Flood Risk Guidance for Development

Warwickshire County Council as Lead Local Flood Authority

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Version 1	Not publicly released	
Version 2	September 2015	
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FOREWORD

Warwickshire County Council (WCC) in its role as Lead Local Flood Authority (LLFA) has produced this Guidance to assist developers and technical experts regarding development design in Warwickshire.

Our water environment has long faced challenges because of development; building on floodplains, culverting watercourses and increased runoff volumes & pollution have all altered catchments to behave differently from their natural state.

Our vision therefore, is to change the way development values the water environment with a focus on holistic, integrated design allowing space for watercourses and sustainable drainage systems from the outset

For many years, SuDS provision has often been limited to a single attenuation feature focussing on water quantity, however well-designed SuDS can provide multiple benefits covering water quality, biodiversity and amenity, increasing the value of these spaces for the communities who will live there. During the past few years, many have learnt of the importance of outdoor space, of being able to sit and watch the world go by, with birds singing, a calmer pace of life away from the hustle and bustle; it is this placemaking that we expect SuDS to support.

Thus, we will expect SuDS to be dispersed around a development to provide benefits for all, not just in one area of a site. Alongside this, SuDS design has often focused on the extreme events. More consideration should be given to regular event and for small-scale SuDS features integrated where space is available within a masterplan.

This guidance therefore sets out the standards to which WCC LLFA expects development to be designed against and the LLFA will recommend refusal of applications where the proposals are not considered good SuDS design.

This guidance also outlines the information required as part of planning applications and it should be noted that all applications will be appraised using current legislation and best practice at the time of application. Where new proposals overlap with historic planning permissions, whilst a material consideration, the LLFA expect development design to evolve and improve those historic proposals.

CONTENTS

1 POLICIES AND GUIDANCE

1.1 National Planning Policy Framework and Planning Practice Guidance

The National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG) provides the overarching national policy and guidance relating to flood risk and sustainable drainage.

The NPPF was updated in July 2021 and the PPG followed suit in August 2022. Both updates put more emphasis on multifunctional SuDS system and this Flood Risk Guidance for Development is intended to set out WCC's expectations in meeting national and local policy and guidance.

Town and Country Planning (Development Management Procedure) (England) Order 2015 Statutory Instrument

On 15 April 2015 the Town and Country Planning (Development Management Procedure) (England) Order 2015 came into force which, under Schedule 4, made Lead Local Flood Authorities a statutory consultee for all 'major' planning applications.

LLFA's remit

The definition of 'major development' is given within Part 1 of the above Order. This is:

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;

Anything that does not fall into the above classifications is considered 'minor development.' The LLFA is only consulted on minor development at the request of the Local Planning Authority (LPA)

For major development, the LLFA is a statutory consultee on local sources of flood risk and surface water drainage matters. Local flood risk is defined as:

- Flooding from ordinary watercourses (not Main Rivers)
- Surface water flooding
- Groundwater flooding

The Environment Agency is responsible for comments relating to flood risk from Main Rivers. These are typically larger rivers and within Warwickshire, include the River Alne, Anker, Arrow, Avon, Cole, Leam, Sowe, Stour, and many other tributaries of those.

Severn Trent Water (STW) is responsible for comments relating to any of their assets. This includes sewer flooding, sewer capacity and foul water drainage.

1.2 Strategic planning documents

There are six local planning authorities (LPAs) in Warwickshire: the County Council (for certain applications), Warwick District Council, Stratford-on-Avon District Council, Rugby Borough Council, Nuneaton & Bedworth Borough Council and North Warwickshire Borough Council.

The LPAs within Warwickshire have a number of strategic planning documents such as Local Plans, Core Strategies and Supplementary Planning Documents. Some town/parish councils within Warwickshire also have adopted Neighbourhood Development Plans. Many of these strategic planning documents contain key flood risk and sustainable drainage policies or guidance.

Table 1 below provides a high-level summary of the various local planning policies across Warwickshire. However, various plans are at different stages of revision therefore the LLFA always recommend undertaking a detailed review of all available national and local policies relevant to flood risk and drainage to inform any site-specific Flood Risk Assessment (FRA) or Drainage Strategy.

1.3 Industry and Other Guidance

There is a wealth of information available on designing sustainable drainage systems, such as the CIRIA SuDS Manual C753 and the Non-statutory Technical Standards for Sustainable Drainage Systems. The key pieces of guidance are referenced at the end of this guide.

WCC Highway Design Guide

Warwickshire County Council, in their role as highways authority, have also prepared the Warwickshire Design Guide to provide direction and guidance to developers and designers when planning and delivering highway infrastructure improvements to the County Council's highway network. Part 5 of the Design Guide details the drainage and flood risk considerations that should be incorporated in to designs.

Table 1 - Local Planning Authorities - Overarching Flooding & Drainage Policies

	North Warwickshire Borough Council	Nuneaton & Bedworth Borough Council	Rugby Borough Council	Stratford District Council * Core Strategy	Warwick District Council
Local Plan Adopted	September 2021	June 2019	June 2019	Adopted July 2016	September 2017
Relevant Flood risk and SuDS policies	LP30 – Built Form LP33 – Water and Flood Risk Management	NE4 – Managing flood risk and water quality	SDC5 – Flood risk management SDC6 – Sustainable Drainage	CS.4 – Water environment and flood risk	FW1 – Reducing Flood risk FW2 – Sustainable Drainage
Policy Expectations					
Discharge rates	New development limited to greenfield runoff rate	All sites should discharge no greater than the greenfield runoff rate	Surface water should be discharged at pre-development greenfield runoff rate	No increase in surface water runoff as a result of development; greenfield sites limited to greenfield runoff rate	New development limited to QBar greenfield runoff rate
SuDS	Water attenuated through high quality SuDS	Surface water managed as close to source as possible Above-ground attenuation preferred to below-ground.	Promote enhanced biodiversity; Improve water quality; Increase landscape value; Provide good quality open spaces.	The design of SUDS should maximise the opportunity to create amenity, enhance biodiversity and contribute to a network of green and blue open spaces.	SuDS must provide water quality, amenity and bio-diversity benefits Presumption against below-ground attenuation
Culverts	Integrate existing watercourses at an early space. Evidence will be required why deculverting is not possible. Culverting allowed only in exceptional circumstances	New development should seek opportunities to provide river restoration & enhancement including deculverting		Culverts only permitted for access Culverts must be removed unless demonstrated impractical to do so.	Culverting of open watercourses will not be allowed

2 PRE-APPLICATION ADVICE

As set out in the National Planning Policy Framework, Planning Practice Guidance, and The SuDS Manual (CIRIA C753), early engagement with the LLFA is highly recommended in order to achieve the best outcomes.

2.1 Freely available flood risk information/guidance

There is a range of freely available flood risk information available online including the Flood Map for Planning[1] showing Main Rivers and Flood Zones extents used for planning purposes. The long-term flood risk service[2] shows flood risk extents mapping for surface water, rivers, the sea and reservoirs.

The PPG provides extended guidance on how to apply the flood risk policies contained within the NPPF. Of particular importance to developers and WCC is Paragraph 059 documenting what information on SuDS should be submitted within planning applications.

2.2 Historic flooding information

Warwickshire County Council's historic flood map is available online[3] and provides information on the number of reports of flooding to the Council.

The relevant district or borough council may hold more detailed information, as may the parish council or residents around the proposed development area. Results of further consultation should be included within your FRA. Any reports of flooding should be considered within the development proposals.

2.3 Chargeable pre-application advice from the LLFA

Warwickshire County Council LLFA have a pre-application service which offers developers tailored advice on their development proposals. It is aimed at developers in the early stages of their development proposals and is a chargeable service. The service can include:

- a search of LLFA records and mapping,
- reviews of documentation,
- informal written advice,
- meetings; and
- site visits.

Contact us directly on frmplanning@warwickshire.gov.uk if you would like specific information on what the LLFA can offer.

[1] https://flood-map-for-planning.service.gov.uk/
[2] https://check-long-term-flood-risk.service.gov.uk/postcode
[3] http://maps.warwickshire.gov.uk/historical-flooding/

3 FLOOD RISK & CLIMATE CHANGE

An understanding of the flood risk to and from a development should be obtained early in the design process to ensure new development is integrated into the natural environment and safeguarding the development over its lifetime.

3.1 Access and egress

Where the proposed primary access/egress route is shown to be within a modelled or known flood risk area (from surface water or river sources), then the developer should provide adequate information to quantify the risk to occupants and propose mitigation with reference to Defra report FD2321.

Warwickshire LLFA will highlight any concerns relating to unsafe depths of flooding and velocities of flows on primary access or egress to the Local Planning Authority and recommend that they consult with their emergency planners and/or emergency services for further assessment on the appropriateness of the development given the risk posed by flooding to the access route to the site. Further information is available in the joint Environment Agency and ADEPT guide '*Flood Risk Emergency Plans for new Development.'*

3.2 Overland flows from outside the development

Where overland flows are emanating from outside of the development, the Flood Risk Assessment and drainage strategy must identify how these flows will be managed. Such flows should be incorporated into exceedance and overland flow routing plans and modelling.

The strategy should consider the use of cut-off ditches or other boundary treatments to intercept the flows and managed as part of the development drainage proposals. Flow paths should be retained and appropriately maintained through blue/green corridors or along highways. Where flow paths are unmaintained (i.e. overland flows) no development should take place where such would be at risk of flooding.

3.3 Culverted watercourses

Culverts are typically manmade underground pipes which are used to convey flow from watercourses and these can have a number of detrimental impacts such as

- Increased flood risk due to lack of capacity and increased velocities
- Lack of bio-diversity and aquatic habitats for nature
- Water quality failings due to a lack of sunlight
- Loss of amenity and a sense of place

De-culverting watercourses

Where a culvert passes through a development site, an opportunity exists to restore the watercourse to a more natural condition. Doing so can help to reduce flood risk, improve water quality, benefit biodiversity and add amenity value. As part of the early stages of the planning process the LLFA expect developers to consider the technical feasibility of de-culverting when developing their proposals for the site.

