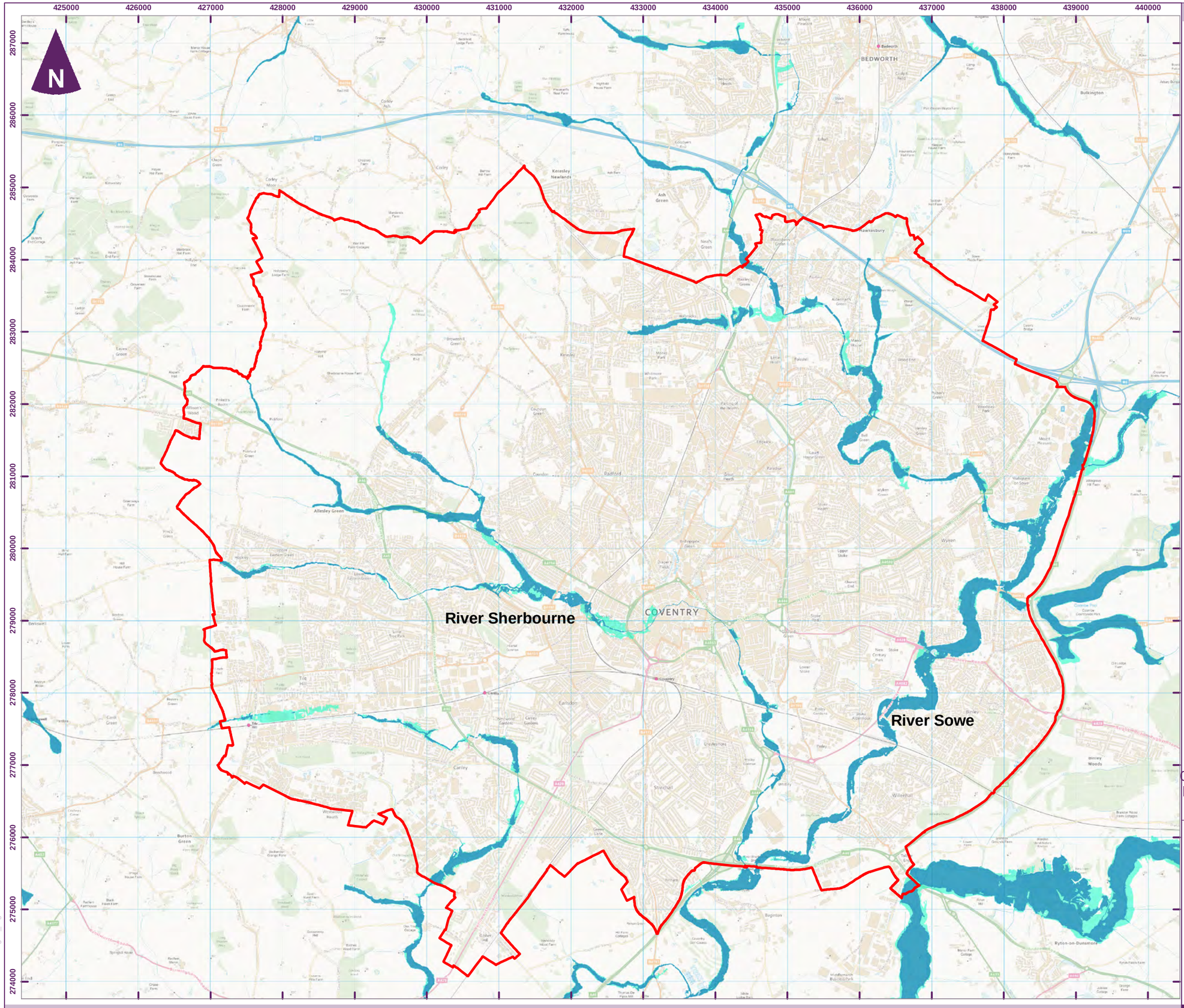
The 2008 SFRA is being updated in parallel with the Water Cycle Study. While not considered within this assessment it will be a key additional source of flood risk information[11].

Fluvial flood risks

Two main rivers run through Coventry City Council administrative area, these are the Sherbourne and Sowe which have a number of smaller tributaries flowing through the City. As Coventry is located near the catchment watershed of the River Severn catchment, the relative size and nature of rivers and the typical daily flows are comparatively small compared to other areas further down the Severn catchment. Watercourses within the City flow through predominantly urbanised areas and are heavily modified, with long culverted sections, artificial beds and banks and with development encroaching on floodplains and extending right up to the river banks. Owing to their 'hidden' nature, and the typical rapid runoff and flood peaks associated with urban catchments, these watercourses pose a notable flood risk to adjacent areas.

A level 1 Strategic Flood Risk Assessment (SFRA) was commissioned by Coventry City Council in 2008 and conducted by Halcrow. It concluded that fluvial flood risk affected relatively small areas of the Coventry City Council area. The key areas being the Sherbourne in the west of the City, the Sowe in the east of the City and the Canley Brook in the southwest. The River Sowe flowed through a predominantly rural area until the late 1960s where commercial and residential developments were constructed along the river. Some of these developments are located in Flood Zone 2 and 3, and there have been a number of historical instances of flooding. Fluvial flood risk in Coventry City Council administrative area is exacerbated by culverted watercourses where flood flows exceed the capacity of culverts to convey flows. The majority of these watercourses are located in the City centre, including the main River Sherbourne, which has a long culverted section through the City Centre.

[11] Coventry City Council, Level 1 and 2 Strategic Flood Risk Assessment Draft Report. Written and Prepared by JBA Consulting Ltd (September 2015)



Key

- Coventry City Council Administrative Area
- Flood Zone 3
- Flood Zone 2

0 0.5 1 1.5 2 km

Scale at A3: 1:51,000

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Figure 3.6
Environment Agency
Fluvial Flood Risk

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The Environment Agency Fluvial Flood Risk Map for the City (Figure 3.6) shows a number of developed areas to be located in Flood Zones 2 and 3, including the key areas listed in Table 3.6;

Table 3.6 Key fluvial flood zone areas in Coventry

Key fluvial flood zone areas	Description
Canley Brook by Tile Hill	A number of commercial and residential properties lie within Flood Zone 2. A hydraulic modelling study of the watercourse was undertaken by the Environment Agency in 2001.
City Centre alongside River Sherbourne	A substantial number of commercial and residential properties lie within Flood Zone 2.
Along River Sowe	Key locations within Flood Zone 2 include commercial and residential properties by: • Rowleys Green; • Longford; • Manor House; • Bell Green; and • Wyken Green.

Flooding from surface water and artificial drainage systems

Surface water flooding is the main flooding concern in Coventry City Council administrative area.

The Environment Agency's Surface Water Flood Risk mapping provides greater detail as to the extent of surface water flood risk across Coventry City Council administrative area (Figure 3.7). In contrast to the map of fluvial flood risk (Figure 3.6), the map clearly shows that surface water flood risk affects more extensive areas of the Coventry City Council area. The mapping highlights topographical features such as valley bottoms, and areas where minor watercourses may have flowed before development occurred. The mapping also shows areas where features of the urban areas (such as roads perpendicularly crossing a drainage pathway) block surface water drainage pathways leading to significant areas/depths of surface water accumulating. Cumulatively, these areas of surface water flood risk affect a large amount of people, property and infrastructure. Unlike for fluvial flooding, the awareness of risk may be lower since typically no evidence of a flow pathway will be present outside of a flood event.

In the 2008 SFRA, twenty three postcode areas within the City were identified as being at risk of flooding from artificial drainage systems and surface water runoff according to the Severn Trent Water DG5 Flood Register[12]. The Level 1 SFRA noted that due to implications of the Data Protection Act (1998), exact locations of properties at risk from surface water flooding cannot be identified by the DG5 register. The post code areas with the most reported incidents were towards the western extent of the City (post code areas: CV5 7 and CV6 1), and towards the southern extent of the City within post code area CV4 7 by Canley (eight reported incidents). Typically, within these postcode areas it will be the low-spots (where the surface water flood map shows areas of flood risk) where these properties are at risk are concentrated.

The DG5 register typically only includes properties with a risk of flooding of once in ten years or more frequently, and excludes properties at risk of flooding in rarer, more 'extreme' weather events. Properties are also removed from the DG5 register once a solution has been delivered, the data therefore only provides a partial supplementary snapshot of a few high-risk properties for which a feasible solution has yet to be delivered. The capacity of sewer systems to deal with extreme events will vary according to the age and condition of the network. Whilst guidance exists on the design events modern sewers, the design events and likelihood of capacities being exceeded and surcharging occurring to cause localised flooding is often unclear for sewer systems. The EA's surface water mapping does however provide a clear indication of the likely low-points where surcharging may occur and the pathways/ areas at risk during these extreme events.

[12] Coventry City Council (2008) Strategic Flood Risk Assessment: Level 1

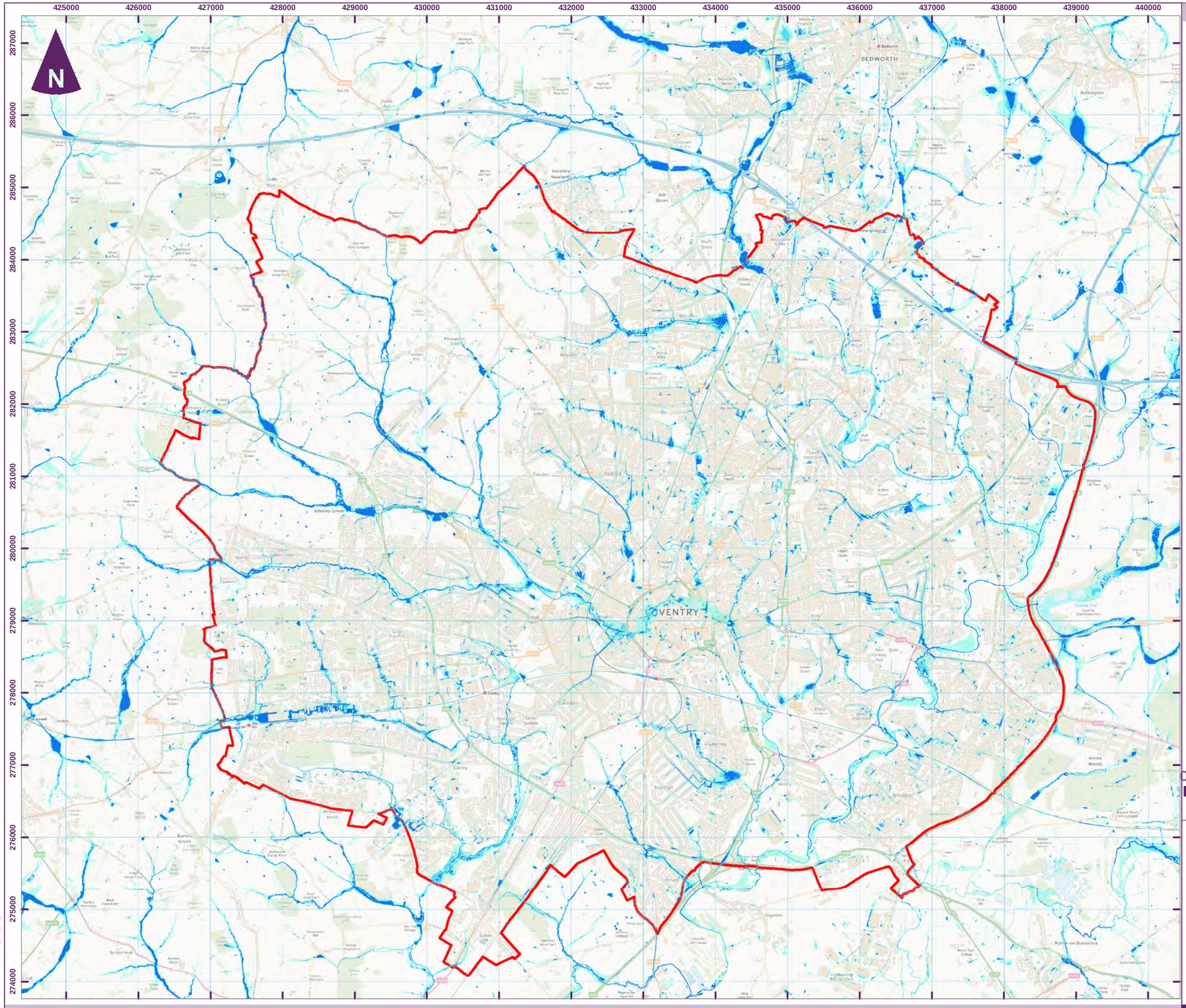

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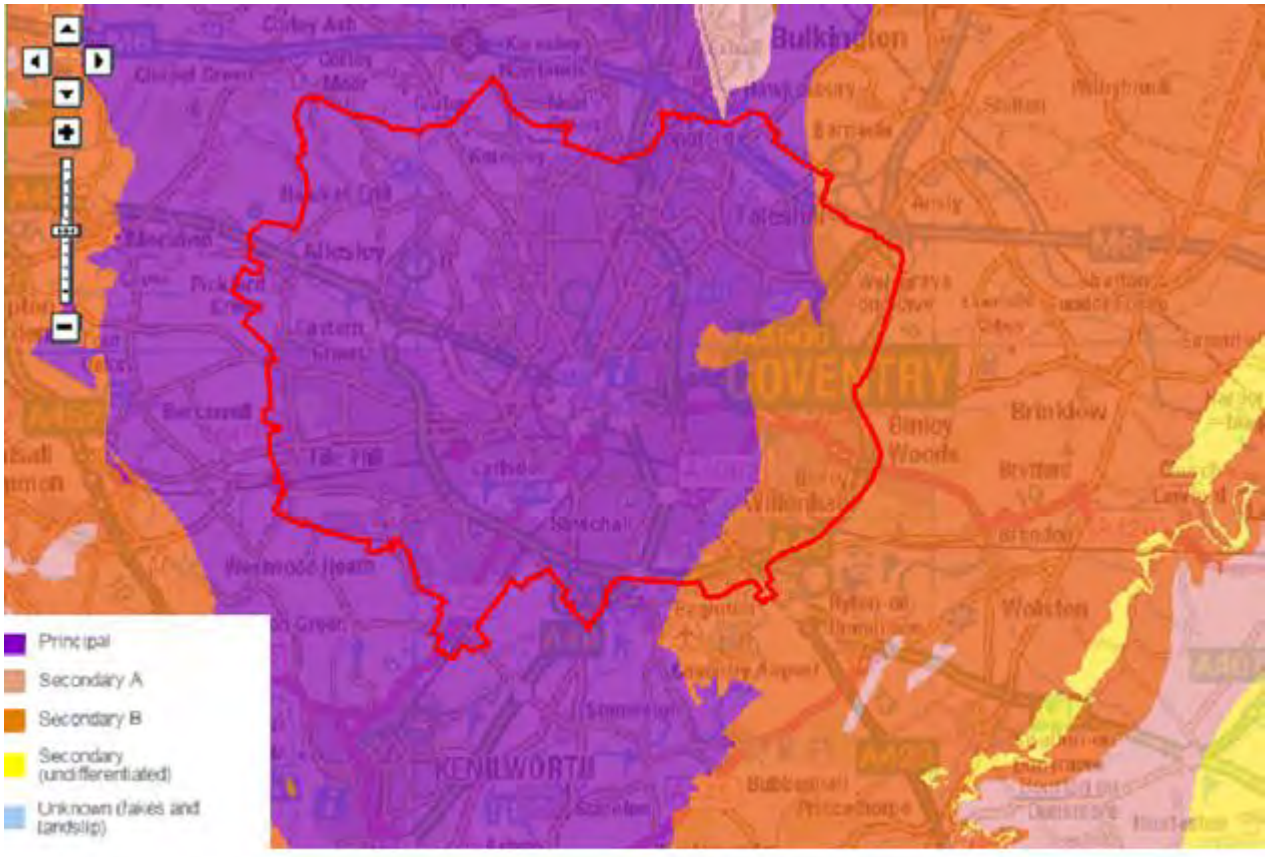
Figure 3.7
Environment Agency
Surface Water Flood Risk

Flooding from groundwater sources

The Environment Agency Groundwater mapping shows that the bedrock underlying the majority of the Coventry City Council administrative area is classified as a Principal aquifer. Principal aquifers are layers of bedrock or superficial deposits that have high intergranular and/or fracture permeability - meaning they can hold significant quantities of water (Figure 3.8). They may support water supply and/or river base flow on a strategically important scale, as indicated by the multiple Groundwater Source Protection Zones (GSPZs) shown on the EA's mapping. Groundwater flow will be from higher ground (such as around Corley), towards the low-lying river valleys within the Coventry City Council area, supporting the baseflow in these key rivers (the Sowe and Sherbourne).

Figure 3.8 Environment Agency aquifer map



Groundwater flooding has not been frequently recorded in Coventry City Council administrative area as, away from the river valleys, groundwater levels are situated well below ground levels. However, regionally some instances of flooding from groundwater have been reported due to a decline in industrial demand[13]. Specific reports of elevated groundwater levels have been received by Coventry City Council in the Keresley area following the closure of coal mining operations and associated pumping in 1991[14].

Groundwater levels are showing a rebound when comparing historical water levels (

[13] Environment Agency - Warwickshire Avon Catchment Abstraction Management Strategy technical document (2005)
[14] Coventry City Council communications (2015)

Figure 3.9). The figure shows rising groundwater levels at the monitoring boreholes, with pronounced increases during the 1980s and 1990s, although the more recent trend appears to indicate that groundwater levels are stable. Continued monitoring will be needed, to ascertain if further groundwater rebound adjustments are ongoing, or if any future changes reflect variations in yearly rainfall. This will enable potential groundwater flooding problems to be identified and actions taken. In some areas the design of watercourse culverts is such that groundwater cannot enter the culverted watercourse due to the use of impermeable materials like mass concrete. Locally elevated groundwater levels may result, increasing the local risk of groundwater flooding.

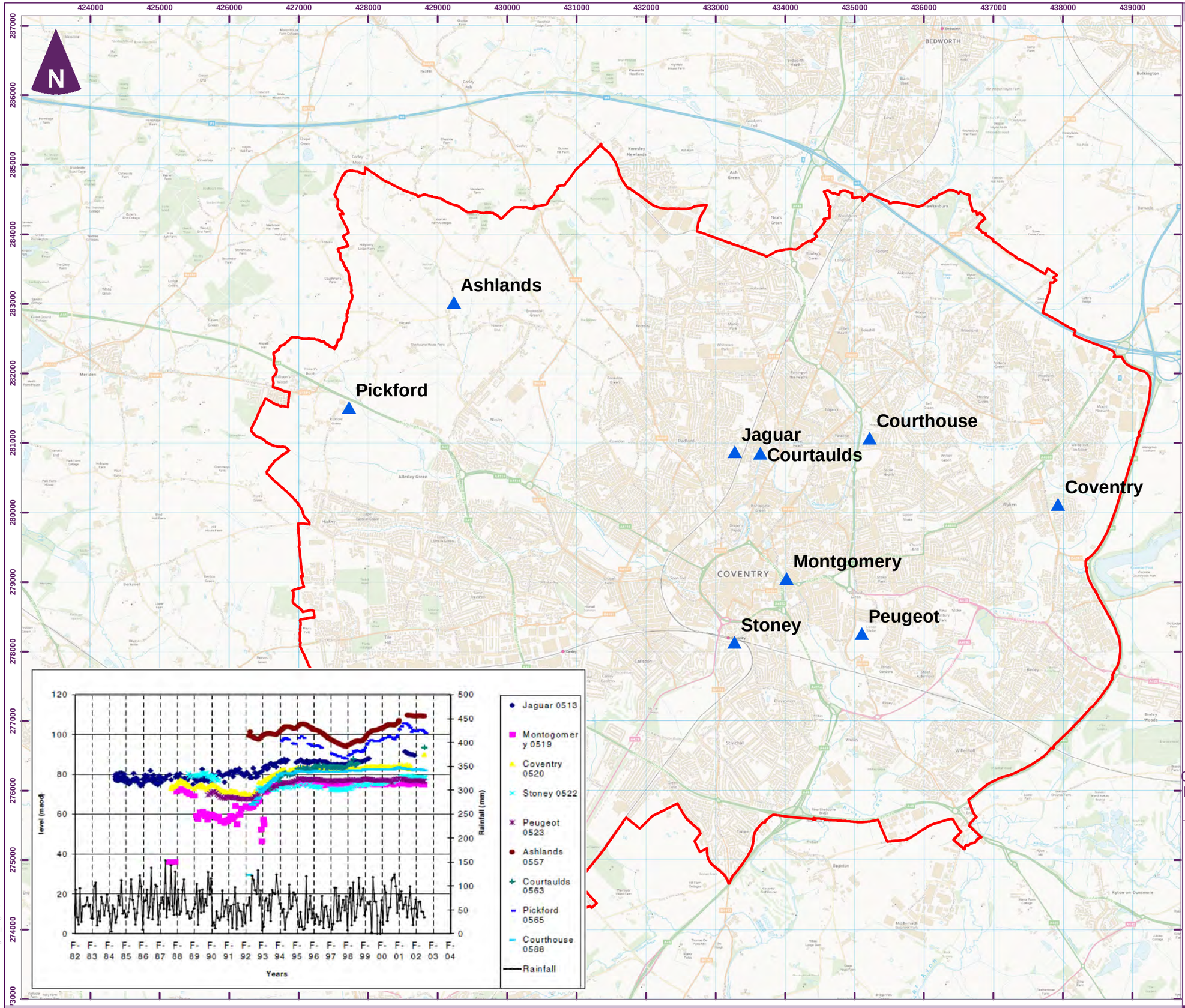


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Figure 3.9
Groundwater levels in monitoring boreholes in the Coventry area

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Flooding from other sources

There are few records of flooding from reservoirs and canals according to the SFRA in Coventry City Council administrative area. Flood events associated with reservoir impoundments breaching are extremely unlikely, due to the level of regulatory oversight and maintenance required of reservoir owners, however the risk has been mapped in order to inform society of the risk in such extreme circumstances. The Environment Agency Flood Risk from Reservoirs mapping (Figure 3.10) shows areas at risk downstream of impounded reservoirs with a capacity above 25,000m^3 (approximately 10 Olympic swimming pools). The mapping shows that areas along the River Sowe corridor would be at risk in the event of a reservoir breach at the dam retaining Coombe Pool, within Coombe County Park (managed by Coventry City Council). There is also a risk along the River Sherbourne upstream of Coventry City Centre, associated water with the risk from covered service reservoirs near of Pinketts Booth west of the City. The areas at risk do though typically coincide with the area of Flood Zone 3 shown on the EA's fluvial flood map. The mapping does not show areas at risk from smaller impounded reservoirs below the 25,000m^3 threshold, from which the consequences could be locally severe.

Two canals are located within Coventry City Council administrative area: the Coventry Canal and the Oxford Canal. Canals can overflow during extreme events when the associated land drainage water level management infrastructure (culverts, sluices) is overwhelmed. Major bank breaches can occur, leading to rapid and deep flooding of adjacent land. The Level 1 SFRA noted a reported incident of canal flooding by Bishops Green (SP 3354 8023), which occurred in 1978 due to a failure of the embankment. Large areas along the Canal in Coventry flooded as a result. It is thought that third party excavation works adjacent to the canal embankment were to blame for the breach.

Figure 3.10 Environment Agency flood risk from reservoirs map

Potential to accommodate growth

Sources and areas of flood risk across Coventry City Council's administrative area have been identified and assessed to understand any major constraints these will have for future growth plans. A summary of the Baseline Assessment findings is provided below.

Sources and scale of flood risk:

- There are areas of Flood Zone 2 and 3 along the River Sowe through the eastern end of Coventry City Council administrative area which will pose significant constraints to future development proposed near the watercourse.
- The River Sherbourne has been culverted through the centre of Coventry City Council administrative area, but there are areas of Flood Zone 2 and 3 along the open channel of the River in the west and south of the City. There are areas of Flood Zone 2 and 3 to the north and east of the culvert inlet representing preferential flow paths of water.
- Surface water flooding is the most extensive type of flooding across the Coventry City Council area. There is the potential for deep surface water flooding with high velocity flows along local valley bottoms and topographical low-points across all areas of the City.
- Rebounding groundwater levels due to lower demand for abstractions from heavy industry and manufacturing potentially pose a threat of groundwater flooding to lower lying parts of Coventry.
- The Coventry City canal has breached in the past causing major flooding to the north east of the city. Any future development growth will need to be designed to manage the risk of flooding associated with the canal.

Mitigations to enable development:

- For fluvial flooding, the approach set out in NPPF should be followed. The Sequential Test should be applied to sites, to promote suitably available sites in within a defined search area, at lower risk of fluvial flooding in preference to higher risk sites. For higher risk sites, the Exception Test will need to be satisfied.
- Flood risk from surface water should be assessed on a site-by-site basis, with opportunities to both enable development of a site, and to alleviate existing flooding problems advanced. In some cases development will need to be set back from areas of risk, or incorporate resilience measures (such as raising).
- In terms of the risk from groundwater flooding, where development is proposed below ground level (i.e. basements), the potential risks from rebounding groundwater will need to be considered.

Flood risk management through planning

The approach outlined in this SFRA follows the sequential risk based approach required by the NPPF. The SFRA process is designed to allow Coventry City Council to use avoidance of flood risk as the principal method of managing flood risk through the spatial planning process. If, in exceptional circumstances, following application of the Sequential Test development is proposed in areas of flood risk, the SFRA provides guidance on managing the risk through site layout and building design. In these circumstances Coventry City Council will need to carry out the Exception Test, based on information supplied in the FRA by the developer, to confirm that requirements of the test, and NPPF have been met

Sequential approach

Through the planning process, NPPF aims to reduce the flood risks faced by future developments, and advocates a risk avoidance approach to spatial planning. A sequential risk-based approach should be applied at all levels of the planning process, starting at the strategic scale. All strategic allocations should be directed to the lowest areas of flood risk where the proportion of land within Flood Zones 2 and 3 is relatively small. For vulnerable uses, key development locations with a low risk of flooding should be favoured over those at greater risk. The approach should though extend down to the site master-planning scale, for

example placing the most vulnerable developments on the lower risk areas of a site, and setting aside high risk areas for water compatible uses. Whilst the sequential process prevents development being steered towards high-risk areas, it accommodates development in areas of risk if it can be shown that the development is not vulnerable to flooding.

In delivering the projected growth over the plan period, Coventry City Council should seek to direct development vulnerable to flooding, such as housing, to sites which the Level 1 SFRA has identified as being in Flood Zone 1, before sites within Flood Zones 2 and 3. Sites within Flood Zones 2 and 3 should only be considered **only** if there are insufficient other sites, or because other sites located within flood risk areas need to be developed for wider sustainability reasons.

Sequential test

The NPPF defines the Sequential Test as a process to steer new development to areas with the lowest probability of flooding. Sequential Test is a key component of the hierarchical approach to avoiding and managing flood risk. This SFRA has mapped the fluvial/surface water flood risk areas in the Coventry City Council administrative area (Section 5). Further guidance on the appropriateness of land use types for each zone is available in Table 3 of the Technical Guidance to the NPPF. There are several key points that Coventry City Council should consider when applying the Sequential Test, these are outlined below:

- increasing the vulnerability of a site by proposing an alternative use of a higher vulnerability (even if consistent with the risk) is considered an increase in flood risk and not in line with the principals of NPPF;
- the most vulnerable land uses should be allocated first, in areas of least risk; and
- placing less vulnerable uses in low risk areas and thus reducing the amount of available space for more vulnerable uses in the lower risk zones is not appropriate. Such a situation can only be considered if it can be demonstrated that the only suitable site for the low vulnerability land use is in the area of low risk.

Exception test

The NPPF Exception Test is applied to a site once it has satisfactorily passed the Sequential Test. The Exception Test recognises that there will be some exceptional circumstances when development within higher risk zones is unavoidable. NPPF states the two components of the Exception Test:

- “it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.”

For Part 1, ‘wider sustainability benefits’, the accompanying NPPF guidance [15] details how this should be demonstrated. For this component of the Exception Test to be satisfied the proposed development will need to score positively against the aims and objectives of Coventry City Council’s Local Plans. Development proposals that fail to demonstrate this should be refused unless appropriate planning conditions/ obligations can be secured. A net sustainability benefit to the community is provided if the development contributes to measures such as: supporting the vitality, economy and regeneration of an area; provides facilities required by the community, if it involves redevelopment of a brownfield site/or a site in close proximity to existing settlement centres; and if unacceptable environmental impacts are minimised, and a net improvement is provided. This should be considered against a context where the development design demonstrates that flood risk will not be made worse (see Part 2) and hence reduce sustainability in flood risk terms.

Part 2 of the Exception Test, is a broader point. Whilst the sequential approach will have been applied in the process of selecting the site, this approach should not stop there. Under the Exception Test, the approach

[15] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/demonstrating-that-the-wider-sustainability-benefits-to-the-community-outweigh-flood-risk-to-satisfy-the-first-part-of-the-exception-test/

should be continued to best layout a site sequentially to direct the most vulnerable uses on the parts of the site at lowest risk from flooding. The entire approach to bringing the site forward for development should centre on minimising flood risk from the outset, it should not simply be a bolt on to a predetermined development proposal. Flood risk aware design should firstly seek to manage flood risk through avoidance through the site master-planning process, measures such as flood resilience (options such as raising of individual ground floor levels, understorey car parking areas) should then be utilised, followed by flood resistance (accepting a development will flood and using materials/ designs to allow a quick recovery). Together this process should be used to design a safe development suitable for the vulnerability of its users. This will need to be demonstrated in a site-specific FRA, which should also demonstrate:

- the development will not increase flood risk elsewhere and where possible help to reduce flood risk;
- provision of safe access and egress:
- the use of SuDS (Section 6);
- design, implementation and operation of flood defence infrastructure as well as funding arrangements; and
- site resident/ user awareness and the provision of flood warnings.

To support application of the Exception Test, the developer of a site may need to obtain further information on flood risk – from a Level 2 SFRA if prepared, from the Environment Agency if available, or by undertaking their own hydraulic modelling. The modelling will need to provide information on flood frequency, depth, velocity and speed of onset and allowing for the effects of future climate change on flood risk.

In assessing a FRA Coventry City Council should expect a satisfactory demonstration that flood risk elsewhere will not be increased. The exact details of this will be depend on the source and magnitude of the risk and the development context. Proposals should avoid land raising (without appropriate floodplain compensation), or redirecting flows (via land re-profiling, demolition/erection of linear built environment features). For major developments, and those including the provision or modification of flood defences, hydraulic modelling will be required. Where floodplain compensation is included, supporting calculations should be included, and these should detail the provision of level-for level compensation. Level-for-level compensation provides the same volume of replacement floodplain storage at the same elevation as the volume of storage that is being lost, and should be calculated for 0.2m deep bands. If compensation is not level-for-level the replacement flood storage may have already been filled with flood water at the start of event, and in fact provide no compensatory storage when it is actually required at the peak of a flood event. For larger floodplains/ defended areas, the volume of storage lost by the footprint of a building is often considered to be minimal compared to the overall volume. However, for extensive buildings, or small floodplains/ defended areas the impact of the loss of storage and its impact on water levels needs to be considered. Opportunities to reduce surface water runoff and the utilisation of SuDS should be included (see Section 6).

