West Berkshire Water Cycle Study Phase 1 - Scoping

Final Report

December 2020

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Revision History

Revision Ref/Date	Amendments	Issued to
S3-P01 30/10/2020	1st Draft	Laila Bassett (WBC)
A1-C02 04/12/2020	Final Draft	Laila Bassett (WBC)

Contract

This report describes work commissioned by West Berkshire Council. Emily Jones and Richard Pardoe of JBA Consulting carried out this work.

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Purpose

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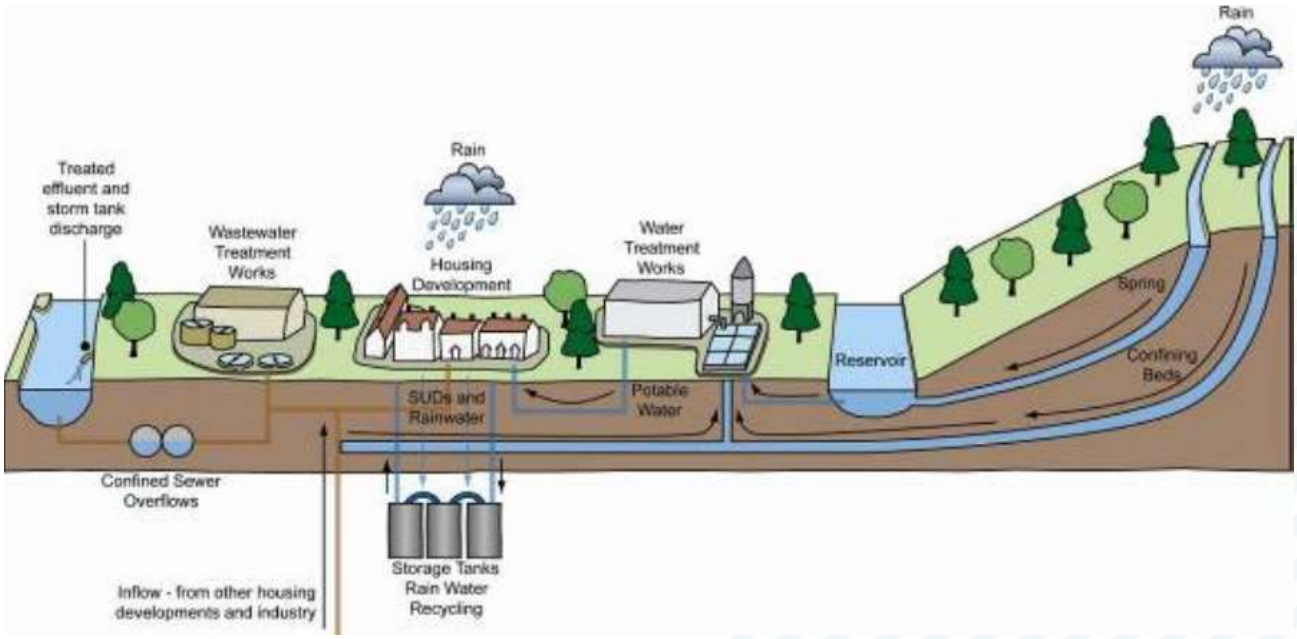
Executive Summary

In March 2020, JBA Consulting was commissioned by West Berkshire Council to undertake a Water Cycle Study (WCS) to inform the West Berkshire Local Plan Review to 2036. This study assesses the potential issues relating to future development across West Berkshire and the impacts on water supply, wastewater collection and 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 Phase 1 Scoping Study will assist West Berkshire 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, and the requirements of the environment (and the environmental legislative tests). Further work is recommended to be carried out within a Phase 2 Outline Study.

The Water Cycle Study has been carried out in co-operation with the water companies, the Environment Agency (EA) and Natural England (NE) whilst also using published information from the neighbouring Local Planning Authorities (LPAs).

Potential development sites were provided by West Berkshire 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. Available information was collated on water policy and legislation, water resources, water quality, and environmental designations within the study area.

The objective of the study is to provide evidence to guide development towards the most sustainable sites. Red / Amber /Green (RAG) assessments have been prepared at the site scale where possible for the different aspects of the water cycle. It should be remembered that where a development is scored amber or red in a water supply or wastewater infrastructure assessment, it does not mean that development cannot or should not take place in that location, merely that significant infrastructure may be required to accommodate it. The decision on the suitability of sites is made up of a number of assessments outside the scope of this report.

Water Resources

Thames Water (TW) are responsible for supplying the study area with water. In common with most of the south east, West Berkshire is an area of serious water stress. The more stringent water efficiency target for new development of 110 l/p/d allowed under Building Regulations is justified, however West Berkshire Council may want to consider going further than the 110l/p/d target, particularly in larger strategic developments.

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 West Berkshire, and also help to achieve reductions in carbon emissions.

Growth plans defined in Water Resource Management Plans (WRMPs) are broadly in line with the growth projections of West Berkshire Council. The WRMP does not predict a supply-demand deficit, except in peak week or drought conditions, and proposes actions over the WRMP planning period to improve resilience.

Water supply infrastructure

An increase in water demand due to growth can cause the hydraulic capacity of the existing supply infrastructure to be exceeded. This is likely to manifest itself as low water pressure at times of high demand.

Allocations and potential allocations across the study area were reviewed by Thames Water and given a relative scoring based on the impact upon the water supply network. Thames Water identified a number of development sites where further modelling and/or upgrades to the network would be required in order to serve those sites. Should these sites be allocated, delivery must be aligned with provision of these upgrades and West Berkshire Council should engage with TW early to enable infrastructure upgrades to be constructed prior to occupation of new developments.

Once there is more certainty on which sites will be allocated in the Local Plan Review, WBC should provide an update to TW to enable further modelling to be undertaken if necessary.

Wastewater collection infrastructure

Thames Water (TW) provides wastewater services to West Berkshire. 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.

Development in areas where there is limited wastewater network capacity will increase pressure on the network, raise the risk of a detrimental impact on existing customers, and increase the likelihood of sewer flooding. Early engagement with Thames Water is required, and further modelling of the network may be needed at the planning application stage.

If there are areas where the current network is a combined sewer system, further separation of foul and surface water may be required, as well as suitably designed Sustainable Drainage Systems (SuDS).

The results in section 0 show that, in order to serve the proposed growth in a number of settlements across West Berkshire, wastewater infrastructure and/or treatment upgrades would be required. Early engagement between developers, the Council and Thames Water is recommended to allow time to plan the strategic infrastructure required to serve these developments.

Wastewater treatment capacity

Headroom at Wastewater Treatment Works (WwTW) can be eroded by growth in population or per-capita consumption, requiring investment in additional treatment capacity or improvements in treatment processes. Thames Water operate all of the WwTWs serving growth across West Berkshire.

Two assessments of WwTW capacity were undertaken.

- JBA performed a headroom assessment comparing the current dry weather flow (DWF) at each WwTW against the permitted flow and adding the additional effluent from growth in the local plan period. Three WwTWs in West Berkshire are predicted to, or are already exceeding, their flow permit (Chieveley, Hungerford, Newbury).
- Thames Water carried out an assessment based on the relative suitability of development sites within each wastewater catchment. The least suitable sites (those where the WwTW would require investment in order to serve growth) were given a red or amber score, and those where minimal investment is required, or where investment is already planned, were given a green score. This assessment took into account capacity at the WwTW, as well as water quality, odour and infiltration within the catchment.

Many of the WwTWs in the study area would require upgrades in order to serve growth during the plan period. West Berkshire Council should consider the time taken to undertake these upgrades when phasing development and early engagement with TW is recommended to ensure required upgrades are in place prior to occupation. TW advised that "safeguarding" of land may be required in order to deliver these upgrades. Safeguarding in this context is ensuring that land required for water infrastructure in the future is not developed, preventing the upgrade. Once there is greater certainty on which development sites will be allocated in the Local Plan Review, TW should advise which WwTW would require safeguarding of land.

Odour

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 measures are retro fitted to existing WwTWs. National Planning Practice 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.

Six sites were identified that were within 800m of a WwTW. At these sites it is recommended that an odour assessment it carried out as part of the planning process. The cost of this should be met by the developer.

Water quality

An increase in the discharge of effluent from Wastewater Treatment Works (WwTW) as a result of development and growth in the area 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 the overall watercourse classification or for individual elements assessed).

This Phase 1 Scoping Study presents the current status of waterbodies within the study area and gathers the data required to model the impact of growth during the plan period on water quality. It is recommended that the modelling of water quality is carried out in a Phase 2 Outline Study.

Flood risk from additional foul flow

In catchments where a large growth in population is expected, and where the WwTW will discharge effluent to a small watercourse, the increase in discharged effluent might have a negative effect on the risk of flooding. An assessment was carried out to quantify such an effect.

The impact of increased effluent flows at WwTW from any of the proposed development is not predicted to have a significant impact upon flood risk in any of the receiving watercourses.

Environmental constraints

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 of an adverse impact on protected sites and identify where further assessment or action is required. The potential impacts of development on a number of protected sites such as Special Area of Conservation (SAC), Special Protection Areas (SPAs) SPAs, Sites of Special Scientific Interest (SSSIs) and Ramsar sites within, or downstream of the study area should be carefully considered in future plan making, as well as the large number of Priority Habitats and Priority Rivers. This Scoping Study identifies the protected sites that are downstream of a WwTW and may experience a deterioration in water quality during the plan period. It is recommended that modelling of this impact is carried out within a Phase 2 WCS.

Runoff from development sites is a potential source of diffuse pollution and could be managed through implementation of SuDS with a focus on treating the 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. In the wider area, opportunities exist to implement natural flood management techniques to achieve multiple benefits of flood risk management, water quality improvement and habitat creation.

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Abbreviations / Glossary

ALS	Abstraction Licensing Strategy
AMP	Asset Management Plan
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
CFMP	Catchment Flood Management Plan
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
EFI	Ecological Flow Indicator
EP	Environmental Permit
EU	European Union
FEH	Flood Estimation Handbook
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
NMP	Nutrient Management Plan
NPPF	National Planning Policy Framework
OAN	Objectively Assessed Need
OfWAT	Water Service Regulation Authority
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
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
SPS	Sewage Pumping Station
SPZ	Source Protection Zone
SS	Suspended Solids
SSSI	Site of Special Scientific Interest
SU	Sewerage Undertaker
SuDS	Sustainable Drainage Systems
SWOX	Swindon and Oxfordshire (WRZ)
SWMP	Surface Water Management Plan
TW	Thames Water
UWWTD	Urban Waste Water Treatment Directive
WaSC	Water and Sewerage Company
WBC	West Berkshire Council
WCS	Water Cycle Study
WFD	Water Framework Directive
WINEP	Water Industry National Environment Programme
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 West Berkshire Council (WBC) to undertake a Water Cycle Study (WCS) to inform the council's emerging Local Plan Review. This study assesses the potential issues relating to future development across West Berkshire and the impacts on water supply, wastewater collection and treatment and water quality. 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.

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:

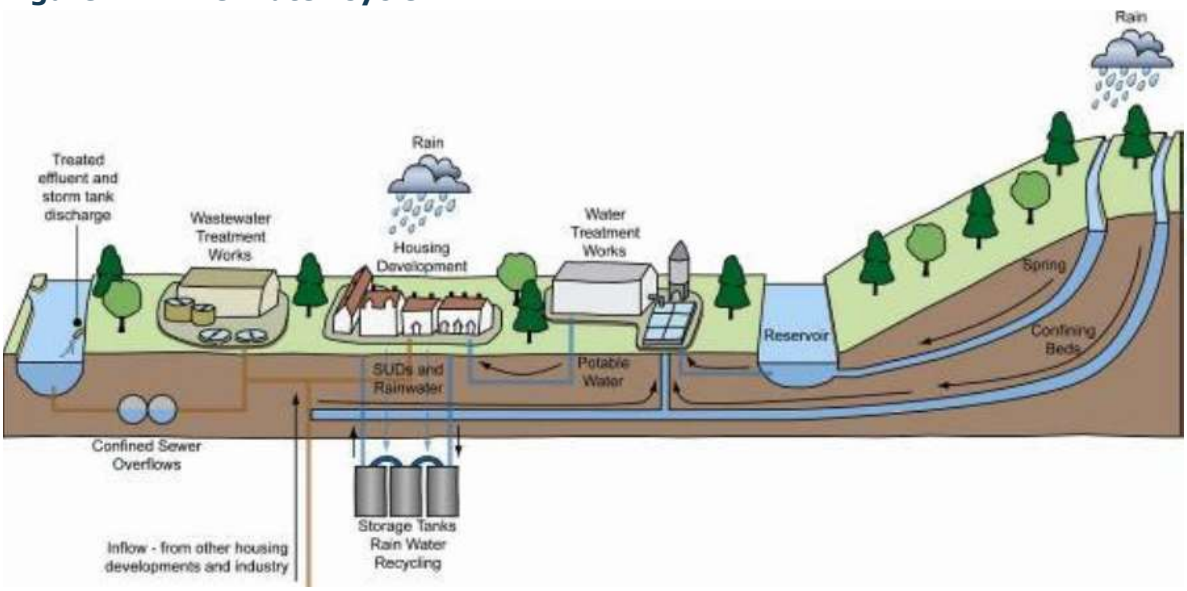
- Phase 1: Scoping study, focussing on formation of a steering group, identifying issues for consideration and the need for an outline study.
- Phase 2: Outline study, to identify environmental constraints, infrastructure constraints, a sustainability assessment and consideration of whether a detailed 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: 29/10/2020

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: 29/10/2020

Figure 1.1: The Water Cycle



Source: Environment Agency – Water Cycle Study Guidance

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 mandatory document, Local Planning Authorities are advised to prioritise the different stages of the WCS to integrate with their Local Plan programme. This report is written to support West Berkshire Council's Local Plan Review to 2036.

The WCS brief stated that the overall objective of the WCS is to understand the environmental and physical constraints of development and identify opportunities for more sustainable planning and improvements that may be required to achieve the required level of development. This should be assessed by considering the following issues:

- Water demand and supply;
- Wastewater infrastructure and treatment;
- Water quality and the environment;
- Flood risk and drainage.

This Phase 1 scoping study will focus on providing information to aid site selection. A Phase 2 WCS is likely to be required to build on this work and carry out more detailed analysis on topics such as water quality if required.

1.5 Study Area

West Berkshire covers an area of approximately 704km^2 and has a population of 158,450 reported in the 2011 census. The main urban areas are Newbury, Thatcham, Hungerford, Pangbourne and Lambourn.

West Berkshire is located within the Thames river basin with the majority of the population living within the Kennet Valley. The study area contains the Rivers Thames, Lambourn, Kennet, Pang, Bourne and the Kennet and Avon Canal.

Thames Water (TW) supply water to the whole of the area, as well as providing wastewater services.

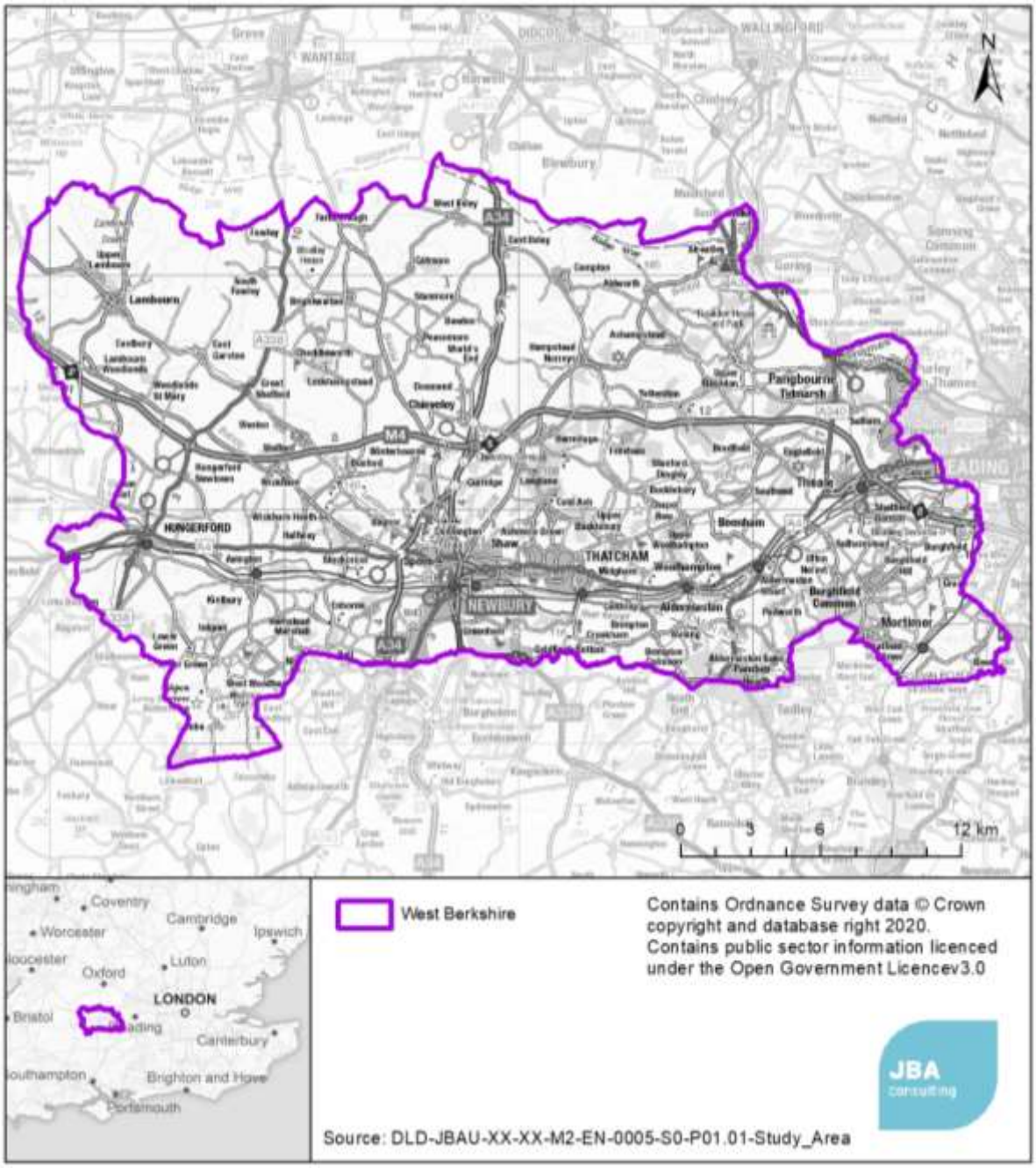


Figure 1.2 West Berkshire WCS study area

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	West Berkshire Council Environment Agency Natural England Thames Water
Details	Discussion of project scope and methodology

Neighbouring Authorities

Engaged Parties	South Oxfordshire District Council Vale of White Horse District Council Basingstoke and Deane Borough Council	Wiltshire County Council Test Valley Borough Council Reading Council Wokingham Borough Council
Details	Request for estimated growth during the plan period in catchments with shared infrastructure	

Collaboration with Water and Wastewater Companies

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

2 Future Growth in West Berkshire

2.1 Growth in West Berkshire

The following section summarises how West Berkshire is expected to grow during the plan period and allows a forecast to be created that can used to estimate the volume of water and wastewater required in the future and assess the impact of the resulting pressure on water infrastructure.

This forecast consists of:

- Allocations - sites allocated in the existing Local Plan, or which are to be considered further for possible allocation in the Local Plan Review
- Committed sites – sites which have grant of planning permission
- Recent completions – sites completed in the last year that may not yet appear in flow data provided by the water companies
- Windfall – sites that have not been specifically identified in the Local Plan. They normally comprise previously developed sites that have unexpectedly become available
- Neighbouring authority growth – growth served by infrastructure within or shared with the study area

West Berkshire Council provided information on expected growth during the plan period which was collated into a forecast for housing and employment. This is summarised for in Table 2.1 and the locations of sites identified in the study are shown in Figure 2.1.

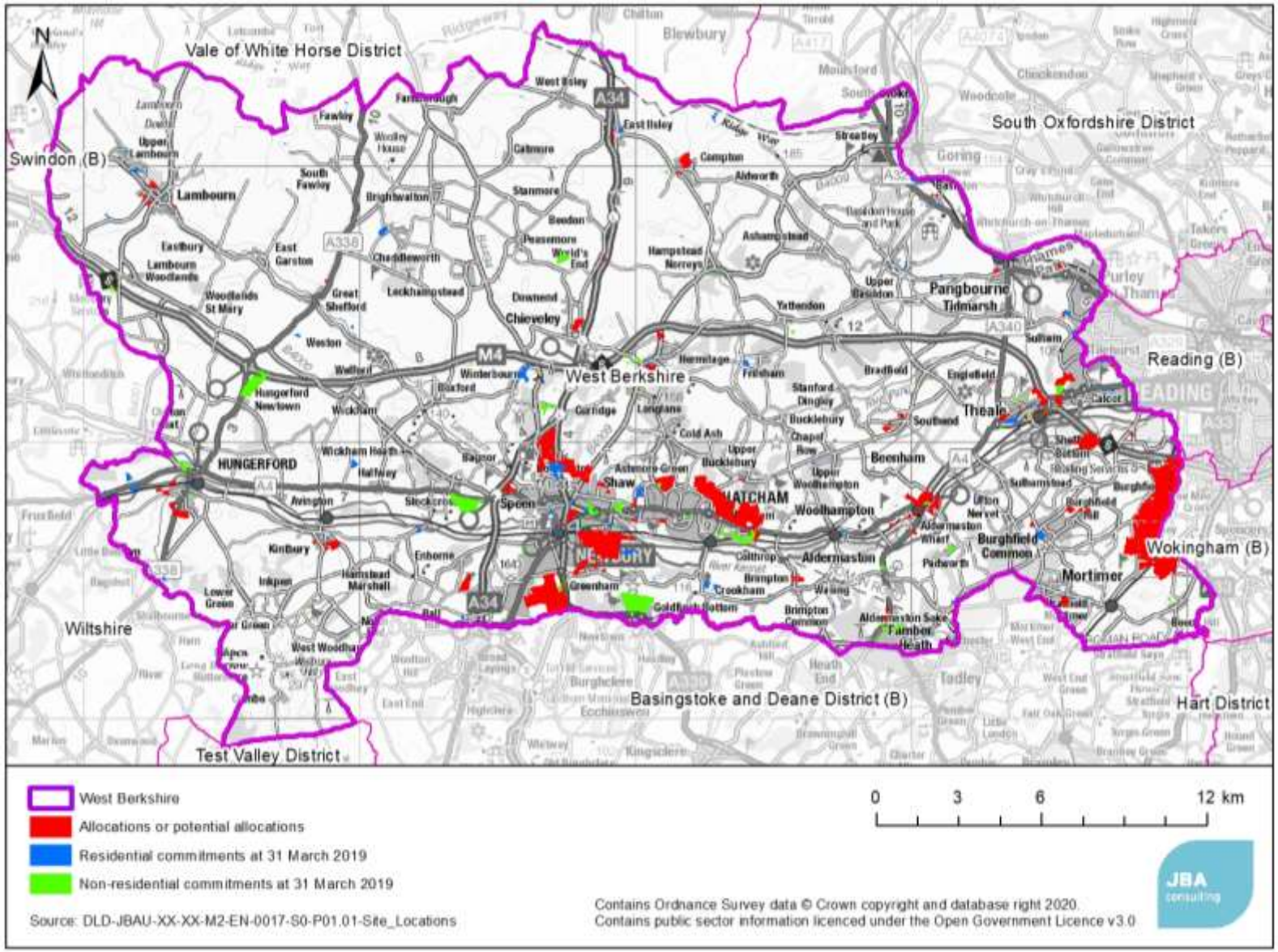


Figure 2.1 Potential development sites in West Berkshire

The NPPF expects local authorities to follow the standard approach for assessing local housing need, unless exceptional circumstances justify an alternative approach. In West Berkshire this results in a housing need of 520 dwellings per annum (pa). This figure is reviewed annually to take into account newly published household projections and affordability ratios.

Because this figure will change annually, WBC have identified its requirement as a range rather than a single figure. The range defined for the Local Plan Review consultation in December 2020 is 520 to 575 dwellings pa (8,840 to 9,775 homes between 2020-36).

WBC provided details of growth identified within the District, which is summarised in Table 2.1 below. 3,783 homes have already been allocated in the existing Local Plan, and there are a further 12,067 homes on sites identified as "potential allocations". Only a proportion of these sites will be included as allocations in the Local Plan Review, and this WCS provides part of the evidence base to help select them. There are also 2,864 homes that are unallocated but have planning permission, and WBC have identified a small site windfall allowance which results in a further 2,020 dwellings. Details were also provided of employment sites, including the potential floorspace and the proposed use.

Table 2.1: Summary of Growth in West Berkshire (2020-36)

Type of Growth	Number of Homes	Employment Floorspace – all types (m^2)
Existing allocations in the West Berkshire Local Plan	3,783	0
Potential Allocations	12,067	430,000
Commitments (Unallocated sites with planning permission)	2,864	285,000
Small site windfall allowance*	2,020	N/A
TOTAL	**20,734**	715,000
Housing need 2019-2036	8,840 – 9,775	N/A

** Though the contribution from large and medium unallocated sites is significant, WBC consider that these should not be included within the windfall allowance. Development of large, and to a lesser extent, medium sites varies significantly from year to year.*

2.2 Growth Outside of West Berkshire

The sewer catchments provided by Thames Water were used to identify neighbouring Local Planning Authority (LPA) areas that may be served by infrastructure within or shared with West Berkshire. Reading, Wokingham and Basingstoke and Deane all share infrastructure with West Berkshire. Published information from each LPA was then used to inform an estimate of growth. This was added to the growth forecast collated from information within the study area. Where there was no trajectory specified by the neighbouring councils, committed development was spread evenly over the next five years (2019/20 to 2023/24) and Local Plan development was spread evenly from 2019/20 to the end of the Local Plan period.

The following authorities border West Berkshire but do not share significant water infrastructure:

- South Oxfordshire
- Vale of White Horse
- Wiltshire
- Test Valley

2.2.1 Reading Borough Council

The adopted Reading Local Plan[3] makes provision for 15,847 dwellings (averaging 689 dwellings per annum) for the period 2013 to 2036. Reading Borough Council also provided details of development sites currently expected to be delivered which total 15,960 dwellings. This higher figure was included in the WCS analysis, and it was assumed that all of Reading's growth would be served by Reading WwTW (which also serves the eastern areas of WBC).

Table 2.2: Summary of Growth in Reading Served by Shared Infrastructure

WwTW	Proposed number of dwellings during plan period	Employment floorspace (m^2)	Time Period
Reading	15,960	201,215	2013 - 2036

3 Reading Borough Local Plan, Reading Borough Council (2019). Accessed online at: https://images.reading.gov.uk/2019/12/Local_Plan_Adopted_November_2019.pdf on: 25/11/2020

2.3 Basingstoke and Deane Borough Council

The Basingstoke and Deane Local Plan 2011-2029 (adopted May 2026)[4] makes provision for 15,300 dwellings between 2011 and 2029 (or 850 homes per year) to meet the requirements of the area.

Basingstoke and Deane Borough Council provided details of development sites within their area. A number of committed sites were found to be served by Silchester WwTW which also serves some south-eastern areas of West Berkshire.

Table 2.3: Summary of proposed growth in Basingstoke and Deane served by shared infrastructure

WwTW	Proposed number of dwellings during plan period	Employment floor space (m^2)	Time Period
Silchester	30 (commitments)	0	Assumed 2020-2025

2.4 Wokingham Borough Council

Wokingham Borough Council provided details of development sites within their area, the most significant being the strategic sites close to the eastern boundary of West Berkshire. These sites would be served by Reading WwTW which also serves parts of West Berkshire.

Table 2.4 Summary of proposed growth in Wokingham served by shared infrastructure

WwTW	Proposed number of dwellings during plan period	Employment floor space (m^2)	Time Period
Reading	12,310	18,500	Assumed 2020-2036

4 Basingstoke and Deane Local Plan (2011 to 2029) accessed online at: https://www.basingstoke.gov.uk/content/doclib/1592.pdf on: 04/11/2020.

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)[5] was published on 27 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[6], 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 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."*

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".*

5 National Planning Policy Framework, Department for Communities and Local Government (2012)
6 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: 29/10/2020

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[7]
- Water Supply, Wastewater and Water Quality[8].
- Housing - Optional Technical Standards[9].

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.

7 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: 29/10/2020.
8 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: 29/10/2020
9 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: 29/10/2020

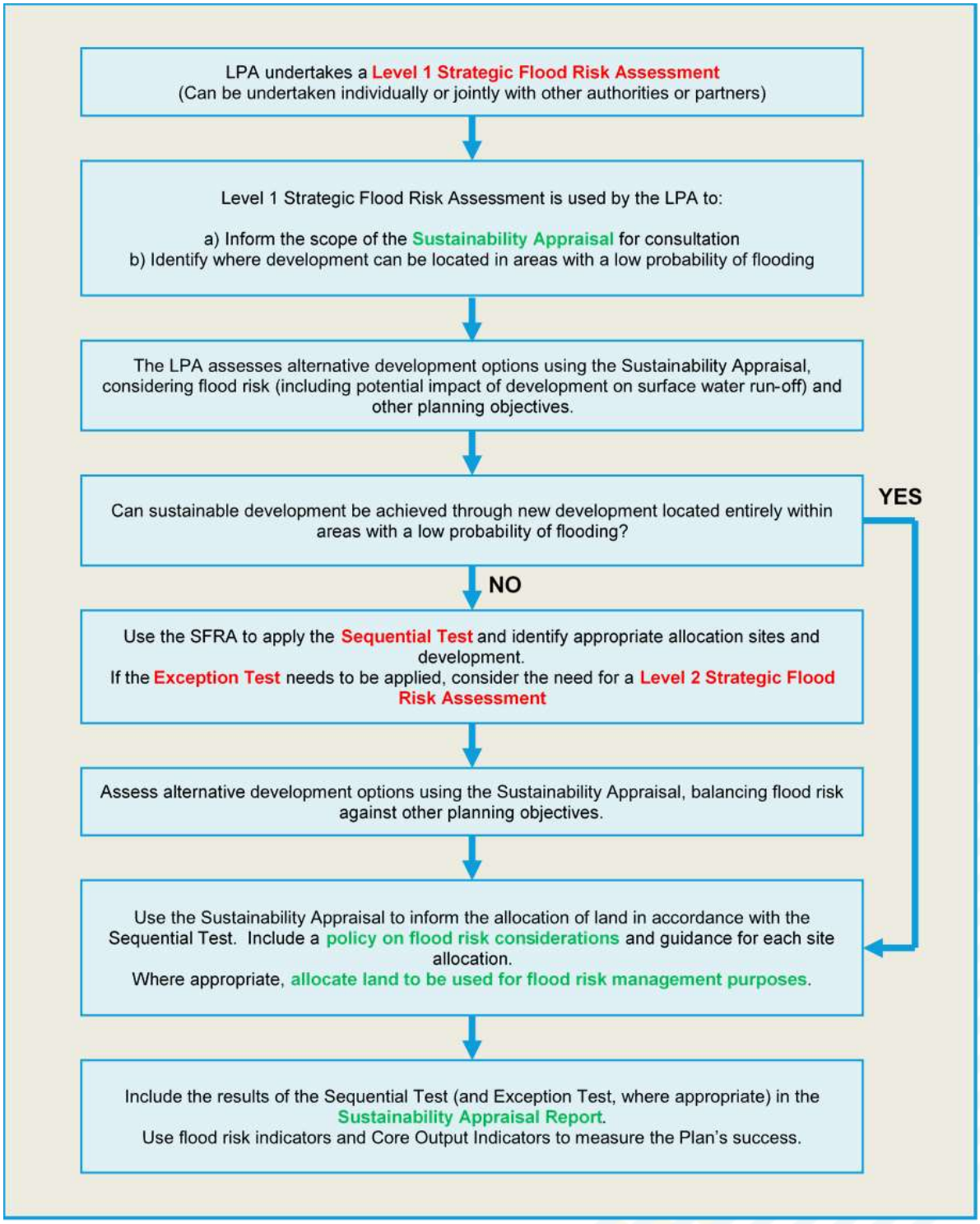


Figure 3.1: Flood Risk and the Preparation of Local Plans

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 for 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. This is recommended in all areas of water stress.
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).

