Leicester City Council Water Cycle Study

Final Report

July 2020

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Leicester City Council

JBA Project Manager

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Revision History

Revision Ref/Date	Amendments	Issued to
22/01/2020	Draft Report (excluding water quality section)	Fabian D'Costa - Leicester City Council
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24/04/2020	Updated report following feedback from STW and LCC	Fabian D'Costa - Leicester City Council
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Contract

This report describes work commissioned by Leicester City Council, by a letter dated 29th June 2018. Lucy Finch and Hannah Hogan of JBA Consulting carried out this work.

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Purpose

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Acknowledgements

JBA would like to acknowledge the assistance of The Environment Agency, Severn Trent Water and Leicester City Council.

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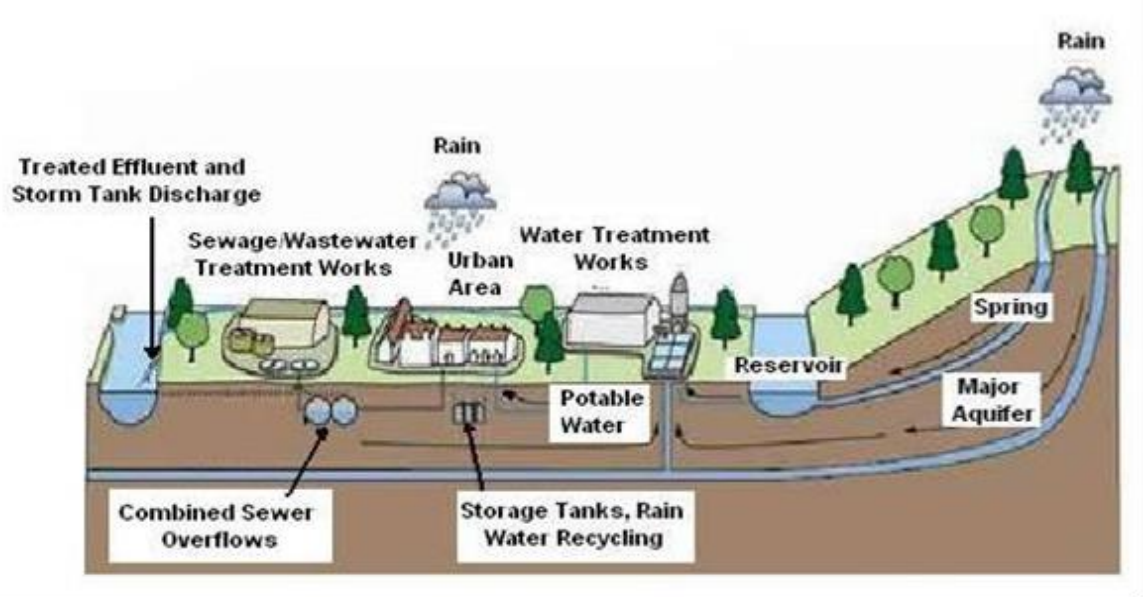
Executive summary

In June 2018, JBA Consulting was commissioned by Leicester City Council to undertake a Water Cycle Study (WCS) to inform the Local Plan. This study assesses the potential issues relating to future development within Leicester and the impacts on water supply, wastewater collection, wastewater treatment and water quality. The Water Cycle Study is required to assess the constraints and requirements that will arise from potential growth on the water infrastructure.

New homes require the provision of clean water, safe disposal of wastewater and protection from flooding. The allocation of large numbers of new homes in certain locations may result in the capacity of existing available infrastructure being exceeded, a situation that could potentially cause service failures to water and wastewater customers, adverse impacts to the environment, or high costs for the upgrade of water and wastewater assets being passed on to the bill payers.

In addition to increased housing demand, future climate change presents further challenges to the existing water infrastructure network, including increased intensive rainfall events and a higher frequency of drought events. Sustainable planning for water must now take this into account. The water cycle can be seen in the figure below and shows how the natural and man-made processes and systems interact to collect, store or transport water in the environment.

The Water Cycle



Source: Environment Agency – Water Cycle Study Guidance

This study will assist Leicester City Council to select and develop sustainable development allocations where there is minimal impact on the environment, water quality, water resources, infrastructure and flood risk. This has been achieved by identifying areas where there may be conflict between any proposed development, the requirements of the environment and by recommending potential solutions to these conflicts.

The Water Cycle Study has been carried out in co-operation with Severn Trent Water (STW), the Environment Agency and the neighbouring Local Planning Authorities (LPAs).

Potential development sites were provided by Leicester City Council and wastewater treatment works (WwTW) likely to serve growth in the area were identified using the Environment Agency consented discharges to controlled waters database. Each development site was then allocated to a WwTW in order to understand the additional wastewater flow resulting from the planned growth.

Water Resources

Leicester City is within the Strategic Grid Water Resource Zone (WRZ). Growth accounted for within STW's Water Resource Management Plan (WRMP) is lower than the Ministry of Housing

Communities and Local Government (MHCLG) household projections, and the Objectively Assessed Need for Leicester City.

The WRMP shows a supply-demand deficit in the Strategic Grid WRZ from 2021-22 if no action is taken, however the WRMP goes on to define a number of actions that will address this. Severn Trent's comments regarding water resources was that they have "no areas of concerns regarding the sites proposed". While the Leicester development area "does not pose a significant risk to the quantitative status of groundwater or surface waterbodies in the area", they recommend "that best practice is always used and that water efficiency measures are specified by the planning authority."

The WCS recommends that the optional efficiency target of 110 litres per person per day, as set out in Building Regulations Part G is adopted. This is recommended in the River Basin Management Plan and is in line with the new National Water Resources Framework that has an objective to achieve an efficiency of 110 l/p/d across England by 2050. Furthermore, it is viable, can be implemented at negligible cost and will reduce energy and water bills for residents.

Severn Trent Water are supportive of the approach to implement water efficient technology, and design new developments based on the optional efficiency target.

Water supply infrastructure

Severn Trent do not anticipate capacity problems within urban areas of their network.

Wastewater collection infrastructure

STW provide wastewater services to the whole of Leicester City. Sewerage Undertakers have a duty under Section 94 of the Water Industry Act 1991 to provide sewerage and treat wastewater arising from new domestic development. Except where strategic upgrades are required to serve very large or multiple developments, infrastructure upgrades are usually only implemented following an application for a connection, adoption, or requisition from a developer. Early developer engagement with STW is therefore essential to ensure that sewerage capacity can be provided without delaying development.

STW provided a red/amber/green assessment of the foul sewer and surface water network in each of the potential development sites. Where sites scored green for these assessments, infrastructure upgrades are unlikely to be required. For red and amber sites where upgrades may be required, early engagement with STW would be necessary to accommodate the development of these sites.

Wastewater treatment capacity

Wanlip WwTW serves the whole of Leicester City and is currently close to exceeding its maximum permitted flow. Over the last few years the observed flow at the treatment works has been decreasing, mostly due to drier summers, and there are planned schemes for AMP7 and AMP8 to further address capacity pressures. As all planned growth in Leicester City will be served by Wanlip WwTW, early engagement between STW and Leicester City Council is required to ensure that opportunities to accommodate this growth within existing upgrade schemes can be realised.

Odour

There are no potential development sites in Leicester City that are close enough to a WwTW that an odour assessment is recommended as part of the planning process.

Water quality

Water quality modelling was carried out using the Environment Agency's SIMCAT and RQP tools. Additional effluent discharges as a result of growth are unlikely to cause a 10% or greater deterioration in the River Soar downstream of Wanlip WwTW in any of the modelled determinands, nor a deterioration in Water Framework Directive (WFD) class.

Good classification is currently being achieved for ammonia and Biochemical Oxygen Demand (BOD), however the current classification for phosphate is poor. Good Ecological Status (GES) cannot currently be achieved for phosphate due to the current limits of treatment technology. The ability to meet GES in the future is not affected by the planned growth.

A transfer of flows from Wanlip to Whetstone WwTWs to provide a short-term increase in treatment capacity has the potential to lead to a localised deterioration in water quality immediately downstream of Whetstone. STW are aware of this potential and the transfer scheme will be designed and permitted accordingly to prevent deterioration.

Flood risk from additional foul flow

A detailed assessment of flood risk can be found in the Leicestershire and Leicester City Level 1 Strategic Flood Risk Assessment (SFRA). The impact of increased discharges of treated wastewater effluent flows due to planned growth was quantified and is not predicted to have a significant impact on flood risk in the receiving watercourse of Wanlip WwTW.

Environmental constraints

There is one SSSI within Leicester City and three downstream of the City. There is a possibility of point source pollution (from Wanlip WwTW) or diffuse pollution (for example from surface runoff from development) to impact these sites. Water quality modelling predicts no deterioration in Phosphate or Ammonia in the river adjacent to these sites, and a 1% deterioration in Biochemical Oxygen Demand (BOD). Opportunities exist to mitigate this through implementation of SuDS schemes to manage surface runoff.

Overall conclusion

This study indicates that while a certain level of growth can be accommodated with minimal additional infrastructure, significant new infrastructure and upgrades to existing network and wastewater treatment works will be required to accommodate all of the proposed growth, including significant upgrades and a transfer of wastewater flows at Wanlip WwTW.

The water quality modelling shows that planned growth at Wanlip can be accommodated in the River Soar catchment without significant deterioration in water quality. Severn Trent Water are aware of the need to provide long term wastewater treatment capacity for Leicester and opportunities exist to manage this in the short term though a transfer of flows and adjustment of permits at Whetstone and Wigston WwTWs and longer term through strategic upgrades beyond 2025.

Summary of actions

Leicester City Council

- Local Plan to adopt enhanced water efficiency standards (110l/p/d) permitted by National Planning Practice Guidance.
- Engagement needed with Severn Trent Water over strategic sites and CDA during Local Plan process to ensure water supply and wastewater infrastructure is in place prior to development
- Engagement with Severn Trent Water to form part of pre-app outside of LP process
- LCC to seek confirmation whether there is capacity for proposed allocations in Reg. 19 responses
- Incorporate water quality criterion into SuDS policy
- Local Plan to include safeguarding of any sites notified by STW

Severn Trent Water

- Continue to regularly review housing growth across supply region through WRMP Annual Update Reports, and where significant change is predicted, engage with local planning authorities
- Advise LCC of any strategic water resource infrastructure developments within the authority where safeguarding of land is required
- Where appropriate, undertake network modelling to ensure adequate provision of water supply and wastewater networks as part of Reg. 19 stage
- Assess growth demands as part of wastewater asset planning activities and feedback to LCC is concerns arise
- Proposals to increase discharges to watercourse may require a flood risk activities environmental permit

Developers

- Engage with STW and LCC early as part of pre-app and app consultations
- Work with STW and the Lead Local Flood Authority closely and early to develop an outline drainage strategy for sites
- Demonstrate to Lead Local Flood Authority that surface water will be disposed of using a sustainable drainage system with connection to surface water sewers seen as a last option.
- Include the design of SuDS at an early stage to maximise the benefits of the scheme, including water quality, biodiversity and amenity benefits where appropriate

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Abbreviations and definitions

ALS	Abstraction Licensing Strategy
AMP	Asset Management Plan
AMR	Automatic Meter Reading
AONB	Area of Outstanding Natural Beauty
AP	Assessment Point
ASNW	Ancient Semi-Natural Woodland
BIDS	Business, Industrial, distribution and Storage
BOD	Biochemical Oxygen Demand
BREEAM	Building Research Establishment Environmental Assessment Methodology
CAMS	Catchment Abstraction Management Strategies
CAPEX	Capital Expenditure
CED	Common End Date
CFMP	Catchment Flood Management Plan
CfSH	Code for Sustainable Homes
CSO	Combined Sewer Overflow
DCLG	Department of Communities and Local Government (Replaced by MHCLG)
DWF	Dry Weather Flow
DWI	Drinking Water Inspectorate
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
EC	European Community
ECA	European Communities Act
EFI	Ecological Flow Indicator
EP	Environmental Permit
EU	European Union
FEH	Flood Estimation Handbook
FFT	Flow to Full Treatment
FWMA	Flood and Water Management Act
FZ	Flood Zone
GIS	Geographic Information Systems
HOF	Hands-Off Flow
HOL	Hands-off Level
JBA	Jeremy Benn Associates
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
l/p/d	Litres per person per day
Ml/d	Mega (Million) litres per day
MHCLG	Ministry of Housing Communities and Local Government
NH4	Ammonia
NPPF	National Planning Policy Framework
OAN	Objectively Assessed Need
OfWAT	Water Service Regulation Authority
OPEX	Operational Expenditure

OS	Ordnance Survey
P	Phosphorous
RAG	Red / Amber / Green assessment
RBD	River Basin District
RBMP	River Basin Management Plan
ReFH	Revitalised Flood Hydrograph
RoFSW	Risk of Flooding from Surface Water (replaced uFMfSW)
RQP	River Quality Planning tool
RZ	Resource Zone
SA	Sustainability Appraisals
SAC	Special Area of Conservation
SBP	Strategic Business Plan
SEA	Strategic Environmental Assessment
SfA	Sewers for Adoption
SFRA	Strategic Flood Risk Assessment
SHELAA	Strategic Housing and Economic Land Availability Assessment
SHMA	Strategic Housing Market Assessment
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPZ	Source Protection Zone
SS	Suspended Solids
SSSI	Site of Special Scientific Interest
STW	Severn Trent Water
SU	Sewerage Undertaker
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
UWWTD	Urban Waste Water Treatment Directive
WaSC	Water and Sewerage Company
WCS	Water Cycle Study
WFD	Water Framework Directive
WRMP	Water Resource Management Plan
WRZ	Water Resource Zone
WTW	Water Treatment Works
WwTW	Wastewater Treatment Works

1 Introduction

1.1 Terms of Reference

JBA Consulting was commissioned by Leicester City Council to undertake a Water Cycle Study (WCS) for Leicester City to inform the draft Local Plan. The purpose of the WCS is to form part of a comprehensive and robust evidence base for the Local Plan which will set out a vision and framework for development in the area up to 2036 and will be used to inform decisions on the location of future development.

Unmitigated future development and climate change can adversely affect the environment and water infrastructure capability. A WCS will provide the required evidence, together with an agreed strategy to ensure that planned growth occurs within environmental constraints, with the appropriate infrastructure in place in a timely manner so that planned allocations are deliverable. This study will examine the water quality, supply and sewerage issues in the City and form part of the evidence base to support the Local Plan at Examination in Public.

1.2 The Water Cycle

Planning Practice Guidance on Water Supply, Wastewater and Water Quality[1] describes a water cycle study as:

"a voluntary study that helps organisations work together to plan for sustainable growth. It uses water and planning evidence and the expertise of partners to understand environmental and infrastructure capacity. It can identify joined up and cost-effective solutions, that are resilient to climate change for the lifetime of the development.

The study provides evidence for Local Plans and sustainability appraisals and is ideally done at an early stage of plan-making. Local authorities (or groups of local authorities) usually lead water cycle studies, as a chief aim is to provide evidence for sound Local Plans, but other partners often include the Environment Agency and water companies."

The Environment Agency's guidance on WCS[2] recommends a phased approach:

- Phase 1: Scoping study, focussing on formation of a steering group, identifying issues for consideration and the need for an outline study.
- Phase 2: Outline study, to identify environmental constraints, infrastructure constraints, a sustainability assessment and consideration of whether a detailed study is required.
- Phase 3: Detailed study, to identify infrastructure requirements, when they are required, how they will be funded and implemented and an overall assessment of the sustainability of proposed infrastructure.

Figure 1.1 below shows the main elements that compromise the Water Cycle and shows how the natural and man-made processes and systems interact to collect, store or transport water in the environment.

1 Planning Practice Guidance: Water supply, wastewater and water quality, Department for Communities and Local Government (2014). Accessed online at: http://planningguidance.planningportal.gov.uk/blog/guidance/ on: 20/01/2020

2 Water Cycle Study Guidance, Environment Agency (2009).
Accessed online at:
http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/geho0109bpff-e-e.pdf
on: 20/01/2020

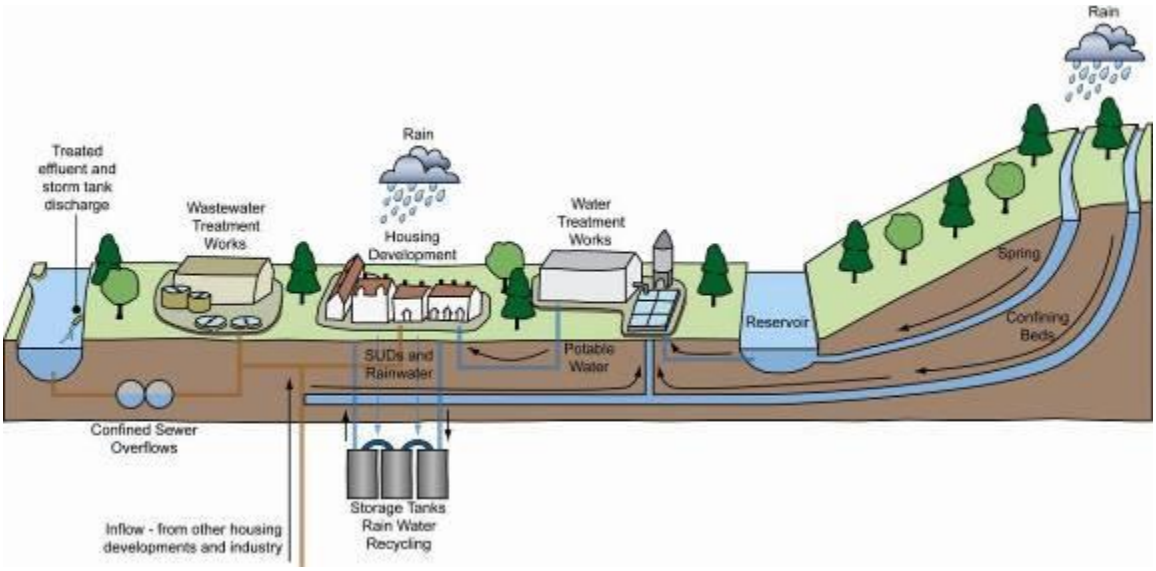


Figure 1.1 The water cycle

1.3 Impacts of Development on the Water Cycle

New homes require the provision of clean water, safe disposal of wastewater and protection from flooding. It is possible that allocating large numbers of new homes at some locations may result in the capacity of the existing available infrastructure being exceeded. This situation could potentially lead to service failures to water and wastewater customers, have adverse impacts on the environment or cause the high cost of upgrading water and wastewater assets being passed on to bill payers. Climate change presents further challenges such as increased intensity and frequency of rainfall and a higher frequency of drought events that can be expected to put greater pressure on the existing infrastructure.

1.4 Objectives

As a WCS is not a statutory instrument, Local Planning Authorities are advised to prioritise the different stages of the WCS to integrate with their Local Plan programme. This scoping report is written as an interim report to support the development of the Comprehensive Local Plan (CLP) and to identify whether an outline/detailed WCS is required. Specific requirements, specified by the project brief, were to:

- Provide a scoping report, taking into account guidance in the NPPF, NPPG, The Water Framework Directive, The Humber River Basin Management Plan and the EA Water Cycle Study Guidance,
- Produce an effective water cycle study in the context of the scoping stage so that:
    - New development takes place only within environment constraints,
    - New development occurs in the most sustainable location, in relation to the water environment,
    - Water cycle infrastructure is in place before new development is occupied and,
    - Opportunities for more sustainable infrastructure options are realised.
- Quantify growth within the study area

- Include the outcomes of stakeholder engagement within the scoping study,
- Gather, assess and use existing data and evidence available, in order to prepare the scoping report and address specific questions,
- Determine any gaps in knowledge/evidence,
- Identify any environmental and major infrastructure constraints,
- Where relevant, cross reference with the replacement Strategic Flood Risk Assessment currently being prepared and its outcomes,
- Identification of the issues and questions to be considered with regards to water resources and water quality,
- Establish whether an outline study is required and define its required scope.

1.5 Study Area

This WCS scoping report has been written for Leicester City Council. The Local Authority area covers 73km^2 of the Leicester Principal Area and now has an estimated population of 350,000 residents.

The area is located within the Lower River Trent catchment, and contains the River Soar and its major tributaries.

Water supply services and wastewater services are provided by Severn Trent Water.

1.6 Record of Engagement

1.6.1 Introduction

Preparation of a WCS requires significant engagement with stakeholders, within the Local Planning Authority area, with water and wastewater utilities, with the environment agency, and where there may be cross-boundary issues, with neighbouring local authorities. This section forms a record of engagement for the WCS.

1.6.2 Scoping Study Engagement

The preparation of this WCS was supported by the following engagement:

Inception meeting

Engaged Parties	Severn Trent Water Environment Agency
Details	Scope of works and data collection requirements reviewed.

Local authorities

Engaged Parties	Leicester City Council Charnwood Borough Council Blaby District Council Oadby and Wigston Borough Council Harborough District Council North West Leicestershire District Council Melton Borough Council Hinckley and Bosworth Borough Council
Details	Request for water cycle studies conducted in their area, and housing and employment growth that would be served by WwTW within or shared with LCC.

Collaboration with Water Companies

Engaged Parties	Severn Trent Water
Details	Water company assessments of water and wastewater infrastructure and capacity constraints.

Stakeholder Review

Engaged Parties	Leicester City Council Severn Trent Water Environment Agency Natural England Water Resources West
Details	Discussion and clarification of key findings Discussion of water efficiency target and water quality of Wanlip

2 Future Growth in Leicester City

2.1 Growth background

Leicester is a rapidly growing city with government projections suggesting a population increase of almost 12% within the administrative area between 2016 and 2031, with the population rising to approximately 388,000 people. As a whole, the population of both Leicester and Leicestershire is predicted to grow to 1,141,000 in the same period – an increase of 11%. This growth arises as consequence of increased life expectancy and birth rates as well as a net movement into the city.

2.2 Housing

2.2.1 Introduction

In response to the growing population, there is a requirement for additional housing. In order to meet the housing demand, the most recent housing strategy, the Leicestershire and Leicestershire Strategic Growth Plan (SGP), is based upon the strengthening of the city as a major urban centre, as well as sustainable urban extensions on the edge of the urban centre. There is also a focus on developing other main settlements in the area (such as Melton Mowbray and Loughborough) as a method of meeting housing demands. Using the Government's standard method for establishing housing need, the City Council calculates that 1,712 dwellings per annum are needed in Leicester City between 2019 and 2036. This gives a total need of 29,104 houses over the period 2019-2036 considered in this study.

2.2.2 Overall growth

Table 2.1 shows the growth in Leicester City over the Local Plan period up to 2036, derived from the data provided by LCC and collated in the site tracker spreadsheet (Appendix A). This shows that there is a deficit compared to the standard methodology assessment of need of 7,742 dwellings.

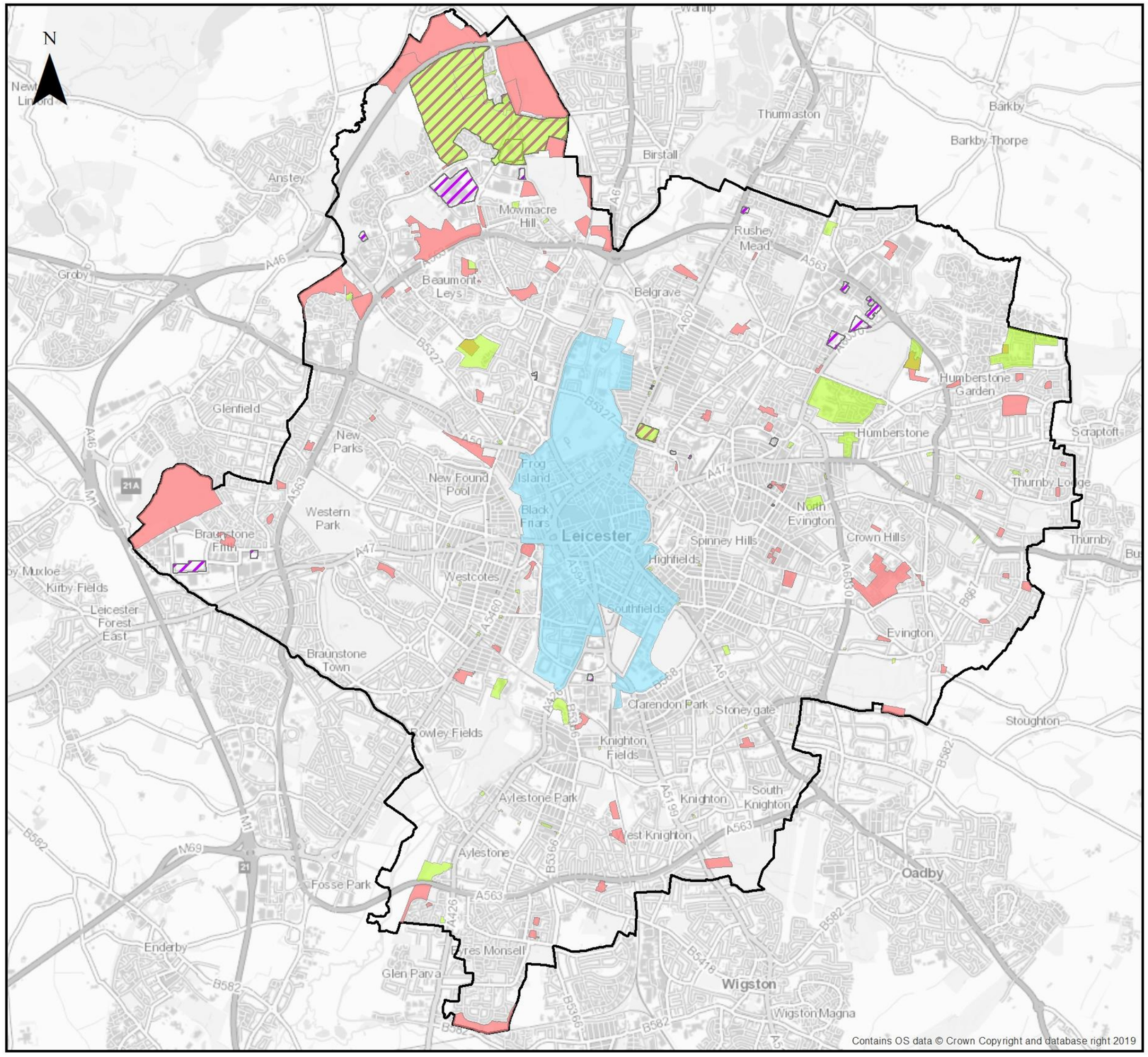
Potential growth in the study is made up of the Central Development Area (CDA), which covers the city centre, and non-CDA development in the rest of Leicester. Of the potential site allocations, 4,905 dwellings are proposed in the CDA, with the remaining 4,080 dwellings outside of the CDA.

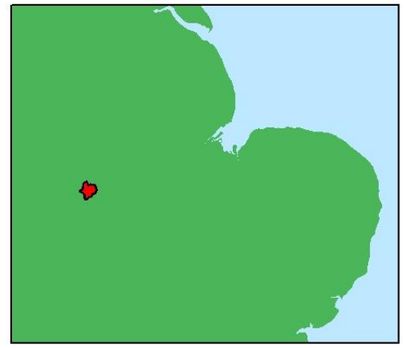
The overall level of housing and employment planned for in the City's draft Local Plan includes, in additional to the potential site allocations, windfall development and commitments. 'Windfall' is an allowance for unplanned development that is likely to come forward over the live of the plan, such as the conversion of existing buildings to flats. 'Commitment' is the number of dwellings and quantum of employment floorspace that already has planning permission, but which have not yet been built-out.

For purposes of this Study (but not the City's draft Local Plan) recent development completions are also included in the growth scenario. This is to ensure that sites that have been recently completed but which may not yet appear in water company flow data are included in the forecast.

Table 2.1 Proposed growth in Leicester City

Type of growth	Number of houses	Employment floorspace (ha)
Draft allocations (non CDA)	4,080	14.4
CDA Allocations	4,905*	4.0
Windfall	2,550	-
Commitments contained in Draft Local Plan	8,448	11.3
Recent completions	2,065	-





Residential Commitments and Completions

Employment Commitments and Completions

Draft Allocations (non CDA)

Leicester City Boundary

Central Development Area

0 0.5 1 2 km

Figure 2.1 Potential growth in Leicester City

2.3 Growth outside Leicester

Where growth within a neighbouring Local Planning Authority (LPA) area may be served by water and wastewater infrastructure within or shared with Leicester City, the neighbouring LPA were contacted as part of a duty to cooperate request to provide information on future growth within the Wanlip WwTW catchment, which serves part of their council area and Leicester City.

2.3.1 Blaby District

Wanlip WwTW serves parts of the north of Blaby District, around Whetstone, Blaby and Leicester Forest East. There are two allocated sites in Blaby that are anticipated to be served by Wanlip WwTW, Lubbesthorpe SUE and north of the A47. The trajectory for these sites were provided by Blaby Council and are outlined in Table 2.2.

Table 2.2 Proposed growth in Blaby District served by Wanlip WwTW

Site	19-20	20-21	21-22	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31	31-32	32-33
	Proposed number of dwellings per year													
Lubbesthorpe SUE	200	250	315	315	315	315	315	315	315	315	315	315	315	64
North of A47		30	60	60	60	60	60	60	60	60	60	60	60	60

2.3.2 Harborough District

Wanlip WwTW serves a very small area of Harborough District in the north-west of the area around Scraptoft, Bushby, Thurnby and Stoughton. Harborough District provided details of two committed sites in the Thurnby/Bushby area, as well as the Scraptoft Strategic Development Area (SDA). Specific trajectory for the committed sites was provided however there was no trajectory for the Scraptoft SDA. Harborough Council stated that the first completions were projected for 2021/22, therefore the trajectory of development for the SDA were spread evenly from 2021/22 to the end of the Local Plan period 2030/31. The trajectory used for development in Harborough District is shown in Table 2.3.