Consideration of climate change

Managing climate change and the associated heightened flood risks are key components of NPPF. Site specific FRAs should take into account climate change, for at least the next 100 years for residential development, unless there is a specific justification for considering a shorter period and upon agreement with Coventry City Council and the Environment Agency. For non-residential development the lifetime depends on the characteristics of that development and should be assessed by the planners based on the anticipated lifetime of the development. Coventry City Council should ensure that the latest climate change guidance, relevant to each type of future development is utilised in the design of that development.

The Environment Agency has published (September 2013) guidance on climate change allowances for FRAs[16] to support the requirements of NPPF. This details allowances for increases in river flows and increases in rainfall intensity over various time horizons to 2115. These allowances should be incorporated in FRAs to ensure appropriate assessment of the impacts of climate change. These allowances are based on the older (2006) Defra FCDPAG3 climate change guidance, but remain the correct climate change

[16] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296964/LIT_8496_5306da.pdf

allowances (at the time of writing - November 2014 [17]) for development under the Town and Country Planning Act (1990).

- **River flows:** for Main Rivers, the EA may hold modelling data including for climate change. Where hydraulic modelling is being carried out, the correct climate change allowance should be factored into model inflows; and
- **Rainfall intensity**: the correct allowance for an increase in rainfall intensity should be factored into the assessment of surface water flood risk – in the modelling of a development's SuDS system, and for strategic urban drainage and surface water management studies.

The UK Climate Projections (UKCP09) [18] has more recently produced a range of climate change estimates and allowances, which are now being used in the planning and design of certain developments such as infrastructure (including flood defences). The UKCP09 projections are more probabilistic, considering a wider range of climate change scenarios, and provide outputs at a higher resolution than previously available. In addition, new accompanying guidance on Adapting to Climate Change was issued by the Environment Agency in 2011 for use by Flood and Coastal Management Authorities. This guidance should be used by risk management authorities for flood and coastal erosion risk management design and planning.

The extent of Flood Zone 2 shows the extent of tidal and fluvial flooding with a 1 in 1,000 year chance of occurring. The Flood Map for Surface Water shows areas at risk from flooding in a 1 in 1,000 year storm in its 'Low' risk category. Mapping is provided in Section 5. Whilst the outline of these areas can give an indication of the areas that might become at risk in the future under the increasing influence of climate change this approach should be applied with caution. Where there are constrictions on a narrow floodplain, flood levels including for climate change can increase substantially; similarly in flat areas the extents of the area at risk can increase well beyond the existing flood extents. Detailed hydraulic modelling is therefore preferred, and is the only method to accurately establish the impacts of climate change on flood levels.

[17] The recommended guidance on allowances may change in future (to incorporate the UKCP09 approach), and should therefore be agreed with the EA/LLFA at the start of any flood risk assessment exercise.
[18] http://ukclimateprojections.metoffice.gov.uk

4. Development plans

This section describes both the housing and proposed employment plans, across the Coventry City Council administrative area, based on information provided within the Council Draft Strategic Housing Land Availability Assessment (SHLAA) produced in September 2014. All growth plans between 2011 and 2031 are described, that will be used within the Capacity assessment in Section 5.

It is important to note that the housing and employment numbers used were derived from Coventry City Council sources that were accurate at the time of data provision (July 2015). Any subsequent changes to the growth numbers have not been considered in this assessment.

4.1 Introduction

Housing needs in the Coventry and Warwickshire Housing Market area (HMA) are anticipated to be over 80,000 homes between 2011 and 2031 (over 4,000 per annum). In this context, Coventry's housing needs equate to 36,220 homes (1,811 per annum), with the remainder being accommodated within Warwickshire. The Coventry and Warwickshire Joint Committee for Economic Growth acknowledge, however, that Coventry will be unable to meet this level of housing need, and as a result a phased redistribution of housing need across the HMA is required. This would reduce the housing target in Coventry to around 23,600 homes, to be considered in the context of land availability and sustainable development.

For the Capacity Assessment Coventry City Council provided data on all development that has occurred since 2011 and mapping of locations of growth proposed through to 2031. This information is based on information provided within the Council Draft Strategic Housing Land Availability Assessment (SHLAA) produced in September 2014. While the housing target for the SHLAA was around 23,600, confirmation provided by Coventry City Council within the GIS and supporting information the numbers were identified to currently be 23,000. This is also accompanied by an estimated 32,000 new jobs across the area by 2031.

Since confirming the emerging levels of housing need, the Council has undertaken further technical evidence work relating to housing need and the relationship with the levels of economic jobs growth. Housing and employment numbers used in this study were derived from Coventry City Council sources and were accurate at the time they were made available (July 2015). This assessment does not include any subsequent changes to these numbers.

The Capacity Assessment considers the full range of potential sites (very large to very small) to flag up the different types of issues, or combinations of issues that could constrain development. Maximum development at sites represents the 'worst case' scenario from water infrastructure and flood risk perspectives. The Capacity Assessment therefore presents the results of 'worst case constraints' together with indications of how much development could be accommodated within existing environmental and infrastructure headroom (based on available information provided by Coventry City Council at the time of undertaking the assessment – July 2015).

The implications of growth on the water environment and water infrastructure do not consider the Coventry City Council data in isolation. The water resource assessment is based on a much wider area and the Capacity Assessment (Section 5) examines the composition of the demand forecast for the extent of the Water Resource Zone. Wastewater treatment operates at the much smaller scale of wastewater treatment catchment area, which can range from a small village to multiple large towns. The Capacity Assessment presents the constraints in terms of available capacity highlighting the risks from competing growth (housing and employment) in neighbouring districts where catchments extend across administrative boundaries.

The Strategic Housing and Land Availability Assessment (SHLAA) data is applied during the Capacity Assessment and focuses on growth within Coventry City Council administrative boundary, but extends to consider wider growth plans where infrastructure catchments and water supply areas include wider growth plans. Both Employment and dwellings are included in the assessment.

4.2 Housing supply

Sites identified within the 23,000 development plans range from large strategic sites of up to 3,000 dwellings to individual sites. A full List of all 1,087 sites is provided in Appendix A.

Of the 23,000 dwellings 2,998 have already been constructed (between 2011 and 2014), while 1,111 are under construction (during 2014/15). The remaining housing are either allocated or already committed (i.e. have been granted planning permission but have not yet commenced construction).

The future development data used in the analyses at the time of this study (August 2015) is as follows:

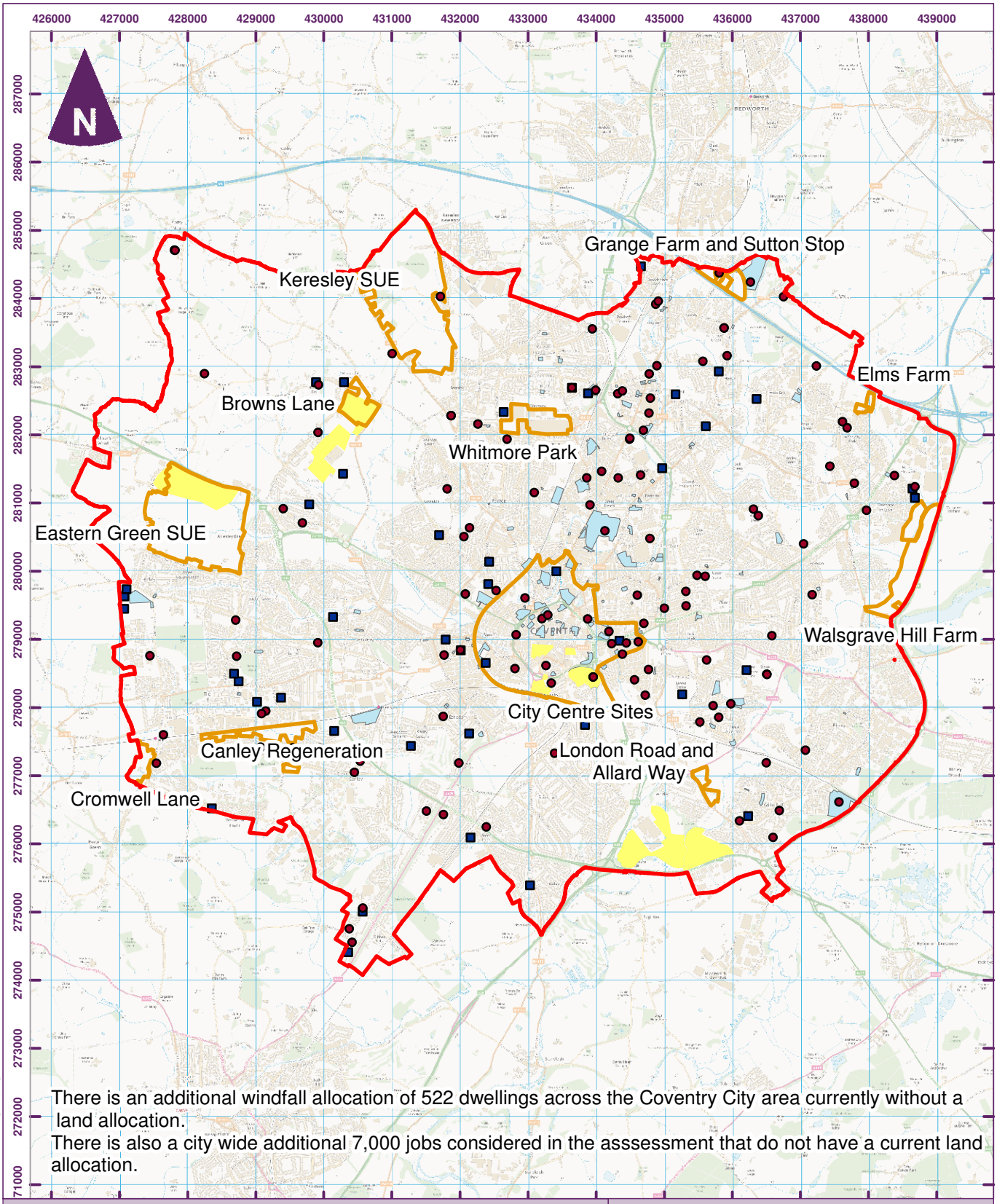
- 2,407 committed dwellings (Planning permission has been granted but construction has not started);
- 10,304 allocated strategic sites;
- 5,658 additional shortlisted sites; and
- a windfall allocation of 522 dwellings across the Coventry City area.

Windfall allocation provides an indication of anticipated housing across the area that at this stage does not have a land allocation.

The dwellings constructed between 2011 and 2015 are anticipated to be already occupied and therefore will be accounted for within the Baseline Assessment. Therefore no consideration is made of these numbers when considering development plans going forward within the Capacity Assessment (Section 5).

Ongoing completions and planning application approvals continually change the balance between committed and allocated data but the planning data as used within this study is presented in Appendix A. Figure 4.1 maps the committed and allocated housing and employment sites. On the basis that planning applications are valid for five years (after which they are revoked) there is significant potential for pressure on the water cycle and water services infrastructure to be realised within the committed sites in the next five years.

A summary of the largest strategic housing growth sites and shortlisted sites are listed in Table 4.1 and labelled within Figure 4.1.



Key

- Sites with Planning Permission
- Sites Under Construction
- Employment Sites
- Strategic Sites
- Shortlisted Sites
- Coventry City Council Administrative Area

0 0.4 0.8 1.2 1.6 2 km

Scale at A4: 1:80,816

Coventry Water Cycle Study

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Figure 4.1
Proposed Growth Within Coventy City Council Adminstrative Boundary

Table 4.1 Large-scale potential strategic development sites within the study area

Site name	Potential No. dwellings
Eastern Green	2300
Cromwell lane	240
Canley Regeneration	750
Land at London Road and Allard Way	160
Walsgrave Hill Farm	842
City Centre Sites	2000
Elms Farm	100
Whitmore Park	500
Keresley SUE	3000
Browns Lane	100
Grange Farm and Sutton Stop	312
BW6	255
F54	450
StM27	300
StM67	286

4.3 Employment

Water use occurs not only within domestic dwellings but also within offices and other sites whilst people are at work. Generating more employment in the future will therefore also put an increase on demand for water and the capacity of existing infrastructure to accommodate this. The level of demand for water and therefore pressures on the existing infrastructure can vary depending on the type of employment with light manufacturing industries being likely to require more process water than office style employment sites.

In addition to the planned housing growth Coventry City Council has proposals for 32,000 jobs to be accommodated across the area. This includes 152ha of proposed land and a city wide allocation for the remaining 7,000 jobs (Figure 4.1 and Table 4.2).

The sites already with a land allocation across Coventry City Council area include a mixture of Use Class B1a, B1b, B1c (office business), B2 (general industry), or B8 (storage). At this stage there is insufficient data on the likely type of industry that would be built on which to estimate a forecast of process water demand for industrial work (i.e. for the B2 use classes). Therefore for the purpose of the capacity assessments in Section 5 all employment is assumed to be of the 'domestic type use'.

Table 4.2 Proposed employment sites

Site name	Potential No. employees
Eastern Green	2,500
Browns Lane - Lyons Park and expansion land	3,000
Whitley business park and expansion land	5,000
City centre South	1,000
Coventry University expansion	1,000
Friargate	15,000
Parkside Techno Park - possible expansion	500

4.4 Trajectory

The planned 23,600 dwelling and 32,000 jobs are proposed in the period between 2011 and 2031, and high level indication is available on when these developments will go ahead. The actual timescales of these development proposals is currently uncertain and is subject to change as planning permissions are requested and subsequently accepted or rejected. Based on available information at the time of writing this Water Cycle Study (information provided during July 2015) an indicative development trajectory can be developed (Table 4.3). The Capacity Assessment will consider the phasing of development, and the indicative timescales of the trajectory as shown here.

Table 4.3 Indicative timescales of proposed growth

	2011/2012	2012/2013	2013/2014	2014/2015	2015/1016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031	Total
Completed Housing	921	994	1,083																		
Under Construction				1,111																	1,111
Planning Permissions				664	524	370	123	329	82	68	57	10	121	79	0	0	0	0	0	0	2,407
Strategic Sites				0	300	500	675	440	496	611	637	795	810	840	740	740	640	720	720	640	10,304
Shortlisted Sites				446	943	617	428	529	450	409	250	196	326	353	292	220	199	0	0	0	5,658
Windfall				30	30	30	30	30	31	31	31	31	31	31	31	31	31	31	31	31	522
Employment Sites (Total no. Employees)				0	3,417	3,417	3,417	3,417	3,417	1,617	1,617	1,617	1,617	1,617	1,216	1,216	1,216	1,216	1,216	750	32,000

5. Capacity assessment (Phase 2)

The primary aim of the Capacity Assessment is to identify potential environmental and water infrastructure limitations to development, to provide an evidence base to support the Local Plan and identification of preferred sites for development. The Coventry City Council Strategic Housing and Land Availability Assessment (SHLAA) data (Section 4) is applied during the Capacity Assessment.

Housing and employment numbers used were derived from Coventry City Council sources and were accurate at the time they were made available (July 2015). The assessment in this report does not include any subsequent changes to these numbers.

5.1 Water resources and water supply capacity assessment

Section 3.2 highlights how Coventry is a relatively small component of the Strategic Grid water resource zone. However, understanding the implications of growth in Coventry on the overall supply-demand balance of the zone remains important. Severn Trent Water is managing a very fine balance between supply and demand (Figure 3.3) and therefore even relatively small deviations from 'forecast' consumption levels have the potential to trigger water resource challenges when applied across a high number of development sites.

This section examines the impact that three alternative demand levels could have on Coventry's overall demand for water. It forecasts Coventry demand on the basis of customers' per capita consumption matching the per capita consumption (pcc) forecast put forward by Severn Trent Water, plus a lower and upper 10 percent deviation. These scenarios illustrate the significance of taking action to ensure new developments are designed to enable residents to use water efficiently. The results inform the recommendations provided in Phase 3.

Converting dwellings and dwelling equivalents to a daily demand for drinking water

Coventry City Council has provided annual time-step trajectories of dwelling developments per site (i.e. those large scale strategic sites, and the smaller individual sites already under construction, with planning permission, and shortlisted. The information provided on the employment sites includes the expected number of employees that the site would generate. It is recognised that these are estimates.

The development data has been converted into assessments of the likely demand for water that they will generate. This information is used to assess the overall impact on water resources required to support this demand, as well as the more localised impacts in terms of demand on local water supply network infrastructure. On the basis that demand for water supply subsequently generates demand for sewerage and wastewater treatment this data is also applied in Section 5.2.

Box 1 Summary of approach to calculate demand for water resource and supply infrastructure

Household demand:
For each individual development an occupancy rate of 2.4 is applied to calculate the associated population (in line with the occupancy rate assumed by Severn Trent Water in its supply-demand balance assessment of the Strategic Grid water resource zone). Since 1990 it has been a legal requirement that all new homes have a water meter installed. Severn Trent Water disaggregates its household customer base into measured and unmeasured customers and forecasts annual time-step per capita consumption (pcc) for both types (plus an average taking all customers into account). In 2015/16 measured pcc stands at 130 litres/person/day. Overtime this is forecast to decline as a result of existing policies targeting consumption and promoting water efficiency at home. This assessment has taken a conservative approach to forecasting the impact of growth on demand and so has not factored in that reduction.

Domestic-type demand in commercial builds:
It is recognised that people do not use as much water at work as they do at home. There are a range of estimates of how much an FTE uses. Best practice[19] states this should be no more than 7.9 litres. In 2014 the UK Government issued water consumption targets for its own estate[20] stating that between 4m^3 and 6m^3 water consumption per FTE per year reflects 'good' practice (typically for office type environments). Assuming 255 days per work year this suggests a range of between 15 and 24 litres/FTE/day. On the basis that new employment sites should benefit from the latest available water using appliance and fittings (which are typically more water efficient than older models) an assumption of 16l/FTE/day has been applied.
Once the daily demand for water for each employment site is calculated it is divided by the comparable measured pcc (in this case 130 litres), and then further by the 2.4 occupancy rate. This calculates a 'dwellings equivalent'

Impact on water resources:
Within the Strategic Grid water resource zone customers can theoretically be supplied with water taken from resources anywhere within the zone, or imported into the zone. On this basis it is not necessary to disaggregate demand between the various development sites. Total demand per annum has been assessed to identify the volume and rate of increase in demand.

Impact on local water supply:
Demand for each individual site (assuming all planned capacity is delivered) is calculated. The high volume demand associated with strategic housing developments and employment sites are identified specifically. The much smaller individual demands from the non-strategic housing developments are grouped spatially and the total demand calculated. The smallest sites (<10 dwellings) are excluded to avoid a very high number of small scale local assessments

The annualised time-step data setting out how many dwellings are forecast to be developed per year per site enable a 16 year profile of additional demand to be forecast. Figure 5.1 shows three alternative forecasts of total demand, based on:

i. application of the annual change in measured pcc (as published in the Severn Trent Water WRMP) to the dwelling population forecasts (the black line);

ii. a slightly more cautious forecast of measured pcc (a 10% increase above the Severn Trent Water forecast) (the red line); and

iii. a more optimistic scenario of enhanced water efficiency (a 10% reduction in the Severn Trent Water forecast) (the blue line).

The chart also shows the absolute contributions to total demand (in relation to scenario (i)) from the different types of site development (i.e. the strategic sites, shortlisted sites, those with planning permission, and the employment sites).

[19] CIRIA (2006) 'Water Key Performance Indicators and benchmarks for offices and hotels'
[20] https://www.gov.uk/government/publications/greening-government-commitments-targets/greening-government-commitment-targets

Figure 5.1 Cumulative water demand projections for the Coventry City region

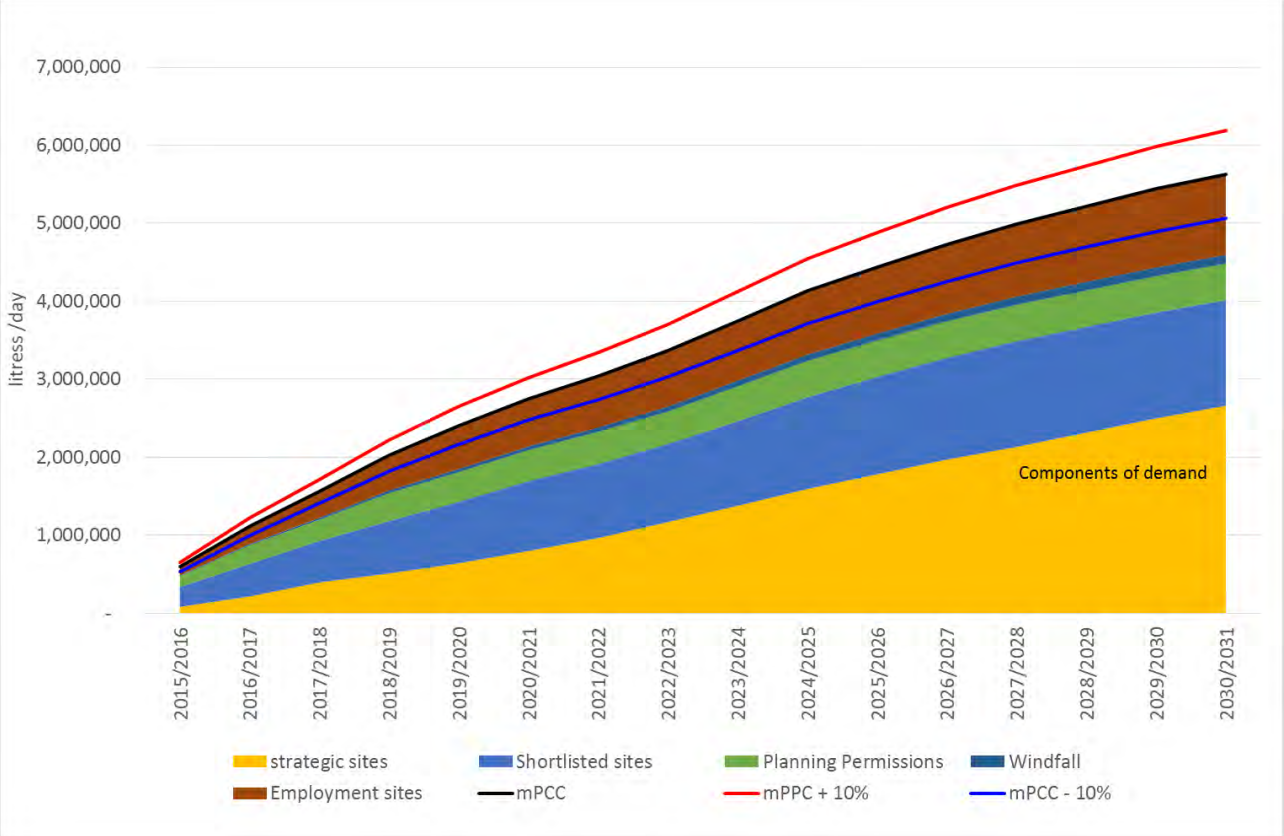


Table 5.1 Cumulative increases in demand (Ml/d) associated with housing and employment

	2015/16*	2019/20	2024/25	2030/31
Strategic sites	0.08	0.64	1.59	2.66
Under Construction	0.25	0.79	1.18	1.36
Shortlisted sites	0.14	0.38	0.47	0.47
Planning Permissions	0.01	0.04	0.08	0.11
TOTAL (Mld)	**0.48**	**1.85**	**3.32**	**4.59**

*Year 1 of development (excluding the existing under construction).
Figures in Table 3.2 based on assumed measured per capita consumption in line with the Severn Trent Water forecast (declining from 130l/h/d) in response to baseline water efficiency activities.

The most significant issue is the rise in overall demand that the Coventry developments are forecast to generate. In year one of development (2015/16) demand is forecast to increase by almost 500,000 litres/day (0.48Ml/d). Figure 5.1 shows how the dominance of the different types of development will change over time. The strategic sites are the single largest contributor to demand but the rate increases from 2022.

The growth rate and associated demand rate is much higher in the first five years of the development trajectory (almost doubling in 2016/17), followed by less steep increases of 40 and 30 % per annum. The rate then slows significantly to approximately 10% p.a and 3% towards the final years of the forecast. This means that the pressure to maintain supplies in line with growth (if capacity is needed) will be most

significant in the short-term, although the pressure will then subsequently be maintained and will continue to build over time.

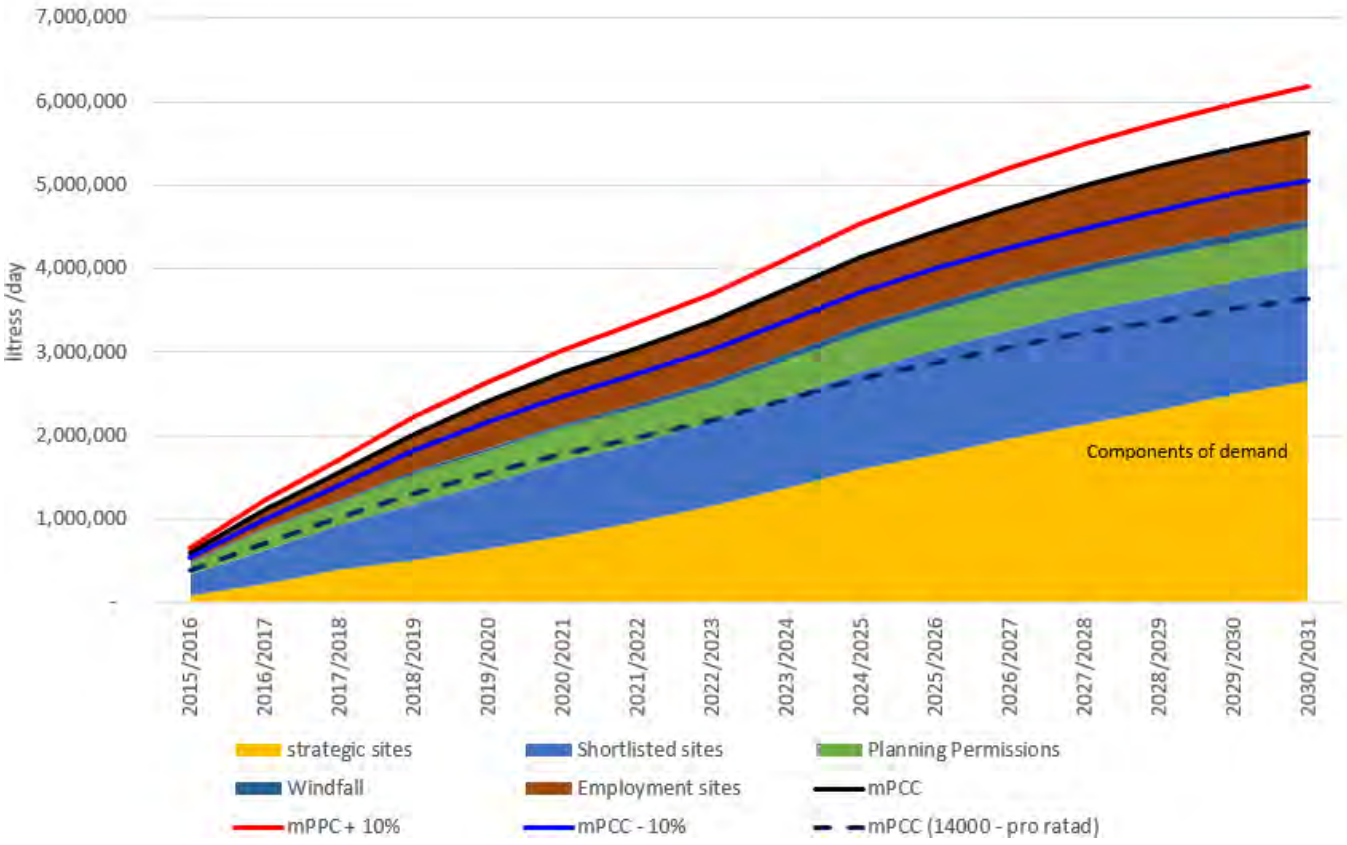
Implications of growth on the supply-demand balance

Severn Trent Water's baseline SDB forecast includes a total of 188,520 new properties and a population increase of 605,630 between 2015/16 and 2030/31. However, as explained in section 3.2 this reflects growth across the entire Strategic Grid water resource zone. Severn Trent Water's most recent AMP/ WRMP plans were completed in 2014, and set out the company's planned investment needs for the period 2015-2020, giving a long term look ahead to 2040. The company has confirmed that for the WRMP14, as per the Environment Agency's planning guideline, that it initially gathered each local authority's forecast housing trajectories from their Local Development Framework Annual Monitoring Reports. The most recent reports available at the time were from December 2012. Severn Trent Water then made assumptions on the likely rate of growth based on recent history and the big uncertainties in the economy and the housing market at the time. To validate these planning assumptions the company then wrote to each of the authorities in its area and consulted on the growth assumptions that it was making. Only a few authorities replied to either update or confirm those assumptions, and unfortunately Coventry did not. This re-emphasises the importance for Coventry Council and Severn Trent Water to improve communications on these shared matters.

The most recent data available from Coventry when Severn Trent Water put their investment plan together was a total housing growth projections of approximately 14,000 households between 2013 and 2028. This is considerably less than the 23,000 new homes that are now planned. As a consequence this creates an enhanced risk that the overall supply-demand balance of the Strategic Grid will have a greater deficit than forecast in the baseline scenario. An extra 9,600 homes could equate to around an extra 3Mld of demand just from the Coventry area. 9,600 homes could support around 23,000 people (at an occupancy rate of 2.3) with an average measured pcc of 130 litres/head/day.

Figure 5.2 adds the water demand trajectory based on the 14,000 homes incorporated by Severn Trent Water in its own plan on to the demand scenarios. It shows markedly how the updated development plans could increase the pressure strategically (i.e. as a pressure within the Strategic Grid) and also local to Coventry (impacts on supply infrastructure).

Figure 5.2 Inclusion of 14,000 properties demand for water



The water companies recognise that there is uncertainty associated with forecasting housing numbers, and that actual development can be both more or less than planned due to the influence of external market forces. In order to take account of this, and other aspects of uncertainty in the forecast, the water company calculates a headroom buffer. It is not possible to examine the proportion of the total headroom that has been allocated to this aspect of the demand uncertainty, and the headroom volume is at the resource zone level, not the city level.