Figure 3.2 PPG: Water Supply, Wastewater and Water Quality Considerations for Plan-Making and Planning 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[10] 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. In some cases, the connection charge may also be waived by the water company where developers can demonstrate that development will be water efficient (110 l/p/d or less).

3.2.5 Building Regulations

The Building Regulations (2010) Part G[11] 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 BRE Standards

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[12], and commercial, leisure, educational facilities and mixed-use buildings by the Building Research Establishment Environmental Assessment Methodology (BREEAM) UK New Construction Standard[13].

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 Council has the opportunity to seek BREEAM or HQM status for all new, residential and non-residential buildings.

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10 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: 29/10/2020

11 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: 29/10/2020

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

13 BREEAM UK New Construction, BRE, (2018). Accessed online at: https://www.breeam.com/NC2018/ on: 29/10/2020

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 10 or 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[14] 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[15]. 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.
- West Berkshire Council are a LLFA. The West Berkshire Sustainable Drainage Systems Supplementary Planning Document[16] provides advice relating to surface water drainages and sets out minimum operating requirements to meet specified policy and standards.
- An updated version of the CIRIA SuDS Manual[17] 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)[18], which contains detailed guidance on all aspects of SuDS construction, with specific information on each SuDS component available as a downloadable chapter.
- Prior to April 2020, Sewers for Adoption version 7, the standard for designing sewers to be adopted by UK water companies did not include SuDS, and neither Southern Water nor Thames Water adopted SuDS.
- As of April 2020, the new Design and Construction Guidance (DCG) came into force in England. This contains details of the water sector's approach to the adoption of SuDS, which meet the legal definition of a sewer. The guidance

14 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: 29/10/2020
15 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: 29/10/2020
16 Sustainable Drainage Systems: Supplementary Planning Document, West Berkshire Council, December 2019. Accessed online at: https://info.westberks.gov.uk/CHttpHandler.ashx?id=46526&p=0 on: 29/10/2020
17 The SuDS Manual (C753), CIRIA (2015).
18 Guidance on the Construction of SuDS (C768), CIRIA (2017), Accessed online at: https://www.ciria.org/ItemDetail?iProductcode=C768&Category=BOOK on: 29/10/2020

replaces Sewers for Adoption 7, and compliance by water companies in England is now mandatory. It is however, as of July 2020, subject of a legal challenge led by Thames Water which is supported by Southern Water.

3.3 Regional Policy

3.3.1 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.

In the Thames River Basin District, the following CFMPs are relevant to the study are:

- Thames: Catchment Flood Management Plan[19]

3.3.2 Surface Water Management Plans (SWMPs)

SWMPs outline the preferred surface water management strategies 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 responsible for surface water management and drainage in their area.

At present, the Thatcham SWMP[20] is the only SWMP that has been completed within the West Berkshire region.

3.3.3 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 Thames Water WRMP 2019[21] covers the West Berkshire region.

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19 Thames Catchment Flood Management Plan, Environment Agency (2009). Accessed online at: https://www.gov.uk/government/publications/thames-catchment-flood-management-plan on: 29/10/2020

20 Thatcham Surface Water Management Plan, West Berkshire Council, 2010. Accessed online at: https://citizen.westberks.gov.uk/media/40506/Thatcham-Surface-Water-Management-Plan-SWMP-Work-in-Progress/pdf/Thatcham_SWMP_Work_in_Progress(Full).pdf?m=637184958672600000 on: 29/10/2020

21 Water Resources Management Plan, Thames Water (2019).Accessed online at: https://www.thameswater.co.uk/about-us/regulation/water-resources#current on: 29/10/2020

3.4 Local Planning Policy

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"*[22].

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 International Environmental Policy

3.5.1 Ramsar

The Convention on Wetlands of International Importance, more commonly known as the Ramsar convention after the city where it was signed in 1971, aims to protect important wetland sites. Under the treaty, member counties commit to:

- Wise use of all their wetlands
- Designating sites for the Ramsar list of "Wetlands of International Importance" (Ramsar Sites) and their conservation
- Cooperating on transboundary wetlands and other shared interests.

"Wise use" of wetlands is defined under the convention as "*the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development*". A handbook on the wise use of wetlands is available from the Ramsar Convention Secretariat[23].

Ramsar Sites are designated by the National Administrative Authority, responsible for the Ramsar Convention in each country. In the case of the UK this is the Joint Nature Conservation Committee (JNCC).

In general, the designation of UK Ramsar sites is underpinned through prior notification of these areas as Sites of Special Scientific Interest (SSSIs) and as such receive statutory protection under the Wildlife and Countryside Act 1981 (as amended). More recently, Paragraph 176 of the NPPF states that Ramsar sites should be given the same protection in the planning process as sites designated under the EU Habitats Directive.

3.6 European Environmental Policy

3.6.1 Urban Wastewater Treatment Directive (UWWTD)

The UWWTD[24] 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

22 Localism Act 2011: Section 110, UK Government (2011). Accessed online at: http://www.legislation.gov.uk/ukpga/2011/20/section/110 on: 29/10/2020
23 Wise use of wetlands, Ramsar Convention Secretariat (2010). Accessed online at: https://www.ramsar.org/sites/default/files/documents/library/hbk4-01.pdf on: 29/10/2020
24 UWWTD Overview, EU (2020). Accessed online at: https://ec.europa.eu/environment/water/water-urbanwaste/index_en.html on: 29/10/2020

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 Wastewater Treatment (England and Wales) Regulations 1994 and 'The Urban Wastewater Treatment (England and Wales) (Amendments) Regulations 2003'.

3.6.2 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.

3.6.3 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. West Berkshire is within the Thames[25] River Basin District (RBD). 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 issues and WFD objectives, outlined in the updated RBMPs are summarised below:

Main Issues:

- Physical modifications
- Pollution from wastewater
- Pollution from towns, cities and transport
- Changes to the natural flow and level of water
- Negative effects of invasive non-native species
- Pollution from rural areas

Objectives:

- Prevent deterioration of the status of surface waters and groundwater
- Achieve objectives and standards for protected areas

25. Thames River Basin District – River Basin Management Plan, EA (2015). Accessed online at: https://www.gov.uk/government/publications/thames-river-basin-district-river-basin-management-plan on: 29/10/2020

- 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
- 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

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.

3.6.4 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

3.6.5 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[26] 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.

3.6.6 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 United Kingdom from the European Union on 31 January 2020, this legislation remains in force during the transition period, until 31 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."[27]

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 Review. Should this situation change, a review of this Water Cycle Study may be required considering any new emerging regulatory regime.

3.7 UK Environmental Policy

3.7.1 Conservation of Habitats and Species Regulations 2017 (as amended)

The Conservation of Habitats and Species Regulations 2010 (commonly referred to as the Habitats Regulations) consolidated the Conservation (Natural Habitats, &c.) Regulations 1994, and transposed the EU Habitats Directive in England and Wales. This was further amended in 2017.

The Habitats Regulations define the requirement for a Habitats Regulations Assessment (HRA) to be carried out. The purpose of this is to determine if a plan or project may affect the protected features of a "habitats site". These include:

- A special area of conservation (SAC)
- A site of Community Importance
- A site hosting a priority natural habitat type or priority species protected in accordance with Article 5(4) of the Habitats Directive
- A Special Protection Area (SPA)
- A potential SPA

All plans and projects (including planning applications) which are not directly connected with, or necessary for the conservation management of a habitat site require consideration of whether the plan or project is likely to have significant effects on that site.

This is referred to as the "Habitats Regulations Assessment screening" and should take into account the potential effects of both the plan/project itself and in combination with other plans or projects.

Part 6 of the conservation of Habitats and Species Regulations 2017 states that where the potential for likely significant effects cannot be excluded, a competent authority must

26 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: 29/10/2020

27 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 29/10/2020

make an appropriate assessment of the implications of the plan or project for that site, in view of the site's conservation objectives.

The competent authority may agree to the plan or project only after having rules out adverse effects on the integrity of the habitats site.

If adverse effects cannot be rules out, and where there are no alternative solutions, the plan or project can only proceed if there are imperative reasons of over-riding public interest and if the necessary compensatory measures can be secured.

The "People over Wind" ECJ ruling (C-323/17) clarifies that when making screening decisions for the purposes of deciding whether an appropriate assessment is required, competent authorities cannot take into account any mitigation measures. This must be part of the appropriate assessment itself.

3.7.2 Wildlife and Countryside Act 1981

Sites of Special Scientific Interest (SSSI) are designated and legally protected under the Wildlife and Countryside Act 1981, Section 28G places a duty to take reasonable steps, consistent with the proper exercise of the authority's functions, to "further to the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which the site is of special scientific interest."[28]

The Government's 25-year Environment Plan[29] has a target of "restoring 75% of our one million hectares of terrestrial and freshwater protected sites to favourable condition, securing their wildlife value for the long term." In line with this, and the Wildlife and Countryside Act 1981, Local Authorities should look put forward options that contribute to conservation or restoration of favourable condition, and at the very least must not introduce policies that hinder the restoration of favourable condition by increasing existing issues.

A site is said to be in "favourable condition" when the designated feature(s) within a unit are being adequately conserved and the results from monitoring demonstrate that the feature(s) in the unit are meeting all the mandatory site specific monitoring targets set out in the favourable condition targets (FCT).

3.7.3 The Natural Environment Rural Communities Act (NERC)

The Natural Environment and Rural Communities Act 2006 (commonly referred to the as the NERC Act), was intended to implement key aspects of the Government's Rural Strategy published in 2004 and established Natural England as a new independent body responsible for conserving, enhancing and managing England's natural environment.

Section 40 of the NERC Act places a duty to conserve biodiversity on public authorities, including Local Planning Authorities and water companies. "The public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity."[30]

Section 41 requires the Secretary of State to publish and maintain a list of species and types of habitat which in the Secretary of State's opinion (in consultation with Natural England) are of "principal importance for the purpose of conserving biodiversity."

28 Wildlife and Countryside Act 1981, HM Government (1981). Accessed online at: http://www.legislation.gov.uk/ukpga/1981/69/section/28G on: 29/10/2020
29 A Green Future: Our 25 Year Plan to Improve the Environment, HM Government (2018). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf on: 29/10/2020
30 Natural Environment and Rural Communities Act 2006, HM Government (2006). Accessed online at: http://www.legislation.gov.uk/ukpga/2006/16/section/40 on: 29/10/2020

3.8 Water Industry Policy

3.8.1 The Water Industry in England

Water and sewerage services in England and Wales are provided by ten Water and Sewerage Companies (WaSCs) and twelve '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

3.8.2 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 7 (AMP7) which runs from 2020 to 2025.

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.

3.8.3 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 study area is covered by the Thames Water – Water Resources Management Plan.

3.8.4 Regional Water Resources Planning

Water resource planning is taking an increasingly regional focus, recognising the need for collaboration between water companies, regulators and abstractors in order to address the challenges of climate change, increasing demand for water and protecting the water environment. Five regional groupings have been formed, including Water Resources South East (WRSE), an alliance of six water companies, the Environment Agency, OfWAT, Consumer Council for Water, Natural England and Defra. The group aims to develop an affordable, sustainable and resilient approach to water resource management in the region. They do this by:

- Developing and maintaining a regional water resources model, contributed to by all of the water companies. This will be used to assess the impact of both demand and supply-side measures, including testing new options for inter-company transfers. This modelling has informed the 2019 WRMPs and is being further developed to inform the next round of WRMPs, due to be finalised in 2024.
- WRSE is moving towards developing a regional plan covering multi-sector resilience, considering the needs of the environment, industry and agriculture as well as public water supply as is covered by WRMPs.
- WRSE is currently tendering for an organisation to produce forecasts of population and properties for the entire WRSE region for the period 2019 to 2100 at the Water Resource Zone (WRZ) level with locations of development sites earmarked for future development by the local authorities.

3.8.5 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[31] 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

31 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: 29/10/2020.

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.

3.8.6 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 of 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 agreements may not be used to obtain funding for water or wastewater infrastructure.

3.8.7 Changes to Charging Rules for New Connections

OfWAT, the water industry's economic regulator, has published new rules covering how water and wastewater companies may charge customers for new connections[32]. These rules apply to all companies in England and will commence on 1st April 2018.

The four relevant water companies for the study area have now published their charging arrangements which can be found in the footnotes[33,] .

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

32 Charging rules for new connection services (English undertakers), OfWAT (2020). Accessed online at: https://www.ofwat.gov.uk/publication/charging-rules-new-connection-services-english-undertakers/ on: 29/10/2020
33 Infrastructure Charges Scheme 2020-21, Thames Water (2020). Accessed online at: https://www.thameswater.co.uk/media-library/home/developers/charges/infrastructure-charges-scheme-2020-21.pdf on: 29/10/2020

development, for example when developing long-term strategic growth schemes, the expenditure cannot be recovered through infrastructure charges.

- Some suppliers offer charging incentives to encourage environmentally sustainable development

3.8.8 Design and Construction Guidance (DCG)

The Design and Construction Guidance contains details of the water sector's approach to the adoption of SuDS, which meet the legal definition of a sewer. This replaces Sewers for Adoption and differs from previous sewers for adoption guidance as compliance by water companies in England will be mandatory.

Sewers for Adoption, up to and including Version 7, had a narrow definition of adoptable sewers as below-ground systems comprising of gravity sewers and manholes, pumping stations and rising mains. This essentially excluded the adoption of SuDS by water companies, with the exception of below-ground storage comprising of oversized pipes or chambers.

The new DCG provides a mechanism for water companies to secure the adoption of a wide range of SuDS components which are now compliant with the legal definition of a sewer. There are however several non- adoptable components such as green roofs, pervious pavements and filter strips. These components may still form part of a drainage design so long as they remain upstream of the adoptable components.

The Design and Construction Guidance states that the drainage layout of a new development should be considered at the earliest stages of design. It is hoped that the new guidance will lead to better managed and more integrated surface water systems which incorporate amenity, biodiversity and water quality benefits.

4 Water Resources and Water Supply

4.1 Introduction

4.1.1 Objectives

The aim of the water resources assessment is to ensure that sufficient water is available in the region to serve the proposed level of growth, and that it can be abstracted without a detrimental impact on the environment, both during the plan period and into the future. The report characterises the study area, identifying the key surface water and groundwater bodies, and local geology. It highlights the pressures on water resources in the region, identifies existing constraints on abstraction and provides evidence for adopting tighter water efficiency targets.

4.1.2 Surface Waters

Figure 4.1 shows the main watercourses within the study area. These watercourses are all located within the Thames River Basin Management Plan (RBMP) catchment.

The River Kennet flows in an easterly direction through Hungerford, Newbury and Thatcham, where it intermittently joins the Kennet and Avon Canal, before it joins the River Thames in Reading. The River Kennet is joined by a number of tributaries, also main rivers, including the River Dun at Hungerford and the River Enborne north of Aldermaston.

The River Lambourn is a groundwater-fed river which issues from the chalk bedrock of the North Wessex Downs at Lambourn. The watercourse flows through Eastbury, Great Shefford and Bagnor, where it meets the Winterbourne Brook, before its confluence with the River Kennet in east Newbury.

The River Pang originates in Compton and flows in a south-easterly direction through Hampstead Norreys to Bucklebury, where it continues north-eastwards through Tidmarsh to its confluence with the River Thames at Pangbourne. The Sulham Brook flows northwards from Theale, parallel to the lower reaches of the River Pang, before joining the River Thames east of Pangbourne.

The Foudry Brook flows from Hampshire into the south-eastern corner of West Berkshire and joins the River Kennet to the west of Reading.

The River Thames is the largest river in the study area and forms part of the northeast border of West Berkshire from South Stoke to Purley-on-Thames.

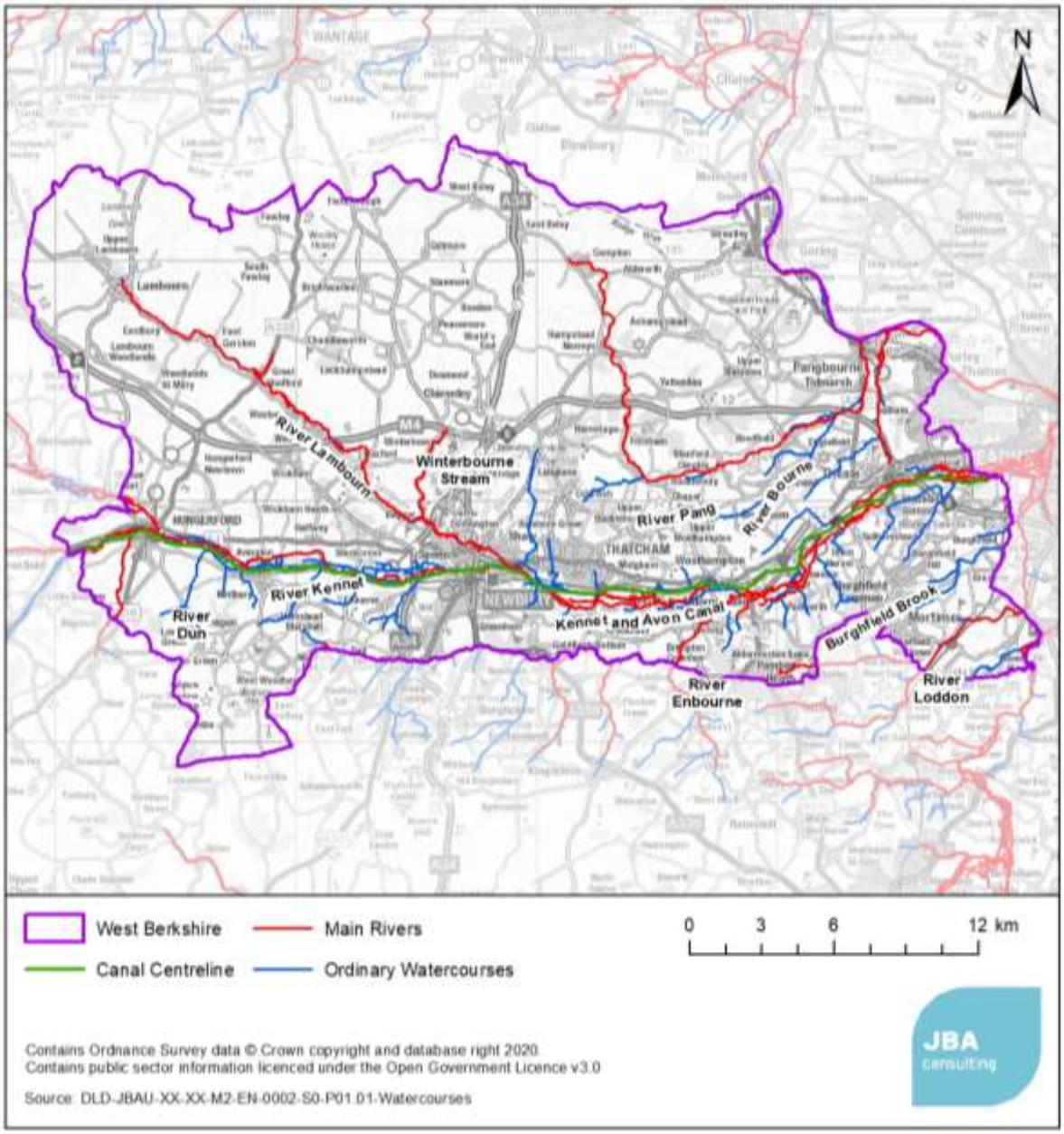


Figure 4.1 Significant surface waterbodies

4.1.3 Groundwaters

There are twelve groundwater bodies within the study area which are shown in Figure 4.2 and their corresponding WFD classification is summarised in Table 4.1 below. Seven of these have poor quantitative status, which in the case of five of these, is due to over-abstraction for water supply. The effect of further abstraction in these areas could be a reduction in river flow in dependent surface waterbodies, or a deterioration in dependent water sensitive ecosystems.

Table 4.1 WFD status of groundwater bodies

Groundwater Body	Quantitative Status	Chemical Status	Overall Status - WFD Cycle 2 (2016)
Berkshire Downs Chalk	Poor	Poor	Poor
Thatcham Tertiaries	Good	Good	Good
Aldermaston Bagshot Beds	Good	Good	Good

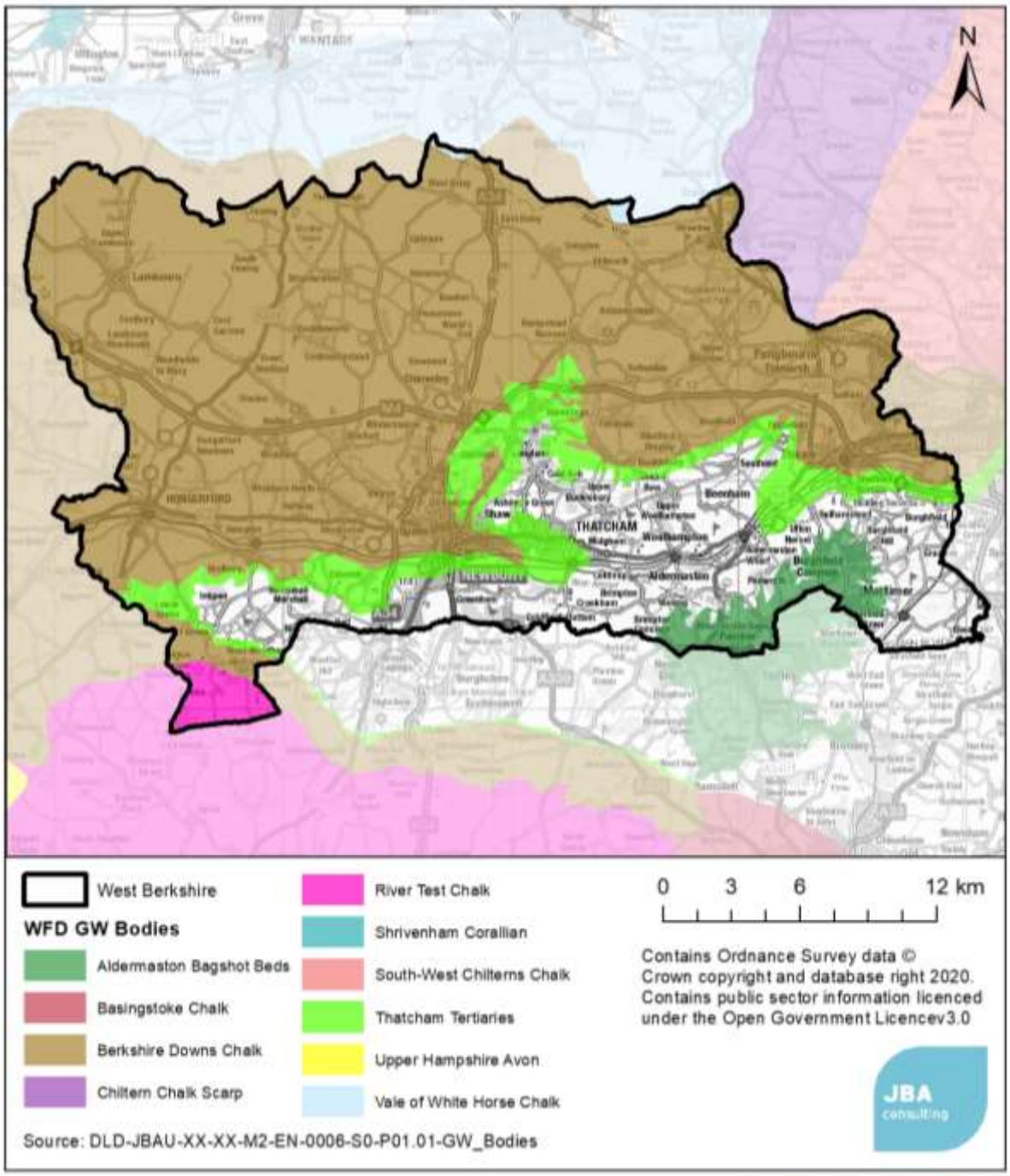


Figure 4.2 Groundwater bodies

4.1.4 Geology

The geology of the catchment is 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 4.3 shows the varying bedrock geology across West Berkshire. The majority of the region is underlain by the White Chalk Group. The exception is the southern area, which is underlain by the Thames Group made up of clay, silt, sand and gravel. Figure 4.4 shows superficial deposits of clay, silt, gravel and sand across West Berkshire.

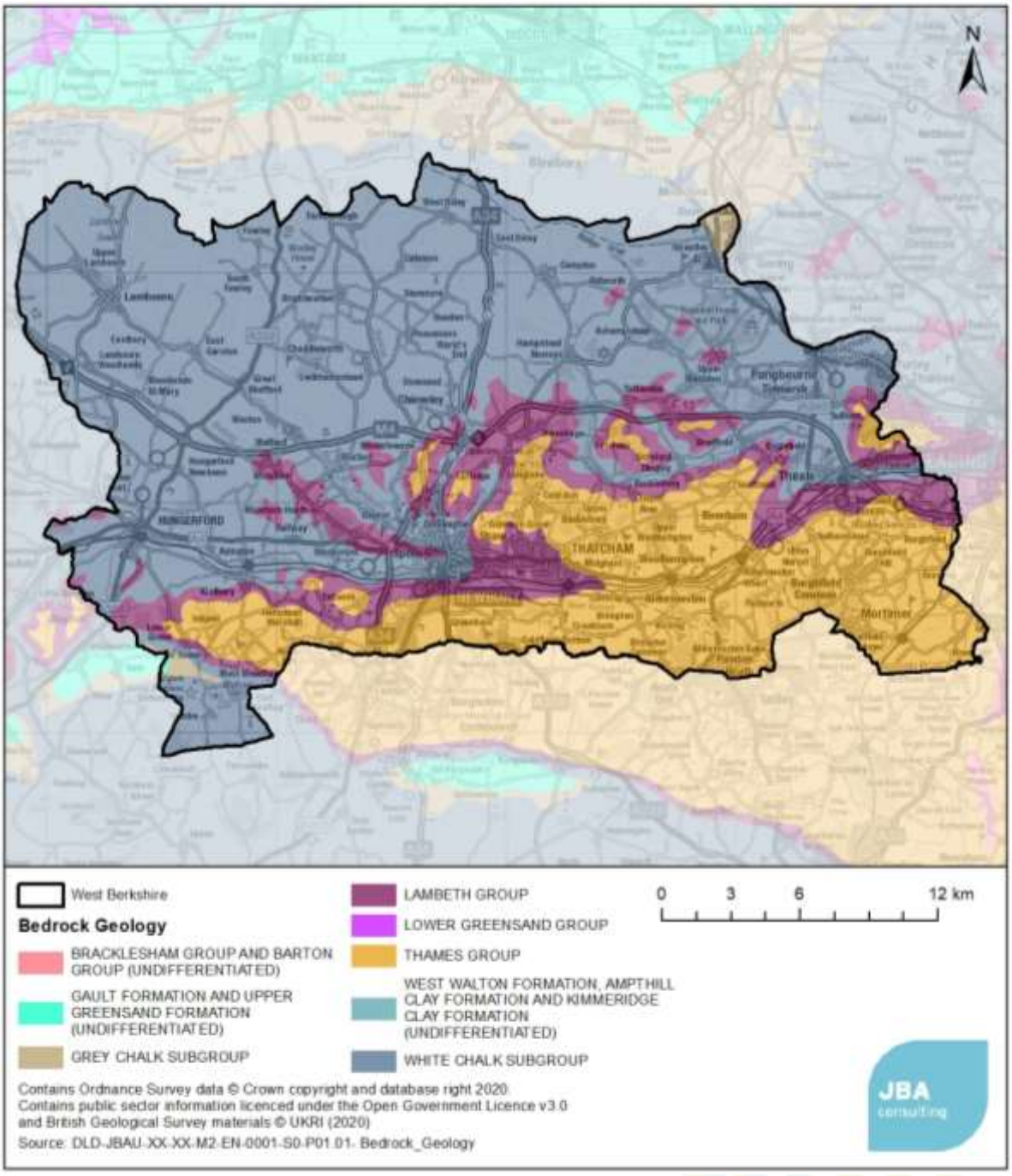


Figure 4.3 Bedrock Geology across West Berkshire

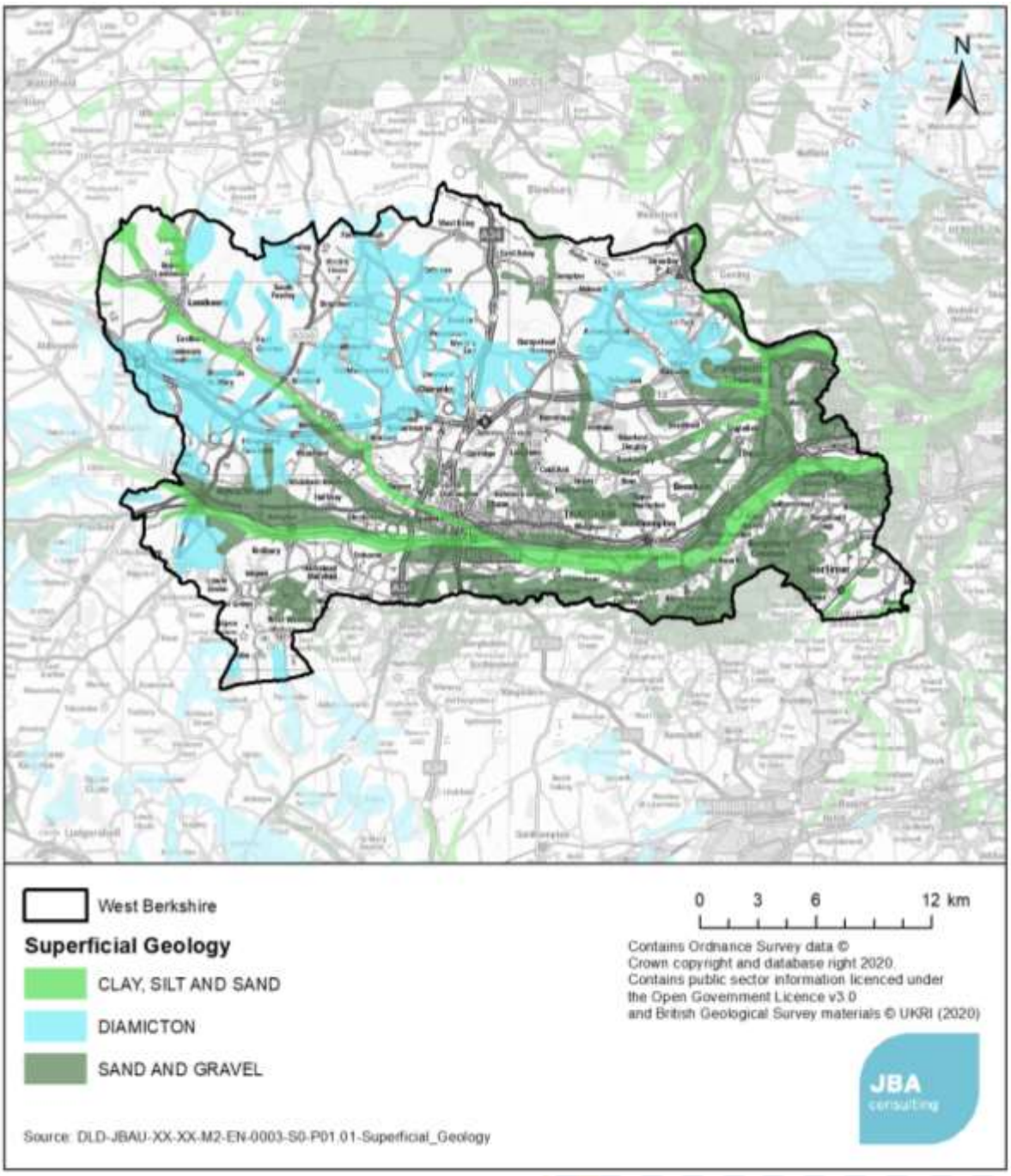


Figure 4.4 Superficial Geology across West Berkshire

4.2 Availability of Water Resources

4.2.1 Abstraction Licencing Strategy

The Environment Agency (EA), when 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 the implementation of 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. Thresholds are usually defined by the flow

percentiles which can be calculated using gauged daily flow data, where for example Q10 is the flow exceeded or equalled for 10% of the time. The CAMS process is published in a series of ALSs for each river basin.