Table 2.3 Proposed growth in Harborough District served by Wanlip WwTW

Site	19-20	20-21	21-22	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31
	Proposed number of dwellings per year											
Thurnby/Bushby Commitments	34	97	102	87	55							
Scraptoft North SDA		110	109	109	109	109	109	109	109	109	109	109

2.3.3 Charnwood Borough

Wanlip WwTW serves approximately half of Charnwood Borough, in the south, including Syston, Sileby, Mountsorrel, Rothley, Woodhouse Eaves, Anstey, Birstall and Thurmaston. The treatment works itself is located in Charnwood Borough. Charnwood Council provided growth information for Wanlip WwTW of 10,494 houses and 40.34 ha of employment land and specific trajectory was given. Mixed B was assumed for all

employment land which following Charnwood's SHELAA methodology, gives a developable area of 39%.

Table 2.4 Proposed growth in Charnwood Borough served by Wanlip WwTW

19-20	20-21	21-22	22-23	23-24	24-25	25-26	26-27	27-28
Proposed number of dwellings per year								
384	523	577	440	464	750	1,103	954	644
Proposed ha of employment development per year								
0	0	0	0	0	2	5	5	4

28-29	29-30	30-31	31-32	32-33	33-34	34-35	35-36	2036+
Proposed number of dwellings per year								
572	543	418	380	380	380	430	377	1,175
Proposed ha of employment development per year								
3	3	3	3	3	3	3	3.34	0

2.3.4 Hinckley and Bosworth Borough

While Hinckley and Bosworth Borough doesn't neighbour Leicester City, part of the north-east of the Borough fall into Wanlip's catchment, including Desford, Ratby, Groby and Markfield. Hinckley and Bosworth Borough Council were contacted for information regarding development served by Wanlip WwTW, however they were only able to provide Borough-wide values, which stated 450 houses/year, 6ha of office space and 25ha of B class employment were estimated for the Borough for the period 2006-2026. It was also stated that the 6ha of office space would equate to 34,000m^2 of floorspace, which therefore assumed a 57% developable area, which was applied by JBA to the 25ha of B class employment to give 142,500m^2 of floorspace. It was assumed that employment development would be spread evenly over the Local Plan period.

From census values, it was calculated that approximately 20% of the Borough is served by Wanlip WwTW, therefore 90 houses per year were estimated to be within the Wanlip WwTW catchment, the employment floorspace was for the Wanlip catchment was also calculated accordingly. As well as this, Hinckley and Bosworth's residential land availability monitoring statement 2018/19 provided trajectory for current sites with planning permission.

Table 2.5 Proposed growth in Hinckley and Bosworth Borough served by Wanlip WwTW

	19/20	20/21	21/22	22/23	23/27	24/25	25/26
Number of dwellings (planning permission sites)	116	21	10				
Number of dwellings (annual estimation)		90	90	90	90	90	90
TOTAL dwellings	**116**	**111**	**100**	**90**	**90**	**90**	**90**
Office floorspace (m^2, annual estimation)	340	340	340	340	340	340	340
Mixed B floorspace (m^2, annual estimation)	1,425	1,425	1,425	1,425	1,425	1,425	1,425

2.3.5 Oadby and Wigston Borough

Wanlip WwTW serves parts of the north of Oadby and Wigston Borough. Oadby and Wigston Council were contacted for details of potential growth in the Borough to be served by Wanlip WwTW however they were only able to provide household projections for the entire Borough. Oadby and Wigston's Local Plan adopted in April 2019 states that there will be a minimum of 300 new homes in the Stoughton Grange area. This area would be served by Wanlip WwTW and it has been assumed that the development of this site would be spread evenly from the year 2019/20 to the end of the Local Plan period in 2031.

2.3.6 North West Leicestershire District

Wanlip WwTW serves a very small area of North West Leicestershire District around Battram, however there is no proposed growth in this area.

3 Legislative and Policy Framework

3.1 Introduction

The following sections introduce several national, regional and local policies that must be considered by the LPA, water companies and developers during the planning stage. Key extracts from these policies relating to water consumption targets and mitigating the impacts on the water from the new development are summarised below.

3.2 National Policy

3.2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[3] was published on 27th March 2012, as part of reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. A comprehensive revision was issued in July 2018. This was further revised in February 2019[4], but the changes were not significant from the July 2018 version for policy areas relevant to the WCS. The NPPF provides guidance to planning authorities to take account of flood risk and water and wastewater infrastructure delivery in their Local Plans. Key paragraphs include:

Paragraph 17:

> *"The development plan must include strategic policies to address each local planning authority's priorities for the development and use of land in its area. These strategic policies can be produced in different ways, depending on the issues and opportunities facing each area. They can be contained in:*
> *a) joint or individual local plans, produced by authorities working together or independently (and which may also contain non-strategic policies); and/or*
> *b) a spatial development strategy produced by an elected Mayor or combined authority, where plan-making powers have been conferred."*

Paragraph 20:

> *"Strategic policies should set out an overall strategy for the pattern, scale and quality of development, and make sufficient provision for:*
> *a) housing (including affordable housing), employment, retail, leisure and other commercial development;*
> *b) infrastructure for transport, telecommunications, security, waste management, water supply, wastewater, flood risk and coastal change management, and the provision of minerals and energy (including heat);*
> *c) community facilities (such as health, education and cultural infrastructure); and*
> *d) conservation and enhancement of the natural, built and historic environment, including landscapes and green infrastructure, and planning measures to address climate change mitigation and adaptation."*

Paragraph 34:

> *"Plans should set out the contributions expected from development. This should include setting out the levels and types of affordable housing provision required, along with other infrastructure (such as that needed for education, health, transport, flood and water management, green and digital infrastructure). Such policies should not undermine the deliverability of the plan."*

3 National Planning Policy Framework, Department for Communities and Local Government (2012)
4 National Planning Policy Framework, Ministry of Housing, Communities and Local Government (2019). Accessed online at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 on: 20/01/2020

Paragraph 149:

> *"Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply..."*

Paragraph 170 (e):

> *"…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans".*

In March 2014, the Planning Practice Guidance was issued by the Department for Communities and Local Government, with the intention of providing guidance on the application of the National Planning Policy Framework (NPPF) in England. The MHCLG is in the process of updating the Guidance to consider the necessary 2018 and 2019 updates of the NPPF. Of the sections relevant to this study, only the Water Supply, Wastewater and Water Quality section has been updated.

- Flood Risk and Coastal Change[5]
- Water Supply, Wastewater and Water Quality[6].
- Housing - Optional Technical Standards[7].

3.2.2 Planning Practice Guidance: Flood Risk and Coastal Change

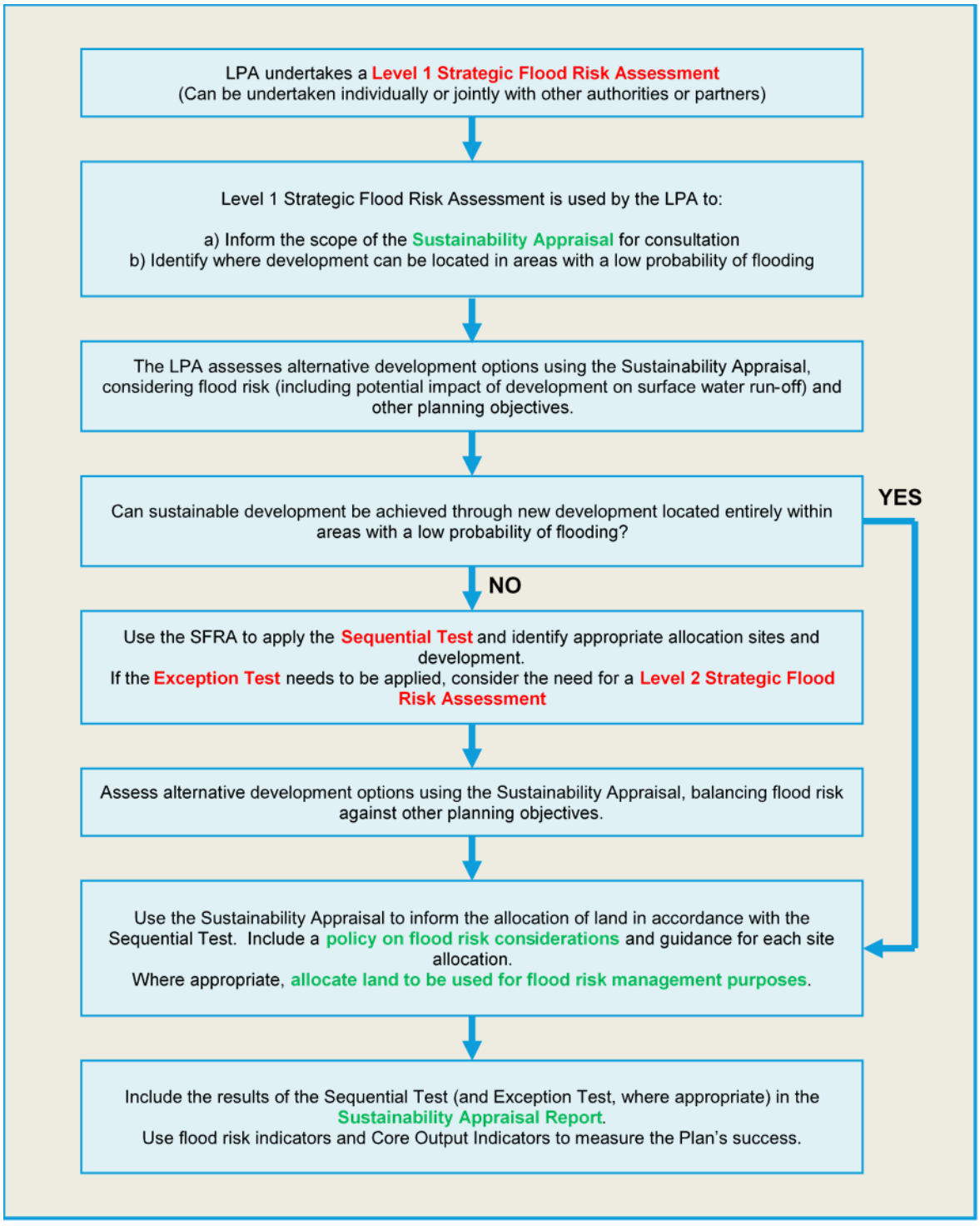
Diagram 1 in the Planning Practice Guidance sets out how flood risk should be considered in the preparation of Local Plans (Figure 3.1). These requirements are addressed principally in the Council's Strategic Flood Risk Assessment.

3.2.3 Planning Practice Guidance: Water Supply, Wastewater and Water Quality

A summary of the specific guidance on how infrastructure, water supply, wastewater and water quality considerations should be accounted for in both plan-making and planning applications is summarised below in Figure 3.2.

5 Planning Practice Guidance: Flood Risk and Coastal Change, Department for Communities and Local Government (2014). Accessed online at: http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/ on: 20/01/2020.
6 Planning Practice Guidance: Water supply, wastewater and water quality, Department for Communities and Local Government (2014). Accessed online at: https://www.gov.uk/guidance/water-supply-wastewater-and-water-quality on: 20/01/2020
7 Planning Practice Guidance: Housing - Optional Technical Standards, Department for Communities and Local Government (2014). Accessed online at: https://www.gov.uk/guidance/housing-optional-technical-standards on: 20/01/2020

Figure 3.1 Flood Risk and the Preparation of Local Plans[8]



8 Based on Diagram 1 of NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 004, Reference ID: 7-021-20140306

Figure 3.2 PPG: Water supply, wastewater and water quality considerations for plan-making and planning applications

Plan-making		Planning applications
Infrastructure	Identification of suitable sites for new or enhanced infrastructure. Consider whether new development is appropriate near to water and wastewater infrastructure. Phasing new development so that water and wastewater infrastructure will be in place when needed.	Wastewater considerations include: First presumption is to provide a system of foul drainage discharging into a public sewer. Phasing of development and infrastructure. Circumstances where package sewage treatment plants or septic tanks are applicable.
Water supply	Not Specified	Planning for the necessary water supply would normally be addressed through the Local Plan, exceptions might include: Large developments not identified in Local Plans; Where a Local Plan requires enhanced water efficiency in new developments.
Water quality	How to help protect and enhance local surface water and groundwater in ways that allow new development to proceed and avoids costly assessment at the planning application stage. The type or location of new development where an assessment of the potential impacts on water bodies may be required. Expectations relating to sustainable drainage systems.	Water quality is only likely to be a significant planning concern when a proposal would: Involve physical modifications to a water body; Indirectly affect water bodies, for example as a result of new development such as the redevelopment of land that may be affected by contamination etc. or through a lack of adequate infrastructure to deal with wastewater.
Wastewater	The sufficiency and capacity of wastewater infrastructure. The circumstances where wastewater from new development would not be expected to drain to a public sewer.	If there are concerns arising from a planning application about the capacity of wastewater infrastructure, applicants will be asked to provide information about how the proposed development will be drained and wastewater dealt with.
Cross-boundary concerns	Water supply and water quality concerns often cross local authority boundaries and can be best considered on a catchment basis. Recommends liaison from the outset.	No specific guidance (relevant to some developments).
SEA and Sustainability	Water supply and quality are considerations in strategic environmental assessment and sustainability appraisal ... sustainability appraisal objectives could include preventing deterioration of current water body status, taking climate change into account and seeking opportunities to improve water bodies.	No specific guidance (should be considered in applications).

3.2.4 Planning Practice Guidance: Housing – Optional Technical Standards

This guidance, advises planning authorities on how to gather evidence to set optional requirements, including for water efficiency. It states that "all new homes already have to meet the mandatory national standard set out in the Building Regulations (of 125 litres/person/day). Where there is a clear local need, local planning authorities can set out Local Plan policies requiring new dwellings to meet the tighter Building Regulations optional requirement of 110 litres/person/day. Planning authorities are advised to consult with the EA and water companies to determine where there is a clear local need, and also to consider the impact of setting this optional standard on housing viability. A 2014 study[9] into the cost of implementing sustainability measures in housing found that meeting a standard of 110 litres per person per day would cost only £9 for a four-bedroom house.

3.2.5 Building Regulations

The Building Regulations (2010) Part G[10] was amended in early 2015 to require that all new dwellings must ensure that the potential water consumption must not exceed 125 litres/person/day, or 110 litres/person/day where required under planning conditions.

3.2.6 BREEAM

The Building Research Establishment (BRE) publish an internationally recognised environmental assessment methodology for assessing, rating and certifying the sustainability of a range of buildings.

New homes are most appropriately covered by the Home Quality Mark[11], and commercial, leisure, educational facilities and mixed-use buildings by the Building Research Establishment Environmental Assessment Methodology (BREEAM) UK New Construction Standard[12].

Using independent, licensed assessors, BREEAM/HQM assesses criteria covering a range of issues in categories that evaluate energy and water use, health and wellbeing, pollution, transport, materials, waste, ecology and management processes.

In the Homes Quality Mark, 400 credits are available across 11 categories and lead to a star rating. 18 credits are available for water efficiency and water recycling. A greater number of credits are awarded for homes using water efficient fittings (with the highest score achieving 100l/p/d or less), and further credits are awarded for the percentage of water used in toilet flushing that is either sourced from rainwater or from grey water.

The BREEAM New Construction Standard awards credits across nine categories, four of which are related to water: water consumption, water monitoring, leak detection and water efficient equipment. This leads to a percentage score and a rating from "Pass" to "Outstanding".

The Councils have the opportunity to seek BREEAM or HQM status for all new, residential and non-residential buildings.

3.2.7 Sustainable Drainage Systems (SuDS)

From April 2015, Local Planning Authorities (LPA) have been given the responsibility for ensuring that sustainable drainage is implemented on developments of ten or

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9 Housing Standards Review: Cost Impacts, Department for Communities and Local Government (2014). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/353387/021c_Cost_Report_11th_Sept_2014_FINAL.pdf on: 20/01/2020

10 The Building Regulations (2010) Part G - Sanitation, hot water safety and water efficiency, 2015 edition with 2016 amendments. HM Government (2016). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/504207/BR_PDF_AD_G_2015_with_2016_amendments.pdf on: 20/01/2020

11 Home Quality Mark, BRE, (2018). Accessed online at: https://www.homequalitymark.com/professionals/standard/ on: 16/04/2020

12 2 BREEAM UK New Construction, BRE, (2018). Accessed online at: https://www.breeam.com/NC2018/ on: 16/04/2020

more homes or other forms of major development through the planning system. Under the new arrangements, the key policy and standards relating to the application of SuDS to new developments are:

- The National Planning Policy Framework, which requires that development in areas already at risk of flooding should give priority to sustainable drainage systems.
- The House of Commons written statement[13] setting out governments intentions that LPAs should "ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate" and "clear arrangements in place for ongoing maintenance over the lifetime of the development." This requirement is also now incorporated in the 2019 update of the NPPF (paragraph 165). In practice, this has been implemented by making Lead Local Flood Authorities (LLFAs) statutory consultees on the drainage arrangements of major developments.
- The Defra non-statutory technical standards for sustainable drainage systems[14]. These set out the government's high-level requirements for managing peak flows and runoff volumes, flood risk from drainage systems and the structural integrity and construction of SuDS. This very short document is not a design manual and makes no reference to the other benefits of SuDS, for example water quality, habitat and amenity.
- Leicester City Council LLFA play a key role in ensuring that the proposed drainage schemes for all new developments comply with technical standards and policies in relation to SuDS. The Council's "Sustainable Drainage Guide"[15] contains guidance for the design and application of SuDS in Leicester.
- An updated version of the CIRIA SuDS Manual[16] was published in 2015. The guidance covers the planning, design, construction and maintenance of SuDS for effective implementation within both new and existing developments. The guidance is relevant for a range of roles with the level of technical detail increasing throughout the manual. The guidance does not include detailed information on planning requirements, SuDS approval and adoption processes and standards, as these vary by region and should be checked early in the planning process.
- CIRIA also publish "Guidance on the Construction of SuDS" (C768)[17], which contains detailed guidance on all aspects of SuDS construction, with specific information on each SuDS component available as a downloadable chapter.
- Severn Trent Connect (part of Severn Trent Water) do not currently have a SuDS adoption manual. In its Addendum to Sewers for Adoption 7th Edition[18], Severn Trent Connect (STC) states that it "will consider the adoption of SuDS as long as the systems are designed and constructed in accordance with the CIRIA SuDS Manual (C753)" and also outlines the SuDS techniques that are adoptable by STC.
- The water industry is currently developing Sewers for Adoption version 8, the guide to the standards that sewers must meet if they are to be adoptable by

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13 Sustainable drainage systems: Written statement - HCWS161, UK Government (2014). Accessed online at: http://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2014-12-18/HCWS161/ on: 20/01/2020

14 Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems, Defra (2015). Accessed online at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards on: 20/01/2020

15 Sustainable Drainage Guide, Leicester City Council (2015). Accessed online at: https://www.leicester.gov.uk/media/179759/suds-guidance-april-2015.pdf on: 20/01/2020

16 The SuDS Manual (C753), CIRIA (2015).

17 Guidance on the Construction of SuDS (C768), CIRIA (2017), Accessed online at: https://www.ciria.org/ItemDetail?iProductCode=C768F&Category=FREEPUBS on: 20/01/2020

18 Addendum to Sewers for Adoption 7th Edition, Severn Trent Connect. Accessed online at: https://www.severntrentconnect.com/media/1567/severn-trent-connect-addendum-to-sewers-for-adoption-7th-final.pdf on: 22/01/2020

water and sewerage companies in England. This is expected to include a significant expansion of what can be considered to be an adoptable surface water sewer, to include some forms of SuDS. If implemented, this could lead to many more SuDS systems being adopted by Severn Trent Water during the plan period[19]. A pre-implementation version was released in April 2018.

3.3 Regional Policy

3.3.1 Leicester City Preliminary Flood Risk Assessments (PFRAs)

In accordance with the Regulations, LLFAs had the task of preparing a Preliminary Flood Risk Assessment (PFRA) report.

PFRAs report on significant past and future flooding from all sources except from Main Rivers and reservoirs, which are covered by the Environment Agency, and sub-standard performance of the adopted sewer network (covered under the remit of Anglian Water and Severn Trent Water). PFRAs are a high-level screening exercise and consider floods which have significant harmful consequences for human health, economic activity, the environment and cultural heritage

An updated PFRA for Leicester City Council was updated in 2017, this included up to date flood mapping.[20]

3.3.2 Leicester City Local Flood Risk Management Strategy

The high-level objectives for managing flood risk, proposed in Leicester City Council's LFRMS[21] are:

- Reduce the number of properties at risk of flooding
- Help residents, property and business owners in the area become more resilient to flood events;
- Reduce the area of highway under water for a given storm event and minimise traffic disruption from flooding;
- Increase the area of green space in the area contributing to mitigating the flooding risk; and,
- Reducing the number of pollution incidents affecting watercourses in the city

3.3.3 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMP) are high level policy documents covering large river basin catchments. They aim to set policies for sustainable flood risk management for the whole catchment covering the next 50 to 100 years. The River Trent CFMP is the most relevant to Leicester City[22].

3.3.4 Surface Water Management Plans (SWMPs)

SWMPs outline the preferred surface water management strategy in a given location and establish a long-term action plan to manage surface water. SWMPs are undertaken, when required, by LLFAs in consultation with key local partners who are

19 Water UK (2017) Sewers for Adoption 8: Revised Principles Paper
20 Leicester City PFRA (2017). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/698266/PFRA_Leicester_City_Council_2017.pdf on: 20/01/2020
21 Leicester City Local Flood Risk Management Strategy (2015) Accessed online at: https://www.leicester.gov.uk/media/178225/master-lfrms-web-lo-res-mar-2015.pdf on: 20/01/2020
22 River Trent Catchment Flood Management Plan, Environment Agency (2009). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/289105/River_Trent_Catchment_Management_Plan.pdf on: 20/01/2020

responsible for surface water management and drainage in their area. Leicester City produced a SWMP for the City in 2012[23].

3.3.5 Water Resource Management Plans

Water Resource Management Plans (WRMPs) are 25-year strategies that water companies are required to prepare, with updates every five years. In reality, water companies prepare internal updates more regularly. WRMPs are required to assess:

- Future demand (due to population and economic growth)
- Future water availability (including the impact of sustainability reductions)
- Demand management and supply-side measures (e.g. water efficiency and leakage reduction, water transfers and new resource development)
- How the company will address changes to abstraction licences
- How the impacts of climate change will be mitigated

Where necessary, they set out the requirements for developing additional water resources to meet growing demand and describe how the balance between water supply and demand will be balanced over the period 2015 to 2040.

- Using cost-effective demand management, transfer, trading and resource development schemes to meet growth in demand from new development and to restore abstraction to sustainable levels.
- In the medium to long term, ensuring that sufficient water continues to be available for growth and that the supply systems are flexible enough to adapt to climate change.

The Severn Trent WRMP covers Leicester and is reviewed in section 0.

3.4 Local and Neighbourhood Planning

3.4.1 Localism Act

The Localism Act (2011) changes the powers of local government, it re-distributes the balance of decision making from central government back to councils, communities and individuals. In relation to the planning of sustainable development, provision 110 of the Act places a duty to cooperate on Local Authorities. This duty requires Local Authorities to *"engage constructively, actively and on an ongoing basis in any process by means of which development plan documents are prepared so far as relating to a strategic matter"*[24].

The Localism Act also provides new rights to allow local communities to come together and shape the development and growth of their area by preparing Neighbourhood Development Plans, or Neighbourhood Development Orders, where the ambition of the neighbourhood is aligned with strategic needs and priorities for the area. This means that local people can decide where new homes and businesses should go and also what they should look like. As neighbourhoods draw up their proposals, Local Planning Authorities are required to provide technical advice and support.

3.5 Environmental Policy

23 Leicester City Surface Water Management Plan, Leicester City Council. Accessed online at: https://www.leicester.gov.uk/media/178251/swmp-main-report.pdf/on: 20/01/2020

24 Localism Act 2011: Section 110, UK Government (2011). Accessed online at: http://www.legislation.gov.uk/ukpga/2011/20/section/110 on: 20/01/2020

3.5.1 Urban Waste Water Treatment Directive (UWWTD)

The UWWTD[25] is an EU Directive that concerns the collection, treatment and discharge of urban wastewater and the treatment and discharge of wastewater from certain industrial sectors. The objective of the Directive is to protect the environment from the adverse effects of wastewater discharges. More specifically Annex II A(a) sets out the requirements for discharges from urban wastewater treatment plants to sensitive areas which are subject to eutrophication. The Directive has been transposed into UK legislation through enactment of the Urban Waste Water Treatment (England and Wales) Regulations 1994 and 'The Urban Waste Water Treatment (England and Wales) (Amendments) Regulations 2003'.

3.5.2 Habitats Directive

The EU Habitats Directive aims to protect the wild plants, animals and habitats that make up our diverse natural environment. The directive created a network of protected areas around the European Union of national and international importance called Natura 2000 sites. These include:

- Special Areas of Conservation (SACs) - support rare, endangered or vulnerable natural habitats, plants and animals (other than birds).
- Special Protection Areas (SPAs) - support significant numbers of wild birds and habitats.

Special Protection Areas and Special Areas of Conservation are established under the EC Birds Directive and Habitats Directive respectively. The directive also protects over 1,000 animals and plant species and over 200 so called "habitat types" (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance.

3.5.3 The Water Framework Directive

The Water Framework Directive (WFD) was first published in December 2000 and transposed into English and Welsh law in December 2003. It introduced a more rigorous concept of what "good status" should mean than the previous environmental quality measures. The WFD estimated that 95% of water bodies were at risk of failing to meet "good status".

River Basin Management Plans (RBMP) are required under the WFD and document the baseline classification of each waterbody in the plan area, the objectives, and a programme of measures to achieve those objectives. Leicester City falls into the Humber River Basin District (RBD)[26]. Under the WFD the RBMPs, which were originally published in December 2009 were reviewed and updated in December 2015. A primary WFD objective is to ensure 'no deterioration' in environmental status, therefore all water bodies must meet the class limits for their status class as declared in the Severn River Basin Management Plan. Another equally important objective requires all water bodies to achieve good ecological status. Future development needs to be planned carefully so that it helps towards achieving the WFD and does not result in further pressure on the water environment and compromise WFD objectives. The WFD objectives as outlined in the updated RBMPs are summarised below:

- Prevent deterioration of the status of surface waters and groundwater
- Achieve objectives and standards for protected areas
- Achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status

25 UWWTD. Accessed online at: https://ec.europa.eu/environment/water/water-urbanwaste/index_en.html On: 20/01/2020
26 Severn River Basin District River Basin Management Plan: 2015, Environment Agency (2015). Accessed at: https://www.gov.uk/government/publications/humber-river-basin-district-river-basin-management-plan on: 20/01/2020

- Reverse any significant and sustained upward trends in pollutant concentrations in groundwater
- Stop discharges/emissions of priority hazardous substances into surface waters
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants

Local Planning Authorities (LPAs) must have regard to the Water Framework Directive as implemented in the Environment Agency's River Basin Management Plans. It is of primary importance when assessing the impact of additional wastewater flows on local river quality.

3.5.4 Protected Area Objectives

The WFD specifies that areas requiring special protection under other EC Directives, and waters used for the abstraction of drinking water, are identified as protected areas. These areas have their own objectives and standards.

Article 4 of the WFD required Member States to achieve compliance with the standards and objectives set for each protected area by 22 December 2015, unless otherwise specified in the Community legislation under which the protected area was established. Some areas may require special protection under more than one EC Directive or may have additional (surface water and/or groundwater) objectives. In these cases, all the objectives and standards must be met.

The types of protected areas are:

- Areas designated for the abstraction of water for human consumption (Drinking Water Protected Areas)
- Areas designated for the protection of economically significant aquatic species (Freshwater Fish and Shellfish)
- Bodies of water designated as recreational waters, including Bathing Waters;
- Nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Wastewater Treatment Directive (UWWTD)
- Areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection including relevant Natura 2000 sites

Many WFD protected areas coincide with water bodies; these areas will need to achieve the water body status objectives in addition to the protected area objectives. Where water body boundaries overlap with protected areas the most stringent objective applies; that is the requirements of one EC Directive should not undermine the requirements of another. The objectives for Protected Areas relevant to this study are as follows:

Drinking Water Protected Areas

- Ensure that, under the water treatment regime applied, the drinking water produced meets the requirements of the Drinking Water Directive plus any UK requirements to make sure that drinking water is safe to drink
- Ensure the necessary protection to prevent deterioration in the water quality in the protected area in order to reduce the level of purification treatment required

Economically Significant Species (Freshwater Fish Waters)

- Protect or improve the quality of running or standing freshwater to enable them to support fish belonging to indigenous species offering a natural diversity; or species, the presence of which is judged desirable for water management purposes by the competent authorities of the Member States

Nutrient Sensitive Areas (Nitrate Vulnerable Zones)

- Reduce water pollution caused or induced by nitrates from agricultural sources
- Prevent further such pollution

Nutrient Sensitive Areas (Urban Wastewater Treatment Directive)

- Protect the environment from the adverse effects of urban wastewater discharges and wastewater discharges from certain industrial sectors

Natura 2000 Protected Areas (water dependent SACs and SPAs)

The objective for Natura 2000 Protected Areas identified in relation to relevant areas designated under the Habitats Directive or Birds Directive is to:

- Protect and, where necessary, improve the status of the water environment to the extent necessary to achieve the conservation objectives that have been established for the protection or improvement of the site's natural habitat types and species of importance

3.5.5 Groundwater Source Protection Zones

The Environment Agency has a Groundwater Protection Policy to help prevent groundwater pollution. In conjunction with this the Environment Agency have defined groundwater Source Protection Zones (SPZs) to help identify high risk areas and implement pollution prevention measures. The SPZs show the risk of contamination from activities that may cause pollution in the area, the closer the activity, the greater the risk. There are three main zones (inner, outer and total catchment) and a fourth zone of special interest which is occasionally applied.