Retaining culverts

If an existing culverted watercourse must be retained within a development site, then its condition and capacity must be surveyed and modelled. This exercise should highlight any works required to ensure the structure will remain fit for purpose for the lifetime of the development.

Due consideration should be given to the likely loading etc. on services or structures that are placed in proximity to the culvert; building over existing culverts will not be accepted.

New culverts

As for the reasons set out above, the LLFA generally oppose the construction of new culverts and will expect detailed justification.

The LLFA do however recognise that there may be instances where culverting is unavoidable, such as short sections to accommodate highway access. Our preference is for a free-spanning bridge rather than a culvert, i.e. keeping a more natural river bed and banks. If a culvert is required, its length should be minimised. Oversized box culverts sunk 150mm below bed level are preferred to round pipe sections.

Land drainage consent

If changes to a watercourse are proposed which would impact flows, such as both deculverting & naturalisation or a new culvert/constriction, then prior written consent of WCC under Section 23 of the Land Drainage Act 1991 must be obtained. This consent is in addition to any planning or building regulation approvals that maybe required.

Early consultation with the LLFA is advised to discuss any requirement for Land Drainage Consent as part of the development design process. For further information on what is required and how much it costs, see the LLFA's "An introduction to Ordinary Watercourse land drainage consents" advice note, which also gives further information on consent requirements from applicants, including our position on culverting.

3.4 Hydraulic modelling

Many ordinary watercourses do not have any modelled flood extents. This, however, does not necessarily mean that they do not have a floodplain or that there is no fluvial flood risk associated with them. Similarly, site topography such as valleys can also direct surface water runoff, forming overland flow routes across open land.

It is therefore important that the flood risks associated with ordinary watercourses or overland flow routes, within or adjacent to the site boundary are understood and adequately represented in the development proposals.

The site-specific FRA should look to address this by undertaking a hydraulic modelling exercise which may also be specifically requested by the LLFA or EA. Failure to assess the flood risks from an ordinary watercourse or overland flow route through a comprehensive hydraulic modelling study will require robust justification.

Modelling results should be used to establish suitable development zones, finished floor levels and appropriate flood resilient/resistant measures as and where necessary. Where fluvial modelling has been completed, we would support the developer providing this to the Environment Agency so that the national flood map can be updated.

Modelling expectations

The detailed requirements regarding the design of a hydraulic or hydrological model have not been specified in this guide. The LLFA expects the developer to instruct a suitably qualified modeller to undertake the work who should follow industry standards and latest guidance produced by the Environment Agency. Where modelling is to be undertaken, the LLFA highly recommend pre-application advice is sought to agree the scope of the exercise.

However, a summary report of the modelling work should be provided to the LLFA and the findings of the modelling exercise should be used within the Flood Risk Assessment and Drainage Strategy to inform the development proposals. This includes, but is not limited to, the following:

- Appropriate and robust hydraulic models should represent the baseline and post-development conditions (along with any temporary / interim scenarios).
    - Comparisons should detail the consequence of any proposed works
    - Outputs should show the depths, velocities and extents, for a range all events up to and including the design flood event
- All hydraulic features such as weirs, bridges or culverts should be appropriately represented.
- Surface water drainage should be placed outside of the modelled flood extents of the 1% annual probability (1 in 100 year return period) event plus an allowance for climate change.
- Finished floor levels set a minimum of 600mm above the 1% annual probability (plus climate change allowance) flood level.

Any hydrological and/or hydraulic modelling report submitted to the LLFA in support of a planning application must be independently reviewed by a suitably qualified third party to ensure that the model meets the required industry standard and that the LLFA can be confident in the output from the model. The applicant can choose to use an independent consultant to do this, or the LLFA can provide a quotation to do this on their behalf.

3.5 Climate change

Revised climate change allowances were released by the Environment Agency in July 2021 regarding peak river flows and in May 2022 regarding peak rainfall allowances.

The revised allowances adopt a Management Catchment approach (as opposed to the prior national scale allowances) with climate change allowances now set at a more localised level based upon the 92 WFD Management Catchment areas.

Warwickshire is covered by two main Management Catchments, the ‘Tame, Anker & Mease’ covering the northern part of the county and the ‘Avon Warwickshire’ catchment covering the southern half of the county. There are however some small

encroachments of other catchments (Soar, Cherwell & Ray, Cotswolds) around the edge of the county.

Helpfully, the same peak rainfall climate change allowances are recommended by the Environment Agency across all Management Catchments intersecting Warwickshire but peak river flows vary. These climate change allowances are subject to change however and any applicant must check for the most up to date allowances online along with information on how to select the most appropriate allowance.

4 SITE CONSIDERATIONS

Like with flood risk, early considerations of the site and its constraints will improve the design of the site and the holistic management of surface water; too many developments are seen to be placed on a site with little thought about how to integrate and improve the wider setting.

4.1 Ground raising and changes in ground level

The LLFA do not support significantly changing the pre-development ground level to facilitate development. Changing ground levels inherently changes the way the land drains and can cause unsuitably deep open water features. This has also been known to have caused issues during and post construction with regards to level differences between development phases.

If a developer is proposing to alter existing ground levels as part of their development proposals, then the drainage strategy must demonstrate that this work will not act to negatively disrupt existing flood flow routes or floodplain and ensure that there will be no increased flood risk on or off site as a result. Flows at the interface will need to be managed.

Any ground raising in an area of known surface water flood risk should ensure level for level compensation for the volume of surface water displaced by any ground raising. This may require modelling of pre and post scheme flows.

Where levels of the proposed development are higher than that of surrounding property, irrespective of any existing drainage infrastructure, boundary treatments (such as filter drains) should be implemented to ensure overland flows, including those from gardens and incidental green spaces, do not impact the existing properties due to the level difference created.

Floodplain compensation

Developments should be steered towards areas of lowest risk and the need to alter ground level be avoided. Where necessary, developments must not impact upon the floodplains ability to store water and where this occurs, compensatory storage provided on a level-for-level and volume-for-volume basis.

Any floodplain compensation areas must:

- Be designed for the 1% AEP event plus climate change,
- Be within the site boundary or in land under control of the developer and in close proximity to the development,
- Provide details on the maintenance of the compensation area to ensure functionality for the lifetime of the development.

Where floodplain compensation is required and proposed, early discussion and agreement with the Environment Agency / Lead Local Flood Authority (as relevant) should be undertaken. Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624.

It should also be noted functional floodplain is defined within the Planning Practice Guidance as the 3.33% annual probability flood extent (1 in 30 year return period).

4.2 Water Framework Directive

All development has the potential to affect the status of a water body but this can be mitigated through good design such as the provision of high quality SuDS.

The EU Water Framework Directive (WFD) aims to improve the quality of all water bodies and achieve Good Ecological Status in several areas (biological, physio-chemical, hydro-morphological and chemical). These aims are delivered through the River Basin Management Plans (RBMPs) and include measures to protect and improve the water environment.

Warwickshire is mainly within the Severn RBMP area, but there are also parts of the county within the Humber RBMP and Thames RBMP; Cycle 3 of the plans covers the period 2022-2027.

Activities such as discharge from development sites, or works to or within watercourses may require a WFD Assessment demonstrating how activities meet the objectives of the RBMP and do not result in the deterioration of WFD statuses. The Environment Agency as Competent Authority hold further guidance on when a WFD Assessment is required and how to complete one. This document may be required to support a planning application and/or Land Drainage Consent application.

4.3 Phased Development Sites

For development sites with many phases, explanation of how the site will adequately consider flood risk and surface water drainage, at all stages of the development will be required. This should avoid interim developed phases that are unprotected or where one small phase of the site being allowed to discharge at the calculated rate for a larger part of the entire development

The LLFA expect the development masterplan to indicate how the surface water drainage for the entire site will be managed on a phase-by-phase basis and progress will only be allowed if adequate measures are in place for that particular phase.

Details relevant to phased sites are set out throughout this guidance document regarding discharge rates (Section 6.3), during construction (Section 7.7), and maintenance (Section 8.2).

4.4 Construction environmental management plans (CEMPs)

As part of the construction works, a Construction Environmental Management Plan will usually be required and may be conditioned as part of a planning permission. The CEMP should identify how issues raised in the EIA (such as siltation, pollution of watercourses, or runoff from bare earth) will be managed on site, and should clearly identify the actions to be taken and by which party.

Appropriate measures should be proposed such as the use of silt fencing. Both during and on completion of construction works, the surface water drainage infrastructure should be de-silted and if applicable culverts/sewers should be CCTV surveyed to ensure they are operating as designed.

Where existing drainage infrastructure, such as those on brownfield sites, will be retained during the construction phase, then sufficient protection will be required. This is to ensure that existing services are not damaged.

During development it may be necessary to alter or divert a watercourse that runs through the site. The developer should hold early discussions with the LLFA regarding any such proposals to ensure that it is appropriate, remembering also that such works are likely to require Ordinary Watercourse Land Drainage Consent. The CEMP should detail when any such diversion or alteration of a watercourse will take place, how it will be done and who will maintain it afterwards.

The key elements of the CEMP should include:

- An overview of the proposed development and associated construction program.
- An assessment of the environmental impacts.
- How adverse impacts will be reduced through design and other mitigation controls.
- How any mitigation measures will be monitored for effectiveness.
- Corrective action procedure.
- Links to other plans or procedures which will impact the CEMP.

4.5 Site Specific Settings

Educational (and similar children's settings)

Water provides great opportunities for learning such as the water cycle, bio-diversity and habitats create or water quality and chemistry. As such, it's important that water is seen as an asset and used appropriately within the design of developments.

Therefore, water should not automatically be buried within underground storage the following suggestions are offered regarding integrating above-ground surface water SuDS features:

- Managing at source – what can be provided beneath each Rainwater Pipe such as raingardens?
- Making conveyance fun – how can water be conveyed across a site whilst avoiding below-ground drainage?
    - Below-ground drainage typically results in deeper attenuation features therefore keeping conveyance on the surface can enable shallower depths.
- Where attenuation is required, how can this be designed to be open and remain safe for all users? For example:
    - Shallow gradients integrating naturally into landscaping
    - Shallow depths, minimising the volume of water provided
    - Granulated beds to ensure features drain dry and do not get muddy
    - Protective planting to discourage entry into features.