All new licences, and some existing licenses, are time limited to a Common End Date specific to the area they are in. This allows for a periodic review of licences within the specific area as circumstances may have changed since the licences were initially granted. 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. 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. 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 Plan (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]. West Berkshire is covered by four ALS areas which are shown in Figure 4.5 below:

- Kennet and Vale of White Horse
- Thames Corridor
- Loddon
- Test and Itchen

34 Managing Water Abstraction, Environment Agency (2018). Accessed Online at: https://www.gov.uk/government/collections/water-abstraction-licensing-strategies-cams-process on: 29/10/2020

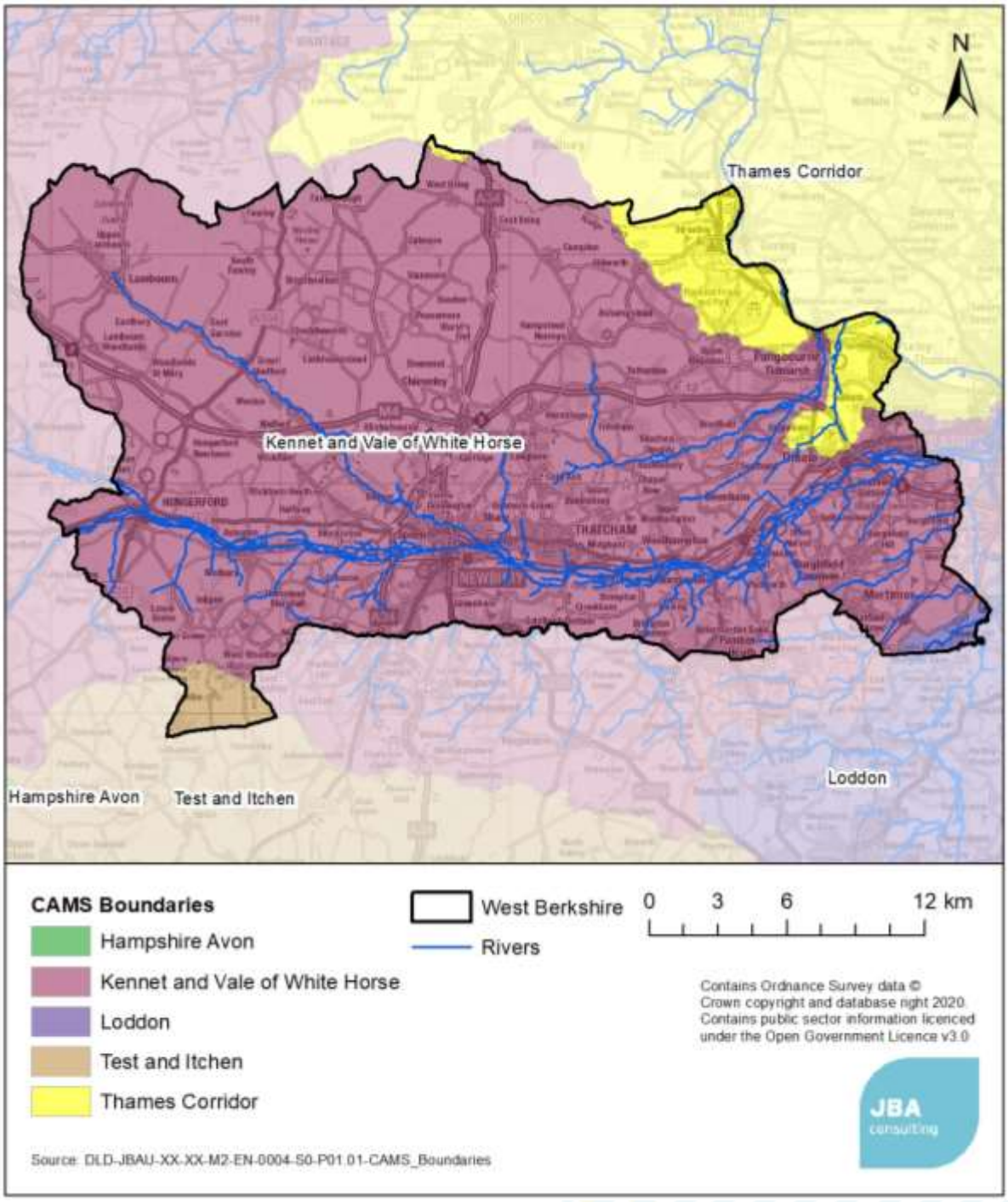


Figure 4.5 CAMS Boundaries covering West Berkshire

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 4.2. 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, which mean abstractions have to stop when the river flow or level falls below a particular value. This value is known as the HOF or HOL and ensures there is always a minimum flow in the river. Surface Water Flows can be assessed at Assessment Points (APs) which are significant points on the river, often where two main rivers join or at a gauging station.

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.

Table 4.2: 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.

Water Resource Availability Colour	Implications for Licensing
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.

Water resource availability is assessed under four different flow conditions:

- Q95 – very low flows which are exceeded 95% of the time
- Q70 – low flows which are exceeded 70% of the time
- Q50 – median flows which are exceeded 50% of the time
- Q30 – high flows which are exceeded 30% of the time

4.2.3 Kennet and Vale of White Horse ALS

The Kennet and Vale of White Horse ALS[35] encompasses the catchments of the River Kennet, Pang, Ray (Wiltshire) and Ock. The Kennet and Avon Canal also runs through the area, parallel to the River Kennet, and often shares the same channel. The River Kennet is a tributary to the River Thames, which has a bespoke licencing strategy. The Lower River Thames is classed as 'water not available for licensing' and so the licensing strategy for the Kennet and Vale of White Horse must take account for river flow requirements along the Thames.

The Kennet catchment is dominated by Chalk, Upper Greensand and Tertiary deposits, with gravel and alluvium deposits near the Rivers Kennet, Lambourn and Pang.

The Kennet and Vale of White Horse ALS has 'restricted water available' during Q30. At Q50, Q75 and Q95 this reduces to 'water not available'. This water availability is the same for both surface water and groundwater across the ALS.

There are 12 APs within the Kennet and Vale of White Horse ALS, five of which fall within West Berkshire, AP7, AP8, AP9, AP10 and AP12. There is restricted water available for licensing at all of these APs.

With the bespoke licensing strategy applied, water is shown to be available across the ALS during Q30 flow conditions. During Q50, water availability becomes restricted, and The Pang catchment shows no water available for abstraction. During Q75 and Q95, flow conditions there is no water available for abstraction when accounting for the licensing strategy.

Resource availability for APs within the Kennet and Vale of White Horse ALS is presented in Figure 4.6 below.

4.2.4 Thames Corridor ALS

The Thames Corridor ALS[36] covers the north eastern area of West Berkshire. The River Thames itself does not flow through West Berkshire. The Thames Corridor ALS has a bespoke licensing strategy to modify the water availability.

During Q30 flow conditions, the area of the ALS within West Berkshire, is shown to have limited water available for abstraction. During the Q50, Q75 and Q95 flow conditions, there is no water available for abstraction, across the whole of the ALS.

35 Kennet and Vale Abstraction Licensing Strategy, Environment Agency (2019). Accessed online at: https://www.gov.uk/government/publications/kennet-and-vale-of-white-horse-catchment-abstraction-licensing-strategy on: 29/10/2020
36 Thames Corridor Abstraction Licensing Strategy, Environment Agency (2019). Accessed online at: https://www.gov.uk/government/publications/thames-catchment-abstraction-licensing-strategy on: 29/10/2020

There are six APs within the Thames Corridor ALS, none of which are within West Berkshire.

The groundwater availability is the same as the surface water availability within the Thames Corridor ALS. Resource availability for APs within the Thames Corridor ALS is presented in Figure 4.7below.

4.2.5 Loddon ALS

The Loddon ALS[37] covers a small area in the south-east of West Berkshire. The River Loddon rises from chalk springs in Basingstoke. The chalk aquifer is the dominant aquifer and feeds many of the streams, rivers and wetlands in the upper catchment as well as supplying many of the public abstractions. The River Loddon is a tributary to the River Thames and so is subject to the bespoke Thames licensing strategy.

There are seven APs within the Loddon ALS, none of which are within West Berkshire.

During Q30 flow conditions, water availability is restricted across the Loddon ALS. During the Q50, Q75 and Q95 flow conditions, water is not available.

The groundwater availability in the Loddon ALS is guided by the surface water assessment. Resource availability for APs within the Loddon ALS is presented in Figure 4.8 below.

4.2.6 Test and Itchen ALS

The Test and Itchen ALS[38] covers a large area of Hampshire. Only a small area, in the south, is within West Berkshire. Both catchments are underlain by chalk, which drives the catchment regimes.

There are 20 APs within the Test and Itchen ALS, none of which are located in West Berkshire. In the area contained within West Berkshire, there is water available for licensing during the Q30, Q50 and Q75 flow conditions. During the Q95 flow conditions, water availability is restricted.

Resource availability for APs within the Test and Itchen ALS is presented in Figure 4.9 below.

37 Loddon Abstraction Licensing Strategy, Environment Agency (2019). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/796162/Loddon-Abstraction-Licensing-Strategy.pdf on: 29/10/2020

38 Test and Itchen Abstraction Licensing Strategy, Environment Agency (2019). Accessed online at: https://www.gov.uk/government/publications/test-and-itchen-catchment-abstraction-licensing-strategy on: 29/10/2020

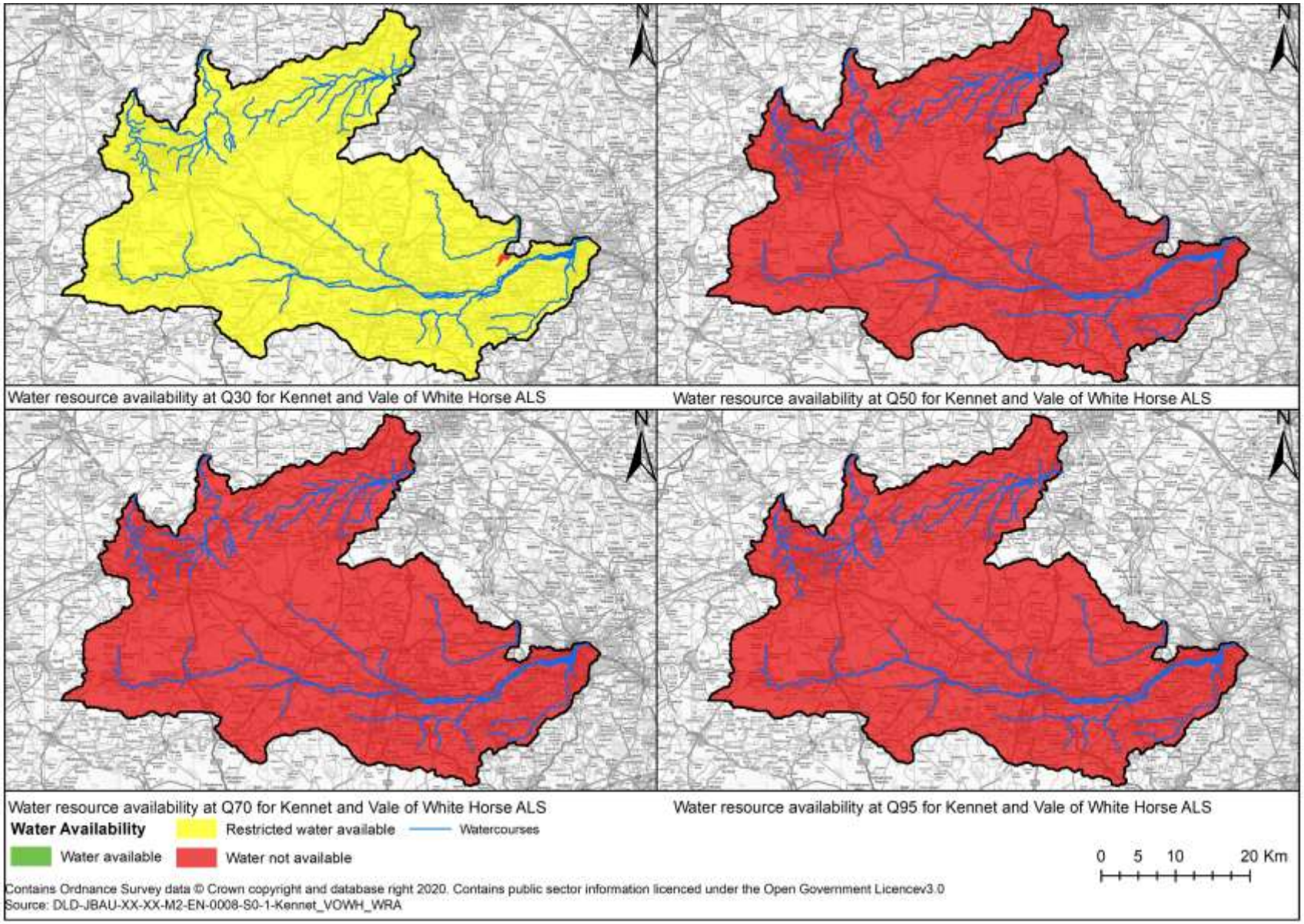


Figure 4.6 Water Resource Availability of the Kennet and Vale of White Horse ALS

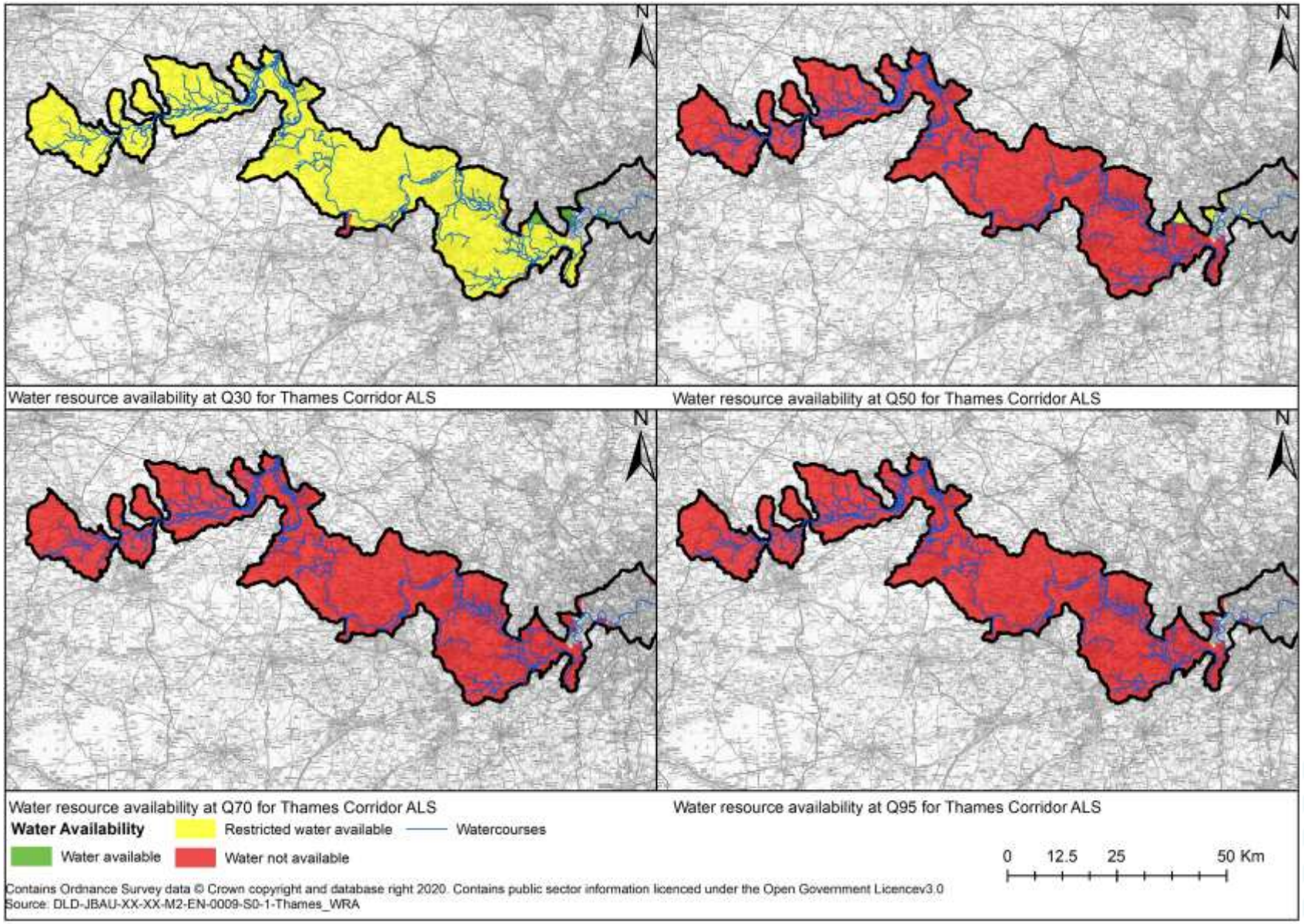


Figure 4.7 Water Resource Availability of the Thames Corridor ALS

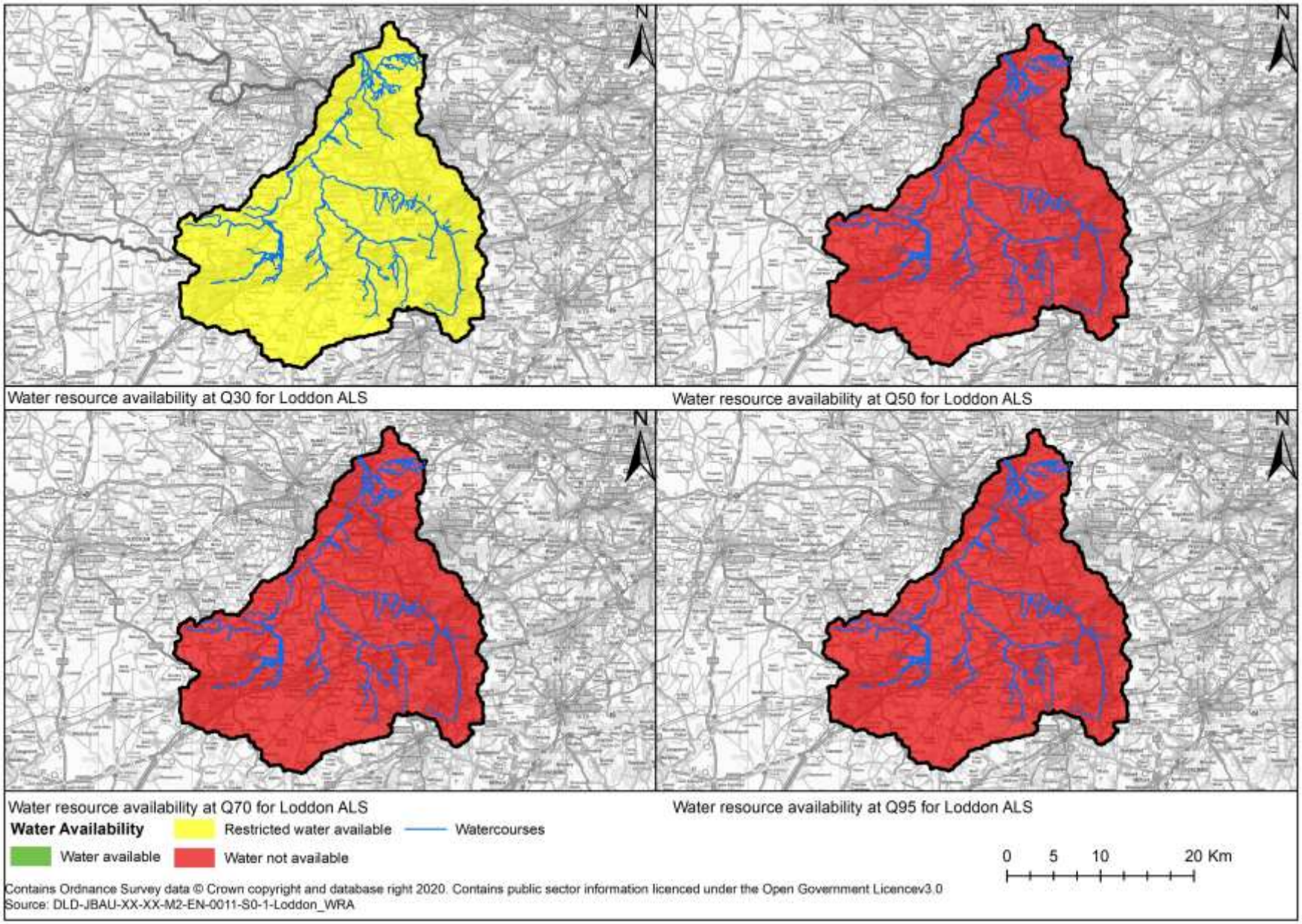


Figure 4.8 Water Resource Availability of the Loddon ALS

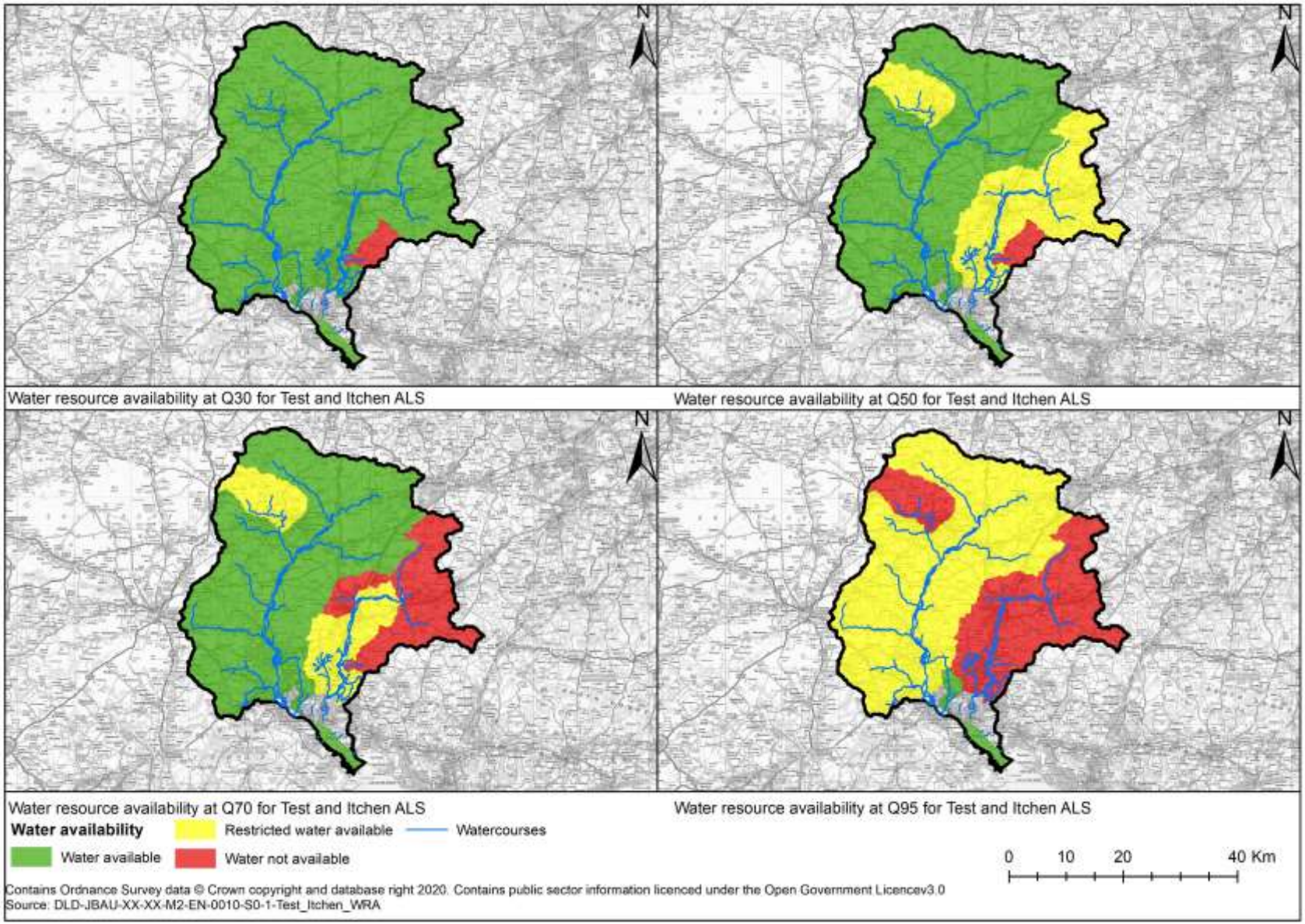


Figure 4.9 Water Resource Availability of the Test and Itchen ALS

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 the development proposed within the emerging Local Plans, with the demand allowed for by Thames Water their Water Resource Management Plan.

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

4.3.2 Water Companies and Water Resources Zones

Thames Water supplies the whole of West Berkshire. Water companies divide their supply areas into Water Resource Zones (WRZ). There are two WRZ's within West Berkshire; Swindon and Oxfordshire (SWOX) and Kennet Valley.

4.3.3 Methodology

The following Water Resource Management Plans were reviewed:

- Thames Water – Water Resources Management Plan 2019[39]

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

The spatial boundaries of the WRZs have been 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[40] were collated for the local authorities which lie within each WRZ. The percentage of the current population of each local authority within the WRZ was estimated from the OS Unique Property Reference Numbers 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 2014 dataset is used as this is also used in the calculation of housing need.

39 Water Resources Management Plan 2019, Thames Water (2020). Accessed online at: https://www.thameswater.co.uk/about-us/regulation/water-resources#current on: 29/10/2020

40 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: 29/10/2020

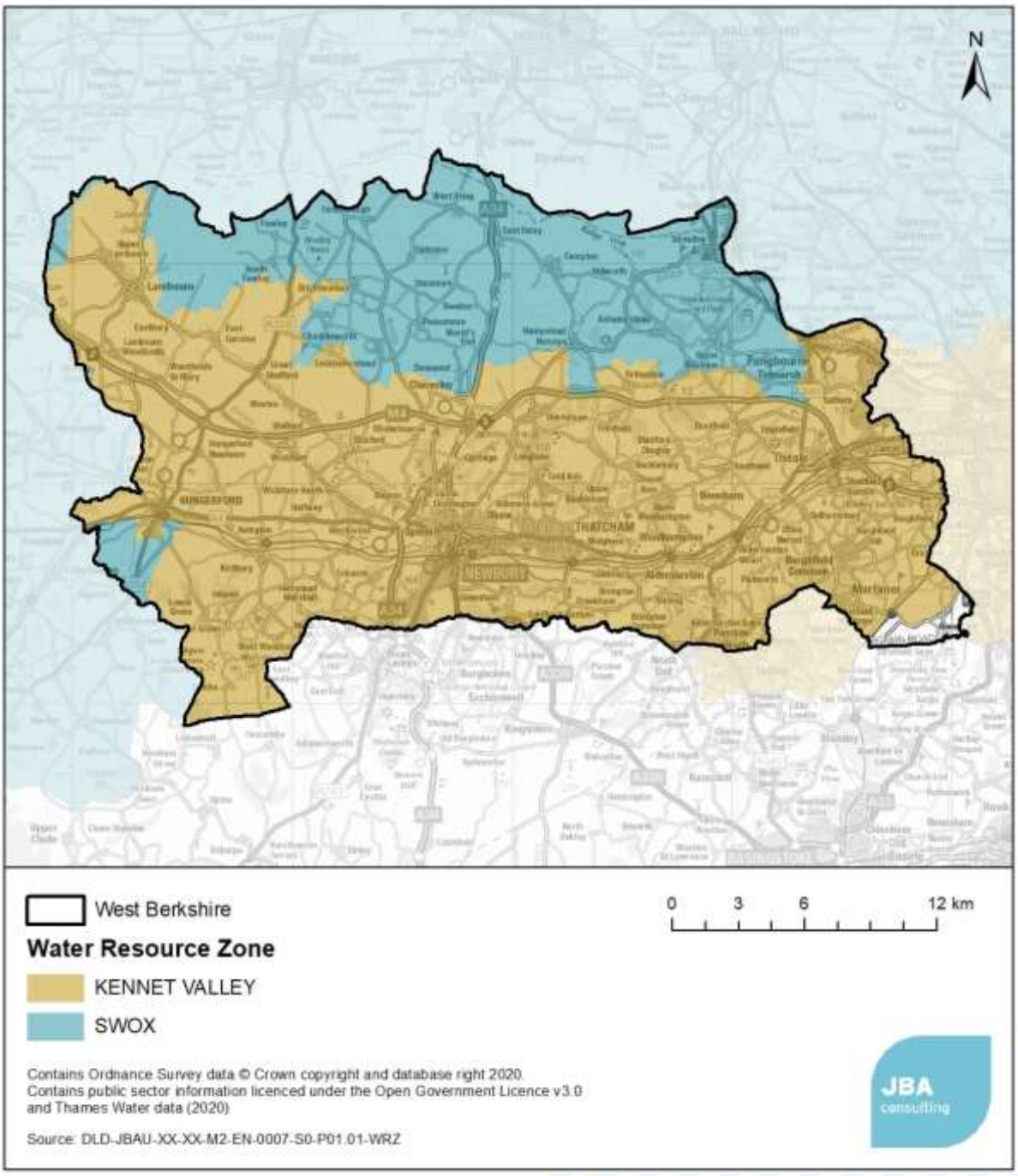


Figure 4.10: Water Resource Zones within West Berkshire

4.4 Water Resource Management Plan Reviews

4.4.1 Thames Water

Thames Water (TW) is responsible for supplying all of West Berkshire. Currently, TW supply approximately 10 million consumers in the south east and for the purposes of water resource planning, the TW supply area has been divided into six Water Resource Zones (WRZ). West Berkshire is covered by the Swindon and Oxfordshire (SWOX) and Kennet Valley WRZs, and the WRMP covers a plan period of 80 years, 2020 to 2100.