Zone 1 (Inner protection zone)

This zone is designed to protect against the transmission of toxic chemicals and water-borne disease. It indicates the area in which pollution can travel to the borehole within 50 days from any point within the zone and applies at and below the water table. There is also a minimum 50 metre protection radius around the borehole.

Zone 2 (Outer protection zone)

This zone indicates the area in which pollution takes up to 400 days to travel to the borehole, or 25% of the total catchment area, whichever area is the largest. This is the minimum length of time the Environment Agency think pollutants need to become diluted or reduce in strength by the time they reach the borehole.

Zone 3 (Total catchment)

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

Zone of special interest

This is defined on occasions, usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment.

The Environment Agency's approach to Groundwater protection[27] sets out a series of position statements that detail how the Environment Agency delivers government policy on groundwater and protects the resources from contamination. The position statements that are relevant to this study with regard to discharges to groundwaters, include surface water drainage and the use of SuDS, discharges from contaminated surfaces (e.g. lorry parks) and from treated sewage effluent.

3.5.6 European Derived Legislation and Brexit

Much of the legislation behind the regulation of the water environment derives from the UK enactment of European Union (EU) directives. Following the departure of the

27 The Environment Agency's approach to groundwater protection, Environment Agency (2018). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/598778/LIT_7660.pdf on: 20/01/2020

United Kingdom from the European Union on 31st January 2020, this legislation remains in force during the transition period, until 31st December 2020. The UK government has signalled that "the UK will in future develop separate and independent policies in areas such as … the environment … maintaining high standards as we do so."[28]

As the details of future changes to environmental regulation are not yet known, this study has used existing, European Union derived environmental legislation, most significantly the Water Framework Directive, to assess the environmental impacts of planned development during the plan period for the Local Plan. Should this situation change, a review of this Water Cycle Study may be required considering any new emerging regulatory regime.

3.6 Water Industry Policy

3.6.1 The Water Industry in England

Water and sewerage services in England and Wales are provided by 10 Water and Sewerage Companies (WaSCs) and 12 'water-only' companies. The central legislation relating to the industry is the Water Industry Act 1991. The companies operate as regulated monopolies within their supply regions, although very large water users and developments are able to obtain water and/or wastewater services from alternative suppliers - known as inset agreements.

The Water Act 2014 aims to reform the water industry to make it more innovative and to increase resilience to droughts and floods. Key measures could influence the future provision of water and wastewater services include:

- Non-domestic customers will be able to switch their water supplier and/or sewerage undertaker (from April 2017)
- New businesses will be able to enter the market to supply these services
- Measures to promote a national water supply network
- Enabling developers to make connections to water and sewerage systems

3.6.2 Regulations of the Water Industry

The water industry is primarily regulated by three regulatory bodies;

- The Water Services Regulation Authority (OfWAT) – economic/ customer service regulation
- Environment Agency - environmental regulation
- Drinking Water Inspectorate (DWI) - drinking water quality

Every five years the industry submits a Business Plan to OfWAT for a Price Review (PR). These plans set out the companies' operational expenditure (OPEX) and capital expenditure (CAPEX) required to maintain service standards, enhance service (for example where sewer flooding occurs), to accommodate growth and to meet environmental objectives defined by the Environment Agency. OfWAT assesses and compares the plans with the objective of ensuring what are effectively supply monopolies and operating efficiently. The industry is currently in Asset Management Plan 6 (AMP6) which runs from 2015 to 2020. AMP7 commences in April 2020.

When considering investment requirements to accommodate growing demand, water companies are required to ensure a high degree of certainty that additional assets will be required before funding them. Longer term growth is, however, considered by the companies in their internal asset planning processes and in their 25-year Strategic Direction Statements and WRMPs.

28 The Future Relationship between the UK and the EU (2020) Accessed online at: https://www.gov.uk/government/speeches/the-future-relationship-between-the-uk-and-the-eu on 25/02/2020

3.6.3 Drainage and Wastewater Management Plans

The UK Water Industry Research (UKWIR) "21st Century Drainage" programme has brought together water companies, governments, regulators, local authorities, academics and environmental groups to consider how planning can help to address the challenges of managing drainage in the future. These challenges include climate change, population growth, urban creep and meeting the Water Framework Directive.

The group recognised that great progress has been made by the water industry in its drainage and wastewater planning over the last few decades, but that, in the future, there needs to be greater transparency and consistency of long-term planning. The Drainage and Wastewater Management Plan (DWMP) framework[29] sets out how the industry intends to approach these goals, with the objective of the water companies publishing plans by the end of 2022, in order to inform their business plans for the 2024 Price Review.

DWMPs will be prepared for wastewater catchments or groups of catchments and will encompass surface water sewers within those areas which do not drain to a treatment works. The framework defines drainage to include all organisations and all assets which have a role to play in drainage, although, as the plans will be water company led, it does not seek to address broader surface water management within catchments.

LPAs and LLFAs are recognised as key stakeholders and will be invited to join, alongside other stakeholders, the Strategic Planning Groups (SPGs) organised broadly along river basin district catchments.

DWMPs cannot inform this study, as process is only just commencing. In the future, however, DWMPs will provide more transparent and consistent information on sewer flooding risks and the capacity of sewerage networks and treatment works, and this should be taken into account in SFRAs, Water Cycle Studies, as well as in site-specific FRAs and Drainage Strategies.

3.6.4 Developer Contributions and Utility Companies

Developments with planning permission have a right to connect to the public water and sewerage systems, however, there is no guarantee that the capacity exists to serve a development.

Developers may requisition a water supply connection or sewerage system or self-build the assets and offer these for adoption by the water company or sewerage undertaker. Self-build and adoption are usually practiced for assets within the site boundary, whereas requisitions are normally used where an extension or upgrading the infrastructure requires construction on third party land. The cost of requisitions is shared between the water company and developer as defined in the Water Industry Act 1991.

Where a water company is concerned that a new development may impact upon their service to customers or the environment (for example by causing foul sewer flooding or pollution) they may request the LPA to impose a Grampian condition, whereby the planning permission cannot be implemented until a third-party secures the necessary upgrading or contributions.

The above arrangements are third party transactions because the Town and Country Planning Act Section 106 agreements and Community Infrastructure Levy funding may not be used to obtain funding for water or wastewater infrastructure.

3.6.5 Changes to Charging Rules for New Connections

29 A framework for the production of Drainage and Wastewater Management Plans, UK Water Industry Research (2018). Accessed online at: http://www.water.org.uk/wp-content/uploads/2018/12/Water-UK-DWMP-Framework-Report-Main-Document.pdf on: 20/01/2020

OfWAT, the water industry's economic regulator, has published new rules covering how water and wastewater companies may charge customers for new connections[30]. These rules apply to all companies in England and commenced on 1st April 2018. Severn Trent Water have now published their charging arrangements[31] The key changes include:

- More charges will be fixed and published on water company websites. This will provide greater transparency to developers and will also allow alternative connection providers to offer competitive quotations more easily
- There will be a fixed infrastructure charge for water and one for wastewater
- The costs of network reinforcement will no longer be charged directly to the developer in their connection charges. Instead, the combined costs of all of the works required on a company's networks, over a five-year rolling period, will be covered by the infrastructure charges payed for all new connections.
- The definition of network reinforcement has changed and will now apply only to works required as a direct consequence of the increased demand due to a development. Where the water company has not been notified of a specific development, for example when developing long-term strategic growth schemes, the expenditure cannot be recovered through infrastructure charges.
- Severn Trent Water[32] will provide 100% discount on the water infrastructure charge whereby builds are demonstrated to be below 110 litres per person per day. They also provide incentives for sewerage infrastructure charge: when there is no surface water connection, 100% discount is applied. Alternatively, when a surface water connection is available via a sustainable drainage system, the charge is reduced by 75%.

3.6.6 Sewers for Adoptions Version 8

Sewers for Adoption (SfA) provides detailed guidance for developers, designers and constructors on how to design and build foul and surface water sewerage systems to a standard such that they will subsequently be adopted by water companies, under Section 104 of the Water Industry Act. This is the method by which most new sewerage is designed, constructed and becomes a public sewer.

The standard, up to and including version 7, has included a narrow definition of sewers to mean below-ground systems comprising of gravity sewers and manholes, pumping stations and rising mains. This has essentially excluded the adoption of SuDS by water companies, with the exception of below-ground storage comprising of oversized pipes or chambers.

Water UK, the industry body representing water and sewerage companies in the UK, has led the development of version 8 (SfA8), which was released as a pre-implementation version in August 2018[33]. This recognises the roles of the various Risk Management Authorities with responsibilities for surface water management, and the expectation within NPPF that SuDS be implemented, as a first preference, for all developments. It therefore widens the definition of what can be defined as adoptable sewers, to include components which:

- drain buildings and yards appurtenant to buildings,

30 Charging rules for new connection services (English undertakers), OfWAT (2017). Accessed online at: https://www.ofwat.gov.uk/publication/charging-rules-new-connection-services-english-undertakers/ on: 20/01/2020
31 New Connections Charging, Severn Trent Water (2018). Accessed online at: https://www.stwater.co.uk/content/dam/stw/stw_buildinganddeveloping/STWChargingArrangementDocument-brandv0.230012018A.pdf on: 20/01/2020
32 Infrastructure Charges Discount Scheme, Severn Trent Water (2018). Accessed online at: https://www.stwater.co.uk/building-and-developing/regulations-and-forms/application-forms-and-guidance/infrastructure-charges/ 20/01/2020
33 Water UK (2018) Sewers for Adoption Eighth Edition. August 2018. Accessed online at: https://www.water.org.uk/publication/sewers-for-adoption/ on: 20/01/2020

- have a channel,
- convey water to a sewer, surface water body or groundwater, and
- have an effective point of discharge with a lawful authority to discharge.

This definition will allow for the adoption of components including swales, rills, bioretention systems, ponds, wetlands, basins, tanks, infiltration trenches and soakaways as adoptable sewers. The CIRIA SuDS Manual is widely referenced as the key source of design guidance. Watercourses and components which drain only highway surfaces are excluded for adoption under SfA 8.

The responsibility for the final approval of SfA 8 lies with the industry regulator OfWAT, and it is anticipated that it will come into effect in April 2020. During the life of the Local Plan, SfA 8 will provide developers with a nationally consistent route for having SuDS components adopted by the relevant water company.

4 Water Resources and Water Supply

4.1 Introduction

4.1.1 Surface Waters

Figure 4.1 shows the main watercourses within the Leicester area, which lies within the River Trent catchment. The main river in Leicester is the River Soar which flows from the south of the city to the north through the centre of Leicester. Tributaries of the River Soar through Leicester include the River Biam, Willow Brook, Bushby Brook, Evington Brook, Saffron Brook and the Melton Brook. The Grand Union Canal also joins the River Soar in the city. Just south of the study area, the Lubbesthorpe Brook, River Sence and Whetstone Brook drain into the River Soar, and north of the study area the River Wreake and the Rothley Brook join the River Soar.

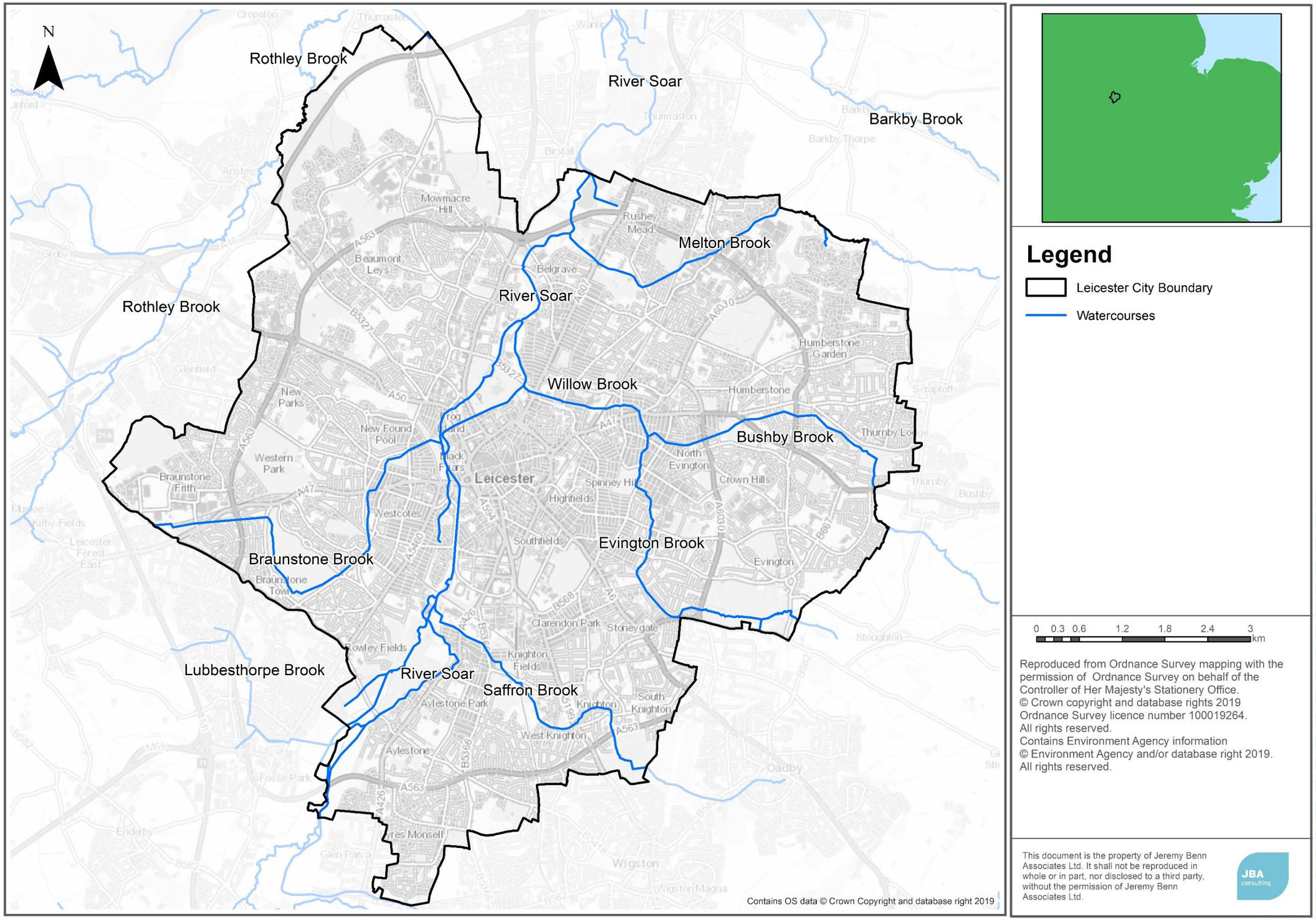


Figure 4.1 Significant watercourses in Leicester City

4.1.2 Geology

The geology of the catchment can be an important influencing factor in the way that water runs off the ground surface. This is primarily due to variations in the permeability of the surface material and bedrock stratigraphy.

Figure 4.2 shows the bedrock geology for the study area. This is mainly comprised of Triassic mudstone, siltstone and sandstone. The eastern part of the study area is comprised of Lias Group mudstone, siltstone, limestone and sandstone.

Figure 4.3 shows superficial (at the surface) deposits of clay, silt and sand along the course of the River Soar, Melton Brook, Willow Brook, Bushby Brook and Rothley Brook within wider areas of sand and gravel and diamicton (clay with flints).

Superficial deposits are the youngest geological deposits formed during the most recent period of geological time. They rest on older deposits or rocks referred to as bedrock. Blank spaces on the map indicate no deposits of this age exist in this area. They may include floodplain deposits, beach sand and glacial moraine.

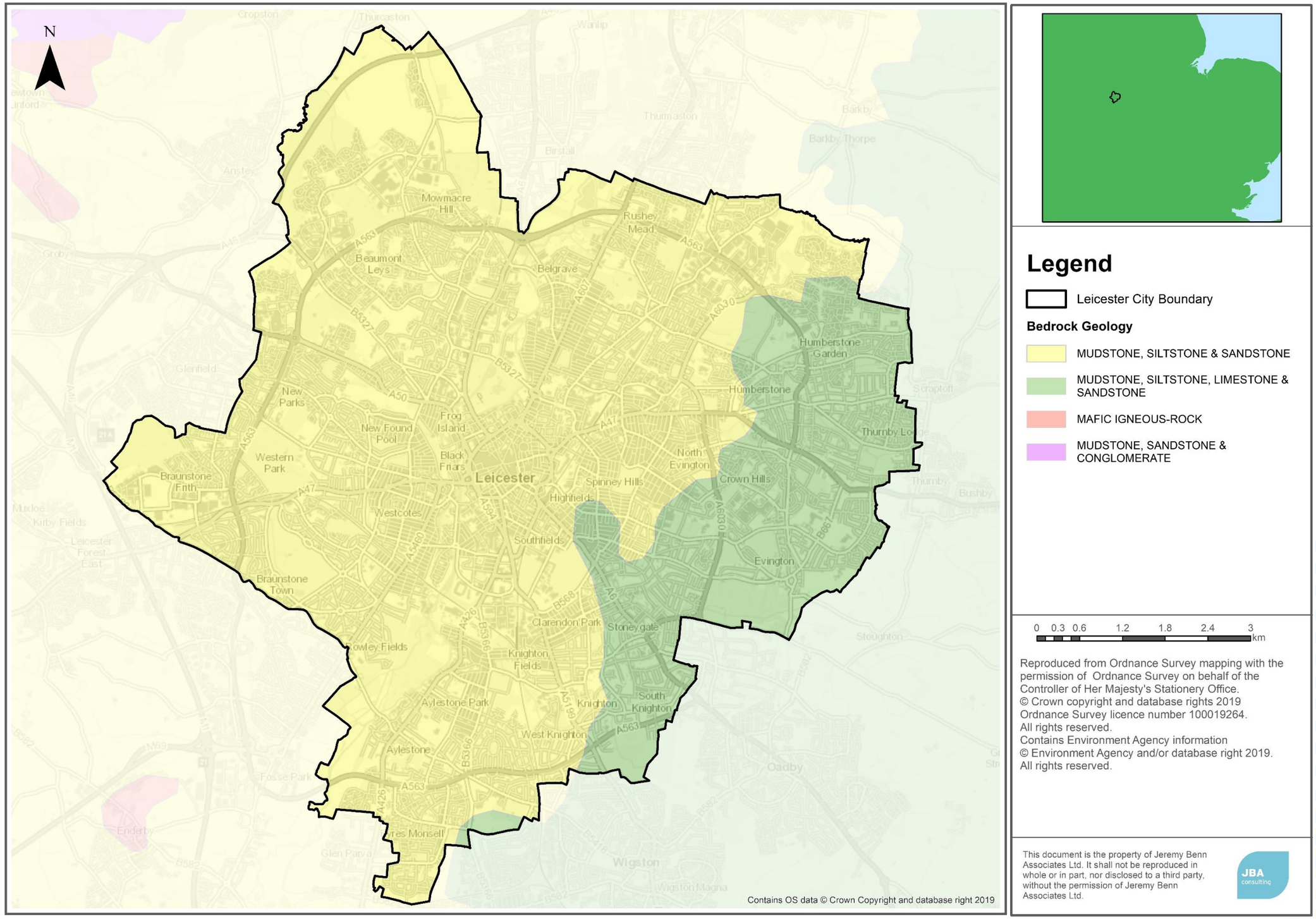


Figure 4.2 Bedrock geology in Leicester City

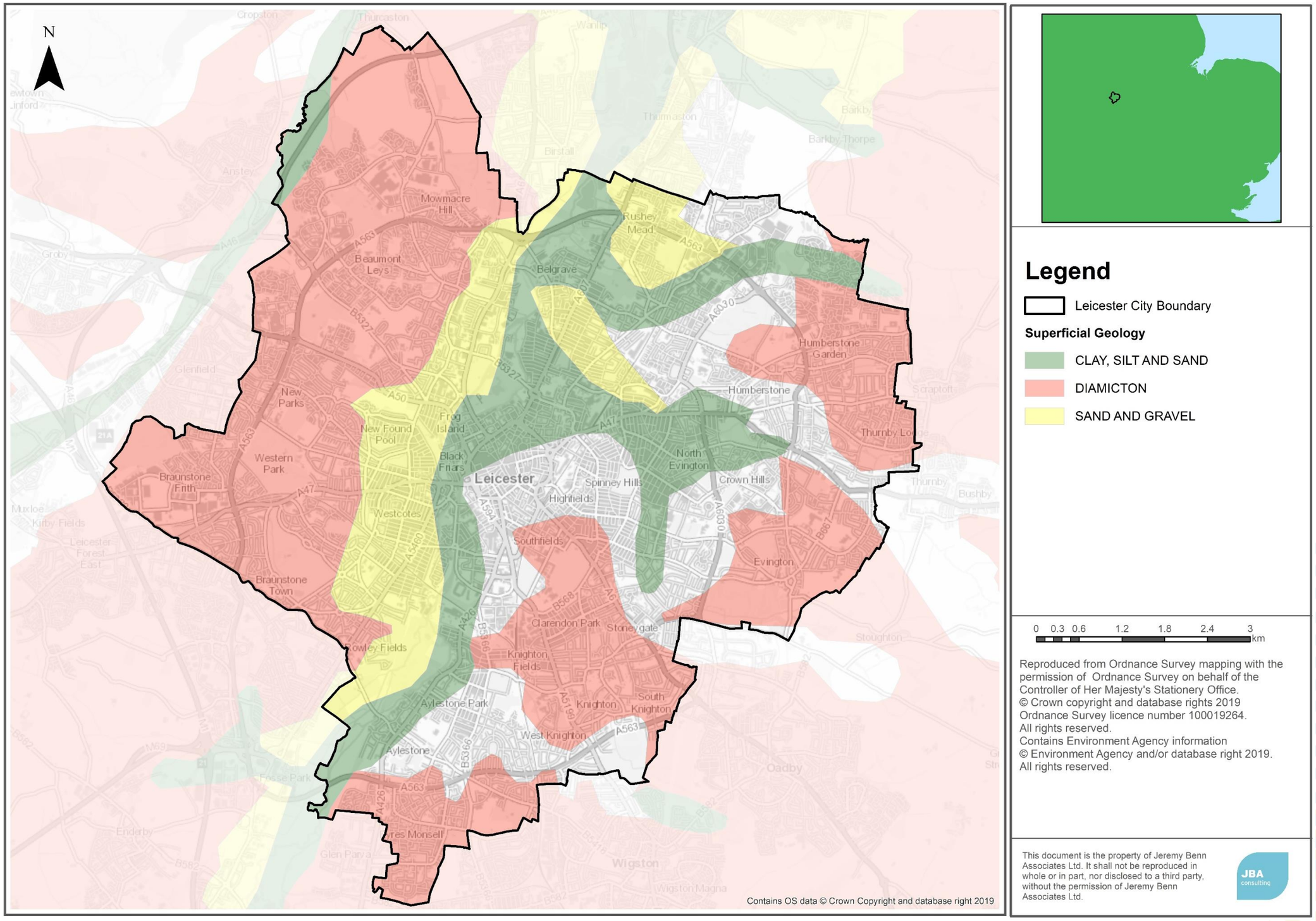


Figure 4.3 Superficial geology in Leicester City

4.2 Availability of Water Resources

4.2.1 Abstraction Licencing Strategy

The Environment Agency (EA), working through their Catchment Abstraction Management Strategy (CAMS) process, prepare an Abstraction Licensing Strategy (ALS) for each sub-catchment within a river basin. This licensing strategy sets out how water resources are managed in different areas of England and contributes to implementing the Water Framework Directive (WFD). The ALS report provides information on the resources available and what conditions might apply to new licences. The licences require abstractions to stop or reduce when a flow or water level falls below a specific threshold, as a restriction to protect the environment and manage the balance between supply and demand for water users. The CAMS process is published in a series of ALSs for each river basin.

All new licences, and some existing licenses, are time limited. This allows time for a periodic review of the specific area as circumstances may have changed since the licences were initially granted. These are generally given for a twelve-year duration, but shorter license durations may also be granted. This is usually based on the resource assessment and environmental sustainability. In some cases, future plans or changes may mean that the EA will grant a shorter time limited licence, so it can be re-assessed following the change. If a licence is only required for a short time period, it can be granted either as a temporary licence or with a short time limit. If a licence is considered to pose a risk to the environment it may be granted with a short time limit while monitoring is carried out. The licences are then replaced with a changed licence, revoked or renewed near to the expiry date.

The ALS are important in terms of the Water Resource Management Plans (WRMP) as this helps to determine the current and future pressures on water resources and how the supply and demand will be managed by the relevant water companies[34]. Leicester City is entirely covered by the Soar ALS as shown in Figure 4.4 below.

4.2.2 Resource Availability Assessment

In order to abstract surface water, it is important to understand what water resources are available within a catchment and where abstraction for consumptive purposes will not pose a risk to resources or the environment. The Environment Agency has developed a classification system which shows:

- The relative balance between the environmental requirements for water and how much has been licensed for abstraction;
- whether there is more water available for abstraction in the area;
- areas where abstraction may need to be reduced.

The availability of water for abstraction is determined by the relationship between the fully licensed (all abstraction licences being used to full capacity) and recent actual flows (amount of water abstracted in the last 6 years) in relation to the Environmental Flow Indicator (EFI). Results are displayed using different water resource availability colours, further explained in Table 4.1. In some cases, water may be scarce at low flows, but available for abstraction at higher flows. Licences can be granted that protect low flows, this usually takes the form of a "Hands-off Flow" (HOF) or "Hands-off Level" (HOL) condition on a licence.

Groundwater availability as a water resource is assessed similarly, unless better information on principle aquifers is available or if there are local issues that need to be taken into account.

34 Environment Agency (2018) Managing Water Abstraction. Accessed Online at: https://www.gov.uk/government/collections/water-abstraction-licensing-strategies-cams-process on: 20/01/2020

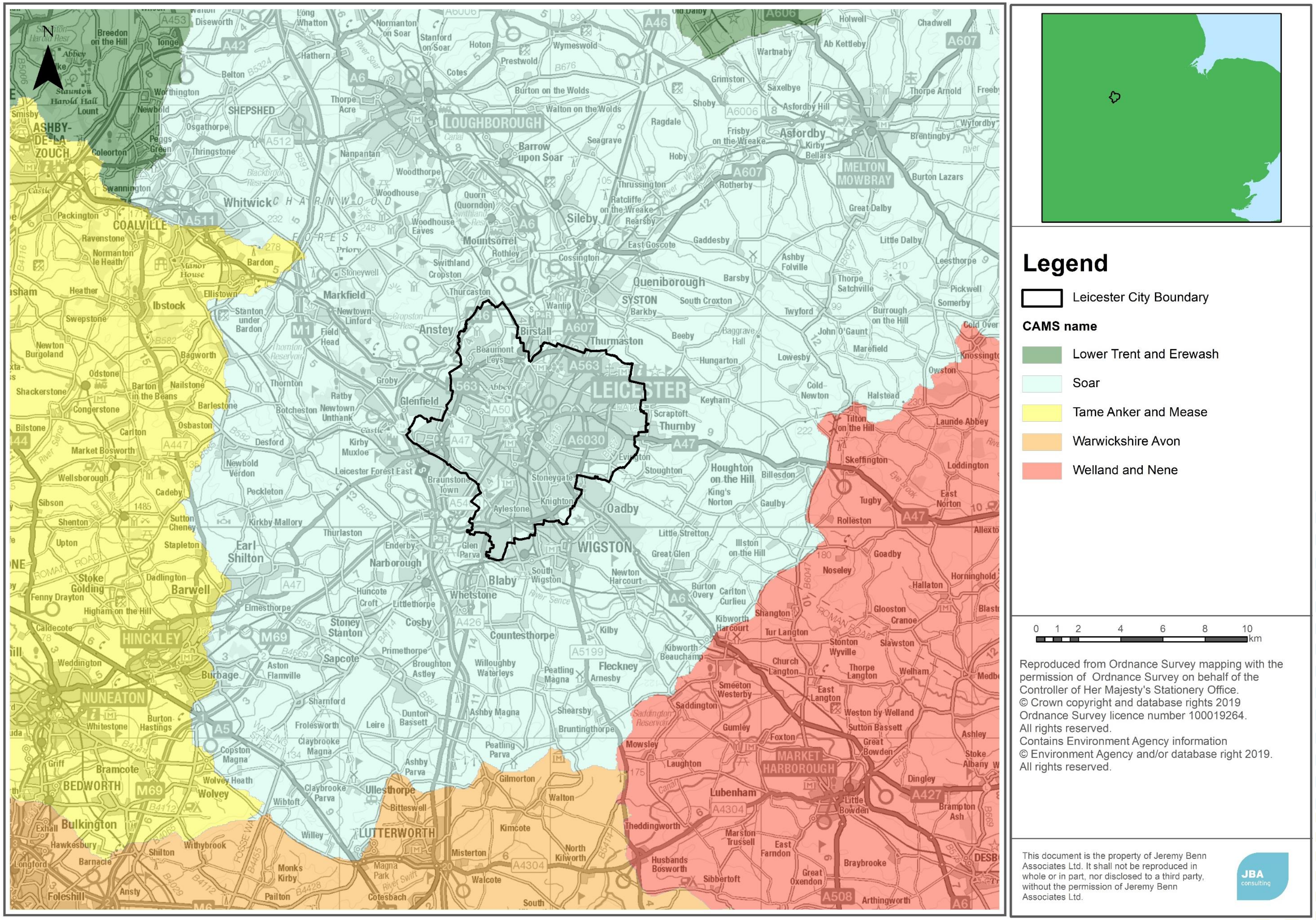


Figure 4.4 Leicester City within the Soar ALS

Table 4.1 Implications of Surface Water Resource Availability Colours

Water Resource Availability Colour	Implications for Licensing
High hydrological regime	There is more water than required to meet the needs of the environment. Due to the need to maintain the near pristine nature of the water body, further abstraction is severely restricted.
Water available for licensing	There is more water than required to meet the needs of the environment. Licences can be considered depending on local/downstream impacts.
Restricted water available for licensing	Fully Licensed flows fall below the Environmental Flow Indicator (EFI). If all licensed water is abstracted there will not be enough water left for the needs of the environment. No new consumptive licences would be granted. It may also be appropriate to investigate the possibilities for reducing fully licensed risks. Water may be available via licence trading.
Water not available for licensing	Recent Actual flows are below the Environmental Flow Indicator (EFI). This scenario highlights water bodies where flows are below the indicative flow requirement to help support Good Ecological Status. No further licences will be granted. Water may be available via licence trading.
HMWBs (and /or discharge rich water bodies)	These water bodies have a modified flow that is influenced by reservoir compensation releases or they have flows that are augmented. There may be water available for abstraction in discharge rich catchments.