Applicants should consider the *Health & Safety Principles for SuDS: Framework and Checklists* (CIRIA RP992) and may wish to consider completing a RoSPA (Royal Society for the Prevention of Accidents) assessment; one may be requested by the LLFA for review by the adopting authority.

The Bewdley School

As part of this guidance document update, Warwickshire County Council Flood Risk Management team visited the Bewdley School in Worcestershire, to see the SuDS installed in 2017 as part of the new science teaching block. The photos shown document the site visit and the good practice used.

Figure 1 - Higher-level rainwater channel (short)

Figure 2 - Higher-level rainwater channel (long)

Figure 1 and Figure 2 show similar examples of rainwater channels above head-height. By keeping the rainwater elevated, the system retains the ability to use above-ground SuDS features whilst still providing the necessary access around the curtilage of the building. Each rainwater channel then uses different 'active' features to highlight water.

Figure 3 (left) - Rainwater pipe with small orifices

During it visit, it was shown to us how the rainwater downpipe shown in Figure 1 and Figure 3 have a number of small diameter (~5mm) holes, seen in Figure 4.

When it rains, this downpipe fills with rainwater which subsequently discharges like a fountain through these orifices into the rill seen at the bottom of Figure 3 and into the raingarden to the left of the rainwater pipe, shown in Figure 8.

Figure 4 (below) - Small orifices in rainwater pipe

Figure 5 - Tipping bucket rainwater pipe outfall

Figure 6 - Water-wheel rainwater pipe outfall

On the other side of the building, a tipping bucket and water-wheel are placed under the rainwater pipes to provide 'active' use of the water. These drain into rills directly beneath them which conveys water to a small pond.

Figure 7 (left) - Small pond

The main attenuation is provided via a small pond and raingarden area. By keeping SuDS features localised close to the source, means features do not need to be overly large.

Given the school setting, safety was also considered during within the design; this small field is fenced off from the wider play areas and forms part of an extended teaching area adjacent to the science classrooms, hence students are only present when there is teacher supervision.

Figure 8 (below) - Raingarden area

(All photos WCC 2023)

Photovoltaic (Solar Farm) development sites

Whilst it is widely considered that greenfield solar farms have negligible impact regarding surface water runoff, the LLFA do not consider this to fully hold as:

- Construction activities can lead to a compaction of the soil
- Shading from panels can lead to varying vegetation
- Introduction of impermeable areas (albeit small) can concentrate runoff
- Surface water dripping from panels can lead to erosion and channelising of flows, especially prior to vegetation establishing.

Accordingly, appropriate mitigation measures are required and the LLFA would expect the developer to consider and include details relating to the following in a Drainage Strategy or Land Management Strategy:

- How can compaction be minimised and treated?
    - Should vehicles be restricted on site?
    - Should any ploughing / furrowing be undertaken after construction to break up compacted areas?
- What type of vegetation will be planted across the site? e.g. high grasses
    - How will it be established quickly in high-risk areas to minimise erosion?
    - How will it be managed / maintained in perpetuity? E.g. grazed by livestock.
- How can panels be designed/built to aid water getting to ground?
    - Can panels have breaks in? e.g. 2x 1m panels rather than one big 2m panel.
- How will surface water be managed?
    - How can impermeable areas be minimised?
    - Where impermeable areas are required, how will runoff be attenuated and controlled?
    - Where will surface water runoff be discharged to?
        - Where infiltration is proposed, testing **must** be conducted (see Section 5.1).
    - Should cut off ditches be positioned strategically around the development to capture surface water runoff?

Sites with high risk of contaminated runoff

Whilst water quality is overseen by the Environment Agency, any materials or chemicals which might impact the contamination of runoff should be considered early in the design process. Example of this might include:

- A car washing facility where various cleaning products are used
- A materials store where aggregates or materials may be washed off in runoff
- Facilities where contaminated firefighting water should be contained.

Early consideration should be given to provision of separate runoff collection systems, on-site treatment, discharge to public foul sewer networks or other alternative disposal methods such as tankers.

5 SURFACE WATER DISCHARGE HIERARCHY

Surface water management must be a consideration on any development site to ensure that surface water is managed using sustainable drainage systems in accordance with the NPPF and PPG. Sustainable drainage systems are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible.

In accordance with Paragraph 056 of PPG and the CIRIA SuDS Manual, surface water run off should be discharged as high up the following hierarchy of drainage options as reasonably practicable, as shown in Figure 9:

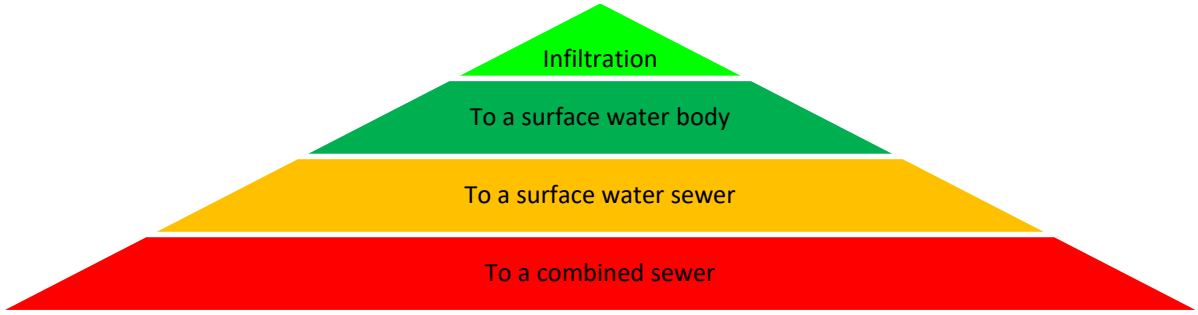

Figure 9 - Discharge Hierarchy

Alongside the above, the use of rainwater harvesting should be considered for all developments.

Some types of sustainable drainage systems may not be practicable in all locations. The above discharge options should all be assessed for any site and the most appropriate option should be established within any FRA or Drainage Strategy.

5.1 Discharge to Ground / Infiltration

The surface water drainage system should, where feasible, discharge into an at-source infiltration system such as a soakaway or infiltration basin. The LLFA highly recommends that this should be a priority aim if it is possible.

Where infiltration is proposed as the means of draining a site, infiltration testing must be provided, regardless of the area drained or site size

Where infiltration testing is requested to be conditioned this will only be supported where a viable alternative outfall is demonstrated

These tests must be carried out in accordance with BRE Digest 365 or CIRIA guidance R156.

Details are also required on the groundwater levels in the vicinity of any proposed soakaways. As stated in CIRIA SuDS Manual, there should be a minimum of 1 metre between the base of the infiltration device and the maximum likely groundwater level to ensure groundwater does not enter infiltration devices. Infiltration features should have a positive high-level overflow or an alternative means of managing exceedance flows. Infiltration systems should not create new pathways for pollutants or mobilise contaminants already in the ground, which can sometimes be a barrier for their use on brownfield sites.

Soakaway design should follow guidance in CIRIA SuDS Manual with regards to half drain times, safety factors, design return periods and construction; they should also comply with relevant buildings regulations, i.e. soakaways should be no closer than 5m to the foundations of adjacent buildings.

As part of the detailed design stage, further infiltration tests may be requested taking into account the final location of the infiltration feature/s.

5.2 Discharge to Watercourse

Where ground or site conditions do not allow for infiltration systems, the next most desirable discharge is to a suitable watercourse.

Downstream connectivity

Where the development is proposing to discharge runoff from the development to a drainage ditch (or similar channel), suitable evidence should be provided to demonstrate that from the point of outfall, the drainage ditch is contiguous and connects to either a suitable watercourse (such as those shown on Environment Agency Detailed River Network mapping) or a sewer maintained by the sewerage undertaker. This is to ensure that the receiving watercourse can convey flows away from the development site.

It must also be shown that the condition of the channel or culvert is suitable for the purpose of adequately draining the development, such as ensuring it is of sufficient depth to receive flows, is free flowing and cannot be easily blocked.

Land ownership or agreement for outfall construction

A developer must be able to show that the location of the outfall/s to the watercourse is/are either within their land ownership or that the necessary permissions have been obtained from the riparian landowner.

Severn Trent Water are unable to requisition a surface water sewer to a watercourse without the necessary landowner permissions and deed of grant of easement. As such, the developer must produce evidence to the LLFA to show that the necessary steps have been taken.

Land Drainage Consent

Where the proposals include works or alterations to a watercourse, it may require consent from the LLFA[4] where it is an Ordinary Watercourse, or from the Environment Agency[5] where it is a Main River. Such consent is required to avoid increasing flood risk, both locally and to those upstream and downstream of the proposed works. Consent is still required even if the applicant has secured planning permission and/or other consents that may be required.

Discharge from one or more outfalls into a watercourse has potential to cause erosion to the river bank and bed. When an outfall is proposed, the applicant must

[4] Warwickshire guidance: https://www.warwickshire.gov.uk/watercourse
[5] EA Flood risk activity environmental permit guidance: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits

consider whether the velocity of the discharge (or effect of multiple outfalls in close proximity) is likely to cause any erosion impacts on the channel in the immediate area or downstream. Appropriate mitigation measures should be proposed.

Early consultation with the LLFA is advised to discuss any requirement for Land Drainage Consent as part of the development design process. For further information on what is required and how much it costs, see the LLFA's "An introduction to Ordinary Watercourse land drainage consents" advice note, which also gives further information on consent requirements from applicants, including our position on culverting.

5.3 Discharge to Sewers

Prior to developing plans to discharge surface water to a sewer, the developer must provide evidence to the LLFA to demonstrate that it is not possible to discharge to an infiltration system or watercourse. A developer's right to requisition a sewer does not negate the need to follow the discharge hierarchy as detailed above.

If the development is close to or over a public sewer, we advise that the applicant contacts Severn Trent Water to discuss their requirements (such as an easement protection or a build-over agreement).

Surface Water Sewer

Where it has been agreed with the LLFA that surface water discharge from the development is not feasible to an infiltration system or watercourse, the developer should consider discharging to a surface water sewer.