However, Figure 3.3 (Phase 1) shows the gap between the sum of the demand components and the blue 'demand' line in the baseline scenario. This gap is the headroom component (a buffer to accommodate uncertainty). The company has calculated that it needs to allow for 47Ml per day of extra water to be able to cope with the consequence of the various uncertain aspects of the forecast, to prevent a supply deficit (this is already included in the baseline forecast). These aspects are:

Supply uncertainty:

- bulk imports (continued availability from neighbouring zones or other companies);
- gradual pollution (increases such as nitrates in groundwater can reduce the volume of water that can be put into supply after treatment);
- accuracy of supply-side data (for example the yield of an abstraction licence may decline from the level forecast); and
- impact of climate change on deployable output (changing weather patterns can impact on how much resource there is available to put to into supply).

Demand uncertainty, based on the demand forecast:

- accuracy of sub-component demand (this is where inaccuracies in projected housing or occupancy rates and population levels can have an impact on the total demand forecast);
- demand forecast variation (this relates to the overall significance of potential variations in total demand); and
- impact of climate change on demand (this includes the impact of different weather patterns on customers' water usage behaviours).

Option uncertainty, encompassing:

- new sources (this is the uncertainty associated with the volume of water that a new source may actually yield); and
- demand management measures (this is the uncertainty of how much water may actually be saved by the demand management schemes planned).

An extra 3Mld (assuming all other growth regions have been adequately confirmed) could increase the 2020 deficit from -14Mld to -17Ml/d (see Figure 3.3) and could drive additional options to secure supplies. This extra 3Ml/d represents about 4% of the anticipated deficit by 2030-31. 3Ml/d could be incorporated by the headroom allowance but Severn Trent Water will likely need to reconsider the implications of this elevated growth, with revised growth figures for other towns and cities supplied by the Strategic Grid Zone, in its next long-term resource plan due in 2019.

For the Strategic Grid, Severn Trent Water has applied the vast majority of headroom to deal with the uncertainty associated with the impact of climate change. This is likely driven by the potential for further changes in weather pattern to trigger more reductions in permitted abstraction levels. In total 20Ml/d has been allocated to cover all the 'other' uncertainties in 2015/16. By 2024/45 this allowance decreases to 6Ml/d and then to less than 3Ml/d by 2029/30.

Impact of climate change

Severn Trent Water's demand forecast for the Strategic Grid includes assumptions of per capita consumption that take account of the potential impacts of climate change. Severn Trent Water has used estimates of future climate impacts from the more recently published (2012/13) UKWIR project, "Impact of Climate Change on Demand", which presents updated estimates of the impact of climate change on water demand. National algorithms enable forecast impacts of climate change on different components of demand in different parts of the country to be made. Severn Trent Water has identified that it is the external use component (i.e. garden watering etc.) that will be subject to the impacts of climate change, and under a climate change scenario has estimated a 0.92% impact on demand by 2040.

Scope to further reduce consumption in the Coventry area

Severn Trent Water uses customer meters and meters within the supply network (district metered areas) to support its assessment of base year and forecast measured and unmeasured water consumption. The baseline forecasts show that unmeasured pcc is currently 141 litres/h/day and could decrease to 132 litres/h/day by 2029/30. Given that the measured pcc is already at 112 litres/h/day (falling to 106 l/h/d by 2029) and taking into account that there are currently slightly more unmeasured than measured customers, the average pcc is 130 l/h/day. This is below the national average which is still approximately 150 l/h/day 2029/30 the average is forecast to fall to around 117 l/h/day. Severn Trent Water already has a range of baseline water efficiency policies in its operational activities which reflect the cost-effectiveness of water efficiency activity in relation to the level of water stress in this area (i.e. moderate water efficiency is required and economically justified but not quite to the same extent facing some of the water companies in the south and east of England). The key components of baseline water efficiency that the company will continue into AMP6 (2015/2020) are to:

- provide information to consumers on how to save water;

- provide a range of water saving products which are free to customers on request;
- provide discounted higher value water saving products (e.g. water butts, showerheads);
- improve and increase company links with third parties to form partnerships – internal and external - to take advantage of scheduled visits to promote water efficiency and to retrofit water efficient devices; and
- provide water efficiency advice and access to free water saving devices as part of the company's free meter optant programme.

Technically there is scope to do more to reduce water demand further and Coventry City Council is encouraged to partake in various water efficiency initiatives, and small scale pilots and water efficiency demonstrator projects are invariably well received. However, there is likely to be limited support for calls for more widespread intensive (and expensive) action to further drive down water consumption. Coventry City Council is urged to help support Severn Trent Water to meet its forecast measured consumption forecasts by strengthening its requirements on housing developers to deliver properties that are designed to enable customers to manage their consumption to the levels presented here (see Section 6 Recommendations).

Spatial assessment of increased pressure on the water supply network

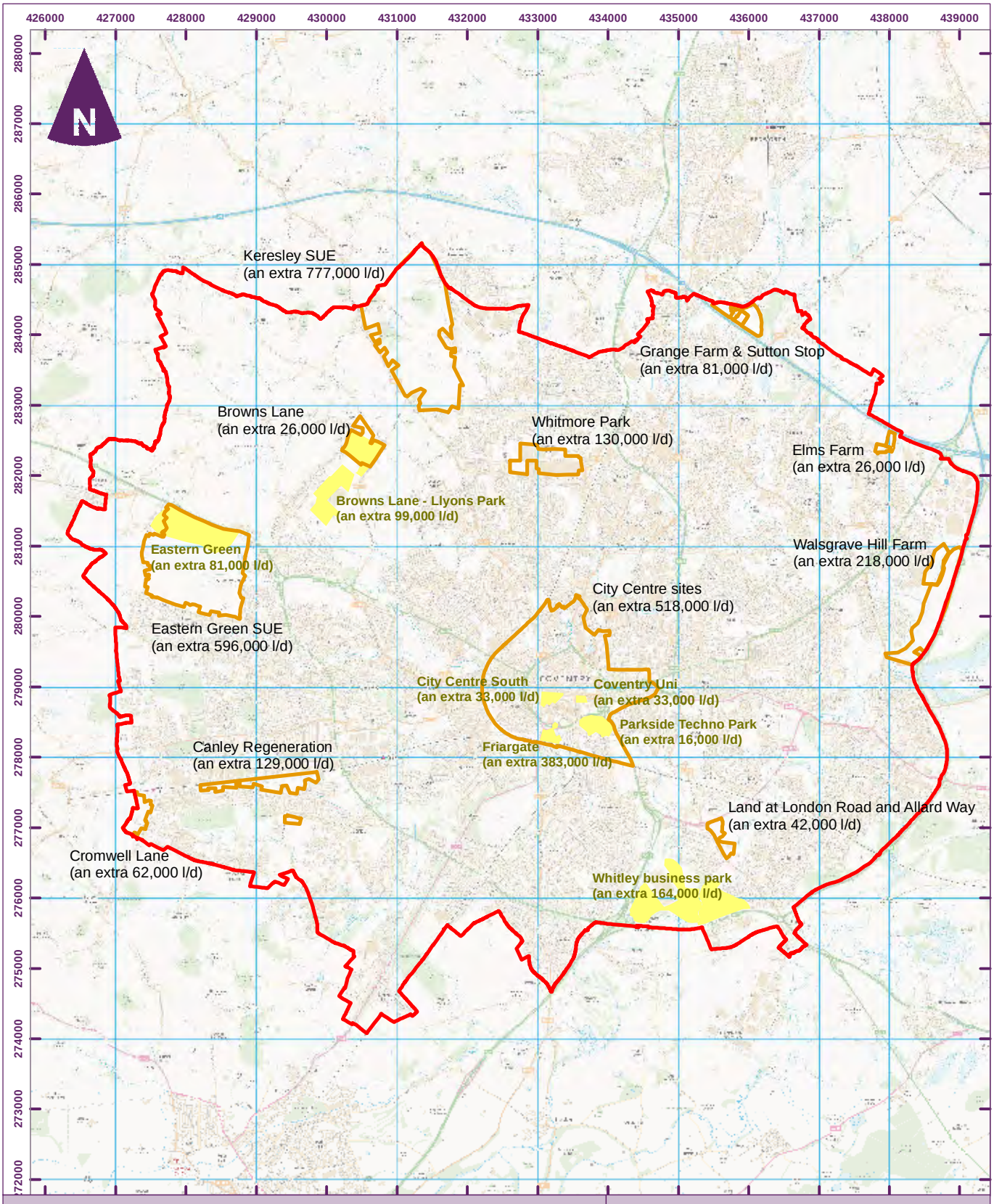
There are ten specific strategic housing development areas, and an aggregated 'city centre' area (see Figure 4.1). The total demand for water supply (and therefore additional pressure on the supply infrastructure) for each specific area is shown in Figure 5.3. There are also 300 smaller scale residential sites with a combined total capacity to provide up to 8876 dwellings. Total demand for water has been calculated for each strategic site, and aggregated totals for the smaller sites (Figure 5.4). The demand has been calculated on the basis of full completion. The following assumptions have been applied:

- new homes will have an occupancy rate of 2.4; and
- new homes will have a meter installed and the current measured per capita consumption (pcc) rate of 130 l/h/day has been applied. As explained in Section 3.2 Severn Trent Water forecasts a declining trend in measured pcc but the current level of 130l/h/day has been applied as a conservative approach.

This information has been shared with Severn Trent Water to support a high level assessment of the capacity of the local water supply infrastructure to meet these needs. To streamline the process a threshold of at least ten dwellings per site has been applied to the higher number of smaller sites. Consequently the impact of 569 dwellings to be distributed around the city are not included in this assessment. Similarly, the potential impact from windfall sites cannot be assessed at this point as their locations are unknown.

Capacity of the supply network to support growth demands

Severn Trent Water has reviewed the study area and the potential supply pressures that the development sites are likely to generate (Figures 5.3 and 5.4). Severn Trent Water has confirmed that in AMP6 (2015-2020) it has a planned programme of water mains renewal to improve the quality and reliability of supplies to customers, and to upsize mains to accommodate planned growth. The company is in the early stages of assessing the investment needs for the areas identified and intends to confirm the detailed mains programme later in this AMP. The company has stated that the timing of this Water Cycle Study consultation is helpful, and that it will include this level of development planning in its investment appraisal.



Key

Employment Sites

Strategic Sites

0 0.4 0.8 1.2 1.6 2 km

Scale at A4: 1:77,980

Coventry Water Cycle Study

amec foster wheeler

Figure 5.3
Strategic sites demand for water supply services

September 2015 7227-Rdg05_Fig5-3.mxd Ryans

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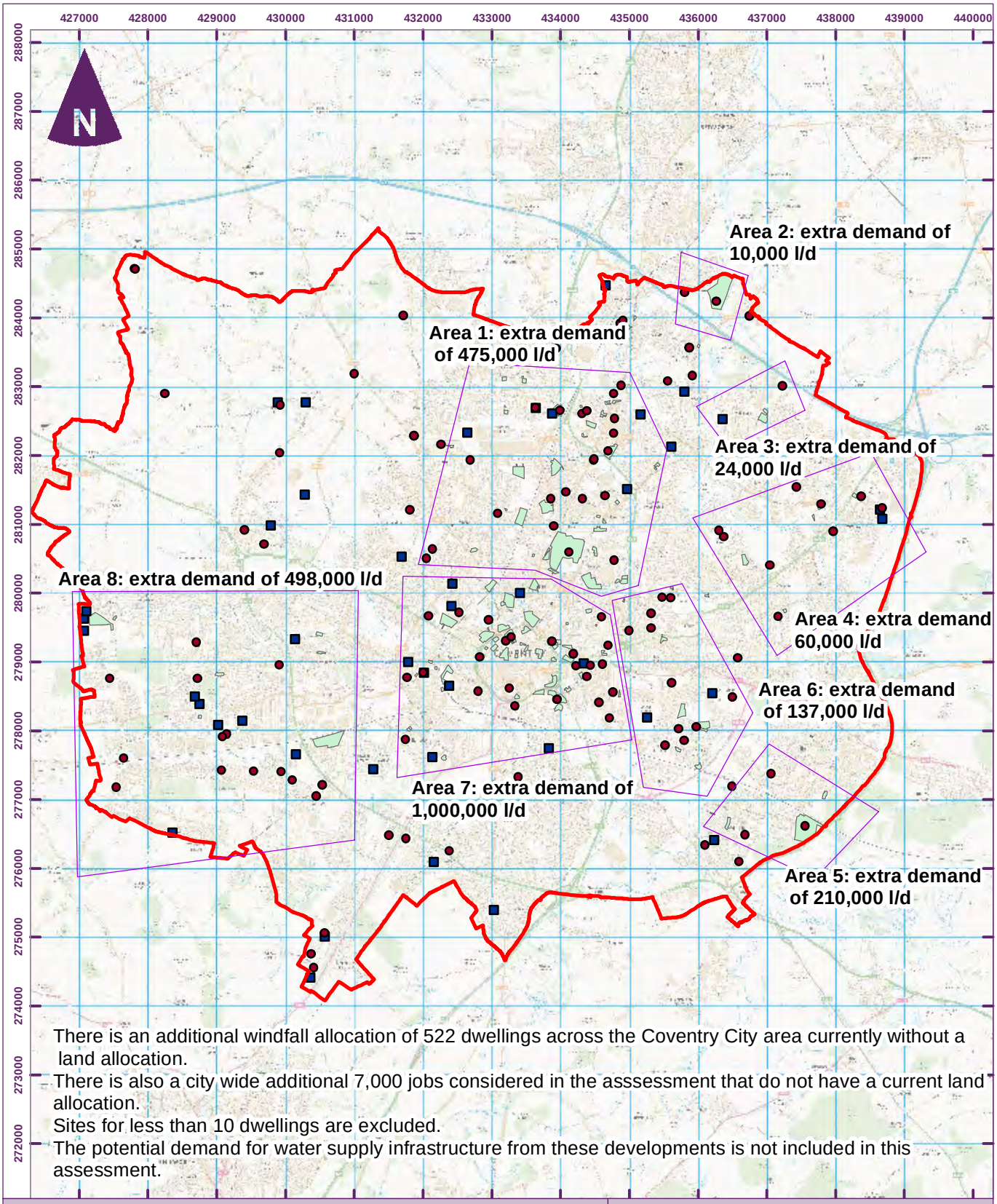


There is an additional windfall allocation of 522 dwellings across the Coventry City area currently without a land allocation.

There is also a city wide additional 7,000 jobs considered in the asssessment that do not have a current land allocation.

Sites for less than 10 dwellings are excluded.

The potential demand for water supply infrastructure from these developments is not included in this assessment.

Key

- Coventry City Council Administrative Area
- Arbitrary area
- Sites with Planning Permission
- Sites Under Construction
- Shortlisted_Sites

0 0.4 0.8 1.2 1.6 2 km

Scale at A4: 1:80,000

Coventry Water Cycle Study

amec foster wheeler

Figure 5.4
Non-strategic sites demand for water supply services

5.2 Waste water treatment and water quality capacity assessment

This section of the Capacity Assessment examines further the wastewater treatment and sewerage network capacity limitations that were identified within the Baseline Assessment (Section 3.3), taking account of SHLAA housing and employment growth plans within the Coventry City Council administrative area. Specifically it examines:

- growth proposed per WwTW catchment based on the SHLAA data;
- Severn Trent Water's Phosphate removal plans and capital maintenance that will be completed by 2020 at Finham WwTW;
- the limited growth that could be accommodated within the existing WwTWs to the north west of Coventry (Meriden and Corley WwTWs);
- the capacity of the WwTWs to accommodate growth in relation to the current and future requirements of the WFD and other designated sites; and
- the sewerage issues raised in the scoping assessment.

Development plans

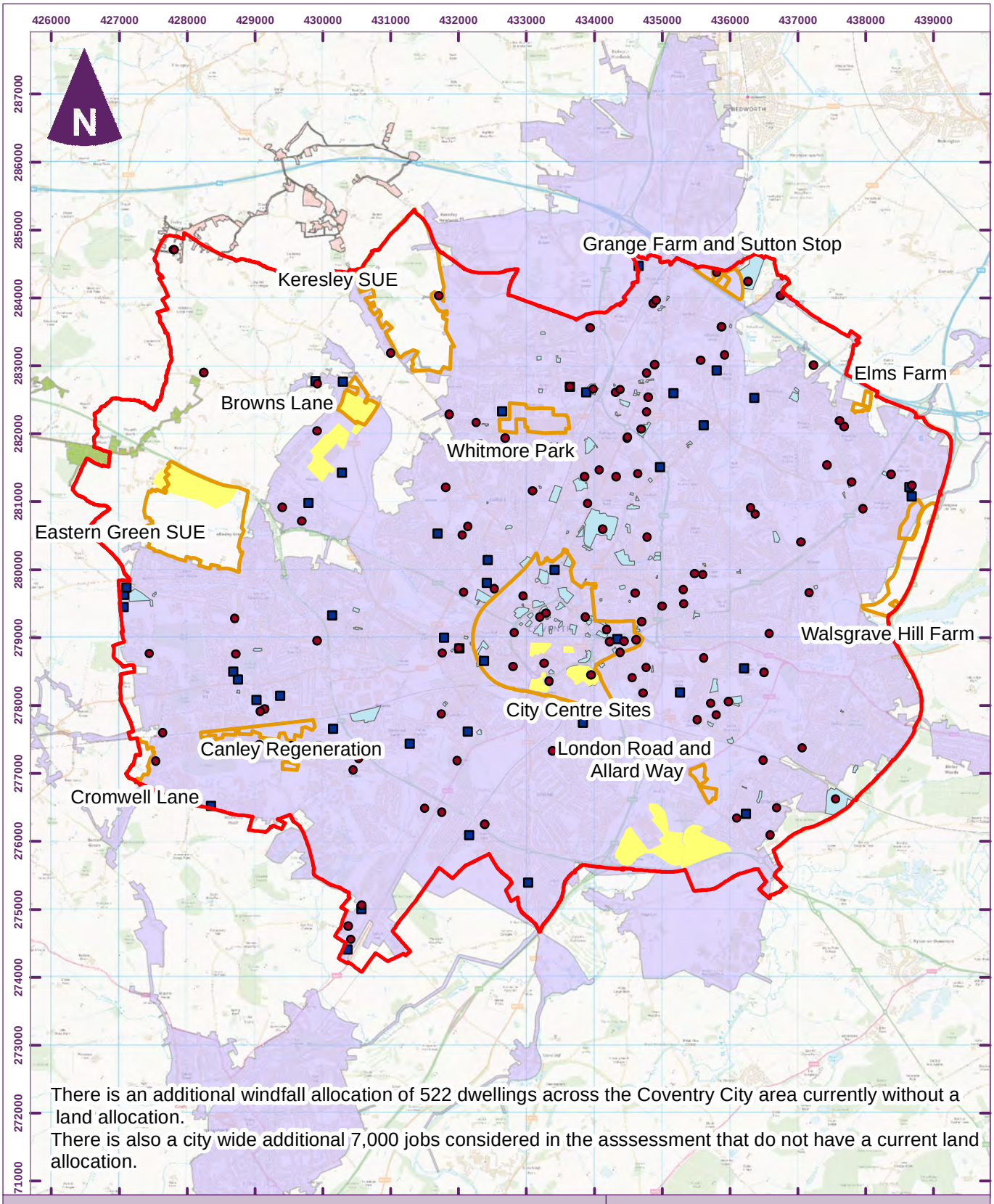
Growth plans within Coventry City Council administrative boundary

All the SHLAA development and employment sites (Section 4) have been mapped against the wastewater treatment works catchment areas (Figure 5.5). It is clear that the majority of the housing and employment growth plans within the Coventry City Council administrative boundary falls within the catchment of Finham WwTW. Small amounts of growth are located within the catchments of the two smaller WwTWs to the west of Coventry.

Table 5.2 lists the WwTWs together with an indication of the additional growth that they could potentially be required to serve (both housing and employment) within the Coventry City Council administrative area. The housing growth plans include sites currently under construction, sites with planning permissions, shortlisted sites and all strategic sites (See Section 4), representing all growth plans from 2015 onwards. Wastewater from developments already constructed between 2011 and 2015 will already be accommodated by the relevant WwTW and therefore have been accounted for within the Baseline Assessment.

A full list of the individual growth sites (housing and employment) and the associated WwTW catchment is provided in Appendix A.

For the purpose of this is assessment it is assumed that any development sites that are located adjacent to or within 150m of a WwTW catchment boundary will be accommodated by that WwTW. Therefore all planned growth considered in this assessment will be accommodated within existing WwTW catchments. All windfall sites (that have no land allocation) are assumed to be accommodated by Finham WwTW.



Key

- Sites with Planning Permission
- Sites Under Construction
- Employment Sites
- Strategic Sites
- Shortlisted Sites
- Coventry City Council Administrative Area

STW Catchments

- Corley WwTW
- Meriden WwTW
- Finham WwTW

0 0.4 0.8 1.2 1.6 2km

Scale at A4: 1:80,816

Coventry Water Cycle Study

amec foster wheeler

Figure 5.5
Proposed Growth Within Coventy City Council Adminstrative Boundary

Table 5.2 WwTW catchments serving Coventry City Council administrative boundary and indicative housing and employment growth served

	WwTW catchment	Housing growth planned (dwellings)	Employment growth planned	Additional growth outside the Coventry City administrative area	Total dwellings (Inc. housing and employment)
Main Urban area of Coventry	Finham	19,998	32,000 Employees (3938 dwelling equivalent****)	7,000 Dwellings and 20,500 Employees (2523 dwelling equivalent****) *	33,459
Corley Moor	Corley	2	0	40 Dwellings**	42
Millisons Wood, Pinketts Booth and surrounding areas	Meriden	2	0	60 Dwellings***	62

* High level indication of growth plans within the southern and eastern parts of the WwTW catchment based on a summary of the Coventry & Warwickshire Joint Committee for Economic Growth and Prosperity/Shadow Economic Prosperity Board Meeting, Friday 21 November 2014, and GIS mapping provided by Coventry City Council
** Estimate provided by North Warwickshire Borough council based on past building rates, planning consents issued and officer opinion as to potential future site and redevelopment opportunities in the Parish and may change if planning restrictions or policy changes.
*** Summary information provided by Solihull Metropolitan Borough Council based on the adopted Solihull Local Plan 2013 and The Strategic Housing Land Availability Assessment 2012
**** Calculated as described in BOX 1, Section 5.1.

Additional growth outside Coventry City Council boundary

As identified within the Baseline Assessment (Section 3.3) all three WwTW catchments extend beyond the Coventry City Council administrative area. Therefore these WwTWs may need to accommodate growth plans of the neighbouring councils as well as those of Coventry City Council. Table 5.2 summarises the estimated housing and employment plans of other councils (anticipated within the catchment of the WwTWs). It is important to note that these numbers are estimates based on council specific Local Plans and previous building rates, and are subject to change. No location specific information is available for the growth in these areas.

Growth plans within the WwTW catchment areas for these neighbouring councils will be considered within the following Capacity Assessment, in addition to the plans within Coventry City Council administrative area. This will give full understanding of possible constraints on the WwTWs.

Total growth considered within the assessment

The total growth considered within the Capacity assessment is provided in Table 5.2. This includes all growth planned both within Coventry City administrative area and the surrounding areas (where applicable), within the three WwTW catchments. Employment within these areas is also included (considered as 'domestic type' volumes of wastewater), and as the wastewater treatment assessment in this study refers to the volumetric capacity in terms of dwelling numbers, the number of employees provided has been converted into a 'dwelling equivalent' value. This was described further in Box 1, Section 5.1.

Waste water Treatment Works capacity assessment

The Baseline Assessment examined the potential capacity of WwTWs to accommodate growth, described further in Section 3.3. In summary the Baseline Assessment identified no development 'showstoppers' but all three WwTWs (Finham, Corley and Meriden WwTWs) have some possible constraint to serving growth. Using the employment and housing plans provided by Coventry City Council and surrounding councils a more specific capacity assessment is undertaken below.

A summary of the conclusions of this part of the assessment are seen in Table 5.3 and described below.

Table 5.3 Summary of growth area and the Waste water Treatment Works capacity assessment

Main area of Coventry (WwTW served by)	WwTW DWF capacity	WwTW quality capacity	Receiving water
Main Urban area of Coventry (Finham)	Some growth currently possible, anticipated new DWF consent may be required for all growth	P removal to be completed by 2020 although ability to accommodate all growth plans unknown, further future investment may be required	Growth Plans to 2031 have the potential to be constrained by the requirements of WFD and downstream designated sites. This is subject to the outputs of Environment Agency investigations.
Corley Moor (Corley)	Capacity in DWF to accommodate current growth plans	Planned phosphate removal will align with growth projections	Limited pressure from WFD and downstream designated sites
Millisons Wood, Pinketts Booth and surrounding areas (Meriden)	Capacity in DWF to accommodate current growth plans	Capacity in water quality consents to accommodate current growth plans	Possible pressure from WFD and SSSI designations, subject to outcomes of further investigations.

There are no absolute constraints to growth plans identified in Section 4. However strategic planning and careful phasing will be required to ensure that required upgrades at WwTWs are in operation before development completion. This will require continuous communication between Coventry City Council, Severn Trent Water and the Environment Agency.

Severn Trent Water have an obligation under Section 94 of the Water Industry Act 1991 to provide capacity to cater for development. Provision is made as and when required, as development plans are confirmed. Severn Trent Water will decide where individual developments are drained, which is assessed on a case by case basis.

Severn Trent Water indicate that there are no known physical constraints to providing additional capacity at the three WwTWs considered in this assessment. It is unlikely that additional land would be required to accommodate further infrastructure but Severn Trent Water would consider land purchase as well as alternative options such as transfer of flows to manage growth pressures.

Growth across the main urban areas of Coventry (Finham WwTW):

The Baseline Assessment identified that Finham WwTW has the potential to exceed the Consented DWF, however further investigation is being undertaken by Severn Trent Water to confirm this. This investigation will help to determine any need for a new WFD consent. During AMP6 phosphate removal and secondary treatment capital maintenance are being implemented, that will be complete by 2020.

Coventry City Council is proposing a total of approximately 23,936 dwellings within the Coventry City Council Area between 2015 and 2031 (this includes the dwelling equivalent calculated for 32,000 employees). Added to the additional growth plans within the WwTW catchment within other council administrative areas results in a total of approximately 33,500 dwellings (Table 5.2) to be accommodated by Finham WwTW in the next 16 years. This includes all the Coventry City Council large scale strategic sites (Figure 5.5) as well as small scale developments, and a city wide requirement for dwellings and employment that do not currently have a land allocation.

With growth of this scale it is clear that timescales of development construction and allowing for appropriate infrastructure upgrading are critical. Severn Trent Water confirm that some of this proposed development will be catered for by the current investment projects for this WwTW, however this may not extend to all the growth plans. Continued communication between Coventry City Council and Severn Trent Water is advised to provide information as and when growth plans are taken forward and allow for upgrades:

- capital maintenance will be undertaken by Severn Trent Water during AMP6, to be completed by 2020, however the exact scope of this maintenance work is still being determined as part of project feasibility work by Severn Trent Water. Indicative trajectory provided (Table 4.3) indicate that 11,291 dwellings (equivalent) are planned before 2020, including strategic sites of Whitmore Park and Elms Farm as well as early phases of development at Canley Regeneration,

Keresley Regeneration, Cromwell Lane and Walsgrave Hill Farm. Communications is critical between the Council and Severn Trent Water to confirm the availability of the WwTW to accommodate this level of growth in advance of the identified upgrade works being completed. It may be that start timescales for the larger sites that extend over longer timescales could be adjusted to fit in with the completion of upgrade works. A level of growth beyond 2020 will be accommodated by the upgrade works however based on the available information it is difficult to pinpoint the year the capacity limit might be reached. It is likely that further upgrade will be required in the future should all ~33,500 dwellings be taken forward. It will be important for Coventry City Council to keep Severn Trent Water informed of growth plans as they are confirmed to ensure that growth planned further in the future (including Eastern Green SUE, Grange Farm and Sutton Stop and City Centre Sites) will be constructed alongside any future upgrade requirements.

- Severn Trent Water indicate that the extent of the secondary treatment capital maintenance is unlikely to include an increase to the consent limit and that the issue over the accuracy of the DWF monitoring needs resolving before a requirement for a new DWF consent can be confirmed. For the purpose of this assessment it is assumed that if this WwTW were to accommodate waste water from all ~33,500 dwellings an increase in the existing DWF consent is likely to be required before 2031. Until further investigation is undertaken by Severn Trent Water on the available capacity of the existing DWF consent no indication can be provided of how close to exceedance of the existing DWF consent Limit the WwTW is. Phasing of development construction would be important to allow time for an increased consent to be obtained from the EA and any associated infrastructure upgrades (if required) to be completed. As part of Severn Trent Water obligation to accommodate demand, alternatives such as flow diversion are likely to be considered as well as DWF consent increases.

Severn Trent Water indicate that there is no requirement on them to design a WwTW to a 2031 horizon and therefore upgrade work is likely to be undertaken as a number of smaller upgrades, rather than one large investment. This will all be dependent on confirmation being provided on the scales and locations of development going forward.

To support all the development plans there is the potential that wastewater treatment capacity will need to be increased at Finham WwTW which may require amended permits. The Environment Agency reviews and grants permits with consents that are designed to either maintain, or enable an improvement in water quality as part of the requirement of the WFD (section 3.3).

As identified in Phase 1 Finham WwTW has the potential to contribute to the current WFD classification of the receiving waterbody and the phosphate failure (Table 3.3). The phosphate removal at this WwTW (operational by 2020) will provide improvement to the discharge to the receiving water, and allow future development to be accommodated. However (Table 3.3) further investigation is required to determine the contribution of WwTW discharges to the failure (section 3.3), and the relative contribution of Finham WwTW to this. Should Severn Trent Water apply to the Environment Agency for a permit to increase the Dry Weather Flow the Environment Agency will assess whether water quality components in the permit need to be made more stringent. If the treatment works is shown to be contributing significantly then this is likely to compound the need for more stringent permit conditions. Growth Plans to 2031 therefore have the potential to be constrained by the requirements of WFD, subject to the outputs of Environment Agency investigations.

Phase 1 identified Guys Cliffe SSSI (Table 3.4) and a number of LWS located downstream of Finham WwTW. While pressure to prevent deterioration in water quality at these sites may constrain future development plans (where water quality changes could be attributable to the WwTW), the upstream WFD requirements (ensuring no deterioration from current status of waterbodies) is most likely to constrain current growth plans at Finham WwTW.

Growth in north-western Coventry

- Corley Moor (served by Corley WwTW).

