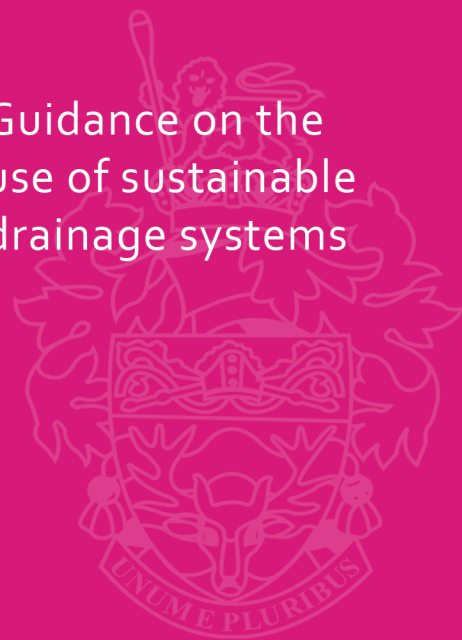


Wokingham SuDS Strategy

January 2017

Guidance on the
use of sustainable
drainage systems



Chapter 1
Introduction

Chapter 2
Opportunities & Constraints

Chapter 3
Where Should SuDS be used?

Chapter 4
Conclusion

SUDS STRATEGY

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11th April 2016

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01

Introduction

1.1 PURPOSE

This guidance document sets out the long term vision for the use of sustainable drainage systems (SuDS) in the Borough with a focus on managing flood risk and improving the water environment.

Wokingham Borough Council is committed to ensuring development is of the highest quality of design, with the aim of achieving sustainable places that are designed to mitigate and adapt to the effects of climate change for current and future generations. Wokingham Borough Council is also committed to addressing flood risk, improving water quality and enhancing biodiversity throughout the Borough.

The use of well designed, constructed and maintained SuDS, not only ensures a more efficient and resilient drainage system, but also helps reduce flood risk and improve the wider water catchment.

SuDS is a consideration when masterplanning all major developments

1.2 BACKGROUND

The Appendix of this report contains the SuDS Technical Guide which sets out the technical requirements for the design of SuDS in the Borough. This document supplements the sustainable development and sustainable drainage system policies found in the Wokingham Borough Core Strategy¹ and the MDD Local Plan.

This document is designed to be used by developers and their design teams when masterplanning all major developments, from the Strategic Development Location (SDL) scale, through to a ten dwelling development, to ensure surface water runoff within the development is sustainably discharged. This Strategy also provides advice to help mitigate flood risk, water quality and biodiversity concerns in the wider catchment.

Developers should initially consider the advice provided in this document, along with the Wokingham Borough SuDS Technical Guidance Document in the Appendix. Thereafter, Wokingham Borough Council offers a pre-application service, details of which are provided on the Borough Council's website.

¹ Wokingham Borough Council (2010) Wokingham Borough Core Strategy, available at www.wokingham.gov.uk/planning/policy/



This document should be used by:

- Developers when selecting proposed sites for development;
- Developers when preparing the brief for their design team to ensure drainage for the proposed development is sustainable;
- Design teams when designing surface water drainage schemes;
- Design teams when designing masterplans / layout plans to ensure the layout accommodates for the drainage scheme;
- Developers when masterplanning SDLs to assist in designing the surface water drainage strategy to ensure flood risk and water quality both on and off site are addressed;
- Developers when masterplanning SDLs and large scale development to assist in incorporating regional SuDS features to help address flood risk both on site and in the wider catchment;
- Consultants when carrying out site specific flood risk assessments;
- Planning officers when determining planning applications, making recommendations to Committee and drawing up Section 106 and/or Community Infrastructure Levy (CIL) obligations that include contributions for SuDS.

- Water companies, management companies, community groups who play an important role in flood risk management across the borough.

1.3 VISION AND OBJECTIVES

Wokingham Borough Council is committed to ensuring the quality of development in the Borough is of the highest quality of design, with the aim of achieving sustainable places that are designed to mitigate and adapt to the effects of climate change.

This Strategy will help achieve the overall vision for the Borough, which aims to ensure Wokingham is “A great place to live, an even better place to do business”

SuDS are recognised as an effective way of providing areas of attractive public open spaces and greener urban environments which help to develop social cohesion amongst communities

The overall Borough vision will be achieved via targeted themes for the Borough; of which the SuDS Strategy will help to deliver the following:

- Facilitate the regeneration of our towns and increase the vibrancy of all our communities

- The use of well-designed SuDS in redevelopment can create better places to live, work and play, through cleaner and greener urban environments.
- Create an environment that allows businesses to thrive.
- Sustainable management of surface water runoff ensures business and transport links are not disrupted by flooding.
- Deliver well designed development and strong communities.

Well-designed SuDS are recognised as an effective way to provide areas of attractive public open space, creating useable areas for social and recreational activities, providing cleaner and greener urban environments and helping to develop social cohesion amongst communities. Improved social cohesion can enhance quality of life, create better communities and enhance productivity.



In addition to contributing to the central themes listed above, this SuDS document has also been developed to assist in delivering key objectives for flood risk and the water environment in the Borough:

- O1: To manage known surface water drainage issues in the Borough;
- O2: To manage water quality issues in the Borough;
- O3: To manage water quantity issues in the Borough;
- O4: To ensure well designed SuDS are used appropriately in all new and re-development;

- O5: To ensure high quality new development and re-development that manages surface water quantity and quality effectively;
- O6: To ensure amenity and biodiversity benefits are provided through the use of SuDS where possible.

1.4 WHY IS A SUDS STRATEGY NEEDED IN THE BOROUGH?

A healthy and safe water environment is fundamental to ensuring the achievement of the Borough vision. Presently areas of the Borough are subject to increased levels of flood risk and some of the watercourses flowing through the borough have poor water quality. This strategy aims to set out how SuDS can be employed to address the flood risk and water environment issues of the Borough.

FLOOD RISK

The impact of flooding can be widespread and often devastating, destroying homes, harming livelihoods and damaging the economy. Property damage, destruction of stock and produce, loss of crops and livestock, and failure of infrastructure (closed roads, loss of power supply etc.) are just some of the impacts that flood events have on the Borough. During the winter 2013/14 flood event surface water flooding of the road network caused significant disruption across the Borough.

Wokingham has experienced a number of flood events in recent years. Many of these are related to surface water flooding, with surface water flooding noted as one of the main contributors to large scale flood events in the Borough, especially the 2007 event.

The latest UK Climate Projections² reaffirm that it is likely winters will get wetter and extreme weather conditions

² Murphy, J.M., Sexton, D.M.H., Jenkins, G.J., Boorman, P.M., Booth, B.B.B., Brown, C.C., Clark, R.T., Collins, M., Harris, G.R., Kendon, E.J., Betts, R.A., Brown, S.J., Howard, T. P., Humphrey, K. A., McCarthy, M. P., McDonald, R. E., Stephens, A., Wallace, C., Warren, R., Wilby, R., Wood, R. A.

such as intense rainfall and long-duration rainfall will become more of a regular occurrence. Many of the existing surface water drainage systems in the Borough are not designed to cope with these extreme conditions. For example, the extensive flooding that affected the Borough in the summer of 2007 was mostly due to surface water overwhelming the surface water drainage systems.

Increasing development within the Borough will result in both river and surface water flooding becoming increasingly more frequent unless action is taken to sustainably manage surface water runoff both within new and re-developments.

The impact of flooding can be widespread and often devastating, destroying homes, harming livelihoods and damaging the economy.

It is therefore essential that new development does not worsen the risk of surface water flooding in the Borough and, where possible, provides betterment on the existing situation both at the development site and in the wider catchment.

WATER ENVIRONMENT

Water quality is fundamental for both the natural environment and human existence. Traditional underground piped drainage systems direct surface water runoff to the nearest watercourse or sewer as quickly as possible, without the opportunity to trap, breakdown or remove pollutants.

Surface water runoff can contain a wide range of pollutants, including agricultural contaminants such as pesticides, fertilisers and sediment; and highway pollutants such as heavy metals, oil residues and hydrocarbons. These pollutants can have significant detrimental impacts on the health of waterbodies, harming and preventing ecological

processes that support fish populations, vegetation and birdlife.

The presence of pollutants in groundwater and waterbodies can also increase the cost associated with supplying sustainable clean drinking water and water available for irrigation and farming.

The Water Framework Directive (established by the European Commission) was adopted by the UK Government in 2003 and aims to achieve a 'good status' for all surface water and groundwater bodies across Europe. 'Good status' comprises the ecological and chemical status of surface waters. These statuses are assessed according to the following criteria:

- biological quality;
- hydromorphological quality (the river bank and bed structure / substrate);
- temperature;
- oxygenation;
- nutrient conditions; and
- pollutants in the watercourse.

Wokingham Borough is within the Thames River Basin District and the majority of the administrative area falls within the northern area of the Loddon catchment. The very northern part of the borough and an area to the north-west of the borough are within the Thames and South Chilterns catchment, with the northern borough boundary following the River Thames (Thames Wallingford to Caversham waterbody and Thames Reading to Cookham waterbody). In the southwest a small area of the borough is within the Kennet and Pang catchment, with parts of the Burghfield Brook, Foudry Brook (West End Brook to M4) and Kennet and Foudry Brook and Clayhill Brook in Reading located within the Borough.

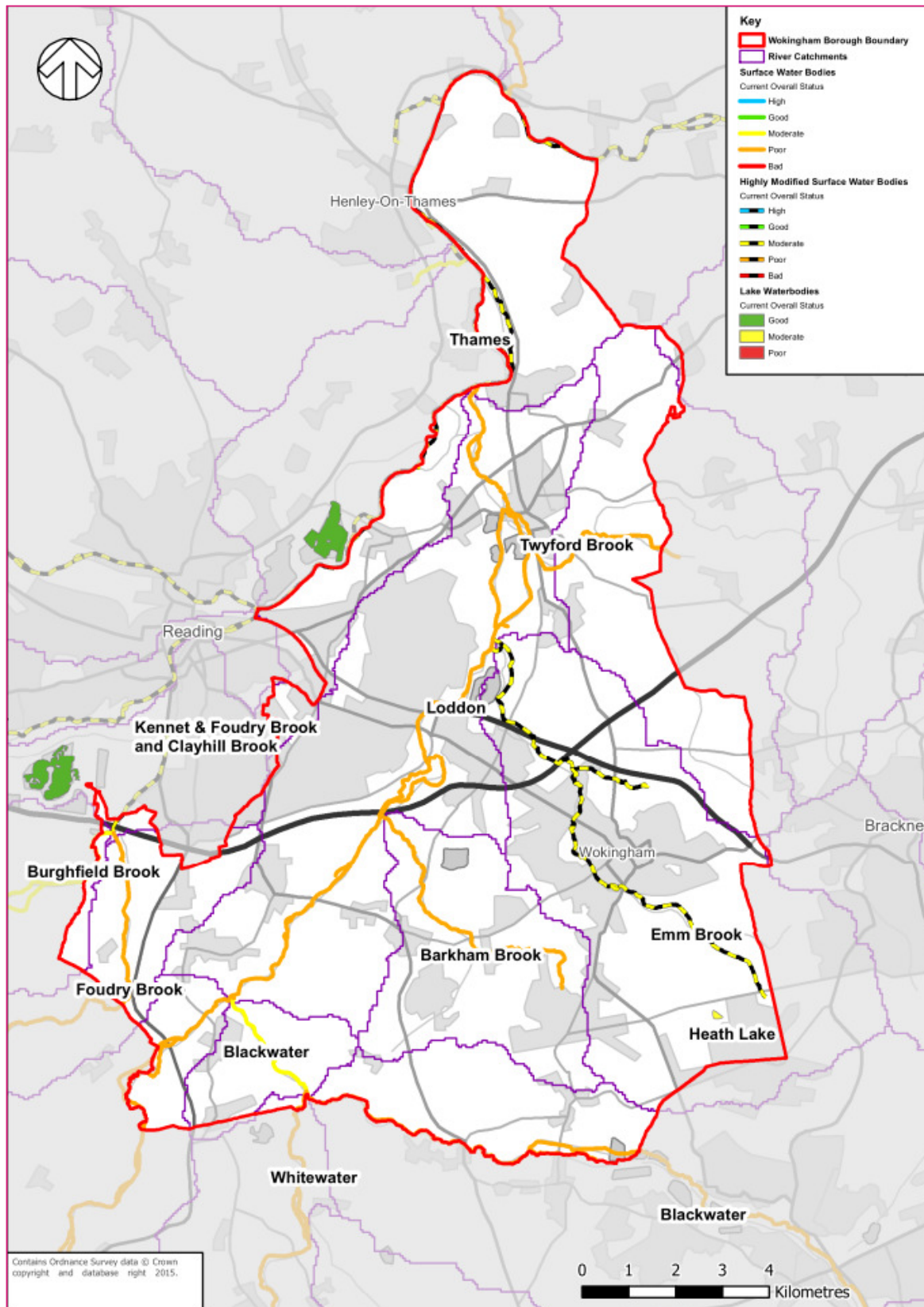
The overall status of the assessed surface water bodies in the Borough is currently either 'poor' or 'moderate', with none of the surface water bodies achieving 'good overall status'. Table 1.1 details the current status of each of the surface water bodies as well as their future objective. Figure 1.1 illustrates the location and current status of the surface water bodies in relation to the Borough boundary.

Table 1.1 Water Framework Directive status of surface water bodies in Wokingham Borough

Waterbody	Overall status	Ecological Status	Chemical Status	Overall Objective
River Loddon	Poor	Poor	Not Assessed	Good Status by 2027
River Loddon (Swallowfield to River Thames confluence)	Poor	Poor	Fail	Good Status by 2027
Blackwater (Bramshill to River Loddon confluence at Swallowfield)	Moderate	Moderate	Good	Good Status by 2027
Barkham Brook	Poor	Poor	Good	Good Status by 2027
Whitewater	Poor	Poor	Not Assessed	Good Status by 2027
Twyford Brook	Poor	Poor	Not Assessed	Good Status by 2027
Emm Brook	Moderate	Moderate	Not Assessed	Good Potential by 2027
Heath Lake	Moderate	Moderate	Not Assessed	Good Status by 2027
Thames (Wallingford to Caversham)	Moderate	Moderate	Good	Good Potential by 2027
Thames (Reading to Cookham)	Moderate	Moderate	Good	Good Potential by 2027
Burghfield Brook	Moderate	Moderate	Good	Good Status by 2027
Kennet & Foudry Brook & Clayhill Brook in Reading	Moderate	Moderate	Good	Good Potential by 2027
Foudry Brook (West End Brook to M4)	Poor	Poor	Fail	Good Status by 2027



Figure 1.1 Water Framework Directive status of surface water bodies in Wokingham Borough



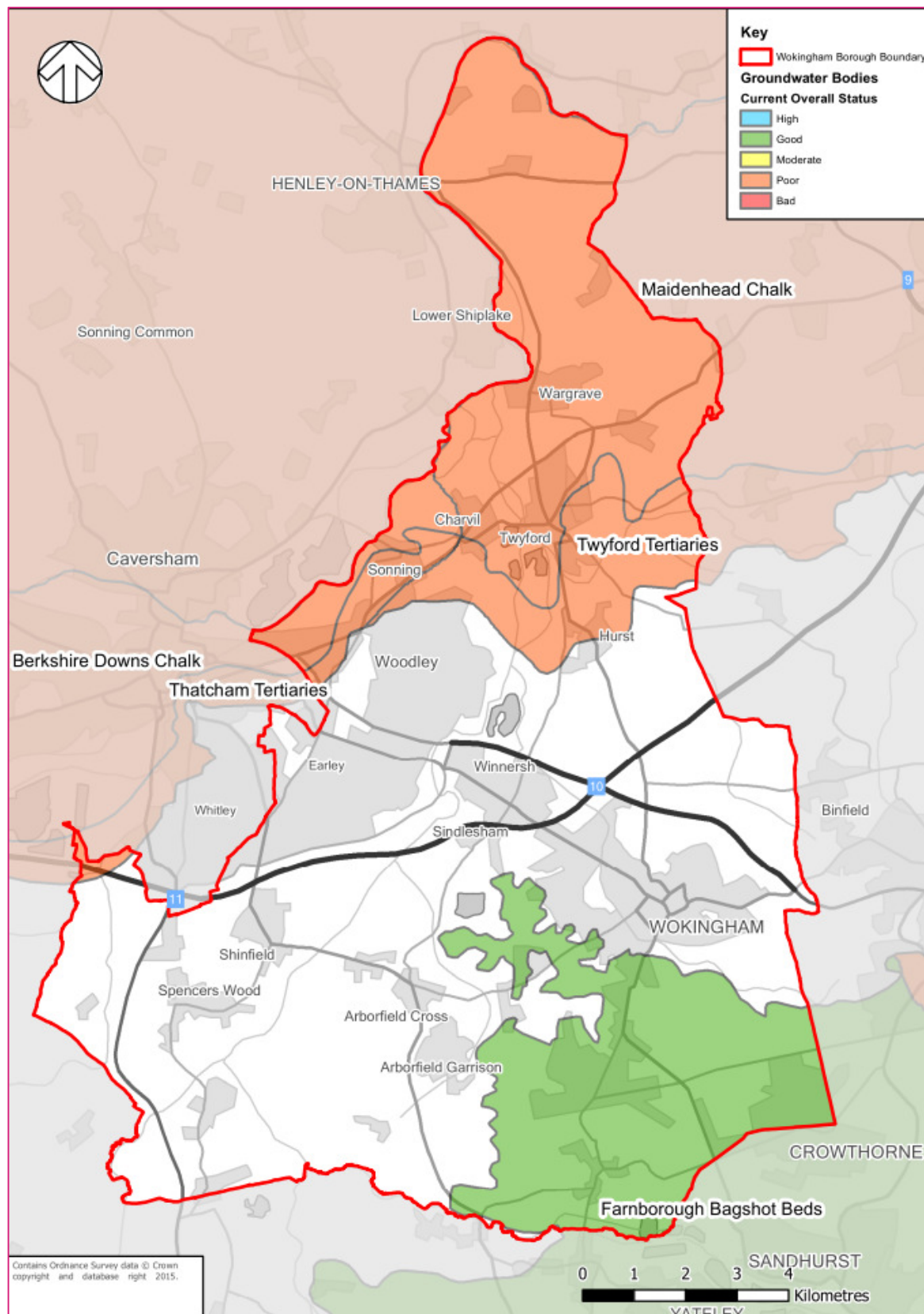
The administrative area of Wokingham Borough spans parts of the Maidenhead Chalk, Twyford Tertiaries, Thatcham Tertiaries, Berkshire Downs Chalk and Farnborough Bagshot Beds. The key statistics for these three groundwater bodies are given in Table 1.2. Figure 1.2 shows the boundaries of these groundwater bodies in relation to the borough boundary.

Table 1.2 Water Framework Directive status of groundwater bodies in Wokingham Borough

Groundwater body	Overall Status	Quantitative Status	Chemical Status	Overall Objective
Maidenhead Chalk	Poor	Poor	Fail	Good Status by 2027
Twyford Tertiaries	Poor	Poor	Good	Good Status by 2027
Thatcham Tertiaries	Poor	Poor	Fail	Good Status by 2027
Berkshire Downs Chalk	Poor	Poor	Fail	Good Status by 2027
Farnborough Bagshot Beds	Good	Good	Good	Good Status by 2027



Figure 1.2 Water Framework Directive status of surface water bodies in Wokingham Borough



Wokingham Borough Council has an obligation to improve water quality throughout the Borough. In seeking to achieve this responsibility, Wokingham Borough Council will look to see the incorporation of SuDS in new development and as discrete projects where the need and opportunity arises. Chapter 3 details of the opportunities for SuDS and the features that Wokingham Borough Council would expect to see at each of the allocated development sites in the Borough in order to improve water quality through the use of SuDS.

WATER QUANTITY / DROUGHT

Drought conditions can have a detrimental impact on the water environment, with reduced flows in waterbodies and low groundwater levels. This has a negative impact on the ecological habitat in watercourses, damaging fish populations, vegetation and birdlife. Low groundwater levels also have a detrimental impact on vegetation and wildlife populations, but also result in a reduction in the amount of water available for abstraction for public drinking water supply and irrigation. Wokingham Borough is predominantly located within the Loddon Catchment, which acquires 55% of its water supply from groundwater³. The catchment is located within an area of severe water stress⁴ and the challenge within the catchment is to maintain water supplies to an increasingly growing urban population and retain the current ecology.