The developer should hold early discussions with Severn Trent Water to establish whether such a connection is possible. The LLFA will require evidence of correspondence with Severn Trent Water (such as a Developer Enquiry) at the Outline or Full planning stage to show that there is a viable means of draining the development, considering the capacity of the system and discharge rate agreed with the LLFA. At the detailed design stage, the LLFA will require evidence of the written agreement to connect to the Severn Trent Water asset which should include details on the point of connection.

Combined Sewer

Surface water should never be discharged into a foul sewer and where possible, not into a combined sewer. Combined sewer discharge/connection should be an absolute final resort, and sufficient evidence must be provided to demonstrate that the above methods (in order) are not possible. The LLFA strongly advises that the applicant seeks further advice by consulting Severn Trent Water to agree the best solution, and for the applicant to explore whether evidence for more sustainable discharge has been missed.

To ensure that there is enough capacity within the sewer network, the LLFA require developers to consult with Severn Trent Water early in the process as this may involve undertaking a sewer capacity assessment.

Foul Sewer

The LLFA will not support any connection into the foul sewer network.

Highways Drains

Typically, ditches adjacent to the highway are the ownership and responsibility of the adjacent land owner. Where the applicant proposes to discharge into existing highway drainage (such as below-ground pipes), the developer must undertake discussions directly with Warwickshire County Council's highways team to agree whether this would be appropriate. They may request a condition survey of the drainage network and seek the repair of any significant defects before considering the outfall as suitable means of draining the site.

6 SURFACE WATER DISCHARGE RATES

The LLFA recommend that the applicant consults with all the relevant Risk Management Authorities (RMAs; WCC LLFA, Severn Trent Water, Environment Agency) to understand existing issues in the vicinity of the development

Regardless of whether another RMA indicates that a receiving water body or surface water sewer has enough capacity, the LLFA still expects developers to follow the discharge hierarchy and calculate allowable rates of runoff as stated in this guide and other policies/guidance.

For discharge via soakaways, the design must use the most conservative infiltration rate measured through percolation tests carried out in the vicinity of the proposed soakaway in accordance with BRE 365 and as stated in CIRIA SuDS Manual.

A permitted discharge rate for surface water from the site should be calculated or demonstrated in one of the following ways.

6.1 Undeveloped (Greenfield) sites

For discharge offsite into a watercourse or sewer, the discharge rate will be based on the calculated pre-development Greenfield runoff rate for the site and this can be calculated using the 'Greenfield Runoff Rate Estimation' tool on HR Wallingford's uksuds.com website.

Rates should not exceed the QBar or QMed greenfield rate for the development unless event specific discharge rates are used alongside provision for Long Term Storage (LTS).

A consistent approach should be utilised in the application of discharge rates to the proposed development. Either one of the following scenarios should be used:

- The discharge rate should be calculated upon the impermeable / contributing area – the same contributing area should be used in the drainage design.

Or

- Discharge rate should be based upon the developable area, taking into account gardens and other incidental green spaces but excluding significant green areas such as public open space. The drainage design should subsequently be undertaken on the premise that the same area is collected wholly in the system.

The LLFA's concern of using the developable area to calculate greenfield runoff rate and designed to only collect the impermeable area leads to a double counting of discharge and the potential to exacerbate flood risk.

Early consultation with the LLFA will be required for any rates proposed above the QBar greenfield rate, on larger developments where several surface water sub-catchments are proposed, or where other considerations arise such as if a surcharged outfall should be accounted for.

6.2 Previously developed (Brownfield) sites

In accordance with some Local Plan policies along with national guidance documents surface water run-off from all previously developed sites should be reduced to greenfield run-off rates.

Where it has been established to the satisfaction of the LLFA this is technically not possible to achieve these rates, development should aim to provide the maximum betterment possible and at least a 50% reduction in discharge rates should be achieved. This should be undertaken using the following process:

1. Determine the maximum surface water attenuation available using all SuDS measures (including features such as green/blue roofs, permeable paving etc).
2. Determine the discharge rate necessary to make full use of the storage. This may require multiple flow control devices to hold attenuation across a network.
3. Check the proposed discharge rate provides the betterment as stated above as calculated in the following paragraph.

The following methods can also be used to estimate the current discharge from a site to apply betterment:

- Establish if the site is currently positively drained; if so, undertake a hydraulic assessment of the network using the existing drainage details to estimate maximum discharge at the outfall;

  Or

- Estimate using the Modified Rational Method, using the industry standard figure of 35 mm/hr as recommended in the SuDS Manual.

Full details of the pre-development drainage characteristics and scale of development should be provided to the LLFA, include the existing drainage details for the site and an assessment of Greenfield rates.

6.3 Phased Development Site Discharge Rates

Where the developments will be phased then information should be provided on how the proposed discharge rate will be suitably met at each phase through a phasing plan. Such plan should consider and document:

- The maximum allowable discharge rate for that phase;

Or

- The maximum contributing/impermeable area from that phase allowed into the wider site drainage infrastructure

WCC LLFA would expect such a plan to evolve as the application progresses, with an updated submission provided with each successive application.

6.4 Cross-catchment discharge

The LLFA recommend that where possible surface water should not be discharged cross catchment to a new receiving watercourse unless there is sound justification for the reasons of the cross-catchment discharge.

If a cross catchment discharge cannot be avoided, the LLFA will require a technical justification for the reasons of the cross-catchment discharge, together with an assessment of the capacity of the receiving watercourse to ensure that the additional flows will not increase the flood risk elsewhere.

6.5 Cumulative impact

Consideration should be given to the cumulative impact on flood risk and water quality where there are proposals for large development sites or several smaller development sites within the same catchment or near each other.

Without due consideration and mitigation, cumulative flood risk impacts are possible within water bodies receiving surface water discharge from new developments. Cumulative water quality impacts are also possible, for example from silt wash-off during construction phases of development.

6.6 Minimum practical discharge rate

It is now possible to restrict outfall discharge rates to below 5 l/s in a variety of ways including newer flow control devices, protected orifices, and better design. The argument for a practical minimum of 5 l/s will be challenged, particularly where the drainage systems are split into multiple small catchments with individual outfalls. Reference is made to Section 28.5.3 of The SuDS Manual (CIRIA C753) regarding perforated risers as a means of providing small discharge rates but protecting against blockage risks.

6.7 Pumped drainage systems

Pumping of surface water in perpetuity is considered by the LLFA to be an unsustainable drainage method. The LLFA preference is for gravity discharge to the surface water drainage system. All alternative methods should be fully considered, including those further down the drainage hierarchy (as described in Chapter 5), if it means that a gravity solution would be possible. Early discussion with the LLFA is advised.

The LLFA requires that the developer attempts to discharge as much surface water runoff as possible via a gravity system, such as through the use of shallow attenuation, source control SuDS, or alternative outfall.

If it can be demonstrated that a partial or completely pumped surface water drainage system is the only viable option, the LLFA require that the residual risk of flooding due to the failure of the pumps be investigated in line with the Design and Construction Guidance (DCG). This must include an assessment of the exceedance flood routes under the following conditions:

- The pumps were to fail and,
- The attenuation storage was full and,
- A design storm occurred.

The developer must then identify any appropriate mitigation to ensure that there is no unacceptable increase in flood risk to the development itself or third parties as a result.

Furthermore, any pumping station should be located within Flood Zone 1 and outside of all areas susceptible to surface water flooding as shown on the Flood Risk from Surface Water mapping.

7 SUDS DESIGN AND EXPECTATIONS

For a long time, SuDS have been provided to manage the quantity of water generated by development and therefore this has focused on the provision of attenuation. This has typically been in a single large feature (such as a basin or tank), sized to accommodate the design storm event of the 1% annual probability (AP, 1 in 100 year) plus an allowance for climate change.

However, a number of overlapping policies and strategic plans, such as the River Basin Management Plans, the Storm Sewer Overflow Reduction Plan and bio-diversity net gain obligations, have pushed the requirements for SuDS to meet wider water quality, amenity and bio-diversity benefits to the forefront.

As such, a single attenuation feature at the downstream end (the so-called 'pipe-to-pond' arrangement) will no longer be acceptable.

SuDS should be considered within a management train approach utilising source control, appropriate above-ground conveyance and strategic, multi-functional attenuation.

Consideration should also be given to the use of educational signs giving the public information on the purpose of SuDS features.

7.1 Source Control & MicroSuDS

As stated within the SuDS Manual "the apparent lack of space should never be a reason for not using SuDS" and WCC LLFA agrees with this statement. The LLFA will therefore challenge developers regarding the provision of small-scale SuDS features and the below examples and sketches are provided to steer designers.

In general, these should be considered where space is already provided for other landscape features thereby providing the multifunctionality adopted by the NPPF and PPG.

Figure 10 - Missed Opportunity - Landscaping planter adjacent to car parking (WCC, 2022)

Figure 10 shows a raised landscape planting area adjacent to car parking with this planter covered in bark chippings. As shown, the chippings are falling off the planter and are gradually being conveyed into the adjacent gully which will in turn require maintenance at some point in the future. This could be considered a missed opportunity to incorporate bio-retention/raingardens.

As an alternative, Figure 11 shows a bio-retention / raingarden installed in the Grangetown area of Cardiff as part of the Greener Grangetown SuDS retrofit scheme, a similar feature could have been installed in place in Figure 10.

The planter is lower than the road and as such takes direct runoff from the road surface thereby keeping the plants watered and established. The feature also traps sediment runoff and treats hydrocarbons thereby improving water quality that is passed downstream.

Figure 11 - Greener Grangetown bio-retention/raingarden area[6]

The cost change may also be considered minimal as the same amount of kerbs, plants and maintenance will be required whilst overall providing much improved water infrastructure.

Elsewhere, small-scale basins could be holistically integrated into developments where space is available. Figure 12 shows the placement of a small-scale attenuation basin within an area of public open space and the basin has been sized and designed based on the space available.