The Baseline Assessment (Section 3.3) identified that Corley WwTW is currently compliant with the existing DWF limit, however is potentially subject to a reduction in the DWF consent Limit sometime between 2015 and 2020 as part of a quality improvement project which as the potential to limit growth plans. Infrastructure

changes are planned in AMP6 to have operational phosphate removal by 2020, which will help towards meeting WFD water quality improvement objectives. A high level estimate of capacity for 400 people is provided.

Coventry City Council have Planning Permission for 2 development sites (to be constructed in 2015/2016) within the catchment of Corley WwTW, with an estimated further 40 dwellings planned by North Warwickshire Borough Council between 2015 and 2031.

Severn Trent Water confirm that the 42 dwellings could be accommodated within the existing assets at the WwTW and that there is also the potential that further growth could be accommodated at this WwTW, however the extent of this remaining capacity is unknown. Severn Trent Water would consider this when specific developments come forward and at that time the most cost effective option will be determined. Keresley SUE site (3000 dwellings) is located approximately 300m from the catchment of Corley WwTW, and accommodation of some of this growth at Corley WwTW could alleviate pressures at Finham WwTW. However the scale of the growth within the Keresley site (3000 dwellings) indicates that existing WTW consent limits at Corley WwTW will be unlikely to accommodate all growth at the site. Investigation by Severn Trent Water, when development is confirmed, will identify the suitability of Corley WwTW to accommodate growth from wider Coventry City.

Severn Trent Water are considering both a reduction in the DWF consent limit and implementation of phosphate removal at Corley WwTW as part of a water quality improvement project. These changes will be effective sometime between 2015 and 2020. This will not pose a constraint to the small level of growth identified within Coventry City Council administrative area, which are anticipated to be constructed by 2015/16. Subject to the level of DWF reduction implemented this would also be unlikely to pose a constraint to the growth plans (40 dwellings) identified within North Warwickshire Borough council area (Table 5.2). Severn Trent Water indicates that the extent of the DWF consent reduction will be in line with demand projections and phosphate removal requirements. However, this reduction in DWF may constrain the ability of this WwTW to receive growth from other sites (e.g. to alleviate growth within Finham WwTW). Severn Trent Water will ultimately decide where individual developments will drain to and make the assessments on a case by case basis, taking into consideration any existing sewage treatment capacity constraints.

The Phosphate removal offers an opportunity for the WwTW to consider accommodating future growth plans while also meeting the requirements of WFD. Conclusions of Phase 1 (Section 3.3) identify that the source of the Breach Brook WFD classification ('Moderate' Status is anticipated to be related to agriculture, rural land management and mixed drainage (urban and transport) (Table 3.3). Based on this information there is no constraint posed to the current growth plans based on WFD requirements, and improvements in water quality will be afforded through the planned phosphate removal and DWF consent reduction as part of quality improvement project.

A number of LWS and LNR designated sites are located downstream of the WwTW. No information is available on the current water quality of these sites. Due to the small scale of growth plans in the north west of Coventry and the improvements afforded through planned phosphate removal and DWF reduction these locally important sites will not pose a constraint to the growth plans in the catchment of Corley WwTW.

- Millisons Wood, Pinketts Booth and surrounding areas (served by Meriden WwTW).

The Baseline Assessment identified that Meriden WwTW currently has capacity within its existing DWF consent limit to accommodate growth. Conclusions of the Severn Trent Water RAG assessment concluded that the WwTW currently has 'limited' capacity within the quality consents, with an increase of up to 25% on the current PE served possible (a high level estimate of 600 people provided within the Baseline Assessment).

Coventry City Council have planning permissions granted for 2 dwellings within the Coventry City Council Boundary that will drain to Meriden WwTW, and an additional estimated 60 dwellings proposed by Solihull Metropolitan Borough Council (Table 5.2). This equates to 62 planned dwellings between 2015 and 2031.

Severn Trent Water confirm that the growth plans within Coventry City Council administrative boundary and those within Solihull Metropolitan Borough Council can be accommodated within the existing WwTW infrastructure and permit limits (DWF and Quality).

While Eastern Green SUE strategic site (2,300 dwellings) and Eastern Green Employment site (1,040 dwelling equivalent) are located adjacent to the catchment of Finham WwTW, they are also located less than 500m from the catchment of Meriden WwTW. To manage growth pressures at Finham WwTW there could be an option for some of the flows from these developments to be transferred to Meriden WwTW catchment. However the scale of the growth indicates that it is unlikely that all the growth could be accommodated within the existing Meriden WwTW consent limits. Severn Trent Water will ultimately decide where individual developments will drain to and make the assessments on a case by case basis, taking into consideration any existing sewage treatment capacity constraints. The most cost effective and efficient option for draining these sites will be considered (including a possible increase in DWF at Meriden WwTW to accommodate more growth).

The WFD information provided for Horn Brook (Table 3.3) identifies Meriden WwTW as a possible contributor to the 2014 WFD classification. However any WwTWs whose discharges reach the River Blythe upstream of Horn Brook are also likely to be contributing to the failure. Further monitoring, modelling and investigations are likely to be undertaken by the Environment Agency to provide more certainty of the WwTWs as a source contributing to the failure (and the relative contribution from other sources as such as Agriculture, Table 3.3), and any actions required to meet the WFD objective. If WwTWs are identified to contribute to the current WFD failure then Meriden WwTW (as well as any upstream WwTWs) may be required to increase any phosphate removal already afforded at the WwTW, or consider a reduction in the DWF from the works. This is unlikely to put a constraint on the small current growth plans (already granted planning permissions) in the north western part of the Coventry City Council area. However tighter quality or DWF consents (including phosphate removal) could constrain growth plans identified within the Solihull Metropolitan Borough Council area (exact timescales of this development are currently unknown, Section 4), or any options to accommodate larger numbers from the Eastern Green sites (anticipated development between 2016 and 2031).

As identified in Table 3.4 there are a number of designated sites (SSSI and LWS) downstream of Meriden WwTW, and the current discharge from the WwTW is unlikely to be currently having an effect on the designated sites. Therefore is likely to be able to accommodate the current growth plans within the WwTW catchment without impacting on these sites. In the future it is possible that tighter consents at the WwTW may be required as part of water quality improvement projects aimed at improving these designated sites. This could constrain growth plans within the Solihull Metropolitan Borough Council areas, or the ability to accommodate growth from the wider Coventry City Council area.

Sewerage capacity assessment

The Baseline Assessment examined the potential capacity of WwTW sewerage network to accommodate waste water from growth, which was summarised in Section 3.3. Localised constraints to the accommodation of large scale developments both within the urban area and the more rural area to the north west of Coventry City were identified. Using the employment and housing plans provided by Coventry City Council and surrounding councils a more specific capacity assessment is undertaken.

Sewerage network capacity assessment is a more localised assessment than the capacity of the WwTW assessment, as it considers the local sewerage network at the point of connection from a specific development site and the route taken to reach the WwTW. Therefore no detailed assessment is undertaken for the growth outside the Coventry City Council administrative boundary.

Growth across the main urban areas of Coventry

The Baseline Assessment (Section 3.3) identified that the capacity of the existing sewerage network across the main urban area of Coventry City is generally good, with a few localised capacity constraints to accommodating future growth. Development will mainly be constrained within the north west of the City where flows will need to travel through extensive local networks before reaching the WwTW.

Coventry City Council have planned for the equivalent of 33,355 dwellings across the catchment of Finham WwTW (housing and employment), ~9,500 of which are located outside the Coventry City administrative boundary (Section 4). Of the 11 large scale sites Keresley SUE, Eastern Green SUE and Browns Lane are all located within the north western part of the city, as well as a number of smaller scale proposed developments (Figure 5.5).

A high level assessment was undertaken by Severn Trent Water for the larger proposed development sites (those with more than 100 proposed dwellings) to provide an indicative scale of the impacts these specific sites would have on the local sewerage network (High, Medium, or Low impact), seen in Table 5.4. It must be noted that the assessment completed was a high level desk top assessment based on the specialist knowledge of the sewerage team in Severn Trent Water. The outputs (Table 5.4) are not based on hydraulic modelling of the sewer network and does not take into account the risks from Combined Sewer Overflows (CSOs) overflowing in heavy rain and spilling sewerage into watercourses.

Severn Trent Water confirm that a detailed assessment will be undertaken once a developer enquiry to make a sewer connection is made, that will inform whether sewer upgrading work is required (if the development proceeds). Capacity upgrades will then be initiated once a site has been granted planning permission.

Table 5.4 Summary of Severn Trent Water sewerage infrastructure assessment

Site name	Indicative proposed dwellings	Potential impact on sewerage infrastructure (highlighting indicates level of constraint)	Notes
Eastern Green	2300 + 2500 Jobs	High	Significant development proposals upstream of an existing small diameter sewerage system with historic reports of sewer flooding. Likely to require extensive capacity improvements to accommodate this development proposal.
Keresley SUE	3000		
Whitmore Park	500	Medium	Localised capacity improvements may be required but not expected to be extensive.
BW6	255		
Cromwell lane	240	Medium/Low	Localised capacity improvements may be required but not expected to be extensive.
Canley Regeneration	750		Whilst this is a large development located close to large diameter sewers, current capacity information indicates localised capacity improvements may be required. Subject to further detailed modelling the extent of any capacity improvements are not expected to be extensive.
City Centre Sites	2000 + 14,500 Jobs	Low	Redevelopment across the city centre is not expected to cause capacity issues provided surface water on existing permeable areas is managed sustainably and any current discharge to the foul/combined system are reduced.
Land at London Road and Allard Way	160		Provided surface water from development is managed sustainably and existing discharge to the foul/combined sewer is reduced or new connections are not connected to the foul/combined sewer then there are no capacity issues envisaged
Walsgrave Hill Farm	842		
Elms Farm	100		
Browns Lane	100		
Grange Farm and Sutton Stop	312		
E2	117		
F51	100		
F54	450		

Site name	Indicative proposed dwellings	Potential impact on sewerage infrastructure (highlighting indicates level of constraint)	Notes
F47	127		
F30	136		
StM29	190		
StM34	130		
StM64	169		
StM27	300		
StM70	120		
StM67	286		
Wo27	153		
Browns Lane - Lyons Park and expansion land	3000 jobs		
Whitley business park and expansion land	5000 Jobs		

Severn Trent Water identify that new development offers the opportunity for improvements in the existing sewer networks, not only through increasing the existing capacity of the infrastructure but also through separation of surface water run-off from foul/ combined sewer discharges. Sustainable surface water management at new sites (e.g. of surface water flow from permeable areas) and reductions in discharge of this surface water at redevelopment sites ensures that more capacity is available within the existing sewer network to accommodate increased volumes from foul discharges with less upgrade requirements.

Overall it is clear from the assessment undertaken by Severn Trent Water that there is no absolute constraint to providing sewerage capacity for these sites, but communication between Coventry City Council, Severn Trent Water and developers is critical to ensure the upgrade work is operational in advance of development completion:

- **Eastern Green SUE and Kersley SUE**: Both these developments are located at the head of the existing sewerage network in the west of the city, with a high potential impact on the sewerage system (Figure 5.5). They are located upstream of existing small diameter (150-225mm diameter) sewerage systems with historic incidents of sewer flooding. Severn Trent Water anticipate extensive capacity improvements (in the case of Eastern Green SUE site this would potentially involve the replacement of Parkhill SPS plus the extension of the existing rising main) to accommodate the levels of growth at these sites (Table 5.4). Hydraulic modelling is likely to be required to confirm the capacity issues once these sites are confirmed for development (usually once a development has been granted planning permission). The main constraint to development at these sites will be timing the development in co-ordination with a programme of sewer network upgrades that would be undertaken by Severn Trent Water. While Severn Trent Water is confident they will be able to provide sewerage upgrades to support demand, they anticipate that it could take 3-4 years before sufficient capacity is available should these proposals be allocated in the local plan. Should development at Eastern Green Site begin during 2022/ 2023 (as identified within the trajectory (Table 4.3) then upgrades could need to be considered during 2018/2019 to be complete in time. This will be dependent on outcomes of further modelling once a developer has submitted a connection request to Severn Trent Water.

- **Whitmore Park, BW6 and Cromwell Lane Sites**: Severn Trent Water identify localised capacity constraints with a medium impact on the sewerage system for these development sites (Table 5.4). In the case of Site BW6, the current sewer capacity (150mm diameter sewerage system) does not indicate current capacity constraints however the pumped flows from the proposed 225 dwellings could result in localised capacity issues. Providing the surface water is managed sustainably and not discharged to the foul/ combined sewer, then the extent of any capacity improvements are not expected to be extensive. More detailed sewer capacity assessments (including sewer modelling) will be required once the developer confirms their intended point of connection for these sites. Which will provide more detail on the extent of upgrade work required and will provide clarity on indicative timescales for this should planning permission be granted.
- **Canley Regeneration Site**: Whilst there are no reports of hydraulic sewer flooding in the vicinity of this development, there may be localised capacity constraints within the development area which are likely to require further assessment (Table 5.4). More detailed sewer capacity assessments will be required once the developer confirms their intended point of connection, but providing surface water from this development is managed sustainably and is not connected to the foul/ combined sewer, then the extent of any capacity improvements are not expected to be extensive. Severn Trent Water also identify several large diameter (750mm dia.) public sewers currently crossing this development site which would need to be diverted depending on the development proposals. No indicative timescales for this sort of diversion work are available.
- The remaining 20 sites considered under Seven Trent Water's assessment have a Low impact to the sewerage network (including Walsgrave Hill Farm and city centre sites), Table 5.4. Severn Trent Water identify that there are no reports of hydraulic sewer flooding in the vicinity of these development sites and current sewer capacity performance data does not indicate any capacity constraints. Provided surface water from these developments are managed sustainably and surface water from new sites is not connected to the foul/ combined sewer and there is a reduced discharge to the foul/combined sewer from redevelopment sites, no capacity issues are envisaged. At Stm34 (a shortlisted site) and Whitley business park and expansion land sites (identified employment sites) Severn Trent Water identify existing sewer pipes that cross the middle of the sites. While these will not pose a significant constraint to growth it is likely that the site layout will need to be carefully considered or works undertaken to divert the pipes. Severn Trent Water consider these to be low impact to the sewerage network, but may have an effect on the phasing of the developments.

A number of these sites have already been granted planning permission (including Whitmore Park and Canley Regeneration). For these sites more detailed assessments will have already been undertaken by Severn Trent Water and it will have been confirmed that capacity provision is not an issue. In these cases upgrade work will be completed in advance of development completion.

There are a large number of additional committed or allocated development sites across the Coventry City administrative boundary that have the potential to be constrained by the existing local sewerage network. No site specific sewerage network assessment has been completed for these sites (a full list of sites can be seen in Appendix A). Based on the conclusions of the Baseline Assessment (Section 3.3) and the information provided by Severn Trent Water for the larger development sites above it is anticipated that:

- any development proposals located in the north-west of the city (Figure 5.5) may encounter capacity issues as flows from these areas would need to drain through existing local networks before reaching the WwTW;
- developments located elsewhere within the urban area of Coventry (but not considered in Severn Trent Water assessment above) are anticipated to be accommodated by the local sewerage network; and
- sewer capacity assessments will be completed by Severn Trent Water once the individual sites are taken forward and the developer confirms their intended point of connection. Providing surface water from these development sites individually are managed sustainably, then the

extent of any capacity improvements are not expected to be extensive and will be very localised.

Growth in north-western Coventry

The north west of Coventry is more rural with less existing sewerage network coverage (Figure 5.5). The Baseline Assessment (Section 3.3) identifies that the scale and phasing of any developments in these areas would need to be carefully considered to ensure connection exists in advance of any new development itself. The diameter of the pipework (and therefore the volumes of sewerage that the network can accommodate) are constraints in some areas of both Corley and Meriden WwTW sewerage networks, and therefore the location and size of development proposals would need to be considered and where appropriate discussed with Severn Trent Water.

Coventry City Council have plans for an equivalent of 42 dwellings in the catchment of Corley WwTW and 62 within the catchment of Meriden WwTW, with the majority of growth proposed being located outside the Coventry City administrative Boundary. The exact location of the proposed growth within the areas surrounding Coventry City are unknown (Section 4). Growth plans within the north west of Coventry City Council administrative area indicate that a total of four dwellings are currently planned.

Severn Trent Water confirm that the potential impact of the growth on the sewerage network within the north western part of Coventry (within southern Corley Moor and Millisons Wood area, Figure 5.5) is Low. The scale of the development is such that it will be able to be accommodated within the existing local sewerage networks. Any larger scale development proposals in the future would be likely to require capacity improvements.

There are possible constraints to growth in the sewerage network of the wider WwTW catchments (outside the Coventry City administrative boundary), requiring consideration of upgrades to existing pipework, to allow greater flow through the network. The locations of the growth outside the Coventry City Boundary is unknown. This is beyond the scope of this assessment, and is therefore not considered further.

Summary and recommendations

This assessment of indicative growth plans to 2031 within Coventry City has identified that there is generally capacity in the existing wastewater treatment and sewerage infrastructure to accommodate growth, but limitations exist in terms of phasing development with required upgrades. It is advised that Coventry City Council, Severn Trent Water and the Environment Agency liaise closely to consider growth numbers, wastewater demands, and the impact of environmental objectives on environmental permits and the level of treatment that will be required at WwTWs.

Severn Trent Water will provide the necessary sewerage and WwTW capacity in parallel with the development of the individual sites, in collaboration with developers and the planning authority, as part of the requirements of Section 94 of the Water Industry Act. The exact location and scale of upgrades will be determined once there is more certainty of the development being taken forward, the size, location and phasing. Each individual planning application will often be supported by studies to clarify the available capacity or connection requirements. Therefore sewerage will not pose an absolute barrier to growth but upgrades will need to be carefully planned to be operational in time for dwelling occupation.

More specifically the following summary points are identified:

Main area urban area of Coventry

- Communication will be required between Coventry City Council and Severn Trent Water regarding growth within Finham WwTW. Although not all the proposed sites may be taken forward for construction, strategic planning will be needed to allow time for infrastructure changes to increase the WwTW capacity, if required, for growth to 2031. Future upgrade, including a possible increase to the DWF consent limit, will be dependent of the timescales of the developments confirmed to be coming forward.
- Growth at this WwTWs has the potential to be more restricted by any tightened water quality consents needed to achieve WFD requirements (if the WwTWs are found to be at fault).

Pressure to improve or prevent deterioration in water quality at Guys Cliffe SSSI or LWS could constrain current growth plans at Finham WwTW as well as demand from any additional sites in the future.

- In terms of the sewerage capacity communication will be required between Severn Trent Water and Coventry City Council, to allow adequate timing for upgrades, based on the following key points:
  - The majority of development sites are anticipated to be accommodated within existing sewerage infrastructure, with minimal upgrades required, with the exception of growth located within the west of Coventry City.
  - Eastern Green and Keresley Sites are anticipated to have 3-4 years before there is sufficient capacity to accommodate planned growth, due to upgrade requirements.
  - Whitmore Park, BW6 and Cromwell Lane sites are identified by Severn Trent Water to have medium impact on the sewerage network. Localised capacity assessments will be required once the sites have been confirmed for development, which may affect development timescales.
  - Canley Regeneration site also required more detailed sewer assessments, but no extensive upgrade is anticipated.
  - Other large scale sites (strategic and allocated sites) are identified to have a low impact on the sewer network. Subject to sustainable surface water management no constraints are envisaged. However, site panning or diversion works are anticipated at sites Stm34 and Whitley business Park and Expansion Land.
- Further water quality modelling will be needed to investigate the impact of reduced DWF consents, or tighter quality consents at WwTWs on growth in the catchments, in trying to achieve 'good' status. The possibility of tighter controls on WwTWs to achieve 'good' status/ potential cannot be confirmed until after Environment Agency modelling and monitoring has taken place.
- The capacity assessments have included the impact of employment sites by applying water consumption assumptions to Use Classes and converting the demand into dwelling equivalents. It is expected that some of the new employment will be in the form of light manufacturing (identified as Use Class type B2), which is likely to have a higher water usage. Whilst this may generate higher water supply demands it could also increase pressure on the treatment works either by discharge of 'biological' (e.g. from food/ drinks manufacturing) or 'chemical' (e.g. engineering outputs) trade effluents. No detailed assessment of the additional pressure that trade effluent will have on the wastewater treatment works has been undertaken as there is no information on which to base assessment at this time. The allocated employment sites within Coventry City are all located within the catchment of, and would likely be served by Finham WwTW. It is recommended that the Council keep both the Environment Agency and Severn Trent Water informed as soon as proposals for light manufacturing sites come online.
- It is important that communication is maintained between Coventry City Council, Severn Trent Water, and the Environment Agency so that existing constraints are accurately understood and the impacts of additional pressure can be identified as early as possible.

North-western Coventry

- Corley Moor (served by Corley WwTW):
  - There is capacity at Corley WwTW to accommodate current growth plans, both within the Coventry City administrative Boundary and also that currently identified within the wider WwTW catchment.
  - Should this WwTW be identified as a possible to receive flows from other development sites (e.g. to alleviate Finham WwTW) then it is likely to be very limited without planned upgraded works.

- There is unlikely to be pressure from WFD or downstream designated sites on growth plans. The current DWF failure is not attributed to WwTW discharges, and Planned Phosphate removal and the water quality improvement project result in no constraints to growth.
- Even for treatment works with capacity within their existing permits the Environment Agency and Severn Trent Water will continue to monitor water quality in receiving waters and if the erosion of treatment capacity headroom begins to impact on Water Framework Directive objectives (i.e. cause or risk of a deterioration) then the permits may need to be re-assessed.
- The current growth plans within Coventry City Council Boundary will be accommodated within the existing sewerage infrastructure. However, Growth plans within the wider WwTW catchment but further consideration of these is outside the scope of this assessment.

- Millisons Wood, Pinketts Booth and surrounding areas (served by Meriden WwTW):
  - Existing infrastructure and permit limits are enough to accommodate the growth plans considered in this assessment.
  - Current growth plans within the Coventry City administrative boundary can be accommodated within existing WFD requirements, however WFD requirements may constrain growth plans in Solihull Metropolitan Borough Council. Future improvements to the downstream SSSI and LWS may constrain further growth.
  - Even for treatment works with capacity within their existing permits the Environment Agency and Severn Trent Water will continue to monitor water quality in receiving waters and if the erosion of treatment capacity headroom begins to impact on Water Framework Directive objectives (i.e. cause or risk of a deterioration) then the permits may need to be re-assessed.
  - As identified for Corley WwTW the scale of growth within the Coventry City administrative Boundary will be accommodated by the existing sewerage network. There are possible constraints to wider growth plans in the WwTW catchment but consideration of these is outside the scope of this assessment.

5.3 Flood Risk Capacity Assessment

Introduction

In 2008 Coventry City Council commissioned a Level 1 and Level 2 SFRA. The Level 1 SFRA looked at the broad level of flood risk across the Coventry City Council area as a whole, with the Level 2 SFRA focusing on specific development sites. In the Level 2 SFRA, 19 sites were assessed using a desk based approach, some of these sites have been refined and carried forward into the assessment detailed in this Water Cycle Study, some have been rejected, and some have progressed to development. The sites assessed in this Water Cycle Study complement the previous Level 2 SFRA work undertaken and build upon the findings of the assessment applicable to current strategic and shortlisted development sites. This Water Cycle Study flood risk capacity assessment provides a desktop appraisal of 11 strategic sites, 129 shortlisted sites and 7 employment sites within Coventry City Council administrative Area.

The 2008 SFRA is being updated in parallel with the Water Cycle Study. While not available to be considered within this assessment, it will be a key additional source of flood risk information[21] and should be reviewed alongside this report.

Development sites at risk from fluvial flooding

Coventry City Council's assessment of fluvial flood risk in its Level 2 SFRA addresses these recommendations by identifying development zones associated with specific watercourses that may be fully or partially unsuitable for development due to their fluvial flood risk. It recommends policies for all parishes in

[21] Coventry City Council, Level 1 and 2 Strategic Flood Risk Assessment Draft Report. Written and Prepared by JBA Consulting Ltd (September 2015)

the area, including that all 'greenfield' developments must maintain surface water runoff rates at greenfield rates.

The Environment Agency's Flood Maps help to identify specific sites at risk from fluvial flooding. Development sites which have a culverted section of watercourse running through them may also be subject to fluvial flood risk even if they are located in Flood Zone 1, due to capacity of the culvert. Site development gives an opportunity to de-culvert channels within the sites, which can bring flood risk and environmental benefits. The Level 2 SFRA discussed development management policies for different areas, often relating to specific fluvial flooding issues and development sites. GIS analysis identified development sites which are located in or near areas at risk of fluvial flooding. Table 5.5 lists the current strategic development sites and their Level 2 SFRA Development Management Policy.

Flood zones

Flood Zones are terms used to describe a series of fluvial and coastal flood extent datasets produced by the Environment Agency. The Environment Agency defines four categories of Flood Zone:

- **Flood Zone 1:** Land least at risk of flooding: assessed as having a less than 1 in 1,000 annual probability of river flooding in any year (>0.1 percent); and
- **Flood Zone 2:** Land assessed as having between 1 in 100 and 1 in 1,000 annual probability of river flooding (1 percent - 0.1 percent) in any year.

The NPPF subdivides Flood Zone 3 into Zone 3a and 3b and defines these individually:

- **Flood Zone 3a:** Land most at risk of flooding: assessed as having a 1 in 100 or greater annual probability of river flooding (1 percent) in any year;
- **Flood Zone 3b:** Land specifically designated to store flood water or allow water to flow in times of flood. SFRAs are required to identify this Flood Zone taking into account local circumstances. Land which would flood with an annual probability 1 in 20 (5 percent) can be considered and discussed as a starting point to identify land that could be allocated as the functional flood plain. Data used in this assessment does not disaggregate between 3a and 3b. This is examined in more detail in the Level 1 SFRA.

Table 5.5 Fluvial flood risk to key strategic sites in Coventry (traffic light colour code refers to constraints due to fluvial flooding in isolation)

Strategic site	Dwellings	Most severe Flood Zone on-site	Current planning status	Level 2 SFRA development management policy
Browns Lane	100	1	Pending	Not covered in the original Level 2 SFRA. Strategic Site is entirely within Flood Zone 1, however, a culverted watercourse exists on-site. The land west of Browns Lane was covered in the SFRA where Flood Zone 2 areas form the River Sherbourne exist. The SFRA notes that the small drains which flow eastwards through the Browns Lane Site have not been modelled and in reality likely pose "some" risk.
Eastern Green SUE	2300	2/3	Pending	The Site is partially covered in the original Level 2 SFRA for land south of the River Sherbourne which is entirely within Flood Zone 1. The Strategic Site has since been extended to include the River Sherbourne and land to the north which is in Flood Zones 2 and 3.
Whitmore Park	500	1	Granted	Not covered in the original Level 2 SFRA. Site is entirely within Flood Zone 1 with no recorded watercourses on-site.
Elms Farm	100	1	Pending	Not covered in the original Level 2 SFRA. Site is entirely within Flood Zone 1 with no recorded watercourses on-site however a small watercourse exists 50m to the east of the Site which may

Strategic site	Dwellings	Most severe Flood Zone on-site	Current planning status	Level 2 SFRA development management policy
				require further investigation. This watercourse has not been modelled.
Canley Regeneration	750	2/3	Granted	The Canley site is bordered along its south western and south eastern boundaries by Canley Brook. Canley Brook is a designated Main River. Flood Zone 3 has been modelled by the Environment Agency using detailed modelling techniques, while Flood Zone 2 has been modelled using the package JFLOW, which is accepted to be a coarse modelling approach. Floor levels should be situated 600mm above the 1 in 100 year flood plus an allowance for climate change. The area of Flood Zone 3 through the site is narrow and does not encroach significantly on the site. It is recommended that this area is used as open green space for amenity purposes.
Keresley SUE	3000	1	Granted	Site lies in Flood Zone 1. While Hall Brook does not show fluvial flood risk, Level 2 SFRA notes that in reality some risk is posed.
Cromwell Lane	240	1	Pending	Not covered in the original Level 2 SFRA. Site is entirely within Flood Zone 1 with a small watercourse on-site which has not been modelled which may require further investigation.
Grange Farm and Sutton Shop	312	3	Pending	Not covered in the original Level 2 SFRA. Site is mainly within Flood Zone 1 with a small area of Flood Zone 3 at the south-east corner of the Site. The Coventry canal is located along the northern boundary of the Site and flood risk from this source will need detailed assessment prior to consent. Properties situated within close proximity to the canal will require a detailed breach and overtopping assessment to ensure that the potential risk to life can be safely managed throughout the lifetime of the development.
Land at London Road and Allard Way	160	1	Pending	Not covered in the original Level 2 SFRA. Site is entirely within Flood Zone 1 however lies close to the River Sowe floodplain. There is a significant step change in topography between Flood Zone 3 and the Site boundary. Flood levels should be compared to on-site levels to ensure that sufficient freeboard is designed into the development prior to consent.
Walsgrave Hill Farm	842	3	Pending	Site straddles the banks of the River Sowe. Large parts of Site within Flood Zone 3. Examination of the local fluvial setting and modelling (JFLOW) leads to the conclusion that the resolution of data is sufficient to guide the site allocation process. Some 50% of the site is affected by Flood Zone 3. Following the NPPF sequential approach, development should be directed to Flood Zone 1, and more detailed modelling maybe required to confirm the exact extents of flood zones across the site.
City Centre Sites	2000	3	Pending	Not covered in the original Level 2 SFRA. Site covers large area where there is a culverted stretch of the River Sherborne. The culvert inlet and outlet is located within the development site and has areas of Flood Zone 2 and 3. There is a large area of Flood Zone 3 around Spoon End near to the culvert inlet. There is potential to naturalise sections of the river which would have ecological and flooding benefits.