The Blackwater Valley Water Cycle Strategy⁵ notes that unmitigated, further development, as well as climate change, will adversely affect the environment and the water supply capabilities in the Borough. Increased development and associated impermeable surfaces and traditional piped drainage systems prevent surface water runoff from infiltrating into the ground, thus restricting groundwater recharge and impacting natural water quantity.

The Loddon Catchment Abstraction Licensing Strategy sets out how the Environment Agency will seek to manage water resources, existing and future abstraction licences and water availability within the Loddon catchment. The primary Loddon catchments within Wokingham Borough are the Lower Loddon and Blackwater. The Loddon Catchment Abstraction Licensing Strategy states that both the Lower Loddon and Blackwater catchments have a local resource status of 'water available for licensing'. For both watercourses this status is overridden by the flow requirements of the Thames, which changes the status to

'Water not available for licensing'. Figure 1.3 is taken from the Loddon Catchment Abstraction Licensing Strategy and indicates the location of the Lower Loddon and Blackwater catchments.

The Loddon Catchment Abstraction Licensing Strategy states that the Chalk formation extends throughout the catchment and is the dominant aquifer in the area. Groundwater in the chalk feeds many of the rivers, streams and wetlands in the upper catchment and also provides most of the water abstracted for public supply. Consequently, development in the Borough must address water quantity and ensure groundwater recharge is not prevented in areas where infiltration to ground is viable.

Figure 1.3 The Loddon Catchment Abstraction Licensing Strategy sub-catchments (source: Loddon Catchment Abstraction Licensing Strategy)

³ Halcrow (April, 2011) Blackwater Valley Water Cycle Strategy Scoping Report

⁴ Environment Agency, Areas of Water Stress, Final Classification

⁵ Halcrow (April, 2011) Blackwater Valley Water Cycle Strategy Scoping Report



1.5 WHAT ARE SUDS?

SuDS are a favoured approach to managing surface water which address the quantity of water, the quality of water and provide amenity benefits. SuDS manage surface water in a way that mimics the natural process, dealing with as much rainfall as possible on the surface and allowing rainwater to be dealt with as close as possible to where it falls. This approach allows rainwater to evaporate or soak into the ground.

The remaining water that does not evaporate or infiltrate is drained to the nearest watercourse, or if not possible surface water sewer, at the same rate and volume as would have naturally occurred prior to development.

SuDS address the quantity of water, the quality of water and provide amenity benefits, managing surface water in a way that mimics the natural process, dealing with as much rainfall as possible, as close as possible to where it falls

SuDS features can be used to slow water down before it enters watercourses or sewers or to store a large volume of water following a storm event before it soaks into the ground. SuDS features can also treat surface water runoff before it is discharged to ground or to a local watercourse, helping improve water quality.

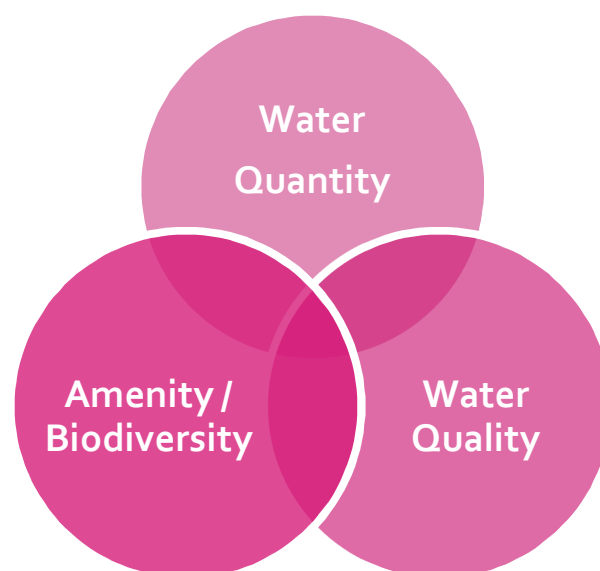
The preferred method of discharging surface water from SuDS to ground, then a watercourse, before a surface water sewer, helps ensure that groundwater recharge is achieved, mitigating for groundwater quantity and drought issues.

Table 1.3 details the various types of SuDS that can be used in Wokingham Borough. The table provides a description of each feature, along with an indication of the typical land take required and the setting they are most suited to.

WHY USE SUDS

There are three main categories under which the benefits to using SuDS can be grouped. This is often referred to as 'the SuDS Triangle':

- address the volume of water to reduce flooding;
- address pollutants in the water to improve water quality; and
- provide amenity and biodiversity benefits to improve the built environment.



In contrast underground piped solutions quickly channel surface water runoff to local watercourses or the sewer system without controlling the rate or volume of water and without treating any pollutants in the water.

WATER QUANTITY

Development typically changes the natural drainage, often replacing naturally draining ground with impermeable surfaces drained by underground piped networks. Development can also remove vegetation and compact the ground. The culmination of these changes results in an increase in the total volume of runoff and the rate at which it flows.

As a result the risk of localised flooding is increased. Further afield the risk of flooding may also increase due to increased discharge to local watercourses or the sewer system. The impact of development on flood risk is only set to increase in the future due to the impacts of climate change⁶.



⁶ Murphy, J.M., Sexton, D.M.H., Jenkins, G.J., Boorman, P.M., Booth, B.B.B., Brown, C.C., Clark, R.T., Collins, M., Harris, G.R., Kendon, E.J., Betts, R.A., Brown, S.J., Howard, T. P., Humphrey, K. A., McCarthy, M. P., McDonald, R. E., Stephens, A., Wallace, C., Warren, R., Wilby, R., Wood, R. A. (2009), *UK Climate Projections Science Report: Climate change projections*. Met Office Hadley Centre, Exeter.

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Table 1.3

SuDS feature	Description	Required land take	Setting
<i>Source Control Features</i>			
Green roofs / walls	Green roofs/walls cover building roofs and walls with vegetation and/or landscaping. By retaining precipitation they reduce runoff volume and attenuate peak flows.	Integrated with the building design	Building
Rain Gardens / Bioretention areas	Rain gardens and bioretention areas are shallow, landscape depressions which are typically under-drained. Enhanced vegetation and filtration removes pollution and reduces runoff downstream. Bioretention areas typically receive road or hard surface runoff, whereas rain gardens are normally designed to receive relatively clean rainwater.	Integrated as part of the landscape / highway design	Open space / highway
Rainwater harvesting	Rainwater from roofs and hard surfaces can be stored and used in and around properties for uses such as flushing toilets, washing machines and irrigation. These systems can work to reduce the rates and volumes of runoff. Communal rainwater harvesting systems can also be implemented within a larger building or multiple buildings.	Integrated with the building design (above or below ground)	Building
Soakaways	Soakaways allow water to quickly soak into permeable layers of soil. They are circular or square excavations, filled with gravel or rubble. Soakaways are typically associated with draining relatively small areas, but these features can be linked together to drain large areas.	Dependent on runoff volumes and underlying soils	Open space
<i>Site Control Features</i>			
Filter strips	A gently sloping strip of grass or dense vegetation with a uniform gradient. Filter strips are designed to allow surface water to run across to promote infiltration and cleansing.	5m in length (minimum)	Open space
Trenches	Trenches are shallow excavations filled with rubble or stone that create temporary subsurface storage for infiltration or filtration.	5m in length (minimum)	Open space / highway
Swales	A swale is a shallow vegetated linear depression with a flat base in which water can be stored or conveyed at low velocities and pollutants can be removed. Swales also offer some attenuation and can be designed to allow infiltration where soil and groundwater conditions are appropriate.	Typically 2-3m wide (need to allow for space to undertake maintenance)	Open space / highway
Pervious surfaces	Pervious surfaces allow water to soak through them whilst also being suitable for pedestrians or vehicles to use. Water is stored beneath the surface and, if conditions are suitable, can be reused or infiltrated to the ground below.	Typically drain twice its area	Open space / highway
Geocellular systems	Geocellular systems are below ground storage arrangements that can be used to convey water or to create an infiltration (soakaway) or storage structure. Geocellular systems are only able to provide attenuation and do not treat water.	Dependent on runoff volumes and underlying soils	Open space / highway
<i>Regional Control Features</i>			
Ponds / basins	Ponds, or retention basins, can provide both storm water attenuation and treatment, with runoff from each rain event being detained and treated in the pool. The retention time promotes pollutant removal through sedimentation and the opportunity for biological uptake mechanisms to reduce nutrient concentrations. Ponds can be designed to provide significant ecological benefits.	Dependent on runoff volumes and underlying soils	Open space
Wetlands	Wetlands are shallow ponds and marshy areas with a range of deep and shallow water, covered almost entirely in aquatic vegetation, which provide both storm water attenuation and treatment. Wetlands detain flows for an extended period to allow sediments to settle, and to remove contaminants by facilitating adhesion to vegetation and aerobic decomposition. Wetlands also provide significant ecological benefits.	Typically require 5-15% of the drainage area to provide adequate treatment	Open space
Underground storage	Underground storage attenuates water in tanks, gravel or plastic crates, providing storm water attenuation.	Dependent on runoff volumes and underlying soils	Open space

SuDS ensure the drainage system is able to adapt and manage extreme rainfall events in order to reduce the risk of flooding both to the development itself and offsite. One of the primary benefits to SuDS is their ability to store and slowly release runoff into the surrounding environment, known as **attenuation**. Water is released through infiltration, transpiration or controlled discharge. Through promoting **infiltration** to ground SuDS also re-charge groundwater, helping manage periods of drought, enabling re-charge of the natural drainage system.

SuDS features can also be used locally to capture, treat and manage water for re-supply of cleansed water to buildings or landscapes

Rainwater re-use or rainwater harvesting can be installed at a range of scales, from individual properties to large scale developments.

Re-using rainwater for non-potable purposes such as toilet flushing or irrigation will help reduce potable water demand and deliver Code for Sustainable Homes, BREEAM and other sustainability targets.

WATER QUALITY

SuDS features can be designed to incorporate **water treatment**. Diffuse pollution originates from a number of sources, including those typically originating from roads and car parking areas such as hydrocarbons, heavy metals and sediment, as well as litter, fertilisers, pesticides and animal waste. Pollutants or contaminants in surface water runoff can be washed into sewers and watercourses making it difficult to comply with water quality legislation. Treating surface water runoff ensures that the water soaking into the ground and discharging to nearby watercourses or sewers is cleaner, benefiting water quality and wildlife. SuDS can be designed to reduce sediment and contaminants in runoff either through settlement or biological breakdown of the pollutants.

Conversely, underground piped drainage networks direct pollutants straight to the natural environment without the opportunity to trap, breakdown or remove pollutants. These pollutants can then accumulate in the natural drainage features, resulting in legacy issues and severely impacting on water quality.

Underground solutions also do not typically allow water to soak into the ground, meaning water is unable to enter the natural drainage system. As a result, groundwater recharge is reduced, potentially reducing contribution to flows in streams and rivers, which can inadvertently affect water quality and biodiversity.

More information on the importance of meeting water quality standards and the need to improve water quality in the Borough is provided in Section 1.4.



Diffuse pollution typically originating from roads and car parking areas such as hydrocarbons, heavy metals and sediment, as well as litter, fertilisers, pesticides and animal waste are common contaminants in surface water runoff which can be washed into sewers and watercourses

AMENITY AND BIODIVERSITY

SuDS can provide **open space** in a development, improving the urban environment and providing community spaces. These SuDS can often serve as multi-functional spaces, as a sports pitch or children's play area during dry periods, and then storing water during and following storm events. Additionally, elements of the development can be adapted to serve as a SuDS feature as well as providing their original function; traffic calming measures for example can be designed as rain gardens.

SuDS that integrate greenery or water features can improve the **amenity** and visual character of a development and in doing so can also increase property values⁷. An increase in the value of properties located alongside green space or with views of high quality public realm has been evidenced in a number of developments, especially in urban developments. The **character** of development can also be enhanced through the inclusion of SuDS features which complement the surrounding landscape and urban design.

SuDS also have the potential to create habitats that encourage **biodiversity**, with a number of features being designed to include a range of natural processes for managing and filtering surface water runoff. The inclusion of plants, trees, and other vegetation is often advantageous to slow and store water while providing filtration. Ecological corridors can be developed as part of SuDS management trains and can incorporate a range of vegetation species.

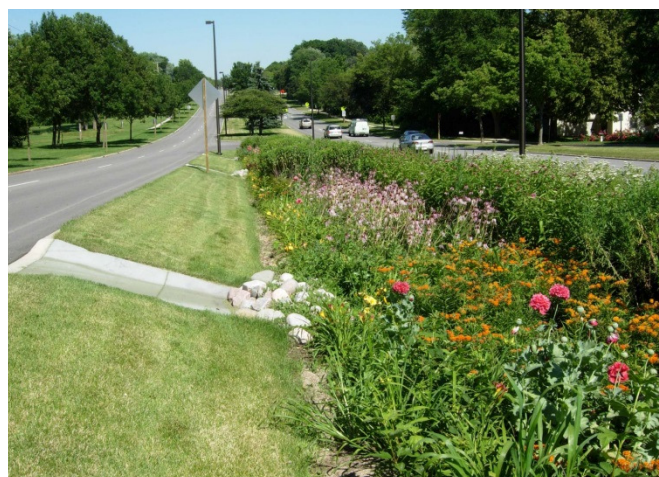
Another benefit of installing SuDS in development is the opportunity they present to **educate** and engage communities about water management and water quality. SuDS features are especially valuable in this respect when incorporated into school environments, serving as a valuable learning and play opportunity for children.

Table 1.4 details the types of SuDS that can be used to achieve each of the benefits discussed above.

1.6 SUDS MANAGEMENT TRAIN

SuDS features are typically most effective when used in series, known as a management train or treatment train. Ensuring that surface water runoff is routed through a number of SuDS features, one after the other, allows the flow and quality characteristics to be more effectively altered.

The initial stage in the management train is **prevention**. Prevention relates to any element of the drainage scheme which serves to prevent runoff and pollutants in the first incidence.



This could involve the reduction in impermeable areas within the development, or the use of good housekeeping measures to reduce pollution.

The second stage is **source control**. Source control features are typically smaller SuDS which deal with the initial rainfall, typically the first 5mm. These features include rain gardens, green roofs and filter drains.

Any runoff that is not dealt with by the source control features is then routed to **site control** features. Site control features are typically larger SuDS such as swales, ponds or wetlands that are designed to deal with a larger volume of water, providing attenuation.

If the volume of water from a development cannot be dealt with onsite, it should then be conveyed to **regional control** features. As the name suggests, these features deal with runoff at a more strategic scale, often receiving runoff from a number of sites, or different phases of a larger site. Regional control features are larger SuDS, such as ponds,

⁷ HR Wallingford, An Assessment of the Social Impacts of Sustainable Drainage Systems in the UK, available at www.susdrain.org/files/resources/evidence/HRW_social_impact_summary.pdf

basins or wetlands which have the capacity to attenuate large volumes of water.

Water should only be conveyed elsewhere if it cannot be managed on site. Dealing with water locally not only reduces the quantity of the water that needs to be dealt with at one point, but also reduces the need to convey water offsite. Typical issues associated with conveying water offsite that need to be managed include additional treatment to the water before it is discharged to the natural environment, or the quantities of runoff generated being greater than the capacity of the natural drainage system at the point at which the management train will discharge.

SuDS features are most effective when used in a management train of stages including – Prevention, Source Control, Site Control and Regional Control. Ensuring that surface water runoff is routed through a number of SuDS features allows flow and quality to be more effectively altered

Runoff does not need to pass through all stages of the management train. Runoff can be routed straight to a site control feature, for example, but as a general principle it is better to deal with runoff locally, returning the water to the natural drainage system as close to the source as possible.

It is best practise to avoid end of pipe solutions where runoff is directly discharged to a site control or regional control feature, such as a basin or pond.

The management train focuses on dealing with water locally, in the sub-catchment in which it originates. The approach therefore promotes the division of the area to be drained based on topography, the drainage characteristics and land uses. Each of these sub-catchments should have its own drainage strategy.

When dividing larger catchments into sub-catchments the impact this will have on the whole catchment management and hydrological cycle should always be considered.



	Attenuation	Infiltration	Rainwater re-use	Water treatment	Open space	Amenity	Character	Biodiversity	Education
Green roofs / walls		-							
Rain gardens / Bioretention areas									
Rainwater harvesting		-			-		-	-	
Soakaways			-		-		-		
Filter strips			-						
Swales									
Pervious surfaces								-	
Geocellular systems				-				-	
Ponds / basins									
Wetlands									
Underground storage				-		-	-	-	-

Table 1.4 Types of SuDS and the benefits they can have.

Benefit

Symbol

Likely

Could be achieved in some cases with good design

Unlikely

-

02

Opportunities & Constraints

2.1 INTRODUCTION

The following section provides an overview of the characteristics of Wokingham Borough that must be considered when designing, constructing and implementing SuDS, including geology, topography, hydrology, historic environment, landscape and townscape character and nature conservation.

This section is divided into a series of stages, ordered in preference of means of surface water discharge, as set out by the National Standards for SuDS. The preferred means of surface water discharge is via infiltration. Only where the subsurface is not suitable for infiltration, should other runoff destinations be considered. The means of discharge and location of SuDS must be determined in advance of the masterplan or land use allocation to ensure adequate and suitable surface water management at the site.

A number of maps provide users of this strategy with a baseline indicator as to the suitable discharge locations and types of SuDS for sites in Wokingham. These maps have been produced as a strategic guide of the Borough and further site investigations will be required to confirm the suitability of site surface water management strategies.

The maps produced highlight areas which have suitable geology for infiltration to occur (Figure 2.1). Developers should use this to test whether infiltration is possible at their site. If infiltration is not possible the proximity to surface water should be taken into account, to assess whether surface water runoff can be discharged into a surface water body. Figure 2.2 provides an outline as to areas which are within 50m of a suitable surface water course.

It should be noted that these maps should be used as a guide, and site specific monitoring and investigation should still be implemented.



Characteristics to consider when implementing SuDS include geology, topography, hydrology, historic environment, townscape character and nature conservation.

2.2 GEOLOGY

The first characteristic that must be considered for every site is the underlying geology which will determine whether infiltration drainage is suitable for the site.

UNDERLYING GEOLOGY

Wokingham's solid geology is comprised of Sedimentary bedrock from the Palaeogene Period and the Cretaceous Period. The south eastern section of the Borough is composed of Bracklesham Group and Barton Group (undifferentiated) – sand, silt and clay. Further north this becomes a diagonal strip of Thames Group bedrock – clay, silt, sand and gravel. This forms part of a belt which covers a lot of the Thames catchment, stretching north east past London.

Further north within the Borough the geology changes to Lambeth Group – clay, silt, sand and gravel, this forms part of a much narrow belt, but one which covers much of the perimeter of the Thames Group bedrock.