[6] cc-by-nc-sa – SusDrain - https://www.flickr.com/photos/139555361@N08/43826085355/in/album-72157671352624927/

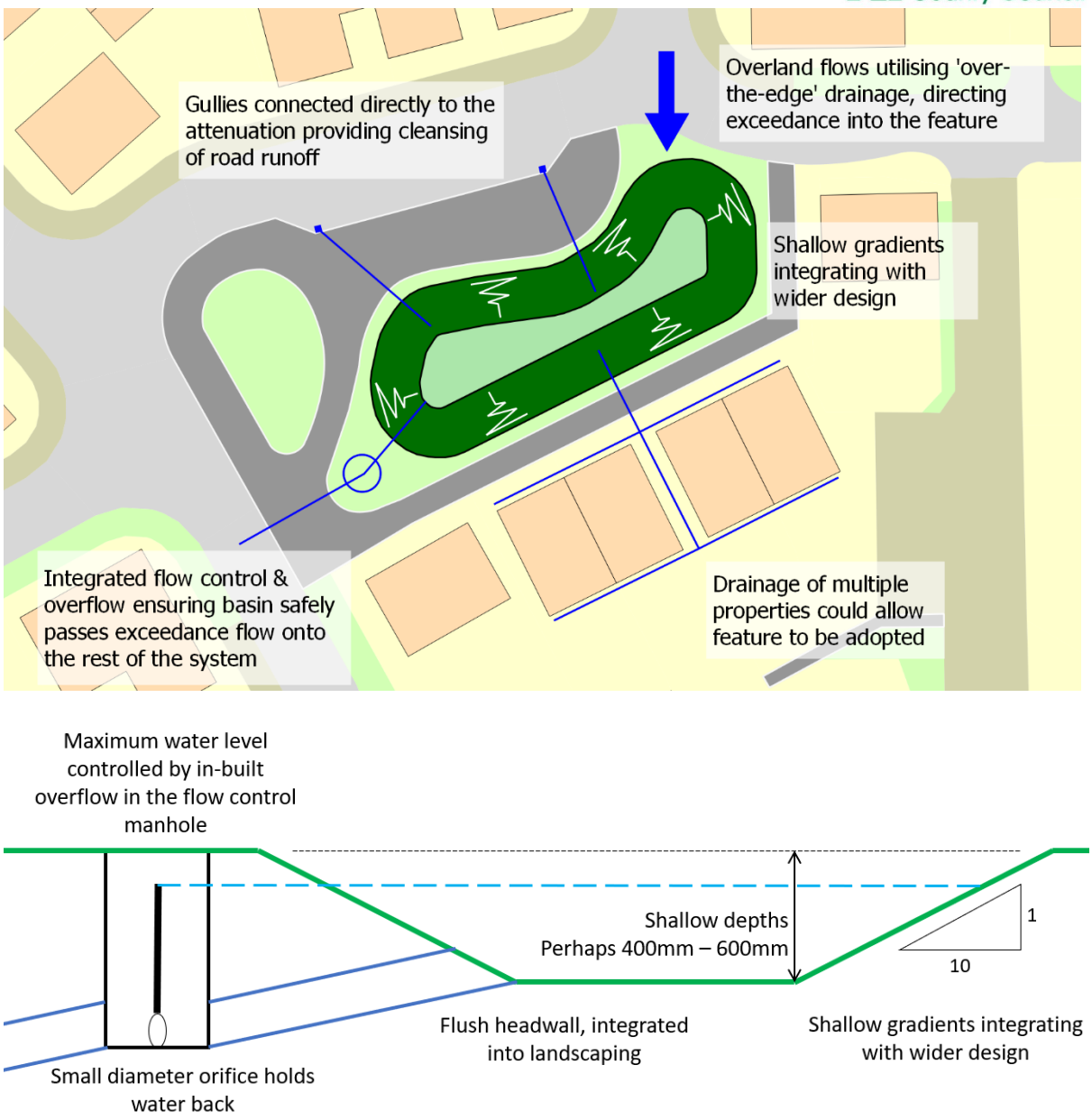

Figure 12 - Open space small-scale basin and cross section

The following points are all worth considering in relation to the above:

- **Depths and gradients**: Shallow depths and gradients work hand-in-hand together, enabling features to be integrated into the landscape design whilst also ensuring safety
- **Calculations**: The volume of storage may be negligible therefore calculations could be simplified demonstrating the area drained, controls and maximum water levels, working together with in-built overflows.
- **Headwalls vs underdrains**: headwalls provided could be small-scale and flush with the banks, connecting pipes of 100mm or 150mm in diameter. Alternatively, porous medium could be installed under the basin negating the

need for headwalls and for water to fill the basin via exfiltration. Some examples are shown below in Figure 13.

- **Flow controls and overflows**: given the basin itself is small and shallow, flow controls could be incorporated into inspection chambers, limiting the need for man-access and improving safety whilst making maintenance easier.
- **Adoption**: By draining multiple properties and with a defined channel through the bed of the feature, it may be adoptable under the Design and Construction Guidance, discussion is recommended with Severn Trent Water.

Figure 13 - Small scale inlet (left) and outlet (right) features (WCC, 2023)

7.2 Above-Ground Conveyance

Features such as swales and filter drains can play a role in both collecting and conveying surface water across a site whilst having the potential to significantly improve water quality, amenity and bio-diversity.

Vegetation within such features provides opportunity to filter out suspended solids and by doing so, this removes a significant pollutant load and can reduce the need for and maintenance of proprietary treatment systems such as silt traps.

Warwickshire has a topography of gently rolling hills which are perfectly suited to the use of such features i.e. sites are steep enough to drive hydraulic processes and provide reasonable capacity/flows whilst not being too steep to risk excessive scour.

Land-take is often cited as a reason for not including swales but in many cases such features may be over-engineered or excessively large. Consider the following:

- A 300mm diameter sewer, typical of upper to middle sections of a drainage network, laid at an average gradient of 1 in 100 has a capacity of 111l/s
- To provide the same 111l/s capacity in an open channel would require a swale of 200mm base width and 125mm depth; rounding to 200mm depth

and assuming 1 in 3 side slopes, such swale is only 1.4m wide, less than the width of a standard pavement.

It's recognised that such shallow swales may be unfeasible to drain all features into as some pipes may require a certain depth of cover. However the use of 'over-the-edge' drainage techniques could direct surface water runoff directly into the swale and adjacent properties could be connected using rills or other similar features.

In places where sites are steep, 'check-dams' can be used to enhance the attenuation function of swales and slow the flows. Where depth is required, the swale could be supplemented with a below-ground filter-drain to connect deeper sewer pipes that cross beneath driveways or roads.

Figure 14 shows an example shallow roadside swale feature collecting surface water runoff from the adjacent carriageway and footway.

Figure 14 - Shallow swale / filter drain with check-dams

7.3 Strategic Attenuation Design

Any holistic SuDS system is likely to require provision of larger strategic attenuation features and the LLFA expect these to be above-ground to meet all four pillars of SuDS; water quantity, water quality, amenity and bio-diversity.

Features should be designed in accordance with best practice to provide maximum benefit and integrated into the landscaping. As such, features should be shallow and where possible the depth of water should not exceed 1m with bank slopes of ideally 1 in 4 bank slopes and as minimum 1 in 3; very deep basins ('bomb craters') are unacceptable.

Where attenuation basins and other open water features are deeper, consideration should be given to the provision of benching as illustrated in Figure 15. The suitable width of these benches must be determined by the developer, but there is some guidance on this in Chapter 36 of the SuDS Manual.

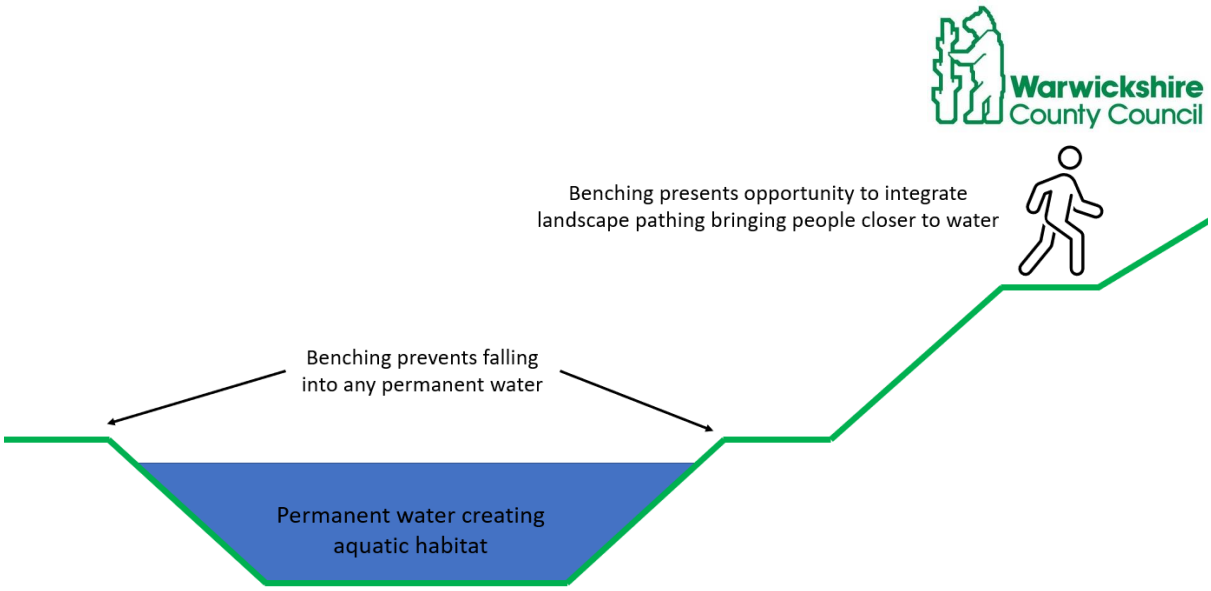

Figure 15 - Attenuation Basin Benching

Consideration should be given to providing spaces of multiple use within well designed above ground SuDS. For example, but not limited to, open areas for sports, play or other recreation. By taking such an approach, and through innovative design, the inclusion of multi-use spaces within SuDS can manage competing demands for space, provide additional areas for development and enhance amenity whilst still delivering their primary purpose.