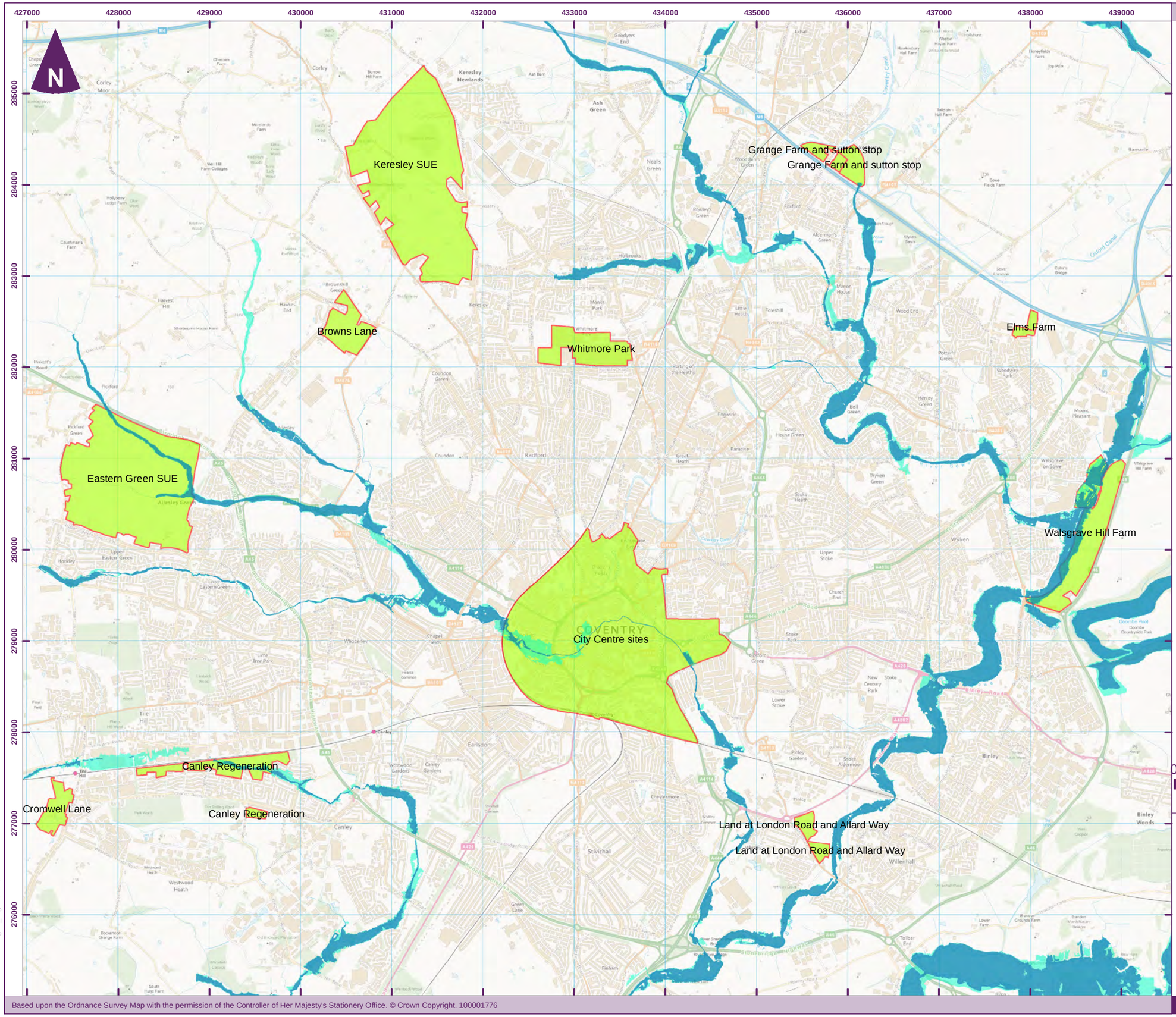
Table 5.6 lists the current employment and shortlisted residential development sites at risk of fluvial flooding. A number of shortlisted sites are for quite large housing developments or employment sites where the option to de-culvert may be significant. Only sites within Flood Zones 2 and 3 have been included in the table. Sites that are listed as within Flood Zone 1 still need adequate assessment of fluvial flood risk in order to scope out constraints to development due to fluvial flooding. There are watercourses within Coventry which are too small to have been included in the Environment Agency flood risk mapping, but nevertheless could

be a source of fluvial flood risk especially in-combination with culvert blockages and surface water flooding. Residential developments entirely within Flood Zone 1, but in close proximity to Flood Zones 2 and 3 need to ensure that finished floor levels are situated 600mm above 1 in 100 year plus Climate Change flood levels.

Table 5.6 Fluvial flood risk to employment and shortlisted residential sites in Coventry

Area	Site	Dwellings	Most Severe Flood Zone on-site	Recommended Level 2 SFRA Development Management Policy
NW Coventry	**HO30**	12	3	Flood Zone 3b has not been modelled throughout the study area. Flood Zone 3 should be considered to define Flood Zone 3b until otherwise confirmed. Acceptable development types within each flood zone are detailed in NPPF Table 3, alongside requirements for the Sequential and Exception Tests (see Section 3 for guidance on application of Sequential and Exception Tests) if development is to be demonstrated as justified. The areas of the site at greatest risk of flooding may not be developable, and if justified suitable mitigations will be required to ensure the development itself is not at risk from flooding, and flood risk elsewhere is not increased
NW Coventry	**Wo29**	8	3	Flood Zone 3b has not been modelled throughout the study area. Flood Zone 3 should be considered to define Flood Zone 3b until otherwise confirmed. Acceptable development types within each flood zone are detailed in NPPF Table 3, alongside requirements for the Sequential and Exception Tests (see Section 3 for guidance on application of Sequential and Exception Tests) if development is to be demonstrated as justified. The areas of the site at greatest risk of flooding may not be developable, and if justified suitable mitigations will be required to ensure the development itself is not at risk from flooding, and flood risk elsewhere is not increased.
NW Coventry	**HO29**	21	3	Flood Zone 3b has not been modelled throughout the study area. Flood Zone 3 should be considered to define Flood Zone 3b until otherwise confirmed. Acceptable development types within each flood zone are detailed in NPPF Table 3, alongside requirements for the Sequential and Exception Tests (see Section 3 for guidance on application of Sequential and Exception Tests) if development is to be demonstrated as justified. The areas of the site at greatest risk of flooding may not be developable, and if justified suitable mitigations will be required to ensure the development itself is not at risk from flooding, and flood risk elsewhere is not increased.
NW Coventry	**Eastern Green**	Employment		Flood Zone 3b has not been modelled throughout the study area. Flood Zone 3 should be considered to define Flood Zone 3b until otherwise confirmed. Acceptable development types within each flood zone are detailed in NPPF Table 3, alongside requirements for the Sequential and Exception Tests (see Section 3 for guidance on application of Sequential and Exception Tests) if development is to be demonstrated as justified. The areas of the site at greatest risk of flooding may not be developable, and if justified suitable mitigations will be required to ensure the development itself is not at risk from flooding, and flood risk elsewhere is not increased.
SW Coventry	**S3**	85	3	Flood Zone 3b has not been modelled throughout the study area. Flood Zone 3 should be considered to define Flood Zone 3b until otherwise confirmed. Acceptable development types within each flood zone are detailed in NPPF Table 3, alongside requirements for the Sequential and Exception Tests (see Section 3 for guidance on application of Sequential and Exception Tests) if development is to be demonstrated as justified. The areas of the site at greatest risk of flooding may not be developable, and if justified suitable mitigations will be required to ensure the development itself is not at risk from flooding, and flood risk elsewhere is not increased.
City Centre	**StM27**	300	3	Flood Zone 3b has not been modelled throughout the study area. Flood Zone 3 should be considered to define Flood Zone 3b until otherwise confirmed. Acceptable development types within each flood zone are detailed in NPPF Table 3, alongside requirements for the Sequential and Exception Tests (see Section 3 for guidance on application of Sequential

Area	Site	Dwellings	Most Severe Flood Zone on-site	Recommended Level 2 SFRA Development Management Policy
				and Exception Tests) if development is to be demonstrated as justified. The areas of the site at greatest risk of flooding may not be developable, and if justified suitable mitigations will be required to ensure the development itself is not at risk from flooding, and flood risk elsewhere is not increased. Flood Zone 3 is located at a culverted area of the River Sherbourne. An effective challenge of this classification could be made for this site with site specific hydraulic modelling, however there are substantial areas of Flood Zone 2 which correspond to modelled surcharge of the culvert inlet to the west of the site.
City Centre South	**StM27**	Employment	3	Flood Zone 3b has not been modelled throughout the study area. Flood Zone 3 should be considered to define Flood Zone 3b until otherwise confirmed. Acceptable development types within each flood zone are detailed in NPPF Table 3, alongside requirements for the Sequential and Exception Tests (see Section 3 for guidance on application of Sequential and Exception Tests) if development is to be demonstrated as justified. The areas of the site at greatest risk of flooding may not be developable, and if justified suitable mitigations will be required to ensure the development itself is not at risk from flooding, and flood risk elsewhere is not increased. Flood Zone 3 is however located at a culverted area of the River Sherbourne and an effective challenge of this classification could be made with site specific hydraulic modelling. There are small areas of Flood Zone 2 which lie at the western edge of the Site. Mitigation measures would need implementing within these areas such as ensuring ease of access and egress to employees and emergency services outside of Flood Zone 2.
South East Coventry	**StM11**	21	3	Flood Zone 3b has not been modelled throughout the study area. Flood Zone 3 should be considered to define Flood Zone 3b until otherwise confirmed. Acceptable development types within each flood zone are detailed in NPPF Table 3, alongside requirements for the Sequential and Exception Tests (see Section 3 for guidance on application of Sequential and Exception Tests) if development is to be demonstrated as justified. The areas of the site at greatest risk of flooding may not be developable, and if justified suitable mitigations will be required to ensure the development itself is not at risk from flooding, and flood risk elsewhere is not increased. Site is located at the outlet of the culverted section of the River Sherbourne. If deculverting of the river were undertaken prior to development a reclassification of the site flood zone could be undertaken.
South East Coventry	**Whitley Business Park and Expansion Lands**	Employment	3	Flood Zone 3b has not been modelled throughout the study area. Flood Zone 3 should be considered to define Flood Zone 3b until otherwise confirmed. Acceptable development types within each flood zone are detailed in NPPF Table 3, alongside requirements for the Sequential and Exception Tests (see Section 3 for guidance on application of Sequential and Exception Tests) if development is to be demonstrated as justified. The areas of the site at greatest risk of flooding may not be developable, and if justified suitable mitigations will be required to ensure the development itself is not at risk from flooding, and flood risk elsewhere is not increased. The River Sowe flows through the Site and there are substantial areas of Flood Zone 3 within the Site. All development should be clear of Flood Zone 3 and all access/egress routes for employees/customers/emergency services would need to be outside of Flood Zone 2



Key

- Flood Zone 3
- Flood Zone 2
- Strategic Sites

0 0.5 1 1.5 2 km

Scale at A3: 1:40,000

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Figure 5.6
Strategic Sites
Fluvial Flood Risk

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427000 428000 429000 430000 431000 432000 433000 434000 435000 436000 437000 438000 439000

285000 284000 283000 282000 281000 280000 279000 278000 277000 276000

N

Browns Lane - Llyons Park and expansion land

Browns Lane - Llyons Park and expansion land

Eastern Green

city centre south

Coventry Uni expansion

Parkside Techno Park - possible expansion

Friargate

Whitley business park and expansion land

Whitley business park and expansion land

Key

Flood Zone 3

Flood Zone 2

Employment Sites

0 0.5 1 1.5 2 km

Scale at A3: 1:40,000

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Figure 5.7
Employment Sites
Fluvial Flood Risk

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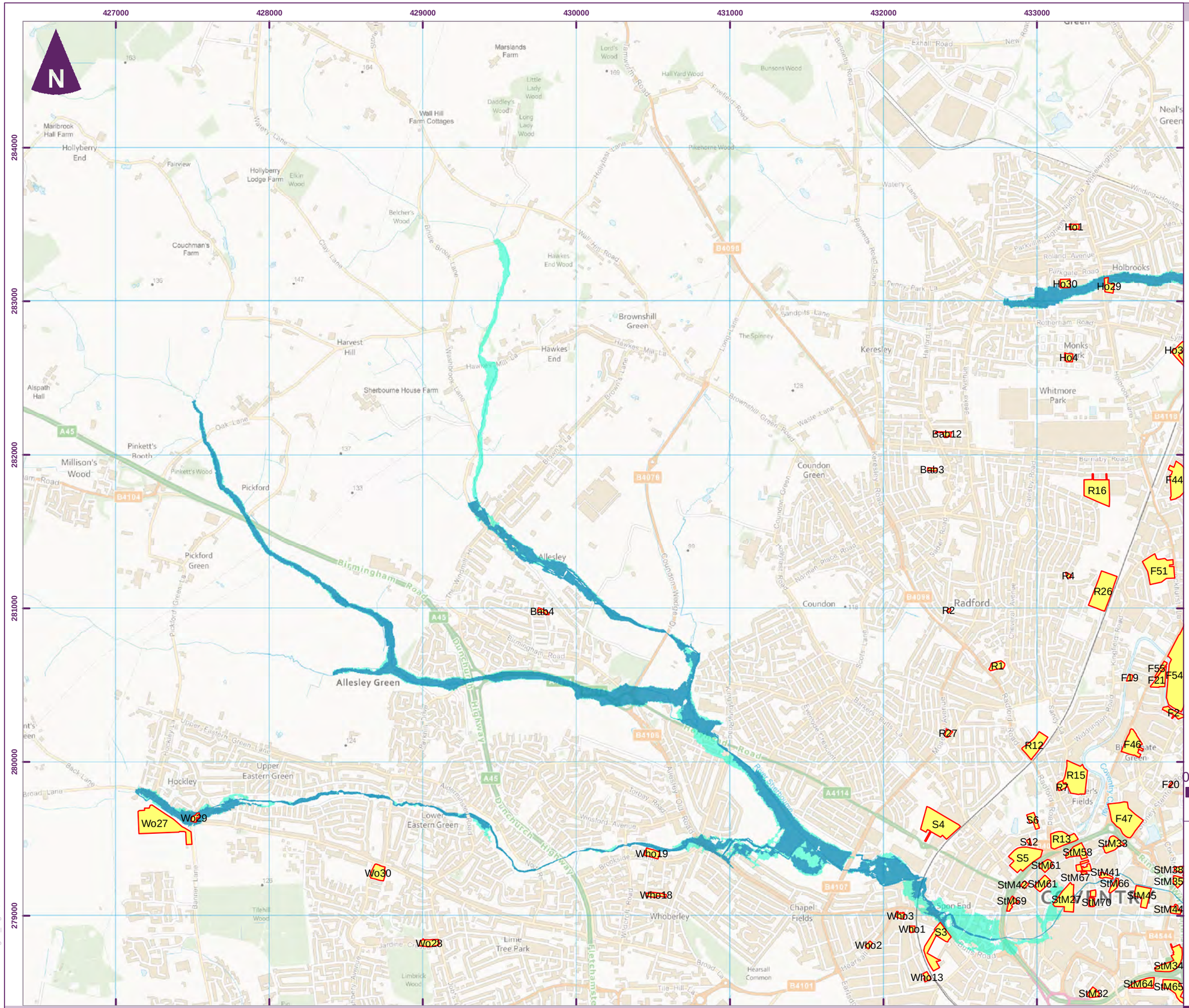

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Figure 5.8
Shortlisted Sites NW Coventry
Fluvial Flood Risk

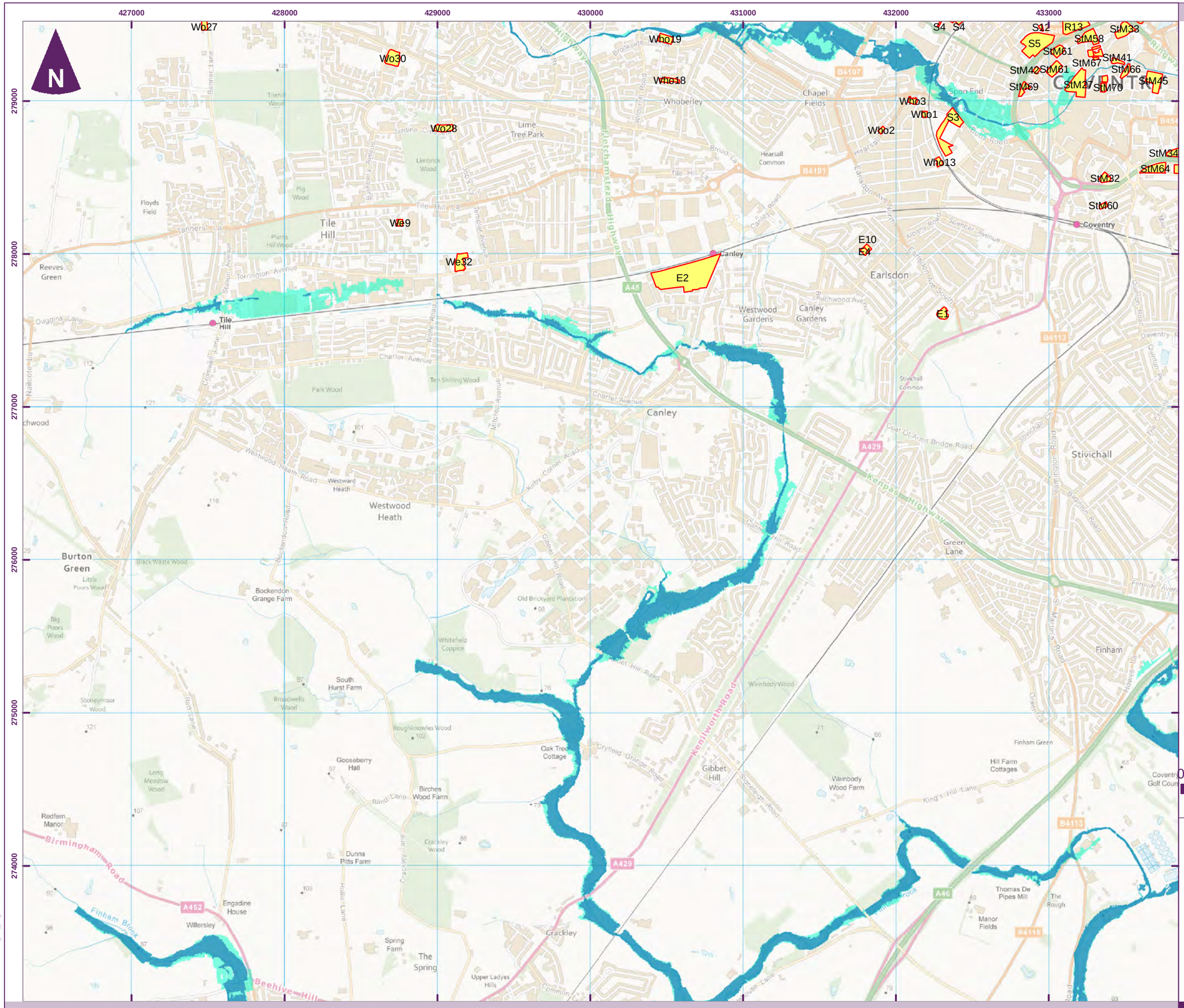

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Figure 5.9
Shortlisted Sites SW Coventry
Fluvial Flood Risk

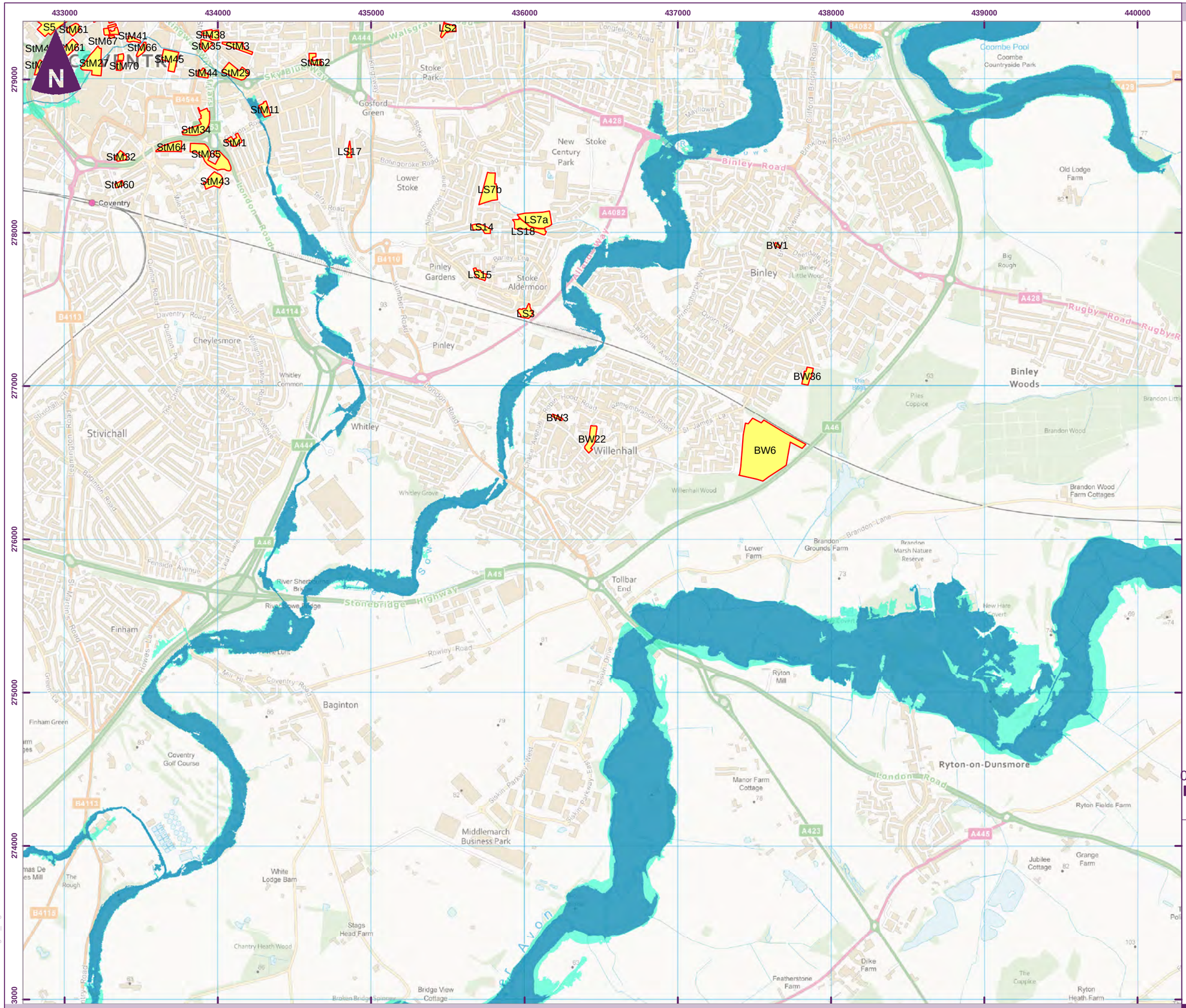

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Figure 5.10
Shortlisted Sites SE Coventry
Fluvial Flood Risk

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433000 434000 435000 436000 437000 438000 439000 440000

284000 283000 282000 281000 280000 279000

Key

- Shortlisted Sites
- Flood Zone 3
- Flood Zone 2

0 0.25 0.5 0.75 1 1.25 1.5 km

Scale at A3: 1:24,000

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Figure 5.11
Shortlisted Sites NE Coventry
Fluvial Flood Risk

Development in fluvial flood risk areas

National Planning Policy Framework NPPF

NPPF specifies that Local Planning Authorities (LPAs) such as Coventry City Council should adopt a risk-based approach to planned development through the application of a Sequential Test, which seeks to steer new development towards areas of lowest flood risk (see Section 3.4 for guidance on the application of the Sequential Test). The extent of areas affected by fluvial flooding should be mapped to flag the need to identify the hazard posed to development. Then with an understanding of development vulnerability, risks can be proactively managed by the spatial planning process, and, if necessary development design to minimise the consequences. This process should include an assessment of the implications of climate change on fluvial flood risk.

NPPF includes the Exception Test which, if justified, allows some scope for departures from the sequential approach. This is for circumstances where it can be: "*demonstrated that the development provides wider sustainability benefits to the community*" (NPPF paragraph 102). However, providing the evidence to justify a departure from the sequential approach on this basis is only one part of the Exception Test. To be permitted, proposed developments will need to demonstrate that flood risks are appropriately managed, the development is safe and flood risk elsewhere is not increased. NPPF directs planning authorities to take opportunities to reduce flood risk through development. Coventry City Council will seek to work with developers to encourage developments that contribute to an overall reduction in flood risk (see Section 3.4 for guidance on the application of the Exception Test).

Local guidance

The Town and Country Planning (Flooding) (England) Direction 2006 has made the Environment Agency (EA) a statutory consultee on all applications for development in flood risk areas, including areas with critical drainage problems and for developments exceeding 1 hectare outside flood risk areas. After discussion with the EA, LPAs are required to notify the Secretary of State if they remain minded to approve a planning application contrary to a sustained objection from the Environment Agency. Coventry City Council is now designated Local Lead Flood Authority (LLFA), they are a statutory consultee for all flooding issues, especially local issues related to areas in Flood Zone 1 with specific drainage problems. LPAs will be able to obtain the advice of the LLFA when assessing minor development applications, and where further clarification is required they are able to consult the LLFA on a non-statutory basis.

Coventry City Council recognise the need to follow the sequential approach laid out in NPPF. The previous Level 1 & Level 2 SFRA, Draft SWMP and Draft LFRMS should be referred to when directing development. Specific policies relating to fluvial flood risk include no culverting of watercourses without an overriding need, consents required for new discharges and works in watercourses (LLFA for ordinary watercourses), and to incorporate development free corridors along watercourses in development proposals to ensure future access for maintenance

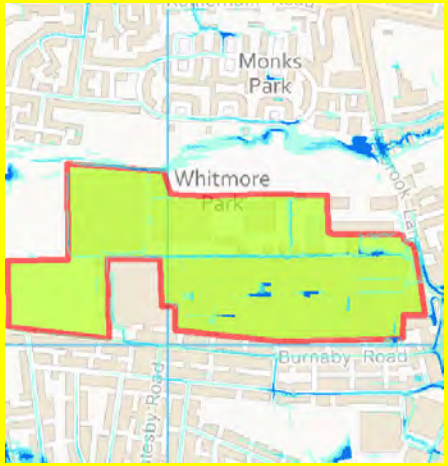
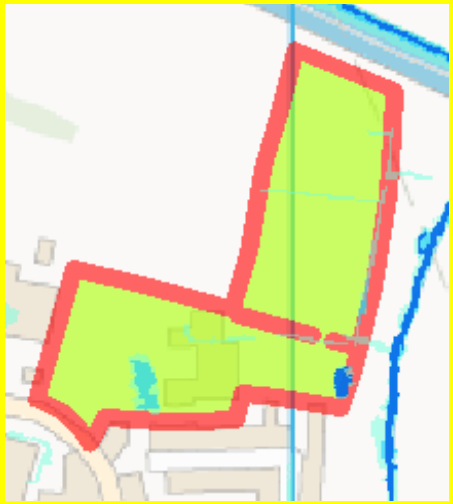
Surface water flooding

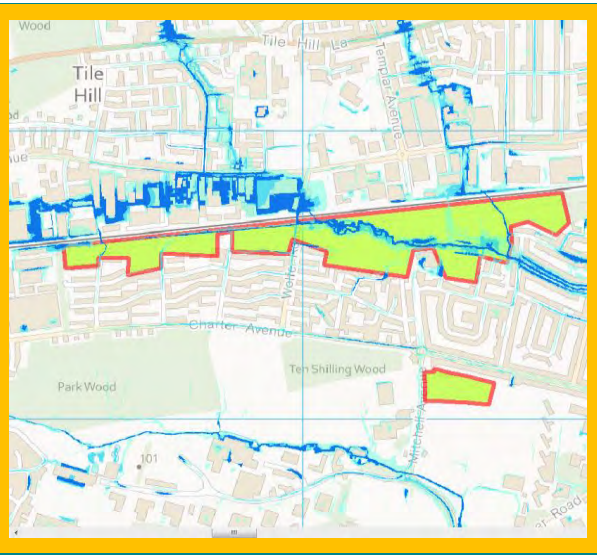
Risks to development sites from surface water flooding

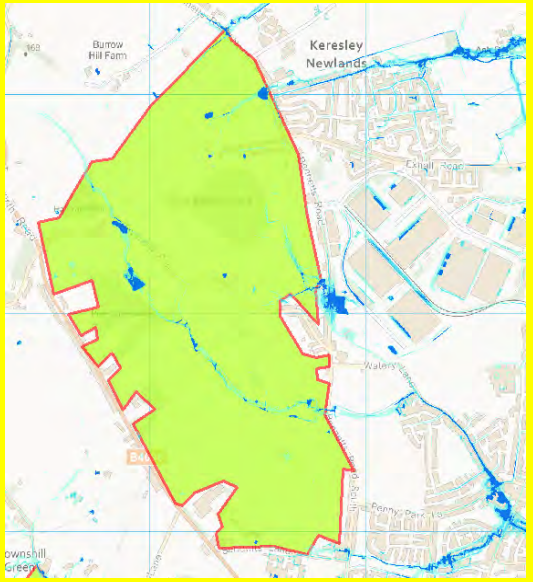
In contrast to fluvial flood risks which follow watercourses through Coventry, risks from surface water flooding are much more widespread across Coventry (see Section 3.4). The Severn Catchment Flood Management Plan (CFMP), Draft LFRM Strategy, Draft SWMP, Draft SWMP and the previous Level 1 & Level 2 SFRAs all focus on the risks from surface water flooding. Surface water flood risks specific to the strategic development sites are listed in Table 5.7. There are surface water flood risks to almost all development sites from the 1 in 1000 year rainfall event, Table 5.8 focuses on the employment and shortlisted residential sites that are at risk of surface water flooding from the 1 in 30 year rainfall event. Figures 5.12-5.15 show the extent of the Environment Agency modelled surface water flood extents and the locations of the shortlisted sites across Coventry.

Table 5.7 Surface water flood risk to key strategic sites in Coventry

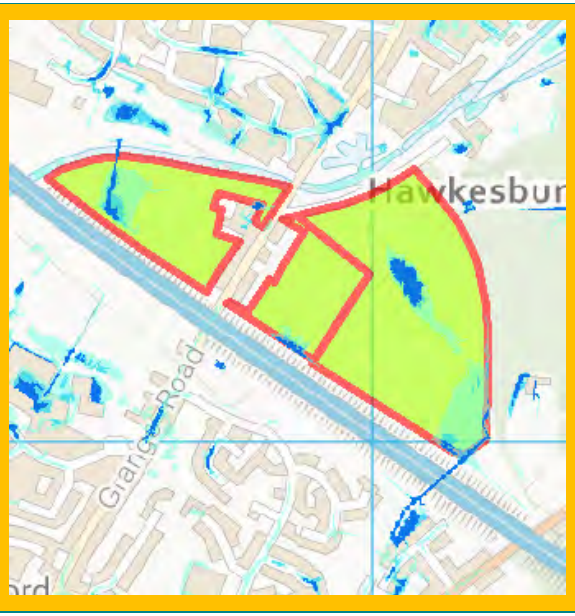
Strategic site	Dwellings	Description of modelled surface water flood risk on-site	Current planning status	Identified surface water/drainage issues identified in previous studies	Modelled surface water flood risk (dark blue = 1 in 30 year, light blue = 1 in 100 year, turquoise = 1 in 1000 year)
Browns Lane	100	Potential for extensive, deep surface water flooding around Brownshill Green Road Roundabout. A watercourse is culverted beneath the road which could be prone to blockage exacerbating the surface water flood risk. Sequential approach to set development back from risk areas.	Pending	Not covered in the original Level 2 SFRA	
Eastern Green SUE	2300	Potential for extensive, deep surface water flooding across the site around the banks of the River Sherbourne and within low lying areas all over the site. Sequential approach to set development back from risk areas.	Pending	The Site is partially covered in the original Level 2 SFRA for land south of the River Sherbourne which is entirely within Flood Zone 1. The Strategic Site has since been extended to include the River Sherbourne and land to the north which is in Flood Zones 2 and 3.	