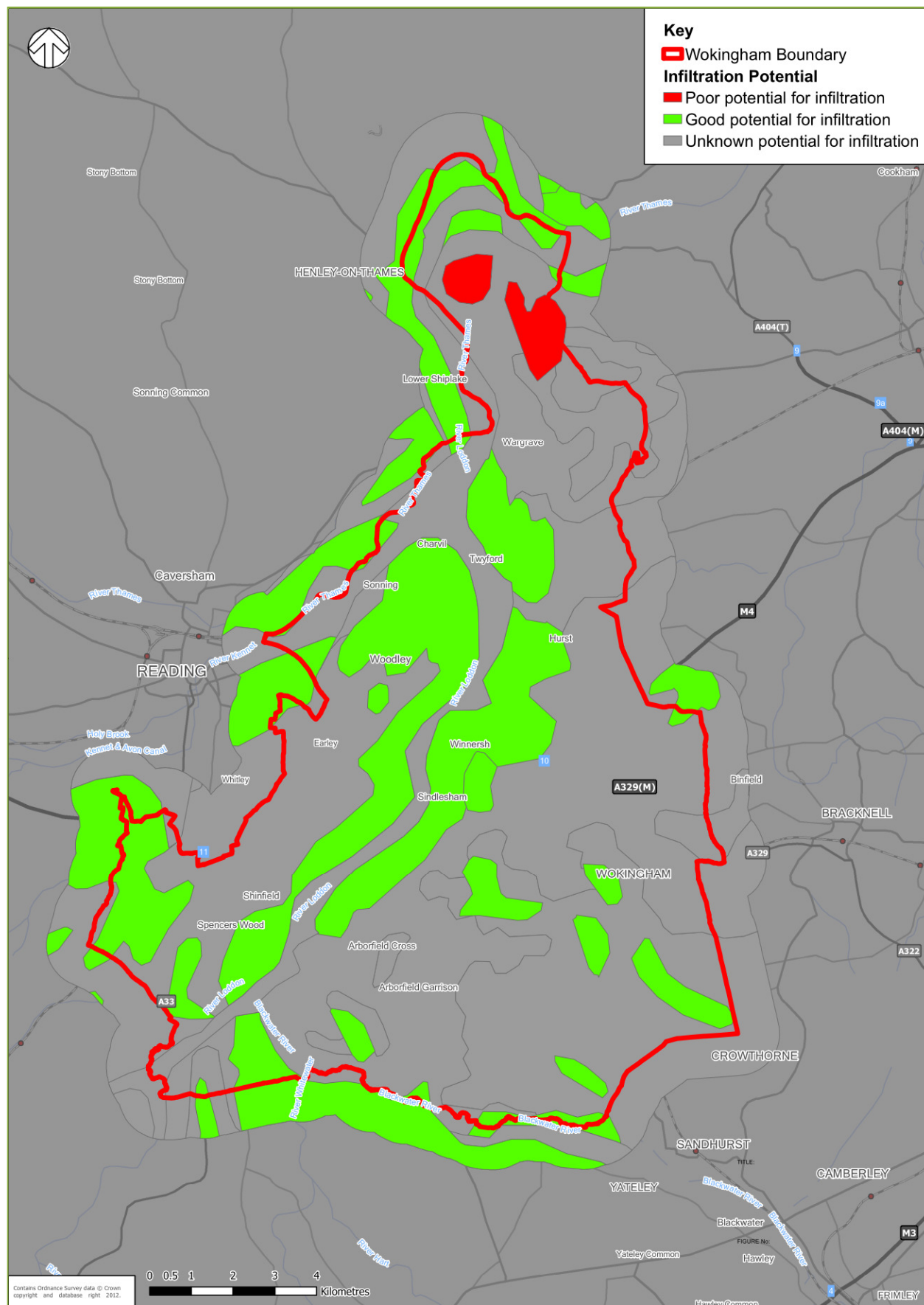
The most northern part of the Borough is composed of the White Chalk subgroup – chalk, however within the eastern section of this bedrock there is also a small area of Lambeth Group and Thames Group geology. The White Chalk subgroup forms part of a band which covers a large area from near Hungerford to Wells-Next-The-Sea.

Surface Geology

Overlying this solid geology are superficial deposits from the Quaternary and Neogene Periods. The northern part of the Borough contains superficial deposits of clay with flints, and the south eastern section of the Borough contains some sand and gravel deposits of uncertain age and origin. The areas of the Borough through which the Rivers Loddon and Thames flow have some alluvium deposits, surrounded by river terrace deposits (undifferentiated). Of these deposits the sand and gravel and river terrace deposits generally have a high permeability, whereas the clay with flints has a low permeability. The permeability of the alluvium deposits is mixed.



Figure 2.1 Geological Suitability for SuDS



Geological Suitability for SuDS

Figure 2.1 shows the infiltration potential of the geology within the Borough of Wokingham. In order for infiltration SuDS to be used, permeable geology must be present to allow water to infiltrate. Developers should use this map to assess whether their site may be suitable for infiltration SuDS.

All of the bedrock within the Borough has been defined as having mixed ability to infiltrate. The British Geological Survey (BGS) study of the physical properties of major aquifers⁸ states that although Chalk is characterised by high porosity characteristics it shows significant regional and stratigraphic variation. This variation is due to dissolution on fracture surfaces causing rubbly materials in some areas, and reworking of chalk causing low permeability chalk in other areas⁹.

The two low permeability areas in the north can potentially be ruled out as suitable sites, but the rest of the Borough should be assessed on a site by site basis.

The Thames and Lambeth Groups are also classed as mixed as the specific type of rock within the bedrock group varies from clay to gravel. The hydraulic connectivity of clay and gravel ranges from approximately 1×10^{-11} m/s to 3×10^{-2} m/s respectively¹⁰. Similarly the Bracklesham Group and Barton Group contains sand, silt and clay, so has hydraulic connectivity ranging from 6×10^{-3} m/s to 1×10^{-11} . As the hydraulic properties of the materials within these bedrock groups are variable site specific studies are recommended in these areas.

Figure 2.1 also shows where superficial deposits overlay bedrock. The Centre for Ecology and Hydrology's Superficial Deposit Hydrogeological Categorisation has been used to assess the permeability of these deposits¹¹. These deposits may further influence the infiltration capacity of an area, reducing or increasing it. From Figure 2.1 it can be seen that two areas within the north of the Borough have low permeability, these areas correspond with the Clay with Flints superficial deposits. Contrastingly, the Borough also contains areas of high permeability, corresponding with River Terrace Deposits and deposits of Sand and Gravel of uncertain age and origin. The Alluvium deposits have been classed as mixed permeability, as they could include clay, sand or silt, which have variable levels of hydraulic connectivity. The variable hydraulic properties of the materials within these superficial groups mean site specific studies are recommended in these areas.



Overall Figure 2.1 shows that site specific studies are necessary before it can be determined whether infiltration is a suitable method for surface water discharge at a proposed development. The two low permeability areas in the north can potentially be ruled out as suitable sites, but the rest of the Borough should be assessed on a site by site basis. Although some areas of superficial deposits are classed as high permeability these should still be investigated further to ensure that groundwater levels are suitable in these areas.

⁸ Allen et al (1997). The physical properties of major aquifers in England and Wales. *British Geological Survey Technical Report*. WD/97/34. 312pp. Environment Agency R&D Publication 8.

⁹ Shepley, M. G. et al (2012) Groundwater Resources Modelling: A Case Study from the UK. *Geological Society of London* 378pp Volume 364 of special publication

¹⁰ Aqtesolv Representative Values of Hydraulic Properties http://www.aqtesolv.com/aquifer-tests/aquifer_properties.htm Accessed February 2015

¹¹ Centre for Ecology and Hydrology Hydrogeological characterisations <http://www.ceh.ac.uk/data/nrfa/data/geology.html> Accessed February 2015

2.3 HYDROLOGY

If the underlying geology is not suitable for infiltration, the next preferable means of discharging surface water runoff is to a local watercourse. There are a number of watercourses within Wokingham Borough, as detailed in the section below and shown in Figure 2.2.

The River Thames runs along the north-west and north boundary of the borough and, along with its tributary the River Loddon, is one of the area's most significant landscape features. Associated with the River Loddon, which flows south to north through the centre of the Borough, are its tributaries; namely the Twyford Brook, Emm Brook, Barkham Brook and the River Blackwater.

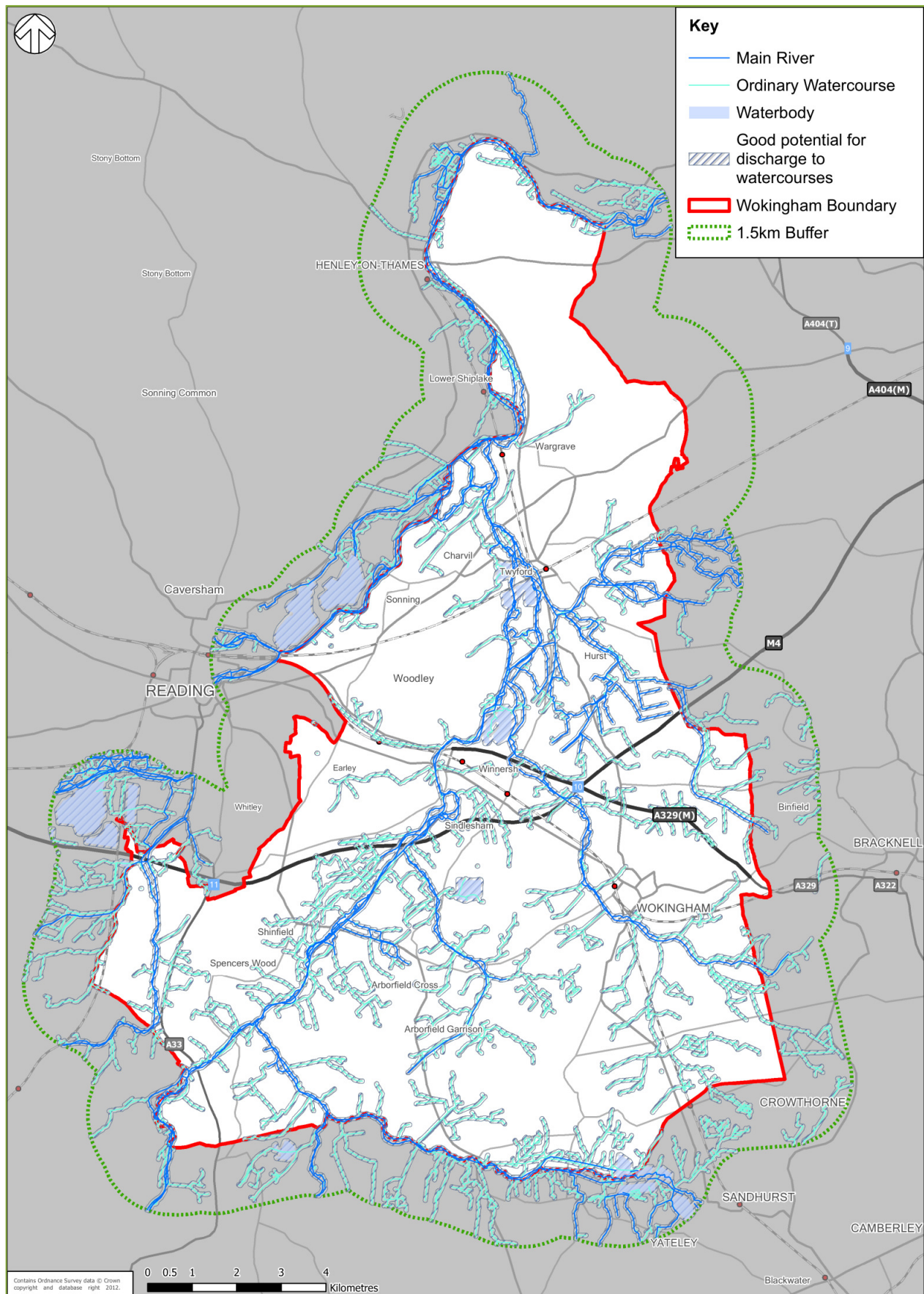
Numerous ordinary watercourses are also associated with these main rivers. A number of towns within the Borough are situated along the length of these rivers, and not surprisingly a considerable proportion of the Borough is affected by fluvial (river) flooding.

HYDROLOGICAL SUITABILITY FOR SUDS

Figure 2.2 shows all areas within Wokingham Borough which are within 50m of a surface water body. Standalone surface water bodies which do not connect to a main river or ordinary watercourse have been removed from this figure as these waterbodies do not present a suitable means for surface water discharge. This figure indicates whether a proposed development site has the potential to discharge to a surface water body.

It should be noted that discharge to such a body is only possible if the watercourse is within or adjacent to the application site boundary or agreement can be reached with a third party to drain across their land.

Figure 2.2 Land within 50m of watercourse



2.4 HISTORIC ENVIRONMENT

Information and advice on the impact of surface water drainage on the historic environment and the mitigation that may be required to reduce the impact on the historic environment should be sought at the land use planning stage from Heritage Gateway's **Historic Environment Record** (www.heritagegateway.org.uk) and, where relevant, **English Heritage** (www.english-heritage.org.uk).

Figure 2.2 indicates the historic features within the Borough to give an indication of the features that should be considered when masterplanning SuDS.

Wokingham Borough Council will only comment on historic environment features and/or designations if they appear to impact on the performance of the surface water drainage strategy for a proposed development. If this is the case, reference will be made to relevant experts within Wokingham Borough Council.

2.5 LANDSCAPE AND TOWNSCAPE CHARACTER

Landscape and townscape character areas are divided into 30 distinctive 'character areas'. Further information on each of the character types and areas can be found in the **Wokingham Borough Council Landscape Character Assessment**, produced in 2004 (www.wokingham.gov.uk/planning/policy/countryside-and-open-space).

Early consultation must be undertaken at the master planning or land use planning stage to ensure SuDS are appropriate to the existing landscape and townscape character.

2.6 NATURE CONSERVATION

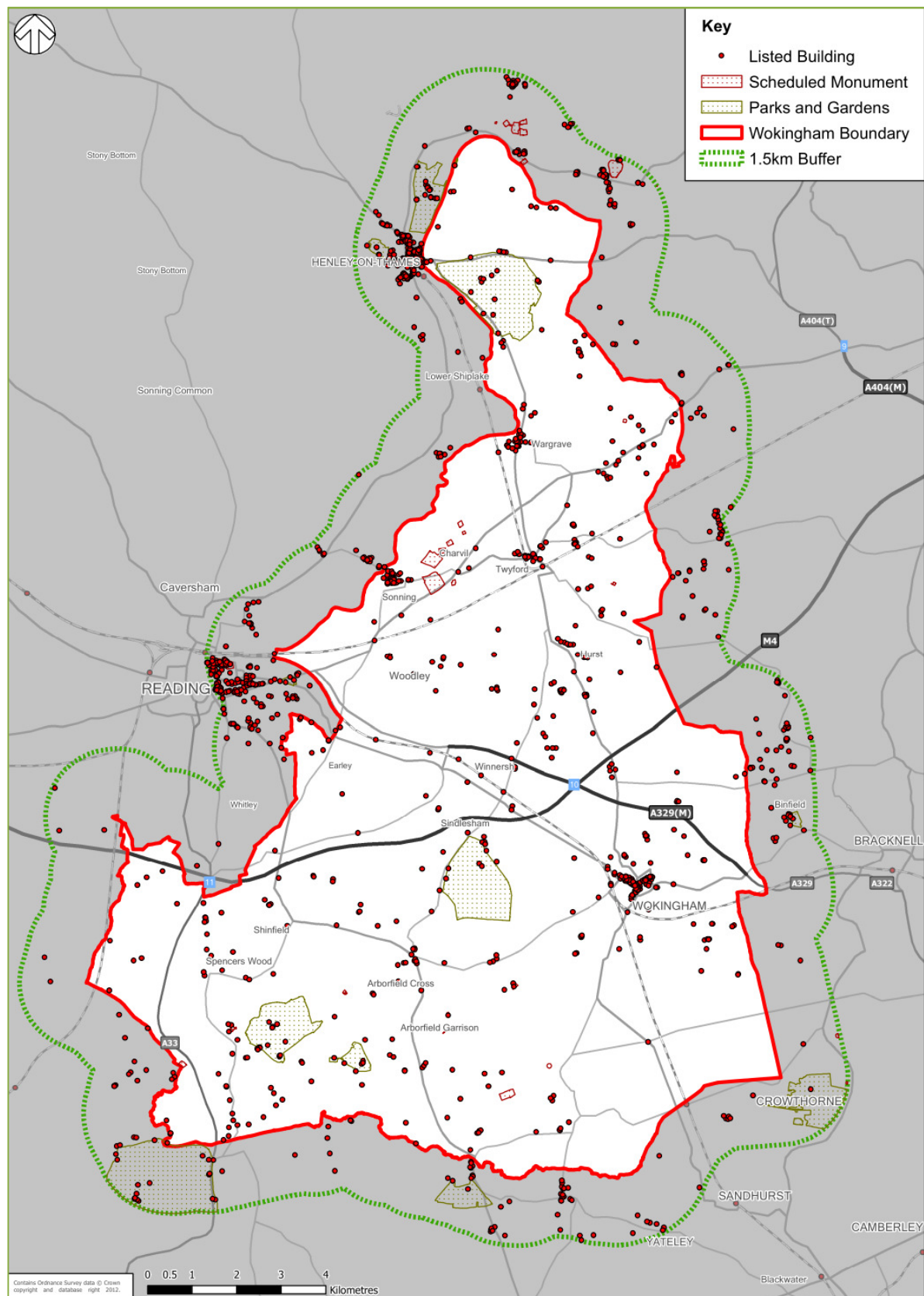
Information about statutory designated international and national areas can be found at **Nature on the Map** (magic.defra.gov.uk). International and national designations are supported by a network of non-statutory, local designated sites of county value for nature conservation. These sites are known as Local Wildlife Sites and further details about these sites can be found [here](http://www.tverc.org/cms/http%3A/www.tverc.org/html/local_wildlife_sites) (www.tverc.org/cms/http%3A/www.tverc.org/html/local_wildlife_sites).

Wokingham Borough Council will only comment on historic environment features and/or designations if they appear to impact on the performance of the surface water drainage strategy for a proposed development. If this is the case, reference will be made to relevant experts within Wokingham Borough Council.

Where protected species or habitats are in the vicinity of SuDS, care should be taken through appropriate maintenance regimes to discourage colonisation of SuDS features by protected species. If colonisation by protected species does occur the ability to carry out appropriate maintenance may impair the full functionality of the SuDS.

Figure 2.4 shows areas within the Borough where polluted surface water discharge could impact on an area protected for its ecological value. If a proposed development is located within this buffer it is likely additional pollution control measures will be required by the Environment Agency to treat surface water runoff before it is discharged to the natural environment. If this is the case, reference will be made to relevant experts within the council.

Figure 2.3 Historic Environment Features



03

Where should SuDS be used?

3.1 INTRODUCTION

The following section is designed to assist with the masterplanning of new and re-developments within the Borough. This section includes information on why particular SuDS features are needed in certain locations, where they should be used and why there is a benefit in using different types of SuDS features.



3.2 WHY ARE PARTICULAR SUDS FEATURES NEEDED IN CERTAIN LOCATIONS?

As detailed in Section 1.4, one of the key benefits of SuDS is their ability to treat surface water runoff, benefiting the water quality of surface water and groundwater bodies, and in turn improving the water environment for ecology. SuDS also help to mitigate against changes in quantity in surface water and groundwater bodies that can result from an increase in impermeable development.

The Water Framework Directive (established by the European Commission) was adopted by the UK Government in 2003 and aims to achieve a 'good status' for all surface water and groundwater bodies across Europe. 'Good status' comprises the ecological and chemical status of surface waters.

Table 3.1 outlines the WFD status of the waterbodies of all of the catchments within a 1km buffer of Wokingham's boundary and details the reasons that any statuses are classed as less than good according to the Water Framework Directive.

Table 3.1 Status of catchments

Catchment	Watercourse	Dominant Land Uses	Status			Reasons for being less than Good
			Overall	Ecological	Chemical	
Loddon – Swallowfield to Thames confluence	Loddon – Swallowfield to Thames confluence	Agricultural, residential, commercial and industrial	Poor	Poor	Fail	Fish levels: poor Phytobenthos levels: poor Phosphate: Moderate
Thames (Reading to Cookham)	Thames (Reading to Cookham)	Agriculture, residential, commercial and industrial	Moderate	Moderate	Good	Macrophytes: moderate Phosphate: Moderate
Twyford Brook	Twyford Brook	Agriculture, residential, commercial and industrial	Poor	Poor	N/A	Invertebrates: poor Macrophytes: moderate Phytobenthos: Poor Phosphate: Moderate Dissolved Oxygen: Poor
Emm Brook	Emm Brook	Agriculture, residential, commercial and industrial	Moderate	Moderate	N/A	Fish: Moderate Phosphate: Poor
Barkham Brook	Barkham Brook	Agriculture, residential, commercial and industrial	Poor	Poor	Good	Fish: Moderate Macrophytes: Poor Phosphates: Poor
Blackwater (Hawley to Whitewater confluence and Bramshill)	Blackwater (Hawley to Whitewater confluence and Bramshill)	Agriculture, residential, commercial and industrial	Poor	Poor	Good	Fish: Poor Macrophytes: Moderate Ammonia: Moderate Phosphate: Moderate
Whitewater	Whitewater	Agriculture, commercial and industrial	Poor	Poor	N/A	Fish: Poor Macrophytes: Moderate
Loddon (Sherfield on Loddon to Swallowfield)	Loddon (Sherfield on Loddon to Swallowfield)	Agriculture, residential, commercial and industrial	Poor	Poor	N/A	Phytobenthos: Poor Phosphate: Moderate
Foudry Brook (West End Brook to M4)	Foudry Brook (West End Brook to M4)	Agriculture, residential and industrial	Poor	Poor	Fail	Fish: Moderate Macrophytes: Poor Phytobenthos: Poor Phosphate: Poor

Catchment	Watercourse	Dominant Land Uses	Status			Reasons for being less than Good
			Overall	Ecological	Chemical	
Burghfield Brook	Burghfield Brook	Agriculture, residential and commercial	Moderate	Moderate	Good	Macrophytes: Poor Phosphate: Moderate
Kennet and Foundry Brook and Clayhill Brook in Reading	Kennet and Foundry Brook and Clayhill Brook in Reading	Agriculture, residential, commercial and industrial	Moderate	Moderate	Good	Fish: Moderate Phytobenthos: Moderate
Kenney and Holy Brook	Kenney and Holy Brook	Agriculture, residential and commercial	Moderate	Moderate	Fail	Unknown
Thames Wallingford to Caversham	Thames Wallingford to Caversham	Agriculture, residential, commercial and industrial	Moderate	Moderate	Good	Phosphate: Moderate
Harpseden Court Drain (west of Henley)	Harpseden Court Drain (west of Henley)	Agriculture, residential, commercial and industrial	Moderate	Moderate	N/A	Unknown
Hamble Brook and Hambledon Stream	Hamble Brook and Hambledon Stream	Agriculture and residential	Poor	Poor	N/A	Fish: Poor
Cut (Binfield to River Thames confluence and Maidenhead Ditch)	No watercourse within 1km from Wokingham Boundary	Agriculture, residential, commercial and industrial	N/A			
Cut at west Bracknell	No watercourse within 1km from Wokingham Boundary	Agriculture, residential, commercial and industrial	N/A			

SuDS can be utilised to provide various pollutant removal mechanisms, which in turn may be able to improve the water quality of waterbodies within Wokingham. CIRIA guidance (C609) and Environment Agency Rural Sustainable Drainage Systems (RSuDS) guidance (2012) both outline the effectiveness of different SuDS techniques in improving water quality.