4.2.3 Soar ALS

The Soar ALS[35] extends from the source of the River Soar in Monks Kirby, south of the study area, to its confluence with the River Trent at Trent Lock.

The vast majority of water supply is imported from neighbouring catchments, meaning there are few water resource pressures within the Soar ALS. Water resources in the Soar ALS are largely reliable, with the majority of the catchment having water resources available at least 70% of the time. Small areas of the catchment are far less reliable, with water resources being available for less than 30% of the time. These areas are outside of the study area, around Markfield and Charnwood Forest and north of Asfordby.

Surface water flows are assessed at Assessment Points (APs), which are significant points on the river, i.e. where two major rivers join or at a gauging station. There are 8 APs within the Soar ALS, none of which fall within the study area. The nearest APs to Leicester City are the River Soar at Littlethorpe AP1, River Sence, AP2, River Wreake AP4 and Rothley Brook AP5. Currently there is water available for further licensing at each of these APs, subject to a HOF of 340ML/d at Kegworth at the downstream end of the River Soar.

Groundwater abstractions which directly affect surface water flows are assessed in the same way as surface water abstractions.

Resource availability for AP 1, 2, 4 and 5 are presented in Table 4.2 below.

35 Soar abstraction licensing strategy (2013) Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291399/LIT_2646_3c9ca3.pdf on: (30/09/2019)

Table 4.2 Soar ALS resource availability

AP	Name	ALS	Local resource availability	HOF Q (1)	Days p.a (2)	HOF (Ml/d) (3)
1	River Soar at Littlethorpe	Soar	Water available for further licensing	340Ml/d at Lower River Soar – Kegworth gauging station	329	17 (available throughout the whole catchment, but not necessarily at any individual assessment point)
2	River Sence					
4	River Wreake					
5	Rothley Brook					

4.2.4 Recommendations for better management practices

The main options for this identified in the ALS are to adopt water efficiency and demand management techniques. Methods include:

- Testing the level of water efficiency before granting an abstraction licence,
- Promoting efficient use of water,
- Taking actions to limit the demand,
- Reducing leakage, and
- Embedding policies for low-water consumption design in new buildings into spatial plans.

This would ultimately cut the growth in abstraction and limit the impacts on flow and the ecology.

4.3 Water Resource Assessment: Water Resource Management Plans

4.3.1 Introduction

When new development within a Local Planning Authority is being planned, it is important to ensure that there are sufficient water resources in the area to cover the increase in demand without risk of shortages in the future or during periods of high demand, and without causing a negative impact on the waterbodies from which water is abstracted.

The aim of this assessment was to compare the future additional demand as a result of development proposed within the emerging Local Plan, with the demand allowed for by Severn Trent Water in their Water Resource Management Plans.

The water resources assessment has been carried out utilising two approaches; initially by reviewing the Water Resource Management Plans (WRMPs) of Severn Trent Water and secondly by providing the water company with a growth estimate allowing them to assess the impact of planned growth on their water resource zone.

4.3.2 Methodology

STW's Water Resource Management Plan (WRMP)[36], covering the period 2020 to 2045 was reviewed and attention was mainly focussed upon:

- The available water resources and future pressures which may impact upon the supply element of the supply/demand balance
- The allowance within those plans for housing and population growth and its impact upon the demand side of the supply/demand balance

36 Water Resources Management Plan 2019, Severn Trent Water (2019). Accessed online at: https://www.severntrent.com/about-us/future-plans/water-resource-management/wrmp-19-documents/on: 20/01/2019

The spatial boundaries for Severn Trent's Strategic Grid WRZ were used to overlay the local authority boundaries. The Ministry for Housing, Communities and Local Government (MHCLG) 2014-based estimates of household growth up to 2041[37] were collated for the local authorities which lie within the Strategic Grid. The percentage of the current population of each local authority within the WRZ was estimated from the OS Code Point dataset and the WRZ boundary. The assessment has used MHCLG figures, because they are available for all LPAs within the water resource zone, and over a consistent timescale and methodology. The resulting total number of households in the base year within the WRZ is comparable with the figures quoted in the WRMPs.

The results were assessed using a red/amber/green traffic light definition to score the water resource zone:

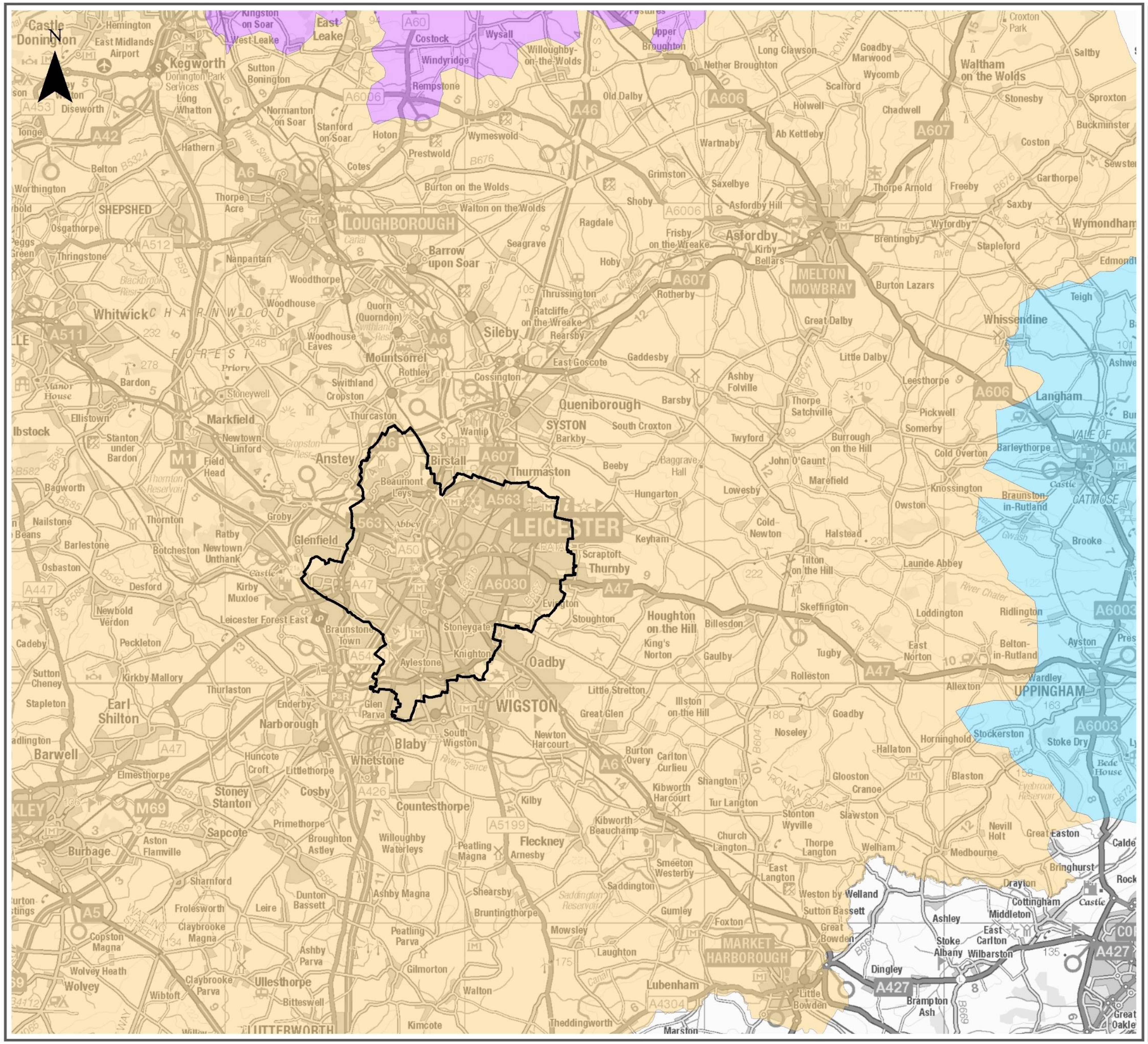
Adopted WRMP has planned for the increase in demand, or sufficient time to address supply demand issues in the next WRMP.	Insufficient evidence in adopted WRMP to confirm that the planned increase in demand can be met.	Adopted WRMP does not take into consideration the planned increase in demand. Additional water resources may be required.

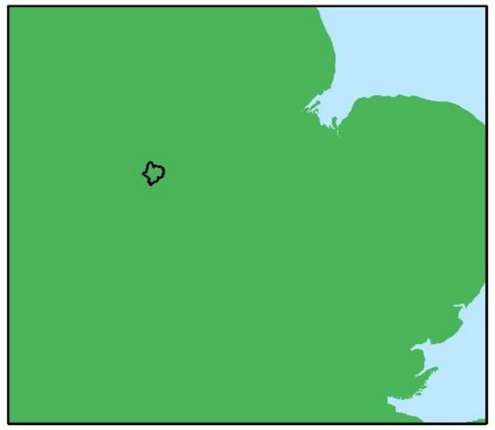
4.3.1 Severn Trent Water

Severn Trent Water is responsible for supplying the entirety of Leicester City with water. For the purposes of water resources planning, the supply area is divided into 15 Water Resources Zones (WRZs) which vary greatly in scale and have unique water resource concerns. Leicester City is entirely covered by the Strategic Grid WRZ, the largest of the resource zones which supplies the majority of Severn Trent Water's customers.

Figure 4.5 shows the location of Leicester City within the Strategic Grid WRZ.

37 2014-Based Household Projections for England, Office for National Statistics (2018). Accessed online at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland on: 20/01/2020





Legend

- Leicester City Boundary
- Strategic Grid WRZ
- Rutland WRZ
- Nottinghamshire WRZ

0 1 2 4 6 8 10 km

Figure 4.5 Leicester City within the Strategic Grid WRZ

Severn Trent's WRMP forecasts a significant deficit between supply and demand for water, with a focus to prevent the risk of future environmental deterioration, meaning that alternative ways of meeting customer demand need to be found as current water sources become unreliable. The water company aims to do this by:

- Using demand management measures to reduce the amount of water that is needed to put into the supply by:
    - Educating customers to use less water,
    - Reducing network leakage,
    - Reducing consumption by increasing the coverage of water meters.
- Making the best of sustainable sources of supply by:
    - Reducing abstraction from sources that have a negative environmental impact,
    - Ensuring future water abstractions do not pose a risk of environmental deterioration (a requirement of the Water Framework Directive),
    - Improving resilience and flexibility of the supply system,
    - Increasing or optimising outputs for existing sustainable sources,
    - Improving habitats and ecological resilience to low flows using catchment restoration techniques,
    - Protecting drinking water supply sources from risk of pollution using catchment management measures,
    - Optimising national use of resources.

Across all of their WRZs, Severn Trent aim to improve long term supply capability by replacing output from unsustainable sources of abstraction. This includes reducing the pressures upon groundwater abstraction ensuring that there is no future increase associated with this source. Consequently, Severn Trent are focusing their supply upon surface water abstraction and existing reservoir storage. Also, it is proposed that the strategic water distribution links will be enhanced to allow increased flexibility around the system to move water to locations that require it most.

Across the water supply area, 34% of supply is provided by groundwater, with the majority (approximately 88%) being derived from Sherwood Sandstone or sandstone aquifers in the Midlands region. The sandstone aquifers have substantial storage and are typically not sensitive to short term changes in precipitation.

Vulnerability assessments upon the WRZ's across the supply area identified those most sensitive to the impacts of climate change. The results showed that the largest WRZs (the Strategic Grid and Nottingham) are both vulnerable to potential changes in temperature and rainfall and were given a "high" vulnerability to climate change.

STW's Strategic Grid, Nottinghamshire and North Staffordshire WRZs show the greatest supply/demand deficit within STW's supply area. Strategic Grid shows a deficit of 16.24 Ml/d by 2021-22, with a maximum potential deficit over the WMRP period of 244.50 Ml/d in 2039-40. Key points outlined in the WRMP to target this deficit in these areas are outlined in Table 4.3.

Table 4.3 Summary of Strategic Grid Water Management Strategy

Delivery Period	Scheme Description	Assumed Benefit
AMP7 2020-2025	River Trent to Site Q water treatment works transfer with Site Q treatment enhancements	26 Ml/d
AMP7 to AMP8 2020-2030	Site E water treatment works expansion and transfer main supported by raw augmentation of the River Trent	35 Ml/d
	Site B water treatment works enhancements	3.6 Ml/d
	Site J water treatment works expansion	15 Ml/d
	Thornton Reservoir to support Site B water treatment works	8 Ml/d
	Site C Reservoir capacity increase (Size A) with transfer from Site C water treatment works to Coventry	9 Ml/d
	Site R water treatment works to Grindleford pipeline capacity increase	7.5 Ml/d
AMP8 2025-2030	Site C water treatment works enhancements	8 Ml/d
	Site F water treatment works expansion	10 Ml/d
	Maximise deployment from Diddlebury water treatment works and Munslow borehole	0.9 Ml/d
AMP7 to AMP9 2020-2035	River Soar to support Site B water treatment works	17 Ml/d
	East Midlands raw water storage (Site CQ) including new water treatment works	45 Ml/d
AMP8 to AMP9 2025-2035	Stanford Reservoir capacity increase (Size A)	2.5 Ml/d
	Site A Reservoir capacity increase (Size A)	2.5 Ml/d
	Ladyflatte boreholes recommissioning	2.7 Ml/d
	Lower Shustoke capacity increase (Size A)	2.5 Ml/d
	Site I water treatment works enhancements	2 Ml/d

4.3.2 Population and household growth

Table 4.4 shows a comparison of household growth forecasts for the Strategic Grid WRZ, the Ministry of Housing Communities and Local Government (MHCLG) 2014-based household projections, and Leicester City Council's Standard Method assessment of housing need. For consistency with the water company dataset start that starts in 2020, the plan period was reduced to 2020-2036 for the following comparison.

The MHCLG 2014-based projections forecast a 17% increase in the number of households in Leicester City between 2020 and 2036, higher than average for the other LPAs in the strategic grid WRZ (13%). The MHCLG projections for all authorities in the Strategic Grid WRZ are broadly in line with the growth that has been accounted for in the WRMP.

LCC's Standard Method assessment of housing need suggests that 29,104 new dwellings are required for the city between 2019 and 2036. Over this period the number of households would increase by approximately 20%, which is greater than what has been accounted for in the WRMP's forecast for the Strategic Grid WRZ.

Table 4.4 Comparison of household growth forecasts

Forecast	2020	2036	% increase
MHCLG 2014-based forecast – Leicester City	136,303	159,377	17%
MHCLG 2014-based forecast – All LPAs in Strategic Grid WRZ	2,247,981	2,543,439	13%
WRMP Forecast – Strategic Grid	2,406,140	2,703,240	12%
Standard Method assessment of housing need (LCC)	136,303	163,695	20%

4.3.3 Summary

All settlements and sites within Leicester City are supplied by Severn Trent Water and are located within the Strategic Grid WRZ. Severn Trent Water's WRMP highlights the significant potential deficit between supply and demand forecast and emphasises the need to reduce this and prevent the risk of future environmental deterioration.

The growth forecast planned for in the WRMP is less than that expected if the level of growth forecast by the MHCLG is realised, and less than is planned by Leicester City Council from their Standard Method assessment of housing need.

Although Severn Trent Water has not relied on new homes being more water-efficient than existing metered homes, the opportunity, through the planning system, to ensure that new homes do meet the higher standard of domestic water usage, at no significant additional cost to the developer, would be in line with general principals of sustainable development, and reducing energy consumed in the treatment and supply of water.

4.4 Severn Trent Water's assessment

Severn Trent's comments regarding water resources was that they have *"no areas of concerns regarding the sites proposed".* While the Leicester development area *"does not pose a significant risk to the quantitative status of groundwater or surface waterbodies in the area",* they recommend *"that best practice is always used and that water efficiency measures are specified by the planning authority."*

4.5 Water efficiency and water neutrality

It is widely recognised that the climate is changing and in response Leicester City Council declared a climate emergency in February 2019[38]. Climate change is predicted to increase pressure on water resources, increasing the potential for a supply-demand deficit in the future, and making environmental damage from over abstraction of water resources more likely. Furthermore, the delivery of water and wastewater services and the heating of water in the home require high energy inputs, and therefore contribute directly to emissions of greenhouse gases. Water efficiency therefore reduces energy use and carbon emissions.

It is important therefore that new development does not result in an unsustainable increase in water abstraction. This can be done in a number of ways from reducing the water demand from new houses through to achieving "water neutrality" in a region by offsetting a new developments water demand by improving efficiency in existing buildings.

38 Climate Emergency, Leicester City Council, 2019. Accessed online at: https://www.leicester.gov.uk/your-council/policies-plans-and-strategies/environment-and-sustainability/climate-emergency/ on: 17/12/2019

Severn Trent Water provided the following comments on water efficiency:

> Part G of Building Regulations specify that new homes must consume no more than 125 litres of water per person per day. We recommend that you consider taking an approach of installing specifically designed water efficient fittings in all areas of the property rather than focus on the overall consumption of the property. This should help to achieve a lower overall consumption than the maximum volume specified in the Building Regulations.
>
> We recommend that in all cases you consider:
>
> - Single flush siphon toilet cistern and those with a flush volume of 4 litres.
> - Showers designed to operate efficiently and with a maximum flow rate of 8 litres per minute.
> - Hand wash basin taps with low flow rates of 4 litres or less.
> - Water butts for external use in properties with gardens.
>
> To further encourage developers to act sustainably Severn Trent currently offer a 100% discount on the clean water infrastructure charge if properties are built so consumption per person is 110 litres per person per day or less. More details can be found on our website
>
> **https://www.stwater.co.uk/building-and-developing/regulations-and-forms/application-forms-and-guidance/infrastructure-charges/**
>
> We would encourage you to impose the expectation on developers that properties are built to the optional requirement in Building Regulations of 110 litres of water per person per day.

It is for Local Authorities to establish a clear need to adopt the tighter water efficiency target through the building regulations. This should be based on:

- Existing sources of evidence such as:
  - The Environment Agency classification of water stress
  - Water resource management plans produced by water companies
  - River Basin Management Plans which describe the river basin district and the pressure that the water environment faces. These include information on where water resources are contributing to a water body being classified as 'at risk' or 'probably at risk' of failing to achieve good ecological status, due to low flows or reduced water availability.
- Consultations with the local water and sewerage company, the Environment Agency and catchment partnerships
- Consideration of the impact on viability and housing supply of such a requirement

4.5.1 Water Stress

Water stress is a measure of the level of demand for water (from domestic, business and agricultural users) compared to the available freshwater resources, whether surface or groundwater. Water stress causes deterioration of the water environment

in both the quality and quantity of water, and consequently restricts the ability of a waterbody to achieve a "Good" status under the WFD.

The Environment Agency has undertaken an assessment of water stress across the UK. This defines a water stressed area as where:

- "The current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand; or
- The future household demand for water is likely to be a high proportion of the effective rainfall available to meet that demand."

In the Environment Agency and Natural Resources Wales assessment the Severn Trent supply region is classed as an area of "moderate" water stress.

4.5.2 River Basin Management Plans

One of the challenges identified in the River Basin Management Plan (RBMP) for the Humber River Basin[39] is "changes to natural flow and levels of water". The management recommendations from the RBMP are listed below:

- **All sectors** take up or encourage water efficiency measures, including water industry work on metering, leakage, audits, providing water efficient products, promoting water efficiency and education.
- **Local Government** sets out local plan policies requiring new homes to meet the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010.
- **Industry manufacturing and other business** implement tighter levels of water efficiency, as proposed by changes to the Building Regulations.
- **Agriculture and rural land management** manage demand for water and use water more efficiently to have a sustainable water supply for the future.
- **Local government** commissions water cycle studies to inform spatial planning decisions around local water resources.

The RBMP goes on to state that "dealing with unsustainable abstraction and implementing water efficiency measures is essential to prepare and be able to adapt to climate change and increased water demand in the future."

4.5.3 National Water Resources Framework

A new National Framework for Water Resources was published by the Government in March 2020. This outlines the water resources challenges facing England and sets out the strategic direction for the work being carried out by regional water resource groups.

A range of options were explored, and the most ambitious scenarios rely on policy change to introduce mandatory labelling of water using fittings and associated standards. The Government is currently reviewing policy on water efficiency following a recent consultation. The framework proposes that regional groups plan to help customers reduce their water use to around 110 l/p/d. This is achievable without policy interventions.

This aligns with the tighter standard of 110 l/p/d per day as described in building regulations. A water efficiency target higher than 110 l/p/d would make the overall target for the UK harder to achieve.

39 Part1: Humber river basin district River basin management plan (LIT 10312), Environment Agency 2015. Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718328/Humber_RBD_Part_1_river_basin_management_plan.pdf on: 31/03/2020

4.5.4 Impact on viability

As outlined in section 3.2.4, the cost of installing water-efficient fittings to target a per capita consumption of 110l/d has been estimated as a one-off cost of £9 for a four-bedroom house. Research undertaken for the devolved Scottish and Welsh governments indicated potential annual savings on water and energy bills for householders of £24-£64 per year as a result of such water efficiency measures[40]. Water efficiency is therefore not only viable but of positive economic benefit to both private homeowners and tenants.

4.5.5 Summary of evidence for tighter efficiency standard

The strategic direction in the UK set out in the new National Water Resources Framework is to attain an average household water efficiency of 110 l/p/d by 2050. This also aligns with the recommendation in the River Basin Management Plan aimed at reducing the impact of abstraction. There would also be a positive economic impact for residents in terms of reduced energy and water bills.

It is therefore recommended that the tighter water efficiency standard of 110 litres per person per day as described in Part G of Schedule 1 to the Building Regulations 2010 is adopted for Leicester.

4.5.6 Water neutrality concept

Water neutrality is a relatively new concept for managing water resources, but one that is receiving increased interest as deficits in future water supply/demand are identified. The definition adopted by the Government and the Environment Agency[41] is:

> ***"For every development, total water use in the wider area after the development must be equal to or less than total water use in the wider area before development".***

It is useful to also refer to the refined definition below:

"For every new significant development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community, where practical to do so, and these water savings must be sustained over time" (V Ashton, 2014)[42]

This definition states the need to sustain water saving measures over time, and the wording "predicted increase in total water demand" reflects the need for water neutrality to be designed in at the planning stage.

Both definitions refer to water use in the region or "wider area", and the extent of this area should be appropriate to local authority boundaries, water resource zones, or water abstraction boundaries depending on what is appropriate for that particular location. For instance, if a development site is in an area of water stress relating to a particular abstraction source, offsetting water use in a neighbouring town that is served by a different water source will not help to achieve water neutrality.

In essence water neutrality is about accommodating growth in a region without increasing overall water demand.

Water neutrality can be achieved in a number of ways:

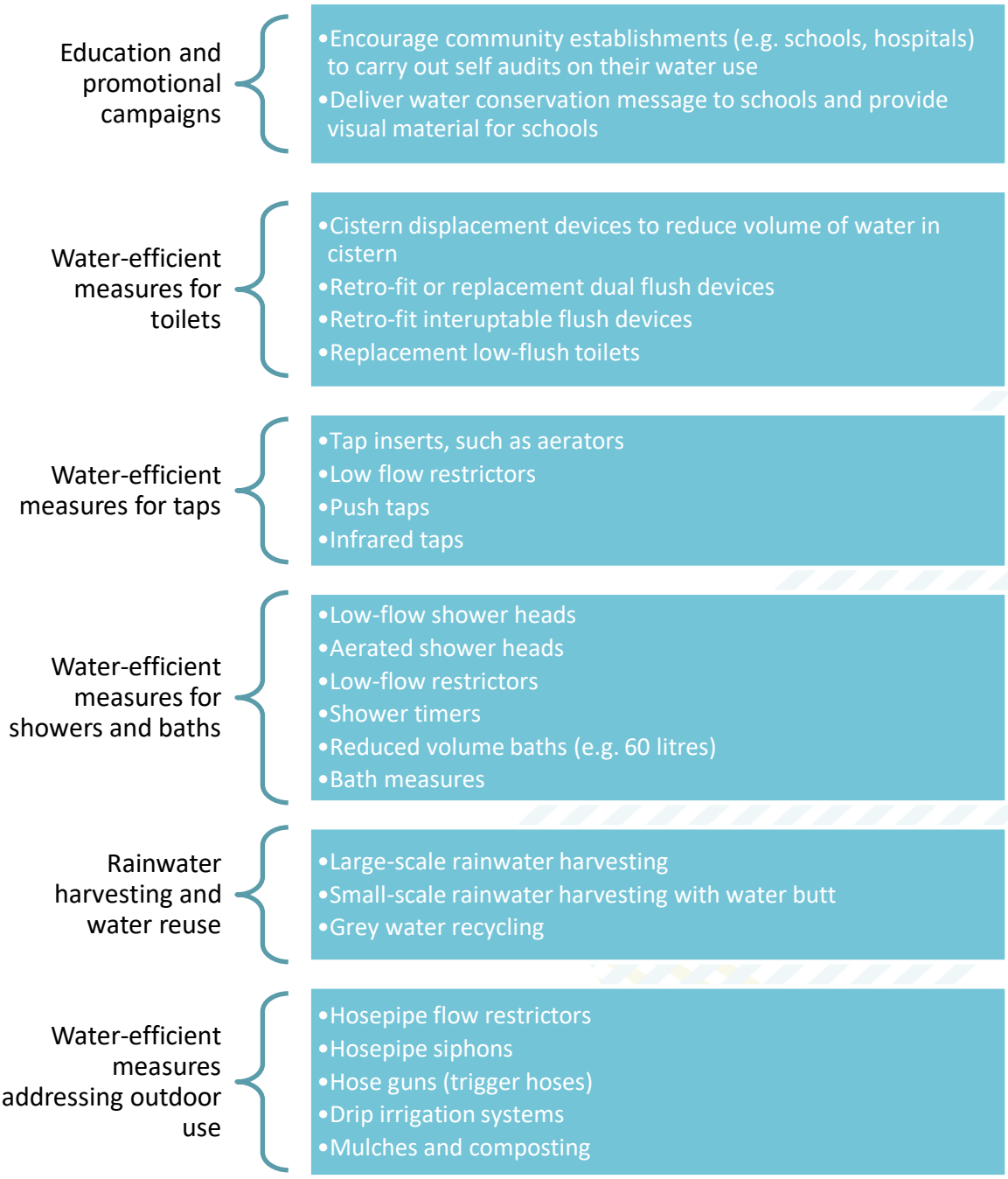
- Reducing leakage from the water supply networks

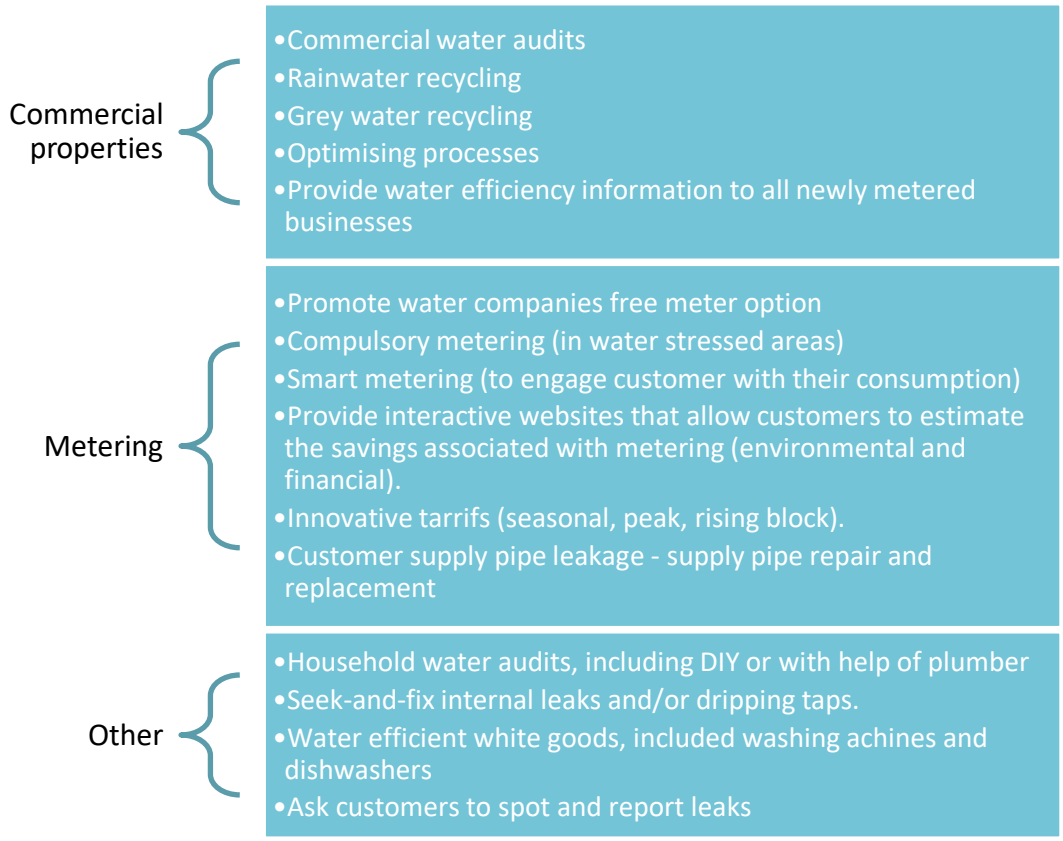
40 Waterwise (2018) Advice on water efficient new homes in England. Accessed online at: https://waterwise.org.uk/wp-content/uploads/2019/10/Advice-on-water-efficient-homes-for-England061118.pdf on 06/04/2020
41 Water Neutrality: An improved and expanded water resources management definition (SC080033/SR1), Environment Agency, 2009. Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291675/scho1009bqzr-e-e.pdf on: 26/11/2019
42 Water Resources in the Built Environment, edited by Booth and Charlesworth (2014). Published by Wiley.