The SWOX is the largest WRZ and is primarily supplied by groundwater (60%) which is supported by surface water abstractions and the Oxfordshire reservoir. The Kennet Valley WRZ is also primarily groundwater (60%) and is supported by surface water abstractions from the River Kennet at the Lower Kennet treatment works.

Change in Demand

There are currently 3,602,900 properties within the TW supply region. The population is expected to significantly grow in this region, with a 21.3% increase by 2044/45 and 42.3% increase by 2099/2100. In line with this, the number of properties served by TW is predicted to increase by 34.9% by 2044/45 and 71.1% by 2099/2100. Table 4.3 shows this percentage increase broken down by WRZ.

Table 4.3: Percentage growth, from base year, of population and property

WRZ	Change in population (%)		Change in properties (%)	
	2044/45	2099/2100	2044/45	2099/2100
SWOX	27.4	45.1	34.3	60.2
Kennet Valley	19.0	33.1	23.3	44.5

Supply-Demand Balance

The WRMP compares the supply and demand forecasts, including headroom, to determine whether resources are projected to be in surplus or deficit at any point in the planning period.

SWOX

During dry year annual average conditions, there is a small surplus forecast throughout the planning period. However, there is a supply-demand deficit when considering peak week conditions.

Kennet Valley

No deficit is predicted based on baseline supply demand balance, for the dry year annual average or peak week conditions. However, the WRZ is not resilient to 1 in 200-year severe drought.

Options

TW has considered options that could improve resilience and resolve a supply-demand deficit. These options are set out based upon each WRZ.

SWOX

Short term (2020/21 – 2044/45) demand management

- Roll out of the progressive metering programme with an aim of installing meters to 92% of houses by 2030.
- Continued promotion of water efficiency with around 8.8 Ml/d saving by the end of AMP7.

Medium term (2024-2040) demand management and water resource development

- Incentive based financial tariff, commencing in 2035.
- Raw water benefits from the South East Strategic Reservoir Option (SESRO) by 2037/38. This reservoir will also reduce abstraction at Farmoor.

Long Term (2040 to 2099) water resource management

- Water transfer from SWOX to SWA WRZ via the River Thames and a new surface water intake at Medmenham enables transfer of surplus water in SWOX up to a maximum of 24 Ml/d and will help mitigate the long-term deficit from 2066 onwards.

Kennet Valley

Medium term (2030-2040) demand management

- Roll out the progressive metering programme with an aim of installing meters in 95% of households by the end of AMP9 (2034/35).

- Metering and proactive water efficiency campaign, along with introduction of financial tariffs, is expected to deliver savings of 10 Ml/d by 2039/40.

4.4.2 Household Growth – Water Supply Boundaries

Table 4.4 shows a comparison of household growth forecasts for the two WRZs serving growth in West Berkshire, the Ministry of Housing Communities and Local Government (MHCLG) 2014-based household projections, and West Berkshire Council's housing need calculated using the Standard Method.

Growth in households if WBC were to deliver its housing needs would be 13.4 – 14.8% which is higher than that predicted in the MHCLG household projections dataset. It is also higher than the MHCLG dataset predicts for neighbouring authorities within the same water resource zones. It is however broadly in line with the growth accounted for in Thames Water's WRMP.

Table 4.4: Comparison of household growth forecasts

Forecast	2020	2036	% increase
MHCLG 2014-based forecast – West Berkshire	66,030	71,889	8.9%
MHCLG 2014-based forecast – All LPAs in Kennet Valley WRZ	150,668	166,573	10.5%
MHCLG 2014-based forecast – All LPAs in SWOX WRZ	439,350	494559	12.5%
WRMP Forecast – Kennet Valley WRZ	177,680	199,590	12.3%
WRMP Forecast – SWOX WRZ	493,350	578,120	17.2%
West Berkshire Housing Need	66,030	74,870 - 75,805	13.4 - 14.8%

4.4.3 Summary

- The water supply across West Berkshire is managed by Thames Water.
- The study area divided between two Water Resource Zones (Kennet Valley and SWOX).
- The WRMP predict a supply-demand surplus during the plan period for both WRZs except in the peak week or drought conditions where a deficit is predicted. The plan goes on to define actions to improve resilience.
- Growth if WBC's housing need were to be delivered is higher than that predicted by MHCLG household projections and but broadly in line with the growth accounted for by Thames Water in their WRMP.

4.5 Water Efficiency and Water Neutrality

4.5.1 Introduction

It is widely recognised that the climate is changing, and West Berkshire Council are one of many in the country to declare a climate emergency. 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 that new development does not cause 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 development's water demand by improving efficiency in existing buildings.

4.5.2 Required evidence

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

4.5.3 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 2013 Environment Agency and Natural Resources Wales water stress assessment[41], the Thames Water (serving West Berkshire) was classified as under "serious" water stress.

41 Water Stressed Areas - Final Classification, Environment Agency, (2013). Accessed online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/244333/water-stressed-classification-2013.pdf on: 29/10/2020

4.5.4 River Basin Management Plans

One of the challenges identified in both the Thames RBMP 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."

4.5.5 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. An adopted water efficiency target higher than 110 l/p/d would make the overall target for the UK harder to achieve and considering the difficulty of retro-fitting existing properties to reduce water demand, new build properties may need to be more efficient than 110l/p/d in order to achieve this.

As part of the National Framework, regional groups were created in which targets and objectives were set with the outcome of delivering resilient and sustainable water resources in the future. West Berkshire is within the South East regional group and the plan covers the period 2025 to 2100 (Section 3.8.4).

4.5.6 Impact on viability

As outlined in section 0 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[42] . Water efficiency is therefore not only viable but of positive economic benefit to both private homeowners and tenants.

42 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: 29/10/2020

4.5.7 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[43] 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 developed by Ashton:

"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)[44]

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:

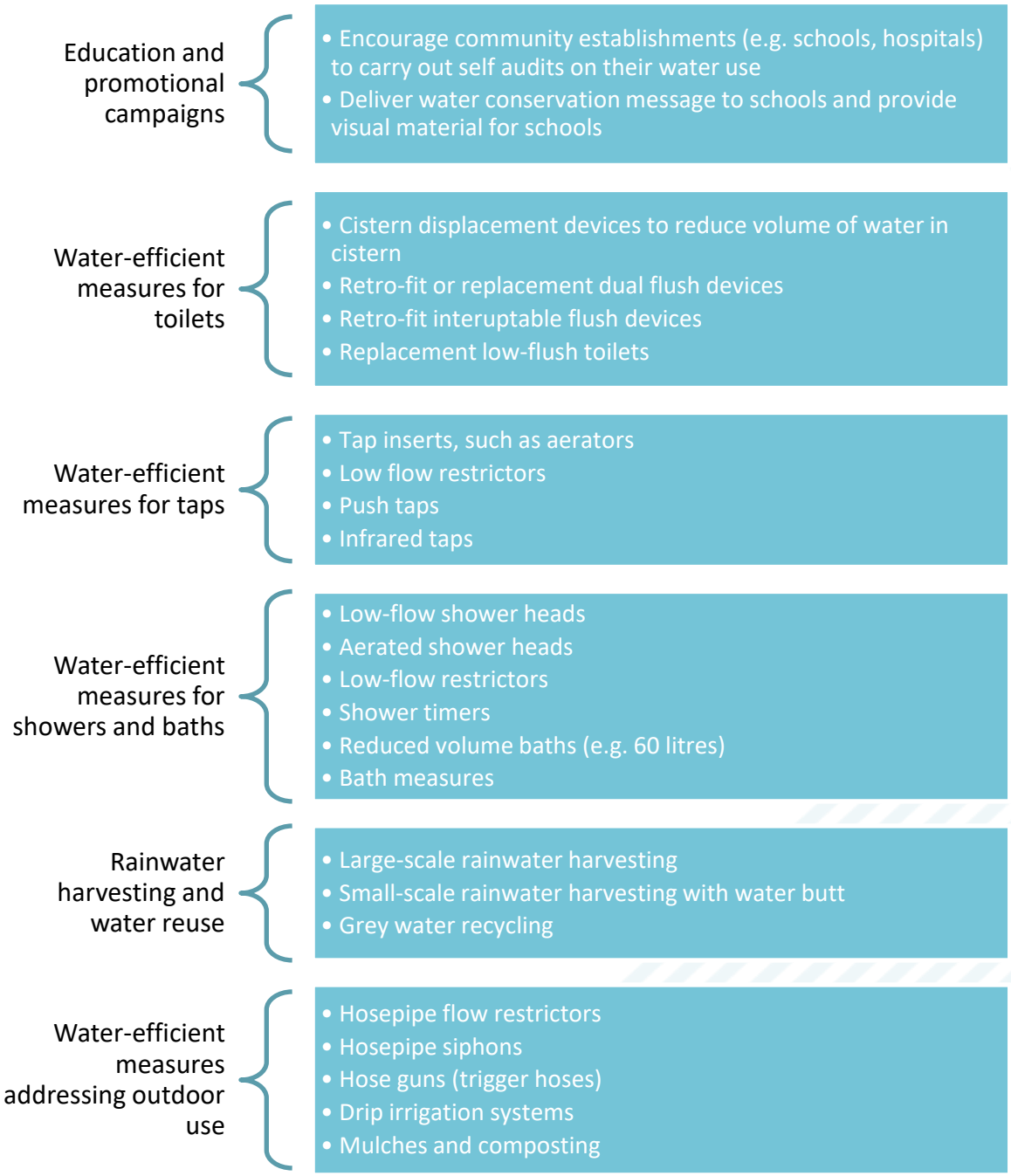
- Reducing leakage from the water supply networks
- Making new developments more water-efficient
- "Offsetting" new demand by retrofitting homes with water-efficient devices
- Encouraging existing commercial premises to use less water
- Implementing metering and tariffs to encourage the wise use of water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

Suggestions for water-efficiency measures are listed in Figure 4.11 below.

43 Water Neutrality: An improved and expanded water resources management definition (SC080033/SR1), Environment Agency, 2009.
44 Water Resources in the Built Environment, edited by Booth and Charlesworth (2014). Published by Wiley.

4.5.8 Consumer Water Efficiency Measures

Figure 4.11: Consumer Water-Efficiency Measures



Source: Adapted from Booth and Charleswell (2014)

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.

4.5.9 Rainwater Harvesting 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 Rainwater Harvesting

- 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 Rainwater Harvesting

- 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 3/4bed 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 Recycling

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

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 the water cannot be stored for extended periods.

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

Domestic water demand can be significantly reduced by using GwR, 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).

The payback period for a GwR system is relatively long, as the initial outlay is large, and the cost of water relatively low. This limits the viability of greywater systems for individual domestic customers as a retro-fit option, and less attractive than RwH in a new build due to the increased maintenance cost.

However, these challenges can be overcome, and large water savings realised if GwR schemes are incorporated at a communal level where costs can be shared between multiple households. Whilst GwR systems at a communal scale can be retrofitted, they are most cost effective when incorporated into a new housing scheme at the master-planning stage.

Employment and commercial sites often offer larger opportunities for both RwH and GwR, as highlighted in the case study below.

Case Study – 20 Fenchurch Street - Aquaco

Aquaco Water Recycling Ltd design and supply both grey water and rainwater recycling systems for residential, commercial and mixed-use developments.

In 2013, Aquaco were commissioned to supply and install a multi-media grey water system within the Walkie Talkie building in London. This system has the capability of processing 20,000 litres of grey water daily, significantly reducing demand for clean water. Here, the grey water is used for the flushing of toilets throughout the building.

The system both filter and treats the grey water, to ensure that it is suitable for reuse.

"Aquaco grey water recycling and harvesting systems reduce wastewater usage by typically 50%"

4.5.10 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.

4.5.11 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

West Berkshire contains two water resource zones, which are classified by the Environment Agency as being under serious water stress, justifying as a minimum the more stringent target of 110l/p/d under building regulations. This is supported by the River Basin Management Plans and aligns with the National Water Resources Framework national target.

WBC may want to consider going further than the 110l/p/d water efficiency target particularly in larger strategic developments. Elsewhere in the south east, Southern Water have committed to achieving a water demand of 100l/p/d day across their supply region by 2040 and have advised councils in their area to adopt this as policy for new developments in their local plan, and to achieve 80l/p/d in strategic developments. This approach was supported in that area by South East Water, SES Water, the Environment Agency and Natural England.

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 West Berkshire, and also help to achieve reductions in carbon emissions.

A comparison was carried out between the level of growth anticipated in each water company's water resource management plan, and West Berkshire's housing need. The WRMP was found to be broadly in line with growth projections of WBC.

West Berkshire's growth forecasts were shared with Thames Water who were asked to comment on the availability of water resources to serve the expected level of growth.

Whilst they provided a detailed water supply infrastructure assessment, they referred to their WRMP for comments on water resources.

4.7 Recommendations

The recommendations for water resources are provided in Table 4.5 below.

Table 4.5: Recommendations for water resources

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.	TW	Ongoing
Provide yearly profiles of projected housing growth to water companies to inform the WRMP update.	WBC	Ongoing
The concept of water neutrality has the potential to provide a benefit in improving resilience to climate change and enabling all waterbodies to be brought up to Good status. Explore further with the water companies and the Environment Agency how the Council's planning and climate change policies can encourage this approach.	WBC, EA, TW	In Local Plan Review and Climate Change Action Plan
Strategic residential developments, and commercial developments should consider incorporating greywater recycling and/or rainwater harvesting into development at the master planning stage in order to reduce water demand.	WBC, TW	In Local Plan Review

4.8 Requirement for further study in Phase 2

No further study of water resources is recommended in a Phase 2 WCS unless the growth forecast is changed significantly from Phase 1.

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[45]. This is particularly feasible within property owned or managed by the local authorities, such as social housing.

5.2 Methodology

Thames Water were provided with all of the allocations and potential allocations in a GIS format, alongside a spreadsheet containing all of the relevant site details (no. of houses, employment floorspace etc). They were asked to provide a Red/Amber/Green (RAG) assessment alongside site specific comments for each site.

A relative ranking - red to green was provided based on a consideration of water treatment capacity, storage and bulk transfer capacity, and water main capacity. Sites with a "green" assessment Thames Water consider to be most suitable, "amber" next suitable, and "red" least suitable from a water supply perspective. It can be thought of an indication that further modelling and/or provision of infrastructure would be required in order to serve that development. It does not mean that development could or should not take place in that location.

In addition to this, Thames Water also provided an assessment of the impact on the local distribution network based on the size of the development site.

45 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: 29/10/2020

5.3 Results

Table 5.1 summarises the RAG assessments made by Thames Water. Where significant issues were identified, they are described in more detail in Table 5.2.

Table 5.1 Summary of Thames Water RAG assessment for water supply

RAG Score	Number of sites	Number of homes	Employment land (m^2)
Green	81	2,152	217,154
Amber	34	4,363	196,840
Red	10	9,689	18,600

Table 5.2 Sites with specific water supply issues

Affected site	TW Comment	Explanation / Recommendation
BH1: Clappers Farm, Grazeley THA10: Land at Siege Cross Farm (this site also forms part of THA20) THA20 (THA6 and THA6 also form part of THA20 but have been given an amber assessment as they are smaller): North East Thatcham	*"Unable to supply with present water resource available to this area. Process treatment investment required at Bishops Green WTW"*	These are all large sites that will require significant additional water resource which would exceed the capacity of the water treatment works (WTW) in this area. Upgrades would be required at this WTW to provide this capacity, and delivery of these development sites would need to be aligned with the upgrade programme.
CA15: Land at Long Lane, North of Highwood Close and Shaw Cemetery, Long Lane, Newbury	*"Elevation check on development location needed for decision on where to supply from, potential for gravity from Cold Ash res or pumping required?"*	For this site further analysis and modelling is required by TW in order to identify the most appropriate solution to serve this site.
CS3 Sandleford Park Strategic Site allocation	*"This development has its own strategic modelling report. Investment options review complete. It is above the capacity of wash common tower to supply. Likely to require phasing with new main from Enborne Grange WTW but within the resource capability and mains reinforcement. Planned investment under AMP7 business plan."*	Whilst this has been given a Red score and requires investment by TW to deliver the required additional capacity, this has been the subject of a modelling report already and a solution exists to resolve this issue.
HSA10 Stonehams Farm, Tilehurst	*"Modelling needed and location definition. To be supplied from Tilehurst zones?"*	This site has been given a RAG score based on its size and location. Further modelling work may be required by TW.
PAD4: Land adjacent Padworth IWMF, Padworth Lane, Lower Padworth	*"Red based on +0.233 additional demand"*	This site has been given a RAG score based on its size. Further modelling work may be required by TW.

Affected site	TW Comment	Explanation / Recommendation
WOK1; Bloomfield Hatch Farm, Bloomfield Hatch, Mortimer WOK2: Pierces Farm, Goodboys Lane, Mortimer WOK4: Land at Grazeley	*"Unable to supply with present water resource available to this area. Modelling of options needed."*	These large development sites (alongside nearby development sites in Wokingham) would exceed the water resources capacity in this area. A number of potential solutions have been identified by TW, but further modelling is required by TW in order to select the most appropriate solution. Delivery of these development sites would need to be aligned with delivery of a solution by TW.

Table 5.3 summarises the local distribution network assessment provided by Thames Water. No network modelling has been undertaken to form this assessment which is based purely on the size of development sites. In general sites with less than 20 dwellings can be accommodated with minimal impact on the network and have therefore been given a "green score". Sites containing between 20 and 50 dwellings have been given an "amber" score and may require some reinforcement of the network depending on location and the capacity of the existing network. Sites larger than 50 dwellings are likely to have an impact on the existing network and require network reinforcement in order to avoid any detrimental effect on existing customers.

Table 5.3 Summary of Thames Water assessments of the supply network

RAG Score	Number of sites	Number of homes	Employment land (m^2)
Green	42	348	1,100
Amber	26	825	1,200
Red	58	15,106	430,144

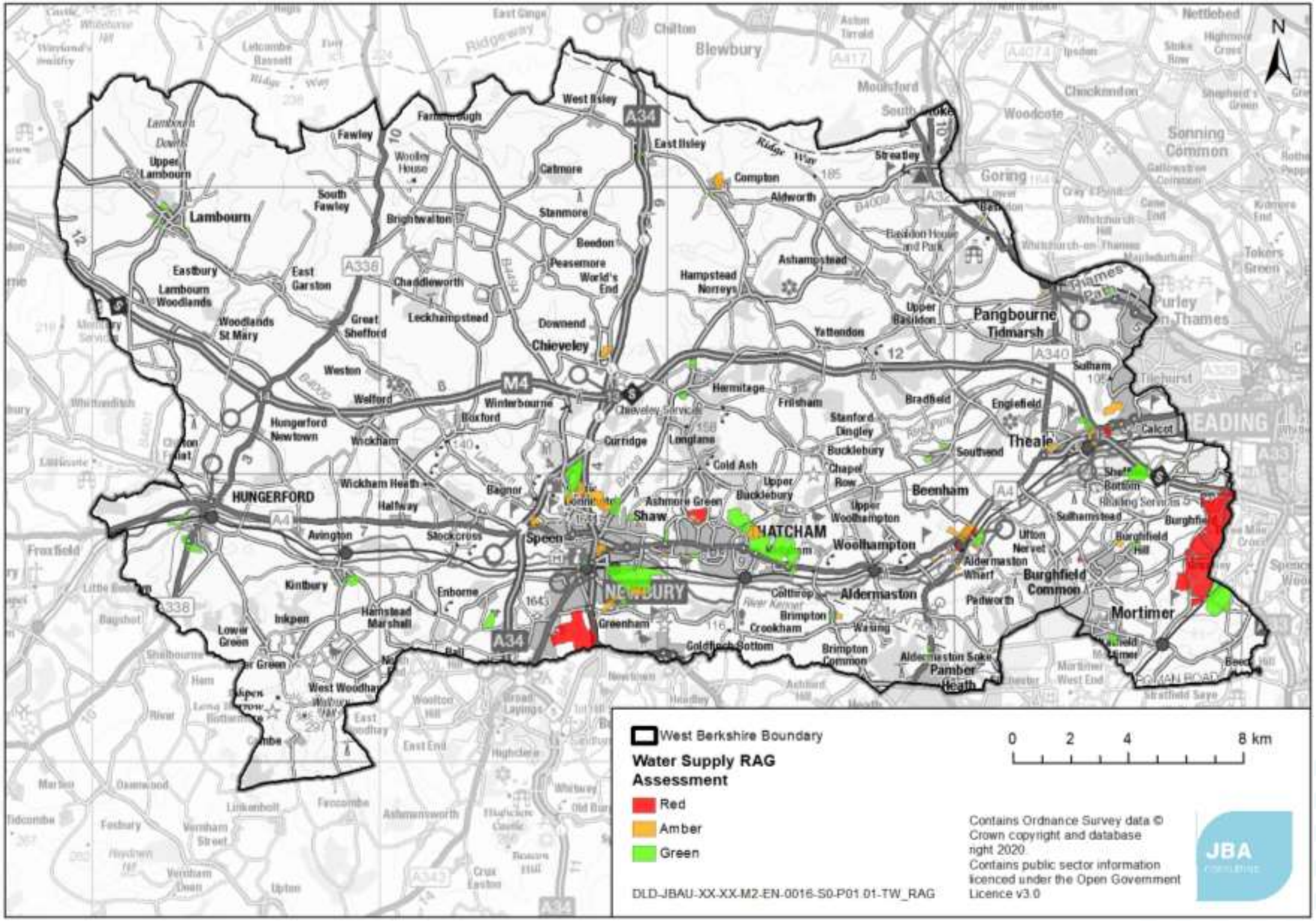


Figure 5.1 Water supply network assessment (Thames Water)

5.4 Conclusions

- Allocations and potential allocations across the study area were reviewed by Thames Water and given a relative scoring based on the impact on the water supply network.
- Thames Water identified a number of sites where further modelling and / or upgrades to the network would be required in order to serve those sites. Should these sites be allocated, delivery must be aligned with provision of these upgrades and WBC should engage with TW early to enable infrastructure upgrades to be constructed prior to occupation of new developments.
- Once there is more certainty on which sites will be allocated in the Local Plan Review, WBC should provide an update to TW to enable further modelling to be undertaken if necessary.

5.5 Recommendations

Table 5.4: Recommendations for water supply infrastructure

Action	Responsibility	Timescale
Consider the need for additional water supply infrastructure when selecting sites for allocation in the Local Plan Review.	WBC	During Local Plan Review process
Development of sites indicated as requiring further modelling or upgrades to capacity should be aligned with provision of infrastructure. Early collaboration between WBC, developers and TW is required.	WBC TW Developers	Ongoing
TW should advise WBC of any strategic water resource / supply infrastructure required within the study area where these may require safeguarding of land to prevent other types of development occurring.	TW	During Local Plan Review process

5.6 Requirements for further study in Phase 2

Once there is greater certainty on which development sites will be allocated in the Local Plan Review, the water supply assessment should be updated.

6 Wastewater Collection

6.1 Sewerage Undertakers

Thames Water are the Sewerage Undertakers (SU) for the whole of West Berkshire. 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.

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). Within the study area there are no CSOs recorded on the EA Consented Discharges to Controlled Waters with Conditions database.

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 the West Berks , 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.

The Drainage Hierarchy should be used to direct surface water to natural outfall routes such as infiltration to the ground or into watercourses, before utilising sewers, as supported by paragraph 80 of the NPPG. Surface water should also not be permitted to connect to a foul sewer.

Another issue when considering sewer capacity is the volume of groundwater infiltration. This is where groundwater enters the public and private sewerage systems through cracks, holes, or faulty joints. In catchments where there is significant groundwater infiltration, capacity in the sewer is used up in the same way as the presence of a surface water misconnection. Under storm conditions this increases the likelihood of sewer flooding or sewage overflows into watercourses. In some West Berkshire catchments prone to significant groundwater infiltration into sewers, there are 'unavoidable discharges', where water is allowed to flow from, or is pumped from foul sewers overloaded with infiltration, in order to prevent flooding. These are being managed through Infiltration Management Plans, in line with Environment Agency policy[46].

6.2 Sewerage System Capacity Assessment

New residential developments and new employment land 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

[46] Environment Agency (2016) Regulatory Position Statement: Discharges made from Groundwater Surcharged Sewers. Version 3 Issued December 2016

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

As in the water supply network assessment, Thames Water were provided with the list of allocations and potential allocations. Using this information, they were asked to assess each site using the range of datasets they hold. Where appropriate the water companies also provided site specific comments.

A red RAG score given by the water companies reflects the presence of sewer flooding, CSO spills or pollution events in the vicinity of the site, on the assumption that an increase in wastewater flows from development would make those occurrences more likely in the future. It also takes into account the size of the site, with larger sites more likely to exacerbate existing issues in the network. Groundwater infiltration in the sewerage network was also taken into account.

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 Results

6.4.1 Foul Sewer Network Assessment

Thames Water carried out an assessment of the sewer network capacity at the sewer catchment level, providing a RAG scoring for all the allocations and potential allocations in that catchment. These can be found in full in Appendix A.

It should be noted that this assessment refers to capacity in the sewer network and not capacity at the receiving WwTW.

At many of the sites scored as red or amber, network reinforcement would be required in order to serve growth during the local plan period. Typically, a network upgrade for a large-scale development could take 18 to 24 months to deliver depending on the complexity of the scheme. This needs to be factored in when phasing development, and early engagement with TW is recommended to ensure that any required network reinforcement is in place prior to occupation of development sites.

Table 6.1 Summary of Thames Water assessment of foul sewer network capacity

RAG Score	Number of sites	Number of homes	Employment land (m^2)
Green	31	7,060	18,900
Amber	42	1,799	39,760
Red	53	7,420	373,934

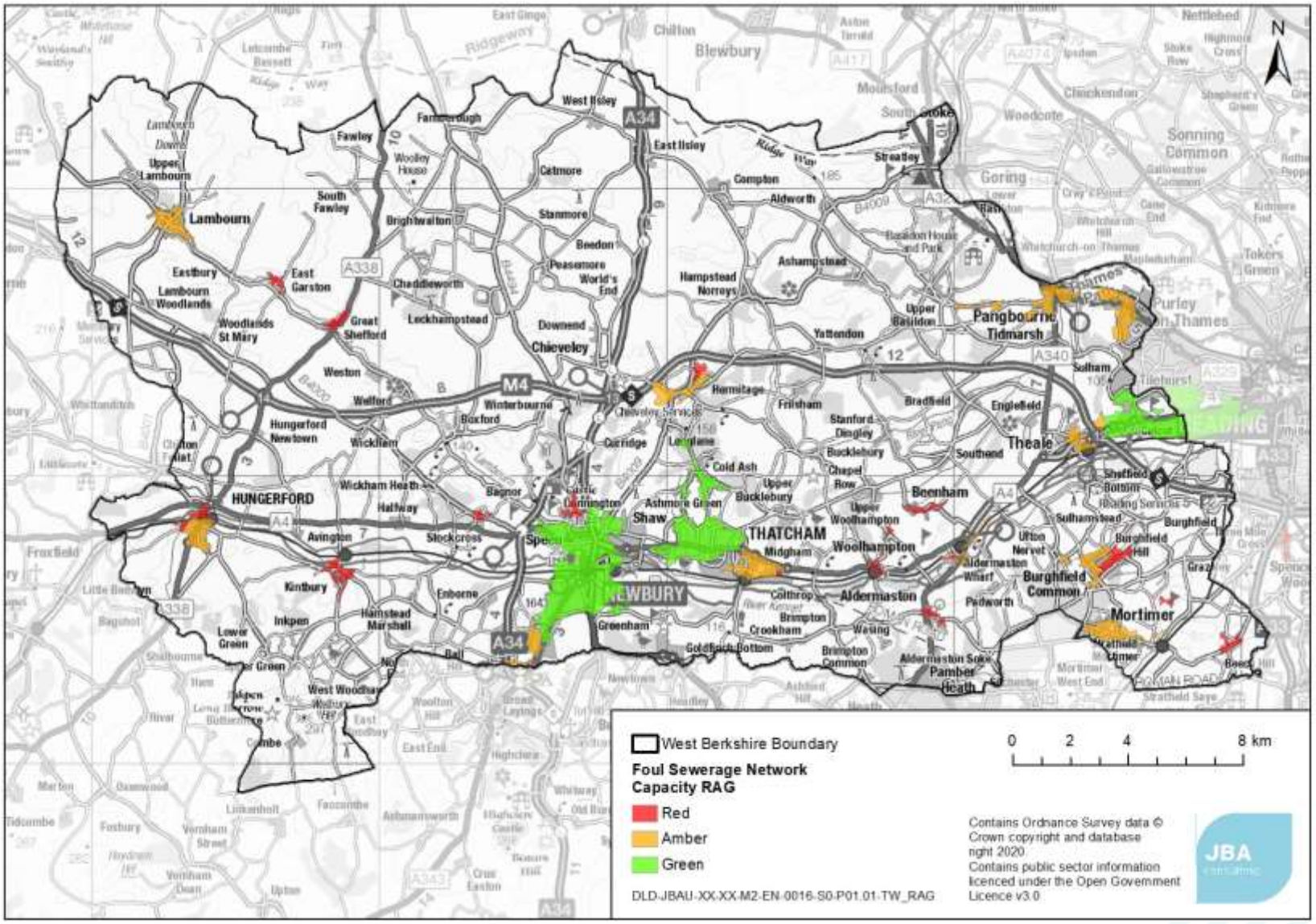


Figure 6.1 Foul sewer network assessment (Thames Water)

6.5 Summary

It should be remembered that Thames Water as 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 essential to ensure that sewerage capacity can be provided without delaying development.

6.6 Conclusions

Development in areas where there is limited wastewater network capacity will increase pressure on the network, increasing the risk of a detrimental impact on existing customers, and increasing the likelihood of sewer flooding. Early engagement with Thames Water is required, and further modelling of the network may be required at the planning application stage. Furthermore, if there are areas where the current network is a combined sewer system, further separation of foul and surface water may be required, as well as suitably designed SuDS.

The results in section 6.4.1 show that in order to serve the proposed growth in a number of settlements in West Berkshire, wastewater infrastructure and/or treatment upgrades would be required. Early engagement between developers, the Council and TW is recommended to allow time for the strategic infrastructure required to serve these developments to be planned.