The reasons for the waterbodies in Wokingham not achieving 'good' status are outlined in Table 3.1. This table is based on the information currently available and it should be noted that there may be other reasons for water quality not being to a high standard. All catchments in Wokingham

contain some agricultural land, with some catchments comprised of predominantly agricultural land. Agriculture is responsible for the majority of the silt entering water in England and for over 60% of the nitrate and 28% of phosphate entering surface waters in England and Wales, therefore by enhancing removal of these pollutants it is likely that water quality will improve in agricultural catchments.

Furthermore, SuDS can provide further benefits such as improving biodiversity of waterbodies. Table 3.1 shows that many waterbodies within Wokingham are at less than 'good' status due to microbiology, so implementing

these techniques could also enhance water quality. A qualitative summary of the potential of SuDS options, adapted from the Environment Agency Rural SuDS guidance¹², for improving water quality is outlined in Table 3.2, these ratings broadly reflect those also outlined in CIRIA C609 Sustainable Drainage Systems - Hydraulic, structural and water quality advice¹³.

Table 3.2 A qualitative summary of the potential of SuDS options

Component	Multiple Benefits				Performance					
	Flow	Water Quality	Biodiversity	Amenity	Flow	Suspended Solids	Total Phosphorous	Total Nitrogen	Pathogens	Pesticides
In-ditch options										
Swales	High	Medium	High	Medium	High	High	Medium	Medium	Medium	Medium
Infiltration Trench	High	Medium	Low	Low	High	High	Medium	Medium	High	Medium
Filter / French drains	High	Medium	Low	Low	High	High	Medium	Medium	Medium	Medium
Barriers & traps	High	Medium	Medium	Low	High	Medium	Medium	Low	Low	Low
Wetland	High	Medium	High	High	High	Medium	Medium	Medium	Medium	Medium
Ponds										
Detention	High	Medium	High	Low	High	High	Medium	Medium	Medium	Medium
Infiltration	High	High	High	Low	High	High	Medium	Medium	High	High
Retention	High	High	High	High	High	High	Medium	Medium	High	High
Woodland / Forestry										
Woodland shelter belts	High	Medium	High	High	High	High	Medium	Medium	Medium	Medium
Buffer strip / headland technology										
New hedges / dry stone dyke	High	Medium	High	High	High	Medium	Medium	Low	Medium	Medium
Dry grass filter strips	High	Medium	Medium	Medium	High	Medium	Medium	Low	Medium	Medium
Buffer strip (dry)	High	High	High	High	High	High	Medium	Medium	High	High
Buffer strip (wet)	High	Medium	High	High	High	Medium	Medium	High	Low	Low
Contour bund	High	Low	Low	Low	High	Low	Low	Low	Low	Low
Filter Berm	High	Low	Medium	Low	High	Low	Low	Low	Low	Low
Wetland										
Artificial / Restored wetland	High	Medium	High	High	High	High	Medium	Medium	High	Medium
Other										
Sediment trap	Low	Medium	Low	Low	Low	High	Medium	Low	Medium	Medium
Pervious surfaces	High	Medium	Low	Low	High	Medium	Medium	Medium*	Medium	Medium
Sedimentation boxes	High	Medium	Low	Low	High	High	High	Low	Medium	Medium
Soak away	High	Medium	Low	Low	High	Medium	Medium	Low	Medium	Medium
Grip (gully) blocking	Low	Medium	High	Low	Low	High				

*Pervious surfaces ability to remove nitrogen is enhanced when below ground infiltration and the use of an underdrain system are relied on. It should be noted that pervious surfaces are unlikely to be practical in agricultural areas.

High	Well-designed systems have been reported or judged by expert opinion to have the potential to provide significant benefit in this area in the majority of locations
Medium	Well-designed systems have been reported or judged by expert opinion to have the potential to provide some benefit in this area at some locations
Low	Well-designed systems have not been reported or judged by expert opinion to provide any benefit in this area at any locations

¹² Environment Agency (2012) Rural Sustainable Drainage Systems, available at: www.gov.uk, accessed July 2015

¹³ CIRIA (2010) Sustainable Drainage Systems - Hydraulic, structural and water quality advice (C609), available at: www.ciria.org/CIRIA, accessed July 2015

When determining which SuDS are appropriate for an area a developer should use the following approach:

- Establish which river basin management catchment the Proposed Development is located;
- Use Table 3.1 to determine the reasons why water quality is less than good in this area;
- Assess the land use type of the development, noting that in agricultural areas it is also preferable to remove nitrates from watercourses; and,
- Use Table 3.2 to determine SuDS which are preferable for this location. Wokingham Borough Council will favour developments that use SuDS with a high potential to improve water quality.

When using SuDS to improve water quality there is often a trade-off between Total Phosphate or sediment removal and Total Nitrogen removal, as different conditions are needed for the removal of each.

This further highlights that using a combination of SuDS features in a treatment train is more effective than measures used in isolation.



3.3 OPPORTUNITIES FOR REGIONAL SUDS

There are four Strategic Development Locations within Wokingham Borough; Arborfield Garrison, South of M4, North Wokingham and South Wokingham. These large development sites provide a number of opportunities to improve water quality and reduce flood risk in the wider catchment by serving as suitable areas for incorporating regional SuDS features.

Regional SuDS features are used to manage runoff from a number of sub-catchments and can provide attenuation for large volumes of water as well as more viable opportunities for discharge to ground/groundwater recharge. Regional SuDS typically include features such as wetlands, ponds and retention / detention basins.

Due to the fact that regional SuDS features are able to attenuate large volumes of water, these features can help reduce the flood risk to the wider catchment both upstream and downstream, in addition to managing surface water discharge from the proposed developments.

Large development sites like Arborfield Garrison provide a number of opportunities to improve water quality and reduce flood risk in the wider catchment by serving as suitable areas for incorporating regional SuDS features.

Regional SuDS features also serve as an additional stage of treatment for surface water runoff, helping improve the quality of discharge and in turn improve the status of surface and groundwater bodies downstream of the development.

Wokingham Borough Council works with developers, at the SDL sites in order to deliver regional features to reduce flood risk and improve water quality within the Borough.

3.4 OPPORTUNITIES FOR SUDS OUTSIDE OF NEW DEVELOPMENT

Water quality improvement, increased amenity and flood risk reduction aspirations for the Borough cannot be met or facilitated through new development alone. Additional opportunities and projects will need to be identified and implemented to reduce flood risk, improve water quality and enhance the biodiversity of aquatic and riparian environments whilst making them more accessible for residents to enjoy.

In addition to the opportunities new development provides Wokingham Borough Council will also encourage implementation of the following features.

REGIONAL SUDS

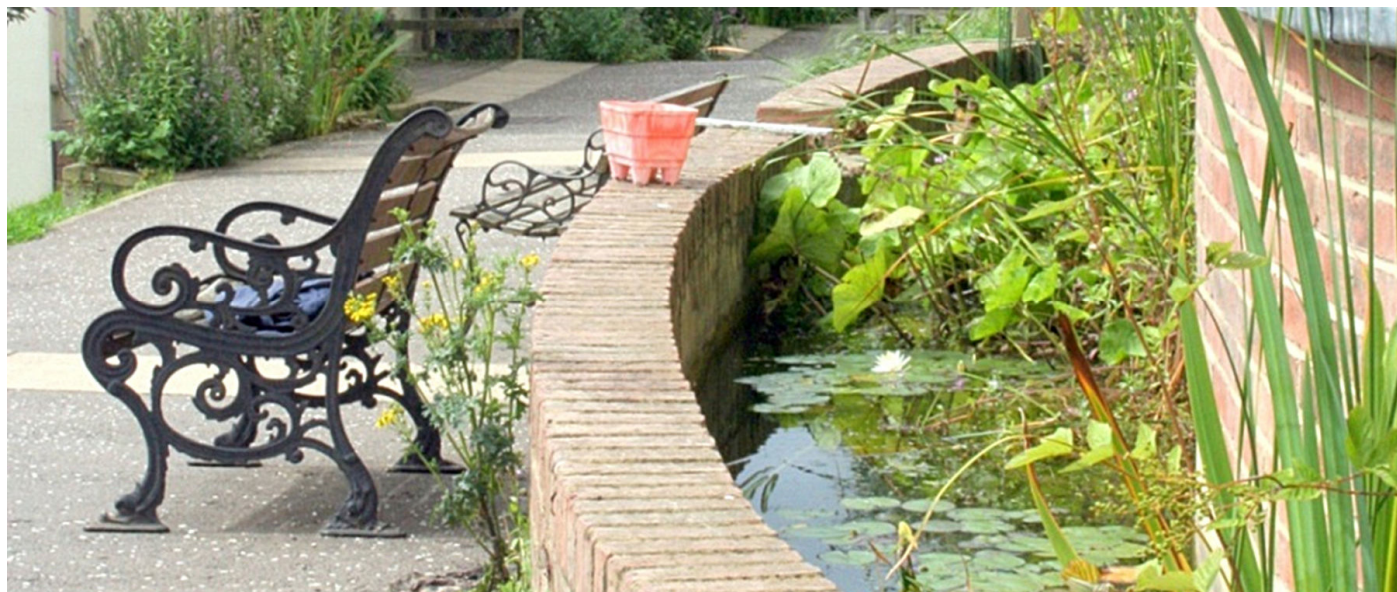
Wokingham recognises that not all development sites have the ability to deliver/incorporate regional SuDS (despite their multiple benefits) or that the position of development sites are advantageous for regional control SuDS.

Therefore Wokingham Borough Council will look for opportunities where new development could benefit from and contribute to regional SuDS delivered by Wokingham Borough Council, landowners, stakeholders and partners.

One of the key objectives of the Wokingham Borough Council Local Flood Risk Management Strategy¹⁴ is to 'ensure that planning and decisions take full account of flood risk, avoiding development in inappropriate locations, preventing an increase in flood risk and minimising existing flood risk wherever possible'. The delivery of regional SuDS features throughout the Borough will help deliver the following measures to meet this LFRMS objective:

- Ensure that the new Strategic Development Sites consider flood risk on and off site and provide betterment wherever possible.
- Ensure that the siting of commercial and domestic properties in terms of flood risk is appropriate.
- Ensure that SuDS schemes are appropriately designed.





BUFFER STRIPS

The available evidence is clear that watercourses in Wokingham do not currently meet the Water Framework Directive target of 'good status' and that measures are required to improve water quality and safeguard the structure of local watercourses in order to achieve good status by their target dates.

The evidence is similarly clear that water quality is impacted by elevated suspended sediment, phosphorous and nitrate levels in many of the watercourses. Consequently Wokingham Borough Council will seek to safeguard buffer strips alongside all watercourses and will work with landowners to increase the width of vegetated margins alongside watercourses wherever possible.

Buffer strips and vegetated margins work best when they are designed to ensure runoff occurs as sheet flow across the area at a velocity which allows the vegetation to filter out sediment and associated pollutants and providing some infiltration into underlying soils. This then reduces the sediment and pollutants reaching the watercourse, helping to improve its quality.

Buffer strips can also comprise a natural or naturalized wetland vegetation or wet woodland alongside a waterbody. These features work by directing the field drain system across the buffer to ensure discharge creates continually wet conditions to encourage the removal of nitrogen from the runoff.

Buffer strips work best when runoff occurs at a velocity which allows vegetation to filter out sediment and pollutants

In addition to buffer strips the planting of mixed woodlands can serve as an effective barrier between pollutants and watercourses. For drainage purposes, woodlands should be developed perpendicular to the slope of the land. Trees intercept and evaporate a significant proportion of rainfall, root depth increases and soil structure improves, infiltration rates increase and overland flow decreases, surface runoff from upslope can be captured and infiltrated. Water infiltration rates up to 60 times higher in areas planted with young trees than in adjacent grazed pastures, have been recorded¹⁵

¹⁵ Environment Agency (2010) Rural Sustainable Drainage Systems (RSuDS), available at: www.gov.uk, accessed July 2015

REVIEW OF WOKINGHAM ASSETS

Wokingham Borough Council has numerous assets across the Borough, including the highway network and a number of public buildings, including schools, libraries and office buildings. As development opportunities arise at these assets consideration will be given to the Water Framework Directive and improvements sought where possible.

The review will identify options to improve the quality of water discharged from roads by enhancing roadside ditches

These reviews will look to establish if measures can be taken to reduce the risks associated with point and diffuse pollution sources. This will include a review of road drainage discharging to watercourses and identification of options to improve the quality of water discharged from roads by enhancing/augmenting roadside ditches.



REVIEW OF POTENTIAL POINT SOURCE POLLUTION

In order to improve the quality of discharges from non-Council owned assets, Wokingham Borough Council will work with land owners and businesses to review surface water discharges to watercourses assessed under the Water Framework Directive. The review will prioritise discharges from local industry to watercourses that are assessed as bad, poor or moderate under the Directive. The review will look to identify measures that could be implemented to improve the quality of discharges from point sources. Such measures may include requests for land owners to install isolation systems on their outfalls and/or to partner with Wokingham Borough Council on discharges to ordinary watercourses to provide vegetated buffer strips designed to improve the quality of surface water discharges.

Wokingham Borough Council will also work to identify any “misconnections” across the Borough. “Misconnections” are discharges from commercial, industrial and residential properties that have been wrongly routed and are either discharging to a watercourse or surface water sewer, when they should in fact be discharging to the foul sewer network. These “misconnections” typically comprise waste water discharges from toilets, baths, showers, sinks, washing machines or dishwashers. Similarly, if pipes which collect rainwater from roofs, roads and other impermeable surfaces are wrongly connected to the foul sewerage network instead of a surface water sewer, water can overwhelm the foul sewer and contribute to flooding.

The first step in identifying “misconnections” will be to produce a Borough-wide campaign to raise awareness of the problems that can be caused by wrongly connected pipes and how to businesses and residents can rectify misconnections if identified on their property. The campaign will also work to raise awareness as to the types of discharges that are appropriate for each type of drain. For example, residential drains taking water from the property roof / drive / patio must not be used to discharge car oil.

4

Conclusion

The Borough of Wokingham has a number of flood risk and water quality issues. Wokingham Borough Council is looking to not only address these issues, but also to improve the natural environment for the benefit of those that live, work and visit the Borough; Sustainable Drainage Systems (SuDS) can play a significant role in addressing all of these.

Wokingham Borough Council is committed to ensuring development is of the highest quality of design, with the aim of achieving sustainable places that are designed to mitigate and adapt to the effects of climate change for current and future generations. In producing sustainable new developments, there are a number of opportunities for Wokingham to address the local issues of flood risk by requiring and encouraging new development to utilise SuDS to reduce runoff rates and volumes. These SuDS features can be used at both a local development scale, but also at the wider regional scale to help mitigate flood risk on a far wider scale.

The Council is also seeking to improve water quality across the Borough. Wokingham Borough Council are looking to achieve this aim by requiring new developments to take greater account of water quality in the design of site



drainage networks, helping to improve water quality from diffuse pollution sources.

Wokingham Borough Council will also look to address diffuse and point source pollution originating from existing development in the wider catchment through reviewing works on the Highways and Council owned developments, as well as working with landowners and businesses to improve the quality of discharge from existing developments.

Appendix A

Technical Guide

Introduction

This Technical section focuses on the delivery of sustainable drainage in new development within the borough of Wokingham. It establishes the requirements of planning applications (and discharge of condition applications) in light of Wokingham Borough Council's statutory responsibility as the Lead Local Flood Authority to comment on major developments with drainage.

This Guide will form the basis for assessment of all planning applications in the borough of Wokingham in line with the following local plan policies:

- Managing Development Delivery Local Plan¹⁶ policy CC10: Sustainable Drainage
- Core Strategy¹⁷ Policy CP1 – Sustainable Development
- Core Strategy Policy C3 – General Principles for Development

Once this Technical Guide is adopted, planning applications will need to show that their proposed development meets the requirements of this guide. As part of the Flood and Water Management Act 2010, Schedule 3 on Sustainable Drainage sets out a range of significant new responsibilities for local authorities around Sustainable Drainage Systems (SuDS).

Government consulted on the implementation of Schedule 3 between December 2012 and March 2013. As a result of the consultations, in September 2014 Government proposed making better use of the planning system to secure SuDS in new development. It was confirmed in December 2014 that this approach would be taken forward and implemented as of 6th April 2015.

¹⁶ Wokingham Borough Development Plan – Adopted Managing Development Delivery Local Plan (February 2014) <http://www.wokingham.gov.uk/planning-and-building-control/planning-policy/key-planning-documents/managing-development-delivery/>

¹⁷ Wokingham Borough Local Development Framework - Adopted Core Strategy Development Plan Document (January 2010) <http://www.wokingham.gov.uk/planning-and-building-control/planning-policy/key-planning-documents/>

In December 2014 it was also proposed that to support local planning authorities (LPAs) in assessing the provision of SuDS in new development, Lead Local Flood Authorities (LLFAs) would be made statutory consultees on all major planning applications with surface water drainage implications.

To deliver this enhanced planning system, planning guidance has been strengthened to give increased weight to the provision and maintenance of SuDS in the determination of planning decisions. Non-statutory technical standards for sustainable drainage systems¹⁸ have been published by DEFRA that set out the requirements for the design, construction, operation and maintenance of SuDS in England and Wales, these changes only apply to major development¹⁹. In addition the National Planning Policy Framework (NPPF) – Planning Practice Guidance (PPG) – Flood Risk and Coastal Change has been updated to provide further clarification on managing flood risk and securing the use of SuDS²⁰.

Purpose of this Technical Guide

Following the implementation of the changes to national planning legislation and guidance, all new drainage systems for major developments must be designed, constructed and maintained in accordance with the Defra Non-statutory Technical Standards for Sustainable Drainage Systems.

The NPPF PPG states that supplementary planning documents should be prepared only where necessary and in line with paragraph 153 of the National Planning Policy Framework²¹. They should build upon and provide more

¹⁸

<https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards>

¹⁹ Major Development is defined as 10 or more dwellings, or the equivalent non-residential or mixed development (as set out in Article 2(1) of the Town and County Planning (Development Management Procedure) (England) Order 2010).

²⁰

<http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/reducing-the-causes-and-impacts-of-flooding/why-are-sustainable-drainage-systems-important/>

²¹

http://planningguidance.planningportal.gov.uk/blog/policy/achieving-sustainable-development/planning-making/#paragraph_153

detailed advice or guidance on the policies in the Local Plan. They should not add unnecessarily to the financial burdens on development. Regulations 11 to 16 of the Town and Country Planning (Local Planning) (England) Regulations 2012²² set out the requirements for producing Supplementary Planning Documents. Paragraph 153 of the National Planning Policy Framework states that supplementary planning documents should be used where they can help applicants make successful applications or aid infrastructure delivery, and should not be used to add unnecessarily to the financial burdens on development.