Inlet / Outlet Headwall Design

The LLFA recognise that in many cases, the design of headwalls is dictated by the adopting body. This should not however preclude the exploration of different inlet and outlet headwall designs.

In many cases, such headwalls are overly large and incongruous to the natural aesthetics of SuDS features. Consider the critique set out in Figure 16, instead could a smaller inlet, such as shown in Figure 13 above, be used combined with some rip-rap to provide a cascade as water falls into the basin?

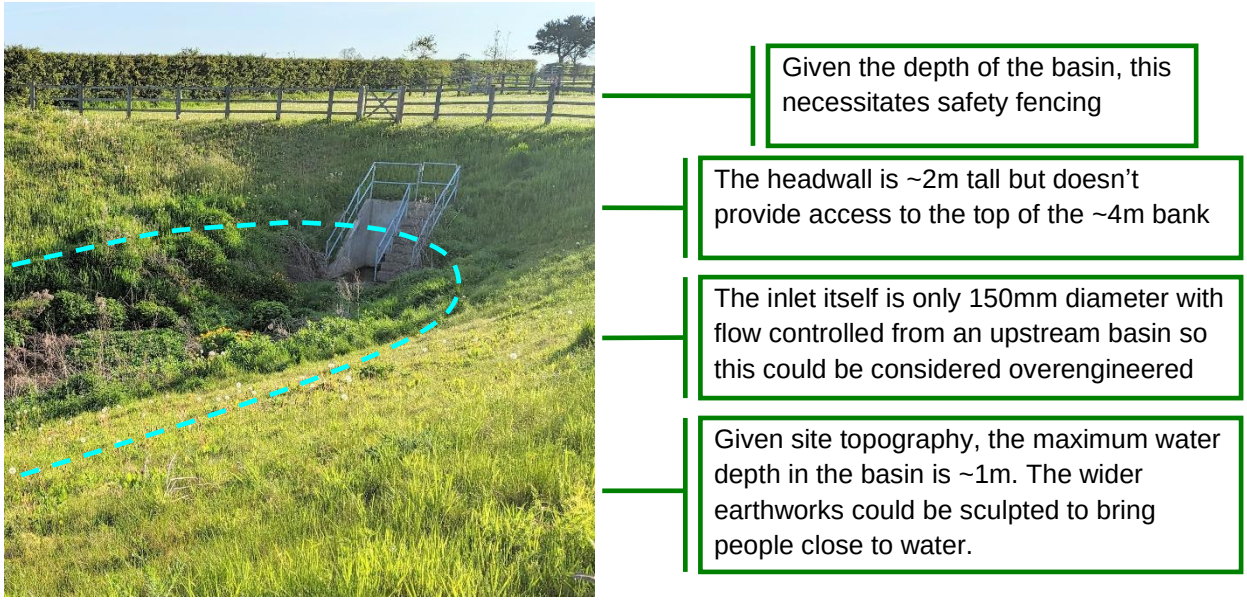

Figure 16 – Overly Large SuDS Basin Inlet

As with large headwalls, the use of screens should be avoided and designed out in most cases. This can be achieved by designing smaller scale SuDS features and dispersing inlets via multiple smaller pipes (as compared to a concentrated larger inlet). The inclusion of screens has maintenance implications, as shown in the blockage caused by the screen shown in Figure 17, where screens are proposed the maintenance of such should be included in any plans.

Figure 17 - Culvert screen with internal blockage

Below-Ground Attenuation

The LLFA do not consider oversized pipes, box culverts or other similar below-ground attenuation as sustainable drainage as they do not offer multiple benefits nor meet all four pillars of SuDS. Where it proposed, sufficient justification as to the appropriateness of the approach will be required and the lack of space available for above-ground features is not considered sufficient justification as this indicates that the development density is too high.

Where it can be demonstrated that it is not practicable to deliver above-ground attenuation, development proposals should maximise opportunities to use SuDS measures which require no additional land take, such as green roofs, permeable surfaces and water butts. Attenuation beneath buildings will not be considered acceptable and an alternative strategy should be proposed.

7.4 Water Quality

The level of pollution found within surface water runoff will depend on the nature of the development from which it arises, the time since the last rainfall event and the duration and intensity of rainfall. Whilst rainwater is considered relatively ‘clean’ once this is mixed with surface pollutants, such as hydrocarbons from oils on roads, the runoff can be very damaging to the wider water ecosystem.

In order to support the RBMPs, the LLFA expect all development to employ suitable treatment trains of SuDS components improve water quality. These are where series SuDS features are connected and pollution is incrementally reduced at each stage, helping to achieve a resilient system ensuring that there is no significant accumulation of silt or pollutants in individual features.

The LLFA require applicants to demonstrate how the pollution risks arising from their development will be mitigated through the surface water drainage strategy. The LLFA recommend applicants refer to the Simple Index Approach (SIA) as described in CIRIA SuDS Manual.

The SIA shows that most SuDS components have an ability to provide water quality treatment by either filtering out pollutants or reducing flow rates to encourage deposition of any contaminants. The level of treatment (or mitigation) required is proportionate to the pollution risk posed by the development.

It should be noted that the LLFA does not consider catch-pits, oil separators and other proprietary treatment systems as pollution management / SuDS features. Such components will only be accepted in exceptional circumstances with very high pollution risks and such proprietary features should be additional to a full SuDS treatment train (not provided instead of).

7.5 Biodiversity Net Gains

The Environment Act received royal assent in November 2021 with the provision for mandatory bio-diversity net gain to ensure that all new development enhances our natural environment; this will come into force in November 2023. The LLFA believe that ecology and flood risk need not be considered in isolation, and that developers can use appropriate drainage design to help work towards this new challenge.

There is a clear preference for multifunctional SuDS features expressed in the NPPF, so that they can deliver towards many environmental gains. The LLFA welcomes creative and integrated SuDS design that contributes towards multiple planning conditions including biodiversity. Features such as attenuation ponds have the potential to contribute towards biodiversity metric scores provided that habitat quality is considered in their design. Factors such as size, surrounding landscape, appropriate planting, water quality and maintenance could influence SuDS value to wildlife.

Biodiversity metrics should also be considered when working around existing watercourses (including ditches) and waterbodies on a development site. Opportunities should be taken where possible to enhance and restore riparian habitats. This aligns with local strategic guidance documents.

For more information please contact planningecology@warwickshire.gov.uk, or visit: http://www.warwickshire.gov.uk/ecology

7.6 Designing for Exceedance

In the context of surface water drainage design, exceedance flows are considered as flood flows caused by a rainfall event greater than the design capacity of the system or by a failure of the system such as a blockage. As such exceedance can happen

during ‘normal’ events and it is not appropriate to rely on calculations demonstrating no flooding occurring.

It is therefore important to consider how exceedance flows will pass through the development and it may be useful to disregard the drainage system entirely and instead focus on the post-development site topography. This should show how exceedance flows will not be directed toward property or flow onto third party land.

Intelligent but simple design (such as kerb heights, location of manholes etc) can help direct overland flows during an exceedance event. The volumes, depths, velocity and extent should be modelled and mapped on a topographical plan of the site.

An example sketch is shown in Figure 18 utilising the highway contours. A kerb is typically 125mm high and this sketch shows the contour area using this to calculate the total storage volume available within the highway. Such sketch demonstrates that in this location, flooding is retained within the carriageway. If flooding is extensive, the flood hazard should also be considered.

Figure 18 - Highway Contours & Flood Depths

Colour Band	Area	Depth	Average Depth	Stored Volume Available
	25m^2	0mm – 25mm	12.5mm	0.31m^3
	33m^2	25mm – 50mm	37.5mm	1.23m^3
	50m^2	50mm – 75mm	62.5mm	3.12m^3
	30m^2	75mm – 100mm	87.5mm	2.63m^3
	18m2	100mm – 125mm*	112.5mm	2.03m^3

Total available storage within carriageway = 9.34m^3 which is greater than the flooded volume.

Further information on building layout, surface pathways and storage can be found in CIRIA C635 '*Designing for exceedance in urban drainage – good practice*'.

7.7 Other Design Matters

Groundwater Levels

Any above or below ground attenuation must take account of the water table and ensure that there is adequate separation between the base of any attenuation and the groundwater level. This is to ensure that the attenuation does not fill with groundwater which would otherwise reduce the designed performance of the attenuation. High groundwater may require extensive earthworks or engineering to ensure basins are not adversely affected by water ingress.

Attenuation features must be located within Flood Zone 1 to ensure there is no ingress of fluvial flood waters into the attenuation which may otherwise affect its capacity. This also ensures there is no detrimental impact on the floodplain or increase in flood risk.

Freeboard

A freeboard of 300mm should typically be provided between the highest design water level and the top of any attenuation feature (such as a basin). This is to take account of residual uncertainty in the design parameters so that the risks of an exceedance event are minimised. This requirement is also stated in CIRIA SuDS Manual.

However, there may be times where such a blunt approach may be inappropriate such as for large but shallow features. Where less than 300mm freeboard is provided, consideration should be given to the volume provided within the attenuation feature, the required volume of storage and the volume within the freeboard. For example:

- $100m^3$ of attenuation within a basin of $100m^2$, fills the basin to 1m deep. The addition of 300mm freeboard provides $30m^3$ of residual volume.
- $100m^3$ of attenuation within a basin of $250m^2$, fills the basin to 0.4m deep. The addition of 300mm freeboard provides $75m^3$ of residual volume.

Interim drainage during construction or on phased sites

Drainage infrastructure must be effective during construction. This includes areas where there are, for example, raised ironworks or silted up gully pots.

Referring back to 'Designing for Exceedance,' consideration of levels and a passive approach to overland flows can help during such time, directing surface water away from properties and not relying on gullies / pipes to be fully operational.

8 DESIGNING FOR MAINTENANCE

The maintenance of all the water environment is a key consideration to ensure the long-term function of such, ensuring systems operate as they should and flood risk is not increased. This starts with consideration of site characteristics or constraints and subsequently runs through the design.