- Making new developments more water-efficient
- "Offsetting" new demand by retrofitting existing homes with water-efficient devices
- Encouraging existing commercial premises to use less water
- Implementing metering and tariffs to encourage the wise use of water
- Education and awareness-raising amongst individuals

Suggestions for water-efficiency measures are listed in Figure 4.6 below.

4.5.7 Consumer water efficiency measures





Source: Adapted from Booth and Charleswell 2014

Figure 4.6 Consumer water-efficiency measures

Water neutrality is a concept that addresses the wastage of water at all points in its supply and usage. It therefore requires measures in new build properties (that could be mandated through policy) as well as in existing properties, in the regulation of water using appliances and fittings, in tackling leakage in water supply systems and consumer pipework, and in public attitudes and behaviours to the use of water. So, meeting the higher efficiency standards in Building Regulations is one important step for new build properties, but is one part of the overall picture. Many interventions are designed to reduce water use if operated in a particular way, and so rely on the user being aware and engaged with their water use. The educational aspect is therefore important to ensure that homeowners are aware of their role in improving water efficiency.

4.5.8 Rainwater and Greywater Recycling

Rainwater harvesting

Rainwater recycling or rainwater harvesting (RwH) is the capture of water falling on buildings, roads or pathways that would normally be drained via a surface water sewer, infiltrate into the ground or evaporate. In the UK this water cannot currently be used as a drinking water supply as there are strict guidelines on potable water, but it can be used in other systems within domestic or commercial premises.

Systems for collection of rainwater can be simple water butts attached to a drainpipe on a house, or it could be a complex underground storage system, with pumps to supply water for use in toilet flushing and washing machines. By utilising rainwater in this way there is a reduced dependence on mains water supply for a large proportion of the water use in a domestic property.

Benefits of RwH

- **RwH reduces the dependence on mains water supply – reducing bills for homeowners and businesses**
- **Less water needs to be abstracted from river, lakes and groundwater**
- **Stormwater is stored in a RwH system reducing the peak runoff leaving a site providing a flood risk benefit (for smaller storms)**
- **By reducing surface water flow, RwH can reduce the first flush effect whereby polluted materials adhering to pavement surfaces during dry periods are removed by the first flush of water from a storm and can cause pollution in receiving watercourses.**

Challenges of RwH

- **Dependency on rainfall can limit availability of harvested rainwater during drought and hot weather events.**
- **Increased capital (construction) costs to build rainwater harvesting infrastructure into new housing (£2,674 for a 3/4 bed detached home)**
- **Payback periods are long as the cost of water is low so there is little incentive for homeowners to invest. For further information see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/353387/021c_Cost_Report_11th_Sept_2014_FINAL.pdf**

Greywater harvesting

Greywater refers to water that has been "used" in the home in appliances such as washing machines, showers and hand basins. Greywater recycling or greywater harvesting (GwH) is the treatment and re-use of this water in other systems such as for toilet flushing. By their nature, GwH systems require more treatment and are more complex than RwH systems, and there are limited examples of their use in the UK.

Greywater re-use refers to systems where wastewater is taken from source and used without further treatment. An example of this would be water from a bath or shower being used on plants in the garden. This sort of system is easy to install and maintain, however as mentioned above the lack of treatment to remove organic matter means that the water can rapidly become septic, so can only be stored for very short periods of time.

Greywater recycling refers to systems where wastewater undergoes some treatment before it is used again. These systems are complex and require a much higher level of maintenance than RwH or greywater re-use systems.

Domestic water demand can be significantly reduced by using GwH, and unlike with a RwH system where the availability of water is dependent on the weather, the source of water is usually constant (for instance if it is from bathing and showering). However, the payback period for a GwH system is usually long, as the initial outlay is large, and the cost of water relatively low. Viability of greywater systems for domestic applications is therefore currently limited in the UK. Communal systems may offer more opportunities where the cost can be shared between multiple households.

4.5.9 Energy and Water use

According to EU statistics (Eurostat 2017), 17% of the UK's domestic energy usage is for water heating. If less water was being used within the home, for instance through more water efficient showers, less water would need to be heated, and overall domestic energy usage would be reduced.

The Government is currently consulting on a Future Homes Standard that will involve changes to Part L (conservation of fuel and power) of the Building Regulations for new dwellings. Whilst there is no direct mention of water efficiency in this consultation, there is an important link between water use and energy use, and therefore between water use and carbon footprint.

4.5.10 Funding for water neutrality

Water neutrality is unlikely to be achieved by just one type of measure, and likewise it is unlikely to be achieved by just one funding source. Funding mechanisms that may be available could be divided into the following categories:

- Infrastructure-related funding (generally from developer payments)
- Fiscal incentives at a national or local level to influence buying decisions of households and businesses
- Water company activities, either directly funded by the five-year price review or as a consequence of competition and individual company strategies
- Joint funding through energy efficiency schemes (and possibly to integrate with the heat and energy saving strategy).

Currently in the UK, the main funding resource for the delivery of water efficiency measures is the water companies, with some discretionary spending by property owners or landlords. For water neutrality to be achieved, policy shifts may be required in order to increase investment in water efficiency. Possible measures could include:

- Further incentivisation of water companies to reduce leakage and work with customers to reduce demand
- Require water efficient design in new development
- Developer funding to contribute towards encouraging water efficiency measures
- Require water efficient design in refurbishments, when a planning application is made
- Tighter standards on water using fittings and appliances.

4.6 Conclusions

The WRMP shows a supply-demand deficit from 2021-22 for the Strategic Grid WRZ if no action is taken. It goes on to define a number of actions that will address this.

Severn Trent's comments regarding water resources was that they have *"no areas of concerns regarding the sites proposed".* While the Leicester development area *"does not pose a significant risk to the quantitative status of groundwater or surface waterbodies in the area",* they recommend *"that best practice is always used and that water efficiency measures are specified by the planning authority."*

Policies to reduce water demand from new developments, or to go further and achieve water neutrality in certain areas could be defined to reduce the potential environmental impact of additional water abstractions in Leicester City, help to achieve reductions in carbon emissions in Leicester and reduce energy and water bills for residents. Achieving water neutrality would require a range of measures including water efficient fittings in new homes, but would also require the implementation of measures beyond the scope of the Local Plan including regulation of water-using appliances and fittings, reduction of leakage from supply mains and consumer pipework, and changes to consumer attitudes and behaviours. Developing a plan for water neutrality is, therefore, beyond the scope of this study, however it is recommended that the Council continues to engage with Severn Trent Water and the Environment Agency and Water Resources West to consider how a water neutrality approach could contribute towards sustainable development in the city.

A policy requiring new residential development to achieve the tighter water efficiency target of 110 l/p/d as described in Part G of Building Regulations is line with the strategic direction outlined in the National Water Resources Framework, and the recommendations of the River Basin Management Plan. Furthermore, it is viable, can be implemented at negligible cost and will reduce energy and water bills for residents.

4.7 Recommendations

The recommendations for water resources are provided in Table 4.5.

Table 4.5 Recommendations for water resources in Leicester City

Action	Responsibility	Timescale
Continue to regularly review forecast and actual household growth across the supply region through WRMP Annual Update reports, and where significant change is predicted, engage with Local Planning Authorities.	STW	Ongoing
Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	LCC	Ongoing
Engage with Water Resources West to allow LCC plans to be considered within regional water resources policy.	LCC	Ongoing
Use planning policy to require the 110l/person/day water consumption target permitted by National Planning Policy Guidance in water-stressed areas.	LCC	In Local Plan
The concept of water neutrality has potentially a lot of benefit in terms of resilience to climate change and enabling all waterbodies to be brought up to Good status. Explore further with Severn Trent Water, Water Resources West and the Environment Agency how the Council's planning and climate change policies can encourage this approach.	LCC, EA, STW	In Local Plan and Climate Change Action Plan
STW should advise LCC of any strategic water resource infrastructure developments within the Authority, where these may require safeguarding of land to prevent other type of development occurring.	STW, LCC	In Local Plan

5 Water Supply Infrastructure

5.1 Introduction

An increase in water demand due to growth can exceed the hydraulic capacity of the existing supply infrastructure. This is likely to manifest itself as low pressure at times of high demand. An assessment is required to identify whether the existing infrastructure is adequate or whether upgrades will be required. The time required to plan, obtain funding and construct major pipeline works can be considerable and therefore water companies and planners need to work closely together to ensure that the infrastructure is able to meet growing demand.

Water supply companies make a distinction between supply infrastructure, the major pipelines, reservoirs and pumps that transfer water around a WRZ, and distribution systems, smaller scale assets which convey water around settlements to customers. This outline study is focused on the supply infrastructure. It is expected that developers should fund water company impact assessments and modelling of the distribution systems to determine requirements for local capacity upgrades to the distribution systems.

In addition to the work undertaken by water companies, there are opportunities for the local authority and other stakeholders to relieve pressure on the existing water supply system by increasing water efficiency in existing properties. This can contribute to reducing water consumption targets and help to deliver wider aims of achieving water neutrality.

A cost-effective solution can be for local authorities to co-ordinate with water supply companies and "piggyback" on planned leakage or metering schemes, to survey and retrofit water efficient fittings into homes[43]. This is particularly feasible within property owned or managed by the local authorities, such as social housing.

5.2 Methodology

Severn Trent Water were provided with a complete list of sites and the potential/equivalent housing numbers for each site. Using this information, STW were asked to comment on the impact of the proposed growth on water supply infrastructure in Leicester City.

5.3 Results

The following response was received Severn Trent Water was received regarding proposed site allocations and water supply:

"When specific detail of planned development location and sizes are available a site-specific assessment of the capacity of our water supply network could be made. Any assessment will involve carrying out a network analysis exercise to investigate any potential impacts. We would not anticipate capacity problems within the urban areas of our network, any issues can be addressed through reinforcing our network. However, the ability to support significant development in the rural areas is likely to have a greater impact and require greater reinforcement to accommodate greater demands."

In this case "specific detail" refers to information received as part of planning applications.

43 Water Efficiency Retrofitting: A Best Practice Guide, Waterwise (2009). Accessed online at: http://www.waterwise.org.uk/wp-content/uploads/2018/01/Waterwise-2009_Water-efficiency-Retrofitting_Best-practice.pdf on: 30/09/2019

5.4 Conclusions

Severn Trent Water responded to the request to assess the impacts of development on water supply infrastructure and confirmed that water supply is not expected to be a constraint to development. Early developer engagement is required to ensure that, as development occurs within the study area, detailed modelling of water supply infrastructure will allow any upgrades to be completed without restricting the timing, location or scale of the planned development.

5.5 Recommendations

Table 5.1 Recommendations for water supply infrastructure

Action	Responsibility	Timescale
As appropriate as part of the planning process, undertake network modelling to ensure adequate provision of water supply is feasible	STW LCC	As part of the planning process
LCC and Developers should engage early with STW to ensure infrastructure is in place prior to occupation.	LCC STW Developers	Ongoing

6 Wastewater Collection

6.1 Sewerage undertakers

Severn Trent Water is the Sewerage Undertaker (SU) for the study area. The role of the sewerage undertaker includes the collection and treatment of wastewater from domestic and commercial premises, and in some areas, it also includes the drainage of surface water from building curtilages to combined or surface water sewers. It excludes, unless adopted by the SU, systems that do not connect directly to the wastewater network, e.g. Sustainable Drainage Systems (SuDS) or highway drainage. At present, STW do not adopt SuDS, although this position is likely to change following the implementation of Sewers for Adoption version 8.

Increased wastewater flows into collection systems due to growth in populations or per-capita consumption can lead to an overloading of the infrastructure, increasing the risk of sewer flooding and, where present, increasing the frequency of discharges from Combined Sewer Overflows (CSOs).

Likewise, headroom at Wastewater Treatment Works (WwTW) can be eroded by growth in population or per-capita consumption, requiring investment in additional treatment capacity. As the volumes of treated effluent rises, even if the effluent quality is maintained, the pollutant load discharged to the receiving watercourse will increase. In such circumstances the Environment Agency as the environmental regulator, may tighten consented effluent consents to achieve a "load standstill", i.e. ensuring that as effluent volume increases, the pollutant discharged does not increase. Again, this would require investment by the water company to improve the quality of the treated effluent.

In combined sewerage systems, or foul systems with surface water misconnections, there is potential to create headroom in the system, thus enabling additional growth, by the removal of surface water connections. This can most readily be achieved during the redevelopment of brownfield sites which have combined sewerage systems, where there is potential to discharge surface waters via sustainable drainage systems (SuDS) to groundwater, watercourses or surface water sewers. In some areas of Leicester City there are known issues of surface water causing localised flooding. Strategic schemes to provide improved local surface water drainage may be required in such areas, rather than solely relying upon on-site soakaways on brownfield or infill plots.

STW are supportive of the use of SuDS and SuDS principles to manage surface water run-off. They recommend that the Drainage Hierarchy is used to direct surface water to natural outfall routes such as infiltration to ground or into watercourse, before utilising sewers, as supported by paragraph 80 of the NPPG. Surface water should also not be permitted to connect to a foul sewer.

6.2 Sewerage System Capacity Assessment

New residential developments add pressure to the existing sewerage systems. An assessment is required to identify the available capacity within the existing systems, and the potential to upgrade overloaded systems to accommodate future growth. The scale and cost of upgrading works may vary significantly depending upon the location of the development in relation to the network itself and the receiving WwTW.

It may be the case that an existing sewerage system is already working at its full capacity and further investigations have to be carried out to define which solution is necessary to implement an increase in its capacity. New infrastructure may be required if, for example, a site is not served by an existing system. Such new infrastructure will normally be secured through private third-party agreements between the developer and utility provider.

Sewerage Undertakers must consider the growth in demand for wastewater services when preparing their five-yearly Strategic Business Plans (SBPs) which set out investment for the next Asset Management Plan (AMP) period. Typically, investment

is committed to provide new or upgraded sewerage capacity to support allocated growth with a high certainty of being delivered. Additional sewerage capacity to service windfall sites, smaller infill development or to connect a site to the sewerage network across third party land is normally funded via developer contributions, as third-party arrangements between the developer and utility provider.

6.3 Methodology

Severn Trent Water were provided with a list of the potential development sites and forecast housing numbers or employment floor space for each site. Using this information, they were asked to assess each site using the range of datasets they hold.

The following red/amber/green traffic light definition was used to score each site area, for the potential impact on sewerage infrastructure and the potential impact on surface water sewerage infrastructure:

Capacity improvements unlikely	May require capacity improvements	Capacity improvements likely

Comments were provided by Severn Trent for each site, summarising known network issues, the assumed connectivity of the site to the sewerage system, the watercourse assumed to be the outfall point for sewage from the site and the location of surface water disposal. Full comments are in the site tracker spreadsheet (Appendix A).

A red assessment does not reflect a "showstopper" and the water companies have a statutory duty to serve new development under the Water Industry Act 1991 – but they show where the most amount of new infrastructure or network reinforcement will be required.

An amber assessment indicates where further modelling may be required to understand local capacity in the network, and a green assessment indicates that no constraints have been identified.

It should be noted that this assessment does not replace appropriate assessments or modelling as part of developer engagement with the sewerage undertaker, evidence of which should be demonstrated to the LPA as an application progresses through the planning process.

6.4 Data collection

The following datasets were to assess the sewerage system capacity:

- Locations of promoted sites in GIS format (provided by LCC)
- Site tracker spreadsheet (see Appendix A)
- Wanlip wastewater catchment (provided by Severn Trent Water)

6.5 Results

6.5.1 Severn Trent Water DWMP

Whilst publication of Drainage and Wastewater Management Plans (DWMPs) is not scheduled until 2022/23, STW have published a draft of their initial findings as they start the process[44]. This has been reviewed to report information of relevance to the sewer networks in Leicester.

Wanlip WwTW is Severn Trent Water's 2nd largest treatment works and is the only treatment works serving Leicester City. It also serves parts of Harborough District,

44 A9: Drainage and Wastewater Management Plan 2018, Severn Trent Water (2018). Accessed online at: https://www.stwater.co.uk/content/dam/stw/about_us/pr19-documents/sve_appendix_a9_drainage_and_wastewater_management_plan.pdf on: 08/01/2020

Charnwood Borough, Hinckley and Bosworth Borough, North West Leicestershire District and Oadby and Wigston Borough, serving a population of approximately 644,583.

The Evington Brook has been defined as a WFD AMP 7 assessment area, and part of the watercourse is within Wanlip WwTW's catchment, which is therefore subject to ongoing Storm Overflow Assessment Framework (SOAF) assessments.

There are known infiltration issues throughout Leicester City centre. Infiltration describes the process of groundwater entering the sewer system through faults in pipes or manholes. It can occur due to age, design, maintenance issues or tree root intrusion. The additional flow in the sewer network reduces spare capacity, increases treatment costs at the WwTW, and can increase the possibility of sewer flooding. The current Sewerage Management Plan (SMP) strategy is to undertake separation of surface water flows from foul flow in existing combined sewer systems as brownfield redevelopment occurs.

6.5.2 Foul sewerage and surface water sewerage network assessment

Table 6.1 summarises the results of STW's RAG assessments of the foul sewerage and surface water sewerage network for all of the potential site allocations. Where sites were proposed for less than 20 houses, Severn Trent's comment was *"Site is of small scale and unlikely to have any significant impacts on the sewerage infrastructure provided that surface water managed sustainably is directed to a sustainable outfall."* These sites were given a RAG rating of green.

Figure 6.1 and Figure 6.2 show a map of the RAG results for the non-CDA sites. A complete list of assessments on a site-by-site basis can be found in the site tracker spreadsheet in Appendix A.

Two non-CDA sites were rated red for the foul sewerage network assessment:

- 579 – Land north of Birstall Golf Course
- 718 – The Paddock, Glenfield Hospital, Hallgate Drive

For these sites, Severn Trent made the following request: *"Please provide further details regarding this site regarding certainty of development, and potential timescales for development to enable us to undertake more detailed assessments and ensure that any necessary capacity improvements can be provided in line with development."*

Sewerage Undertakers have a duty under Section 94 of the Water Industry Act 1991 to provide sewerage and treat wastewater arising from new domestic development. Except where strategic upgrades are required to serve very large or multiple developments, infrastructure upgrades are usually only implemented following an application for a connection, adoption, or requisition from a developer. Early developer engagement with water companies is therefore essential to ensure that sewerage capacity can be provided without delaying development.

Table 6.1 Foul and surface water sewerage network assessment results

Foul sewerage RAG assessment	Total potential number of houses	% in each category	Total potential employment land (ha)	% in each category	Surface water sewerage RAG assessment	Total potential number of houses	% in each category	Total potential employment land (ha)	% in each category
Non-CDA sites									
Red	85	2%	1.9	13%	Red	0	0%	0.0	0%
Amber	2,342	57%	7.0	49%	Amber	397	10%	2.0	14%
Green	1,653	41%	5.5	38%	Green	3,683	90%	12.4	86%
CDA sites									
Red	126	3%	0.0	0%	Red	182	3%	0.0	0%
Amber	3,579	73%	4.0	100%	Amber	3,761	77%	4.0	100%
Green	1,200	24%	0.0	0%	Green	962	20%	0.0	0%
TOTAL									
Red	211	2%	1.9	10%	Red	182	2%	0.0	0%
Amber	5,921	66%	11.0	60%	Amber	4,158	46%	6.0	32%
Green	2,853	32%	5.5	30%	Green	4,645	52%	12.4	68%

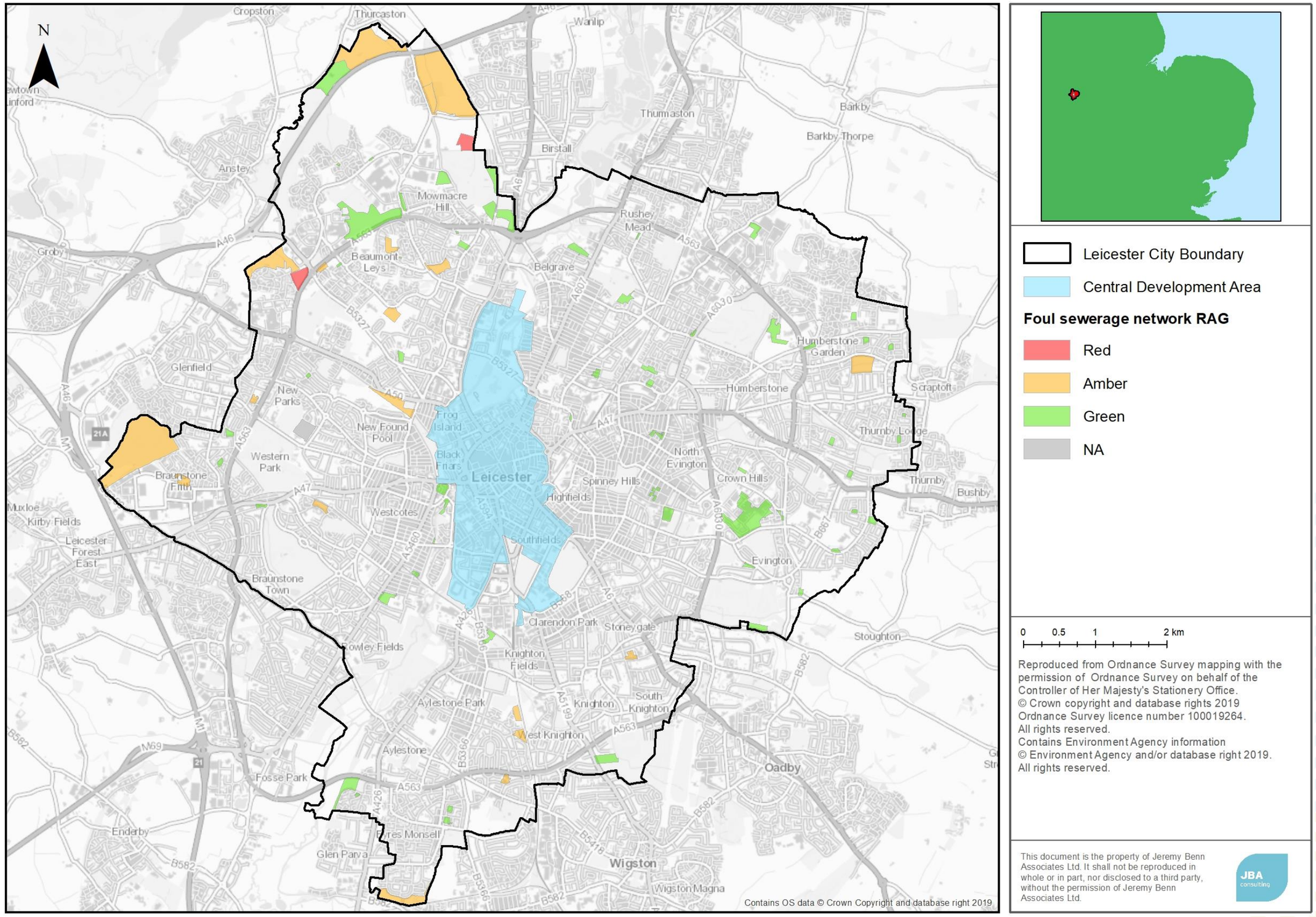
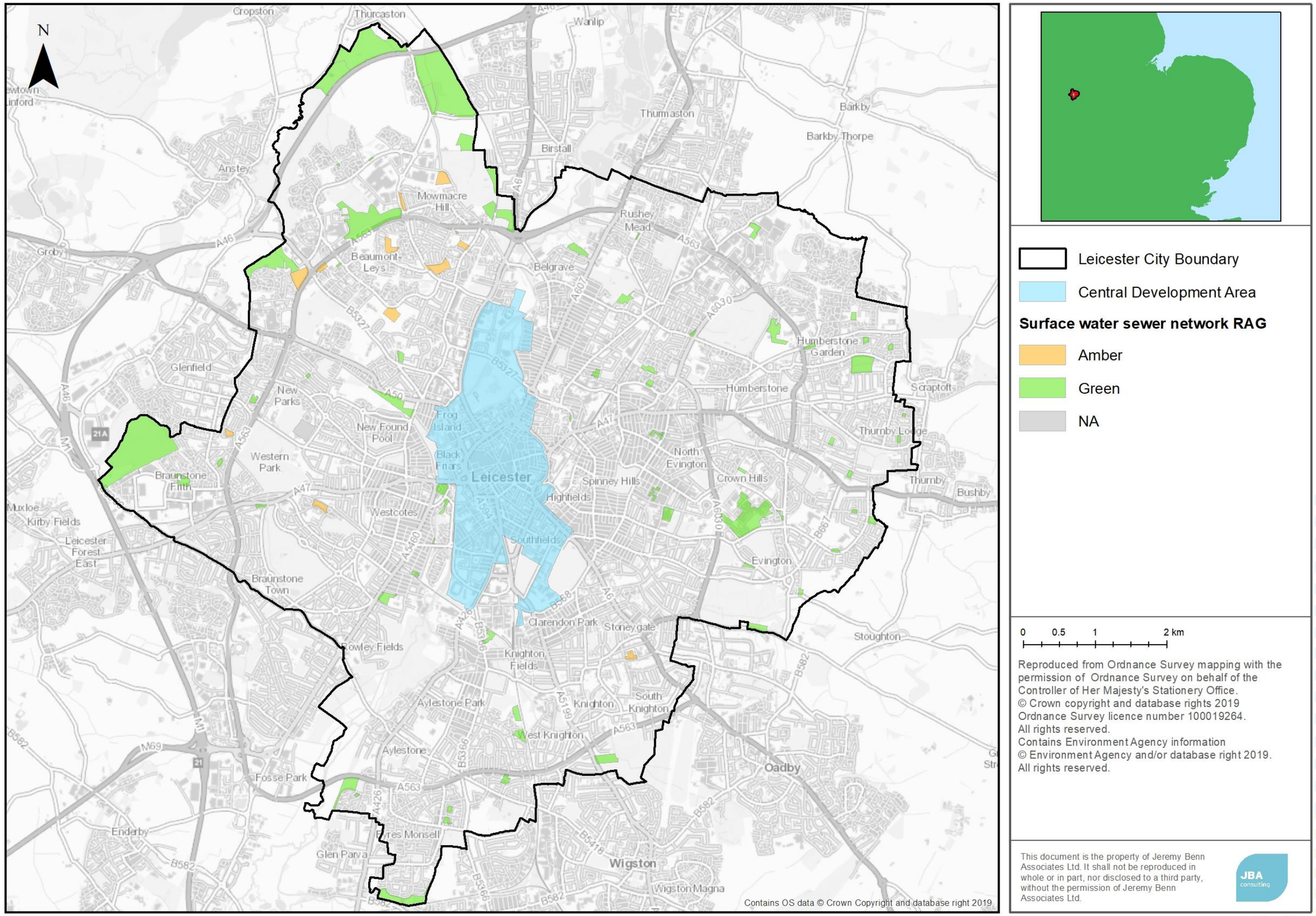


Figure 6.1 Foul sewerage network RAG results (non-CDA sites)



Leicester City Boundary

Central Development Area

Surface water sewer network RAG

Amber

Green

NA

0 0.5 1 2 km

Figure 6.2 Surface water sewerage network RAG results (non-CDA sites)

6.6 Conclusions

STW provided an assessment of the wastewater sewer and surface water sewer capacity for development sites provided to them as part of this study. This assessment identifies sites where there may be constraints in the sewer network that require some network reinforcement in order to accommodate growth. Phase of these sites needs to be carefully managed between Leicester City council and STW to ensure that infrastructure is in place prior to occupation.