This Technical Guide sets out the local requirements for sustainable drainage in Wokingham Borough. These local requirements support Wokingham Borough Council's vision for the implementation Sustainable Drainage Systems throughout the borough to achieve the following:

- Facilitate the regeneration of our towns and increase the vibrancy of our communities.
- The use of well-designed SuDS in redevelopment to provide many of the aspects that create better places to live, work and play, creating better, cleaner and greener urban environments.
- Create an environment that allows businesses to thrive.
- Sustainable management of surface water runoff to ensure business and transport links are not disrupted by flooding.
- Deliver well designed development and strong communities

This Technical Guide is provided to ensure a consistent approach is taken when providing pre-application advice, assessing proposals, developing drainage solutions for development and granting approval.

This Technical Guide is designed as both a single comprehensive document and as a series of smaller documents that Wokingham Borough Council may choose to issue as discrete guidance to developers, designers and consultants who are seeking clarification on the Council's

requirements for the design of sustainable surface water drainage in Wokingham Borough.

Who is this Guide for?

This guide is primarily for use by developers and those involved in applying for planning applications. These include:

- Landscape designers
- Architects and Urban Designers
- Development Management and other Borough Council officers
- Borough Council maintenance team
- The requirements of the national planning policy and planning guidance implemented in April 2015 are applicable to major development²³. This is defined as any of the following:
 - the winning and working of minerals or the use of land for mineral-working deposits;
 - waste development;
 - the provision of dwelling houses where
 - the number of dwelling houses to be provided is 10 or more; or
 - the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);
 - the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or
 - development carried out on a site having an area of 1 hectare or more;

In addition the Wokingham Borough Managing Development Delivery Local Plan (2014) and the Wokingham Borough Sustainable Design and Construction (2010) SPD requires all developments no matter what size to produce a Surface Water Drainage Strategy involving

²²

<http://www.legislation.gov.uk/ukxi/2012/767/regulation/11/made#regulation-11-made> to <http://www.legislation.gov.uk/ukxi-2012-767-regulation-16>

²³ See article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010 for a definition of major development.

the introduction of SuDS techniques where appropriate. Furthermore, incremental small scale development can also impact on issues of flood risk and water quality.

Therefore this guide is applicable to all new development in Wokingham and will form the basis for the assessment of drainage provision in all planning applications.

WBC officers will use this guide to assess the drainage provisions proposed for all new development and advise on planning approval and the requirement for planning conditions.

This guide will be a living draft, meaning new information and updates will be continually added as they emerge. This is especially important as this edition of the guide precedes the issue of the updated SuDS Manual (CIRIA C697).

This guidance (or discrete parts of it will be updated when considered necessary by the LLFA. These updates will be based on (but not necessarily limited to):

- lessons learnt from the implementation of sustainable drainage in Wokingham;
- revisions to planning policy; and/or
- revisions to national standard and/or best practice guidance.

Pre-Application Consultation

Given the 'live' nature of this document, applicants are encouraged to engage with the LLFA as soon as possible to ensure they are working to the latest version of this document and best practice / thinking with regards to sustainable drainage in any given part of the borough of Wokingham.

Climate Change Allowances

In February 2016, the Environment Agency updated previous climate change allowances to support the National Planning Policy Framework. The table below shows peak rainfall intensity allowance in small and urban catchments. The revised rainfall allowances will need to be accounted for in surface water drainage design.

Further information on peak rainfall intensity allowances, and also peak river flow allowances can be found on the [Environment Agency website](#).

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Links to Current Wokingham Borough Policy

Core Strategy

The Core Strategy sets out the vision for how the borough will develop in the period to 2026 and planning policies that will be used to achieve this. It is one of the Local Plans for Wokingham Borough and forms part of the Wokingham Borough Development Plan. Planning law requires that planning applications must be determined in accordance with the Development Plan, unless material considerations indicate otherwise.

Core Strategy Policy CP1 – Sustainable Development has several aspects that link directly to the use of SuDS. It states that planning permission will be granted to developments that provide a range of things including; limiting any adverse effects on water quality, provision of adequate drainage, incorporation of facilities for recycling of water and management of flood risk from all sources.

Core Strategy Policy C3 – General Principles for Development states that planning permission will be granted to developments that have no detrimental impact upon the landscape, geological features or watercourses.

Managing Development Delivery Local Plan

The Managing Development Delivery Local Plan also forms part of the Wokingham Borough Development Plan and therefore planning applications must be determined in accordance with it.

Policy CC10 – Sustainable Drainage gives specific requirements for provision of drainage in new

development. The requirements of policy CC10 are set out below.

Policy CC10: Sustainable Drainage

1. All development proposals must ensure surface water arising from the proposed development including taking into account climate change is managed in a sustainable manner. This must be demonstrated through
 - a) A Flood Risk Assessment, or
 - b) Through a Surface Water Drainage Strategy.
2. All development proposals must
 - a) Reproduce greenfield runoff characteristics and return run-off rates and volumes back to the original greenfield levels, for greenfield sites and for brownfield sites both run-off rates and volumes be reduced to as near greenfield as practicably possible.
 - b) Incorporate Sustainable Drainage Systems (SuDS), where practicable, which must be of an appropriate design to meet the long term needs of the development and which achieve wider social and environmental benefits
 - c) Provide clear details of proposed SuDS including the adoption arrangements and how they will be maintained to the satisfaction of the Council [as the Lead Local Flood Authority (LLFA)]
 - d) Not cause adverse impacts to the public sewerage network serving the development where discharging surface water to a public sewer.

Sustainable Design and Construction SPD (2010)

The Wokingham Borough Sustainable Design and Construction (2010) SPD provides further information on SuDS. To ensure SuDS are integrated holistically into a development the SPD lists a number of stages that need to occur before development commences. It also states that all development is expected to produce a Surface Water Drainage Strategy in compliance with the most recent guidance, and should involve the introduction of SuDS techniques and take into account climate change.

Sustainability issue 5 also states that green/brown roofs should be considered on all buildings where appropriate.

Borough Design Guide SPD (2012)

The Wokingham Borough Council – Borough Design Guide SPD (2012) is a material consideration in all planning applications. The Borough Design Guide SPD gives guidance on the incorporation of SuDS into different types of development, these are set out below:

Residential Development:

- Open spaces should contribute to the green infrastructure of the Borough and, where suitable, include features such as ponds and soakaways. For these features to be considered as part of an open space they must be designed to enrich the landscape and ecology of the space, for instance by introducing wetland habitats, and not simply be functional landscape drainage features.

Streets and Spaces

- The SuDS strategy for a proposed development may use a combination of different features. It will depend upon local ground conditions, in particular whether the subsoil is clay, or chalk/sand. SuDS design should be considered from the earliest stage and should take any opportunities to integrate features that will contribute to local character.
- S16: The long term management and maintenance responsibility for streets and spaces and their landscapes, including street trees and SuDS, must be identified by designers. These matters need to be considered from the outset in relation to such matters as the layout and design, safety, choice of materials, street furniture and planting species.

Non-Residential Development

- NR10: For Car Parking designers should incorporate SuDS measures such as swales or permeable paving into the scheme to facilitate drainage and flood attenuation.

Wokingham Borough Strategic Flood Risk Assessment (2012)

The Wokingham Borough Strategic Flood Risk Assessment (2012) states that in accordance with Government policy it is recommended that developers seek to use SuDS for the management of surface runoff. SuDS should be considered early within the site planning process as optimum placement of SuDS devices will affect the site design.

Roles and Responsibilities

Developers / Applicants are strongly advised to undertake early consultation with all relevant parties as soon as possible.

Wokingham Borough Council as the Local Planning Authority and Lead Local Flood Authority (LLFA)

As the Local Planning Authority, Wokingham Borough Council is responsible for the review and determination of all planning applications in the Borough. This includes taking account of the new changes to planning legislation

and the Non-statutory technical standards for sustainable drainage systems to enhance the requirements for sustainable drainage in new development.

WBC is responsible for ensuring that major²⁴ new development delivers drainage in line with the new Non-statutory technical standards for sustainable drainage systems. Within WBC this function is delegated to the Lead Local Flood Authority.

Under the Flood and Water Management Act 2010 (The Act), Wokingham Borough Council is a Lead Local Flood Authority (LLFA), responsible for the management of flood risk from surface water, ordinary watercourses and groundwater in the borough of Wokingham.

WBC as LLFA is a statutory consultee on all planning applications for Major Development, with surface water drainage implications²⁵.

Environment Agency

The Environment Agency (EA) will be a statutory consultee on all planning applications where:

The proposed drainage system involves the discharge of water within 20m of a Main River either directly or indirectly;

The development is within an identified Flood Zone (2 or 3);

²⁴ The Town and Country Planning (Development Management Procedure) (England) Order 2015 - Article 2 (1)

“major development” means development involving any one or more of the following — (a) the winning and working of minerals or the use of land for mineral-working deposits; (b) waste development; (c) the provision of dwellinghouses where — (i) the number of dwellinghouses to be provided is 10 or more; or (ii) the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i); (d) the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or (e) development carried out on a site having an area of 1 hectare or more;

²⁵ The Town and Country Planning (Development Management Procedure) (England) Order 2015 - SCHEDULE 4 Consultations before the grant of permission

The development has an area greater than 1ha and is within Flood Zone 1; or

The development is within a critical drainage area.

EA consultation and standing advice related to planning applications can be found at <https://www.gov.uk/government/organisations/environment-agency>. The EA will no longer comment on surface water matters flooding matters.

Sewerage Undertakers

The relevant sewerage undertaker (Thames Water or private owner) is not a statutory consultee on planning applications. However the NPPF PPG (Paragraph 86) states that local planning authorities are advised to consult the relevant sewerage undertaker where a connection with a public sewer is proposed. In addition it is highly recommended that the developer engages early with the relevant sewerage undertaker.

The sewerage undertaker will provide information about the availability and capacity of the sewerage network. The Sewerage Undertaker may have to carry out a capacity study (possibly at the applicants expense) before it can advise on the available capacity, permitted rate of discharge or point of connection.

The sewerage undertaker may also be required to adopt and maintain certain elements of the drainage.

The Highways Authority

As the Highways Authorities, Wokingham Borough Council Highways and Highways England are not statutory consultees with regards to drainage. The NPPF PPG (Paragraph 86) states that local planning authorities are advised to consult the relevant highway authority for a road affected by a proposed drainage system. In addition it is highly recommended that the developer engages early with the relevant highways authority.

Wokingham Borough Council Highways is responsible for adopting and maintaining drainage systems which serve publicly maintained roads under the Highways Act (1980). Under the Flood and Water Management Act (2010) (the Act) this responsibility remains unchanged.

Wokingham Borough Council Public Open Space

The Public Open Space team are responsible for the management of public open space in Wokingham and therefore any SuDS features that are located there will fall under their responsibility. Therefore they should specifically be consulted over any proposal for SuDS in public open space to ensure their requirements can be incorporated into the design and maintenance arrangements.

National and Local Guidance for Sustainable Drainage

Following the ministerial statement on 18th December 2014 by the Department for Communities and Local Government (DCLG), Non-statutory technical standards for sustainable drainage systems have been published by DEFRA.

This section follows the structure of the Non-statutory technical standards for sustainable drainage (March 2015) which set out requirements for the design, construction, operation and maintenance of SuDS in England and Wales. These standards only apply to major development.

The Wokingham Borough Managing Development Delivery Local Plan (2014) and the Wokingham Borough Sustainable Design and Construction (2010) SPD require that all planning applications manage surface water runoff in a sustainable manner, and provide a drainage strategy.

Checklists for the expected contents of different types of planning application are given in Appendix A. These have been developed to give a proportionate and risk based approach to the level of detail required. Factsheets outlining the different SuDS measures available to use in providing a drainage scheme for a new development are included in Appendix B. These include the key design criteria that are expected to be met when including a certain measure within the drainage scheme for a proposed development.

Flood Risk Outside The Development

S1 Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g. the sea or a large estuary) the

peak flow control standards (**S2** and **S3** below) and volume control technical standards (**S4** and **S6** below) need not apply.

Wokingham Borough has no surface water bodies within its administrative area that can accommodate uncontrolled surface water discharges. Peak flow control standards **S2** and **S3** and volume control standards **S4** and **S6** will apply for all proposed (major) developments in the Wokingham administrative area.

LOCAL STANDARDS

In addition to the above National Standards, Wokingham Borough Council has the following local standards:

WokBC-LS1 The design of the drainage system must mitigate any potential negative impact of surface runoff from the development on the flood risk outside the development boundary.

WokBC-LS2 The application must include details of catchments and flows discharging into/across the site from all sources (fluvial, surface water and groundwater). The submitted documents (drawings and relevant calculations) shall identify sources of water entering the site predevelopment, how flows will be routed / managed through the development, where flows exited the site pre-development and where they leave post development, without exacerbating flood risk to neighbouring property.

WokBC-LS3 If the SuDS system discharges to a water body, it should be demonstrated that high water levels within the receiving water body for the design storm event of the discharging system would not exacerbate flood risk to neighbouring property or affect the performance of the drainage system and its ability to discharge flow from the site.

WokBC-LS4 All proposals to discharge to a water body, public or private sewer shall be accompanied with correspondence confirming acceptance of the proposal from the receiving network owner and that the receiving network has the necessary capacity to receive additional flows and/or that required reinforcement works will be provided.

Further information is provided in Chapter 3 and 4 of the SuDS Manual (CIRIA C697).

Peak Flow Control

S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

LOCAL STANDARDS

In addition to the above National Standards, Wokingham Borough Council has the following local standards:

WokBC-LS5 In addition to the requirements of S2, Wokingham requires demonstration that discharges from the proposed development for all return periods from the 1 in 1 through to the 1 in 100 year (inclusive), do not exceed their corresponding greenfield/previously developed discharge rates. Demonstration of this is required for the 1 in 1 year, 1 in 30 year, 1 in 100 year and 1 in 100 year including allowances for climate change.

WokBC-LS6 All proposed discharges of 5l/sec or below from a single structure should be reviewed in terms of maintenance and blockage potential.

WokBC-LS7 All flow control devices restricting the rate of flow must have a bypass feature to manage flows when a blockage occurs. The bypass can be an internal weir overflow within the chamber discharging to the outfall pipe or channel.

WokBC-LS8 The design of all flow control must be supported by appropriate calculations and drawings that enable the performance of the drainage system to the required standards to be confirmed.

WokBC-LS9 Attenuation and flow control should be provided for all sub-catchments present across a development site so as to maintain the local water balance / contributing areas to local water bodies. Each sub-catchment must have its own drainage strategy.

WokBC-LS10 Attenuation storage must be provided to limit the rates of runoff to the required greenfield / pre development discharge rates.

Further information is provided in Chapter 3 and 4 of the SuDS Manual (CIRIA C697).

Volume Control

S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

LOCAL STANDARDS

In addition to the above National Standards, Wokingham Borough Council has the following local standards:

WokBC-LS11 Long term storage must be provided to limit the volume of runoff from the 1 in 100 year event with an allowance for 40% climate change, unless discharge rates have been restricted to QBar.

WokBC-LS12 All design of volume control must be supported by appropriate calculations and drawings that enable the performance of the drainage system to the required standards to be confirmed.

WokBC-LS13 All surface storage features (ponds, wetlands and basins) must provide a 300mm freeboard above the maximum design water level, unless otherwise agreed.

WokBC-LS14 All surface conveyance features (swales and channels) must provide a 150mm freeboard above the maximum design water level, unless otherwise agreed.

WokBC-LS15 The drainage system must be designed so that the capacity of the drainage system takes account of the likely impacts of climate change and likely changes in impermeable area²⁶ within the development over the design life of the development. To allow for future urban expansion within the development (urban creep), an increase in paved surface area of 10% should be used, unless this would produce a percentage impermeability greater than 100%.

Further information is provided in Chapter 3 and 4 of the SuDS Manual (CIRIA C697).

Flood Risk within the Development

S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.

S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

LOCAL STANDARDS

In addition to the above National Standards, Wokingham Borough Council has the following local standards:

WokBC-LS16 As the drainage system requires appropriate space and the overland flow routes during exceedance events must be considered, it is essential that consultation with stakeholders takes place before the masterplan is fixed.

WokBC-LS17 Overland flow/exceedance routes/storage areas should be outside private ownership areas unless otherwise avoidable.

WokBC-LS18 It should be demonstrated that any blockage within the system and extreme rainfall volumes can be accommodated through safe overflow routes. Flow across the site should be diverted away from buildings and main access-egress routes across the site.

WokBC-LS19 For major development the route and depth of overland flows must be demonstrated for the proposed final ground levels incorporating the buildings and walls. The application shall provide details of flood depths and flood water velocities (for events up to the 100 year plus allowance of the effects of climate change) in the overland flow / exceedance routes to demonstrate properties / occupants will not be placed at an unacceptable risk during overland flow / exceedance events.

WokBC-LS20 The location and form of buildings (e.g. terraces or linked detached) shall not impede overland flow routes or create ponding. The position of walls, bunds or other obstructions may direct but must not impede flow routes or create ponding.

WokBC-LS21 Small controls (orifice plates, slots etc.) shall be visible from the surface without the need for removal or covers or use of special access facilities (e.g. visible through gratings). Thus any blockage can be readily identified by walk-by inspection.

WokBC-LS22 All details of non-standard structures or chambers in excess of 1m deep or 600mm diameter, or 600mm high shall be submitted with structural design calculations relating to the ground conditions proven by site investigations.

Structural Integrity

S10 Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.

S11 The materials, including products, components, fittings or naturally occurring materials, which are specified

²⁶ BS 8582:2013 Code of practice for surface water management for development sites - Section 8.3

by the designer must be of a suitable nature and quality for their intended use.

LOCAL STANDARDS

In addition to the above National Standards, Wokingham Borough Council has the following local standards:

WokBC-LS22 All details of structures or chambers in excess of 1m deep or 600mm diameter, or 600mm high shall be submitted with structural design calculations relating to the ground conditions proven by site investigations.

WokBC-LS23 Proprietary systems are only acceptable if the designers, suppliers and installers provide a full replacement warranty for the life span of the SuDS (e.g. 'Geocellular' system, vortex separators etc.).

WokBC-LS24 All infiltration systems must be sited so that they do not compromise the structural stability of buildings or roads. They must not be situated within 5m of any building or road and if situated on chalk geology they must be sited in accordance with CIRIA C754 – Engineering in Chalk.

Designing For Maintenance Considerations

S12 Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity.

Local Standards

The effectiveness of SuDS over their lifetime is dependent on their maintenance. Wokingham Borough Council as the LLFA and statutory consultee on major planning applications will seek to ensure through planning obligations or planning conditions that there are clear arrangements for the maintenance of the drainage system for the lifetime of the development. On this basis in addition to the above National Standards, Wokingham Borough Council has the following local standards:

WokBC-LS25 The drainage system must be designed to take account of the operation, maintenance and repair requirements of both surface and subsurface components, allowing for any personnel, vehicle or machinery access required to undertake this work.

WokBC-LS26 The drainage system must be designed to ensure that the maintenance and operation requirements are economically proportionate for all parties involved.

WokBC-LS27 Schedules for the recommended planned maintenance activities for each component of the drainage system shall be submitted to the Local Planning Authority for review with the planning application. The schedules shall clearly illustrate how safe access can be achieved to enable the required maintenance activities to be carried out.

WokBC-LS28 Arrangements for the maintenance of the drainage system for the entire lifetime of the development must be clearly defined and agreements demonstrated to be in place to ensure these arrangements do not lapse. Furthermore, Wokingham Borough Council will not adopt below ground storage features. Therefore, developers will be required to provide details of who will be responsible for maintaining such features.

WokBC-LS29 Maintenance records for all SuDS features including both regular activities such as vegetation control and intermittent interventions such as sediment removal, repairs/replacement works shall be maintained for the lifetime of the development. These records shall be available at the request of the Lead Local Flood Authority.

WokBC-LS30 Agreements must be in place to ensure the operation of the drainage system for the lifetime of the development. This must include arrangements for any features of the drainage system that require operation including all electrical and mechanical components. In addition arrangements must be in place to ensure any blockages are identified and removed for the lifetime of the development to ensure the performance of the drainage system is maintained.

Further information is provided in Chapter 22 of the SuDS Manual (CIRIA C697).

Construction

S13 The mode of construction of any communication with an existing sewer or drainage system must be such that the making of the communication would not be prejudicial to the structural integrity and functionality of the sewerage or drainage system.

S14 Damage to the drainage system resulting from associated construction activities must be minimised and

must be rectified before the drainage system is considered to be completed.