8.1 Designing around ordinary watercourses

It is important for any development adjacent to an ordinary watercourse to ensure that adequate access is available for maintenance activities such as vegetation clearance, grass cutting, inspection of assets, dredging etc. Physical separation of activities from the watercourse also maintains bank vegetation, enriches the riparian habitat and promotes connectivity between the watercourse and its floodplain.

Easements

Historically, an easement of 8m has been required measured from the top of the river bank perpendicular to the direction of flow. This remains a good guide however it is recognised that this may not be appropriate in all instances and therefore the following should be considered:

- How large is the watercourse and what is the typical flow?
    - e.g. an ephemeral ditch may be easier to maintain than a watercourse with a 500mm depth of water
- What maintenance will need to be undertaken?
    - May it be limited to vegetation management?
    - May more thorough removal of litter and sediments be needed e.g. at culvert inlets?
- How will such maintenance be undertaken?
    - Do you need to use machinery such as lawnmowers or excavators?
    - How big are they? Can they fit through access such as garden gates?

From the above therefore, a small ditch which has intermittent flow could be suitably maintained by using handheld tools and therefore smaller easement may be suitable. Alternatively a larger watercourse or one with a deeper baseflow may need specialist or larger equipment to maintain it.

Ideally this easement should be free of all development for the reasons given above, however in some instances it may be acceptable for low-level development (such as parking areas and pavements) to encroach into this easement. This should be discussed and agreed with the LLFA at an early stage in the planning process to ensure it would be appropriate. Built development, such as walls, fences and building that would impede future maintenance access to the watercourse would not be acceptable.

Ownership & Boundary Treatment

Of equal importance is the aspect of ownership and who is responsible for maintenance. Many times, the riparian owner is responsible but this should be considered alongside the above points relating to the ability of individuals to undertake the appropriate maintenance.

Alongside this, most property boundaries are well defined by fences, walls or similar features. As stated above, fences should not be placed in easements or across watercourses, as shown in therefore it is important to consider how boundaries will be delineated.

Figure 19 - A fence through a watercourse (unconsented and not acceptable; WCC 2018)

Culverted watercourses

Similar issues remain when the watercourse is culverted beneath a development. To facilitate maintenance activities/repair works, the LLFA would strongly recommend that no buildings/structures are located above any culverted watercourse and an adequate easement is provided should need the need arise for excavation.

Consideration should also be given to who will be responsible for maintaining such a feature. Usually, this is the riparian owner and this is the person that owns the land above the culvert. This however becomes complex where the culvert passes through multiple properties (e.g. through multiple gardens) and particularly where access are not available within each land ownership.

8.2 Designing around SuDS features (and other water bodies)

As with the design of the SuDS features themselves, the earlier maintenance is considered the better and this starts from the location of features. To facilitate any future maintenance activities on shared surface water drainage infrastructure, the LLFA expect that all storage systems are placed within publicly available space.

The developer should demonstrate that future access to any SuDS features is possible for inspection and maintenance, by for example, providing an adequate development-free easement around such features.

The LLFA recommends an easement around the perimeter of any open water feature to allow for a maintenance vehicle to gain access. Where possible, easements for maintenance access should be within designated public open space to ensure long term protection. Typically, a minimum of 3m should be considered a starting width for an easement but in line with the considerations given previously, thought should be given to the size and depth of features along with how features will be maintained.

At the detailed design stage, the LLFA will require the adoption and maintenance of all drainage features to be duly considered. An adoption and maintenance plan must show how the drainage systems will be maintained for the lifetime of the development and the party responsible for the maintenance of the system. CIRIA SuDS Manual provides templates and useful information on maintenance regimes for a variety of SuDS features.

Prior to the discharge of the surface water drainage condition/s, the LLFA will require evidence that an appropriate adoption/maintenance in-principle agreement is place between the developer and the relevant maintenance company/adopting body. See the CIRIA SuDS Manual for more details. Where a development is phased, the LLFA would expect such details to be provided on a phase-by-phase basis or for interim details prior to completion.

Schedule 3 of the Flood & Water Management Act (LLFA position on adopting SuDS)

On 10th January 2023, the Defra published[7] "the Review for implementation of Schedule 3 to the Flood & Water Management Act 2010;" this recommended implementation of Schedule 3 which the government has accepted. Warwickshire County Council will take on the role of the SuDS Approval Body (SAB)

Further information regarding this will be posted on our website as it becomes available.

https://www.warwickshire.gov.uk/severe-weather/planning-and-sustainable-drainage/2

[7] https://www.gov.uk/government/publications/sustainable-drainage-systems-review

9 SURFACE WATER DRAINAGE MODELLING

The bullet points below provide a summary of the design parameters that should be used if the developer is using industry standard surface water drainage modelling software. The drainage strategy should outline the reasons for any departure from these design parameters.

- As outlined within the software, Micro Drainage's 'Quick Storage Estimate' should not be used for design and will not be accepted.
- Rainfall Methodology: Both FSR & FEH
  - Developers are expected to use the most conservative rainfall in their drainage calculations and this could be either FEH or FSR.
- Urban creep 10%
  - Urban creep is the conversion of permeable surfaces to impermeable ones over time, e.g. surfacing of front gardens to provide additional parking spaces, extensions to existing buildings, creation of large patio areas.
  - An allowance for urban creep is required as part of the surface water drainage proposals for new residential development in Warwickshire.
- Volumetric Runoff Coefficients (Cv Values): 1.0 (summer & winter)
  - A Cv value of 1 should be used within the drainage design where only the impermeable area is collected within the surface water system. New developments should be designed in a way where no surface water can collect and pool unintentionally in areas of depressions or cracks.
  - Where large areas of a site are permeable it should be considered whether these large areas will contribute to the positive drainage system. If they do not then an equivalent area should be removed from calculations associated with site runoff.
  - As outlined on the UKSuDS website, HR Wallingford have addressed the incorrect use of 84% as a runoff coefficient value (summer default Cv value).
    - Within the "What Runoff model and runoff coefficients should be used?" question within the FAQs[8] it states *"The assumption of 84% and 0% respectively (which is commonly applied by users of MicroDrainage and other design tools) is not particularly conservative for assessing storage requirements… This approach was justified in a paper in the 1990s based on the original runoff model in the Wallingford Procedure which was issued in 1983. This justification is a misuse of the correlation equation which had been developed, and has since which been rendered obsolete based on the fact that the original equation was shown to under-predict runoff for large rainfall events."*
- MADD Factor / Additional Storage: 0
  - This parameter accommodates additional storage volume which may be present in pipework that is not formally represented within the

[8] https://www.uksuds.com/training-support/frequently-asked-questions

model, such as private 'round the houses' drainage or localised cracks / depressions etc.

- The MADD Factor within Micro Drainage defaults to 2.0 and this is multiplied by $10m^3/ha$; Causeway Flow short-circuits this calculation into an additional storage parameter of $20m^3/ha$.
- This should be set to zero as:
  - Sites should not be designed to pond water on the surface (excepting formal attenuation and exceedance storage areas).
  - The volume of storage within private drainage (typically small 100mm diameter pipes etc) may be considered negligible.
- Where oversized pipes provide storage, these should be explicitly modelled.
- Where a MADD Factor / Additional Storage Parameter is used, it should be site-specific and justified. For example, the total length/volume of un-modelled pipework could be calculated and used to inform the appropriate parameter.

- Surcharged Outfall: As appropriate
  - The invert level of any surface water outfall and nearby attenuation should be compared to the potential flood levels.
  - A surcharged outfall should be modelled where there is the potential that water cannot leave the proposed drainage system
  - Surcharged outfalls should ideally be based on modelled hydrographs (head-time) at the outfall; where this is not available an appropriate depth and time should be chose and justified.
  - Such parameters should be input into drainage modelling software with the appropriate time intervals (multiple pages of a constant water level at 1-minute intervals is not necessary), see the example in Figure 20.

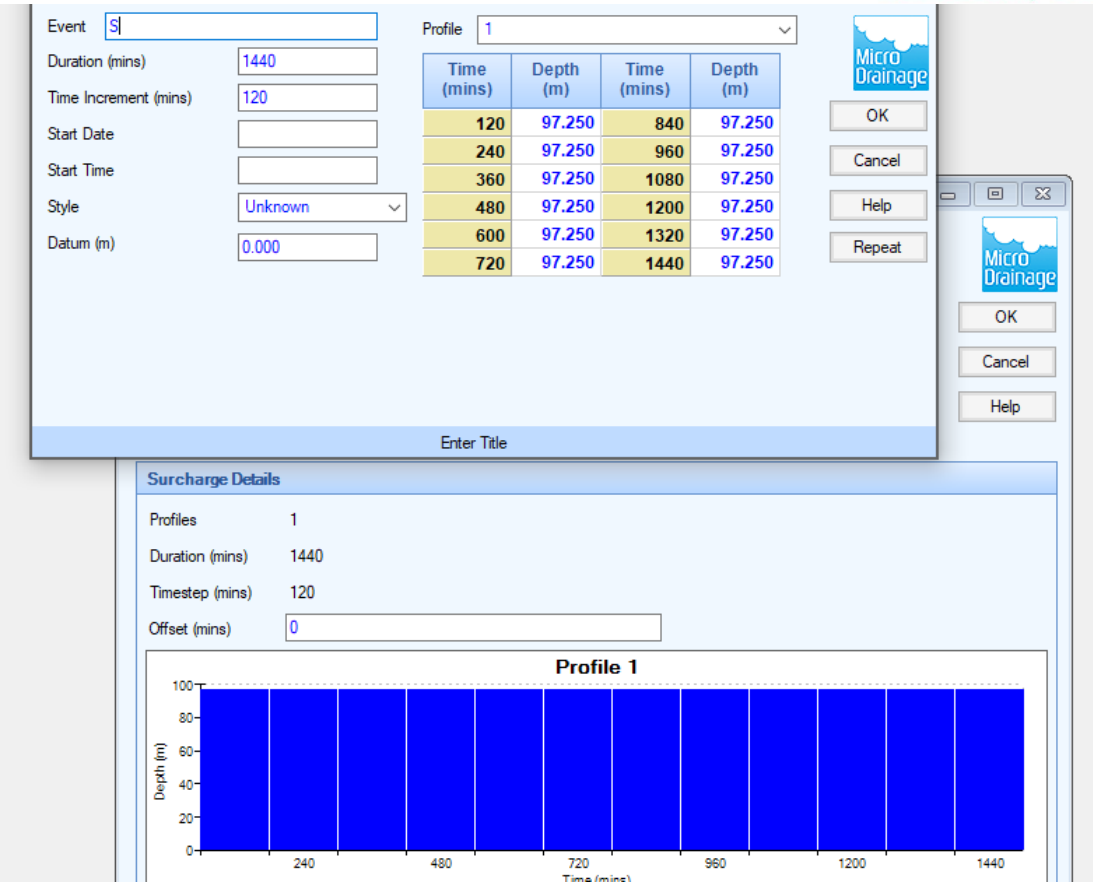

Figure 20 - Appropriate Surcharged Outfall Time Interval (within Micro Drainage)

10 INFORMATION REQUIRED WITH PLANNING APPLICATIONS

This section provides an indication of the information the LLFA will require from the applicant at the various stages of the planning process. Although this list will cover our key requirements in most instances, development proposals can be varied and complex. As such the LLFA may request information in addition to that listed below where it is justified but should remain proportionate to the size of development.