6.7 Recommendations

Table 6.2: Recommendations from Wastewater Network Assessment

Action	Responsibility	Timescale
Early engagement between the council and TW is required to ensure that where strategic infrastructure is required, it can be planned in by TW.	WBC TW	Ongoing
Take into account wastewater infrastructure constraints in phasing development in partnership with the SU.	WBC TW	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: 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.	TW and 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

6.8 Requirement for further study in Phase 2

Once there is greater certainty on which development sites will be allocated in the Local Plan Review, the foul sewer network assessment should be updated.

7 Wastewater Treatment

7.1 Wastewater Treatment Works in West Berkshire

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.

Thames Water operate all the WwTWs serving growth across West Berkshire. The location of these WwTWs is shown in Figure 7.1 below.

Each development site identified by the council, alongside windfall and neighbouring authority growth was assigned to a WwTW using the sewerage drainage area boundaries provided by TW. Where a development site was not within a boundary, the nearest sewer catchment was chosen.

Actual connection of a development site to a particular WwTW may be different and will depend on the capacity of the receiving works, and the local sewer network.

Very small developments in rural areas may be suitable for on-site treatment and discharge, however the Environment Agency will not usually permit this where there is a public sewerage system within a distance calculated as 30m per dwelling.

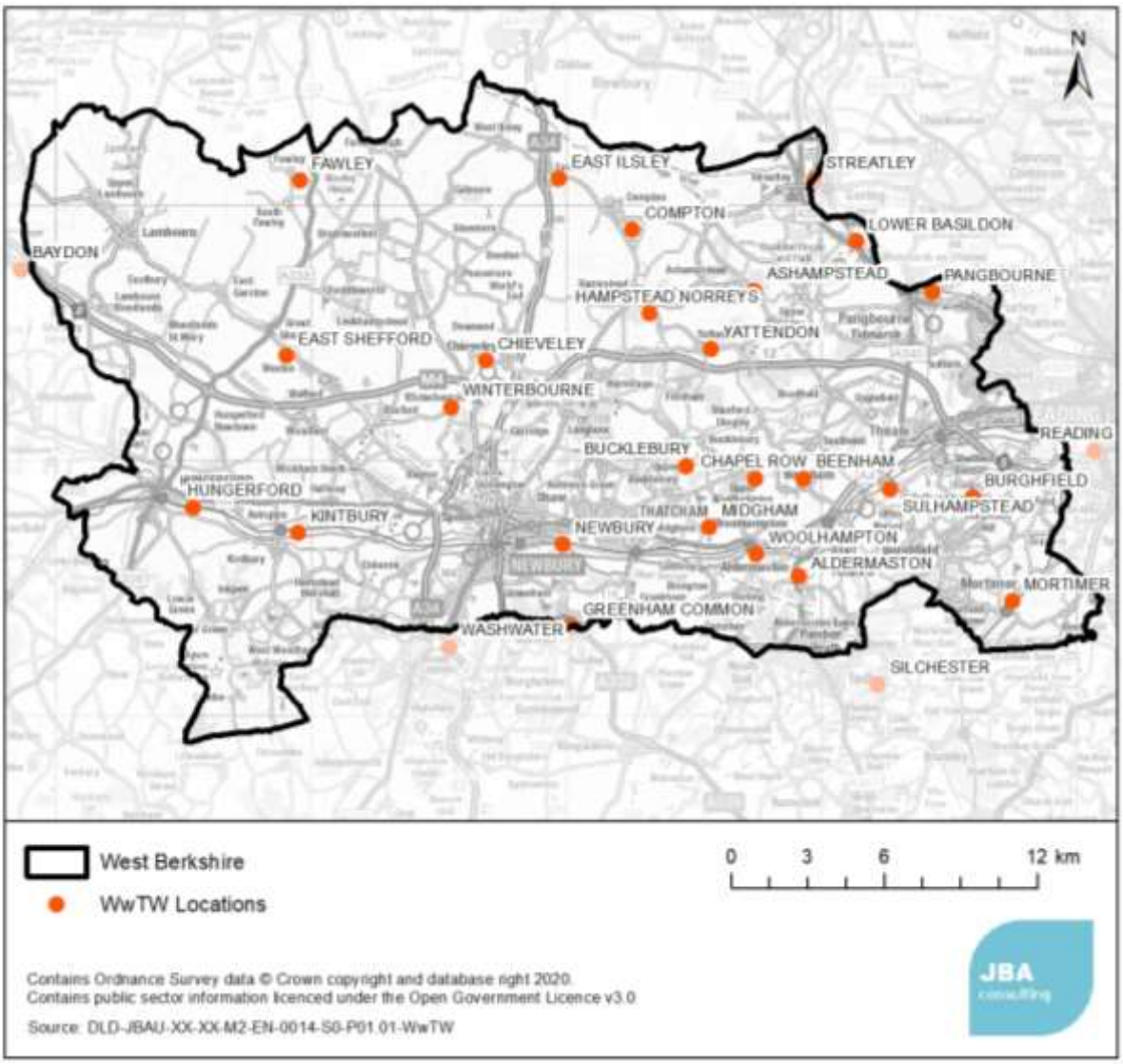


Figure 7.1 Location of WwTW serving growth in the study area

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 7.2 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.

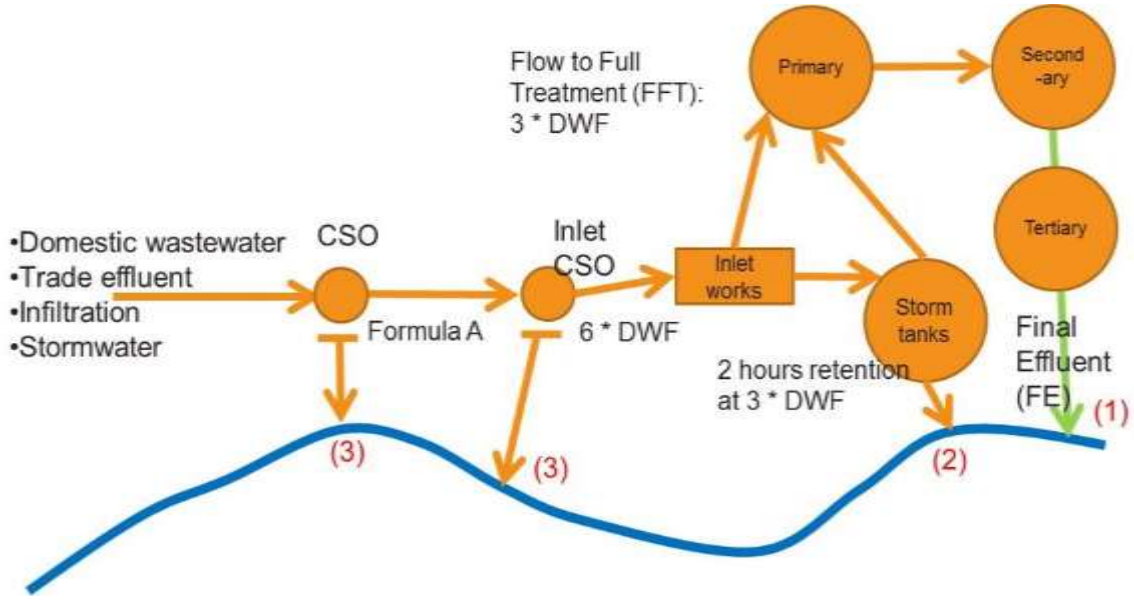


Figure 7.2 Overview of typical combined sewerage system and WwTW discharges

Environmental permits are used alongside water quality limits as a means of controlling the pollutant load discharged from a WwTW 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).

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

Thames Water were provided with the proposed sites and the potential housing numbers and employment space for each site (see Appendix A). TW were then invited to provide an assessment of the receiving WwTW and provide any additional comments about the impacts of development.

The TW 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:

- TW provided their Dry Weather Flow (DWF) statistics, and from this the 20th percentile (80% exceedance flow) for 2017-2019 was calculated. The flow data was cleaned to remove zero values and low outlier values which would bring the measured DWF down.

- Growth was assigned to a WwTW using the sewerage drainage area boundaries as described above.
- For each site, 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 for each WwTW being assessed.
- For the purposes of this assessment, every site identified in a wastewater catchment was assumed to be developed. This represents a reasonable worst-case scenario for wastewater treatment demand.

Table 7.1: Per Capita Consumption Values Used in Water Demand Calculations

Water Company	Water Resource Zone	Occupancy rate (persons per dwelling)	Per capita consumption (m3/person/day)
Thames Water	Kennet Valley	2.2	0.135
Thames Water	SWOX	2.5	0.138

7.4 Results

Thames Water provided a relative ranking – red to green – based on available capacity as well as other issues such as infiltration, water quality and odour. This is summarised in Table 7.2 below, and the full site by site assessment can be found in Appendix A.

Sites with a "green" assessment Thames Water consider to be most suitable, "amber" next suitable, and "red" least suitable from a wastewater treatment perspective. It can be thought of as an indication that further modelling and/or provision of upgrades would be required in order to serve that development. It does not mean that development could or should not take place in that location.

JBA also carried out a headroom assessment based on a comparison of the current discharge and permitted discharge, and whether future growth could be accommodated purely from a flow permit perspective. Both assessments are summarised by WwTW in Table 7.3. In many cases the two assessments differ as the JBA assessment only takes into account headroom in the flow permit. Three WwTWs were identified as likely to exceed or be close to exceeding their flow permit during the plan period.

It should be remembered that this assessment assumes that every existing allocation which has not yet been built out or potential allocation within each sewer catchment is allocated representing a worst-case for each WwTW. In many cases the amount of development in each catchment will be less.

Within Table 7.3, two figures for housing growth and employment growth are quoted. The first is the total from allocations or potential allocations, the second in brackets is the total growth in that catchment including sites already in the planning system, recent completions, windfall and neighbouring authority growth.

Table 7.2 Summary of Thames Water assessment of WwTW capacity

RAG Score	Number of sites	Number of homes	Employment land (m^2)
Green	24	1,013	0
Amber	50	5,266	355,590
Red	52	10,000	77,004

Many of the WwTW would require an upgrade and / or an increase in the flow permit in order to accommodate growth (based on every identified site being delivered). Some of these are already included in TW's "go to green" plan – an investment programme to improve compliance and performance at WwTWs.

If an upgrade to a WwTW is already committed to within TW's business plan (water companies operate on a five-year investment cycle, the current cycle being AMP7 – 2020 to 2025) delivery of an WwTW could typically take 2-3 years as a general guide. This is highly dependent on the nature and complexity of the scheme. If it is not already contained within the business plan, it would need to be included in the next AMP period starting in 2025.

This has implications for phasing of development sites and early engagement with Thames Water is recommended so that infrastructure can be planned appropriately and delivered prior to occupation of development sites.

Thames Water provided an additional comment on growth around Newbury:

"Newbury is undergoing growth projects over the next 2+ years to accommodate more development. Any proposed development sites (that are too large for the network) will have to have a modelling study, which will take into account the Newbury growth project. Phasing of the sites will be able to begin at a pace that will not overtake the growth upgrades. Details on phasing amounts and timescales will be given once the development sites have gone through their modelling studies"

At several WwTWs TW commented that land may need to be safeguarded in order to provide the required upgrades to serve growth. Safeguarding in this context is where an upgrade at a WwTW requires additional land and needs to be protected from other forms of development that may prevent the upgrade from being delivered. These WwTWs are:

- Bucklebury
- Chieveley
- East Shefford (situated south east of Great Shefford)
- Hungerford
- Lower Basildon
- Newbury
- Pangbourne
- Silchester
- Washwater
- Woolhampton

Once there is greater certainty on which development sites will be allocated in the Local Plan Review and therefore what level of growth will be served by each WwTW, TW should advise if land needs to be safeguarded at these WwTWs.

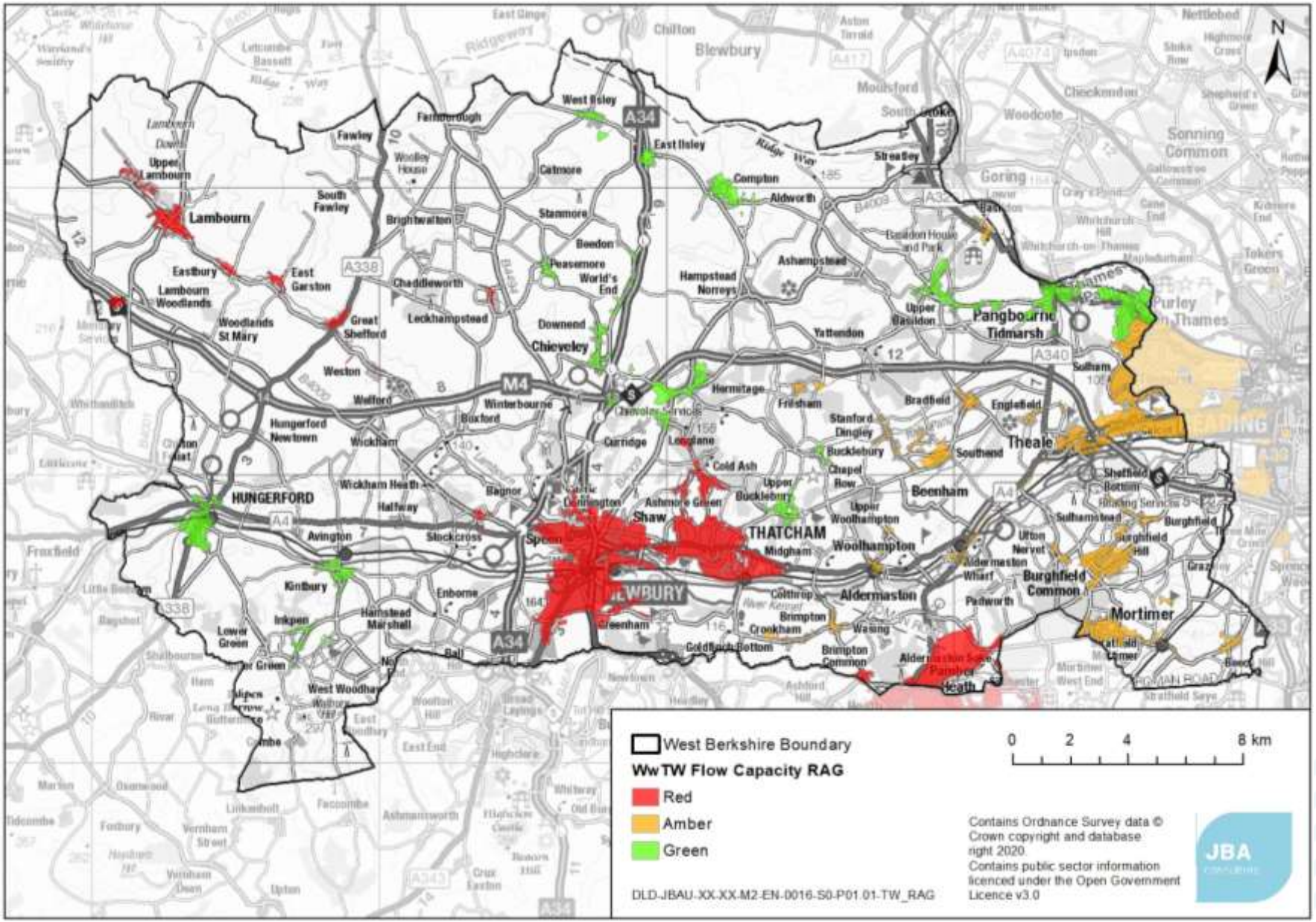


Figure 7.3 JBA flow capacity assessment

Table 7.3: Summary of WwTW Flow Assessment

WwTW	Housing growth from allocations	Employment floor space from allocations (m^2)	JBA Headroom Assessment	TW RAG Assessment	Comments
Aldermaston	0 (1 total)	0 (2,126 total)	Green	Not assessed	No allocations or potential allocations so no assessment required
Ashampstead	0 (1 total)	0	Green	Not assessed	No allocations or potential allocations so no assessment required
Baydon	0	0 (440 total)	Green	Not assessed	No allocations or potential allocations so no assessment required
Beenham	0 (4 total)	0	Green	Not assessed	No allocations or potential allocations so no assessment required
Bucklebury	15 (23 total)	0	Green	Green	TW - *"Potential inlet & storm return upgrade needed, may require some land"*
Burghfield	279 (415 total)	0	Green	Amber	TW advised that there are actions planned to improve water quality for water framework directive compliance and "*System suffers from groundwater infiltration which manifests at the STW during wet winters*"
Chapel Row	0	0 (270 total)	Green	Not assessed	No allocations or potential allocations so no assessment required
Chieveley	305 (594 total)	0 (16,869 total)	Amber	Amber	TW advised of a project under "Go to Green" to reduce risk of exceeding flow permit planned in 2020-25. This permit is being negotiated with the EA and actions planned to improve water quality for Habitats Directive Compliance. This may require land to be safeguarded.
Compton	173 (223 total)	0 (31,184 total)	Green	Green	TW advised of a scheme to improve the discharge from this WwTW as population growth has tipped this WwTW into a higher threshold and it must comply with more stringent regulations under the Urban Waste Water Treatment Regulations (UWWTR). Additionally, the "*Network upstream suffers from groundwater*

WwTW	Housing growth from allocations	Employment floor space from allocations (m^2)	JBA Headroom Assessment	TW RAG Assessment	Comments
					infiltration which manifests itself at the works in wet winters"
East Ilsley	31 (46 total)	0 (130 total)	Green	Green	TW – "Network suffers from groundwater infiltration which manifests itself at the works during prolonged winters"
East Shefford	165 (232 total)	0 (10,743 total)	Green	Red	TW - *"Network suffers from groundwater infiltration which manifests itself at the works during prolonged winters"* TW also advised that there is a "Go to Green" scheme at this WwTW and land may need to be safeguarded.
Fawley	0 (3 total)	0	Green	Not assessed	No allocations or potential allocations so no assessment required
Greenham Common	0	0 (73,436 total)	Green	Not assessed	No allocations or potential allocations so no assessment required
Hungerford	264 (379 total)	0 (7,301 total)	Amber	Green	TW advised of a scheme under "Go to Green" in AMP7 to "*improve compliance risk which will have a design horizon of 2026. Land would be safeguarded for Go to Green*" Flow compliance risk refers to the risk of discharges from this WwTW exceeding the permitted discharge.
Hampstead Norreys	0 (2 total)	0 (1,795 total)	Green	Not assessed	No allocations or potential allocations so no assessment required
Kintbury	158 (191 total)	0 959 total)	Green	Green	TW advised of a scheme under "Go to Green" in AMP7 to "*improve compliance risk which will have a design horizon of 2026"*
Leckhampstead	7 (8 total)	0 (360 total)	Green	Red	No comments provided by TW.

WwTW	Housing growth from allocations	Employment floor space from allocations (m^2)	JBA Headroom Assessment	TW RAG Assessment	Comments
Lower Basildon	16 (25 total)	0	Green	Amber	TW advised "Site does have some issues, may require land in future"
Midgham	0 (1 total)	0 (215 total)	Green	Not assessed	No allocations or potential allocations so no assessment required
Mortimer	0 (152 total)	0	Green	Not assessed	No allocations or potential allocations so no assessment required
Newbury	9,796 (13,855 total)	39,300 (153,440 total)	Amber	Red	TW advised a "Go to Green" scheme is being planned but "*not yet briefed for AMP7. Awaiting impact assessment of increased development flows on the STW from Process modelling. Likely to need some kind of upgrade in AMP7 but do not have business approval at this stage*"
Pangbourne	67 (123 total)	0 (140 total)	Green	Green	TW advised of a scheme under "Go to Green" in AMP7 to "*improve compliance risk which will have a design horizon of 2026*" and "*Go to Green will require safeguarded land*"
Reading	4,636 (34,463 total)	355,590 (591,051 total)	Green	Amber	TW – "*Given the odour limits for the site, any encroachment nearer the current works would be risky*" The odour assessment did not identify any sites encroaching closer to the WwTW than current urban area.
Silchester	8 (50 total)	37,704 (61,535 total)	Green	Red	TW advised "*Site will require an upgrade in due course – would safeguard land*"
Streatley	0 (2 total)	0	Green	Not assessed	No allocations or potential allocations so no assessment required
Sulhamstead	0 (1 total)	0	Green	Not assessed	No allocations or potential allocations so no assessment required
Washwater	24	0	Green	Red	No comments provided by TW

WwTW	Housing growth from allocations	Employment floor space from allocations (m^2)	JBA Headroom Assessment	TW RAG Assessment	Comments
	(29 total)				
Winterbourne	0 (1 total)	0	Green	Not assessed	No allocations or potential allocations so no assessment required
Woolhampton	183 (266 total)	0 (1,012 total)	Green	Amber	TW advised "*Requires an upgrade – would safeguard land*"
Yattendon	0 (1 total)	0 (3,822 total)	Green	Not assessed	No allocations or potential allocations so no assessment required

Note: The total number of homes and employment floor space includes recent completions, sites already in the planning system and growth within neighbouring authority areas.

7.4.1 Conclusions

Two assessments of WwTW capacity were undertaken:

- JBA performed a headroom assessment comparing the current DWF at each WwTW to the permitted flow and adding the additional effluent from growth in the local plan period.

  Three WwTWs in West Berkshire are predicted to, or already exceeding their flow permit during the plan period:

  - Chieveley
  - Hungerford
  - Newbury

- Thames Water carried out an assessment based on the relative suitability of development sites within each wastewater catchment, with the least suitable sites (those where the WwTW would require investment in order to serve growth) given a red or amber score, and those where minimal investment is required, or where investment is already planned, were given a green score. This assessment took into account capacity at the WwTW, water quality, odour and infiltration within the catchment.

Many of the WwTWs in the study area would require upgrades in order to serve growth during the plan period. WBC should consider the time taken to undertake these upgrades when phasing development and early engagement with TW is recommended to ensure required upgrades are in place prior to occupation. Once there is greater certainty on which development sites will be allocated in the Local Plan Review, TW should advise which WwTW would require safeguarding of land.

7.5 Recommendations

Table 7.4: Recommendations for Wastewater Treatment

Action	Responsibility	Timescale
Consider WwTW capacity when selecting allocations for inclusion the Local Plan Review.	WBC	During Local Plan Review process
Consider the available WwTW capacity when phasing development going to the same WwTW.	WBC, TW, EA	Ongoing
Provide Annual Monitoring Reports to TW detailing projected housing growth.	WBC	Ongoing
TW to assess growth demands as part of their wastewater asset planning activities and feedback to the Council if concerns arise.	TW	Ongoing

7.6 Requirement for further study in Phase 2

Once there is greater certainty on which development sites will be allocated in the Local Plan Review, a more accurate prediction of additional wastewater to be treated at each WwTW can be made. The WwTW capacity assessment should then be updated to identify which WwTW will require further modelling and / or upgrades and this can be considered when phasing development sites, as well as land requiring safeguarding.

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 suggest that an odour assessment may be required if the site of a proposed development if close to a WwTW or is encroaching closer to the WwTW than existing urban areas. If there are no existing developments close to a WwTW, it is more likely that an odour assessment is required to identify any potential issues. 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. The prevailing wind direction across West Berkshire is South West. For each Thames Water WwTW in West Berkshire, the land within an 800m radius of the asset has been identified and any sites that fall within this area have been highlighted.

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 West Berkshire Council)
- WwTW locations (from "Consented discharges to controlled waters with conditions" database)

8.4 Results

Table 8.1 identifies the six sites within West Berkshire which fall within 800m of WwTW. The 800m buffer does not take into account the size of the works, the treatment processes present or the condition of the WwTW which can all affect the magnitude of the odour. Where there is already urban area closer to the treatment works than the proposed site, the nature of odour on the new site is likely to be known and reported so these sites represent are lower risk. There are no proposed sites which are closer to the WwTW than existing urban areas.

Sites that are given an amber assessment will not necessarily experience nuisance odour but should undergo an odour assessment as part of the planning process.

Table 8.1: Sites within 800m of WwTWs in West Berkshire

WCS Site Ref.	Site Address	WwTW	Distance (m)	WwTW Location in Relation to Site	Closer than existing urban area?
BAS1	Land off Reading Road, Lower Basildon	Lower Basildon WwTW	540	NW	No
BAS2	Land adjacent Reading Road, Lower Basildon	Lower Basildon WwTW	692	NW	No
KIN3	Land east of Kiln Farm, Kintbury, RG17 9XD	Kintbury WwTW	767	SW	No
THA9	Land at Lower Way Farm, Thatcham, RG19 3TL	Newbury WwTW	449	N	No
MID4	Land north of the A4 Bath Road, junction of New Hill Rd, Woolhampton	Woolhampton WwTW	594	NW	No
EI2	Land south of Fidler's Lane, East Ilsley	East Ilsley WwTW	480	W	No

8.5 Conclusions

Six sites across West Berkshire are close enough to a WwTW for there to be a risk of nuisance odour. If these sites were to be allocated in the Local Plan Review, an odour assessment is recommended as part of the planning process, funded by developers. The remaining sites have been given a rating of green.

8.6 Recommendations

Table 8.2: Recommendations from the Odour Assessment

Action	Responsibility	Timescale
Consider odour risk in the sites identified to be potentially at risk from nuisance odour	WBC	Ongoing
Carry out an odour assessment for sites identified as amber as part of the planning process and paid for by the developer.	Site Developers	Ongoing

8.7 Requirement for further study in Phase 2

No further study of odour is recommended in Phase 2 unless new sites are identified.

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[47] (now withdrawn) set out a hierarchy for how the no-deterioration requirements of the WFD should be implemented on inland waters. 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 ensures 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"[48] 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.

BOD – Biochemical Oxygen Demand

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.

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

47 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: 28/09/2019

48 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: 28/09/2019

oxidized by bacteria into nitrate (NO3) or nitrite (NO2). 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 WwTWs.

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 Approach

It is expected that during the local plan period thirty WwTWs will see an increase in effluent as a result of growth within their catchment. If no action were taken, this has the potential to reduce water quality downstream. It is recommended at that the impact of growth during the local plan period on water quality is modelled in the Phase 2 Outline WCS. This modelling work can then be used to inform the environmental assessment outlined in Section 11.

This scoping study presents the current water quality as stated in the WFD Cycle 2.

9.3 Results

Figure 9.1 shows the overall WFD classification for waterbodies in West Berkshire. This is broken down in Table 9.1 into the determinands usually assessed in WCSs for each of the waterbodies that are predicted to receive additional effluent from growth during the plan period. Several of the WwTW discharge to small watercourses which are not within the WFD classifications. For these, the downstream watercourse status has been included. A total of 28 WwTW have been included. Of these, three waterbodies have an overall classification of "poor", 19 are classified as "moderate" and six are considered to have a "good" status. The BOD, ammonia and phosphate conditions for each watercourse is also considered. Four WwTWs serving growth in the plan period discharge to ground via an infiltration system so are not included in the table below. The number of dwellings / employment land planned is small and does not include any allocations or potential allocations.

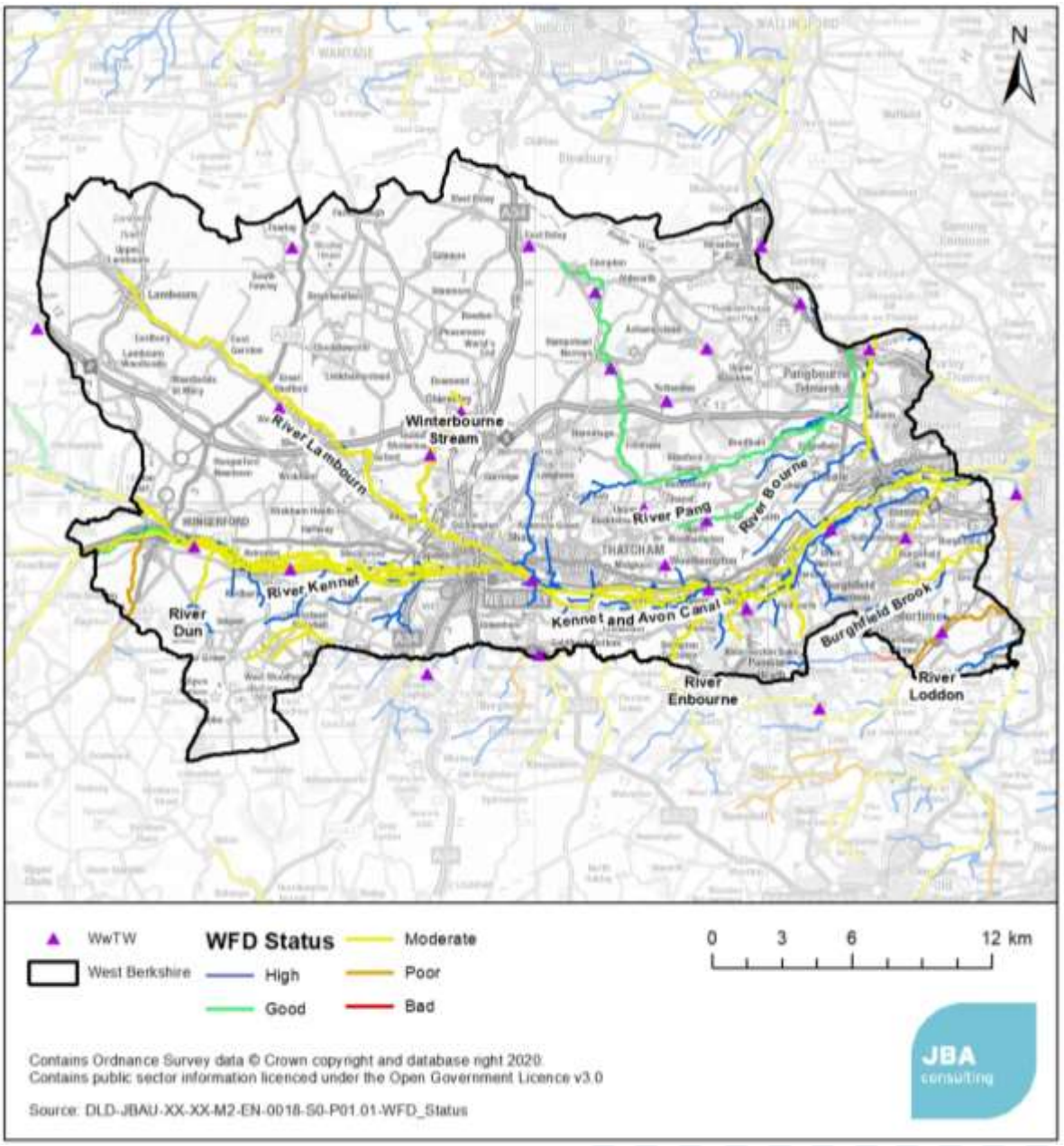


Figure 9.1: WFD status for waterbodies in the study area

Table 9.1: 2016 WFD classifications for waterbodies acting as discharge point for WwTW within study area

WwTW	Discharging Waterbody	Overall Status	BOD	Ammonia	Phosphate
Aldermaston	Fishermans Brook – N/A* – Kennet and Holy Brook considered	Moderate	High	High	Good
Beenham	Webbs Lane Stream – N/A* - Pang considered	Good	Not Available	High	Good
Bucklebury	Briff Lane Stream - N/A* - Pang considered	Good	Not Available	High	Good
Burghfield	Clay Hill Brook	Moderate	Not Available	High	Moderate
Chapel Row	River Bourne – N/A* - Pang considered	Good	Not Available	High	Good
Chieveley	Winterbourne Stream	Moderate	Not Available	High	Good
Compton	Pang	Good	Not Available	High	Good
East Shefford	Lambourn (source to Newbury)	Moderate	Not Available	High	Good
Hampstead Norreys	Pang	Good	Not Available	High	Good

WwTW	Discharging Waterbody	Overall Status	BOD	Ammonia	Phosphate
Hungerford	Kennet and Avon Canal – Summit to Copse Lock	Moderate	Moderate	High	High
Greenham Common	Enborne (Burghclere Brook to Kingsclere Brook)	Moderate	Not available	High	Poor
Hamstead Marshall	Hamstead Stream – N/A* – Enbourne (source to downstream A34) considered	Moderate	Not Available	High	Good
Kintbury	Kennet and Avon Canal – Summit to Copse Lock	Moderate	Moderate	High	High
Leckhamstead	Cattleford Brook – N/A – considered Leckhamstead Brook	Poor	Not Available	High	High
Lower Basildon	Pang	Good	Not Available	High	Good
Mortimer	Foudry Brook (West End Brook to M4)	Poor	Not Available	High	Poor
Midgham	Kennet and Avon Canal (Copse Lock to Reading)	Moderate	High	High	Not Available
Newbury	Kennet (Lambourn confluence to Enborne confluence)	Moderate	Not Available	High	High

WwTW	Discharging Waterbody	Overall Status	BOD	Ammonia	Phosphate
Pangbourne	Sulham Brook	Moderate	Not Available	Moderate	High
Reading	Foudry Brook (West End Brook to M4)	Poor	Not Available	High	Poor
Silchester	Silchester Brook	Moderate	Not Available	Good	Poor
Streatley	River Thames (Wallingford to Caversham)	Moderate	High	High	Moderate
Sulhamstead	Sulhamstead Stream – N/A* - considered Kennet and Avon Canal (Copse Lock to Reading)	Moderate	High	High	Not Available
Washwater	Pound Street Brook – N/A* - considered Enborne (downstream A34 to Burghclere Brook)	Moderate	Not Available	High	Poor
Woolhampton	Spring Ditch – N/A* - considered Kennet (Lambourn confluence to Enborne confluence)	Moderate	Not Available	High	High
Winterbourne	Winterbourne Stream	Moderate	Not Available	High	Good

**N/A – these waterbodies have not been included within the 2016 Cycle of WFD classification. The downstream watercourse (into which the unclassified stream flows) has been considered as alternative.*

9.3.1 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 11.15.3 and 11.15.4.
- 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.