LOCAL STANDARDS

In addition to the above National Standards, Wokingham Borough Council has the following local standards:

WokBC-LS31 The drainage system must be constructed in accordance with the approved design such that materials, including products, components, fittings or naturally occurring materials, are adequately mixed or prepared and applied, used, or fixed so as to perform adequately the functions for which they are intended and constructed in a workmanlike manner.

WokBC-LS32 Once constructed in accordance with the approved design, an approving body must presume that a drainage system is functioning in accordance with the approved design unless there is evidence to demonstrate that it is not.

WokBC-LS33 Temporary flood and pollution control measures must be used during the construction phase in order to ensure:

the site and surrounding areas do not flood prior to completion of the drainage system;

successful, efficient SuDS are constructed; and

downstream pollution is avoided.

WokBC-LS34 During the construction phase particular attention needs to be given to:

- site access;
- site drainage during construction;
- storage of materials; and
- protection of surfaces from erosion, sedimentation and over compaction.

WokBC-LS35 Access arrangements during construction should ensure buffer zones around drainage features are avoided and valuable vegetation is not disturbed or damaged.

WokBC-LS36 Silt-laden site runoff must not be allowed to enter SuDS drainage systems unless it has been allowed for in the design and specification.

WokBC-LS37 Sediment basins, traps and runoff control measures must be installed before any major site grading is undertaken, with additional traps and fences being installed where necessary as grading takes place.

WokBC-LS38 The final construction of SuDS (such as soiling and seeding) should not normally take place until the end of site development work, although the form of the drainage will be constructed during the earthworks phase. The SuDS may be completed at an earlier stage so long as adequate provision is made to remove any silt that is deposited during construction operations.

WokBC-LS39 Any pervious surfaces should not be constructed unless adequate protection is provided to prevent clogging or binding once it has been constructed. The function of permeable systems will be destroyed if soil or subsoil is deposited on the surface and should be avoided.

WokBC-LS40 SuDS with surface-formed features, such as filter strips and swales, must be fully stabilised by planting or temporary erosion protection before any runoff is allowed to flow on to or through them. This will prevent erosion of the sides and base of the features, and ensure clogging of other parts of the system by the silt that is entrained does not occur.

Prior to undertaking construction planning the CIRIA Site handbook for the construction of SuDS (C698) should be consulted. The handbook provides further detailed information about the requirements that need to be accounted for during the construction stage.

Further information is provided in Chapter 21 of the SuDS Manual (CIRIA C697).

Design

There are no National Standards to assist in the suitable/appropriate design of SuDS. To ensure consistency in approach to the design and assessment of planning applications with drainage components Wokingham Borough Council expect the flood local standards to be applied:

WokBC-LS41 The drainage system must be designed so that surface runoff not collected for use must be discharged to one or more of the following, listed in order of priority:

- discharge into the ground (infiltration); or where not reasonably practicable,
- discharge to a surface water body; or where not reasonably practicable,
- discharge to a surface water sewer, highway drain, or another drainage system; or where not reasonably practicable,
- discharge to a combined sewer.

WokBC-LS42 Details submitted with the drainage proposals shall demonstrate why discharge to one of the above is not reasonably practical before consideration of alternative discharge routes.

WokBC-LS43 The destination of all discharges must be clearly defined and justified. This must include the location of any outfall points marked on appropriate plans.

WokBC-LS44 Applicants shall provide confirmation of agreement in principal with all relevant stakeholders for all proposed outfall points.

WokBC-LS45 Any proposed discharge to ground shall be supported by appropriate infiltration testing results in accordance with the requirements of Building Regulations Approved Document H – Part H3. Infiltration testing results must be recorded at the same position and depths proposed for infiltration devices.

WokBC-LS46 Any designs that propose deviations from standard best practice should be discussed in advance with Wokingham Borough Council. Evidence of correspondence and agreement that the proposed departure is acceptable must be provided with the planning application.

Further information is provided in Chapter 3 and 4 of the SuDS Manual (CIRIA C697) and Sewers for Adoption 7th Edition.

Water Quality

There are no national standards to assist in the suitable/appropriate design of SuDS with regards to Water Quality. Wokingham Borough Council recognises the

obligation it has to ensure the quality of the aquatic environment for current and future generations. With this in mind Wokingham Borough Council has the following local standards:

WokBC LS47 The drainage system must be designed and constructed so surface water discharged does not adversely impact the current water quality of receiving water bodies or its potential for improvement in water quality, both during construction and when operational.

WokBC LS48 To ensure that appropriate treatment is provided of surface water runoff to ensure adverse impacts on the water quality or receiving water bodies is minimised, appropriate treatment train components must be included in the drainage system following the guidance of the SuDS manual (Table 3.3).

WokBC LS49 At least one surface SuDS feature shall be deployed within the management train. Only if surface features are demonstrated as not viable, as a last resort an approved propriety engineered pollution control feature, such as vortex separator, serviceable/replaceable filter screens, and pollution interceptors may be used.

WokBC LS50 If the proposed development site is contaminated due to previous uses, discussions must be held with Wokingham Borough Council to establish the appropriate level of treatment required for surface water runoff before discharge from the site.

WokBC LS51 If the proposed development site has contaminated ground and the runoff is proposed to discharge to ground, appropriate measures must be taken to ensure infiltration devices do not mobilise pollutants and contaminate groundwater. Agreement to the proposed mitigation proposals shall be sought from the Environment Agency.

WokBC LS52 Prior to discharge into any inaccessible infiltration system measures must be provided to remove silt, suspended or floating matter.

WokBC LS53 All outfalls to watercourses from a proposed development should include a means to isolate the site drainage system in the event of a pollution incident on site. This may be provided by a penstock or stop logs immediately upstream of the outfall to protect the receiving watercourse.

Further information is provided in Chapter 3 of the SuDS Manual (CIRIA C697).

Multi-functionality

There are no national standards to assist in the suitable/appropriate design of SuDS with regards to their multi-functionality. Wokingham Borough Council recognises the potential for elements of drainage systems to serve multiple functions. With this in mind Wokingham Borough Council has the following local standards:

WokBC LS54 Where site constraints dictate SuDS can be designed as part of multi-functional spaces such as sports and recreational areas. The expected design frequency of inundation areas and attenuation function should be determined in order to facilitate and manage multi-function use.

WokBC LS55 Access for the mobility impaired should be provided for multi-functional areas. It is recommended that a surfaced path 3m wide with a longitudinal gradient not exceeding 1 in 20 should be included. For steeper slopes, landings shall be provided in accordance with BS 8300 Section 5. See also paragraph 5.8.2 of BS 8300, Table 1: limits for ramp gradients.

WokBC LS56 Where dry detention basins or infiltration basins are proposed, a lower area should be provided to restrict the wet areas during frequent events and thus maximise the duration and extent of areas used for recreation.

Landscape and Visual Impact

There are no national standards to assist in the suitable/appropriate design of SuDS with regards to ecology. Wokingham Borough Council recognises the contribution well designed SuDS can have to create / enhance local habitats and increase local biodiversity. With this in mind Wokingham Borough Council has the following local standards:

WokBC LS57 Water should be kept above the ground surface wherever possible and SuDS should be considered as an integral part of the landscape or urban design. Development proposals should take into account landscaping proposals to maximise the potential for green attenuation systems to be distributed throughout the site.

WokBC LS58 SuDS features should be visually attractive, such as ponds and wetlands, with details such as channels, canals and cascades to provide visual interest.

WokBC LS59 Where possible, all hard structures such as inlets, outlets and headwalls should be designed to be unobtrusive. Appropriate cladding such as local stone should be considered.

WokBC LS60 The shape and depth of swales or basins below surrounding ground should be integrated into the landscape.

Further information is provided in Chapter 20 of the SuDS Manual (CIRIA C697).

Ecology

There are no national standards to assist in the suitable/appropriate design of SuDS with regards to their potential ecological benefits. Wokingham Borough Council recognises the obligation it has to ensure the quality of the aquatic environment for current and future generations. With this in mind Wokingham Borough Council has the following local standards:

WokBC LS61 Where present, natural drainage features on and / or around development sites shall be retained and appropriately enhanced.

WokBC LS62 Local plant material must be used where possible to allow natural colonisation of SuDS features. Invasive or vigorously colonising species should be avoided. All planting in open SuDS should be native to the UK, ideally of local provenance, and from an accredited source to avoid the introduction of alien species.

WokBC LS63 Tree and shrub selection and care must take into account the need for permanent vegetated ground cover and must not compromise access.

WokBC LS64 A shallow aquatic edge to ponds and wetlands should be included, with a maximum depth of 450mm and minimum width of 1m.

WokBC LS65 The primary function of SuDS is flood prevention, consequently the maintenance regime must not be restricted by ecological requirements to the detriment of flood prevention. The design of the shape or depth of water bodies or type of vegetation should not be deliberately selected to create habitats for protected

species. The SuDS should have a maintenance regime which discourages the development of protected habitats. Grass strimming, grass cutting and silt removal, dredging shall be carried out on a frequent basis to maintain the designed flow regime. To discourage excessive vegetation within the main body of a water feature the bed should be at least 1m below normal water level and thus limit light levels on the bed.

Further information is provided in Chapter 20 of the SuDS Manual (CIRIA C697).

Health and Safety

There are no national standards to assist in the suitable/appropriate design of SuDS with regards to their health and safety requirements. Wokingham Borough Council recognises the obligation it has to ensure drainage systems are safe for current and future generations. With this in mind Wokingham Borough Council has the following local standards:

WokBC LS66 Information should be provided to inform residents and the public of the SuDS design and features on the site.

WokBC LS67 All open water features must be assessed regarding the risk of drowning, particularly to small children, and must demonstrate that all reasonable measures have been taken to minimise the risk of drowning or harm. Risk to the public, maintenance staff and wildlife must also be minimised.

WokBC LS68 The management of open water features must consider the potential risk of Weil's disease, transmitted through rat urine. CIRIA Report RP 992-5 WP1 Safety Framework and Checklist provides further guidance.

WokBC LS69 Although malaria is not currently a risk in the UK, this must be considered in the design of wetlands by reducing preferential breeding areas for mosquitoes such as small temporary pools unconnected to open water. In well-designed SuDS the water must be moving with a residence time of only a few days. In addition, emergent vegetation must have minimal submerged growth to reduce the available locations for larvae to develop.

WokBC LS70 Where open water habitat is located within 8 miles of an airport, guidance provided by the [Civil Aviation](#)

[Authority \(www.caa.co.uk\)](#) must be followed to minimise the risk of aircraft bird strike.

Further information is provided in Chapter 22 and 24 of the SuDS Manual (CIRIA C697).

Planning Conditions

WBC and LPA will make use of planning conditions to ensure that the national and local requirements for SuDS are met by new developments. Appendix A sets out the expected contents of planning applications of different scales of applications and at different stages of the planning process. These checklists contain the information required to comply with the SuDS Standards, however if any of these are not met WBC may choose to use planning conditions to ensure the required level of information is provided.

The following sections detail some typical conditions which may be placed upon planning approvals with regards to drainage and the provision of SuDS. The list is not exhaustive. Conditions specific to development sites and/or the details submitted with planning applications may give rise to alternative / additional planning conditions being attached to planning permissions.

Pre-commencement conditions

No development shall commence until a surface water drainage scheme for the site, based on sustainable drainage principles and an assessment of the hydrological and hydro geological context of the development, has been submitted to and approved in writing by the local planning authority. The scheme shall be implemented in accordance with the approved details before the development is completed.

No development shall take place until a surface water drainage scheme (SWDS) for the site, based on sustainable drainage principles and an assessment of the hydrological and hydro-geological context of the development, has been submitted to and approved in writing by the Local Planning Authority. The drainage strategy shall demonstrate that surface water run-off generated up to and including the 1 in 100 years critical storm, with a suitable allowance for climate change included, will not exceed the run-off from the undeveloped site following the corresponding rainfall event and that flood risk will not be

increased elsewhere and that surface water run-off from the site over any other property will not increase as a result of the development. The SWDS shall subsequently be implemented in accordance with the approved details before the development is completed. The SWDS shall include details of how the surface water drainage shall be maintained and managed after completion.

The development shall be carried out in accordance with the submitted NPPF Flood Risk Assessment & Preliminary Surface Water Drainage Strategy

Development shall not commence until a drainage strategy detailing any on- and off-site drainage works, along with proposed points of connection, has been submitted to and approved by the Local Planning Authority in consultation with the sewerage undertaker. No discharge surface water from the site shall be accepted into the public system until the drainage works referred to in the strategy have been completed.

Prior to commencement of the development a minimum of 6 months of ground water monitoring data (Incorporating a full October to March period) must be submitted to the Local Authority. The data should be related to levels below ground level and above Ordnance Datum. The maximum level of the groundwater recorded should be used to inform the design of any infiltration devices across the site.

No development shall take place until full details of the Drainage System(s) have been submitted to and approved in writing by the Local Planning Authority. These shall include:

- Results of intrusive ground investigations demonstrating the depth of the seasonally high groundwater table and infiltration rates determined in accordance with BRE Digest 365.
- Confirmation of the design standard of the proposed soakaway(s), ensuring that the soakaway(s) has been built in line with The Building Regulations 2010 – Drainage and Waste Disposal, Section H3, and is not built within 5m of a building or road.

- Full details of all components of the proposed drainage system including dimensions, locations, gradients, invert and cover levels and drawings as appropriate.
- Confirmation that the maximum discharge level of any infiltration SuDS feature has been kept as shallow as possible, and is above the seasonally high ground water level. There should be at least 1 metre between the base of the feature and the seasonally high ground water level.
- Agreement in principal from the Environment Agency for discharge to ground for this type of development.

Pre-occupation conditions

No building or use hereby permitted shall be occupied or the use commenced until the sustainable urban drainage scheme for this site has been completed in accordance with the submitted details. The sustainable urban drainage scheme shall be managed and maintained thereafter in accordance with the agreed management and maintenance plan. Written confirmation of agreements for the management and maintenance of the drainage scheme shall be submitted and approved by the local planning authority.

No building or use hereby permitted shall be occupied or the use commenced until a GIS shape file for the drainage system serving the site as agreed with the adopting authority is submitted to the local planning authority.

No building or use hereby permitted shall be occupied or the use commenced until evidence of legal covenants associated with the deeds of properties relating to any aspects of a drainage system(s) that passes through private ownership but serves multiple properties is submitted to the local planning authority.

Planning Application Drainage Checklists

Major Development Outline Applications

Outline planning applications for Major Developments must include the following information and details on the proposed drainage strategy and system(s).

Ref.	Documentation required	Requirement met/included
	<p>The applicant shall submit a description of the proposed drainage system(s) with an explanation of key operating principles and design decisions including but not necessarily limited to:</p> <ul style="list-style-type: none"> ■ Identification of the destination of discharge (in accordance with Building Regulation Part H hierarchy) with appropriate justification for the selection; ■ Identification of proposed points of connection(s) to water bodies, sewers, public surface water sewers or highway drains etc.; ■ Evidence of agreement in principal from key third parties whose systems the proposed drainage system will need to connect / impact (Environment Agency, Lead Local Flood Authority, Thames Water or adjacent landowner); ■ Identification of the SuDS techniques that will be applied at the site with appropriate justification for the selection; ■ A description of how water will be collected and dealt with across the site by the proposed SuDS techniques including what volumes are to be stored where; ■ A description of the water quality treatment measures applied to surface water as it drains the site; ■ Where necessary a description of how the proposed system(s) will deal with surface water overland flow flooding originating from off-site areas; ■ Where necessary, an explanation of why it is not reasonably practicable to achieve any of the non-statutory technical standards for sustainable drainage systems (March 2015); ■ Where proposing discharge to ground; evidence to support proposed infiltration rates used in initial calculations. This should include nearby borehole logs, geological mapping and if available any geotechnical investigations, infiltration tests and records of groundwater monitoring. Consideration shall also be given to the implications of any local Source Protection Zones; ■ Where necessary, identification of any mechanical or electrical features necessary for the effective operation of the drainage strategy; and; ■ Proposals for the adoption and maintenance of the entire drainage system(s), including a schedule, with written agreement in principal from the adopting/maintaining body. 	
	Plans & Drawings Required	

	<p>The applicant shall submit plans defining the proposed drainage system including but not necessarily limited to:</p> <ul style="list-style-type: none"> ■ Topographic survey of the site including local surface water drainage features; ■ Position of the site relative to surrounding flood sources, including where necessary identification of surface water/groundwater flows entering the development from adjacent land; ■ Where necessary definition of sub-catchments within the site; ■ A conceptual plan of the proposed drainage system(s) identifying the proposed point(s) of outfall, position of SuDS techniques / drainage features, the attenuation features, conveyance routes (including exceedance routes) comprising the drainage system(s); and ■ A thematic plan of the existing and proposed developments identifying land uses / coverings significant in informing discharge rates. 	
	Calculations Required	
	<p>Overview design calculations and design parameters to demonstrate conformity with the design criteria for the site. These should include:</p> <ul style="list-style-type: none"> ■ Demonstration through calculation of the existing and proposed (unmitigated) development discharge rates for the 1, , 30 and 100 year (including allowance for the effects of climate change) design storm events; ■ Demonstration through calculation(s) of the volumes of surface water storage required to attenuate site discharges to pre-development / agreed discharge rates; ■ Demonstration through calculation(s) that the proposed drainage system(s) will not result in flooding off site under the 100 year return period design storm including allowance for climate change; and ■ Demonstration through calculation(s) that provision is made to meet long term storage volumes required for the site, unless discharge rates have been restricted to QBar for all storm events up to and including the 1 in 100 year including allowance for climate change 	

Additional requirements for a large site or multi-plot development (including Strategic Development Locations).

Ref.	Detail required	Requirement met/included
	<ul style="list-style-type: none"> ■ Plans demonstrating the phasing of drainage infrastructure (in keeping with wider development phasing proposals, demonstrating how flood risks and drainage will be managed throughout and on completion of the development. 	

Major Development Full Application (and/or discharge of conditions or reserved matters)

Full planning applications for Major Development and/or discharge of conditions or reserved matters must include the following information and details on the proposed drainage strategy and system(s).

Ref.	Documentation required	Requirement met/included
	<p>In addition to documentation required for outline applications, the applicant shall also submit:</p> <ul style="list-style-type: none"> ■ Confirmation of the destination of discharge(s) (in accordance with Building Regulation Part H hierarchy) with appropriate justification for the(ir) selection; ■ Details of any offsite works required, together with any necessary consents; ■ Where necessary, a full planting schedule with accompanying plan; ■ Where proposing to discharge to ground the results of site specific ground investigation (accounting for the variability in ground conditions), including geo-environmental characterisation and infiltration test results shall be provided. These investigations shall account for: <ul style="list-style-type: none"> • Evidence of infiltration tests, providing representative results, at the location and depth of any intended infiltration device; • Records of recorded groundwater levels over a number of visits to establish confidence in seasonal variability on groundwater levels. ■ Exceedence routes – confirmation that exceedence routes will remain clear of development in perpetuity; ■ Confirmation of the arrangements for the adoption, management / operation and maintenance of the drainage system, including but not necessarily limited to: <ul style="list-style-type: none"> • Details of which body will be responsible for operating and maintenance for the drainage proposals including their written confirmation; • A management statement to outline the management goals for the site and required maintenance; • Description of maintenance schedule and materials and tools needed; • A maintenance schedule; • Legal agreements to ensure the continued operation and maintenance of the drainage system for the lifetime of the development; • Health and safety plan, if appropriate, considering all potential health and safety risks posed by the proposed drainage system including but not limited to areas of open water, confined spaces, and steep slopes; • Access arrangements for maintenance of all aspects of the proposed drainage systems; and • Operational characteristics of any mechanical features including maintenance and energy requirements. 	
	Plans & Drawings Required	

	<p>In addition to plan and drawing required for outline applications, the applicant shall also submit:</p> <ul style="list-style-type: none"> ■ Detail drawings of connections (including flow control devices) to water bodies, sewers, public surface water sewers, highway drains and SuDS; ■ Phasing plans for implementation of the drainage system(s); ■ Details of source control measures including location, type levels and detail drawing; ■ Details of site control measures including location, type levels and detail drawing; ■ Where appropriate, details of regional control measures including location, type levels and detail drawing; ■ Details of all other drainage features including levels, detail location and detail drawings; ■ Details of those components of the drainage system(s) comprising the 'management train' for the site; ■ Conveyance and exceedance routes; ■ The destination of runoff with clearly defined outfall locations; and ■ Any surface water/groundwater flow routes entering the development from adjacent land. 	
	Calculations Required	
	<p>In addition to calculations required for outline applications, the applicant shall also submit:</p> <ul style="list-style-type: none"> ■ Full design calculations and design parameters to demonstrate conformity with best practice standards. This shall include a calculation pack for the following storm events: <ul style="list-style-type: none"> • 1:1 year; • 1:30 year; • 1:100 year; and, • 1:100 year with climate change. <p>The calculations shall be able to be referenced to appropriate drawings of the drainage system with pipe and manhole references and clearly labelled storage and conveyance features (basins, swales, tanks etc.); and,</p> ■ Confirmation of attenuation volumes provided in each storage feature along with details of freeboard allowance for each feature. 	