Strategic site	Dwellings	Description of modelled surface water flood risk on-site	Current planning status	Identified surface water/drainage issues identified in previous studies	Modelled surface water flood risk (dark blue = 1 in 30 year, light blue = 1 in 100 year, turquoise = 1 in 1000 year)
Whitmore Park	500	Potential for surface water flooding along the eastern edge of the site along Holbrook Lane. Sequential approach to set development back from risk areas.	Granted	Not covered in the original Level 2 SFRA.	
Elms Farm	100	Some surface water flood risk is posed at the south eastern corner of the site near to the adjacent watercourse which is culverted beneath the M6. Sequential approach to set development back from risk areas.	Pending	Not covered in the original Level 2 SFRA.	

Strategic site	Dwellings	Description of modelled surface water flood risk on-site	Current planning status	Identified surface water/drainage issues identified in previous studies	Modelled surface water flood risk (dark blue = 1 in 30 year, light blue = 1 in 100 year, turquoise = 1 in 1000 year)
Canley Regeneration	750	Deep surface water flooding is a risk along the watercourse which flows through the site. The modelled areas of surface water flooding correspond with the areas of modelled fluvial flooding, indicating that the watercourse can cause in combination events of channel capacity exceedance and runoff from heavy rainfall onto the site. Sequential approach to set development back from risk areas.	Granted	Any development should utilise suitable SuDS and careful consideration to overland flow routes (e.g. avoiding obstructing these) as part of the site design should be encouraged. Any SUDS design must take account of groundwater and geological conditions. Significant serious flooding has been identified near Tile Hill, to the north of the site which could affect access, egress routes.	

Strategic site	Dwellings	Description of modelled surface water flood risk on-site	Current planning status	Identified surface water/drainage issues identified in previous studies	Modelled surface water flood risk (dark blue = 1 in 30 year, light blue = 1 in 100 year, turquoise = 1 in 1000 year)
Keresley SUE	3000	Small areas of surface water flood risk are modelled around the small watercourse that runs through the site and a large area of potential deep surface water flooding exists at the eastern boundary of the site along Bennetts road. There is a culverted watercourse beneath the road which indicates there is potential for in combination events of impeded drainage, surface water runoff, and fluvial flooding. Sequential approach to set development back from risk areas.	Granted	A DIA will be required for this site to assess the appropriate SUDS techniques that should be adopted for the site to achieve greenfield runoff rates with a minimum reduction of 20%, to ensure no worsening of existing flooding problems elsewhere. Adoption of SUDS is critical to ensure that the development does not exacerbate flood risk elsewhere, and should be reviewed at the masterplanning stage, specifically the space required in the site for SUDS. It is important that a strategic approach to SUDS adoption is applied to the entire site.	

Strategic site	Dwellings	Description of modelled surface water flood risk on-site	Current planning status	Identified surface water/drainage issues identified in previous studies	Modelled surface water flood risk (dark blue = 1 in 30 year, light blue = 1 in 100 year, turquoise = 1 in 1000 year)
Cromwell Lane	240	Small areas of surface water flood risk are modelled around the small watercourse that runs through the site. There is an existing waterbody on-site in a low lying area which may be at risk of overtopping during heavy rainfall. Sequential approach to set development back from risk areas.	Pending	Not covered in the original Level 2 SFRA. Significant serious flooding has been identified near Tile Hill, to the north of the site which could affect access, egress routes.	

Strategic site	Dwellings	Description of modelled surface water flood risk on-site	Current planning status	Identified surface water/drainage issues identified in previous studies	Modelled surface water flood risk (dark blue = 1 in 30 year, light blue = 1 in 100 year, turquoise = 1 in 1000 year)
Grange Farm and Sutton Shop	312	Potential for deep surface water flooding along low lying areas through the middle of the site and at the western boundary along the Coventry Canal. Sequential approach to set development back from risk areas.	Pending	Not covered in the original Level 2 SFRA. Site is mainly within Flood Zone 1 with a small area of Flood Zone 3 at the south-east corner of the Site. The Coventry canal is located along the northern boundary of the Site and flood risk from this source will need detailed assessment prior to consent. Properties situated within close proximity to the canal will require a detailed breach and overtopping assessment to ensure that the potential risk to life can be safely managed throughout the lifetime of the development.	

Strategic site	Dwellings	Description of modelled surface water flood risk on-site	Current planning status	Identified surface water/drainage issues identified in previous studies	Modelled surface water flood risk (dark blue = 1 in 30 year, light blue = 1 in 100 year, turquoise = 1 in 1000 year)
Land at London Road and Allard Way	160	Small areas of surface water flood risk at the edges of the site along a small watercourse which flows in to the River Sowe. Most of the site is not at risk of surface water flooding. It is clear from the modelled flood extents that the Site slopes towards the River Sowe so there is little scope for surface water to accumulate on the site. Sequential approach to set development back from risk areas.	Pending	Not covered in the original Level 2 SFRA.	

Strategic site	Dwellings	Description of modelled surface water flood risk on-site	Current planning status	Identified surface water/drainage issues identified in previous studies	Modelled surface water flood risk (dark blue = 1 in 30 year, light blue = 1 in 100 year, turquoise = 1 in 1000 year)
Walsgrave Hill Farm	842	Extensive areas of surface water flood risk along the banks of the River Sowe. The site is gently sloping so there is scope for surface water to accumulate, however deep fast moving surface water flooding is only modelled at the north western end of the site. Sequential approach to set development back from risk areas.	Pending	Site straddles the banks of the River Sowe. Large parts of Site within Flood Zone 3. Examination of the local fluvial setting and modelling (JFLOW) leads to the conclusion that the resolution of data is sufficient to guide the site allocation process. Some 50% of the site is affected by Flood Zone 3. Because Flood Zone 3b does not exist for this section of watercourse, Flood Zone 3 should be deemed equal to Flood Zone 3b, where, in accordance with NPPF, only Water Compatible developments can be placed. The wide nature of the floodplain in this area suggests it would be sensitive to climate change. It is recommended that an alternative site is considered and that development of this site does not go ahead.	

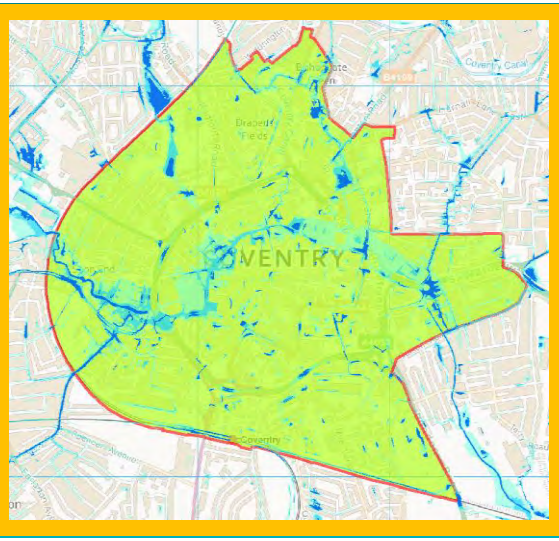
Strategic site	Dwellings	Description of modelled surface water flood risk on-site	Current planning status	Identified surface water/drainage issues identified in previous studies	Modelled surface water flood risk (dark blue = 1 in 30 year, light blue = 1 in 100 year, turquoise = 1 in 1000 year)
City Centre Sites	2000	Extensive, deep, fast flowing surface water flooding is modelled across the centre of Coventry. Particular areas of high risk are located along the culverted stretches of the River Sherbourne which are low lying and prone to run on from surrounding areas. Within sites, the sequential approach will need to be taken to setting out development. Flood risk management measures may be required on some sites, and development options at the highest risk sites may be constrained.	Pending	Not covered in the original Level 2 SFRA.	

Table 5.8 Employment and shortlisted residential sites at risk from modelled 1 in 30 year surface water flooding

Area	Site	Dwellings
NW Coventry	Bab3	6
	Ho30	12
	R16	60
	R15	47
	S5	51
	S4	57
	R1	21
	S12	9
	Wo27	153
	Wo29	8
	Eastern Green	Employment
	Browns Lane – Lyons Park and expansion land	Employment
SW Coventry	E2	117
	S3	85
	Friargate	Employment
SE Coventry	LS7a	57
	LS7b	65
	LS18	41
	BW1	5
	BW22	34
	StM11	21
	StM65	67
	Parkside Techno Park	Employment
	Whitley Business Park and Expansion Land	Employment
NE Coventry	Ho3	34
	F12	14
	F45	42
	F15	29
	F51	100
	F54	450

Area	Site	Dwellings
	F46	54
	F47	127
	F30	136
	He7	7
	He9	6
	StM29	190
	Wy18	39
	L23	24
City Centre	StM34	130
	StM27	300
	StM66	66
	StM41	60
	StM45	84
	StM44	38
	StM61	95
	City Centre South	Employment

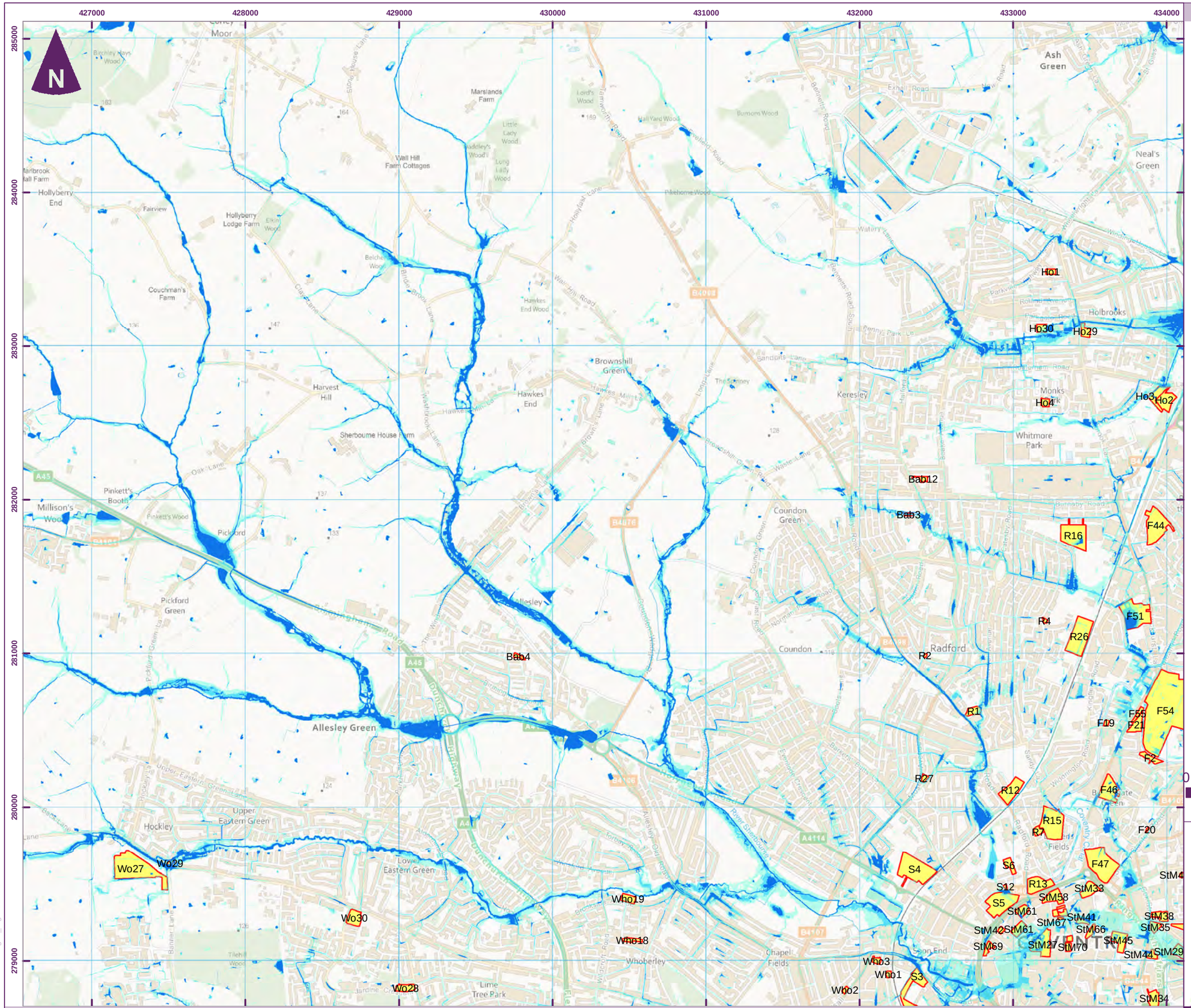


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Figure 5.12
Shortlisted Sites NW Coventry Surface Water Flood Risk

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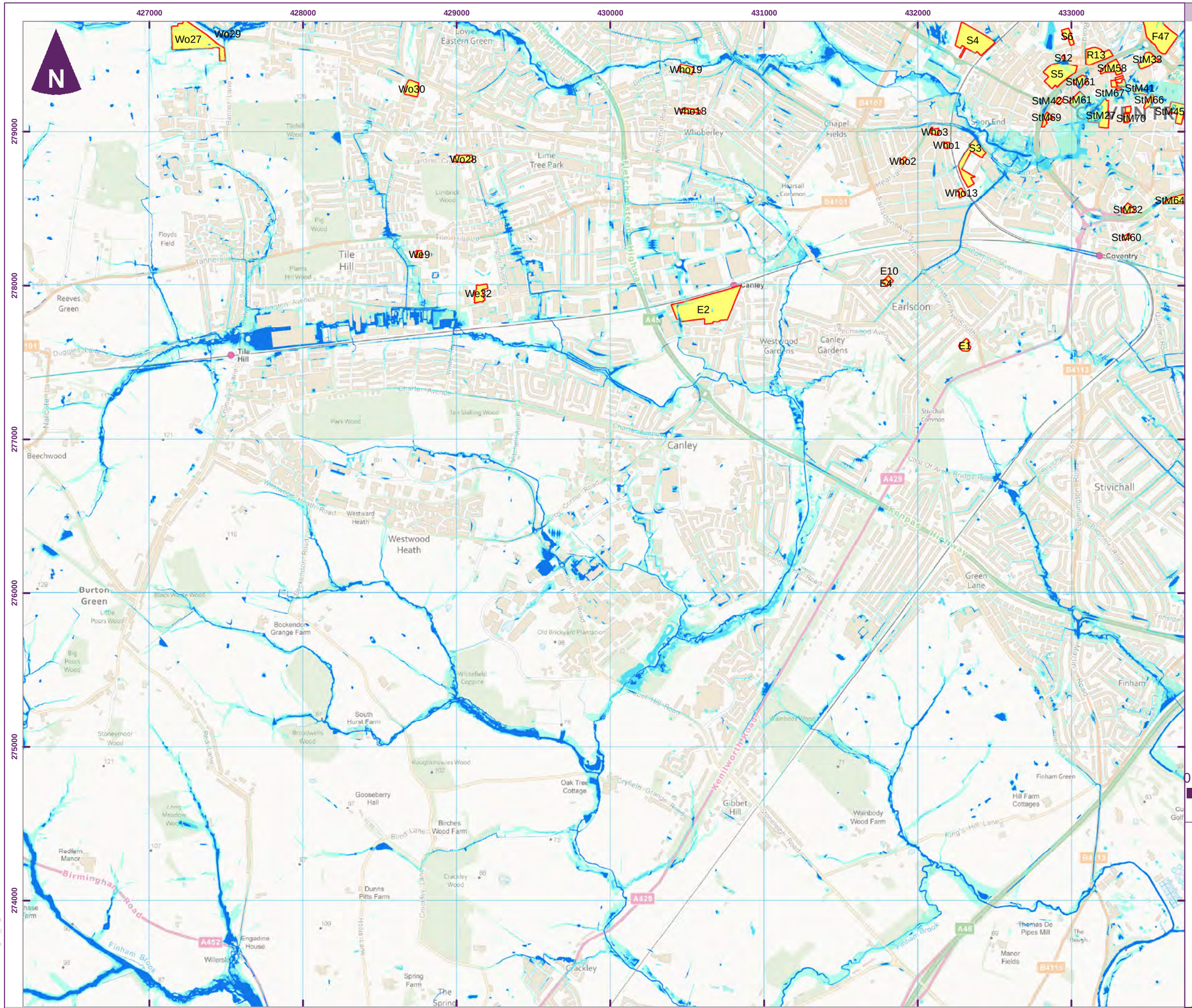

Key

- 30 Year Surface Water Flooding Extent
- 100 Year Surface Water Flooding Extent
- 1000 Year Surface Water Flooding Extent
- Shortlisted Sites

0 0.25 0.5 0.75 1 1.25 1.5 km

Scale at A3: 1:24,000

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Figure 5.13
Shortlisted Sites SW Coventry
Surface Water Flood Risk

September 2015

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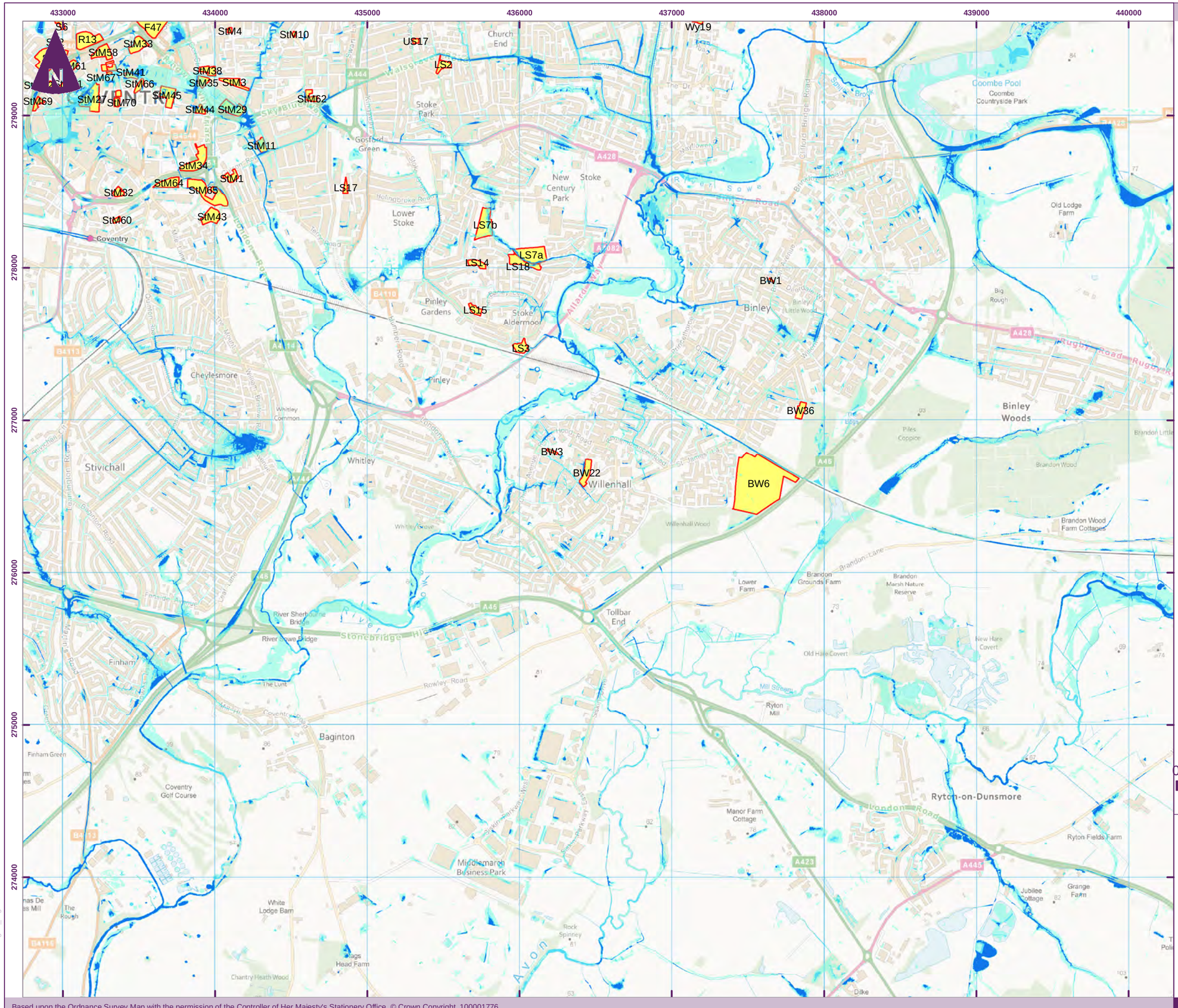

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Figure 5.14
Shortlisted Sites SE Coventry
Surface Water Flood Risk

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433000 434000 435000 436000 437000 438000 439000 440000

285000 284000 283000 282000 281000 280000 279000

N

Key

30 Year Surface Water Flooding Extent

100 Year Surface Water Flooding Extent

1000 Year Surface Water Flooding Extent

Shortlisted Sites

0 0.25 0.5 0.75 1 1.25 1.5 km

Scale at A3: 1:24,000

37227 Coventry
Water Cycle Study

amec foster wheeler

Figure 5.15
Shortlisted Sites NE Coventry
Surface Water Flood Risk

Development in surface water flood risk areas

- The NPPF sequential approach should be applied when assessing the suitability of developments at risk of surface water flooding. Development should be steered away from greenfield sites with critical drainage problems where possible. For brownfield sites, a proposed development will need to be safe from flooding, and avoid increasing flood risk in adjacent areas. The sequential approach should be applied within a site, with the most sensitive development types placed in the lowest risk areas of the site.
- Updated flood maps for surface water and the resulting predicted surface water flood depth, velocity and direction should be a consideration in determining the suitability and sustainability of development.
- Localised pluvial flood risk in fluvial flood risk Zone 1 will require a site specific risk assessment appropriately scaled to the requirements of the LLFA. For sites in areas with historic drainage problems a Drainage Impact Assessment should be prepared if the site area is greater than 0.25 hectares. These Drainage Impact Assessments should be inclusive of a consideration of surface water drainage and measures to mitigate against any potential increase in run off. In addition to this, Figures 5.12 to 5.15 should be reviewed to assess whether the site is within a zone of potential surface water flood risk. As part of these assessments, the responsible party for the receiving sewer or watercourse[22] should be contacted to discuss the proposed method of managing surface water;
- **Site specific FRAs should consider the local drainage infrastructure in detail**. When preparing site specific FRAs the impact of blockages to any culverts along Ordinary Watercourses, and blockage surface water drains and the likely consequences should be considered. If necessary it might be appropriate to slightly raise ground floor levels to reduce potential damages. Such mitigation should be supported by evidence to demonstrate that surface water flow routes are not altered to the extent that the risk of flooding is made worse elsewhere; and
- **An area identified at risk from surface water flooding** – either from flood mapping or from historical records – should not be excluded from development solely on that basis. Surface water flooding can often be carefully managed and good site design may not only reduce the risk of flooding on-site but helps to alleviate flooding problems downstream from the development. Such opportunities for a strategic drainage approach are being developed as part of Surface Water Management Plans.

Groundwater flooding

The limited information available regarding groundwater flooding in previous studies consequently means that each development must be assessed independently for groundwater flood risk and cannot be considered in this Study due to lack of available data. The PFRA presents groundwater flood risk mapping that indicates groundwater flood risk is greatest in the low lying areas in the east and south east of Coventry. However, this mapping is intended as a high-level screening tool only, and specific local investigation is required to confirm the level of risk to any given site. Groundwater levels have been noted to be rebounding following cessation of industrial abstractions (

[22] The water company with sewerage responsibility: Severn Trent Water, or the relevant council department in the case of highways drains and Ordinary Watercourses, and the Environment Agency in the case of Main Rivers.

Figure 3.9). Developments in areas potentially at risk should be assessed for their vulnerability to rising groundwater levels over the lifetime of the development, especially in low lying areas in eastern and southern Coventry.

Basements

For new developments, it is recommended that habitable rooms in basements should be avoided in Flood Zone 3 or areas known to be at risk of groundwater flooding. Adaptation of existing properties, to include a basement for habitable rooms should be discouraged in Flood Zone 3 or where mapping shows a high risk of groundwater flooding. Basements for less vulnerable uses or non-habitable rooms must be designed with safe internal escape. Each application should be discussed with Coventry City Council and the Environment Agency.

Summary and recommendations

This assessment of indicative growth plans to 2031 within Coventry City has identified that there is generally capacity to accommodate growth in areas where fluvial flood risk is low or can be mitigated against. Where a risk of fluvial flooding has been identified at an assessed site, there is scope for this flood risk to be mitigated against by applying the sequential approach. For greenfield sites, development should be directed to Flood Zone 1. Careful design can set development back from areas of fluvial flood risk, with this land serving as blue/ green corridors. For brownfield sites, those in Flood Zone 1 should be prioritised for development. The sequential and exception tests will need to be applied to assess the redevelopment of brownfield sites in Flood Zones 2 and 3. For some sites an avoidance strategy may be feasible (place development in lowest risk areas of the site), for other sites the development design will need to incorporate suitable flood risk management measures. All sites should be developed so that both the proposed development is safe from flooding and flood risk to existing development is not increased, and is where possible reduced.

Whilst surface water flood risk is widespread across the city, for many of the potential development sites development can be laid out sequentially to avoid areas of risk. For sites with more difficult surface water flood risk problems, the sequential approach should be applied, bringing forward the lowest risks sites first.

The future management of runoff from new developments will be key to achieving Coventry City Council's growth aspirations without increasing flood risk. Developers should liaise with Coventry City Council (as LPA and LLFA), the Environment Agency and Severn Trent Water to ensure developments incorporate suitable SuDS (see Section 6) in the design of their surface water drainage systems. Local Planning Authorities will be able to reference the advice of the LLFA when assessing minor development applications, and where further clarification is required they are able to consult the LLFA on a non-statutory basis

Where possible, runoff should be managed via infiltration on-site, and where this is not possible, flows should be routed to existing watercourses with the pre-development runoff rate maintained. This will ensure that alterations to the natural water cycle are reduced. It will also reduce the degree of additional pressure placed on the existing sewer network, and may facilitate options to reduce pressures at some locations where a more sustainable drainage solution is constructed as a result of the development. Discharge of surface water to the sewer network being a last resort.

With regards to sewer network capacity, Severn Trent Water will provide the necessary drainage capacity in parallel with the development of the individual sites, in collaboration with developers and the planning authority. The exact location and scale of new drainage systems will be determined once there is more certainty of the development being taken forward, the size, location and phasing. Each individual planning application will often be supported by studies to clarify the available capacity or connection requirements to the surface water drainage network. Therefore, where required, surface water drainage via sewers should not pose an absolute barrier to growth.

5.4 Conclusions

Summary conclusions from the key disciplines that affect the water environment are:

- Water supply: water resources used to supply this area with drinking water are under pressure and whilst Severn Trent Water is able to undertake system improvements to augment resources and reduce leakage, managing demand remains a core part of the solution. It is on the basis that measured customers are enabled to manage their demand to less than 130l/h/d that a water secure forecast are planned. This puts impetus on the Council to ensure that all new developments are built to conform to at least the basic levels of water efficiency. Water supply infrastructure could be a temporary constraint, unless development is phased appropriately. Any constraints should only be temporary as Severn Trent Water has a planned programme of water mains renewal to improve the quality and reliability of supplies to customers. This includes upsizing mains to accommodate planned growth. The company is in the early stages of assessing the investment needs for the study area and will confirm the detailed mains programme by 2020.
- Waste water and sewerage: there is generally capacity in the existing wastewater treatment and sewerage infrastructure to accommodate growth, but limitations exist in terms of phasing development with required (capacity or WFD initiated) upgrades. Severn Trent Water will provide the necessary sewerage and WwTW capacity in parallel with the development of the individual sites, in collaboration with developers and the planning authority, as part of the requirements of Section 94 of the Water Industry Act.
- Flood risk: there is generally capacity to accommodate growth. At individual sites fluvial flood risk is low or can be mitigated against. Whilst surface water flood risk is widespread across the city, for many of the potential development sites development can be laid out sequentially to avoid areas of risk. Careful planning of developments will ensure minimal additional pressure put on existing systems by utilising natural attenuation and infiltration methods. Each development must be assessed independently for groundwater flood risk.

6. Strategy recommendations (Phase 3)

6.1 General overview

It is clear that whilst there is capacity to support growth across Coventry City administrative boundary the water environment and water services infrastructure cannot support all of the development in the locations put forward by Coventry City Council until a range of investigations and upgrades have been completed. There are some areas where growth is largely unconstrained by the water environment but there are others which are highly constrained and will require concerted joined up effort between Coventry City Council, the Environment Agency, and Severn Trent Water to resolve. Inevitably, the development plans need to be phased to enable Coventry City Council to meet its housing requirements by prioritising those sites which are least constrained, and planning well in advance for the sites that likely need to pushed back to give time for the supporting infrastructure to be developed.

This section identifies considerations for the phasing of development, and clarifies the actions that Coventry City Council can take to work with its partners, the Environment Agency and Severn Trent Water to effectively plan and implement development that will be sustainable.

It is important that Coventry City Council review the outputs of the final 2008 SFRA Update[23], once finalised, to ensure that any significant changes are identified. Coventry City Council should reflect on the conclusions given here in light of the new SFRA. It is important to note that the housing and employment numbers used were derived from Coventry City Council sources and were accurate at the time they were made available (July 2015). The assessment in this report does not include any subsequent changes to these numbers.

6.2 Phasing of development

Careful consideration and phasing of development will be critical within Coventry City Council administrative boundary to ensure that adequate infrastructure and investigation had been undertaken in advance of development construction or completion. In the short term, i.e. at least within the next five years, Coventry City Council should be able to deliver its housing requirements, through delivery of committed housing or by focussing allocated development in the areas with adequate current infrastructure or capacity to accommodate growth.