9.4 Conclusions

Growth during the local plan period will increase the discharge of treated wastewater from WwTWs in West Berkshire. There is a potential for this to cause a deterioration in water quality in the receiving watercourses.

Further modelling is recommended of this impact in a Phase 2 WCS.

9.5 Recommendations

Table 9.2 Water quality recommendations

Action	Responsibility	Timescale
Provide annual monitoring reports to TW detailing projected housing growth in West Berkshire	WBC	Ongoing
Take into account the full volume of growth (from West Berkshire and	TW	Ongoing

Action	Responsibility	Timescale
neighbouring authorities) within the catchment when considering WINEP schemes or upgrades at WwTW		

9.6 Requirement for further study in Phase 2

Modelling the impact of additional discharges from WwTW on water quality is recommended in a Phase 2 WCS.

It is proposed that SIMCAT an EA water quality modelling tool is used for this, and a detailed methodology will be discussed with the EA prior to Phase 2.

10 Flood Risk from Effluent Discharge

10.1 Introduction

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.

10.2 Methodology

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

- Calculate the increase in DWF attributable to planned growth;
- Identify the point of discharge of these WwTWs;
- At each outfall point, identify the FEH v1.0 catchment descriptors associated with the WwTW;
- 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 rating 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 applied 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 each WwTW as a percentage of the Q30 and Q100 peak flow. The analysis shows that additional flows from the WwTWs post development would have a negligible effect on the predicted peak flow events with return periods of 30 and 100 years.

The following WwTWs have been excluded as they discharge to groundwater via an infiltration system:

- Ashampstead WwTW
- Baydon WwTW
- Fawley WwTW
- Yattendon WwTW

At Aldermaston, Beenham, Bucklebury and Leckhampstead the flow estimate methodology could not be applied as there was no data for the receiving watercourse. The nearest available point a flow estimate could be made was selected, which for all four was a larger watercourse, and so would underestimate additional flow as a percentage. As these WwTW are all small and the increase in effluent is also small, flood risk is still considered to be low.

Table 10.1: Summary of additional effluent as a % of Q30 and Q100 Peak Flows

WwTW	FEH stat Q30 (m^3/s)	FEH stat Q100 (m^3/s)	Additional effluent (m^3/d)	% increase in effluent during plan period	Flow increase as % of Q30	Flow increase as % of Q100	Comment
Aldermaston	69.62	86.82	10.7	15%	0.00%	0.00%	WwTW discharges to small watercourse – flow estimate taken at nearest available point which is a larger watercourse. However, increase in effluent during plan period is small (10m3/day) – flood risk assessed as low
Ashampstead	Groundwater discharge – not assessed						
Baydon	Groundwater discharge – not assessed						
Beenham	1.84	2.53	1.5	2%	0.00%	0.00%	WwTW discharges to small watercourse – flow estimate taken at nearest available point which is a larger watercourse. However, increase in effluent during plan period is small (1.5m3/day) – flood risk assessed as low
Bucklebury	0.43	0.58	8.6	6%	0.02%	0.02%	WwTW discharges to small watercourse – flow estimate taken at nearest available point which is a larger watercourse. However, % increase in effluent during plan period is small – flood risk assessed as low
Burghfield	1.60	2.20	154.9	13%	0.11%	0.08%	
Chapel Row	1.27	1.74	0.2	N/A	0.00%	0.00%	
Chieveley	1.71	2.22	239.7	28%	0.16%	0.13%	
Compton	1.43	1.93	85.8	42%	0.07%	0.05%	
East Ilsley	1.12	1.51	18.7	17%	0.02%	0.01%	

WwTW	FEH stat Q30 (m^3/s)	FEH stat Q100 (m^3/s)	Additional effluent (m^3/d)	% increase in effluent during plan period	Flow increase as % of Q30	Flow increase as % of Q100	Comment
East Shefford	6.57	8.66	99.7	11%	0.02%	0.01%	
Fawley	Groundwater discharge – not assessed						
Greenham Common	32.42	45.46	368.8	171%	0.01%	0.01%	
Hampstead Norreys	1.70	2.24	2.1	2%	0.00%	0.00%	
Hungerford	24.45	31.60	191.7	18%	0.01%	0.01%	
Kintbury	27.61	35.80	71.4	14%	0.00%	0.00%	
Leckhampstead	2.22	3.06	2.1	N/A	0.00%	0.00%	WwTW discharges to small watercourse – flow estimate taken at nearest available point which is a larger watercourse. However, increase in effluent during plan period is small – flood risk assessed as low
Lower Basildon	0.07	0.09	9.4	N/A	0.16%	0.12%	
Midgham	1.84	2.53	2.1	N/A	0.00%	0.00%	
Mortimer	14.92	19.64	130.9	11%	0.01%	0.01%	
Newbury	46.69	60.23	5677.5	24%	0.14%	0.11%	
Pangbourne	0.97	1.34	46.3	2%	0.06%	0.04%	
Reading	29.83	41.86	14510.5	27%	0.56%	0.40%	
Silchester	2.55	3.53	548.4	10%	0.25%	0.18%	
Streatley	187.69	225.45	0.7	1%	0.00%	0.00%	
Sulhamstead	1.30	1.79	0.4	N/A	0.00%	0.00%	
Washwater	1.28	1.70	1.9	0%	0.00%	0.00%	
Winterbourne	0.05	0.06	0.4	N/A	0.01%	0.01%	
Woolhampton	4.59	6.29	108.8	30%	0.03%	0.02%	
Yattendon	Groundwater discharge – not assessed						

10.4 Conclusions

The impact of increased effluent flows is not predicted to have a significant impact upon flood risk in any of the receiving watercourses.

Increases in discharges of treated wastewater effluent as a result of growth are not expected to significantly increase flood risk.

10.5 Recommendations

Table 10.2: Recommendations from the 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).	TW	During design of WwTW upgrades

10.6 Requirement for further study in Phase 2

No further assessment of flood risk is recommended in a Phase 2 WCS unless there are significant changes in the growth forecast.

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.

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 11.15.2. 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. Groundwater bodies are also given a status under the WFD which is reported in Section 4.1.3 for the groundwater bodies across West Berkshire.

Within the study area and downstream are many sites with environmental designations such as:

- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)
- Sites of Special Scientific Interest (SSSI)
- Ramsar sites (Wetlands of International Importance)
- Priority Habitats and Priority Headwaters

A description of these, and the relevant legislation that defines and protects them, can be found in section 3.5 to 3.7.

11.5 Assessment of impact risk

11.5.1 Methodology

Due to the large number of sources (30 WwTWs) and receptors the study area was divided into river catchments for further analysis. The defined catchments are shown in Figure 11.1 and are as follows:

- River Enborne and tributaries (Penwood Stream, Earlstone Stream, Ecchinswell Brook, Kingsclere Brook and Baughurst Brook).
- Upper Kennet and tributaries (Og).
- Lower Kennet, Holy Brook and tributaries (Clayhill Brook).
- Middle Kennet and tributaries (Aldbourne, Shalbourne, Inkpen Stream, Froxfield Stream).
- Pang
- Lambourn and tributaries (Winterbourne).
- Thames (Wallingford to Caversham) to and Sulham Brook
- Foudry Brook and tributaries (Silchester Brook, Burghfield Brook, West End Brook).
- Thames downstream of Kennet.

In order to identify protected sites that may be at risk, Flood Zone 2 from the Risk of Flooding from Rivers and the Sea mapping was used to define an area that was either adjacent to a river, or could be reasonably expected to receive surface water from a river. Where a WwTW was present in the catchment upstream of the protected site, it was considered that there was a risk of deterioration in water quality due to growth during the local plan period. Where there were no WwTWs serving growth upstream, risk of deterioration is considered to be low, and would not be shown by water quality modelling. However, in these cases the overall catchment water quality should be considered where for example they are designated for migratory fish species that may spend part of their lifecycle elsewhere in the catchment.

Priority Habitats have been mapped, but due to the large number of sites, these have not been assessed individually.

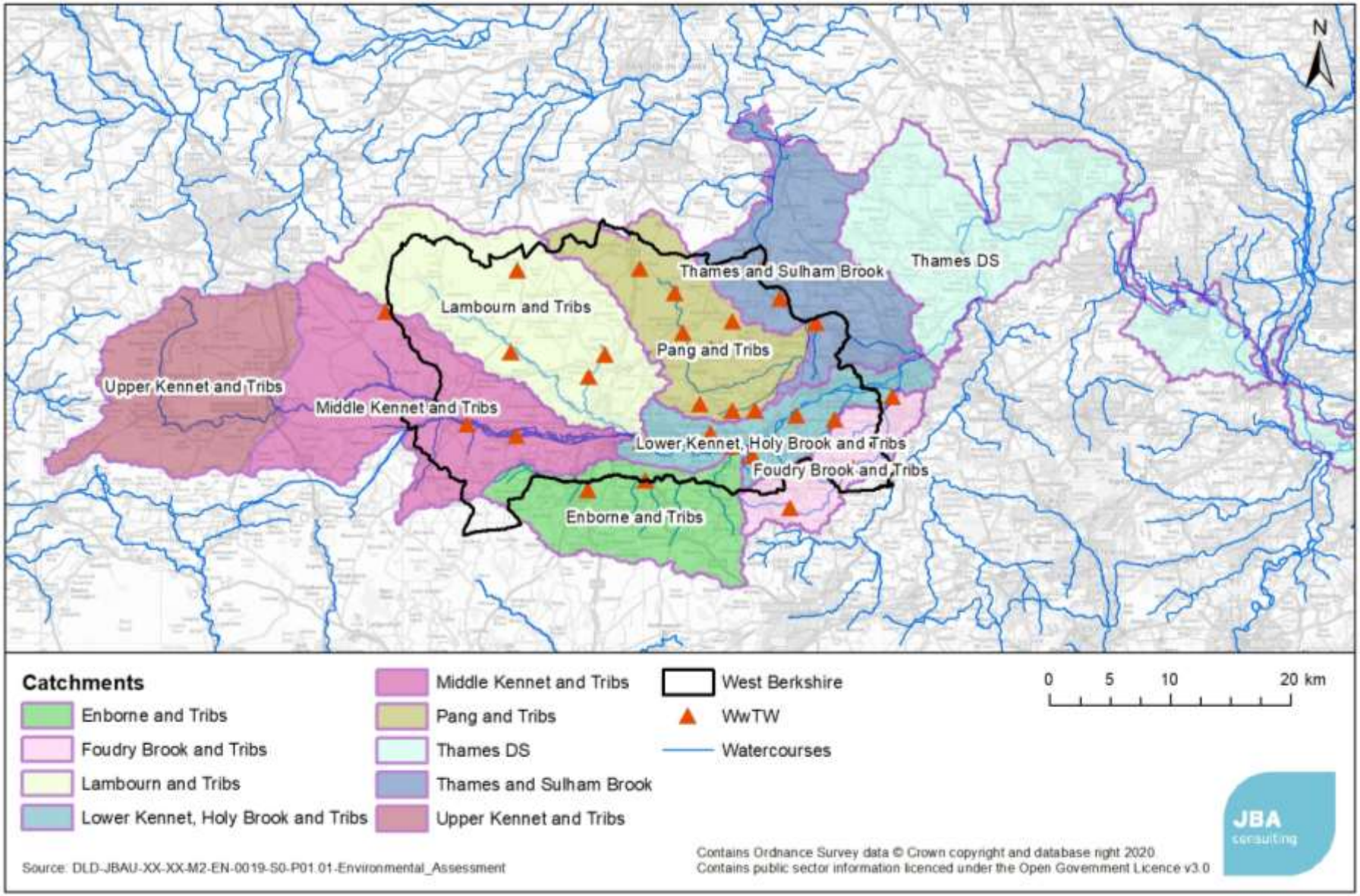


Figure 11.1 Catchments for environmental assessment

11.5.2 River Enborne and tributaries

Table 11.1 contains the protected sites that are within the River Enborne catchment, and adjacent to a watercourse. There are two SSSI's located within this catchment.

Ashford Hill Woods and Meadows is an SSSI, located along the Baughurst Brook, which comprises of varied complex woodland and agriculturally unimproved meadows. The site is home to threatened and rare species. It is also noted that the watercourse is clear and unpolluted.

The Greenham and Cookham Commons are located on a ridge between the Rivers Enborne and Kennet and comprise of heathland, grassland, woodland and gorse scrub. The heathland and acid grassland there is the single largest tract of this habitat type in Berkshire.

Table 11.1 Protected sites in the Enborne catchment adjacent to watercourses

WwTW in catchment (Sources)	Adjacent watercourse (pathway)	Protected site(s) (Receptor)	Likely impact
Washwater WwTW Greenham Common WwTW	River Enborne	Greenham and Crookham Commons	Impact possible
		Ashford Hill Woods and Meadows	Low – no upstream WwTW

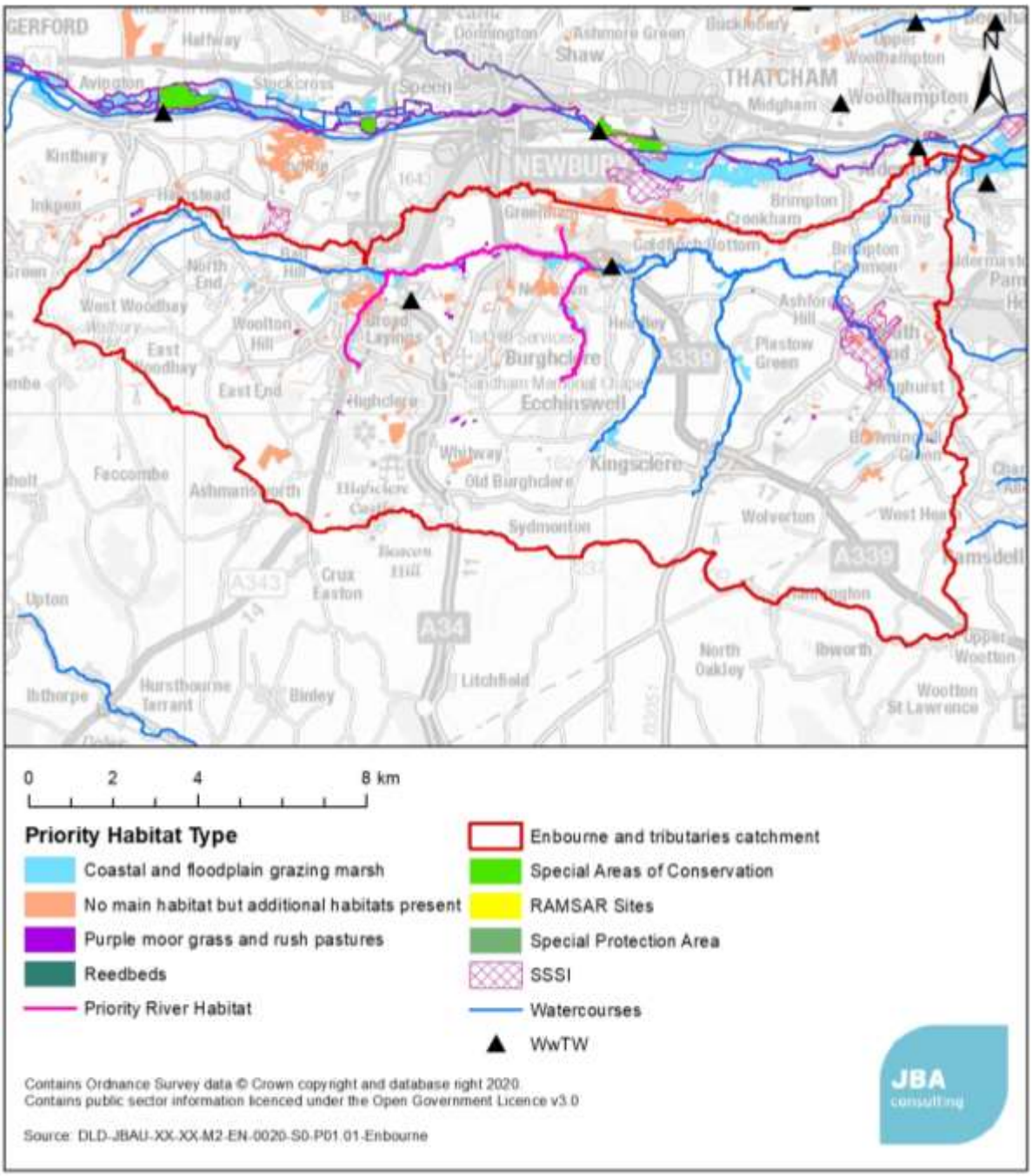


Figure 11.2 Protected sites within the Enborne catchment

11.6 Upper Kennet and tributaries

The Upper Kennet catchment forms the headwaters for the River Kennet. There are no WwTWs with proposed growth within this catchment and so there is likely to be no impact from the proposed development within West Berkshire.

11.7 Middle Kennet and tributaries

The Middle Kennet catchment is shown in Figure 11.3. Along the River Kennet, there are several protected areas, shown in Table 11.2.

The Kennet and Lambourn Floodplain SSSI and SAC includes six areas along the river, which are chosen to favour the protection of the nationally rare Desmoulin's whorl snail. The areas also support species-rich grasslands.

The Kennet Valley Alderwood SSSI and SAC are alluvial forests which have the largest remaining fragments of ash-alder woodland on the Kennet floodplain. The area has two woodlands, namely the Wilderness and part of Ryott's Plantation.

The Chiltern Foliat Meadows SSSI occupies the banks of the River Kennet. It is an extensive system of wet meadows, watercourses, tall fen vegetation and scrub. This site supports a variety of flora and birds.

Table 11.2: Protected areas within the Middle Kennet catchment

WwTW in catchment (Sources)	Adjacent watercourse (pathway)	Protected site(s) (Receptor)	Likely impact
Baydon WwTW Hamstead Marshall WwTW Hungerford WwTW Kintbury WwTW	River Kennet	Freeman's Marsh SSSI	Impact possible
		Kennet and Lambourn floodplain SSSI	Impact possible
		Chiltern Foliat Meadows SSSI	Impact possible
		Kennet Valley Alderwood SSSI	Impact possible
		River Kennet SSSI	Impact possible
		Kennet and Lambourn Floodplain SAC	Impact possible
		Kennet Valley Alderwood SAC	Impact possible
		Redhill Wood	Low – no upstream WwTW

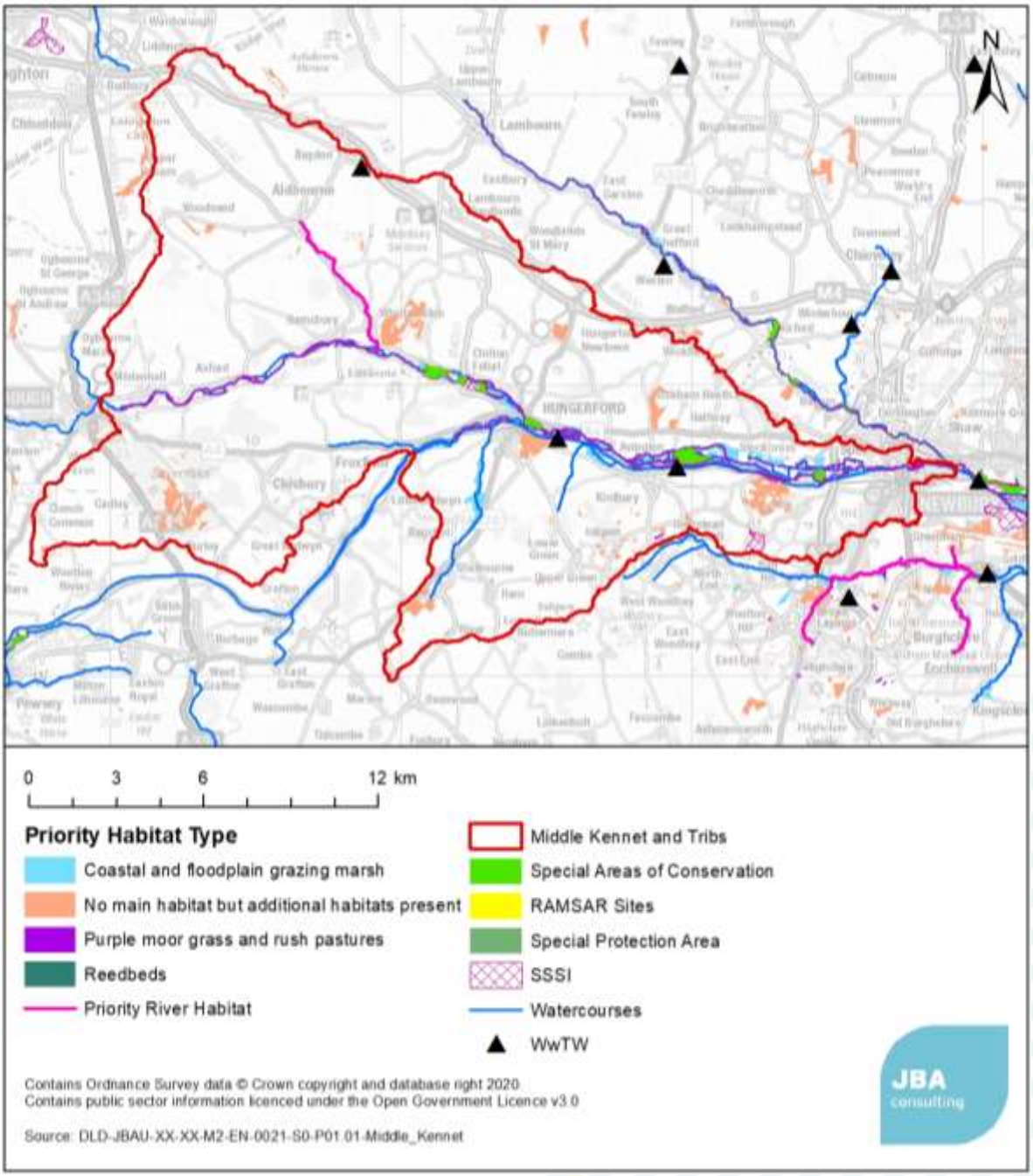


Figure 11.3: Protected sites within the Middle Kennet Catchment

11.8 Lower Kennet, Holy Brook, and tributaries

The Lower Kennet catchment is shown in Figure 11.4. Along the River Kennet there are several sites classified as SSSI and a SAC as shown in Table 11.3.

The Bowdown and Chamberhouse SSSI consists of a mix of heathland, acid grassland, mixed scrub and woodland. The Woolhampton Reed Bed is made up of dense reed beds with small areas of tall fen vegetation and carr woodland. The area supports a colony of reed warblers which are almost unique to this area. There are also a variety rare or uncommon flora and fauna.

The Thatcham Reed Bed has a similar habitat make-up to that of the Woolhampton Reed Beds. It is nationally important for the presence of rare species including the Desmoulin's whorl snail.

The Brimpton Pit SSSI is recognised as a SSSI as a result of its geological importance, providing an insight into the environmental changes during the Ice Age.

The Aldermaston Gravel Pits SSSI consists of mature flooded gravel workings surrounded by dense vegetation which homes a variety of habitats for breeding birds and wildfowl. The area is recognised as being of regional importance on passage and during winter months.

Table 11.3: Protected area within the Lower Kennet catchment adjacent to watercourses

WwTW in catchment (Sources)	Adjacent watercourse (pathway)	Protected site(s) (Receptor)	Likely impact
Aldermaston WwTW Burghfield WwTW Midgham WwTW Newbury WwTW Reading WwTW Sulhamstead WwTW Woolhampton WwTW	River Kennet	Bowdown and Chamberhouse Woods SSSI	Impact possible
		Woolhampton reed bed SSSI	Impact possible
		Brimpton pit SSSI	Impact possible
		Aldermaston gravel pits SSSI	Impact possible
		Thatcham reed beds SSSI	Impact possible
		Kennet and Lambourn Floodplain SAC	Impact possible

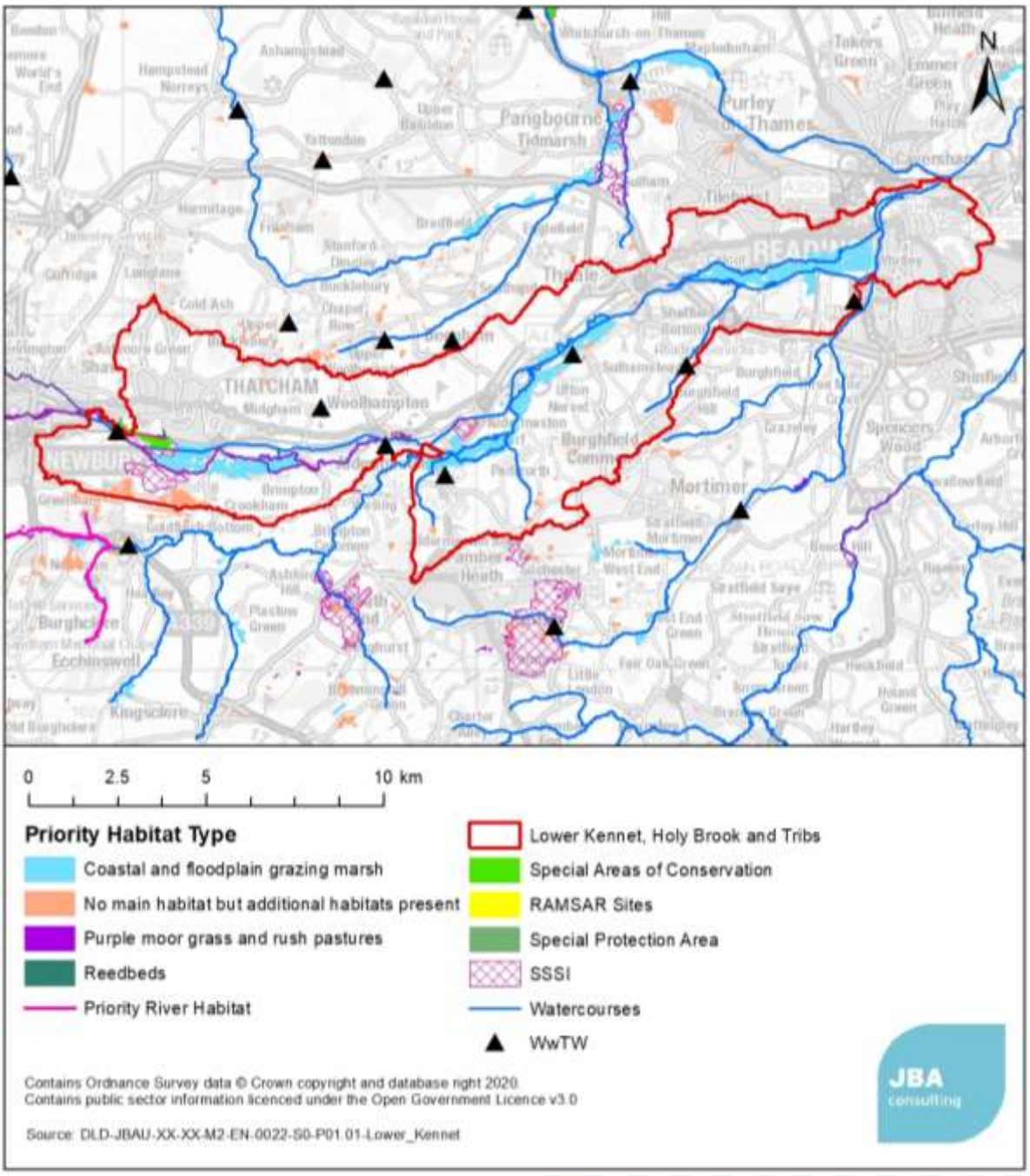


Figure 11.4: Protected areas within the Lower Kennet and Holy Brook Catchment

11.9 Pang

The Pang catchment is shown in Figure 11.5. There is one SSSI which may be impacted by change in discharge from the WwTW upstream, as shown in Table 11.4.

Sulham and Tidmarsh Woods and Meadows are underlain by a variety of soils which is reflected in the mosaiced damp copses and seasonally flooded meadows which is now a rarity in Southern England as a result of intensified management and urban encroachment.