Additional requirements for a large site or multi-plot development.

Ref.	Detail required	Requirement met/included
	Plans demonstrating the phasing of drainage infrastructure (in keeping with wider development phasing proposals, demonstrating how flood risks and drainage will be managed throughout and on completion of the development.	

Minor Development Outline Application

For an outline planning application it must include the following information and details on the proposed drainage strategy and system.

WBC to provide any additional requirements to the following.

Ref.	Detail required	Requirement met/included
	<p>Description of the proposed drainage system with an explanation of key design decisions including:</p> <ul style="list-style-type: none"> ■ Selection of the destination of discharge with appropriate justification for the choice ■ Identification of connections to watercourses, sewers, public surface water sewers or highway drains. ■ Selection of appropriate SuDS techniques for site ■ Consideration of adequate space within the development for the drainage system ■ Consideration of water quality 	
	Evidence of consultation with key third parties whose systems the proposed drainage system will need to connect (Environment Agency, Thames Water or adjacent landowner).	
	<p>Overview design calculations and design parameters to demonstrate conformity with the design criteria for the site. These should include:</p> <ul style="list-style-type: none"> ■ Definition of the performance parameters the drainage system needs to meet ■ Allowable discharge rates and volumes from the site or infiltration rates ■ Required attenuation and long term storage volume needed to meet the required discharge rates ■ Ability of the proposed destination of discharge (waterbody, sewer or the ground) to accept runoff from the site. ■ Inclusion of allowance for climate change. 	
	<p>Plan of proposed drainage system with catchment areas including:</p> <ul style="list-style-type: none"> ■ Sub-catchments within the site ■ Impermeable areas ■ Permeable land uses (public open space and gardens) ■ Proposed drainage system features including the main storage features and conveyance routes ■ The destination of discharge from the site and outfall locations ■ Surface water/groundwater flows entering the development from adjacent land. 	
	Identification of any mechanical or electrical features including maintenance and energy requirements.	
	Indication of potential for infiltration and likely infiltration rates based on	

	available data. This should include nearby borehole logs, geological mapping and if available any geotechnical investigations or infiltration tests.	
	Concept details of how water quality standards will be reached through use of appropriate SuDS measures within the drainage system for each catchment within the development.	

Minor Development Full Application

For a full planning application it must include the following information and details on the proposed drainage strategy and system.

WBC to provide any additional requirements to the following.

Ref.	Detail required	Requirement met/included
	<p>Full design calculations and design parameters to demonstrate conformity with the design criteria for the site. This should be a calculation pack for the following storm events:</p> <ul style="list-style-type: none"> ■ 1:1 year ■ 1:30 year ■ 1:100 year ■ 1:100 year with climate change <p>The calculations should be able to be easily referenced to appropriate drawings of the drainage system with pipe and manhole references and clearly labelled storage and conveyance features (basins, swales, tanks etc.)</p>	
	<p>Suitable Construction Details.</p> <ul style="list-style-type: none"> ■ Cross sections of storage and conveyance features that form part of the drainage system. ■ Typical details of inlets, outlets, manhole chambers, flow control structures and any proprietary devices to be used in the drainage system 	
	<p>Plan of proposed drainage system with catchment areas including:</p> <ul style="list-style-type: none"> ■ Sub-catchments within the site ■ Impermeable areas ■ Phasing ■ The proposed 'management train' and total land take ■ Location and type of source control measures ■ Site control measures ■ Conveyance and exceedance routes ■ The destination of runoff with clearly defined outfall locations ■ Any surface water/groundwater flow routes entering the development from adjacent land. 	
	Details of connections (including flow control devices) to watercourses, sewers, public surface water sewers, highway drains and SuDS.	
	Details of any offsite works required, together with any necessary consents.	
	Operational characteristics of any mechanical features including maintenance and energy requirements.	
	Plan demonstrating sub-catchments for the 1 in 100 year storm when the system is at capacity and demonstrating flow paths for exceedance.	

	Access arrangements for maintenance of all aspects of the proposed drainage systems.	
	<p>Management plan for operation and maintenance of the drainage system which provides:</p> <ul style="list-style-type: none"> ■ Details of which body will be responsible for operating and maintenance for individual aspects of the drainage proposals ■ A management statement to outline the management goals for the site and required maintenance ■ Description of maintenance schedule and materials and tools needed ■ A maintenance schedule ■ Legal agreements to ensure the continued operation and maintenance of the drainage system for the lifetime of the development. <p>A site plan including access points, easements and outfalls</p>	
	Health and safety plan, if appropriate, considering all potential health and safety risks posed by the proposed drainage system including but not limited to areas of open water, confined spaces, and steep slopes.	
	<p>Ground investigation, including infiltration test results, where appropriate. These investigations should account for:</p> <ul style="list-style-type: none"> ■ The presence of constraints that must be considered prior to planning infiltration SuDS ■ The drainage potential of the ground ■ Potential for ground instability when water is infiltrated ■ Potential for deterioration in groundwater quality as a result of infiltration <p>This information is available via the British Geological Survey, by contacting enquiries@bgs.ac.uk.</p> <p>Evidence of infiltration tests, particularly at the location of any intended infiltration device, and groundwater level monitoring is also required.</p>	
	<p>Assessment of the potential water quality impact of the proposed development and how the drainage system will perform to ensure that there are no detrimental impacts on the water quality of the receiving water body.</p> <p>This should include a description of how appropriate use of the management train principles has been used to deliver water quality benefits and prevent pollution of receiving waterbodies.</p> <p>If the proposed destination of discharge is the ground, appropriate consideration should be given to potential contamination and an assessment made to ensure pollutants are not mobilised that may contaminate groundwater.</p>	
	Confirmation of land ownership of all land required for drainage and relevant permissions.	

Appendix B

Policy Context

Introduction

Sustainable surface water management has increasingly been recognised as an important consideration in national, regional and local planning as an effective means to assist in the management of flooding. A number of these policy documents must be adhered to when designing SuDS features in the Borough. The main documents are summarised below, along with links to where the full documents can be found.

European Legislation and Guidance

Water Framework Directive 2000/60/EC

The Water Framework Directive sets the challenge to meet the objectives of the improvement and the protection of the water environment across Europe, including all rivers, canals, lakes, estuaries, wetlands and coastal waters as well as water under the ground. The Directive serves as the major driver for the sustainable management of water in the UK.

The Water Framework Directive can be viewed [here](#) or by visiting ec.europa.eu/environment/water/water-framework/.

National Legislation and Guidance

The National Planning Policy Framework (2012) (NPPF)

The NPPF for England promotes the integration of SuDS features within development proposals to control surface water, improve water quality and increase biodiversity. Flood risk must be managed now and over the development's lifetime, taking account of climate change.

The NPPF is supported by a number of Planning Practice Guidance (PPG) documents. The Flood Risk and Coastal Change PPG states that priority should be given to the use of SuDS in developments in order to reduce flood risk and remove pollutants from runoff. The PPG also requires that the design of SuDS allows for maintenance of the system, to

ensure it continues to provide effective drainage. The NPPF and PPG can be viewed [here](#) or by visiting www.gov.uk.

The Flood and Water Management Act (2010) (FWMA) (the Act)

As part of the Flood and Water Management Act 2010, Schedule 3 on Sustainable Drainage set out a range of significant new responsibilities for local authorities around SuDS. Government consulted on the implementation of Schedule 3 between December 2012 and March 2013 which raised a number of issues with the proposals. As a result of the concerns an alternative approach was presented for making better use of the planning system to secure SuDS in new development. This approach was implemented on the 6th April 2015 and requires that in considering planning applications for major developments, local planning authorities should consult the relevant Lead Local Flood Authority on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

This requirement is set out in Schedule 4 of the [Town and Country Planning Act](#).

The National Standards and Specified Criteria for Sustainable Drainage

The use of the planning system to secure SuDS in new development will be supported by National Standards and Specified Criteria that set out the requirements for the design, construction, operation and maintenance of SuDS in England and Wales.

The Standards set out a number of requirements covering affordability/viability; runoff destinations; off-site flood risk; peak flow control; volume control; flood risk within the development; water quality; structural integrity; designing for economic sustainability; construction; maintenance; and operation.

It is worth noting that the standard for runoff destination adapts the hierarchy set out in Part H of the Buildings Regulations (2010), requiring that surface water runoff not collected for reuse must be discharged to one or more of the following, in order of priority:

- discharge into the ground (infiltration); or, where not reasonably practicable,
- discharge to a surface water body; or, where not reasonably practicable,
- discharge to a surface water sewer, highway drain, or another drainage system; or, where not reasonably practicable,
- discharge to a combined sewer.

The Wokingham SuDS Technical Guidance supplements the national planning guidance, setting out the local requirements for SuDS in the Borough.

The National Standards and Specified Criteria can be viewed at www.gov.uk.

The Buildings Regulations – Part H (December 2010)

In addition to establishing a hierarchy for surface water disposal, Part H of the Buildings Regulations: Drainage and Waste Disposal sets out a number of requirements that must be adhered to when designing infiltration SuDS features. In addition, the regulations require separate drainage systems to be provided for any areas where materials which could cause pollution are stored or used.

Click [here](http://www.planningportal.gov.uk) to view the Building Regulations or visit www.planningportal.gov.uk.

River Basin Management Plans (RBMP)

River Basin Management Plans (RBMP) have been prepared under the Water Framework Directive, which requires all countries throughout the European Union to manage the water environment to consistent standards. RBMPs assess the pressures facing the basin and set out potential actions to address them. The Plans are produced in a continuous process of planning and delivery. The Water Framework Directive introduces a formal series of six year cycles for River Basin Management Plans. The first cycle ends in 2015, with the second Plan to be published in autumn 2015.

The Wokingham Borough Council administrative area is covered by the Thames River Basin Management Plan. The main issues to address in the Thames River Basin include:

- point source pollution from water industry sewage works;

- physical modification of water bodies;
- diffuse pollution from agricultural activities;
- abstraction; and
- diffuse pollution from urban sources

The Thames RBMP lists a number of actions to help address the above issues and achieve improvements.

The Thames RBMP can be accessed [here](http://www.environment-agency.gov.uk), or at www.environment-agency.gov.uk.

Local Guidance

Wokingham Borough Core Strategy (January 2010)

Wokingham Borough Council's Core Strategy was adopted in January 2010 and forms part of the suite of documents which make up the Council's Local Development Framework. The Core Strategy sets out the vision for how the Borough will be developed in the period up to 2026. The document contains a number of policies on the various different types of development in the Borough, which will ensure that development takes account of the health, wellbeing and quality of life of the Borough's residents. All development proposals in the Borough will need to comply with the relevant Core Strategy policies.

The following Core Strategy policy must be adhered to when designing SuDS for new and re-development:

Policy CP1: Sustainable Development

Under policy CP1 planning permission will be granted for development proposals that:

- 1) *Maintain or enhance the high quality of the environment;*
- 2) *Minimise the emission of pollutants into the wider environment;*
- 3) *Limit any adverse effects on water quality (including ground water);*
- 4) *Ensure the provision of adequate drainage;*
- 5) *Minimise the consumption and use of resources and provide for recycling;*
- 6) *Incorporate facilities for recycling of water and waste to help reduce per capita water consumption;*
- 7) *Avoid areas of best and most versatile agricultural land;*
- 8) *Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;*
- 9) *Avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater);*
- 10) *Provide attractive, functional, accessible, safe, secure and adaptable schemes;*
- 11) *Demonstrate how they support opportunities for reducing the need to travel, particularly by private car in line with CP6; and*
- 12) *Contribute towards the goal of reaching zero-carbon developments as soon as possible by:*
 - a) *Including appropriate on-site renewable energy features; and*
 - b) *Minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form.*

The Core Strategy also stresses that landowners and developers have primary responsibility for protecting their land against the risk of flooding and that they are also responsible for managing the drainage of their land such that they do not adversely affect adjoining properties. The document reiterates the importance of designing development in accordance with relevant national policy to ensure development is steered away from areas that are most at risk from flooding and does not exacerbate existing flooding problems. Flood risk management should be

incorporated into the development and changes to flood risk over the lifetime of the development as a result of climate change should be considered. The Core Strategy also stresses the importance of using SuDS to minimise the risk and impact of flooding and notes that developers will be expected to provide and fund effective SuDS maintenance regimes.

Wokingham Borough Managing Development Delivery Local Plan (February 2014)

Adopted in February 2014, Wokingham Borough Council's Managing Development Delivery Local Plan supports the Borough's Core Strategy, providing additional detail and support to the Core Strategy policies. Together the Core Strategy and the Managing Development Delivery Local Plan set out how the Borough will develop up to 2026.

All surface water drainage strategies for new developments and re-developments in the Borough must comply with the following Managing Development Delivery Local Plan policy:

Policy CC10: Sustainable Drainage

- 1) *All development proposals must ensure surface water arising from the proposed development including taking into account climate change is managed in a sustainable manner. This must be demonstrated through:*
 - a) *A Flood Risk Assessment; or*
 - b) *Through a Surface Water Drainage Strategy.*
- 2) *All development proposals must:*
 - a) *Reproduce greenfield runoff characteristics and return run-off rates and volumes back to the original greenfield levels, for greenfield sites and for brownfield sites both run-off rates and volumes be reduced to as near greenfield as practicably possible; and*
 - b) *Incorporate Sustainable Drainage Systems (SuDS), where practicable, which must be of an appropriate design to meet the long term needs of the development and which achieve wider social and environmental benefits*
 - c) *Provide clear details of proposed SuDS including the adoption arrangements and how they will be maintained to the satisfaction of the Council [as the Lead Local Flood Authority (LLFA)]*
 - d) *Not cause adverse impacts to the public sewerage network serving the development where discharging surface water to a public sewer.*

Policy CC10 stresses the importance of ensuring SuDS are an integral part of a development scheme, which will always be more effective when considered at the early stage of the design process before the rest of the development is designed.

SuDS should be the first choice for managing surface water. All development proposals must follow the SuDS Management Train and be technically feasible. This is especially important for strategic developments, where a whole-site approach to SuDS should be applied to ensure the most sustainable and effective management of surface water.

SuDS should be designed to be positive features and opportunities should be taken to integrate SuDS features that will contribute to the local character of the space.

The long-term maintenance of SuDS within the development must be addressed in order to ensure the drainage system remains functional and effective over the lifetime of the development.

Wokingham Borough Council Strategic Flood Risk Assessment (February 2012)

The Strategic Flood Risk Assessment (SFRA) provides an overview of all sources of flood risk throughout the Borough. It builds upon existing knowledge of flood risk and that sourced through consultation with the Environment Agency, Thames Water and Town and Parish Councils.

The SFRA informs the preparation of Local Plans and future planning decisions, including planning application decisions. The document sets out a number of recommendations that must be addressed in the production of planning applications. The following SFRA recommendation reiterates the use of SuDS in developments:

"In accordance with Government policy it is recommended that developers seek to use SuDS for management of surface runoff. SuDS should be considered early within the site planning process as optimum placement of SuDS devices will affect the site design."

Catchment Flood Management Plans

CFMPs provide an overview of flood risk across a river catchment; they consider all types of flooding and consider the impacts of climate change. Key policies and actions at the catchment scale are provided in order to assist in the management of flood risk. CFMPs have been produced by the Environment Agency and are to be used as a tool that informs the management of flood risk on a river catchment basis. A CFMP has been developed for the River Thames catchment. Wokingham Borough extends over three sub areas of the CFMP, namely the Loddon; the Upper and Middle Blackwater; and the Addlestone Bourne, Emm Brook, The Cut. These sub areas fall under two main policy units within the Thames CFMP:

■ **The Upper and Middle Blackwater**

Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

■ **The Loddon, Addlestone Bourne, Emm Brook, The Cut**

Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

To view the River Thames CFMP click [here](#) or visit www.gov.uk.

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Allocated Development Sites

Introduction

Following on from the summary table provided in Section 1.5, the following section provides details of the drainage and flood risk pressures in the catchment of each of the potential development sites and the expectations on each site in terms of addressing these pressures.

Land at 146 London Road (RU103)

Proposed Development: 15 residential dwellings

Current Use: Greenfield

Site Size: 0.63ha

Flood Zone: 1

Area in Flood Zone: 100%

This in-fill development is situated to the north-west of Ruscombe centre. The closest Main River is the River Loddon, located approximately 1.25km to the west of the site. There are a number of drainage ditches within Ruscombe; however none of these ditches are located within or adjacent to the site boundary. The western half of the site is shown to be at risk of surface water flooding with a low to high chance of occurrence. This area is part of a larger overland flow path which flows from north-east to south-west, towards the River Loddon.

The proposed development is located in the Loddon (Swallowfield to Thames) catchment. The overall Water Framework Directive status of the Loddon (Swallowfield to Thames) is Poor. The reasons the water body is at less than good status are fish levels, phytobenthos levels, and phosphate levels.

The site is located on bedrock of Lambeth Group (Clay, Silt and Sand), which is overlain by superficial deposits of River Terrace Deposits (Sand and Gravel).

The site is located above a groundwater aquifer classified as a Secondary A Aquifer. Secondary A Aquifers are typically permeable layers of rock, capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers. The site is also located in groundwater source protection zone 3, which is defined as the area around a source within

which all groundwater recharge is presumed to be discharged at the source.

The site is situated at an elevation approximately 5m higher than the River Loddon. Underlying groundwater levels in this location are likely to be directly related to the river level; the elevated nature of the site therefore suggests that high groundwater levels are not likely to be an issue at this site. However, the site is located above a groundwater aquifer and groundwater SPZ (zone 3). Seasonal variations in groundwater levels at the site should therefore be monitored, along with infiltration testing, in order to determine the potential to discharge surface water runoff to ground.

If infiltration is found not to be viable at the site, Wokingham Borough Council would expect all surface water drainage to be discharged to the public surface water sewer, in accordance with the hierarchy of discharge set out in Part H of the Building Regulations: Drainage and Waste Disposal. Either infiltration or discharge to public surface water sewers would be expected as the means of discharge for this site due to the absence of watercourses within the vicinity of the application site.

In order to ensure greenfield runoff rates and volumes at the site, Wokingham Borough Council would look to see the use of above ground source control and site control SuDS features. In order to improve the water quality of the wider catchment Wokingham Borough Council would look to see the use of features such as buffer strips, sedimentation boxes, and swales to reduce the Total Phosphorous in waterbodies and features such as swales, wetlands and buffer strips to enhance biodiversity of the waterbodies. The use of larger site control features such as ponds and detention basins may also be viable for this site, depending on seasonal variations in groundwater levels. The relatively small size of the site may mean that these features are not feasible for the proposed development.

Wokingham Borough Council would also expect to see a description of how the proposed drainage system will deal with the surface water overland flow flooding originating from off-site areas.

A minimum of three stages of treatment would be required at this proposed development site, due to the groundwater aquifer underlying the site and the groundwater SPZ (zone 3) in which the site is located. In order to ensure the

underlying aquifer is not contaminated from surface water runoff at the site, SuDS features at the beginning of the treatment train may require lining.

Land Off Smith Walk (WK175)

Proposed Development: 18 residential dwellings

Current Use: Greenfield

Site Size: 0.67ha

Flood Zone: 1

Area in Flood Zone: 100%

The proposed development site is situated at the southern end of Fernlea Drive to the west of Wokingham town centre. The closest watercourse to the site is the Emm Brook, approximately 85m to the south-east of the site. The site is outside of the Emm Brook floodplain and is therefore wholly situated in Flood Zone 1. A very small area along the western boundary of the site is shown to be at low risk of surface water flooding.

The proposed development is located in the Emm Brook catchment and the overall Water Framework Directive Status of the Emm Brook is moderate. The reasons that the water body is at less than good status are fish levels and phosphate levels.