6.7 Recommendations

Table 6.2 Recommendations from wastewater network assessment

Action	Responsibility	Timescale
Early engagement between LCC and STW is required to ensure that where strategic infrastructure is required, it can be planned in by STW.	LCC, STW	Ongoing
Take into account wastewater infrastructure constraints in phasing development in partnership with the sewerage undertaker	LCC, STW	Ongoing
Developers will be expected to work with the sewerage undertaker closely and early in the planning promotion process to develop an outline Drainage Strategy for sites. The Outline Drainage strategy should set out the following: What – What is required to serve the site Where – Where are the assets / upgrades to be located When – When are the assets to be delivered (phasing) Which – Which delivery route is the developer going to use s104 s98 s106 etc. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as a basis for a drainage planning condition to be set.	STW, Developers	Ongoing
Developers will be expected to demonstrate to the Lead Local Flood Authority (LLFA) that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to surface water sewers seen as the last option. New connections for surface water to foul sewers will be resisted by the LLFA.	Developers, LLFA	Ongoing
For sites rated amber and red for the surface water sewerage assessment, consider limiting discharge to greenfield rates. This could be implemented via Local Plan policies.	LCC, Developers	Ongoing

7 Wastewater Treatment

7.1 Wastewater Treatment Works

Wastewater services in Leicester City are provided by Severn Trent. There are no WwTWs in Leicester City itself and the entire area is served by Wanlip WwTW. Figure 7.2 shows the Wanlip WwTW catchment within Leicester and the nearest treatment works to the study area.

7.2 Wastewater Treatment Works Flow Permit Assessment

7.2.1 Introduction

The Environment Agency is responsible for regulating sewage discharge releases via a system of Environmental Permits (EPs). Monitoring for compliance with these permits is the responsibility of both the EA and the plant operators. Figure 7.1 summarises the different types of wastewater releases that might take place, although precise details vary from works to works depending on the design.

During dry weather, the final effluent from the Wastewater Treatment Works (WwTW) should be the only discharge (1). With rainfall, the storm tanks fill and eventually start discharging to the watercourse (2) and Combined Sewer Overflows (CSOs) upstream of the storm tanks start to operate (3). The discharge of storm sewage from treatment works is allowed only under conditions of heavy rain or snow melt, and therefore the flow capacity of treatment systems is required to be sufficient to treat all flows arising in dry weather and the increased flow from smaller rainfall events. After rainfall, storm tanks should be emptied back to full treatment, freeing their capacity for the next rainfall event.

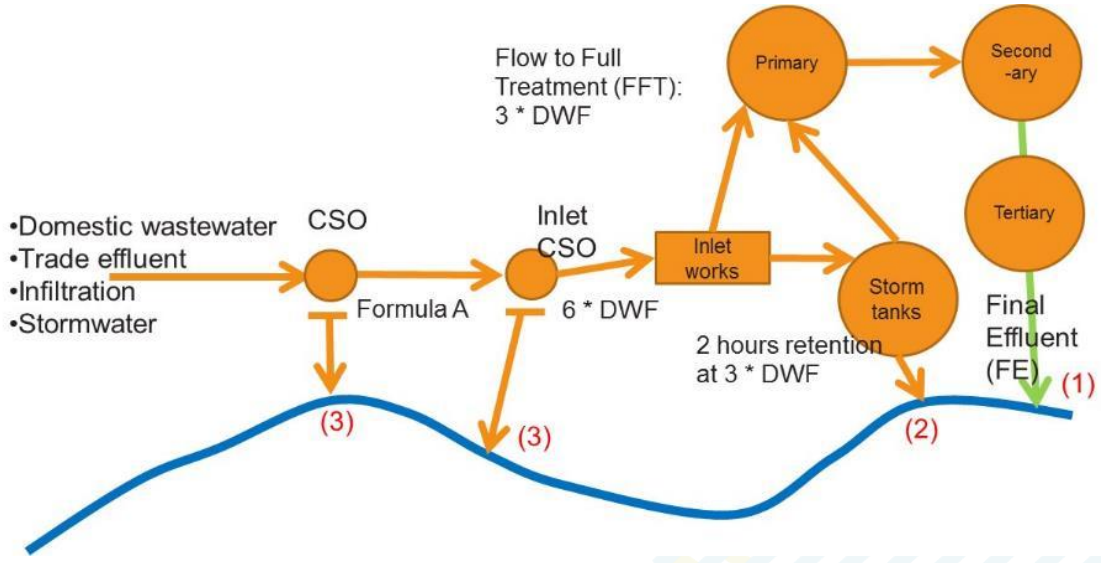
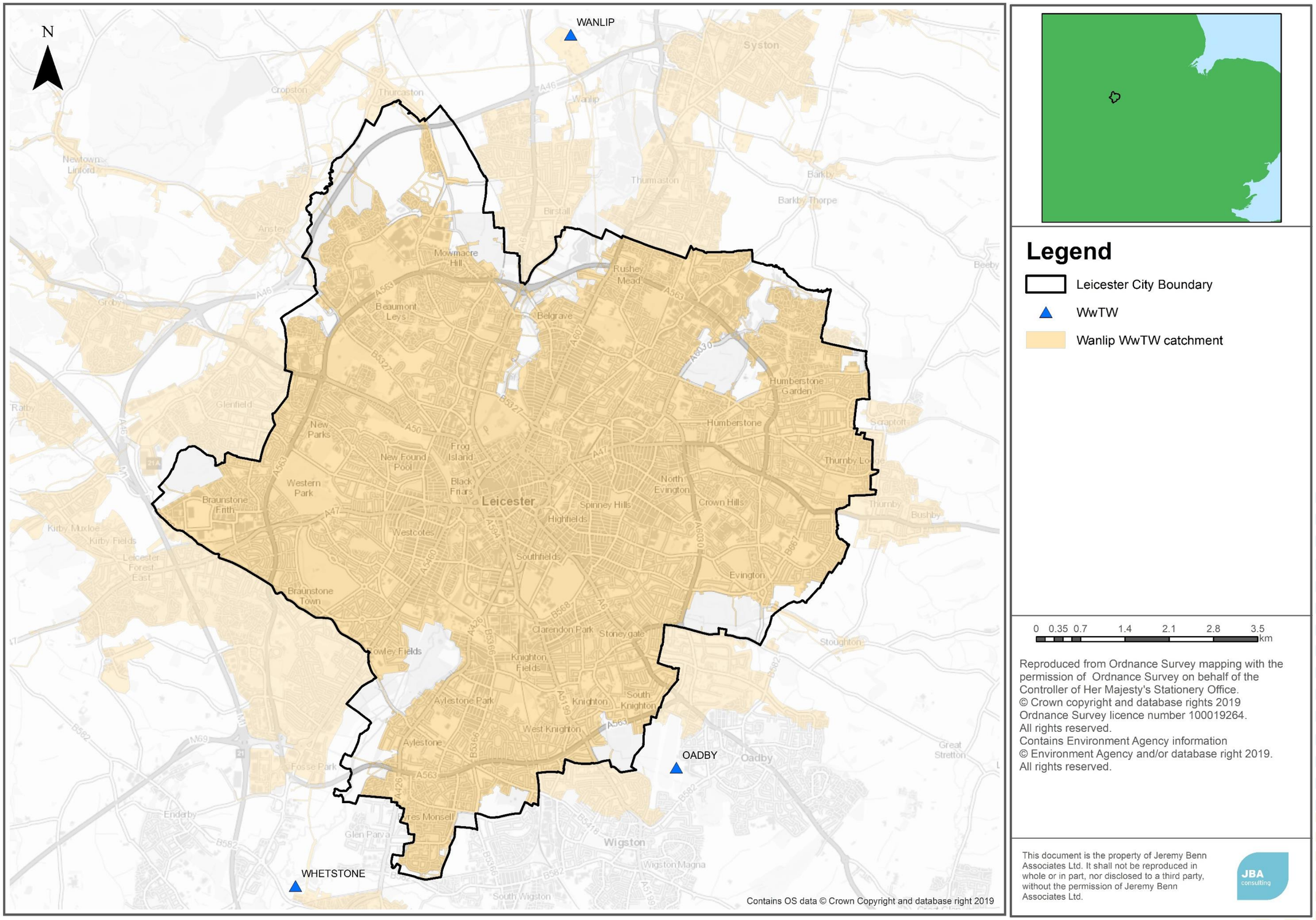


Figure 7.1 Overview of typical combined sewerage system and WwTW discharges

Environmental permits are used alongside water quality limits as a means of controlling the pollutant load discharged from a water recycling centre to a receiving watercourse. Sewage flow rates must be monitored for all WwTWs where the permitted discharge rate is greater than 50 m^3/day in dry weather.

Permitted discharges are based on a statistic known as the Dry Weather Flow (DWF). As well as being used in the setting and enforcement of effluent discharge permits, the DWF is used for WwTW design, as a means of estimating the 'base flow' in sewerage modelling and for determining the flow at which discharges to storm tanks will be permitted by the permit (Flow to Full Treatment, FFT).



Legend

- Leicester City Boundary
- WwTW
- Wanlip WwTW catchment

0 0.35 0.7 1.4 2.1 2.8 3.5 km

Figure 7.2 WwTW near Leicester City

WwTW Environmental Permits also consent for maximum concentrations of pollutants, in most cases Suspended Solids (SS), Biochemical Oxygen Demand (BOD) and Ammonia (NH4). Some works (usually the larger works) also have permits for Phosphorous (P). These are determined by the Environment Agency with the objective of ensuring that the receiving watercourse is not prevented from meeting its environmental objectives, with specific regard to the Chemical Status element of the Water Framework Directive (WFD) classification.

Increased domestic population and/or employment activity can lead to increased wastewater flows arriving at a WwTW. Where there is insufficient headroom at the works to treat these flows, this could lead to failures in flow consents.

7.3 Methodology

Severn Trent Water were provided with the potential housing numbers for each site (See Appendix A). STW were then invited to provide an assessment of Wanlip WwTW as the receiving WwTW and provide any additional comments about the impacts of the development.

The STW assessment consists of two factors, the hydraulic capacity of the WwTW (consented flow vs current flow) and the capacity of the WwTW to treat a given load. The assessment may also reflect upgrades already planned at WwTW.

A parallel assessment of WwTW capacity was carried out by JBA using measured flow data supplied by the water companies. The process was as follows:

- STW provided their Dry Weather Flow (DWF) statistics calculated as the 20th percentile (80% exceedance flow) for 2014-2018. The 2018 value was used to assume the present-day values.
- The future DWF was calculated using the occupancy rates and per-capita consumption values obtained from the Water Resource Management Plans (Table 7.1), and the assumption that 95% of water used is returned to sewer. Permitted headroom was used as a substitute for actual designed hydraulic capacity.

Table 7.1 Values used in water demand calculations

Water Company	Water Resource Zone	Occupancy rate (persons per dwelling)	Per capita consumption (m3/person/day)
Severn Trent Water	Strategic Grid	2.2	0.121

7.4 Results

JBA's flow permit assessment in Figure 7.3 below shows that the current 80th percentile flow is above the permitted flow, and, without mitigation, this exceedance will continue to grow during Leicester's Local Plan period.

It should be noted that for planning purposes, the 80th percentile is used when assessing remaining capacity in a flow permit. However, compliance with the permit is assessed using the 90th percentile and therefore Wanlip is not currently considered to be in breach of its permit.

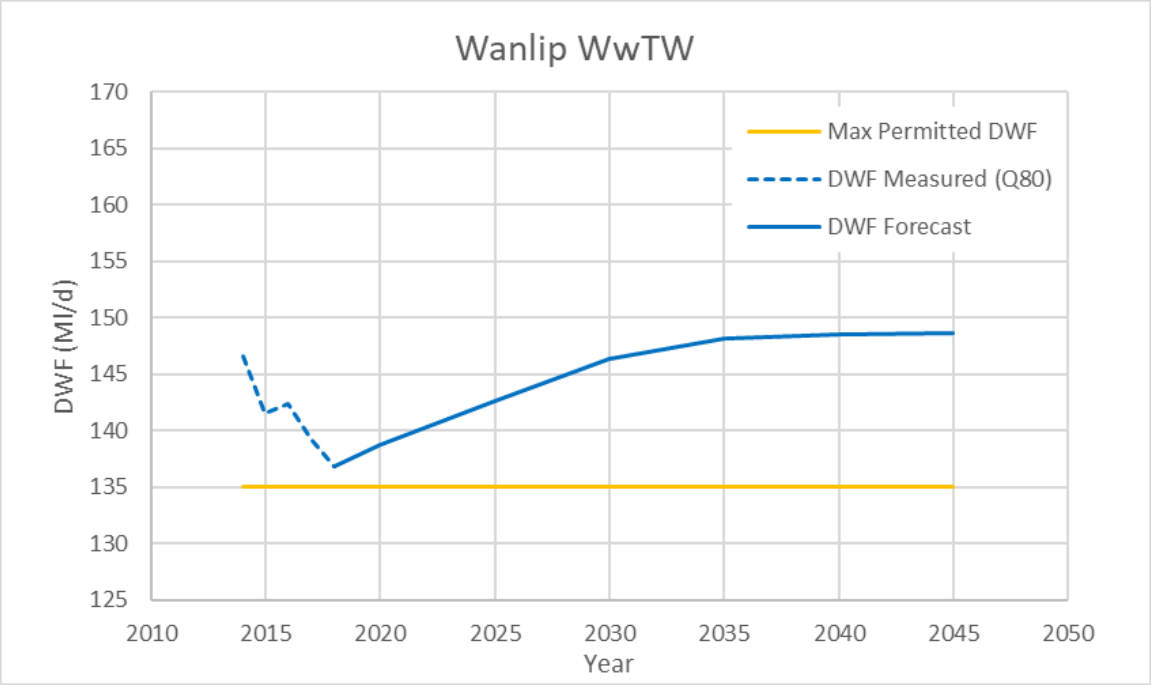


Figure 7.3 Flow permit assessment for Wanlip WwTW (80th%ile flow)

Severn Trent Water provided the following comments regarding the flow exceedance issues at Wanlip WwTW:

"We recognise that Wanlip STW has been operating at capacity, in terms of its DWF permit, for a number of years. It is expected Wanlip STW will be subject to a tighter permit for Phosphate in AMP8 to deliver WFD objectives. Subject to confirmation of the EA's hazardous substance permitting policy, reductions in effluent concentrations for Hexabromocyclododecane (HBCDD) and Tributyltin (TBT) may also be required in AMP8, when significant investment will need to take place to meet new discharge quality requirements as well as ensure DWF compliance in the face of significant planned development over the next 10-20 years.

We plan, therefore, to transfer approximately 3,500 m^3/d DWF from the Wanlip catchment to the Whetstone catchment in AMP7 to provide a short-term solution for ensuring DWF compliance and accommodating planned development in the catchment, with long term capacity provision through AMP8 investment."

STW provided flow data at Wanlip WwTW for 2014-2018, which shows that over this period, the observed flow at the treatment works has been decreasing, largely due to relatively wet weather conditions in 2015/16, and relatively drier weather conditions in 2017/18.

The water quality modelling carried out in section 9 suggests that the transfer of flows from Wanlip WwTW to Whetstone WwTW could lead to a localised deterioration in water quality downstream. STW are aware of this, and any transfer will be accompanied by the appropriate permit adjustments to ensure that there is no downstream river quality deterioration.

7.5 Conclusions

Leicester City is entirely served by Wanlip WwTW. Results of the flow permit assessment for Wanlip WwTW shows that it is close to its permitted flow and is likely to exceed it during the Local Plan period if no action was taken. Severn Trent Water are however aware of this and have a number of solutions to the issue, including tighter permits for effluent discharges from the WwTW and transferring some of the flows to Whetstone WwTW.

Due to the planned upgrades at Wanlip WwTW, early engagement between STW and Leicester City Council is required to ensure that opportunities to accommodate the planned growth proposed in Leicester City within existing upgrade schemes can be realised.

7.6 Recommendations

Table 7.2 Recommendations for wastewater treatment

Action	Responsibility	Timescale
Consider the available capacity at Wanlip WwTW when phasing development.	LCC, STW	Ongoing
Provide Annual Monitoring Reports to STW detailing projected housing growth.	LCC	Ongoing
STW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	STW, LCC	Ongoing

8 Odour Assessment

8.1 Introduction

Where new developments encroach upon an existing Wastewater Treatment Works (WwTW), odour from that site may become a cause for nuisance and complaints from residents. Managing odour at WwTWs can add considerable capital and operational costs, particularly when retro fitted to existing WwTWs. National Planning Policy Guidance recommends that plan-makers consider whether new development is appropriate near to sites used (or proposed) for water and wastewater infrastructure, due to the risk of odour nuisance.

8.2 Methodology

Sewerage undertakers recommend that an odour assessment may be required if the site of a proposed development is close to a WwTW and is encroaching closer to the WwTW than existing urban areas. The closest WwTW to each site is determined, along with the distance and direction of the WwTW to that site. The actual odour experienced is dependent on the size of the works, the type of treatment processes present, and the age and condition of the site. There is also significant variation due to current weather conditions.

To take into account the size of the works, the dry weather flow (DWF) was used to calculate an approximate population served by each WwTW and this was used to assign a "trigger" distance, with the maximum trigger distance being 800m. Where the distance between the site and the WwTW is less than the trigger distance, an odour assessment is recommended.

Another important aspect is the location of the site in respect to the WwTW. Historic wind direction records for sites around Leicester indicate that the prevailing wind is to west north-west (Kegworth and Cottesmore) recorded at METAR weather stations[45].

A red/amber/green assessment was applied by JBA:

Site is unlikely to be impacted by odour from WwTW	Site location is such that an odour impact assessment is recommended	Site is in an area with confirmed WwTW odour issues

8.3 Data Collection

The datasets used to assess the impact of odour from a WwTW were:

- Site location in GIS format (provided by LCC)
- WwTW locations (from "Consented discharges to controlled waters with conditions" database)
- Site tracker spreadsheet (see Appendix A)

8.4 Results and conclusions

Oadby WwTW is the only treatment works within 800m of the Leicester City boundary, however there are no potential sites within 800m of Oadby WwTW and therefore all sites are unlikely to be impacted by odour from a WwTW and have been given a RAG rating of green.

45 RenSMART website http://www.rensmart.com/Weather/WindArchive#monthlyLayer accessed on: 28/10/2019

9 Water Quality

9.1 Introduction

An increase in the discharge of effluent from Wastewater Treatment Works (WwTW) as a result of development and growth in the area in which they serve can lead to a negative impact on the quality of the receiving watercourse. Under the Water Framework Directive (WFD), a watercourse is not allowed to deteriorate from its current WFD classification (either as an overall watercourse or for individual elements assessed).

It is Environment Agency (EA) policy to model the impact of increasing effluent volumes on the receiving watercourses. Where the scale of development is such that a deterioration is predicted, a variation to the Environmental Permit (EP) may be required for the WwTW to improve the quality of the final effluent, so that the increased pollution load will not result in a deterioration in the water quality of the watercourse. This is known as "no deterioration" or "load standstill". The need to meet river quality targets is also taken into consideration when setting or varying a permit.

The Environment Agency operational instructions on water quality planning and no-deterioration are currently being reviewed. Previous operational instructions[46] (now withdrawn) set out a hierarchy for how the no-deterioration requirements of the WFD should be implemented on inland waters and in the absence of new guidance remain the most relevant document. The potential impact of development should be assessed in relation to the following objectives:

- **Could the development cause a greater than 10% deterioration in water quality?** This objective is to ensure that all the environmental capacity is not taken up by one stage of development and there is sufficient capacity for future growth.
- **Could the development cause a deterioration in WFD class of any element assessed?** This is a requirement of the Water Framework Directive to prevent a deterioration in class of individual contaminants. The "Weser Ruling"[47] by the European Court of Justice in 2015 specified that individual projects should not be permitted where they may cause a deterioration of the status of a water body. If a water body is already at the lowest status ("bad"), any impairment of a quality element was considered to be a deterioration. Emerging practice is that a 3% limit of deterioration is applied.
- **Could the development alone prevent the receiving watercourse from reaching Good Ecological Status (GES) or Potential?** Is GES possible with current technology or is GES technically possible after development with any potential WwTW upgrades.

The overall WFD classification of a water body is based on a wide range of ecological and chemical classifications. This assessment focuses on three physico-chemical quality elements; Biochemical Oxygen Demand (BOD), Ammonia, and Phosphate.

Biochemical Oxygen Demand (BOD)

BOD is a measure of how much organic material – sewage, sewage effluent or industrial effluent – is present in a river. It is defined as the amount of oxygen taken up by micro-organisms (principally bacteria) in decomposing the organic material in a water sample stored in darkness for 5 days at 20°C. Water with a high BOD has a low level of dissolved oxygen. A low oxygen content can have an adverse impact on aquatic life.

46 Water Quality Planning: no deterioration and the Water Framework Directive, Environment Agency (2012). Accessed online at: http://www.fwr.org/WQreg/Appendices/No_deterioration_and_the_WFD_50_12.pdf on: 20/01/2020

47 PRESS RELEASE No 74/15, European Court of Justice (2015). Accessed online at: https://curia.europa.eu/jcms/upload/docs/application/pdf/2015-07/cp150074en.pdf on: 20/01/2020

Ammonia

Nitrogen is an essential nutrient required by all plants and animals for the formation of amino acids. In its molecular form nitrogen cannot be used by most aquatic plants, and so it is converted into other forms. One such form is ammonia (NH_3). This may then be oxidized by bacteria into nitrate (NO_3) or nitrite (NO_2). Ammonia may be present in water in either the unionized form NH_3 or the ionized form NH_4. Taken together these forms care called Total Ammonia Nitrogen.

Although ammonia is a nutrient, in high concentrations it can be toxic to aquatic life, in particular fish, affecting hatching and growth rates.

The main sources in rivers include agricultural sources, (fertilizer and livestock waste), residential sources (ammonia containing cleaning products and septic tank leakages), industrial processes and wastewater treatment works.

Phosphate

Phosphorus is a plant nutrient and elevated concentrations in rivers can lead to accelerated plant growth of algae and other plants. Its impact on the composition and abundance of plant species can have adverse implications for other aspects of water quality, such as oxygen levels. These changes can cause undesirable disturbances to other aquatic life such as invertebrates and fish.

Phosphorus (P) occurs in rivers mainly as Phosphate (PO_4), which are divided into Orthophosphates (reactive phosphates), and organic Phosphates.

Orthophosphates are the main constituent in fertilizers used in agriculture and domestic gardens and provide a good estimation of the amount of phosphorus available for algae and plant growth and is the form of phosphorus that is most readily utilized by plants.

Organic phosphates are formed primarily by biological processes and enter sewage via human waste and food residues. Organic phosphates can be formed from orthophosphates in biological treatment processes or by receiving water biota.

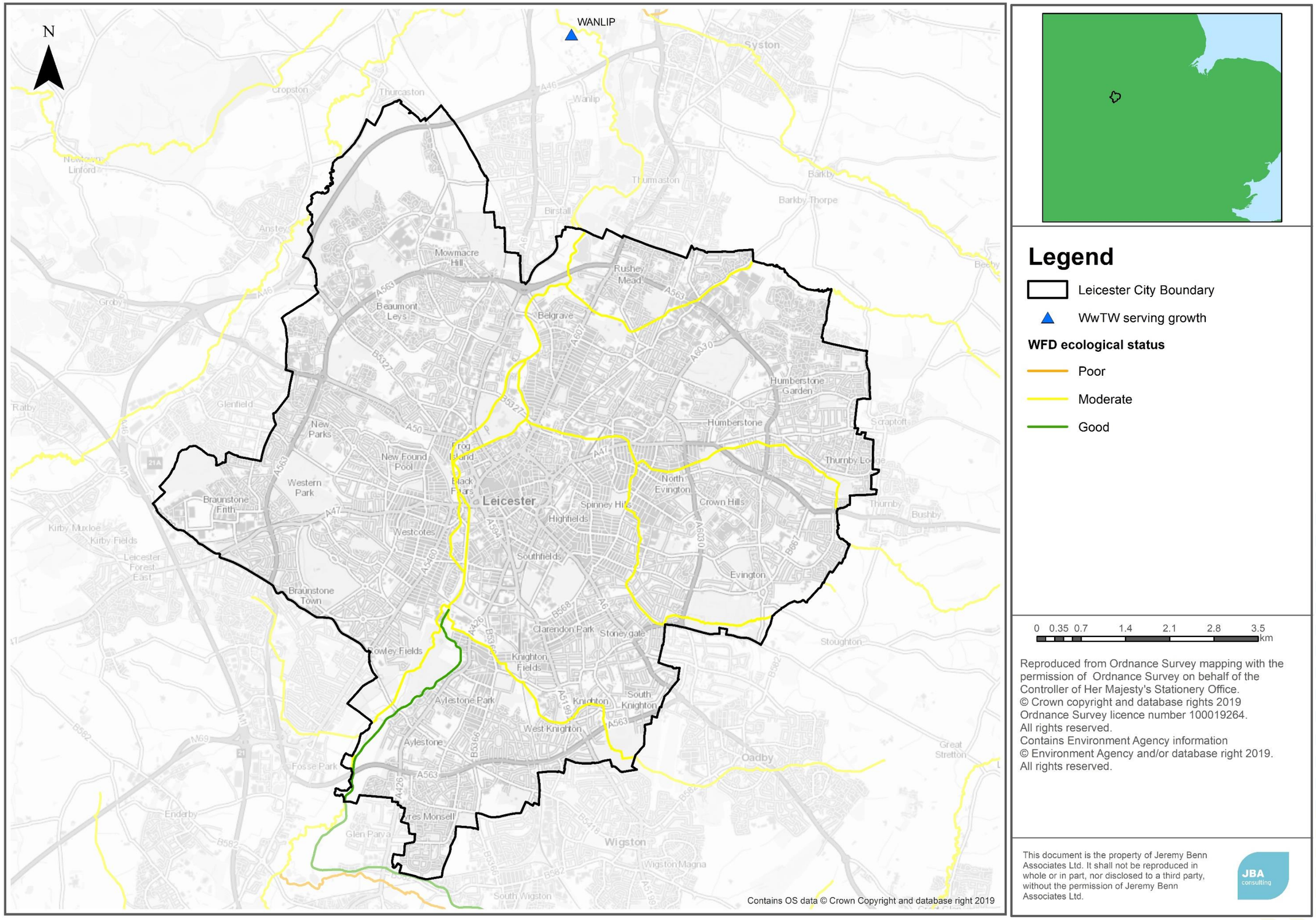
Although it is phosphorus in the form of phosphates that is measured as a pollutant, the term phosphorus is often used in water quality work to represent the total phosphorus containing pollutants.

9.2 Water Framework Directive Status

Figure 9.1 shows the Cycle 2 Water Framework Directive overall waterbody classifications for watercourse in the study area, and the location of the Wanlip WwTW which will serve growth in Leicester City. The majority of waterbodies in Leicester have a moderate ecological status, with a small part of the Grand Union Canal in the south of the City having a good ecological status.

The RBMP for the River Humber[48] estimates that pollution from wastewater affects 38% of water bodies within this river basin district.

48 Humber river basin district River basin management plan (LIT 10312), Environment Agency (2015). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718328/Humber_RBD_Part_1_river_basin_management_plan.pdf on: 06/01/2020



Legend

- Leicester City Boundary
- WwTW serving growth

WFD ecological status

- Poor
- Moderate
- Good

0 0.35 0.7 1.4 2.1 2.8 3.5 km

Figure 9.1 WFD status of waterbodies in Leicester

9.3 Methodology

SIMCAT is used by the Environment Agency to model potential deterioration of waterbodies and to support decision making to guide development to locations where environmental deterioration will be reduced. SIMCAT is a 1D stochastic, steady state, deterministic model which represents inputs from point-score effluent discharges and the behaviour of solutes in the river (Cox, 2003) .

SIMCAT can simulate inputs of discharge and water quality data and statistically distribute them from multiple effluent sources along the river reach. It uses the Monte Carlo method for distribution that randomly models up to 2,500 boundary conditions. The simulation calculates the resultant water quality as the calculations cascade further downstream.

Once the distribution results have been produced, an assessment can be undertaken on the predicted mean and ninety percentile concentrations or loads.

The methodology followed is summarised in Figure 9.2 below.

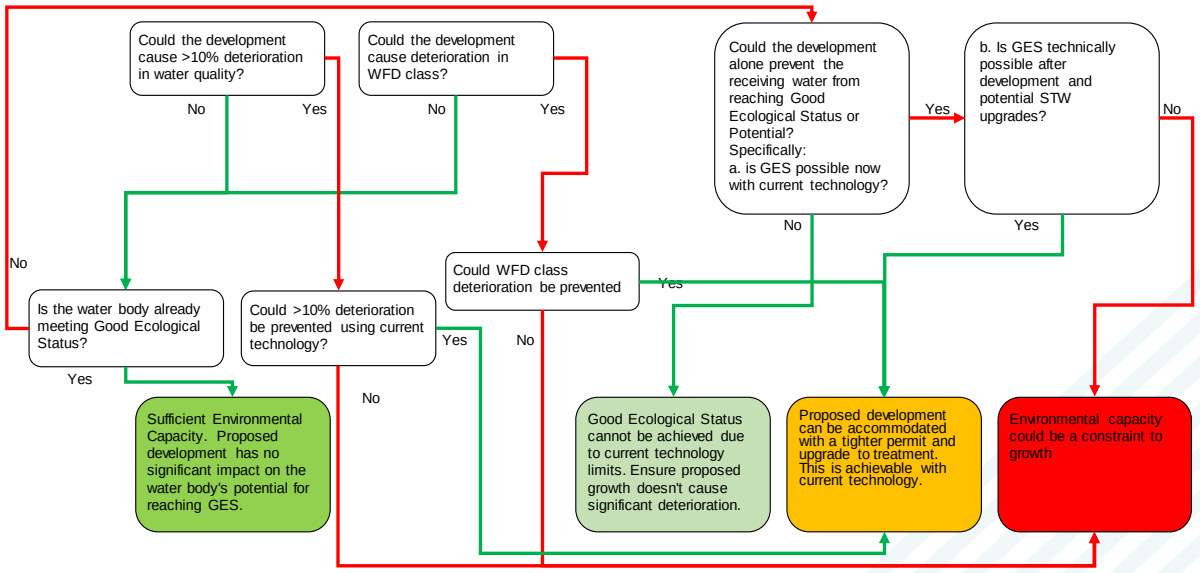


Figure 9.2 Water quality impact assessment following EA West Thames guidance

Where modelling indicated growth may lead to a deterioration in the watercourse, or where the watercourse is not currently meeting at least a 'Good' class for each determinand, the models were used to test whether this could be addressed by applying stricter discharge concentrations. In such cases, a Technically Achievable Limit (TAL) was considered.