Table 11.4: Protected area within the Pang catchment adjacent to watercourses

WwTW in catchment (Sources)	Adjacent watercourse (pathway)	Protected site(s) (Receptor)	Likely impact
Ashampstead WwTW Beenham WwTW Bucklebury WwTW Chapel Row WwTW Compton WwTW East Ilsley WwTW Hampstead Norreys WwTW Yattendon WwTW	Pang	Sulham and Tidmarsh Woods and Meadows	Impact possible

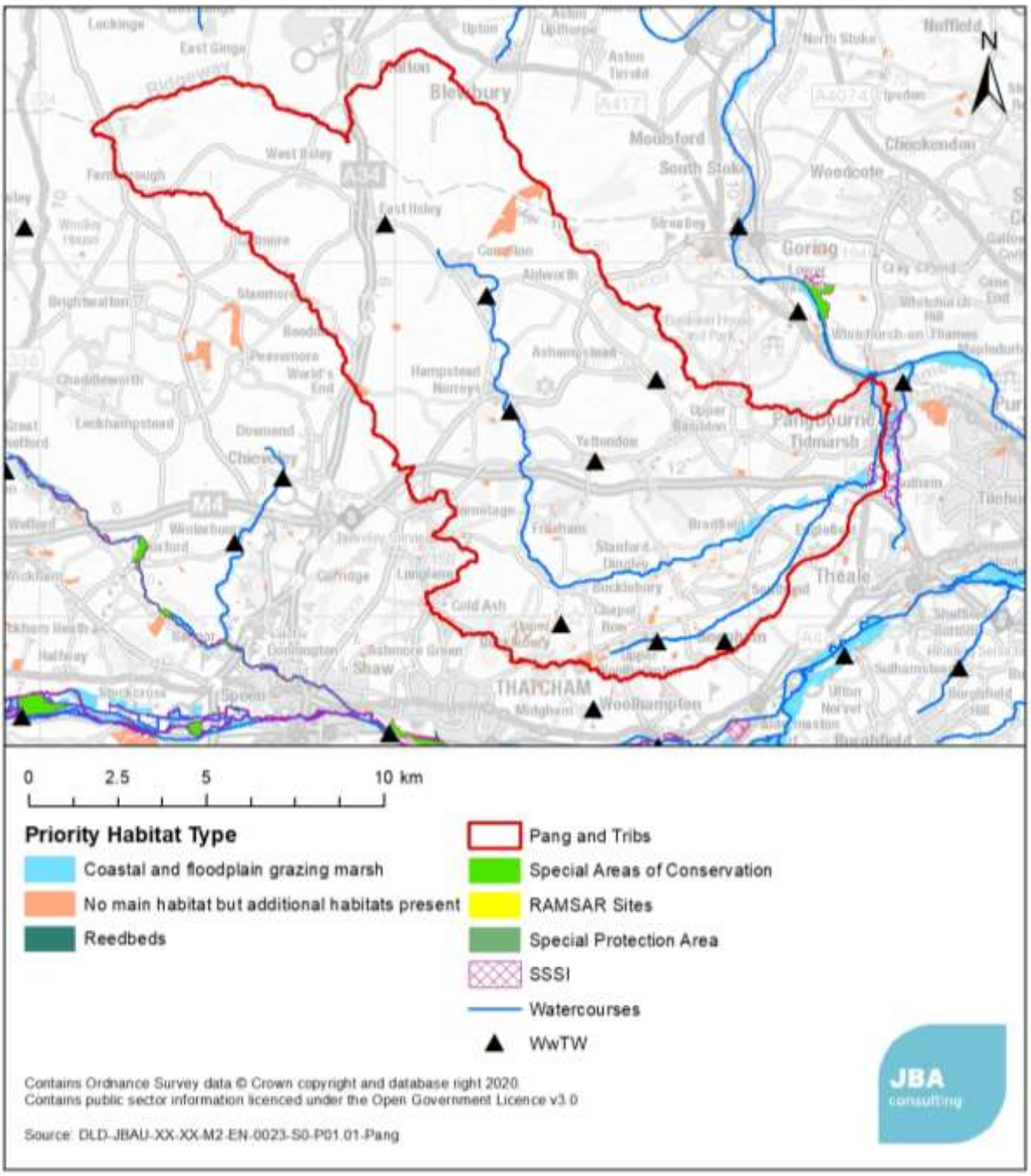


Figure 11.5: Protected areas within the Pang Catchment

11.10 Lambourn and Tributaries

The Lambourn and Winterbourne catchment is shown in Figure 11.6. There are several designated SSSIs within the catchment, as shown in Table 11.5.

Easton Farm Meadow SSSI is a small meadow with unimproved herb-rich grassland which is a habitat that is rare and rapidly declining across Berkshire.

Boxford Water Meadows SSSI comprises of a series of flood pastures and water meadows along the Lambourn. The area supports a range of rare fauna and flora.

Table 11.5: Protected area within the Pang catchment adjacent to watercourses

WwTW in catchment (Sources)	Adjacent watercourse (pathway)	Protected site(s) (Receptor)	Likely impact
Boxford WwTW Chieveley WwTW East Shefford WwTW Fawley WwTW Wickham WwTW Winterbourne WwTW	Lambourn	Easton Farm Meadow SSSI	Impact possible
		Kennet and Lambourn Floodplain SSSI	Impact possible
		Boxford Water Meadows SSSI	Impact possible
		River Lambourn SSSI	Impact possible
		Thatcham Reed Beds SSSI	Impact possible
		River Kennet	Impact possible

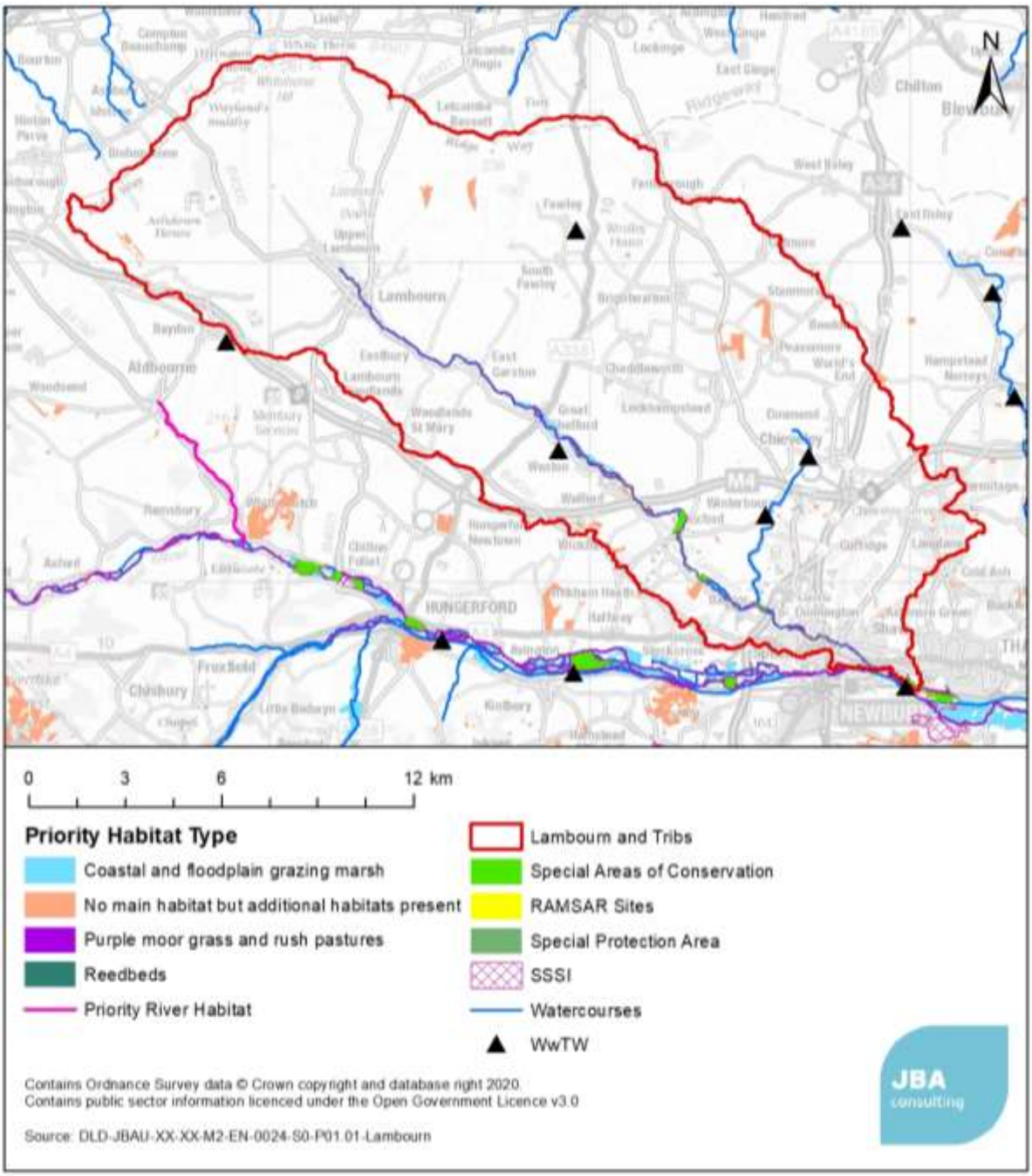


Figure 11.6: Protected areas within the Lambourn Catchment

11.11 Foudry Brook and tributaries

The Foudry Brook catchment is shown in Figure 11.7. There are two SSSIs within the catchment, with one located along the Silchester Brook. Table 11.6 shows the protected areas within the catchment.

The Pamber Forest and Silchester Common SSSI consists of an extensive ancient woodland, two heathland commons and a series of unimproved wet meadows. The diverse landscape provides a habitat for a variety of species including many nationally rare species of bird listed in Annex 1 of the EC Directive on the Conservation of Wild Birds.

Table 11.6: Protected area within the Foudry Brook catchment adjacent to watercourses

WwTW in catchment (Sources)	Adjacent watercourse (pathway)	Protected site(s) (Receptor)	Likely impact
Mortimer WwTW Silchester WwTW	Silchester Brook	Pamber Forest and Silchester Common	Impact possible

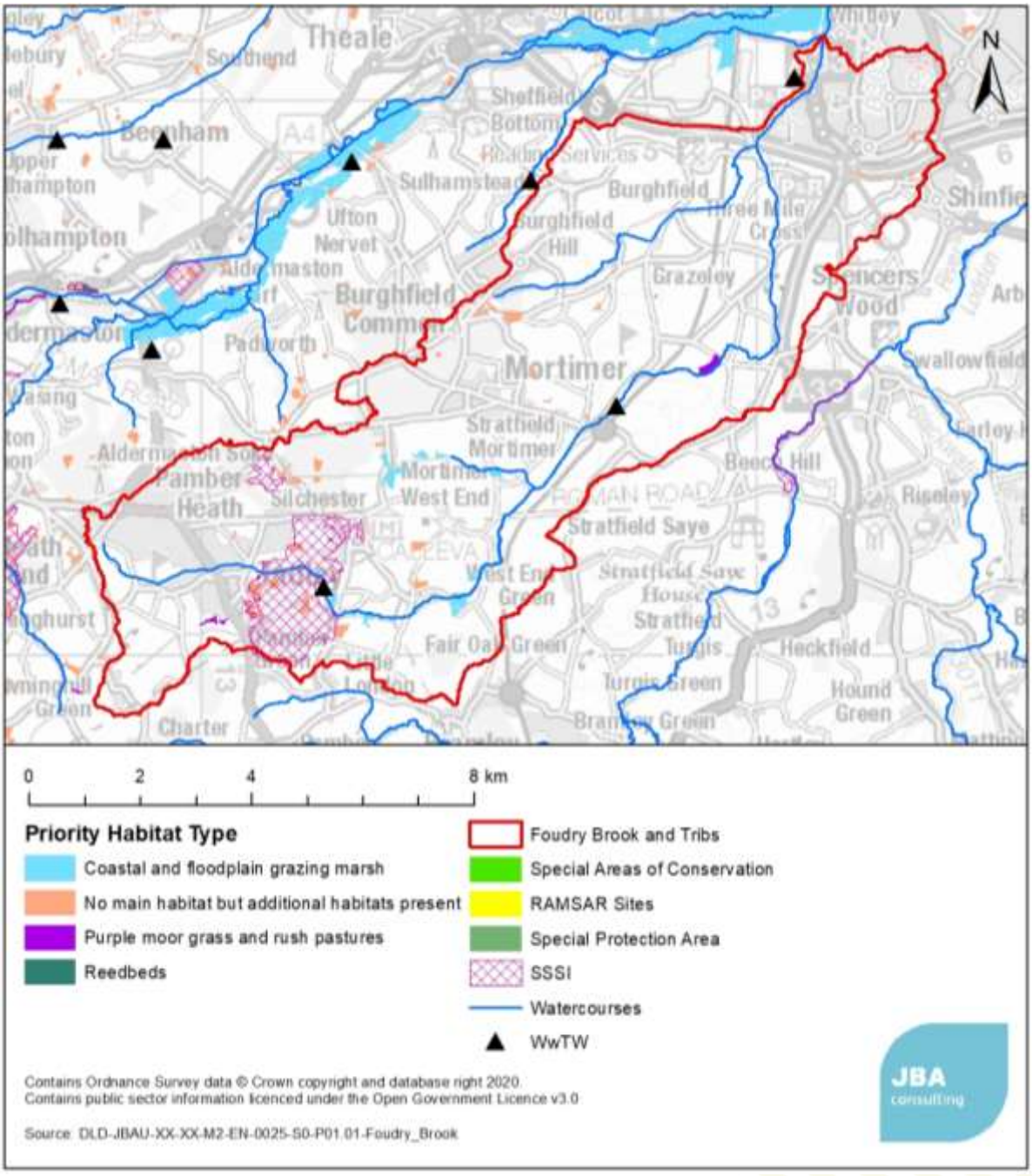


Figure 11.7: Protected areas within the Foudry Brook Catchment

11.12 Thames (Wallingford to Caversham) and Sulham Brook

The majority of this catchment is outside of West Berkshire. However, there are WwTW located here which are likely to serve some of the proposed growth. The catchment is shown in Figure 11.8. Table 11.7 shows the protected areas which are adjacent to watercourses and may be impacted by growth.

The Hartslock SSSI consists of a mixture of semi-natural habitats which is typical of the Chiltern scarp. The area provides habitat for a diverse range of flora and fauna including a plant species listed in Schedule 8 of the Wildlife and Countryside Act.

Table 11.7: Protected area within the Thames and Sulham Brook catchment adjacent to watercourses

WwTW in catchment (Sources)	Adjacent watercourse (pathway)	Protected site(s) (Receptor)	Likely impact
Goring WwTW Lower Basildon WwTW Pangbourne WwTW Streatley WwTW	River Thames	Hartslock SSSI	Impact possible
		Sulham and Tidmarsh Woods and Meadows	Low – no WwTW (within catchment) upstream

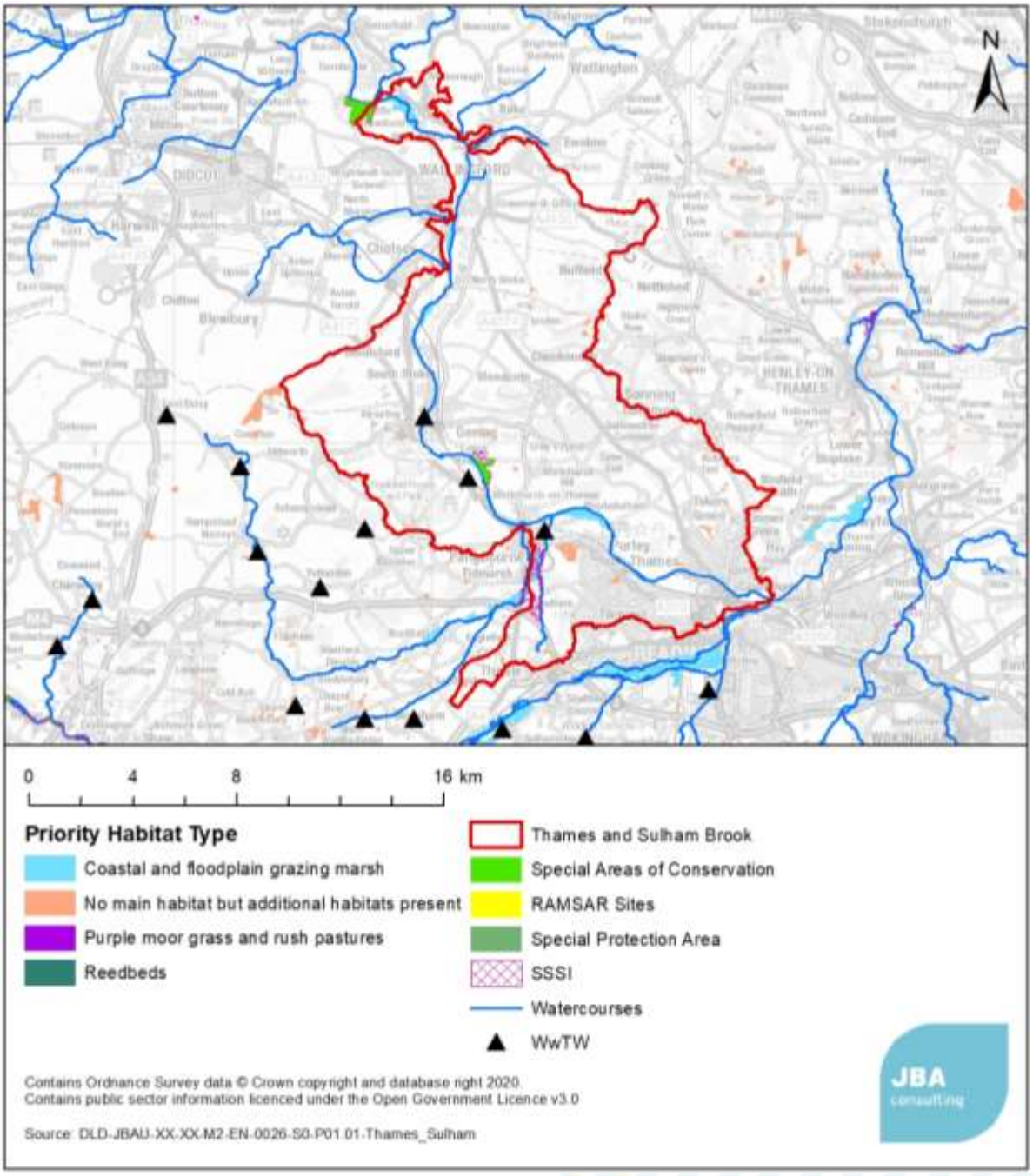
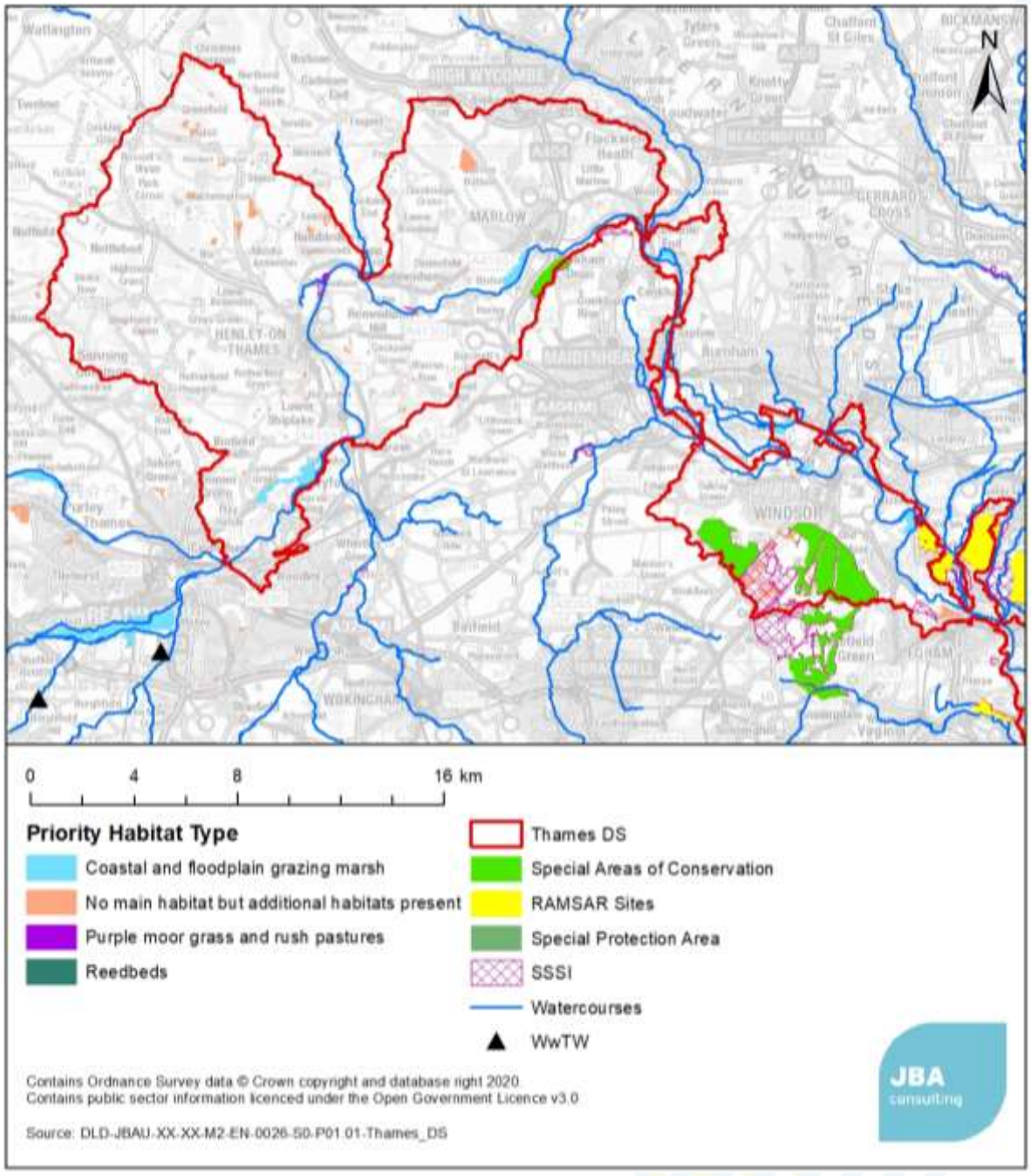


Figure 11.8: Protected areas within the Thames and Sulham Brook Catchment

11.13 River Thames (Downstream of River Kennet)

This catchment is downstream of the catchments considered above. There are no WwTW here that are likely to serve the proposed growth. However, any additional flows through the WwTW, and into the rivers, may have a detrimental impact upon this catchment and its protected areas.



11.14 Summary of water quality impact on protected sites

Section 11.5 presents the predicted water quality impact on protected sites within or downstream of West Berkshire. In the majority of catchments, a WwTW is present upstream of a protected site (SAC, SPAs, Ramsar sites, and SSSIs) which may present a risk to water quality when considering additional discharges from a WwTW.

Modelling of the impact of growth during the local plan period on water quality is recommended so deterioration at downstream protected sites can be estimated and assessed further in the Habitats Regulations Assessment. The modelling work can also

predict if improvements in wastewater treatment works upstream could prevent this deterioration.

11.15 Protection and mitigation

11.15.1 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 is 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[49] 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 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.

49 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: 04/10/2019

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[50] 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 West Berkshire

Source protection zones (SPZs) form a key part of the Environment Agency's approach to controlling the risk to groundwater supplies from potentially polluting activities and accidental releases of pollutants.

The Source Protection Zones (SPZs) that are present in the West Berkshire area are shown in Figure 11.9 and show that:

- The majority of West Berkshire is covered by SPZs.
- Western areas of West Berkshire are not within a designated SPZ.
- Large areas in the east of West Berkshire are within Zone 2 of an SPZ.

The Environment Agency's Manual for the Production of Groundwater Source Protection Zones[51], details position statements which provide information about the Environment Agency's approach to managing and protecting groundwater.

In each Local Authority area, proposed developments location within or close to Source Protection Zones, should be assessed in relation to the relevant Environment Agency position statements.

Thames Water confirmed that they are not aware of any issues with wastewater from the foul sewer network entering a source protection zone within the study area.

50 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: 29/10/2020

51 Manual for the Production of Groundwater Source Protection Zones, Environment Agency (2019). Accessed online at: https://www.gov.uk/government/publications/groundwater-source-protection-zones-spz-production-manual on: 29/10/2020

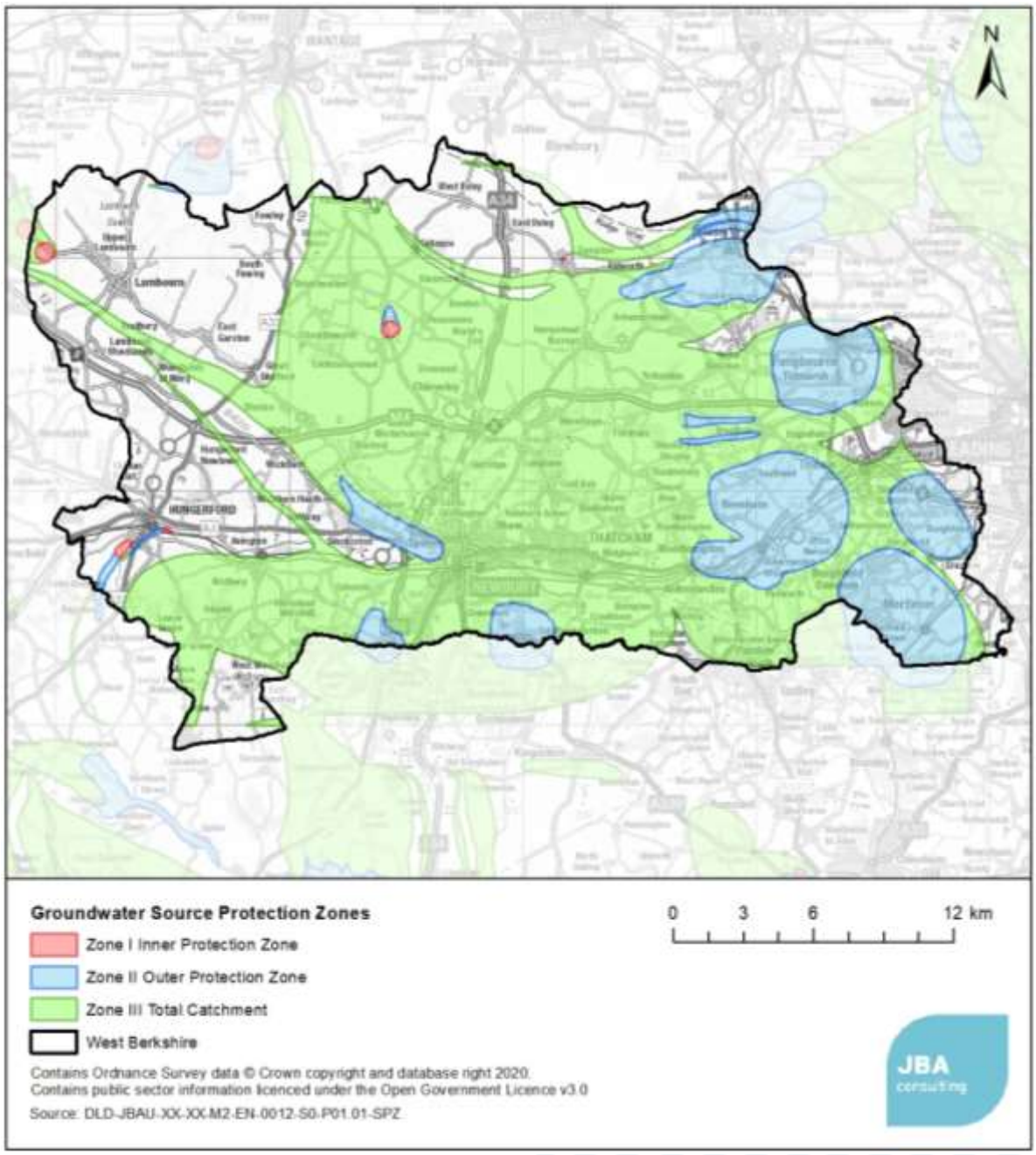


Figure 11.9: Source Protection Zones in the Study Area

11.15.2 Surface Water Drainage and SuDS

Since April 2015[52], 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).

Lead Local Flood Authorities (LLFAs) are the statutory consultees 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 attempt to replicate natural drainage patterns, through capturing rainwater at source, and releasing it slowly into the ground or a 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. SuDS also have the advantage of providing effective Blue and Green infrastructure and ecological and public amenity benefits when designed and maintained properly.

National standards on the management of surface water are outlined within the Defra Non-statutory Standards for Sustainable Drainage Systems[53]. The CIRIA C753 SuDS Manual[54] and Guidance for the Construction of SuDS[55] provide the industry best practice guidance for design and management of SuDS

Local guidance, provided by the Lead Local Flood Authorities covering the study area, is detailed below:

- West Berkshire Council (WBC) is a Lead Local Flood Authority. The WBC SuDS Supplementary Planning Document[56] contains advice from the LLFA relating to surface water drainage and sets out the minimum operating requirements as required in the National Planning Policy Framework (NPPF). The SPD provides guidance on the approach that should be taken to SuDS in new developments in West Berkshire so as to manage and mitigate surface water flood risk.

11.15.3 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

52 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. Accessed online at: https://www.parliament.uk/documents/commons-vote-office/December%202014/18%20December/6.%20DCLG-sustainable-drainage-systems.pdf on: 29/10/2020

53 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: 29/10/2020

54 CIRIA Report C753 The SuDS Manual, CIRIA (2015). Accessed online at: https://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters.aspx on: 29/10/2020

55 Guidance on the Construction of SuDS (C768), CIRIA (2017), Accessed online at: https://www.ciria.org/ItemDetail?iProductcode=C768&Category=BOOK on: 29/10/2020

56 SuDS Supplementary Planning Document, West Berkshire Council (2018). Accessed online at: https://info.westberks.gov.uk/CHttpHandler.ashx?id=46526&p=0 on: 29/10/2020

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 11.10 below.

The non-statutory technical standards for SuDS are currently being updated. Feedback on the draft text highlighted the need for the update to place a greater emphasis on multiple benefits with water quality being the most desired benefit not currently included[57]. A new standard has therefore been created for water quality: *"Apply a 'SuDS approach' that manages the quality of the surface water runoff to prevent pollution and protect both groundwater and surface water"*.