The geology underlying the site is classified as Unproductive Strata, which is defined as rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. Therefore, the site is not underlain by an aquifer. Despite the close proximity of the site to the Emm Brook, it is anticipated that the underlying geology and absence of an underlying aquifer means that the groundwater levels beneath the site are not likely to be in continuity with flows in the Emm Brook, and the risk of groundwater flooding at the site is anticipated to be low.

It is anticipated that the infiltration rate at the site will be low due to the underlying geology (London Clay Formation) and infiltration will not serve as a feasible means of discharge for the site. If infiltration at the site is found to be unviable, Wokingham Borough Council would expect to see discharge to a watercourse (ditch connected to a larger watercourse) where possible. Alternatively, if connection to a watercourse is not feasible, Wokingham Borough Council

would expect to see discharge to the Thames Water surface water sewer network.

In order to ensure greenfield runoff rates and volumes at the site, Wokingham Borough Council would look to see the use of above ground source control and site control SuDS features. In order to improve the water quality of the wider catchment Wokingham Borough Council would look to see the use of features such as buffer strips, sedimentation boxes, and swales to reduce the Total Phosphorous in waterbodies and features such as swales, wetlands and buffer strips to enhance biodiversity of the waterbodies. Below ground site control features such as permeable paving may also prove suitable for this site. The use of larger site control features such as ponds and detention basins may be appropriate to attenuate runoff at the site but are likely to need to be lined in order to ensure groundwater seepage does not occur. The relatively small size of the site may mean these features are not feasible for the proposed development.

Land Off Norton Road (WK176)

Proposed Development: 7 residential dwellings

Current Use: Previously developed

Site Size: 0.15ha

Flood Zone: 1

Area in Flood Zone: 100%

The proposed development site is located on the land to the east of Norton Road and Kendrick Close, just south of Wokingham town centre. The closest watercourse to the development is the Emm Brook, which is situated approximately 325m to the south of the site. The site is situated at an elevation approximately 10m higher than the watercourse, and as a result is wholly located in Flood Zone 1. There are a number of areas shown to be at risk of surface water flooding along the eastern boundary and through the western area of the site. These areas are indicated to be part of an overland flow route which originates to the north of the site.

The proposed development is located in the Emm Brook catchment and the overall Water Framework Directive Status of the waterbody is moderate. The reasons that the water body is at less than good status are fish levels and phosphate levels.

The site is located on a bedrock of London Clay Formation (Clay, Silt and Sand) and Bagshot Formation (Sand). No superficial deposits overlie the bedrock within the vicinity of the site. The geology underlying the site is classified as Unproductive Strata, which is defined as rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. Therefore, the site is not underlain by an aquifer. It is anticipated that the underlying geology and absence of an underlying aquifer means the risk of groundwater flooding at the site is anticipated to be low.

Infiltration testing should be undertaken at the site to confirm the potential to discharge surface water runoff to ground. If infiltration is found not to be feasible at the site, Wokingham Borough Council would expect all surface water drainage to be discharged to a watercourse (ditch connected to a larger watercourse) where possible. Alternatively, if connection to a watercourse is not feasible, Wokingham Borough Council would expect to see discharge to the Thames Water surface water sewer network, in

accordance with the hierarchy of discharge set out in Part H of the Building Regulations: Drainage and Waste Disposal.

In order to ensure betterment of existing runoff rates and volumes for the site, Wokingham Borough Council would look to see the use of above ground source control and site control SuDS features. In order to improve the water quality of the wider catchment Wokingham Borough Council would look to see the use of features such as buffer strips, sedimentation boxes, and swales to reduce the Total Phosphorous in waterbodies and features such as swales and buffer strips to enhance biodiversity of the waterbodies. The use of larger site control features such as ponds and detention basins are not likely to be viable for this site due to the relatively small size of the site.

Wokingham Borough Council would also expect to see a description of how the proposed drainage system will deal with the surface water overland flow flooding originating from off-site areas.

A minimum of two stages of treatment would be required at this proposed development site, due to the potential for surface water contamination from pollutants in surface water runoff.

Land Off Viscount Way (WD110)

Proposed Development: 57 residential dwellings

Current Use: Previously developed

Site Size: 2.04ha

Flood Zone: 1

Area in Flood Zone: 100%

The proposed development site is located to the east of London Bridge Road in the centre of Woodley. The site currently forms part of an industrial estate, and the units within the site boundary are currently used for light industrial and commercial purposes. There are no watercourses within the immediate vicinity of the site, with the nearest watercourse being the River Loddon, approximately 850m to the south-east of the site. The site is completely within Flood Zone 1. Discrete areas of the site are indicated to be at low to medium risk of surface water flooding.

The proposed development is located in the Loddon (Swallowfield to Thames) catchment and the overall Water Framework Directive status of the River Loddon is poor.

The reasons the water body is at less than good status are fish levels, phytobenthos levels and phosphate levels.

A groundwater aquifer lies beneath part of the site and is classified as a Secondary A Aquifer. Secondary A Aquifers are typically permeable layers of rock, capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers. Seasonal variations in groundwater levels at the site should be monitored, along with infiltration testing, in order to determine the potential to discharge surface water runoff to ground.

If infiltration is found not to be feasible at the site, Wokingham Borough Council would expect all surface water drainage to be discharged to a public surface water sewer, in accordance with the hierarchy of discharge set out in Part H of the Building Regulations: Drainage and Waste Disposal.

In order to ensure greenfield runoff rates and volumes at the site, Wokingham Borough Council would look to see the use of above ground source control and site control SuDS features. In order to improve the water quality of the wider catchment Wokingham Borough Council would look to see the use of features such as buffer strips, sedimentation boxes, and swales to reduce the Total Phosphorous in

waterbodies and features such as swales, wetlands and buffer strips to enhance biodiversity of the waterbodies. The use of larger site control features such as ponds and detention basins may also be viable for this site, depending on seasonal variations in groundwater levels.

A minimum of two stages of treatment would be required at this proposed development site, due to the potential for both groundwater and surface water contamination from pollutants in surface water runoff. In order to ensure the underlying aquifer is not contaminated from surface water runoff at the site, all SuDS features in the area of the site overlying the aquifer must be lined.

Land To Rear Of 216b-242a Nine Mile Ride (F1140)

Proposed Development: 40 residential dwellings

Current Use: Greenfield

Site Size: 3.98ha

Flood Zone: 1

Area in Flood Zone: 100%

This proposed development site is situated to the south of Nine Mile Ride in the vicinity of Wick Hill. The closest watercourse to the site is an unnamed ordinary watercourse approximately 75m to the south-east of the site. A second unnamed ordinary watercourse is located approximately 500m to the north-east of the site. Both of these watercourse flow in an easterly direction, before flowing north to join the Emm Brook. The proposed development site is not located in the floodplain of these ordinary watercourses and is therefore, wholly within Flood Zone 1. A small area in the western area of the site is indicated to be at low risk of surface water flooding.

This development is located within both Barkham Brook and Emm Brook catchments. The Barkham Brook has an overall status of poor, due to fish levels, macrophyte levels and phosphate levels. The Emm Brook has an overall status of moderate due to fish levels and phosphates levels.

The majority of the site is situated on bedrock of Camberley Sand Formation (Sand). An area in the south-east corner is situated on bedrock of Windlesham Formation (Sand, Silt and Clay). The watercourse to the south-east of the site is also underlain by the Windlesham Formation. There are no superficial deposits overlying the bedrock in this location.

Both of the bedrock formations in the vicinity of the site are groundwater aquifers and are both classified as Secondary A Aquifers. Secondary A Aquifers are typically permeable layers of rock, capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers.

The underlying geology suggests that underlying groundwater levels in the area overlying the Windlesham Formation are likely to be directly related to the river levels in the watercourse. Groundwater levels beneath the south-east corner of the proposed development site are therefore

likely to be high at certain times of the year, and as a result, the risk of groundwater flooding cannot be disregarded.

Seasonal variations in groundwater levels at the site should be monitored, along with infiltration testing, in order to determine the potential to discharge surface water runoff to ground. The proximity to the watercourse and the underlying geology in the south-east corner suggests discharge to ground is not likely to be feasible for this area of the site. Discharge to ground is anticipated to viable for the remainder of the site.

If infiltration is found not to be viable at the whole site, Wokingham Borough Council would expect all surface water drainage to be discharged to the tributary of the Emm Brook, in accordance with the hierarchy of discharge set out in Part H of the Building Regulations: Drainage and Waste Disposal. The land between the site and the Emm Brook tributary would need to be requisitioned in order to allow surface water flows to be discharged to the watercourse. Wokingham Borough Council would expect the use of a new ditch to discharge surface water runoff to the watercourse, as opposed to a pipe.

In order to ensure greenfield runoff rates and volumes at the site, Wokingham Borough Council would look to see the use of above ground source control and site control SuDS features. In order to improve the water quality of the wider catchment Wokingham Borough Council would look to see the use of features such as buffer strips, sedimentation boxes, and swales to reduce the Total Phosphorous in waterbodies and features such as swales, wetlands and buffer strips to enhance biodiversity of the waterbodies. Below ground site control features such as permeable paving may also prove suitable for this site. The use of larger site control features such as ponds and detention basins are not recommended in the south-east corner of the site, due to the likely high groundwater levels within the vicinity of the site.

A minimum of two stages of treatment would be required at this proposed development site, due to the potential for both groundwater and surface water contamination from pollutants in surface water runoff. In order to ensure the underlying aquifer is not contaminated from surface water runoff at the site, all SuDS features must be lined.

Land At Valley Nursery (SA104)

Proposed Development: 16 residential dwellings

Current Use: Greenfield

Site Size: 1.57ha

Flood Zone: 1

Area in Flood Zone: 100%

The proposed development site at Valley Nursery is located to the north of Hurst. The site is approximately 450m east of the River Loddon and 500m west of the Kayersbridge Brook. The Whistley Green Ditch flows approximately 60m from the western site boundary and the Hatchgate Ditch 100m from the south-western corner of the site boundary. All three watercourses are designated as Main River by the Environment Agency. The site is located outside of the floodplain of these watercourses and is therefore wholly located in Flood Zone 1. The northern area of the site is shown to be at low risk of surface water flooding.

The proposed development is located in the Loddon (Swallowfield to Thames) catchment and the overall Water Framework Directive status of the River Loddon (Swallowfield to Thames) is poor. The reasons the water body is at less than good status are fish levels, phytobenthos levels and phosphate levels.

A groundwater aquifer lies beneath the site and is classified as a Secondary A Aquifer. Secondary A Aquifers are typically permeable layers of rock, capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers. The site is also located in groundwater source protection zone 3, which is defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source.

The proximity of the proposed development site to the River Loddon and Kayersbridge Brook, coupled with the underlying geology suggests that underlying groundwater levels in this location are likely to be directly related to the river levels in these watercourses. Given that the site is located at an elevation not significantly different to these watercourses, groundwater levels beneath the proposed development site are likely to be high at certain times of the year, and as a result, the risk of groundwater flooding cannot be disregarded.

Seasonal variations in groundwater levels at the site should be monitored, along with infiltration testing, in order to determine the potential to discharge surface water runoff to ground.

If infiltration is found not to be feasible at the site, it is recommended an investigation into the condition, flow, capacity and outfall of the Whistley Green Ditch and the Hatchgate Ditch drainage ditches adjacent to the site boundary be undertaken.

If infiltration is found not to be viable and the drainage ditches will not serve as a sufficient means of outfall, Wokingham Borough Council would expect all surface water drainage to be discharged to a public surface water sewer, in accordance with the hierarchy of discharge set out in Part H of the Building Regulations: Drainage and Waste Disposal. The land between the site and the ditches would need to be requisitioned in order to allow surface water flows to be discharged to the watercourses. Wokingham Borough Council would expect the use of a new ditch to discharge surface water runoff to the Whistley Green Ditch and/or Hatchgate Ditch, as opposed to a pipe.

In order to ensure greenfield runoff rates and volumes at the site, Wokingham Borough Council would look to see the use of above ground source control and site control SuDS features. In order to improve the water quality of the wider catchment Wokingham Borough Council would look to see the use of features such as buffer strips, sedimentation boxes, and swales to reduce the Total Phosphorous in waterbodies and features such as swales, wetlands and buffer strips to enhance biodiversity of the waterbodies. Below ground site control features such as permeable paving may also prove suitable for this site. The use of larger site control features such as ponds and detention basins are not recommended, due to the likely high groundwater levels within the vicinity of the site.

A minimum of three stages of treatment would be required at this proposed development site, due to the groundwater aquifer underlying the site and the groundwater SPZ (zone 3) in which the site is located. In order to ensure the underlying aquifer is not contaminated from surface water runoff at the site, all SuDS features at the site must be lined.

Land At Sonning Farm (SO101)

Proposed Development: 25 residential dwellings

Current Use: Greenfield

Site Size: 1.32ha

Flood Zone: 1

Area in Flood Zone: 100%

The site at Sonning Farm is located to the south of Sonning village centre, just south of Charvil Lane (B478). The closest watercourse to the site is an unnamed drainage ditch, approximately 300m north of the site and the River Thames is approximately 900m to the west of the site. The site is not located in the floodplain and is therefore wholly situated within Flood Zone 1. An area along the northern boundary is shown to be at low risk of surface water flooding.

The proposed development is located within the Thames (Reading to Cookham) catchment and the overall status of the Thames (Reading to Cookham) is moderate. The reasons that water body is at less than good status are macrophytes levels and phosphate levels.

A groundwater aquifer lies beneath the site and is classified as a Secondary A Aquifer. Secondary A Aquifers are typically permeable layers of rock, capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers.

The site is situated at an elevation approximately 10m higher than the River Thames. Underlying groundwater levels in this location are likely to be directly related to the river level; the elevated nature of the site therefore suggests that high groundwater levels are not likely to be an issue at this site. The site is however, located above a groundwater aquifer and seasonal variations in groundwater levels at the site should therefore be monitored, along with infiltration testing, in order to determine the potential to discharge surface water runoff to ground.

If infiltration is found not to be viable at the site, Wokingham Borough Council would expect all surface water drainage to be discharged to the public surface water sewer, in accordance with the hierarchy of discharge set out in Part H of the Building Regulations: Drainage and Waste Disposal. Either infiltration or discharge to public surface water sewers would be expected as the means of discharge for

this site due to the absence of watercourses within the vicinity of the application site.

In order to ensure greenfield runoff rates and volumes at the site, Wokingham Borough Council would look to see the use of above ground source control and site control SuDS features. In order to improve the water quality of the wider catchment Wokingham Borough Council would look to see the use of features such as buffer strips, sedimentation boxes, and swales to reduce the Total Phosphorous in waterbodies and features such as swales, wetlands and buffer strips to enhance biodiversity of the waterbodies. The use of larger site control features such as ponds and detention basins may also be viable for this site, depending on seasonal variations in groundwater levels. The relatively small size of the site may however mean these features are not feasible for the proposed development.

A minimum of two stages of treatment would be required at this proposed development site, due to the potential for both groundwater and surface water contamination from pollutants in surface water runoff. In order to ensure the underlying aquifer is not contaminated from surface water runoff at the site, all SuDS features must be lined.

Land North Of The Shires (WK151)

Proposed Development: 7 residential dwellings

Current Use: Greenfield

Site Size: 0.9ha

Flood Zone: 1

Area in Flood Zone: 100%

This proposed development is located to the north-east of Barkham, adjacent to Sandy Lane and the Shires. The closest watercourse to the site is an unnamed tributary of the Emm Brook, located approximately 225m to the north-east of the site. This watercourse flows in a north-easterly direction to join the Emm Brook approximately 1.25km from the site boundary. The site is not located in the floodplain of the unnamed ordinary watercourse and is therefore located in Flood Zone 1.

The proposed development is located within the Barkham Brook catchment and the overall status of the Barkham Brook is poor. The reasons that the water body is at less than good status are fish levels, macrophyte levels and phosphate levels.

A groundwater aquifer lies beneath the site and is classified as a Secondary A Aquifer. Secondary A Aquifers are typically permeable layers of rock, capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers.

The site is situated at an elevation approximately 10m higher than the Emm Brook tributary. Underlying groundwater levels in this location are likely to be directly related to the river level; the elevated nature of the site therefore suggests that high groundwater levels are not likely to be an issue at this site. The site is however, located above a groundwater aquifer and seasonal variations in groundwater levels at the site should therefore be monitored, along with infiltration testing, in order to determine the potential to discharge surface water runoff to ground.

If infiltration is found not to be viable at the site, Wokingham Borough Council would expect all surface water drainage to be discharged to the tributary of the Emm Brook, in accordance with the hierarchy of discharge set out in Part H of the Building Regulations: Drainage and Waste

Disposal. The land between the site and the ditches would need to be requisitioned in order to allow surface water flows to be discharged to the watercourse. Wokingham Borough Council would expect the use of a new ditch to discharge surface water runoff to the tributary, as opposed to a pipe.

In order to ensure greenfield runoff rates and volumes at the site, Wokingham Borough Council would look to see the use of above ground source control and site control SuDS features. In order to improve the water quality of the wider catchment Wokingham Borough Council would look to see the use of features such as buffer strips, sedimentation boxes, and swales to reduce the Total Phosphorous in waterbodies and features such as swales, wetlands and buffer strips to enhance biodiversity of the waterbodies. The use of larger site control features such as ponds and detention basins may also be viable for this site, depending on seasonal variations in groundwater levels. The relatively small size of the site may however mean these features are not feasible for the proposed development.

A minimum of two stages of treatment would be required at this proposed development site, due to the potential for both groundwater and surface water contamination from pollutants in surface water runoff. In order to ensure the underlying aquifer is not contaminated from surface water runoff at the site, all SuDS features must be lined.

Land Off Wheatsheaf Close (Wl111)

Proposed Development: 24 residential dwellings

Current Use: Greenfield

Site Size: 0.72ha

Flood Zone: 1

Area in Flood Zone: 100%

The land of Wheatsheaf Close is located to the south-west of Sindlesham, between Harrow Way and Wheatsheaf Close. Two unnamed watercourses are located within 300m of the site. The nearest watercourse is located approximately 185m to the north-east of the site and flows in a northerly direction to flow into the River Loddon 850m from the site boundary. The second is located approximately 285m to the north-west of the site and joins the Barkham Brook approximately 725m to the north of the site. The site is not located in the floodplain of these watercourses and therefore lies wholly within Flood Zone 1. The site is indicated to be at low risk of surface water flooding, with an overland flow route flowing through the centre of the site from south to north.

The proposed development is located in the Loddon (Swallowfield to Thames) catchment and the overall status of the Loddon (Swallowfield to Thames) is poor. The reasons the water body is at less than good status are fish levels, phytobenthos levels and phosphate levels.

A groundwater aquifer lies beneath the site and is classified as a Secondary A Aquifer. Secondary A Aquifers are typically permeable layers of rock, capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers.

The site is situated at an elevation approximately 5m higher than the nearest watercourses. Underlying groundwater levels in this location are likely to be directly related to the river level; the elevated nature of the site therefore suggests that high groundwater levels are not likely to be an issue at this site. The site is however, located above a groundwater aquifer and seasonal variations in groundwater levels at the site should therefore be monitored, along with infiltration testing, in order to determine the potential to discharge surface water runoff to ground.

If infiltration is found not to be viable at the site, Wokingham Borough Council would expect all surface water

drainage to be discharged to the watercourse to the north-east of the site, in accordance with the hierarchy of discharge set out in Part H of the Building Regulations: Drainage and Waste Disposal. The land between the site and the ditches would need to be requisitioned in order to allow surface water flows to be discharged to the watercourse. Wokingham Borough Council would expect the use of a new ditch to discharge surface water runoff to the tributary, as opposed to a pipe.

In order to ensure greenfield runoff rates and volumes at the site, Wokingham Borough Council would look to see the use of above ground source control and site control SuDS features. In order to improve the water quality of the wider catchment Wokingham Borough Council would look to see the use of features such as buffer strips, sedimentation boxes, and swales to reduce the Total Phosphorous in waterbodies and features such as swales, wetlands and buffer strips to enhance biodiversity of the waterbodies. The use of larger site control features such as ponds and detention basins may also be viable for this site, depending on seasonal variations in groundwater levels. The relatively small size of the site may however mean these features are not feasible for the proposed development.

A minimum of two stages of treatment would be required at this proposed development site, due to the potential for both groundwater and surface water contamination from pollutants in surface water runoff. In order to ensure the underlying aquifer is not contaminated from surface water runoff at the site, all SuDS features must be lined.

The following section provides details of the drainage and flood risk pressures in the catchment of each of the SDLs and the expectations on each site in terms of addressing these pressures.

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