The EA advised that the following permit values are achievable using treatment at TAL, and that these values should be used for modelling all WwTW potential capacity irrespective of the existing treatment technology and size of the works:

- Ammonia (95%-ile): 1mg/l
- BOD (95%-ile): 5mg/l
- Phosphorus (mean): 0.25mg/l

This assessment did not take into consideration if it is feasible to upgrade each existing WwTW to best available technology due to constraints of costs, timing, space, carbon costs etc.

9.3.1 Modelling approach

Existing SIMCAT models developed by the Environment Agency were supplied for the River Trent catchment which includes the River Soar; one modelling Ammonia and BOD, the other modelling Phosphorous. The models were understood to have been largely based on observed flow and quality data for the period 2010 to 2012. A widespread update of the model, and the resultant recalibration were not within scope of this project. It was therefore decided to update just the effluent flow and quality statistics at Wanlip and Whetstone WwTWs. In addition to this, Severn Trent Water provided details of upgrades to phosphate treatment processes at a number of WwTWs that would have an impact on overall water quality in the catchment. These were incorporated into the baseline model.

The two models were run as received from the Environment Agency to check calibration for the reaches of interest. It was found that observed flows were within the confidence limits of the model, so the model was accepted as "fit for purpose" for this study.

Flow data for the last five years was supplied by STW, and effluent quality data was obtained from the EA Water Quality Data Archive in order to update both models.

The updated models were then run as a 2018 baseline.

Additional effluent flow from growth during the local plan period was added to current flow at Wanlip treatment works and the model re-run as a future scenario.

As outlined in section 7, an option available to STW is to redirect part of the Wanlip WwTW catchment into the Whetstone WwTW catchment to reduce the risk of the flow permit being exceeded at Wanlip WwTW. A further baseline and future scenario were therefore developed to include a transfer of 3.5 Ml/d.

Figure 9.3 shows the River Soar as it passes through Leicester with the relative position of Wanlip and Whetstone WwTWs.

It should be noted that where this modelling work predicts a theoretical risk of deterioration in water quality downstream of a WwTW, the EA would not allow a deterioration under the Water Framework Directive, and in reality STW will work with the EA to ensure this does not occur.

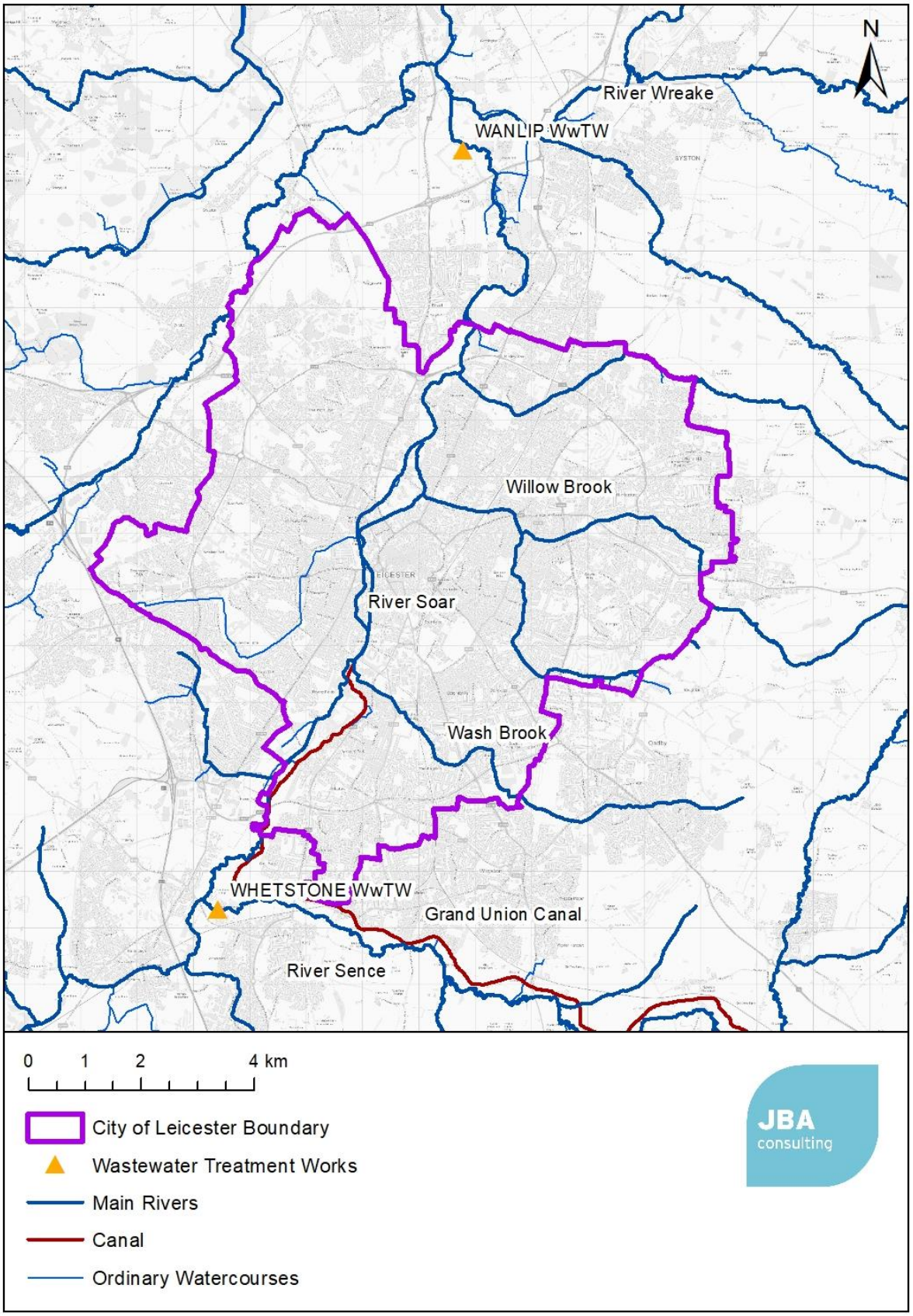


Figure 9.3 River Soar catchment at Leicester

9.4 Results

9.4.1 Water Framework Directive status

The SIMCAT model was run using the 2018 baseline scenario and compared to the current reported WFD Cycle 2 (2016) status. Table 9.1 and Table 9.2 were used to define the WFD class for each determinand.

Table 9.1 WFD class boundaries for Ammonia and BOD

Determinand	High mg/l	Good mgl	Moderate mg/l	Poor mg/l
NH4	0.3	0.6	1.1	2.5
Biochemical Oxygen Demand (BOD)	4	5	6.5	9
Phosphate	Reach specific - See table below			

Table 9.2 WFD Reach specific phosphate targets

WQ Sampling Point	Site Name	Altitude	Alkalinity	Type	High ugL	Good ugL	Moderate ugL	Poor ugL
WQ 48939750	RIVER SENCE (SOAR) AT WIGSTON	67	217	3	42	77	190	1042
WQ 48939020	RIVER SENCE (SOAR) AT CONFLUENCE WITH RIVER SOAR	60	199	3	41	77	188	1039
WQ 46261980	RIVER SOAR AT EVANS WEIR	55	194	3	42	77	189	1041
WQ 46259100	RIVER SOAR AT WANLIP	46	193	3	43	79	193	1050
WQ 46257100	RIVER SOAR AT SILEBY MILL	43	191	3	43	80	194	1052

River Sence

The area of interest for this study starts at Whetstone WwTW on the River Sence close to its confluence with the River Soar, Table 9.3 shows the Cycle 2 WFD status for this reach of the River Sence, and a comparison to the updated baseline in SIMCAT. The results suggests that BOD may have deteriorated since the model was created in 2012. This means that the results from SIMCAT for this reach may be a conservative estimate as the river may be more sensitive to changes in BOD than in reality.

Table 9.3 WFD summary for River Sence from Countesthorpe Brook to Soar

	Ecological Status	Biological Oxygen Demand (BOD)	Ammonia	Phosphate
2016 WFD Cycle 2 Classification	Poor	Good	High	Poor
SIMCAT 2018 Baseline	N/A	High	High	Poor
Objectives	Moderate by 2021	N/A	N/A	Good by 2027

Note: The ecological status is set by more than BOD, Ammonia and Phosphate elements so an ecological status cannot be ascertained from SIMCAT for the 2018 baseline.

Table 9.4 shows the reasons for not achieving good status listed on the EA's Catchment Data Explorer, with discharge from WwTW and from urban drainage listed as a reason for not achieving good status for phosphate.

Table 9.4 Reasons for not achieving good status (River Sence from Countesthorpe Brook to Soar)

Type	Activity	Category	Classification Element
Diffuse	Transport Draining	Urban and transport	Macrophytes and Phytobenthos Combined
Point	Sewage discharge (continuous)	Water industry	Macrophytes and Phytobenthos Combined
Point	Sewage discharge (continuous)	Water industry	Invertebrates
Diffuse	Transport Drainage	Urban and transport	Invertebrates
Diffuse	Transport Drainage	Urban and transport	Phosphate
Point	Sewage discharge (continuous)	Water industry	Phosphate

River Soar

The River Sence meets the River Soar south of Leicester between Glen Parva and Whetstone and flows north into Leicester. The reach of the River Soar (Soar from Sence to Rothley Brook) flows from the confluence with the Sence to the confluence with Rothley Brook north of Leicester.

Table 9.5 WFD Summary for the River Soar from Sence to Rothley Brook

	Ecological Status	Biological Oxygen Demand (BOD)	Ammonia	Phosphate
2016 WFD Cycle 2 Classification	Poor	High	High	Poor
SIMCAT 2018 Baseline	N/A	High	High	Poor
Objectives	Good by 2027	N/A	N/A	Good by 2027

Table 9.6 shows the reasons for not achieving good status listed on the EA's Catchment Data Explorer, with discharge from WwTW and from urban drainage listed as a reason for not achieving good status for phosphate.

Table 9.6 Reasons for not achieving good status for the River Soar from Sence to Rothley Brook

Type	Activity	Category	Classification Element
Point	Sewage discharge (continuous)	Water industry	Phosphate
Point	Sewage discharge (continuous)	Water industry	Macrophytes and Phytobenthos Combined
Point	Sewage discharge (intermittent)	Water industry	Macrophytes and Phytobenthos Combined
Diffuse	Transport Drainage	Urban and transport	Phosphate

9.4.2 Modelling results

Could the development cause a greater than 10% deterioration in water quality?

The baseline model was re-run after the additional effluent flow from development was added to Wanlip WwTW. The effect on water quality is shown in Table 9.7. Deterioration in Phosphate was predicted to be close to 0%, despite an increase in flow of nearly 3%. This is because the current discharge quality at Wanlip for Phosphate is close to the upstream water quality and so the volume of discharge has a negligible effect.

A deterioration in BOD and ammonia of 1 to 3% is observed downstream of Wanlip WwTW.

A further scenario was run testing the option of diverting 3.5 Ml/d of wastewater from Wanlip WwTW to Whetstone WwTW. The results of this are shown in Table 9.8 below. It is predicted that the transfer of flow will cause a localised deterioration in the concentration of ammonia immediately downstream of Whetstone WwTW of up to 15%. The percentage deterioration falls to 10.5% at the confluence with the River Soar, and the effect is negligible at the downstream extent of the model.

A deterioration is also seen in BOD and Phosphate downstream of Whetstone, however there is a slight betterment in BOD concentration at the downstream extent of the model due to the difference in treatment quality between the two WwTWs.

It should be noted that improvements in phosphate treatment at Whetstone WwTW and Wigston WwTW (upstream of Whetstone on the River Sence) are planned in AMP7 and have already been incorporated into the baseline model.

Once growth is factored into the model, the localised deterioration downstream of Whetstone WwTW is still predicted, however the concentrations downstream of Wanlip are broadly in line with the future growth scenario without the transfer of flow.

It can therefore be said that growth itself is not causing a 10% or greater deterioration in quality and no change in WFD class. The transfer from Wanlip to Whetstone should be subject to further study in collaboration with the Environment Agency before it is adopted.

The results of the modelling, in particular the transfer scenario were discussed with Severn Trent Water who confirmed that they are aware of this as a potential issue, and any transfer of flow would occur alongside changes in permit levels agreed with the Environment Agency to prevent this deterioration in ammonia concentration.

Could the development cause a deterioration in WFD class of any element assessed?

No deterioration in WFD class in any of the modelled determinands was predicted within the model in the either scenario with or without the transfer.

Table 9.7 Impact of growth on water quality

Location	WQ Sampling Point	2018 - Baseline			Future			Percentage Change			
		NH4	BOD	P	NH4	BOD	P	Flow	NH4	BOD	P
Upstream of WwTW	WQ 48939750	0.56	3.24	0.42	0.56	3.24	0.42	0.0%	0.0%	0.0%	0.0%
At point of discharge	WHETSTONE WwTW	0.48	3.39	0.37	0.48	3.39	0.37	0.0%	0.0%	0.0%	0.0%
Downstream of WwTW	WQ 48939020	0.47	3.40	0.37	0.47	3.40	0.37	0.0%	0.0%	0.0%	0.0%
River Soar	WQ 46261980	0.19	3.07	0.31	0.19	3.07	0.31	0.0%	0.0%	0.0%	0.0%
Upstream of WwTW	WQ 46259100	0.17	2.49	0.26	0.17	2.49	0.26	0.0%	0.0%	0.0%	0.0%
At point of discharge	WANLIP WwTW	0.42	3.83	0.33	0.43	3.89	0.34	2.7%	2.4%	1.6%	3.0%
Downstream of WwTW	End of reach	0.41	3.76	0.33	0.41	3.79	0.33	2.7%	0.0%	0.8%	0.0%
River Soar	WQ 46257100	0.27	2.74	0.31	0.27	2.77	0.31	1.6%	0.0%	1.1%	0.0%

WFD CLASS
HIGH
GOOD
MODERATE
POOR
BAD

Table 9.8 Impact of the transfer of flow from Wanlip to Whetstone

Location	WQ Sampling Point	2018 - Baseline			2018 - Transfer			Percentage Change				2018 - Transfer Future			Transfer future vs 2018 Baseline			
		NH4	BOD	P	NH4	BOD	P	Flow	NH4	BOD	P	NH4	BOD	P	Flow	NH4	BOD	P
Upstream of WwTW	WQ 48939750	0.56	3.24	0.42	0.56	3.24	0.42	0.0%	0.0%	0.0%	0.0%	0.56	3.24	0.42	0.0%	0.0%	0.0%	0.0%
At point of discharge	WHETSTONE WwTW	0.48	3.39	0.37	0.55	3.59	0.37	4.3%	14.6%	5.9%	0.0%	0.55	3.59	0.37	4.3%	14.6%	5.9%	0.0%
Downstream of WwTW	WQ 48939020	0.47	3.40	0.37	0.54	3.60	0.37	4.2%	14.9%	5.9%	0.0%	0.54	3.60	0.37	4.2%	14.9%	5.9%	0.0%
River Soar	WQ 46261980	0.19	3.07	0.31	0.21	3.08	0.31	1.5%	10.5%	0.3%	0.0%	0.21	3.08	0.31	1.5%	10.5%	0.3%	0.0%
Upstream of WwTW	WQ 46259100	0.17	2.49	0.26	0.18	2.46	0.26	1.2%	5.9%	-1.2%	0.0%	0.18	2.46	0.26	1.2%	5.9%	-1.2%	0.0%
At point of discharge	WANLIP WwTW	0.42	3.83	0.33	0.42	3.82	0.33	0.0%	0.0%	-0.3%	0.0%	0.43	3.87	0.33	2.6%	2.4%	1.0%	0.0%
Downstream of WwTW	End of reach	0.41	3.76	0.33	0.40	3.74	0.33	0.0%	-2.4%	-0.5%	0.0%	0.41	3.76	0.33	2.6%	0.0%	0.0%	0.0%
River Soar	WQ 46257100	0.27	2.73	0.40	0.27	2.72	0.40	0.0%	0.0%	-0.4%	0.0%	0.28	2.76	0.40	1.6%	3.7%	1.1%	0.0%

Could the development alone prevent the receiving watercourse from reaching Good Ecological Status (GES) or Potential?

Where treatment at TAL and reductions in diffuse sources in the present day could improve water quality to meet Good class, it is important to understand whether this could be compromised as a result of future growth within the catchment.

Guidance form the EA suggests breaking this down in to two questions:

a) Is GES possible now with current technology?

b) Is GES technically possible after development and any potential WwTW upgrades?

If the answer to questions a) and b) are both 'Yes' or 'No' then the development can be assessed as having no significant impact on the water bodies potential for reaching GES. However, if the answer to a) is 'Yes' and the answer for b) is 'No' then development is having a significant impact.

The modelling predicts that ammonia and BOD both achieve GES, both before and after growth, however phosphate remains Poor in both scenarios.

RQP was used to carry out a single site assessment at Wanlip WwTW. In this assessment it is assumed that improvements in the catchment have improved the upstream river water quality to the mid-point of good class for each determinand. The targets for use in this assessment are shown in Table 9.9 and Table 9.10 below.

Table 9.9 WFD Targets

Determinand	Statistic	High	Good	Mid-point of Good
BOD	90 %ile	4.0	5.0	4.5
Ammonia	90 %ile	0.3	0.6	0.45
Phosphorous	Annual mean	0.043	0.079	0.061

Table 9.10 WFD Mid-point of "Good"

Determinand	90%ile (mg/l)	Coefficient of variation (mg/l)	Mean (mg/l)	Standard Deviation (mg/l)
BOD	4.5	0.6	2.58	1.55
Ammonia	0.45	1	0.22	0.22
Phosphorous	N/A	0.8	0.061	0.049

The assessment predicted that in order to achieve GES, a permit level of 0.1 mg/l would be required at Wanlip WwTW. The same permit level is required (within the precision of RQP) to achieve GES once growth has been factored in. This exceeds the technically achievable limit for phosphate treatment so it can be said that GES cannot be achieved due to current technology limits and would not be prevented due to growth.

A further assessment was undertaken with the river quality target set to moderate status. This predicts that should upstream water quality be improved, a permit limit of 0.36 would allow moderate ecological status to be attained, and this is not affected by the addition of growth.

Table 9.11 Permit levels required to meet WFD targets for Phosphate at Wanlip WwTW

Target	Permit level required at current flow (mg/l)	Permit level required to accommodate future flows (mg/l)
Good ecological status	0.1	0.1
Moderate ecological status	0.36	0.35

9.4.3 Priority substances

As well as the physico-chemical water quality elements (BOD, Ammonia, Phosphate etc.) addressed above, a watercourse can fail to achieve Good Ecological Status due to exceeding permissible concentrations of hazardous substances. Currently 33 substances are defined as hazardous or priority hazardous substances, with others under review. Such substances may pose risks both to humans (when contained in drinking water) and to aquatic life and animals feeding in aquatic life. These substances are managed by a range of different approaches, including EU and international bans on manufacturing and use, targeted bans, selection of safer alternatives and end-of-pipe treatment solutions. There is considerable concern within the UK water industry that regulation of these substances by setting permit values which require their removal at wastewater treatment works will place a huge cost burden upon the industry and its customers, and that this approach would be out of keeping with the "polluter pays" principle.

We also consider how the planning system might be used to manage priority substances:

- Industrial sources – whilst this report covers potential employment sites, it doesn't consider the type of industry and therefore likely sources of priority substances are unknown. It is recommended that developers should discuss potential uses which may be sources of priority substances from planned industrial facilities at an early stage with the EA and, where they are seeking a trade effluent consent, with the sewerage undertaker.
- Agricultural sources - There is limited scope for the planning system to change or regulate agricultural practices. UK water companies are involved in a range of "Catchment-based Approach" schemes aimed at reducing diffuse sources of pollutants, including agricultural pesticides.
- Surface water runoff sources - some priority substances e.g. heavy metals, are present in urban surface water runoff. It is recommended that future developments would manage these sources by using SuDS that provide water quality treatment, designed following the CIRIA SuDS Manual. This is covered in more detail in sections 11.7.1 and 11.7.2.
- Domestic wastewater sources - some priority substances are found in domestic wastewater as a result of domestic cleaning chemicals, detergents, pharmaceuticals, pesticides or materials used within the home. Whilst an increase in the population due to housing growth could increase the total volumes of such substances being discharged to the environment, it would be more appropriate to manage these substances through regulation at source, rather than through restricting housing growth through the planning system.

No further analysis of priority substances will be undertaken as part of this study.

STW have commented that Wanlip WwTW is expected to be subject to tighter permits for Phosphate, Hexabromocyclododecane (HBCDD) and possibly Tributyltin (TBT) in AMP8, when significant investment will need to take place to meet new discharge quality requirements. Hexabromocyclododecane was widely used in fire retardants for buildings, but its manufacture and use is now prohibited. Specialist disposal is required when renovating or demolishing buildings. Tributyltin, which is highly toxic to freshwater and marine life, is banned for use in anti-fouling paints, but is still used in some disinfectants.

9.5 Conclusions

The impact of increased discharges of treated effluent as a result of growth in Leicester has been assessed using the EA's SIMCAT and RQP tools. The following conclusions were drawn:

- Additional effluent discharge at Wanlip WwTW is unlikely to lead to a 10% or greater deterioration in any of the modelled determinands
- Good ecological status is currently being achieved for BOD and Ammonia downstream of Wanlip WwTW and no deterioration is predicted due to growth
- The WFD status is currently Poor for Phosphate, and this is not predicted to deteriorate due to growth
- A transfer of flows from Wanlip to Whetstone WwTWs could result in a localised deterioration in ammonia downstream of Whetstone. Severn Trent Water are aware of this potential and plan of adjusting permit levels appropriately to prevent deterioration.
- Good ecological status (GES) for phosphate cannot currently be achieved in the River Soar downstream of Wanlip WwTW even if upstream river quality were improved and treatment at Wanlip were at the technically achievable limit. The ability of the River Soar to meet GES is not impacted by growth.
- Moderate ecological status could be achieved downstream of Wanlip WwTW in the future and would not be impacted by growth.

It should be noted that where this modelling work predicts a theoretical risk of deterioration in water quality downstream of a WwTW, the EA would not allow a deterioration under the Water Framework Directive, and in reality STW will work with the EA to ensure this does not occur.

10 Flood Risk Management

10.1 Assessment of additional flood risk from increased WwTW discharges

In catchments with a large planned growth in population and which discharge effluent to a small watercourse, the increase in the discharged effluent might have a negative effect on the risk of flooding. An assessment has been carried out to quantify such an effect on Wanlip WwTW which is the only WwTW serving growth in Leicester City.

10.2 Methodology

The following process has been used to assess the potential increased risk of flooding due to extra flow reaching Wanlip WwTW:

- Calculate the increase in DWF attributable to planned growth;
- Identify the point of discharge of Wanlip WwTW;
- At the outfall point, use the FEH Webservice[49] to extract the catchment descriptors;
- Use FEH Statistical method to calculate peak 1 in 30 (Q30) and 1 in 100 (Q100) year fluvial flows;
- Calculate the additional foul flow as a percentage of the Q30 and Q100 flow

A red/amber/green score was applied to score the associated risk as follows:

Additional flow ≤5% of Q30. Low risk that increased discharges will increase fluvial flood risk	Additional flow ≥5% of Q30. Moderate risk that increased discharges will increase fluvial flood risk	Additional flow ≥5% of Q100. High risk that increased discharges will increase fluvial flood risk

The hydrological assessment of river flows was applied using a simplified approach, appropriate to this type of screening assessment. The Q30 and Q100 flows quoted should not be used for other purposes, e.g. flood modelling or flood risk assessments.

10.3 Results

Table 10.1 reports the additional flow from Wanlip WwTW as a percentage of the Q30 and Q100 peak flow (using the lowest from either the ReFH or FEH Stat method to be the most conservative). Note that where the ReFH peak flow is stated as n/a, the catchment was unsuitable for using the ReFH method. The results show that additional flows from Wanlip WwTW post development would have a negligible effect on the predicted peak flow events with return periods of 30 and 100 years.

Table 10.1 Summary of DWF as a % of Q30 and Q100 peak flows

WwTW	ReFH Q30 m^3/s	ReFH Q100 m^3/s	FEH Stat Q30 m^3/s	FEH Stat Q100 m^3/s	Add. Average DWF Ml/d	Add. Flow m^3/s	Flow increase % Q30	Flow increase % Q100
Wanlip	n/a	n/a	112.94	147.46	11.73	0.136	0.12%	0.09%

49 FEH Web Service © and database right NERC (CEH) 2015. All rights reserved Accessed online at: https://fehweb.ceh.ac.uk/ Catchment descriptors extracted on: 28/10/2019

10.4 Conclusions

A detailed assessment of flood risk can be found within the Leicestershire and Leicester City Level 1 Strategic Flood Risk Assessment[50].

The impact of increased effluent flows is not predicted to have a significant impact upon flood risk in the River Soar (the receiving watercourse of Wanlip WwTW).

10.5 Recommendations

Table 10.2 Recommendations from flood risk assessment

Action	Responsibility	Timescale
Proposals to increase discharges to a watercourse may also require a flood risk activities environmental permit from the EA (in the case of discharges to Main River), or a land drainage consent from the Lead Local Flood Authority (in the case of discharges to an Ordinary Watercourse).	STW	During design of WwTW upgrades

50 Leicestershire and Leicester City Level 1 Strategic Flood Risk Assessment. Accessed online at: https://www.llstrategicgrowthplan.org.uk/the-plan/stage-two/developing-the-evidence-base/leicestershire-leicester-city-level-1-strategic-flood-risk-assessment/ on: 06/01/2020

11 Environmental Opportunities and Constraints

11.1 Introduction

Development has the potential to cause an adverse impact on the environment through a number of routes, such as worsening of air quality, pollution to the aquatic environment or disturbance to wildlife. In the context of a Water Cycle Study, the impact of development on the aquatic environment is under assessment.

A source-pathway-receptor approach can be taken to investigate the risk and identify where further assessment or action is required.

11.2 Sources of pollution

Water pollution is usually categorised as either diffuse or point source. Point source sources come from a single well-defined point, an example being the discharge from a WwTW. Section 9 models the WwTW serving growth within LCC as point sources of pollution and predicts the likely concentration of pollutants downstream.

Diffuse pollution is defined as "unplanned and unlicensed pollution from farming, old mine workings, homes and roads. It includes urban and rural activity and arises from industry, commerce, agriculture and civil functions and the way we live our lives."

Examples of diffuse sources of water pollution include:

- Contaminated runoff from roads – this can include metals and chemicals
- Drainage from housing estates
- Misconnected sewers (foul drains to surface water drains)
- Accidental chemical/oil spills from commercial sites
- Surplus nutrients, pesticides and eroded soils from farmland
- Septic tanks and non-mains sewer systems

The most likely sources of diffuse pollution from new developments include drainage from housing estates, runoff from roads and discharges from commercial and industrial premises. The pollution risk posed by a site will depend on the sensitivity of the receiving environment, the pathway between the source of the runoff and the receiving waters, and the level of dilution available. After or during heavy rainfall, the first flush of water carrying accumulated dust and dirt is often highly polluting.

Whilst the threat posed by an individual site may be low, a number of sites together may pose a cumulative impact within the catchment.

Runoff from development sites should be managed by a suitably designed SuDS scheme, more information on SuDS can be found in section 11.7.1.

Potential impacts on receiving surface waters include the blanketing of riverbeds with sediment, a reduction in light penetration from suspended solids, and a reduction in natural oxygen levels, all of which can lead to a loss in biodiversity.

11.3 Pathways

Pollutants can take a number of different pathways from their source to a "receptor" – a habitat or species that can be impacted. This could be overland via surface water flow paths, via the river system, or via groundwater or a combination of all three.

11.4 Receptors

A receptor in this case is a habitat or species that is adversely impacted by a pollutant. Both the rivers and groundwater as well as being pathways, can also be considered to be receptors, and the impact on the ecological status of rivers as defined within the Water Framework Directive is the subject of Section 9.

The Habitats Regulations Assessment process is designed to ensure that consideration is given within planning policy to sites protected by European Directives, namely Special Areas of Conservation (SAC) or Special Protection Areas (SPA). There are no SPAs or SACs in Leicester City.

SSSIs are not subject to the HRA process, but are protected under the Wildlife and Countryside Act, and the impact of development on these sites must also be considered.

11.5 Assessment of impact risk

Section 9 presents an analysis of water quality downstream of each WwTW serving growth in the study area, Equating a deterioration in water quality to a significant impact at a protected site such as a SSSI is difficult, but the data can be used to highlight areas of risk for further analysis in the Habitats Regulation Assessment.

One SSSI exists within the study area (Gipsy Lane Pit SSSI) but as this is not close to a watercourse with upstream WwTWs serving growth, it has not been considered further.

Within 20km downstream of Wanlip WwTW on the River Soar there are three SSSIs, Barrow Gravel Pits and Loughborough Meadows (Table 11.1).