57 News article on draft NSTS, HR Wallingford (2020). Accessed online at: http://www.uksuds.com/news/draft-updated-standards on: 30/12/2020

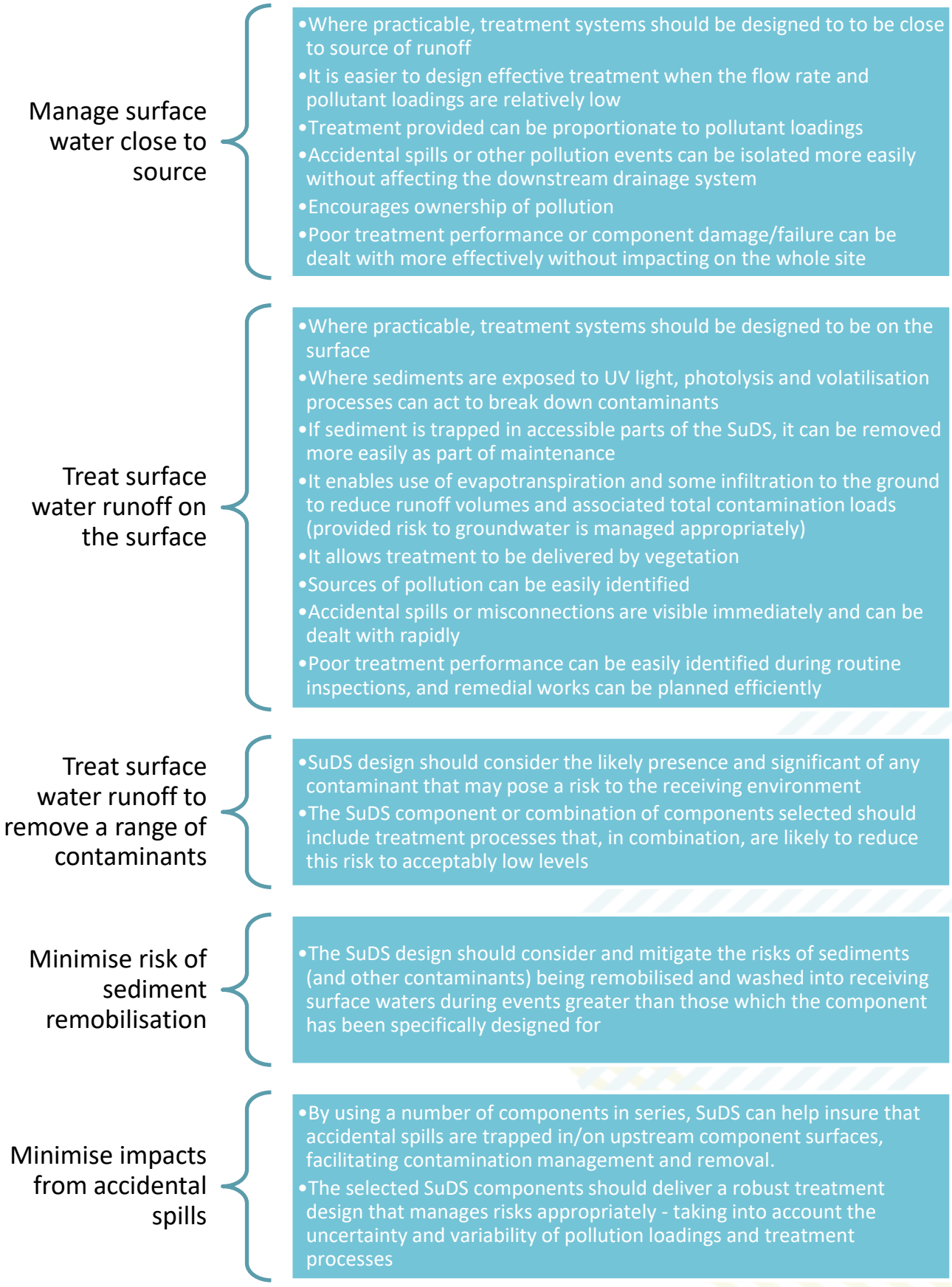


Figure 11.10 Considerations for Suds Design for Water Quality

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 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.

11.15.4 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.

11.15.5 Suitable SuDS Techniques

The hydraulic and geological characteristics of each property development site across West Berkshire should be assessed to identify the most appropriate forms of surface water management and any constraining factors to the utilisation of SuDS. These assessments are designed to inform the early stage site planning process and should be followed up the site-specific detailed drainage assessments.

Appropriate SuDS techniques have been categorised into five main groups, as shown in Table 11.8. This table should be used as an indicative guide of general suitability. Further site-specific investigation should be conducted to determine what SuDS techniques could be used on a particular development, informed by detailed ground investigations.

Table 11.8: Summary of SuDS Categories

SuDS Type	Technique
Source Controls	Green Roof, Rainwater Harvesting, Pervious Pavements, Rain Gardens
Infiltration	Infiltration Trench, Infiltration Basin, Soakaway
Detention	Pond, Wetland, Subsurface Storage, Shallow Wetland, Extended Detention Wetland, Pocket Wetland, Submerged Gravel Wetland, Wetland Channel, Detention Basin
Filtration	Surface Sand filter, Sub-Surface Sand Filter, Perimeter Sand Filter, Bioretention, Filter Strip, Filter Trench
Conveyance	Dry Swale, Under-drained Swale, Wet Swale

11.15.6 Natural Flood Management

Natural Flood Management (NFM) is used to protect, restore and re-naturalise the function of catchments and rivers to reduce flood risk. A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes in order to store or slow down flood waters before they can damage flood risk receptors (e.g. people, property, infrastructure, etc.). NFM involves taking action to manage flood and coastal erosion risk by protecting, restoring and emulating the natural regulating functions of catchments, rivers, floodplains and coasts. Techniques and measures, which could be applied in West Berkshire include:

- Peatland and moorland restoration in upland catchments
- Offline storage areas
- Re-meandering streams
- Targeted woodland planting
- Reconnection and restoration of functional floodplains
- Restoration of rivers and removal of redundant structures
- Installation or retainment of large woody material in river channels

- Improvements in management of soil and land use
- Creation of rural and urban SuDS

In 2017, the Environment Agency published on online evidence base[58] to support the implementation of NFM and with JBA produced maps showing locations with the potential for NFM measures[59]. These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in which to locate them. There are limitations with the maps; however, it is a useful tool to help start dialogue with key partners.

11.15.7 Multiple Benefits of NFM

In addition to flood risk benefits, there are also significant benefits in other areas such as habitat provision, air quality, climate regulation and water quality.

Many NFM measures have the ability to reduce nutrient and sediment sources by reducing surface runoff flows from higher ground, reducing soil erosion, trapping sediment at the edge of agricultural land, or encouraging deposition of sediments behind natural dams upstream in watercourses.

Suitable techniques may include:

- Leaky dams
- Woodland planting
- Buffer strips
- Runoff retention ponds
- Land management techniques (soil aeration, cover crops etc)

58 Working with natural processes to reduce flood risk, Environment Agency (2018). Accessed online at: https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk on: 29/10/2020
59 Mapping the potential for working with natural process, Environment Agency and JBA (2017). Accessed online at: https://www.arcgis.com/home/item.html?id=7315f943998847e2b3797a85665f5438 on: 29/10/2020

Case Study – Black Brook Slow the Flow

Four engineered log dams were installed on Black Brook at an estimated cost of £2,000, funded by Natural England and the Environment Agency to restore Stanley Bank SSSI. The scheme aimed to improve habitat and reduce the risk of flooding. However, the scheme also resulted in reduced levels of phosphate and nitrate in Black Brook, with phosphate concentrations falling by 3.6mg/l. By 2035, it is predicted that 792m^3 of sediment will be stored in three ponds retained by the jams.

Reproduced from Case Study 17. Black Brook Slow the Flow, St Helens, Norbury, Rogers and Brown, EA WwNP Evidence Base 2017. Photograph taken on 8 May 2015; courtesy of Matthew Catherall

11.15.8 Integrated Constructed Wetlands

An integrated constructed wetland (ICW) is an artificial wetland created for the purpose of treating polluted water, whether this is municipal wastewater, grey water from residential properties, or agricultural runoff.

They are usually unlined, free surface flow wetlands, designed to contain and treat influents within emergent vegetated areas.

Defra carried out a systematic review of the effectiveness of various wetland types, including ICWs for mitigating agricultural pollution such as phosphate and nitrate. The overall conclusion was that all wetland types are very effective at reducing major nutrients and suspended sediments, with the exception of nitrite in ICWs. Nitrate is only reduced when passing through overland buffer strips and through constructed wetlands with vegetation, where the systematic review showed a mean reduction of 29% across the evidence included in the study.

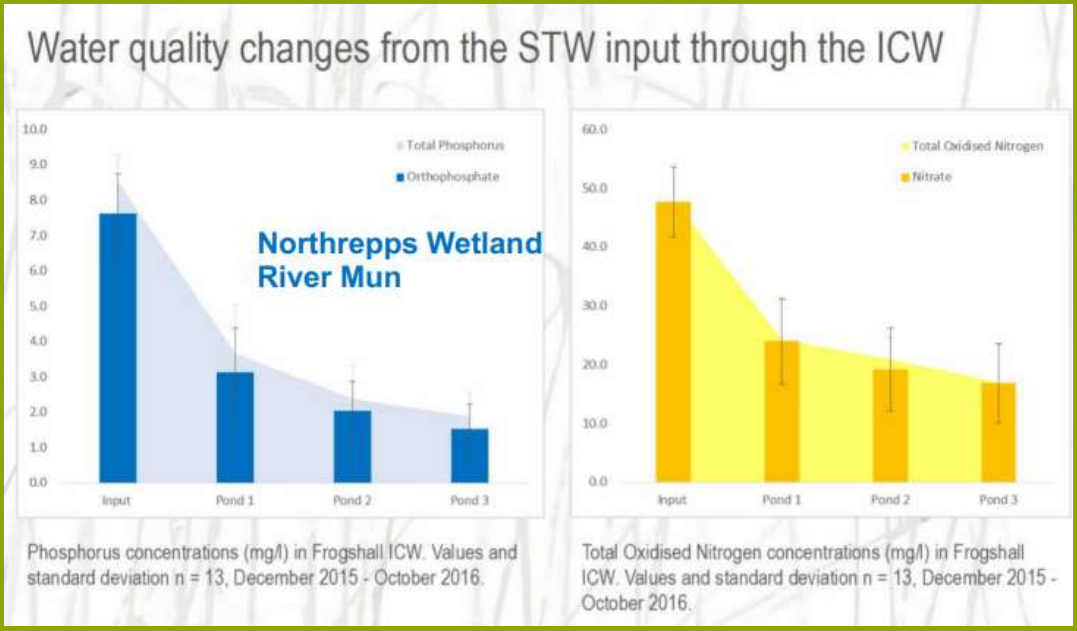
The mean reduction in Total Phosphorus across the evidence base was 78%.

Case Study – Frogshall ICW

The Upper River Mun in Norfolk was experiencing chronic pollution, and a loss in biodiversity in the river. Investigation found that nutrients from a Sewage Treatment Works upstream were contributing to this issue.

A pilot ICW was created consisting of three shallow ponds, filled with 18,000 emergent aquatic plants, and the outfall from the treatment works was diverted to pass through the wetland.

Early monitoring has shown that 90% of the phosphate is being removed by the wetland, and a large increase in biodiversity downstream observed.



Reproduced from "Stripping the Phosphate" a presentation by the Norfolk Rivers Trust (2018).

https://www.theriverstrust.org/media/2018/08/2.-Stripping-the-phosphate-David-Diggens-Norfolk-Rivers-Trust.pdf

11.15.9 Agricultural Management

There is a big potential to improve water quality by interventions aimed at agricultural sources, especially considering the measures already taken by the water companies to reduce their contribution to phosphate load.

Potential schemes could include:

- Buffer strips
- Cross slope tree planting
- Runoff retention basins
- Contour ploughing
- Cover crops

There is considerable overlap with NFM measures, and the challenges are also very similar. Exact impacts are difficult to measure, although modelling tools such as

Farmscoper[60] exist to help with this. Once a scheme is implemented it relies on the landowner to continue to maintain it in order to maintain the mitigation benefit.

Funding for agricultural interventions could come from Catchment Sensitive Farming or a Payment for Ecosystem Services approach.

Case Study – Wessex Water - EnTrade

Wessex Water catchment team used EnTrade to invite farmers to bid to grow cover crops over winter to reduce the nitrogen leaching into the watercourse.

This avoided the need to upgrade Dorchester WwTW to provide the same nitrogen removal capacity.

A trial auction was held in 2015, and two further auctions have since taken place attracting 557 bids from 63 farmers to save 153 tonnes of nitrogen.

"Using EnTrade to create a market in measures to deliver reductions in nitrogen has delivered a 30% saving for Wessex Water compared to traditional catchment approaches."

Ruth Barden, Director of Environmental Strategy, Wessex Water

11.15.10 Barriers

Whilst there are many benefits to implementing NFM and constructed wetlands, or modifying agricultural practises, the impact of these techniques is hard to quantify, and relies on ongoing maintenance to maintain that benefit. Where a potential scheme is not on a development site it will also require permission and support of the landowner. It may not be possible to influence this through planning policy.

11.15.11 Conclusions

- The potential impact of development on a number of protected sites such as SAC, SPAs, Ramsar sites and SSSIs within, or downstream of the study area should be carefully considered in future plan making. There are also a larger number of Priority Habitats and Priority Rivers.

60 Farmscoper webpage, ADAS (2020). https://www.adas.uk/Service/farmscoper Accessed on 22/01/2020

- There are a number of Groundwater Source Protection Zones, primarily in central and eastern areas of the study area. The impact of future development on groundwater should be investigated fully.
- Development sites within the study area could be sources of diffuse pollution from surface runoff.
- SuDS are required on all development sites. Their design should consider both water quantity and water quality and site level investigations should be undertaken to define the most appropriate SuDS types for each specific development.
- Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity.
- West Berkshire Council should be consulted at an early stage of development to ensure that SuDS are implemented and designed in response to site characteristics and policy factors.
- In the wider area, opportunities exist to implement natural flood management techniques to achieve multiple benefits of flood risk, water quality and habitat creation.

11.16 Recommendations

Table 11.9: Recommendations from Environmental Constraints and Opportunities Section

Action	Responsibility	Timescale
Consider the environmental impact of development on protected sites downstream of receiving wastewater treatment works in the Habitats Regulations Assessment	WBC	Local Plan Review Development
The Local Plan Review should include policies that require all development proposals with the potential to impact on areas with environmental designations to be considered in line with the relevant legislation and where stated in consultation with Natural England (for national and international designations and priority habitats).	WBC	Ongoing
The Local Plan Review should include policies that require development sites to adopt SuDS to manage water quality of surface runoff.	WBC	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.	WBC, TW, 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.	WBC Developers	Ongoing

Action	Responsibility	Timescale
Opportunities for Natural Flood Management that include schemes aimed at reducing / managing runoff should be considered to reduce nutrient and sediment pollution within West Berkshire.	WBC EA and NE	Ongoing

11.17 Requirement for further study in Phase 2

Further assessment of the impact of development on protected sites within West Berkshire is recommended in a Phase 2 WCS. This should use the water quality modelling work to predict the deterioration in water quality in watercourses adjacent to protected sites identified in the section above. This will provide additional evidence to aid to the HRA process.

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 an area wide basis; the available climate models are generally insufficiently refined to draw different conclusions for different parts of the study area 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 Summary of UK Climate Projections

The UK Climate projections 2018 (UKCP18), released November 2018, provide updated projections of how the climate might change in the UK over the 21st Century. This section provides an overview of the main differences between UKCP18 and UKCP09, and the key issues raised. A detailed analysis can be found in the Final Phase 1 Scoping Study Report. The projections benefit from a new set of emissions scenarios (known as RCPs) that consider mitigation efforts, updated methodology using the newest climate models and climate data and an updated baseline period of 1981-2000.

General climate change trends projected over UK land for the 21st century are broadly consistent with UKCP09 projections, showing an increased chance of milder, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of extremes. Cold, drier winters and cooler, wet summers will still occur due to natural climate variability, but these are likely to become less frequent over the 21st Century. However, there are some differences between UKCP09 and UKCP18 (e.g. temperature and rainfall) that may be important for climate risk assessments. These differences depend on season, location and greenhouse gas emission scenario and there is a large overlap of projected ranges for the majority of climate metrics. The biggest differences are within the highest (95th) and lowest percentiles (5th) (so in the lower probability, extreme range)[61].

The UKCP18 probabilistic projections for the South East of England, for RCP 8.5 (high emissions scenario, to represent a worst-case scenario) by 2080 are as follows:

61 Lowe et al., 2018. UKCP18 Science Overview Report. Available at: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf

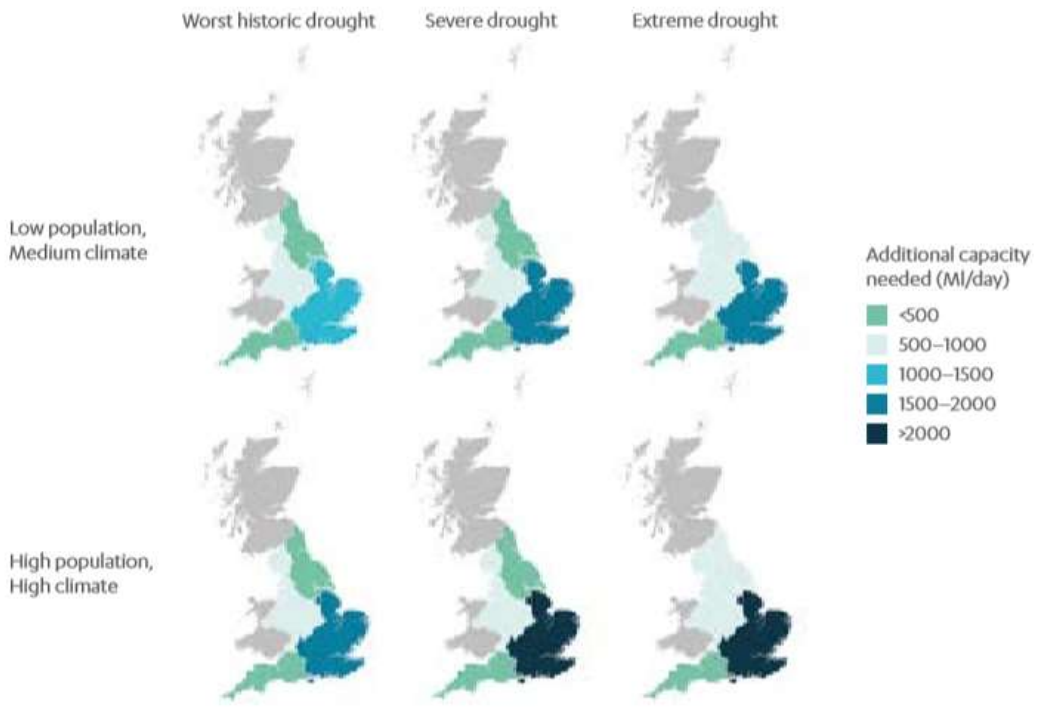
- Drier summers with a change in average summer precipitation of between -2% and -76%. Trends over the 21st century indicate dry summers are going to become much more frequent by 2100.
- Hotter summers will become much more common with a change in average summer temperatures of between 2.9°C and 8.6°C.
- Wetter winters with a change in average winter precipitation of between -2% and 57% (central estimate: 24%). Trends over the 21st century indicate that in general wet winters will become more frequent by 2100.
- Milder winters will become more common with a change in average winter temperatures of between 1.5°C and 5.7°C.

The key differences between UKCP09 and UKCP18 for this region vary dependent on climate metric, season and percentile ranges. For seasonal and annual trends in precipitation, there are some relatively big differences between the two sets of projections in the low and high percentiles. UKCP18 shows slightly larger reductions in precipitation than UKCP09. UKCP18 also shows slightly smaller increases in precipitation (90th percentile) in comparison to UKCP09. For seasonal and annual temperature, the differences between the two sets of projections appear to be dependent on season. The biggest differences are in winter with UKCP18 showing slightly less warming than UKCP09.

12.2.1 Water resources

Drawing from the UKCP18 projections, West Berkshire is likely to experience drier summers than was originally estimated in the UKCP09 by 2080. It can be assumed that hot, dry summers are likely to become more frequent over the 21st Century, which may have an impact on water demand and on the availability of water for abstraction from rivers during summer months. An overall increase in wet winters over the 21st century as consistent with UKCP09, which should be beneficial for aquifer recharge and the availability of groundwater resources. However, dry winters will still occur due to natural climate variability and it is not possible to estimate the relative probability of multiple dry seasons occurring consecutively (both summer and winter) from the data presented and the impact this will have on water availability. A detailed study of UKCP18 data would be required to fully understand the impact that the UKCP18 projections will have on water resources in the study area.

The National Infrastructure Commission has analysed the UK's long-term infrastructure needs in response to predicted drought. In order to maintain the current standard of resilience (the worst historic drought), the system would require 2,700- 3,000 million additional litres of water per day (Ml/day) to account for a rising population and the environmental and climate pressures expected by 2050. Figure 12.1 displays the spatial variation of the need for additional water capacity. Depending on the drought scenario (0.5% to 0.2% annual probability) an additional shortage as large as 1,000 Ml/day may be encountered. The 'Preparing for a Drier Future' report suggests that a 'twin-track' approach of reducing demand and increasing supply is the most cost efficient and sustainable way to deliver resilience. It is suggested that a minimum of 1,300 Ml/day of additional supply infrastructure will be required, which might be achieved using transfers, reservoirs, re-use and desalination. Comparatively, demand can be reduced by introducing additional metering and reducing leakages.



Note: medium climate refers to an average medium emission scenario, high climate refers to a drier, medium emissions scenario with less water in the South East (see Annex 1).

Figure 12.1 NIC Assessment of additional water resources capacity

Source: 'Preparing for a drier future', National Infrastructure Commission[62]

12.2.2 Wastewater infrastructure

The UKCP18 2.2km local projections provide projections for short duration heavy rainfall (i.e. convective storms) which affect urban drainage systems, but additional analysis will be needed before these projections can be translated into any guidance. Again, it is not possible to comment on how this may change wastewater management in the future. At the time of writing, the most up-to-date projections for future short duration high intensity rainfall are those from the UKWIR (UK Water Industry Water Research) 2017 project 'Rainfall intensity for sewer design - Stage 2', which should be used for wastewater management projects. Thames Water was a member of the project steering group for this research and owns a copy of the report.

12.3 Water company assessments

Thames Water have published a risk assessment[63] 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 TW's 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".

62 National Infrastructure Commission (2018) Preparing for a drier future. Accessed Online at: https://www.nic.org.uk/wp-content/uploads/NIC-Preparing-for-a-Drier-Future-26-April-2018.pdf on 17/07/2020

63 Thames Water's progress in planning for climate change, Thame Water (2016). Accessed online at: https://corporate.thameswater.co.uk/-/media/Site-Content/Thames-Water/Corporate/AboutUs/Protecting-our-environment/adaptionreport.pdf on: 21/02/2020

Table 12.2: Climate Change Consequences Scoring 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 Thames 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 Thames 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.	Thames Water have considered odour in WwTW upgrades as part of 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 Thames Water.	
Flooding from increased WwTW discharge	Low	No - not considered	

(1) River Basin Management Plan

(2) TW WRMPs

12.4 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 the water companies. Consideration of changes in water and wastewater demand should be considered when carrying out detailed site assessments in the future.

Table 12.3: Conclusions and Recommendations from Climate Change Assessment

Action	Responsibility	Timescale
When undertaking detailed assessments of environmental or asset capacity, consider how the latest climate change guidance can be included.	EA, TW	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.	WBC 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

A summary of the conclusions for each section of the study are shown in Table 13.1.

Table 13.1: Summary of Conclusions from the Study

Assessment	Conclusion
Water resources	• Both WRZs in the study area are classed as being under serious water stress – justifying the more stringent target of 110 l/p/d under building regulations. • WBC may want to consider going further than the 110l/p/d water efficiency target particularly in larger strategic developments. • 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 West Berkshire, and also help to achieve reductions in carbon emissions. • The WRMP was found to be broadly in line with growth projections of WBC.
Water supply infrastructure	• Allocations and potential allocations across the study area were reviewed by Thames Water and given a relative scoring based on the impact on the water supply network. • Thames Water identified a number of development sites where further modelling and/or upgrades to the network would be required in order to serve those sites. Should these sites be allocated, delivery must be aligned with provision of these upgrades and WBC should engage with TW early to enable infrastructure upgrades to be constructed prior to occupation of new developments. • Once there is more certainty on which sites will be allocated in the Local Plan Review, WBC should provide an update to TW to enable further modelling to be undertaken if necessary.
Wastewater collection	• Development in areas where there is limited wastewater network capacity will increase pressure on the network, increasing the risk of a detrimental impact on existing customers, and increasing the likelihood of sewer flooding. Early engagement with Thames Water is required, and further modelling of the network may be required at the planning application stage. • If there are areas where the current network is a combined sewer system, further separation of foul and surface water may be required, as well as suitably designed SuDS. • The results in section 6.5.1 show that in order to serve the proposed growth in a number of settlements in West Berkshire, wastewater infrastructure and/or treatment upgrades would be required. Early engagement between developers, the Council and TW is recommended to allow time for the strategic infrastructure required to serve these developments to be planned.
Wastewater Treatment Works Flow	• Two assessments of WwTW capacity were undertaken.

Assessment	Conclusion
Permit assessment	• JBA performed a headroom assessment comparing the current dry weather flow (DWF) at each WwTW to the permitted flow and adding the additional effluent from growth in the local plan period. Three WwTWs in West Berkshire are predicted to, or are already exceeding their flow permit (Chieveley, Hungerford, Newbury). • Thames Water carried out an assessment based on the relative suitability of development sites within each wastewater catchment. The least suitable sites (those where the WwTW would require investment in order to serve growth) given a red or amber score, and those where minimal investment is required, or where investment is already planned, were given a green score. This assessment took into account capacity at the WwTW, water quality, odour and infiltration within the catchment. • Many of the WwTWs in the study area would require upgrades in order to serve growth during the plan period. WBC should consider the time taken to undertake these upgrades when phasing development and early engagement with TW is recommended to ensure required upgrades are in place prior to occupation. Once there is greater certainty on which development sites will be allocated in the Local Plan, Review TW should advise which WwTW would require safeguarding of land.
Odour Assessment	• Six sites across West Berkshire are close enough to a WwTW for there to be a risk of nuisance odour. If these sites were to be allocated in the Local Plan Review, an odour assessment is recommended as part of the planning process, funded by developers. The remaining sites have been given a rating of green.
Water quality impact assessment	• Growth during the local plan period will increase the discharge of treated wastewater from WwTWs in West Berkshire. There is a potential for this to cause a deterioration in water quality in the receiving watercourses. • Further modelling of this impact is recommended in a Phase 2 WCS.
Flood risk from additional WwTW flow	• The impact of increased effluent flows at WwTW from any of the proposed developments is not predicted to have a significant impact upon flood risk in any of the receiving watercourses.
Environmental Constraints and Opportunities	• The potential impacts of development on a number of protected sites such as SAC, SPAs, SSSIs and Ramsar sites within, or downstream of the study area should be carefully considered in future plan making. There are also a larger number of Priority Habitats and Priority Rivers. • There are a number of Groundwater Source Protection Zones, primarily in central and eastern areas of the study area. The impact of future development on groundwater should be investigated fully. • Development sites within the study area could be sources of diffuse pollution from surface runoff. • SuDS are required on all development sites. Their design must consider both water quantity and water quality and site level

Assessment	Conclusion
	investigations should be undertaken to define the most appropriate SuDS types for each specific development. • Opportunities exist for these SuDS schemes to offer multiple benefits of flood risk reduction, amenity value and biodiversity. • In the wider area, opportunities exist to implement natural flood management techniques to achieve multiple benefits of flood risk, water quality and habitat creation.

13.2 Recommendations

Table 13.2 below summarises the recommendations from each section of the report.

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.	TW	Ongoing
	Provide yearly profiles of projected housing growth to water companies to inform the WRMP.	WBC	Annually
	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 the water companies and the Environment Agency how the Council's planning and climate change policies can encourage this approach.	WBC, EA, TW	In Local Plan Review and Climate Change Action Plan
	Strategic residential developments, and commercial developments should consider incorporating greywater recycling and/or rainwater harvesting into development at the master planning stage in order to reduce water demand.	WBC, TW	In Local Plan Review
Water Supply	Consider the need for additional water supply infrastructure when selecting sites for allocation in the Local Plan Review.	WBC	During Local Plan Review process
	Development of sites indicated as requiring further modelling or upgrades to capacity should be aligned with provision of infrastructure. Early collaboration between WBC, developers and TW is required.	WBC TW Developers	Ongoing
	TW should advise WBC of any strategic water resource / supply infrastructure required within the study area where these may require safeguarding of land to prevent other types of development occurring.	TW	During Local Plan Review process
Wastewater Collection	Early engagement between the council and TW is required to ensure that where strategic infrastructure is required, it can be planned in by TW.	WBC TW	Ongoing

Aspect	Action	Responsibility	Timescale
	Take into account wastewater infrastructure constraints in phasing development in partnership with the sewerage undertaker	WBC TW	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, ie. 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.	TW and 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 WwTW capacity when selecting allocations for the Local Plan Review.	WBC	During Local Plan Review process
	Consider the available WwTW capacity when phasing development going to the same WwTW.	WBC, TW, EA	Ongoing
	Provide Annual Monitoring Reports to TW detailing projected housing growth.	WBC	Ongoing
	TW to assess growth demands as part of their wastewater asset	TW	Ongoing

Aspect	Action	Responsibility	Timescale
	planning activities and feedback to the Council if concerns arise.		
Odour	Consider odour risk in the sites identified to be potentially at risk from nuisance odour	WBC	Ongoing
	Carry out an odour assessment for sites identified as amber as part of the planning process and paid for by the developer.	Site Developers	Ongoing
Water Quality	Provide annual monitoring reports to TW detailing projected housing growth in West Berkshire	WBC	Ongoing
	Take into account the full volume of growth (from West Berkshire and neighbouring authorities) within the catchment when considering WINEP schemes or upgrades at WwTW	TW	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 discharges to an Ordinary Watercourse).	TW	During design of WwTW upgrades
Environment	Consider the environmental impact of development on protected sites downstream of receiving wastewater treatment works in the Habitats Regulations Assessment	WBC	Local Plan Review development
	The Local Plan Review should include policies that require all development proposals with the potential to impact on areas with environmental designations to be considered in line with the relevant legislation and where stated in consultation with Natural England (for national and international designations and priority habitats).	WBC	Local Plan Review development
	The Local Plan Review should include policies that require development sites to adopt SuDS to manage water quality of surface runoff.	WBC	Local Plan Review development

Aspect	Action	Responsibility	Timescale
	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.	WBC TW 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.	WBC Developers	Ongoing
	Opportunities for Natural Flood Management that include schemes aimed at reducing / managing runoff should be considered to reduce nutrient and sediment pollution within West Berkshire	WBC, EA, NE	Ongoing

13.3 Requirement for further study in Phase 2

A Phase 2 Outline Water Cycle Study is recommended building on the work completed in Phase 1. This should be conducted following the draft local plan review consultation (due to take place between December 2020 and February 2021) when there is greater certainty on the potential allocations that will be allocated in the Local Plan Review.

Table 13.3 Recommendations for Phase 2

Topic	Phase 2 Recommendation
Water resources	No further assessment of water resources is required unless a significant change is made to the growth forecast following the draft consultation.
Water supply	The water supply assessment should be updated using the latest growth forecast based on draft allocations. This will involve further consultation with TW.
Wastewater network	The wastewater network assessment should be updated using the latest growth forecast based on draft allocations. This will involve further consultation with TW.
Wastewater treatment	A new growth scenario will produce an updated forecast for each WwTW in the study area which will be used to update the capacity assessment and allow TW to advise on the requirement for upgrades and land to safeguard.
Odour	No further assessment is recommended unless new sites are identified.
Water quality	Modelling of the impact of the local plan on water quality is recommended using the EA's SIMCAT modelling tool.
Flood risk	No further assessment of flood risk from additional effluent is recommended unless a significant change is made to the growth forecast following the draft consultation.
Environmental impact	The output of the water quality modelling should be used to predict deterioration in watercourses adjacent to protected sites identified in Phase 1.

Appendices

A Site tracker spreadsheet

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Dublin
Edinburgh
Exeter
Glasgow
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Isle of Man
Limerick
Newcastle upon Tyne
Newport
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Skipton
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