To allow adequate time for upgrade works and solutions to be identified for planned growth to 2031 the following need to be considered:

- Coventry City's growth plan far exceeds the growth that Severn Trent Water has included for the area as part of its wider forecasting of the Strategic Grid zone. The inaccuracy could be accommodated within the headroom that the company has factored in – but a 3Ml/d additional demand should be investigated. Development plans should be discussed with Severn Trent Water at the earliest opportunity to enable the company to begin factoring in this pocket of higher demand into its longer term forecast of the Strategic Grid water resource zone.
- Severn Trent Water should investigate and confirm the potential DWF exceedance at Finham WwTW. Should the WwTW be near exceedance then it is likely that and increased DWF consent will need to be considered. This would require water quality modelling to understand the implications of increased output on the Water Framework Directive quality objectives. Dependant on the outcomes of this investigation there is the potential to delay growth plans within this WwTW catchment should significant upgrade be required, or alternative drainage solutions need to be sought.
- Further upgrade works may be required at all three WwTWs in the future, to accommodate increased capacity at the works or provide improvements in Quality to meet downstream objectives. While current upgrade work at Finham WwTW will increase the capacity of the

[23] Coventry City Council, Level 1 and 2 Strategic Flood Risk Assessment Draft Report. Written and Prepared by JBA Consulting Ltd (September 2015)

WwTW (capital maintenance and P removal) Severn Trent Water indicate that this may not be enough to accommodate all growth planned to 2031. There is also the potential for future pressure at Meriden and Finham WwTWs from downstream designated sites or WFD requirements, should improvements in water quality be required. Continued communication between Coventry City Council, Severn Trent Water and Environment Agency is advised.

- Coventry City Council and Severn Trent Water need to be in continual communication as sites are taken forward to ensure that the sites can be adequately served by the sewerage system. This is particularly true for sites within the north west of the city, at the head of the sewerage system. While Severn Trent Water are confident that they can provide sewerage upgrade to support demand, their biggest concern relates to Eastern Green SUE and Keresley SUE sites (Figure 5.5) where it is anticipated that 3-4 years are likely to be required before sufficient capacity is available should these sites be taken forward.
- A number of assumptions were used in the consideration of employment site capacity. It is expected that some of the new employment will be in the form of light manufacturing (identified as Use Class type B2), which is likely to have a higher water usage than considered here. It is recommended that the Council keep both the Environment Agency and Severn Trent Water informed as soon as proposals for light manufacturing sites come online.
- Surface water flood risk is identified as a constraint across Coventry City Council administrative boundary. This is not an absolute constraint and it is advised that Coventry City Council, Severn Trent Water and the Environment Agency liaise closely to consider growth numbers, and the impact of increased development on the existing network of surface water drainage systems. Developments will need to be carefully planned so as to not put pressure on existing systems by utilising natural attenuation and infiltration methods as much as possible (see Section 6 for more detail on the use of SuDS). These will be implemented at the time of development construction, with adequate time required in advance to design the most appropriate SuDS solution for each individual site.

6.3 Actions, duties, and recommendations

Severn Trent Water is appointed as the water and sewerage undertaker for Coventry through an appointment made under the Water Industry Act 1991 and the principal duties of a water and sewerage undertaker are set out in that legislation. Section 37 of that Act places a duty upon a water undertaker to develop and maintain an efficient and economical system of water supply within its area. Similarly, Section 94 places a duty upon a sewerage undertaker to provide, improve and extend a system of public sewers to ensure that its area is effectually drained and the contents of those sewers effectually dealt with so that there is no deterioration in environmental performance or increase in sewer flood risk.

In order to ensure Severn Trent Water can meet its obligations and plan effectively Coventry City Council has responsibilities to communicate confirmed development plans to Severn Trent Water as soon as they are available and in line with the statutory timeline for the development of Water Resource Management Plans. Severn Trent Water has already finalised its Business Plan for the 2014 Periodic Review leading into the implementation period of AMP6. Only 14,000 of the 23,600 committed growth has been taken into account for this period. The next round of statutory planning will commence in the years leading up to the 2019 Periodic Review, i.e. the main timeframes for providing data on the next phase of growth would be 2017 and 2018, although it is recommended that Coventry City Council maintains ongoing dialogue. With regard to the council's 20 year planning horizon, the Council should be prepared to submit development plan data in time for the 2024 and subsequent 2029 Water Resource Management Plans.

Information on development will be used by Severn Trent Water to reforecast demand for water and thus develop robust plans to secure the supply-demand balance. More locally however, confirmed data will be used to quantify the impacts on water supply and sewerage infrastructure. This has been done at a high level but advice from the water company is that the investment in detailed modelling is usually only undertaken once development plans are confirmed. The location and quantity of housing (and employment) growth is used by Severn Trent Water to quantify the likely increased volumes of sewage that will drain to each respective wastewater treatment works. The proposed increase is combined with the current demand (measured as Dry Weather Flow, DWF).

Once the forecast new DWF has been calculated, if this exceeds the maximum DWF on the treatment works' discharge consent Severn Trent Water contacts the Environment Agency to request a change to the consent. Before a new discharge consent is granted the Environment Agency will model the impact of the increased volume on the receiving water and calculate revised maximum concentrations for the substances within treated effluent, i.e. phosphates, nitrates, ammonia etc. An increased volume is highly likely to require the concentrations to be reduced in order to continue protecting the water quality in the receiving water. Reduced concentrations typically require further upgrades in terms of the level of treatment applied to the sewage.

The Water Framework Directive requires (as a minimum) that the ecological status of water bodies do not deteriorate, and so even for wastewater treatment works that have substantial headroom within their capacity the Environment Agency will be required to ensure that increasing the volume discharged from a treatment works does not cause deterioration. This could potentially put Severn Trent Water into a very difficult situation where the company may need to spend millions of pounds to deliver the requirements.

6.4 Environmental management measures/ sustainability strategy

The following environmental management measures and strategies are recommended/ required in advance of or during development construction.

It is recommended that Coventry City Council develops a structured reporting system to track and report developments that are under construction, developments that have been given planning permission, and developments which are still in the application or allocation stage (if a similar procedure is not already in place). A structured annual system also be supported with a less formal arrangement for Coventry City Council to keep key individuals in Severn Trent Water and the Environment Agency up to date with any significant progress or potentially contentious planning applications. This could be part of the official planning application consultation process, or a less formal more open ongoing dialogue could be established.

Water efficiency requirements in residential and commercial development applications

In addition to maintaining regular dialogue with Severn Trent Water on the progress and rate of growth, Coventry City Council also has a responsibility to support Severn Trent Water's water demand assumptions by requiring all new homes are built to suitable levels of water efficiency.

Coventry City Council is advised to develop robust policies on water efficiency in new developments (homes and employment sites). The Code for Sustainable Homes is a voluntary initiative which includes technical guidance on how to manage demand for water through sustainable design. Measured per capita consumption across Coventry needs to be effectively managed to a level of below 110 litres per person per day. This is challenging but achievable without requiring measures such as rainwater harvesting. All opportunities to encourage reduced demand for mains water could be considered to reduce pressure on very limited water resources in the region.

Part G (Approved Document G) of schedule 1 of the Building Regulations covers the requirements with respect to Water Efficiency (in addition to Sanitation and Hot Water Safety). It incorporates guidance from the 'Water Efficiency Calculator for New Dwellings' which sets out the methodology for calculating the level of water consumption that would be expected under according to the water fittings and fixtures installed in new dwellings[24]. The Code for Sustainable Homes also uses this calculator as its consumption assessment method. The calculator does not take into account water using behaviours. There are different combinations of water efficiency across different water fittings. Table 6.1 provides an example of good practice water fittings that would achieve the water efficiency requirements without impacting on performance or significantly impacting on costs for the developers:

[24] http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partg/waterefficiency

Table 6.1 Water consumption levels of fittings and fixtures that will achieve 110 litres /person/day

The water calculator for new dwellings					
Installation type	**Unit of measure**	**Capacity/flow rate (1)**	**Use Factor (2)**	**Fixed Use (litre/person/day) (3)**	**Litres/person/day (4) = [(1)x(2)]+(3)**
WC (fixed flush)	Flush volume (litres)		4.42	0.00	0.00
WC (dual flush)	Full flush volume (litres)	4.5	1.46	0.00	6.57
	Part flush volume (litres)	2.6	2.96	0.00	7.70
WCs (multiple fittings)	Average effective flushing volume (litres)		4.42	0.00	0.00
Taps (excluding kitchen taps)	Flow rate (litres/min)	4	1.58	1.58	7.90
Bath (where shower also present)	Capacity to overflow (litres)	180	0.11	0.00	19.80
Shower (where bath also present)	Flow rate (litres/min)	9	4.37	0.00	39.33
Bath only	Capacity to overflow (litres)		0.50	0.00	0.00
Shower only	Flow rate (litres/min)		5.60	0.00	0.00
Kitchen sink taps	Flow rate (litres/min)	7	0.44	10.36	13.44
Washing machine	Litres/kg dry load	6.14	2.10	0.00	12.89
Dishwasher	Litres/place setting	0.67	3.60	0.00	2.41
Waste disposal unit	Litres/use		3.08	0.00	0.00
Water softener	Litres/person/day		1.00	0.00	0.00
	(5)		**Total calculated use (litres/person/day) = Σ (column 4)**		**110.04**

Since 1990 all new homes automatically have a water meter installed so that customers pay for what they use, dis-incentivising people to waste water. Nationally about a third of all homes now have a water meter, and the Strategic Grid is slightly higher than this at just under 40 percent. However, Severn Trent Water would like to increase its meter penetration across its customer base to help manage demand and Coventry City Council is encouraged to take opportunities to promote Severn Trent Water's free metering programme and water efficiency advice to residents across the district. Measures to help occupants in new and existing homes to save water will increase resilience across the whole area as climate change and environmental objectives limit the amount of water that can be taken from the environment. Similarly Council policies targeting domestic type water consumption in new employment buildings would also increase resilience, and help save companies money as all commercial properties are required to have a water meter and to pay for what they use.

BREEAM[25] "the Building Research Establishment Environmental Assessment Method" is a well-established initiative that sets the standard for best practice in sustainable design and has become the de facto measure

[25] http://www.breeam.org

used to describe environmental performance of buildings and communities. The BREEAM assessment methodology for offices[26] specifies the baseline demands of the individual components in offices and light industrial buildings, and the more water efficient levels at which BREEAM credits can be obtained. By applying these baseline demands to usage factors the average baseline demand per FTE in a B Class building is approximately 36 litres per day (24 per cent of the average daily per capita consumption). By improving the consumption level of individual components demand per FTE can be reduced, e.g. to 20 litres per day, and the water saving benefits maximised across multiple sites. It is recommended that Coventry City Council uses BREEAM to specify the sustainability performance requirements for new development applications.

Table 6.2 Demand components in B class developments and FTE consumption rates

Component	Unit	'Ownership' among FTE	No of Uses per FTE/day	Baseline water volumes	Baseline litres/ FTE/day	Reduced water volumes	Reduced litres/ FTE/day
WC	Effective flush	100 %	3	6	18	4	12
hand basin	l/min	100%	3x15 sec	12	9	4	3
Shower	l/min	10%	1x3 min	14	4.2	8	2.4
Urinal 2+	l/bowl/hr	0.8%*	3	7.5	1.8	1.5	0.36
Kitchen tap	l/min	25%**	1x1min	12	3	6	1.5
Domestic sized dishwasher	l/cycle	6%***	1	17	1.02	13	0.78
Total					**35.7**		**20.0**

In many cases domestic-type fittings in commercial properties may be set at slightly lower levels than in households reflecting their basic functional use rather than 'life-style' requirements.

*Up to 60 male FTE per every two urinal installations (British Standard 2006)

**Arbitrary assumption. A quarter of workers use a kitchen tap for one minute.

***Assumes 1 dishwasher load per 15 FTE

Flood risk at the development/ building design stage

When the location of a development has been justified via the NPPF Sequential and Exception Tests (as appropriate), the following measures may need to be incorporated in the design to protect against flooding. This final step in the flood risk management hierarchy is to mitigate through building design. NPPF considers this as the least preferred option and should not be used in place of the sequential approach to land use planning on a site. Paragraph 059 of the NPPF PPG recommends the use of the 'Improving the

[26] BREEAM New Construction Non-domestic buildings. Technical Manual 2011 SD 5073 2.0 2011. http://www.breeam.org/breeamGeneralPrint/breeam_non_dom_manual_3_0.pdf

Flood Performance of New Buildings: flood resilient construction' (2007) report [27] for guidance on improving the flood performance of New Buildings. The guide identifies a hierarchy of building design. This is set out below:

Flood avoidance

Constructing a building and its surrounds (at site level) in such a way to avoid it being flooded (e.g. by raising it above the flood level).

Flood resistance

Constructing a building in such a way to prevent flood water entering the building and damaging its fabric.

Flood resilience

Constructing a building in such a way that although flood water may enter the building its impact is reduced (i.e. no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated).

Flood repairable

Constructing a building in such a way that although flood water enters a building, elements that are damaged by flood water can be easily repaired or replaced.

The Flood Resilient Construction Report (Department for Communities and Local Government, 2007), sets out to help the designer determine the best option or design strategy for flood management at the building site level, based on knowledge of basic flood parameters (e.g. depth, duration and frequency). These factors should be determined by the site specific FRA during the planning application process. Depending on these parameters (in particular depth) and after utilising options for flood avoidance at site level, designers may opt for a water exclusion strategy or a water entry strategy.

In a **Water Exclusion Strategy**, emphasis is placed on minimising water entry whilst maintaining structural integrity, and using materials and construction techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (up to a possible maximum of 0.6m).

In a **Water Entry Strategy**, emphasis is placed on allowing water into the building facilitating draining and consequent drying. Standard masonry buildings are at risk of structural damage if there is a water level difference between outside and inside the building of about 0.6m or more. This strategy is therefore favoured when high flood water depths are involved.

Role and suitability of SuDS

Sustainable Drainage (or Sustainable Urban Drainage Systems – SuDS) is an important technique to manage and limit runoff rates. Coventry City Council as LLFA has fully integrated the requirement for SuDS into its Draft LFRM Strategy, the management policies for which indicate that SuDS should be used to attenuate and reduce run off from all new development sites, regardless of whether the site has been noted for specific surface water flooding issues.

Infiltration, and open attenuation (basin, swale) SuDS constructed from natural materials should be used in preference to underground storage in tanks/ oversized pipes. This ensures ease of maintenance and will assist in providing landscape/ amenity benefit and the biological processing of some contaminants.

Coventry City Council is establishing a SuDS Approving Body to coordinate the design and management of SuDS at new development sites. This is in line with the Environment Agency's Catchment Flood Management Plan (CFMP) for the Coventry area, (set out in the Severn CFMP), which seeks to restore natural flood storage and attenuation. The CFMP also highlights that local authorities should take

[27] Communities and Local Government, 2007. *Improving the Flood Performance of New Buildings – Flood Resilient Construction.* London: Department for Communities and Local Government.

responsibility for surface water flooding in their area, which under the FWMA, Coventry City Council as LLFA has progressed through its Draft LFRM Strategy. The decision on whether SuDS would be inappropriate in relation to a particular development proposal is a matter of judgement for the LPA. In making this judgement, the LPA will follow the following steps;

1. Seek advice from the relevant flood risk management bodies, principally the LLFA, including on what sort of SuDS they would consider to be reasonably practicable;
2. The judgement of what is reasonably practicable should be by reference to the technical standards published by the Department for Environment, Food and Rural Affairs and take into account design and construction costs.
3. Has the developer demonstrated that the various SuDS options have been assessed?;
4. If none of the SuDS options are feasible, does Buildings Regulations part H[28] still allow disposal to a combined sewer as a last resort? Does the current planning practise guidance still list this as the final option?

Coventry City Council plan to utilise the Sustainable Drainage Supplementary Planning Document in the final submission of the LFRM Strategy. The aim is that developments will be planned differently so that at an early stage blue corridors within the development site can be identified which would flood or have water flowing through them during extreme rainfall events. By identifying and allocating these areas, flow routes and SuDS can be strategically placed to maximise their effectiveness early in the development design process. This will enhance the ability of the site drainage system to store, treat and discharge runoff from the development in a appropriate manner which does not increase flood risk elsewhere. The use of SuDS will increase the avaialble capacity compared to sites where both surfacewater and wastewater are accomodated within the sewerage network.

SuDS Management Train

To mimic catchment processes as closely as possible, a SuDS 'Management Train' process is typically incorporated in a development's drainage stategySuDS[29]. This ensures that different SuDS techniques are constructed in series to incrementally reduce pollution, flow rates and volumes of runoff from developments. The scale of the SuDS Management Train will depend on the type and scale of the development. Source control measures should be used as the first stage of any SuDS management train for new developments. Source control measures improve the water quality of runoff and provide attenuation and may help reduce the need for large flow attenuation and flow control structures at the end of the SuDS management train. Source control measures help to retain the first ~5mm of rainfall and the initially high 'first flush' of pollutant load.

Developments involving heavy traffic or industry will require additional stages of SuDS such as swales and/or reed embayments situated in series between hardstanding areas and attenuation basins to meet the required water quality standards, detailed guidance is given in the CIRIA SuDS Manual. The extra features provide additional area for silt and debris to settle out, and for the degradation of contaminants. Maintenance of accumulated silt in features such as (dry) swales is also simpler than removing high silt loads from the (wet) main attenuation basin.

Developers should propose a series of SuDS commesurate with the potential pollution loadings of the propsoed development. Coventry City Council should seek to ensure that appropriate measures are included in drainage strategies when consulted at the development design stage and when reviewing planning applciations.

SuDS

- **The management of runoff during the construction period** is an important consideration, particularly for large sites and details of measures to mitigate for this phase of development are required as part of an FRA. The Water Framework Directive (WFD) places specific

[28] Building Regulations, Approved Document H - Drainage and Waste Disposal (2010)
[29]CIRIA, The SuDS Manual (C697) (2007)

requirements on the management of non-point source pollution such as that from construction site silts. Methods to reduce the volume of solids (and runoff) leaving the site include:

- phased removal of surface vegetation at the appropriate construction phase;
- provision of a grass buffer strip around the construction site and along watercourses;
- the covering of stored materials;
- ensuring exposed soil is re-vegetated as soon as feasibly possible;
- protection of storm water drain inlets; and
- silt fences, siltation ponds and wheel washes.

Development discharge rates

Coventry City Council in their role as LLFA require that new developments manage surface water runoff on-site according to the following criteria[30];

- Development discharge rates are to be managed to the greenfield Qbar rate. Where there are known flooding issues, the site discharge should be restricted to the greenfield Qbar rate minus 20%. For larger sites, outfalls for the attenuated flows should be spread over multiple locations along the receiving watercourses to mimic the natural greenfield runoff pattern.
- The discharge rates for brownfield sites should also be to the greenfield Qbar rate. Again, for larger sites, the uses of multiple discharge points is encouraged.
- Discharges must be managed so that the 1 in 100 year plus Climate Change rainfall event can be retained on-site.

The former arrangement where Severn Trent Water would accommodate surface water flows of a magnitude acceptable to them from new development has been superseded. It is the role of the LLFA to decide the limiting development runoff into water bodies and the appropriate surface water storage design parameters[31].

Designing for exceedance

During the design of new developments, consideration must be made for the management of exceedance events and blockages of culverts. Developments should include effective design so that exceedance flows can be safely and effectively routed through development sites. Sites should be laid out so that flood water is kept away and out of properties, and instead routed to areas of greenspace/roads for temporary storage. The design of drainage systems to safely and sustainably accommodate periods when the design flow capacities are exceeded during extreme events should be in accordance with CIRIA guidance[32].

SuDS suitability review

In order to undertake a desk based SuDS suitability review for the development locations the geology and groundwater context of the sites was assessed. SuDS are designed to reduce runoff by attenuating water transfer. The permeability of the surrounding soil and the sensitivity of any local groundwater sources determine whether techniques are chosen to carry this out through direct infiltration or offline storage. This section outlines the method used to determine for each of the allocated sites which type of sustainable drainage technique is appropriate.

Step 1: Determine the permeability of the site

The British Geological Survey Open Report (2006) categorises soils permeability and those relevant to Coventry are listed in Table 6.3. High permeability suggests infiltration type SuDS could be technically feasible, although this is subject to the water protection concerns of the area (Step 2). Moderate to low

[30] Coventry City Council communications (2015)
[31] Coventry City Council communications (2015)
[32] CIRIA Designing for exceedance in urban drainage - good practice (C635) (2006)

permeability does not lend itself to infiltration methods and attenuation measures may be more appropriate. GIS layers of soil types were not available for this study however Figure 6.1 outlines the locations of superficial deposits across Coventry. Permeable superficial deposits help in the effective infiltration of site runoff to the water table below, sites that are underlain by superficial deposits are listed in Table 6.4.

Table 6.3 Permeability of superficial deposits found in Coventry

Superficial deposit	Superficial permeability		Inferred permeability for SuDS suitability selection
	Maximum permeability	Minimum permeability	
Clay and Silt	Low	Very Low	Low
Clay, Silt, Sand and Gravel	Very High	Low / Very Low	Moderate
Sand and Gravel	Very High	High	High

Table 6.4 Sites where superficial deposits are found in Coventry

Shortlisted sites	Strategic sites	Employment sites
Ho1, F11, L3, F3, F6, F4, E10, E4, Bab12, F44, F15, F57, He13, Ho4, L8, LS7b, LS14, LS15, StM12, StM9, StM2, StM13, Wo28, Wo27, Wo29, Wo30, L23, US17, F58, F33, F31	Browns Lane, Eastern Green SUE, Whitmore Park, Keresley SUE, Cromwell Lane, Grange Farm and Sutton stop, Land at London Road and Allard Way	Eastern Green, Browns Lane - Lyons Park and expansion land, Whitley business park and expansion land

Step 2: Determine the risk of infiltration contaminating local water supplies

Development and drainage has to be sensitive to the risk of contaminating public water supplies. Source Protection Zones (SPZs) have been defined by the Environment Agency for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply[33]. 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. The maps show three main zones (1, 2 and 3) which represent 50 day travel time, 400 day travel time and total catchment area respectively. Figures 6.2, 6.3 and 6.4 show the SPZ locations across Coventry in relation to the development sites (all three categories of protection are found in the study area).

[33] http://apps.environment-agency.gov.uk/wiyby/37833.aspx

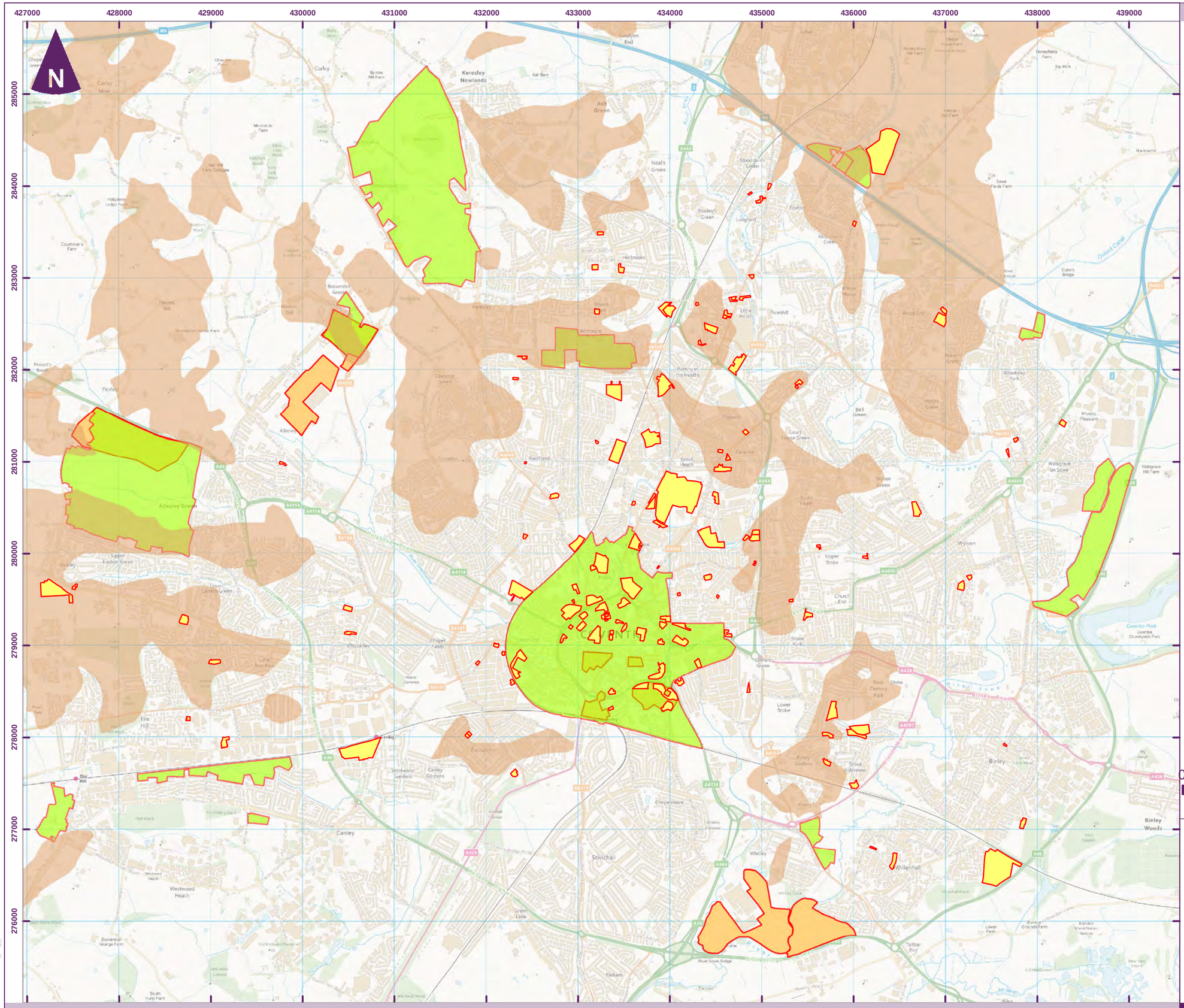

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Figure 6.1
All Sites
Superficial Deposits

file: C:\WCS\WCS_Fig_6.1.mxd

427000 428000 429000 430000 431000 432000 433000 434000 435000 436000 437000 438000 439000

285000 284000 283000 282000 281000 280000 279000 278000 277000 276000

N

Keresley SUE

Browns Lane

Eastern Green SUE

Grange Farm and sutton stop

Grange Farm and sutton stop

Whitmore Park

Elms Farm

Walsgrave Hill Farm

COVENTRY

City Centre sites

Canley Regeneration

Canley Regeneration

Cromwell Lane

Land at London Road and Allard Way

Land at London Road and Allard Way

Key

Groundwater SPZ

- Zone 1
- Zone 2
- Zone 3
- Strategic Sites

0 0.5 1 1.5 2 km

Scale at A3: 1:40,000

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Figure 6.2
Strategic Sites
Groundwater SPZ

file: C:\WCS\WCS_Fig_6.2.mxd

427000 428000 429000 430000 431000 432000 433000 434000 435000 436000 437000 438000 439000

285000 284000 283000 282000 281000 280000 279000 278000 277000 276000

N

Browns Lane - Llyons Park and expansion land

Browns Lane - Llyons Park and expansion land

Eastern Green

city centre south

Coventry Uni expansion

Parkside Techno Park - possible expansion

Friargate

Whitley business park and expansion land

Whitley business park and expansion land

COVENTRY

Key

Groundwater SPZ

- Zone 1
- Zone 2
- Zone 3
- Employment Sites

0 0.5 1 1.5 2 km

Scale at A3: 1:40,000

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Figure 6.3
Employment Sites
Groundwater SPZ

file: C:\WCS\WCS_Fig_6.3.mxd

427000 428000 429000 430000 431000 432000 433000 434000 435000 436000 437000 438000 439000

285000 284000 283000 282000 281000 280000 279000 278000 277000 276000

N

Key

Shortlisted Sites

Groundwater SPZ

Zone 1

Zone 2

Zone 3

0 0.5 1 1.5 2 km

Scale at A3: 1:40,000

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Figure 6.4
Shortlisted Sites
Groundwater SPZ

Development sites SuDS suitability

Sites that intersect the Inner Zone (SPZ1) inevitably are also within SPZ2 and the wider SPZ3, whereas sites in the lower zones do not necessarily intersect SPZ 1 or SPZ2. Table 6.5 identifies the sites that intersect the SPZs showing the highest zone which they intersect. All other sites not listed are outside of the SPZ area.

Table 6.5 SPZ classifications of development sites in Coventry

SPZ category	Sites	Sector	Implications for SuDS
1 Inner Protection Zone (50 day travel time)	Who3 Land at London Road and Allard Way City Centre Sites Browns Lane	Residential Strategic	Where infiltration SuDS are proposed for anything other than clean roof drainage in a SPZ1 the EA will require a risk assessment to demonstrate that pollution of groundwater would not occur. They will also require approval from the SuDS Approval Body (SAB). Attenuation drainage is more preferable especially if the discharge can drain away from the Inner Zone of SPZ 1.
2 Outer Protection Zone (400 day travel time)	Ho1 Ho30 R27 R13 S5 S4 S3 StM27 StM42 StM69 S6 S12 Wo28 Wo27 Wo29 Wo30 Who13 Who1 Who2 StM61 Keresley SUE Eastern Green SUE Browns Lane - Lyons Park and expansion land City Centre South	Residential Strategic Employment	Strictly controlled – similar to SPZ1. Developers should consult with the Environment Agency and the SuDS approval body (i.e. Coventry City Council).
3 Source Catchment Protection Zone	E10 E4 E2 F47 R12 R15 R7 StM66 StM70 StM68 StM41 StM33 StM58 StM67 We32 We9 Who18 E1 R1 StM57 Canley Regeneration Cromwell Lane Eastern Green	Residential Strategic Employment	The contamination potential can be lower in SPZ3 but is dependent on the infiltration potential of the geology. The higher the infiltration potential from surface to groundwater the more restrictive the requirements will be for appropriate SuDS techniques.

SPZ category	Sites	Sector	Implications for SuDS
	Friargate Whitley business park and expansion land		

Direct infiltration is not permitted in areas sited above aquifers that have specifically been designated as the Inner Zone of a Source Protection Zone (SPZ). The implications for SuDS listed in this table are very brief. It is recommended that all developments refer to the Environment Agency guidance, "Sustainable Drainage Systems (SUDS): A guide for developers"[34], or the "*National Standards for sustainable drainage systems: Designing, constructing, operating and maintaining drainage for surface runoff*"[35] published by Defra in 2011 to understand the restrictions.

Each site has been categorised based on its geology and SPZ. Appropriate SuDS have been determined for each combination of permeability and SPZ classification based on the CIRIA SuDS Manual (2013). These are listed in Table 6.6. The table includes design changes that could be required such as impermeable linings. Within this list, some SuDS have further constraints, such as the space available, the slope of the site, the groundwater depth under the site, and the use the site is intended for. Such information is only available following a detailed site analysis, which is beyond the scope of this project. For example if high groundwater levels have been identified after specific site analysis, it may not be appropriate to use infiltrating SuDS.