Table 11.1 Wanlip WwTW relative to environmental designations

Source	Pathway	Receptor	Distance downstream (km)	Potential Impact
Wanlip WwTW	River Soar	Barrow Gravel Pits SSSI (SK568166)	8.5km	Water quality deterioration possible.
		Cotes Grassland SSSI (SK553208)	15km	
		Loughborough Meadows SSSI (SK538216)	17km	

The water quality modelling results were used to predict the concentration of pollutants in the waterbody adjacent to the three SSSIs. The nearest EA water quality sampling point was used as the assessment point, and the predicted deterioration is shown in Table 11.2. No deterioration is expected in Ammonia or Phosphate, and deterioration in BOD is 1.1%

Table 11.2 Predicted deterioration adjacent to SSSIs

Assessment Point	Name	Ammonia % deterioration	BOD % Deterioration	Phosphate % Deterioration
MD-46257100	River Soar at Sileby Mill	0.0%	1.1%	0.0%

11.5.1 Diffuse sources of water pollution

The most likely sources of diffuse pollution from new developments include drainage from housing estates, runoff from roads and discharges from commercial and industrial premises. Potential development sites within Leicester could be considered as sources of additional runoff, with environmental designations being the receptors.

The pollution risk posed by a site will depend on the sensitivity of the receiving environment, the pathway between the source of the runoff and the receiving waters, and the level of dilution available. The potential development sites were analysed along with surface water flow routes and Lidar data, and this shows that none of the potential development sites are likely to be sources of water pollution to any environmentally designated sites. Other development sites e.g. committed sites and windfall, may still contribute to a cumulative impact within the catchment and so management of water quality of surface runoff from these sites should still be considered.

11.6 Groundwater Protection

Groundwater is an important source of water in England and Wales.

The Environment Agency is responsible for the protection of "controlled waters" from pollution under the Water Resources Act 1991. These controlled waters include all watercourses and groundwater contained in underground strata.

The zones are based on an estimate of the time it would take for a pollutant which enters the saturated zone of an aquifer to reach the source of abstraction or discharge point (Zone 1 = 50 days, Zone 2 = 400 days, Zone 3 is the total catchment area). The Environment Agency will use SPZs (alongside other datasets such as the Drinking Water Protected Areas (DrWPAs) and aquifer designations as a screening tool to show:

- areas where it would object in principle to certain potentially polluting activities, or other activities that could damage groundwater,
- areas where additional controls or restrictions on activities may be needed to protect water intended for human consumption,
- how it prioritises responses to incidents.

The EA have published a position paper[51] outlining its approach to groundwater protection which includes direct discharges to groundwater, discharges of effluents to ground and surface water runoff. This is of relevance to this water cycle study where a development may manage surface water through SuDS.

Sewage and trade effluent

Discharge of treated sewage of $2m^3$ per day or less to ground are called small sewage discharges (SSDs). The majority of SSDs do not require an environmental permit if they comply with certain qualifying conditions. A permit will be required for all SSDs in source protection zone 1 (SPZ1).

For treated sewage effluent discharges, the EA encourages the use of shallow infiltration systems, which maximise the attenuation within the drainage blanket and the underlying unsaturated zone. Whilst some sewage effluent discharges may not pose a risk to groundwater quality individually, the cumulative risk of pollution from aggregations of discharges can be significant. Improvement or pre-operational conditions may be imposed before granting an environmental permit. The EA will only agree to developments where the addition of new sewage effluent discharges to ground in an area of existing discharges is unlikely to lead to an unacceptable cumulative impact.

Generally, the Environment Agency will only agree to developments involving release of sewage effluent, trade effluent or other contaminated discharges to ground if it is satisfied that it is not reasonable to make a connection to the public foul sewer. The EA would normally expect to only permit new private discharges where the distance

51 The Environment Agency's approach to groundwater protection, Environment Agency (2018). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Envirnment-Agency-approach-to-groundwater-protection.pdf on: 23/01/2019

to connect to the nearest public sewer exceeds the number of dwellings * 30m. So, for example, a development of 100 dwellings would need to be more than 3km from a public sewer. The developer would have to provide evidence of why the proposed development cannot connect to the foul sewer in the planning application. This position will not normally apply to surface water run-off via sustainable drainage systems and discharges from sewage treatment works operated by sewerage undertakers with appropriate treatment and discharge controls.

Deep infiltration systems (such as boreholes and shafts) are not generally accepted by the EA for discharge of sewage effluent as they bypass soil layers and reduce the opportunity for attenuation of pollutants.

Discharges of surface water run-off to ground at sites affected by land contamination, or from sites for the storage of potential pollutants are likely to require an environmental permit. This could include sites such as garage forecourts and coach and lorry parks. These sites would be subject to a risk assessment with acceptable effluent treatment provided.

Discharge of clean water

"Clean water" discharges such as runoff from roofs or from roads, may not require a permit. However, they are still a potential source of groundwater pollution if they are not appropriately designed and maintained.

Where infiltration SuDS schemes are proposed to manage surface runoff they should:

- be suitably designed;
- meet Government non-statutory technical standards[52] for sustainable drainage systems – these should be used in conjunction with the NPPF and PPG; and
- use a SuDS management treatment train

A hydrogeological risk assessment is required where infiltration SuDS is proposed for anything other than clean roof drainage in a SPZ1.

Source Protection Zones in Leicester City

There are no Source Protection Zones within Leicester City.

11.7 Surface Water Drainage and SuDS

Since April 2015[53], management of the rate and volume of surface water has been a requirement for all major development sites, through the use of Sustainable Drainage Systems (SuDS).

Leicestershire County Council as Lead Local Flood Authority (LLFA), is statutory consultee to the planning system for surface water management within major development, which covers the following development scenarios:

- 10 or more dwellings
- a site larger than 0.5 hectares, where the number of dwellings is unknown
- a building greater than 1,000 square metres
- a site larger than 1 hectare

SuDS are drainage features which are designed to replicate natural drainage patterns, through capturing rainwater at source, and releasing it slowly into the ground or a

52 Sustainable Drainage Systems: non-statutory technical standards, Department for Environment, Food & Rural Affairs (2015). Accessed online at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards on: 30/09/2019

53 Department for Communities and Local Government (2014) House of Commons: Written Statement (HCWS161) Written Statement made by: The Secretary of State for Communities and Local Government (Mr Eric Pickles) on 18 Dec 2014. Available at: https://www.parliament.uk/documents/commons-vote-office/December%202014/18%20December/6.%20DCLG-sustainable-drainage-systems.pdf on: 12/09/2019

water body. They can help to manage flooding through controlling the quantity of surface water generated by a development and improve water quality by treating urban runoff. SuDS can also deliver multiple benefits, through creating habitats for wildlife and green spaces for the community.

National standards on the management of surface water are outlined within the Defra Non-statutory Standards for Sustainable Drainage Systems[54], with local guidance specified by Leicester City Council[55]. The CIRIA C753 SuDS Manual[56] and Guidance for the Construction of SuDS[57] provide the industry best practice guidance for design and management of SuDS.

11.7.1 Use of SuDS in Water Quality Management

SuDS allow the management of diffuse pollution generated by urban areas through the sequential treatment of surface water reducing the pollutants entering lakes and rivers, resulting in lower levels of water supply and wastewater treatment being required. This treatment of diffuse pollution at source can contribute to meeting WFD water quality targets, as well as national objectives for sustainable development.

This is usually facilitated via a SuDS Management Train of a number of components in series that provide a range of treatment processes delivering gradual improvement in water quality and providing an environmental buffer for accidental spills or unexpected high pollutant loadings from the site. Considerations for SuDS design for water quality are summarised in Figure 11.1 below.

54 Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems, DEFRA (2015) Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf on: 12/09/2019
55 Sustainable Drainage Guide, Leicester City Council (2015). Accessed online at: https://www.leicester.gov.uk/media/179759/suds-guidance-april-2015.pdf on: 17/12/2019
56 CIRIA Report C753 The SuDS Manual, CIRIA (2015). Accessed online at: https://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters.aspx on: 12/09/2019
57 Guidance on the Construction of SuDS (C768), CIRIA (2017), Accessed online at: https://www.ciria.org/ItemDetail?iProductcode=C768&Category=BOOK on: 12/09/2019

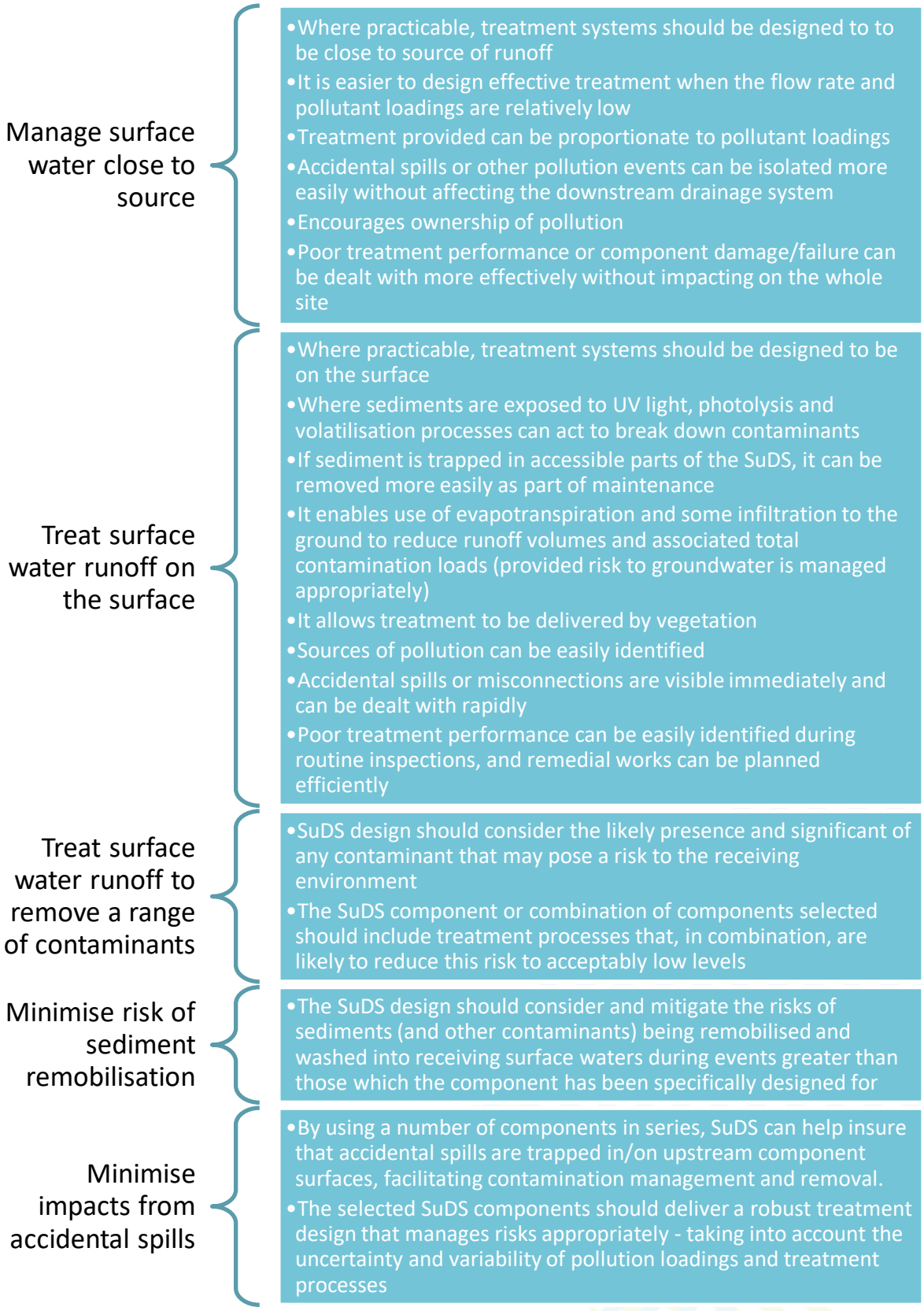


Figure 11.1 Considerations for SuDS design for water quality

Managing pollution close to its source can help keep pollutant levels and accumulation rates low, allowing natural processes to be more effective. Treatment can often be delivered within the same components that are delivering water quantity design criteria, requiring no additional cost or land-take.

SuDS designs should control the 'first flush' of pollutants (usually mobilised by the first 5mm of rainfall) at source, to ensure contaminants are not released from the site. Best practise is that no runoff should be discharged from the site to receiving watercourses or sewers for the majority of small (e.g. less than 5mm) rainfall events.

Infiltration techniques will need to consider Groundwater Source Protection Zones (GSPZs) and are likely to require consultation with the Environment Agency.

Early consideration of SuDS within master planning will typically allow a more effective scheme to be designed.

11.7.2 Additional benefits

Flood Risk

The Strategic Flood Risk Assessment contains recommendations for SuDS to manage surface water on development sites, with the primary aim of reducing flood risk.

SuDS are most effective at reducing flood risk for relatively high intensity, short and medium duration events, and are particularly important in mitigating potential increases in surface water flooding, sewer flooding and flooding from small and medium sized watercourses resulting from development.

Water Resources

A central principle of SuDS is the use of surface water as a resource. Traditionally, surface water drainage involved the rapid disposal of rainwater, by conveying it directly into a sewer or wastewater treatment works.

SuDS techniques such as rainwater harvesting, allow rainwater to be collected and re-used as non-potable water supply within homes and gardens, reducing the demand on water resources and supply infrastructure.

Climate Resilience

Climate projections for the UK suggest that winters may become milder and wetter and summers may become warmer, but with more frequent higher intensity rainfall events, particularly in the south east. This would be expected to increase the volume of runoff, and therefore the risk of flooding from surface water, and diffuse pollution, and reduce water availability.

SuDS offer a more adaptable way of draining surfaces, controlling the rate and volume of runoff leaving urban areas during high intensity rainfall, and reducing flood risk to downstream communities through storage and controlled release of rainwater from development sites.

Through allowing rainwater to soak into the ground, SuDS are effective at retaining soil moisture and groundwater levels, which allows the recharge of the watercourses and underlying aquifers. This is particularly important where water resource availability is limited, and likely to become increasingly scare under future drier climates.

Biodiversity

The water within a SuDS component is an essential resource for the growth and development of plants and animals, and biodiversity benefits can be delivered even by very small, isolated schemes. The greatest value can be achieved where SuDS are planned as part of a wider green landscape, providing important habitat, and wildlife connectivity. With careful design, SuDS can provide shelter, food, foraging and

breeding opportunities for a variety of species including plants, amphibians, invertebrates, birds, bats and other animals.

Amenity

Designs using surface water management systems to help structure the urban landscape can enrich its aesthetic and recreational value, promoting health and well-being and supporting green infrastructure. Water managed on the surface rather than underground can help reduce summer temperatures, provide habitat for flora and fauna and act a resource for local environmental education programmes and working groups and directly influence the sense of community in an area.

11.8 Conclusions

- A number of SSSIs exist outside of Leicester City that should be carefully considered in future plan making.
- There is potential for additional discharge from Wanlip WwTW to impact sites with environmental designations (see Section 9).
- Development sites within Leicester could be sources of diffuse pollution from surface runoff.
- SuDs are required on all sites and their design must consider water quality as well as water quantity.
- Runoff from these sites should be managed through implementation of a SuDS scheme with a focus on treating water quality of surface runoff from roads and development sites
- Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity.

11.9 Recommendations

Table 11.3 Recommendations from environment constraints and opportunities section

Action	Responsibility	Timescale
The local plan should include policies that require all development proposals with the potential to impact on areas with environmental designations to be considered in consultation with Natural England (for national designations).	LCC	Ongoing
The Local Plan should include policies that require development sites, where a pathway exists for surface water to a site with an environmental designation, to adopt SuDS to manage water quality of surface runoff.	LCC	Ongoing
The local plan should include policies that encourage development sites, where no obvious pathway exists to a site with an environmental designation, to consider the adoption of SuDS to manage the cumulative impact of development within the catchment (unless it is not reasonably practicable to do so).	LCC	Ongoing
In partnership, identify opportunities for incorporating SuDS into open	LCC	Ongoing

spaces and green infrastructure, to deliver strategic flood risk management and meet WFD water quality targets.	STW EA	
Developers should include the design of SuDS at an early stage to maximise the benefits of the scheme	Developers	Ongoing
Work with developers to discourage connection of new developments into existing surface water and combined sewer networks. Prevent connections into the foul network, as this is a significant cause of sewer flooding.	LCC Developers	Ongoing

12 Climate change impact assessment

12.1 Approach

A qualitative assessment was undertaken to assess the potential impacts of climate change on the assessments made in this water cycle study. This was done using a matrix which considered both the potential impact of climate change on the assessment in question, and also the degree to which climate change has been considered in the information used to make the assessment.

The impacts have been assessed on a Leicester area wide basis; the available climate models are generally insufficiently refined to draw different conclusions for different parts of Leicester or doing so would require a degree of detail beyond the scope of this study.

Table 12.1 Climate change pressures scoring matrix

		Impact of pressure		
		Low	**Medium**	**High**
Have climate change pressures been considered in the assessment?	Yes - quantitative consideration			
	Some consideration but qualitative only			
	Not considered			

12.2 Severn Trent Water infrastructure

Severn Trent Water have published a risk assessment[58] for both water resources, wastewater treatment and wastewater sewerage networks that identifies the level of threat from climate change in key service areas. In the case of WwTW, the highest perceived risks are in asset performance and pollution incidents, both of which can be attributed to an increased risk of flooding. In the case of the wastewater network, sewer flooding, resulting from increased rainfall intensity overwhelming the sewer network is added to the risks of impacts on asset performance and pollution incidents.

Consideration of the impact of climate change on water resources is included in Severn Trent Water's WRMP, with the main risk being the increased likelihood of severe drought events. Allowance is made within the baseline supply forecast by adjusting the "Water Available for Use". Each WRZ is classified as "low", "medium" or "high" vulnerability, to identify which WRZs are the most vulnerable to potential changes in rainfall and temperatures. The Strategic Grid WRZ which is classified as "high vulnerability". The results of the modelling showed that the Strategic Grid WRZ is the WRZ most affected by the potential impacts that climate change has on surface water sources. The Strategic Grid WRZ is directly affected by reduced river flows and reservoir infill.

58 Severn Trent Water's Climate Change Adaptation Report 2015-2020, Severn Trent Water (2015). Accessed online at: https://www.stwater.co.uk/content/dam/stw/about_us/documents/Full-Climate-change-adaptation-report-2015-2020.pdf on: 17/12/19

Table 12.2 Scoring of climate change consequences for the water cycle study

Assessment	Impact of Pressure (source of information)	Have climate change pressures been considered in the Water Cycle Study?	RAG
Water resources	High	Yes – quantitative assessment within the WRMP. Climate change impacts on consumption have been calculated in accordance with UKWIR report "Impact of Climate Change on Water Demand" (2013).	
Water supply infrastructure	Medium - some increased demand in hot weather	Yes - quantitative assessment within the WRMP.	
Wastewater Collection	High - Intense summer rainfall and higher winter rainfall increases flood risk	Yes – qualitative assessment in climate change adaptation reports by Severn Trent Water. This has not been considered in site by site assessments.	
Wastewater treatment	Medium - Increased winter flows and more extreme weather events reduces flow headroom	Yes – qualitative assessment in the Severn Trent Water climate change adaptation reports. This has not been considered in site by site assessments.	
WwTW odour	Medium – higher temperatures will exacerbate existing odour control issues.	Severn Trent Water have not considered odour in their climate adaptation plan.	
Water quality	Nutrients: High Sanitary determinands: Medium to High	Qualitative assessments have been included in the climate change adaptation policy papers from Severn Trent Water.	
Flooding from increased WwTW discharge	Low	No - not considered	

(1) River Basin Management Plan

(2) STW WRMPs

12.3 Conclusions and Recommendations

The impact of Climate Change on water resources and water infrastructure are receiving increasing levels of attention by water companies and sewerage undertakers at a strategic level. This has not been included in assessments at a site level as detailed modelling has not been carried out by Severn Trent Water. Consideration of changes in water and wastewater demand should be considered when carrying out detailed site assessments in the future.

Action	Responsibility	Timescale
When undertaking detailed assessments of environmental or asset capacity, consider how the latest climate change guidance can be included.	EA, STW, LCC	As required
Take "no regrets"* decisions in the design of developments which will contribute to mitigation and adaptation to climate change impacts. For example, consider surface water exceedance pathways when designing the layout of developments.	LCC and Developers	As required

* "No-Regrets" Approach: "No-regrets" actions are actions by households, communities, and local/national/international institutions that can be justified from economic, and social, and environmental perspectives whether natural hazard events or climate change (or other hazards) take place or not. "No-regrets" actions increase resilience, which is the ability of a "system" to deal with different types of hazards in a timely, efficient, and equitable manner. Increasing resilience is the basis for sustainable growth in a world of multiple hazards (Heltberg, Siegel, Jorgensen, 2009; UNDP, 2010).

13 Summary and overall conclusions

13.1 Summary of study

The aim of this water cycle study is to provide the evidence to inform the selection of potential site allocations in Leicester City, taking into account the constraints in the water environment and in water and wastewater infrastructure.

Table 13.1 summarises the conclusions from each section of the study, with Table 13.2 outlining the final recommendations for the Council, developers and Severn Trent Water as water and wastewater supplier for Leicester City.

STW as water supplier commented that there would not be issues with regards to the potential site allocations and water resources and water supply.

The majority of Leicester's potential site allocations would not require significant upgrades to the foul sewerage and surface water sewerage network, however where upgrades would be required, early engagement between the Council, STW and developers would be needed to ensure the correct infrastructure is in place prior to occupation, and that it is provided in a cost-effective manner.

Wanlip WwTW serves the whole of Leicester City and is currently exceeding its maximum permitted flow. Over the last few years the observed flow at the treatment works has been decreasing due to measures put in place by STW to mitigate the flow exceedance issues, and there are planned schemes for AMP7 and AMP8 to further address capacity pressures. As all planned growth in Leicester City will be served by Wanlip WwTW, early engagement between STW and Leicester City Council is required to ensure that opportunities to accommodate this growth within existing upgrade schemes can be realised.

Table 13.1 Summary of conclusions from the study

Assessment	Conclusion
Water resources	• The WRMP shows a supply-demand deficit from 2021-22 if no action is taken. It goes on to define a number of actions that will address this. • Severn Trent's comments regarding water resources was that they have "no areas of concerns regarding the sites proposed". While the Leicester development area "does not pose a significant risk to the quantitative status of groundwater or surface waterbodies in the area", they recommend "that best practice is always used and that water efficiency measures are specified by the planning authority." • A policy requiring new residential development to achieve the tighter water efficiency target of 110 l/p/d as described in Part G of Building Regulations is line with the strategic direction outlined in the National Water Resources Framework, and the recommendations of the River Basin Management Plan. Furthermore, it is viable, can be implemented at negligible cost and will reduce energy and water bills for residents.
Water supply infrastructure	• Severn Trent Water responded to the request to assess the impacts of development on water supply infrastructure. STW confirmed that water supply is not expected to be a constraint to development. • Early developer engagement is required to ensure that, as development occurs within the study area, detailed modelling of water supply infrastructure will allow any upgrades to be completed without restricting the timing, location or scale of the planned development

Wastewater collection	• The majority of Leicester's potential site allocations would not require significant upgrades to the foul sewerage and surface water sewerage network. • Early engagement with Severn Trent Water is required, and further modelling of the network may be required at the planning application stage.
Wastewater Treatment Works Flow Permit assessment	• Wanlip WwTW is currently exceeding its permitted flow and will continue to do so throughout the Local Plan period. Severn Trent Water are however aware of this and have a number of solutions to the issue, including tighter permits for effluent discharges from the WwTW and transferring some of the flows to Whetstone WwTW. • Due to the planned upgrades at Wanlip WwTW, early engagement between STW and Leicester City Council is required to ensure that opportunities to accommodate the planned growth proposed in Leicester City within existing upgrade schemes can be realised.
Water quality impact assessment	• Additional effluent discharge at Wanlip WwTW is unlikely to lead to a 10% or greater deterioration in any of the modelled determinands • Good ecological status is currently being achieved for BOD and Ammonia downstream of Wanlip WwTW and no deterioration is predicted due to growth • The WFD status is currently Poor for Phosphate, and this is not predicted to deteriorate due to growth • A transfer of flows from Wanlip to Whetstone WwTWs could result in a localised deterioration in ammonia downstream of Whetstone. Severn Trent Water are aware of this potential and plan of adjusting permit levels appropriately to manage this impact. • Good ecological status (GES) for phosphate cannot currently be achieved in the River Soar downstream of Wanlip WwTW even if upstream river quality were improved and treatment at Wanlip were at the technically achievable limit. The ability of the River Soar to meet GES is not impacted by growth. • Moderate ecological status could be achieved downstream of Wanlip WwTW in the future and would not be impacted by growth.
Odour Assessment	• There are no potential development sites in Leicester City at risk of nuisance odour from WwTW.
Flood risk from additional WwTW flow	• The impact of increased effluent flows is not predicted to have a significant impact upon flood risk in the receiving watercourse (River Soar) of Wanlip WwTW.
Environmental Constraints and Opportunities	• There is one SSSI within Leicester City, and several downstream of the City which should be carefully considered in future plan-making. • Wanlip WwTW is a potential point source of pollution outside of the study area. • Development sites within Leicester City could be sources of diffuse pollution from surface runoff. • Runoff from these sites should be managed through implementation of a SuDS scheme with a focus on treating water quality of surface runoff from roads and development sites.

	• Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity. • SuDS for a single site could be demonstrated to have limited impact, but it is the cumulative impact of all development across the catchment (combined with the potential effects of climate change) that should be taken into account. For this reason, SuDS should be considered on sites that do not have a direct pathway to a SSSI.

Table 13.2 Summary of recommendations

Aspect	Action	Responsibility	Timescale
Water resources	Continue to regularly review forecast and actual household growth across the supply region through WRMP Annual Update reports, and where significant change is predicted, engage with Local Planning Authorities. Take the latest growth forecasts into account in the 2019 WRMP.	STW	Ongoing
	Provide yearly profiles of projected housing growth to water companies to inform the WRMP.	LCC	Annually
	Use planning policy to require the 110l/person/day water consumption target permitted by National Planning Practice Guidance[59] in water-stressed areas.	LCC	In emerging Local Plan
	Water companies should advise LCC of any strategic water resource infrastructure developments within the Authority, where these may require safeguarding of land to prevent other type of development occurring.	STW, LCC	In emerging Local Plan
Water supply	Where appropriate undertake network modelling to ensure adequate provision of water supply is feasible	STW, LCC	As part of the planning process
	LCC and Developers should engage early with STW to ensure infrastructure is in place prior to occupation.	LCC, STW, Developers	Ongoing
Wastewater collection	Early engagement between LCC and STW is required to ensure that where strategic infrastructure is	LCC, STW	Ongoing

59 Planning Practice Guidance, Housing: Optional Technical Standards, Paras 13, 14 & 15, MHCLG (2015)., Accessed online at: https://www.gov.uk/guidance/housing-optional-technical-standards on: 20/01/2020

Aspect	Action	Responsibility	Timescale
	required, it can be planned in by STW.		
	Take into account wastewater infrastructure constraints in phasing development in partnership with the sewerage undertaker	LCC, STW	Ongoing
	Developers will be expected to work with the sewerage undertaker closely and early in the planning promotion process to develop an outline Drainage Strategy for sites. The Outline Drainage strategy should set out the following: What – What is required to serve the site Where – Where are the assets / upgrades to be located When – When are the assets to be delivered (phasing) Which – Which delivery route is the developer going to use s104 s98 s106 etc. The Outline Drainage Strategy should be submitted as part of the planning application submission, and where required, used as a basis for a drainage planning condition to be set.	STW, Developers	Ongoing
	Developers will be expected to demonstrate to the Lead Local Flood Authority (LLFA) that surface water from a site will be disposed using a sustainable drainage system (SuDS) with connection to surface water sewers seen as the last option. New connections for surface water to foul sewers will be resisted by the LLFA.	Developers, LLFA	Ongoing
Wastewater treatment	Consider the available capacity at Wanlip WwTW when phasing development.	LCC, STW	Ongoing
	Provide Annual Monitoring Reports to STW detailing projected housing growth in Leicester.	LCC	Ongoing
	STW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	STW, LCC	Ongoing
Flood Risk Management	Proposals to increase discharges to a watercourse may also require a flood risk activities environmental permit from the EA (in the case of discharges to Main River), or a land drainage consent from the Lead Local Flood Authority (in the case of	STW	During design of WwTW upgrades

Aspect	Action	Responsibility	Timescale
	discharges to an Ordinary Watercourse).		
Environment	The Local Plan should include policies that require development sites, where a pathway exists for surface water to a site with an environmental designation, to adopt SuDS to manage water quality of surface runoff.	LCC	Ongoing
	The local plan should include policies that encourage development sites, where no obvious pathway exists to a site with an environmental designation, to consider the adoption of SuDS to manage the cumulative impact of development within the catchment (unless it is not reasonably practicable to do so).	LCC	Ongoing
	In partnership, identify opportunities for incorporating SuDS into open spaces and green infrastructure, to deliver strategic flood risk management and meet WFD water quality targets.	LCC, STW, EA	Ongoing
	Developers should include the design of SuDS at an early stage to maximise the benefits of the scheme	Developers	Ongoing
	Work with developers to discourage connection of new developments into existing surface water and combined sewer networks. Prevent connections into the foul network, as this is a significant cause of sewer flooding.	LCC Developers	Ongoing

Appendices

A Site tracker spreadsheet

Offices at

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Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
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