Techniques such as permeable surfaces are typically located within urban areas and although they offer source control by managing flow intensity entering the system, they do not promote any wildlife benefit. Tanked systems are typically located underground and as such they offer no landscape, wildlife or pollution control benefit. Therefore, these systems are only to be used once all other sustainable techniques have been assessed and considered unsuitable. SuDS techniques that promote infiltration of surface water are preferred over those which promote attenuation before discharge to a watercourse.

Proposing a SUDS Solution

The proposed masterplan for each development should be designed alongside the SuDS system to ensure that space has been made available for the SuDS system. By considering the SuDS design at an early stage within the design process it results in a system that not only manages surface water but also provides amenity and ecological benefit to the entire development.

In order to provide a positive source control solution it is recommended that parking areas and private driveways are constructed out of permeable paving in all developments. The capture and temporary storage of the initial rainfall via this technique reduces the intensity of rainfall entering the drainage system and also helps to clean the run-off water by removing some pollutants such as suspended solids and engine oils. By designing the lower layers of the pavement with a high void ratio, this technique would reduce the amount of attenuation required in the attenuation ponds. The exact division between permeable and impermeable surfaces can be confirmed at the detailed design. Where possible swales should be used for strategic conveyance, rather than piped drainage. Piped drainage will need to be used in urban areas connecting individual units of the development into the strategic SuDS.

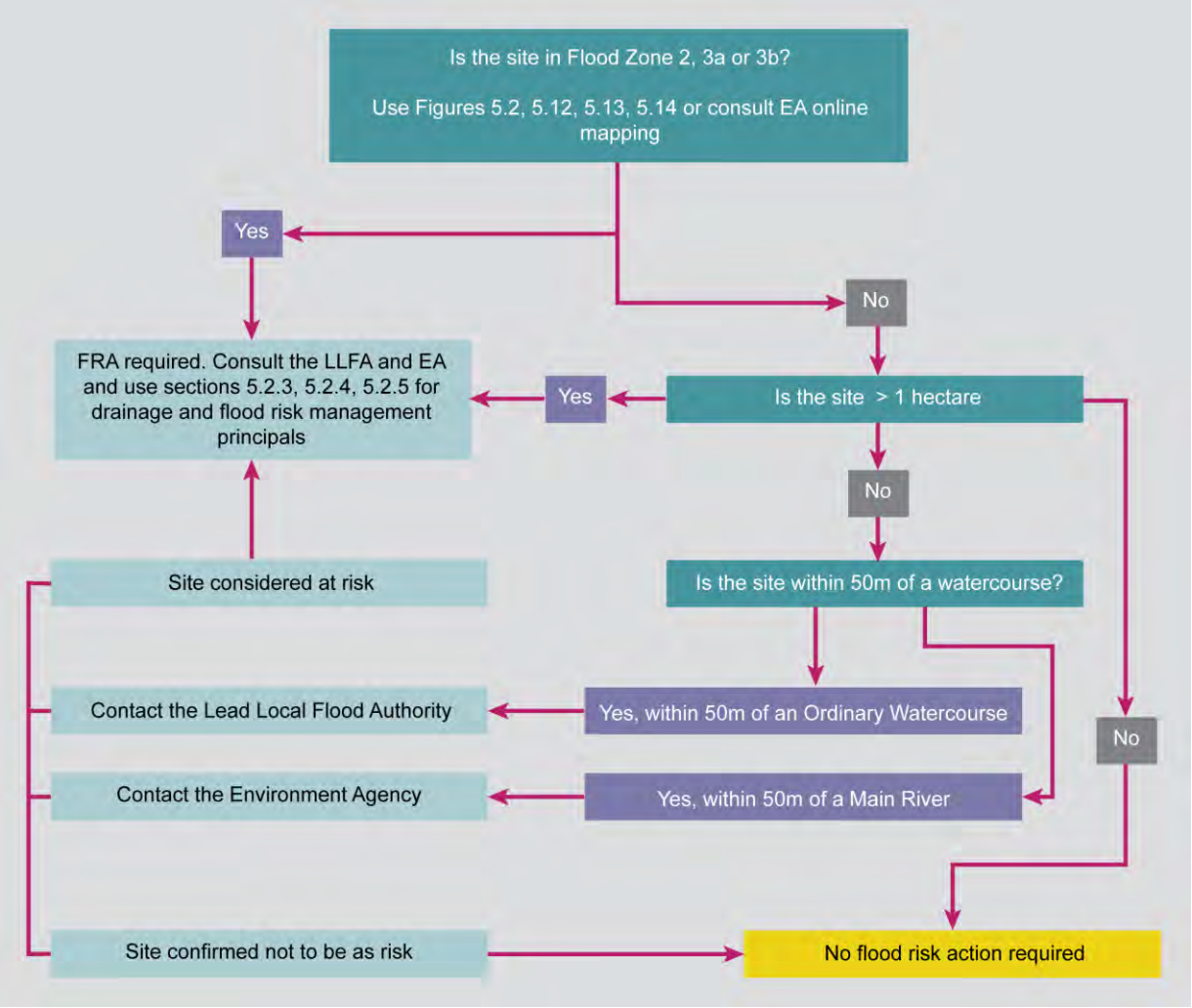
Use of a developer checklist

A site-specific flood risk assessment is carried out by (or on behalf of) a developer to assess the flood risk to and from a specific development site. This assessment often accompanies the planning application being submitted. This will be a requirement for all of the proposed developments within Coventry City Council that meet the growth plans where a site is 1 hectare or greater in Flood Zone 1; located in Flood Zones 2 and 3; has critical drainage problems (as notified to the local planning authority by the Environment Agency); or

[34] http://www.rtpi.org.uk/media/12399/SuDS_a5_booklet_final_080408.pdf
[35] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82421/SuDS-consult-annexa-national-standards-111221.pdf

where the site may be subject to other sources of flooding. The criteria for determining if a site-specific flood risk assessment is required is outlined in Figure 6.5.

Figure 6.5 FRA requirement decision tree



The assessment will demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account. A Planning checklist has been developed that provides clarity on the specific requirements of the Flood Risk Assessment[36]. The checklist ensures that a number of key questions can be answered by the assessment[36], including (but not limited to) the following:

- Development Description and Location:
  - What type of development is proposed and where?
  - What is the flood risk vulnerability Classification?
- Definition of the flood hazard;
  - What sources of flooding could affect the site?
  - What are the existing surface water drainage arrangements for the site?
- Probability of flood risk:
  - Which flood zone is the site in?

[36] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/site-specific-flood-risk-assessment-checklist/

- What is the probability of the site flooding?

- Consideration of climate change:
  - How is flood risk at the site likely to be affected by climate change?
- Detailed development proposals;
  - Have land uses most sensitive to flood damage have been placed in areas of the site that are at least risk of flooding?
- Flood Risk management Measures:
  - How will the site be protected from flooding, including the potential impacts of climate change, over the development's lifetime?
- Off-site impacts:
  - How will it be ensured that the proposed development will not increase flood risk elsewhere?
  - How will run-off from the completed development be prevented from causing an impact elsewhere?
- Residual Risks:
  - Will any flood related risks remain after measures to protect the site from flooding have been implemented?
  - How, and by whom, will these risks be managed over the lifetime of the development?

Table 6.6 SuDS hierarchy for development sites

SuDS type	Suitable for zone						Other SuDS suitability considerations		
	Low permeability		Medium permeability		High permeability		Site type	Groundwater	Site slope
	SPZ 0,3,2	SPZ1	SPZ 0,3,2	SPZ1	SPZ 0,3,2	SPZ1			
Green/Brown Roofs	Yes	Yes	Yes	Yes	Yes	Yes	Densely developed areas, but must consider building structure		
Rainwater Harvesting	Yes	Yes	Yes	Yes	Yes	Yes	High Density development.		
Swales	Yes	Lined	Yes	Lined	Yes	Lined	Low density development, landscaped.	If intended dry swale, >1m below surface	Ineffective on very flat or very steep slopes (>1 in 40)
Detention Basin	Yes	Lined	Yes	Lined	Yes	Lined	Low density development. Accommodates larger drainage catchment.		Flat area required
Geocellular/Modular	Yes	Lined	Yes	Lined	Yes	Lined	High density development. Non-polluting catchment if not within SuDS treatment train.		Gentle slope required
Bio-retention areas	Yes	Lined	Yes	Lined	Lined	Lined	Small, non-polluted/industrial drainage catchment. Requires landscaping area.		Flat area required
Ponds	Yes	Lined	Yes	Lined	Lined	Lined	Requires low density development, landscaped areas		Flat area required
Sand Filter	No	Lined	No	Lined	No	Lined	Small catchment drainage area < 4 ha		Ineffective on very flat sites
Filter Strips	Yes	No	Yes	Lined	Yes	Lined	Low density developments, landscaped areas	>1m below surface	Gentle slope required

6.5 Design criteria and maintenance considerations

Sewerage pipe design criteria and maintenance

Sewerage pipework will be designed and constructed to minimum design criteria, identified as part of the Water Industry Act 1991. This will ensure that sewer mains are of adequate size to convey population generated (peak dry weather) flows, plus a general allowance for inflow from surface waters, trade effluent and groundwater infiltration[37]. There are a number of construction criteria to be met that include specifications relating to layout, accessibility, reliability and hydraulic design (including minimum pipe diameters required according to their location in the sewerage network). Severn Trent Water will meet these criteria in any upgrades or new infrastructure required to accommodate growth plans. Maintenance of these sewerage networks, outside the property boundary of any dwelling or property, falls to Severn Trent Water.

Outfall options

In all development cases, SuDS systems need to be designed with consideration of outfall options. Each part of the SUDS management train reduces the impact of the quantity of water leaving the development and improves the quality of water before release to the wider environment. Once surface water runoff has been cleaned using the SUDS, then, as confirmed in the Building Regulations 2000: approved document H[38]:

"*Drainage and waste disposal, water will either flow to natural drainage or discharge to the sewer in the following sequence of preference:*

- *an adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable;*
- *a watercourse; or where that is not reasonably practicable; and*
- *a surface water sewer*".

In accordance with Coventry City Council Draft LFRM Strategy; "No person shall, without consent, cause an increase in runoff volume or flow from any development or redevelopment. Flows and volumes are restricted to the greenfield Qbar less 20% value for any site using the most appropriate form of calculation agreed with the LLFA as a specific requirement of the SFRA and SWMP".

SuDS maintenance

The LPA will require details of adoption and future maintenance arrangements for SuDS. This is key to ensuring that SuDS and the water recycling technologies function as intended and provide the required benefits during their life-time. In the planning permission, appropriate planning conditions may be included to facilitate future enforcement.

In cases where Severn Trent Water adopt SUDS, maintenance will be undertaken from the end of the intermediate SuDS management area, where the adoption break point is identified and agreed with Severn Trent Water. It will continue up to the point where flows infiltrate into the ground, flow into a watercourse or enter the sewer network. In some situations this may be a natural outfall through a wetland channel, diffuse outfall like an infiltration basin or a conventional outfall where water enters the sewer network. The outfall arrangements for each SUDS will need to be agreed with Severn Trent Water prior to adoption. The Environment Agency, Internal Drainage Board and Riparian Owner should be consulted at each design stage as necessary. As part of a final design it is recommended that maintenance work is carried out along any on-site watercourse to remove any debris that could significantly block the watercourse.

[37] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82516/new-build-sewers-consult-annexb-sos-standards-111220.pdf
[38] http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADH_2002.pdf

6.6 Funding considerations

Delivering the necessary supporting water and sewerage infrastructure is critical to facilitating the envisaged residential growth across Coventry City. Communities require access to water, drainage, flood defences and green infrastructure. Whilst the specific cost of the required water and sewerage infrastructure are investigated in detail by water companies, the funding mechanisms that Coventry City Council need to be aware of are outlined below:

- Under the Water Industry Act (1991) the water companies have a duty to provide public water supplies for domestic purposes, and to provide public sewer systems. However, they also have an obligation to manage customer bills by delivering a service that is cost-effective and good value for money. Ofwat is the economic regulator for the water and sewerage industry in England and Wales and the water companies are subject to asset planning controls. Water companies are willing to invest in infrastructure improvements once it is certain that investment is required. The timing of that investment is subject to the Asset Management Planning (AMP) cycles.
- The Water Services Regulation Authority (Ofwat) is the economic regulator of water and sewerage companies in England and Wales. Severn Trent Water funds its activities via revenue raised from customer bills and the amount it can charge is set by Ofwat during the Periodic Review of prices (price determination). For every five year asset management planning (AMP) cycle, companies submit a business plan to Ofwat. The plans set out each company's view of what it needs to do to maintain its assets, improve services to customers and deal with its impact on the environment. Ofwat makes its pricing decision based on the information submitted in the Water Resource Management Plans and overall Business Plans and its own assessment on what level of investment will represent good value for money for customers. Once the price determination is finalised this sets the investment budget for the Asset Management Period (AMP).
- Any infrastructure requirements which arise after agreement of the five year AMP will normally be considered for the following AMP period. AMP6 will cover the period 2015 to 2019. Water companies are able to submit interim determinations within the five-year planning cycle to seek additional funding for unforeseen requirements, but most plans should be covered by the normal submission process. This Water Cycle Strategy covers a longer planning period and can therefore inform longer term water company asset planning.
- When a developer wishes to proceed with a particular site, they can requisition the appropriate water company (or companies if separate for water and wastewater) to provide local network infrastructure in accordance with the relevant provisions of the Act (Section 98 for sewerage and Section 41 for water). Severn Trent Water has previously stated that requisitions are a means for a developer to request that a public sewer be provided to serve their development and that payment would not normally be required to create additional capacity in existing public sewers. However, provisions within the legislation do allow cost to be shared between the developer and water undertaker (via a “Requisition Agreement”) if it is demonstrated that there is/was no sewerage problem before development and that a specific development is the sole driver for improved services. For local infrastructure serving more than one development site, it is necessary to share costs equitably between developers. Any infrastructure requirements which arise after agreement of the five year AMP will normally be considered for the following AMP. In the case of a dispute Ofwat has a process for handling disputes and appeals regarding the requisitioning of water mains and public sewers[39].
- Water sewerage undertakers expect that they will only be responsible for removing foul waste from new developed sites as the planning system requires surface water drainage to be managed using SuDS techniques.
- Detailed hydraulic modelling is required to demonstrate the specific infrastructure improvements that would be needed for a specific development. Water companies are unlikely to pay to model particular sites outside of the Asset Management Planning (AMP) cycle. Developers are

[39] http://www.ofwat.gov.uk/consumerissues/selflay/gud_pro_disappmainsewer.pdf

unlikely to agree to fund modelling where there is potential for the results to prohibit development.

- All parties require some level of certainty in order to move forward.

Appendix A
Proposed development sites within Coventry City administrative boundary

Strategic sites

Site Name/Site Reference	Total Growth Planned	WwTW Catchment
Browns Lane	100	Finham WwTW
Eastern Green SUE	2300	Finham WwTW
Whitmore Park	500	Finham WwTW
Elms Farm	100	Finham WwTW
Canley Regeneration	750	Finham WwTW
Keresley SUE	3000	Finham WwTW
Cromwell Lane	240	Finham WwTW
Grange Farm and sutton stop	312	Finham WwTW
Land at London Road and Allard Way	160	Finham WwTW
Walsgrave Hill Farm	842	Finham WwTW
City Centre Sites	2000	Finham WwTW

Employment Sites

Site Name/Site Reference	Total Growth Planned	WwTW Catchment
Eastern Green	2500	Finham WwTW
Browns Lane - Llyons Park and expansion land	3000	Finham WwTW
Whitley business park and expansion land	5000	Finham WwTW
city centre south	1000	Finham WwTW
Coventry Uni expansion	1000	Finham WwTW
Friargate	15000	Finham WwTW
Parkside Techno Park - possible expansion	500	Finham WwTW
Remaining city wide employment provison	7000	Finham WwTW

Shortlisted Sites

Site Name/Site Reference	Total Growth Planned	WwTW Catchment
Bab12	6	Finham WwTW
Bab3	6	Finham WwTW
Bab4	6	Finham WwTW
BW1	5	Finham WwTW
BW22	34	Finham WwTW
BW3	6	Finham WwTW
BW36	20	Finham WwTW
BW6	255	Finham WwTW
E1	12	Finham WwTW
E10	7	Finham WwTW
E2	117	Finham WwTW
E4	9	Finham WwTW
F11	16	Finham WwTW
F12	14	Finham WwTW
F15	29	Finham WwTW
F19	5	Finham WwTW
F2	20	Finham WwTW
F20	5	Finham WwTW
F21	32	Finham WwTW
F22	5	Finham WwTW
F3	12	Finham WwTW
F30	136	Finham WwTW

Site Name/Site Reference	Total Growth Planned	WwTW Catchment
StM29	190	Finham WwTW
StM3	95	Finham WwTW
StM32	36	Finham WwTW
StM33	94	Finham WwTW
StM34	130	Finham WwTW
StM35	68	Finham WwTW
StM38	23	Finham WwTW
StM4	5	Finham WwTW
StM41	60	Finham WwTW
StM42	29	Finham WwTW
StM43	50	Finham WwTW
StM44	38	Finham WwTW
StM45	84	Finham WwTW
StM57	37	Finham WwTW
StM58	77	Finham WwTW
StM60	6	Finham WwTW
StM61	95	Finham WwTW
StM62	8	Finham WwTW
StM63	19	Finham WwTW
StM64	169	Finham WwTW
StM65	67	Finham WwTW
StM66	66	Finham WwTW

F31	10	Finham WwTW
F33	6	Finham WwTW
F4	42	Finham WwTW
F44	46	Finham WwTW
F45	42	Finham WwTW
F46	54	Finham WwTW
F47	127	Finham WwTW
F5	27	Finham WwTW
F51	100	Finham WwTW
F54	450	Finham WwTW
F55	14	Finham WwTW
F56	10	Finham WwTW
F57	11	Finham WwTW
F58	10	Finham WwTW
F6	15	Finham WwTW
He1	15	Finham WwTW
He13	57	Finham WwTW
He7	7	Finham WwTW
He9	6	Finham WwTW
Ho1	5	Finham WwTW
Ho2	49	Finham WwTW
Ho29	21	Finham WwTW
Ho3	34	Finham WwTW
Ho30	12	Finham WwTW
Ho4	6	Finham WwTW
L2	7	Finham WwTW
L23	24	Finham WwTW
L3	16	Finham WwTW
L33	10	Finham WwTW
L34	9	Finham WwTW
L6	7	Finham WwTW
L8	7	Finham WwTW
LS14	22	Finham WwTW
LS15	16	Finham WwTW
LS17	7	Finham WwTW
LS18	41	Finham WwTW
LS2	53	Finham WwTW
LS3	11	Finham WwTW
LS7a	57	Finham WwTW
LS7b	65	Finham WwTW
R1	21	Finham WwTW
R12	48	Finham WwTW
R13	50	Finham WwTW
R15	47	Finham WwTW
R16	60	Finham WwTW
R2	5	Finham WwTW
R26	49	Finham WwTW
R27	8	Finham WwTW
R4	6	Finham WwTW
R7	16	Finham WwTW
StM67	286	Finham WwTW
StM68	60	Finham WwTW
StM69	49	Finham WwTW
StM70	120	Finham WwTW
StM9	30	Finham WwTW
US17	7	Finham WwTW
US3	7	Finham WwTW
US4	7	Finham WwTW
We32	33	Finham WwTW
We9	7	Finham WwTW
Who1	6	Finham WwTW
Who13	9	Finham WwTW
Who18	14	Finham WwTW
Who19	22	Finham WwTW
Who2	5	Finham WwTW
Who3	7	Finham WwTW
Wo27	153	Finham WwTW
Wo28	87	Finham WwTW
Wo29	8	Finham WwTW
Wo30	19	Finham WwTW
Wy18	39	Finham WwTW
Wy19	14	Finham WwTW
Wy20	9	Finham WwTW
StM2	10	Finham WwTW
StM27	300	Finham WwTW
StM10	5	Finham WwTW
StM11	21	Finham WwTW
StM12	18	Finham WwTW
StM13	18	Finham WwTW
S12	9	Finham WwTW
S3	85	Finham WwTW
S4	57	Finham WwTW
S5	51	Finham WwTW
S6	24	Finham WwTW
StM1	21	Finham WwTW

Under Construction

Site Name/Site Reference	Total Growth Planned	WwTW Catchment
Phase 8 Banner Lane	3	Finham WwTW
Phase 9 Banner Park NW Bestway S of Social Club	22	Finham WwTW
Phase 7 Banner Lane	8	Finham WwTW
Land Adj 312 Westwood Heath Road	1	Finham WwTW
Pinnock Place Bohun Street	4	Finham WwTW
Former City College Torrington Avenue	18	Finham WwTW
Land at Junction of James Green Road and Bohun Street	2	Finham WwTW
Canley Regeneration Site Prior Deram Walk	76	Finham WwTW
45 Templar Avenue	4	Finham WwTW
Garages The Wardens Avenue	10	Finham WwTW
Hawkes End Farm Hawkes Mill Lane Allesley	1	Finham WwTW
162 Kenilworth Rd	1	Finham WwTW
Cryfield Heights Rear of 7 Gibbet Hill Road	1	Finham WwTW
Land between 220 and 222 Brookside Avenue	4	Finham WwTW
Highfield, Staircase Lane Allesley	1	Finham WwTW
112 Hawkes Mill Lane	1	Finham WwTW
15 Nightingale Lane	1	Finham WwTW
Former Petrol Filling Station Allesley Old Rd	14	Finham WwTW
50 Latham Road	1	Finham WwTW
17 Westhill Road	1	Finham WwTW
Land adj 27 Gretna Road	3	Finham WwTW
32 Warwick Avenue	1	Finham WwTW
5 Chepstow Close	2	Finham WwTW
New Century Park Allard Way	34	Finham WwTW
WOOD END, MANOR FARM PHASES 1A2-1A4	8	Finham WwTW
Land East of Brade Drive	14	Finham WwTW
Land Adj The Chesnut Pub Brade Drive	4	Finham WwTW
Former AXA building, Coventry City Centre	300	Finham WwTW
Land at Lythalls Lane and Holbrook Way	25	Finham WwTW
Land to South of Lythalls Lane	15	Finham WwTW
37 Far Gosford Street	2	Finham WwTW
Vantage Park Land at Junction of Pheonix Way Stoney Stanton Road	2	Finham WwTW
Phase 2 Former Acetate Old Church Road	35	Finham WwTW
Land at Wilsons Lane	24	Finham WwTW
Peugeot Phase 3 North and East	69	Finham WwTW
3 Aldermans Green Road	1	Finham WwTW
Land to rear of 2 Clark Street	1	Finham WwTW
Land at Beake Avenue	47	Finham WwTW
76 St Martins Road	1	Finham WwTW
58 Cornelius Street	1	Finham WwTW
Central Depot, Foleshill Road	74	Finham WwTW
Land North of Albany Road	262	Finham WwTW
Former Coventry Health Care Barkers Butts Lane	10	Finham WwTW
1 Crampers Field	2	Finham WwTW

Planning Permission

Site Name/Site Reference	Total Growth Planned	WwTW Catchment
125 Station Avenue	24	Finham WwTW
R/O 75 Cromwell Lane	1	Finham WwTW
14 Green Lane Corley	1	Corley WwTW
Timberyard Cottage Green Lane	1	Corley WwTW
Land West of 194 Torrington Avenue	36	Finham WwTW
Land at C/O Torrington Avenue and Alan Marcell Close	18	Finham WwTW
Leys Farm Harvest Hill Lane	2	Meriden WwTW
196 Sir Henry Parkes Road	1	Finham WwTW
Former Dolphin Pub Sheriff Avenue	15	Finham WwTW
11-29 Wendiburgh Street	10	Finham WwTW
Former Canley Clinic Kele Rd	5	Finham WwTW
George Rowley House Thimbler Road	9	Finham WwTW
Land fronting 234 Broad Lane	1	Finham WwTW
Allesley Post Office 127 Birmingham Road	1	Finham WwTW
Allesley Garage 244 Birmingham Road	3	Finham WwTW
Hill Top Farm Hawkes Mill Lane	1	Finham WwTW
165 Browns Lane	2	Finham WwTW
RO Merton House Cryfield Grange Road	1	Finham WwTW
Poynton Birches Cryfield Grange Road	3	Finham WwTW
11 Gibbet Hill Road	2	Finham WwTW
Land adjacent to 72 Charter Avenue	1	Finham WwTW
5a Regency Drive	1	Finham WwTW
5 Arden Street	1	Finham WwTW

Site Name/Site Reference	Total Growth Planned	WwTW Catchment
Maplewood Tamworth Road	3	Finham WwTW
34 Fivefield Road	2	Finham WwTW
119 Kenpas Highway	1	Finham WwTW
1 Regent Street and 17-28 Queens Road	184	Finham WwTW
Land off Middleborough Road	24	Finham WwTW
1 Hewitt Avenue	1	Finham WwTW
First Interiors Watch Close	15	Finham WwTW
10 Lammas Road	1	Finham WwTW
Land between 85 and 87 Three Spires Avenue	7	Finham WwTW
Land Rear of Christchurch Road	12	Finham WwTW
216 Treherne Road	1	Finham WwTW
5 Ulverscroft Road	1	Finham WwTW
London Rd Social Club 25 Paradise Street	68	Finham WwTW
London Road Social Club 25 Paradise Street	79	Finham WwTW
adj 9 Park Rd & 7 Manor Rd	24	Finham WwTW
Alda Court Manor House Drive	6	Finham WwTW
Land at the junction of Pridmore Road and Lockhurst Lane	6	Finham WwTW
Crow in the Oak Lockhurst Lane	12	Finham WwTW
Former Buildbase Unit Lythalls Lane	34	Finham WwTW
Land Adj Orpington Drive Hen Lane	8	Finham WwTW
Land Adj 2 Grafton Street	1	Finham WwTW
155 St Georges Road	3	Finham WwTW
244 St Georges Road	2	Finham WwTW

Rear of 87 Hearsall Lane, Latham Road Earlsdon	1	Finham WwTW
90 Craven Street	3	Finham WwTW
Land adjacent 16 Fullers Close	2	Finham WwTW
Rostherne, New Road	2	Finham WwTW
Rothserne New Road Keresley	3	Finham WwTW
Land to rear of 44 Brighton Street	2	Finham WwTW
2-6 Hood Street	7	Finham WwTW
R/O 3-11 Newdigate Road	2	Finham WwTW
RO 67-75 Cross Road	3	Finham WwTW
36-54 Station Street West	28	Finham WwTW
12 Eld Road	1	Finham WwTW
4 The Stampings E of Foleshill Rd adj Sorting Office	2	Finham WwTW
4 The Stampings	2	Finham WwTW
8a Carlton Road	1	Finham WwTW
Phase 3 Former Acetate OId Church Road	96	Finham WwTW
Phases 5 and 7 of Acetate Old Church Rd	65	Finham WwTW
1159-1167 Foleshill Road	13	Finham WwTW
RO 129 Lythalls Lane	1	Finham WwTW
Garages Congleton Close	2	Finham WwTW
1a Sydnall Road	9	Finham WwTW
Land adj 36 Sydnall Road	2	Finham WwTW
Land at Corner of Acron Street and The Barley Lea Stoke Aldermoor	7	Finham WwTW
Stoke Aldermoor District Centre Whitworth Avenue	13	Finham WwTW
55 Terry Road	11	Finham WwTW
Land bounded by Sky Blue Way, Gosford St and Far Gosford St	41	Finham WwTW
83a b and c Gulson Rd	2	Finham WwTW
Land off Far Gosford St RO 19-33 Bramble St & 88-95 Grafton St	11	Finham WwTW
Land adj to 6 Augustus Rd	1	Finham WwTW
Rear of 30-32 Britannia Street	4	Finham WwTW
Land R/O 48-72 Coventry Street	19	Finham WwTW
Land behind 55-77 Stoke Row	13	Finham WwTW
Cedar Bungalow Silverdale Close	4	Finham WwTW
Cedar Bungalow Silverdale Close	6	Finham WwTW
Land Adjacent to 212 Windmill Road	2	Finham WwTW
Grange Farm Grange Road Longford	5	Finham WwTW
Land Adj 10 Littlethorpe	2	Finham WwTW
Adj 90, 98 and 106 Yarningdale Rd	2	Finham WwTW
Land Adj 2 Tarquin Close	6	Finham WwTW
New Century Park Phase 2	18	Finham WwTW
Phas 2 New Century Park E of Brindle Ave	257	Finham WwTW
Whitworth Avenue	32	Finham WwTW
2 Herrick Road	1	Finham WwTW
Engineers House, Lyng Hall, Blackberry Lane	3	Finham WwTW
Land Adj 114 Aldermans Green Road	4	Finham WwTW
Pennygate Lentons Lane	1	Finham WwTW
Former Electric Power Station Land off Aldermans Green Road	24	Finham WwTW

50 The Moorfield	1	Finham WwTW
14A Bulls Head Lane	1	Finham WwTW
168-172 Shakespeare Street	4	Finham WwTW
Haven Lodge, Clay Lane	12	Finham WwTW
Land Between Broad Lane and Bush Close	19	Finham WwTW
Land between 14-22 Fairlands Park	3	Finham WwTW
29 Woodland Avenue	1	Finham WwTW
Land RO Benson Rd and Sadler Rd	3	Finham WwTW
Theatre One Ford Street	17	Finham WwTW
Land bounded by Upper Well Street, Lamb Street, Chapel Street and corpo	84	Finham WwTW
Land at Chapel St, Lamb St and Bishop Street	61	Finham WwTW
97 Chorley Way	14	Finham WwTW
Land bounded by Lythalls Lane, Sunningdale Avenue and Holbrooks Lane 30	75	Finham WwTW
Paragon Park Foleshill Road	113	Finham WwTW
Ritz Cinema Windmill Road	9	Finham WwTW
Land East of 25 St James Lane	2	Finham WwTW
Former Cauldon St Austell Road	14	Finham WwTW
11a Hall Lane	3	Finham WwTW
Wyken Croft Primary School Wyken Croft	1	Finham WwTW
Adj 110 Woodway Lane	1	Finham WwTW
38 Pandora Road	2	Finham WwTW
Land adj 31 Linwood Drive	1	Finham WwTW
Jack Ball House 468 Woodway Lane	8	Finham WwTW
The Chesnut Brade Drive	19	Finham WwTW
RO 2 and 3 mount pleasant cottages Manfield Avenue	2	Finham WwTW
Bruker UK Ltd Banner Lane	17	Finham WwTW
Tile Hill Social Club, Jardine Crescent	29	Finham WwTW
Former Lyng Hall School Playing Field Blackberry Lane	178	Finham WwTW
Land off Middle Ride	257	Finham WwTW
193 Princethorpe Way	10	Finham WwTW
Land Rear of the Boat Inn Shilton Lane	98	Finham WwTW