10.1 Flood Risk Assessments

In line with the National Planning Policy Framework, flood risk assessments will need to be submitted for sites in Flood Zone 2 or 3 or sites over 1ha where a 'more vulnerable' use is sought. The Flood Risk Assessment should assess the risk of flooding from all sources and where relevant should provide hydraulic modelling.

10.2 Surface water drainage requirements

The updated Planning Practice Guidance in paragraph 059 expects a Sustainable Drainage Strategy (report) to be submitted. The PPG sets out in general terms what should be included in this and the LLFA has provide further comments regarding SuDS and drainage as to what is expected of applicants and planning applications.

Overall, it is expected the same broad topics to be reviewed at each stage in the planning process but the level of detail to be provided and the scrutiny undertaken by the LLFA will increase as design develops. The sections below given an overview of what is expected at each stage and Table 2 provides a matrix of details is expected.

Outline planning

At Outline planning stage, the LLFA will require the applicant to submit an Outline Surface Water Drainage Strategy based on SuDS principles. The strategy should inform the Masterplan / indicative site layout by identifying suitable placement and design of the surface water drainage infrastructure. It should mitigate flood risk, provide opportunity to manage water quality and identify potential for amenity and biodiversity.

Full planning

At the 'full' planning stage proposals for surface water drainage should be well developed and this should be reflected in the level of detail provided. A surface water drainage scheme should be provided based on SuDS principles demonstrating how the development attenuates surface water runoff, improves water quality and provides amenity and biodiversity. This should be supported by network level calculations demonstrating the performance of the system.

Reserved Matters

At the Reserved Matters planning stage proposals for surface water drainage should be well developed and can be considered as bringing an Outline up to the level of Full planning permission. A surface water drainage scheme should be provided

based on SuDS principles and the parameters set out in the prior outline planning permission, demonstrating how the Reserved Matters (and importantly the layout) to be approved provide sufficient space for SuDS.

Discharge of Conditions

At the 'discharge of condition' stage proposals for surface water drainage should be approaching a level of detail suitable for tender or construction. Documentation should show the drainage scheme including SuDS features, specific details (e.g. standard details or cross sections) and demonstrate the performance and of the system through calculations and exceedance management respectively. Such scheme should be in line with the original planning application/permission and where significant changes are made, justification should be provided.

Table 2 - Planning Application Drainage Information Matrix

Level of planning:	Outline	Full	Reserved Matters	Discharge of Conditions
Discharge Location (in line with hierarchy	Evidence of following the drainage hierarchy, justification of the proposed outfall location. E.g. land ownership plans demonstrating riparian ownership, STW Developer Enquiry (within 6 months date), survey plans showing levels are sufficient to allow a gravity outfall		Location remains in line with (or improves upon) that approved at Outline	Technical acceptance of the outfall E.g. S106 approval, land drainage consent
Discharge Rate	Calculation of existing discharge rates and proposed rates limited in line with policy. Estimation of impermeable area to inform discharge rates	Rates limited in line with policy Impermeable area based on proposed layout masterplan used, provide evidence of areas and pro-rata rates to calculate the overall discharge rate	Rates revised in line with proposed layout masterplan contributing area.	Demonstration of rates in line with those agreed previously.
Appraisal of SuDS (see Appendix A)	Review of all SuDS features to determine suitability and justification where features are excluded. Provide understanding of which features may be considered later and how relevant information will be passed forward in the design.		Updated appraisal considering all features Demonstrate continuation of features proposed within outline strategy Consideration of smaller-scale SuDS (e.g. raingardens) which may not have been quantified at Outline stages	Demonstrate continuation of features proposed within strategy / scheme Consider 'quick-wins' and small scale improvements to design (see Section 7, in particular Figure 10 & Figure 11)
Proposed Drainage Plans	Indicative strategies demonstrating that sufficient space has been made available for strategic attenuation. An understanding of wider source control and conveyance features and that space for such features has been considered.	Drainage schemes showing the location of all SuDS features including source control, conveyance and strategic attenuation features. Evidence of contributing areas, rates and features where a development is phased.	Drainage schemes showing the location of all SuDS features, in line with the principles set out within any Outline Permission drainage strategy.	Detailed design plans of the proposed drainage scheme, approaching a level of design suitable for tender or construction.
Calculations	High-level calculations to demonstrate the performance of strategic attenuation features e.g. Micro Drainage Source Control	Detailed network level calculations representing the network, strategic attenuation features and flow controls. Calculations should cover a range of storm durations up to and including the critical duration, for events up to the design event.		Detailed network level calculations representing the network, most SuDS features, and flow controls Calculations should cover a range of storm durations up to and including the critical duration, for events up to the design event.
Cross Sections & Standard Details	Dependent on the scale & nature of the application	Indicative cross sections & standard details		Detailed cross section and standard detail drawings approaching a level of design suitable for tender or construction. Details should show all relevant levels / dimensions such as diameters, invert levels, weir levels etc.
Exceedance & Overland Flow Routing	Indicative understanding of where water is currently routed, where it will be routed as part of the proposed development and that neither the proposed development or existing receptors are put at increased risk	Demonstration, based on indicative levels, of where water is currently routed, where it will be routed as part of the proposed development and that neither the proposed development or existing receptors are put at increased risk	Indicative routing plans submitted at outline should be refined based upon the layout to be approved and indicative levels. Such should demonstrate where surface water runoff will be routed as part of the proposed development minimising the risk to properties.	Overland flow drawings should work hand-in-hand with proposed external levels across a development. Such should demonstrate how surface water runoff is routed across the development, minimising the risk to properties.

Level of planning:	Outline	Full	Reserved Matters	Discharge of Conditions
Maintenance Information	How will features be maintained and how does the development proposals support this e.g. easements, Indicatively, who will be responsible for undertaking the maintenance			Detailed understanding of maintenance activities, suitable for a layperson to be able to undertake them with no prior knowledge of the site. Contact information of who will be responsible for undertaking/organising the maintenance e.g. Management Company, landowner etc.

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12 APPENDIX A: SUDS FEATURE APPRAISAL PRO-FORMA

The LLFA expect all SuDS features to be considered as part of a holistic approach to surface water management. To this end, the below pro-forma should be used as a guide at all stages of the design. The LLFA will expect this to be completed as part of planning applications.

Some developers and consultants also provide similar information as part of flood risk assessments or drainage strategy reports. The LLFA will accept this however it is important that such considers all features and provides suitable justification as to why features have or haven't been included.

It is recognised some features may only be considered later in the design as the layout/masterplan evolves alongside any landscape and planting plans. However, it is nonetheless important to ensure all features are considered early with this thinking recorded such that it can be returned to as the design evolves.

<table>
<tr><td>Feature:</td><td>Included: Yes / No</td></tr>
<tr><td rowspan="2">Green / Blue Roofs</td><td>To be considered at next stage of design: Yes / No</td></tr>
<tr><td>Excluded: Yes / No</td></tr>
<tr><td colspan="2">Reasons for & issues to be considered at next stage of design:
E.g. awaiting plot-level masterplan to determine location & quantum
E.g. awaiting detailed design levels</td></tr>
<tr><td colspan="2">Justification for exclusion:
E.g. Other planning constraints – would not be in keeping with the character of the area</td></tr>
</table>

Feature:	Included: Yes / No
Bio-Retention / Raingardens	To be considered at next stage of design: Yes / No
	Excluded: Yes / No
Reasons for & issues to be considered at next stage of design: • E.g. awaiting plot-level masterplan to determine location & quantum • E.g. awaiting detailed design levels	
Justification for exclusion: • E.g. Other planning constraints – would not be in keeping with the character of the area	

Feature:	Included: Yes / No
Filter Drains / Filter Strips	To be considered at next stage of design: Yes / No
	Excluded: Yes / No
Reasons for & issues to be considered at next stage of design: • E.g. awaiting plot-level masterplan to determine location & quantum • E.g. awaiting detailed design levels	
Justification for exclusion: • E.g. Other planning constraints – would not be in keeping with the character of the area	

Feature:	Included: Yes / No
Tree Pits	To be considered at next stage of design: Yes / No
	Excluded: Yes / No
Reasons for & issues to be considered at next stage of design: • E.g. awaiting plot-level masterplan to determine location & quantum • E.g. awaiting detailed design levels	
Justification for exclusion: • E.g. Other planning constraints – would not be in keeping with the character of the area	

Feature:	Included: Yes / No
Swales	To be considered at next stage of design: Yes / No
	Excluded: Yes / No
Reasons for & issues to be considered at next stage of design: • E.g. awaiting plot-level masterplan to determine location & quantum • E.g. awaiting detailed design levels	
Justification for exclusion: • E.g. Other planning constraints – would not be in keeping with the character of the area	

Feature:	Included: Yes / No
Permeable Paving	To be considered at next stage of design: Yes / No
	Excluded: Yes / No
Reasons for & issues to be considered at next stage of design: • E.g. awaiting plot-level masterplan to determine location & quantum • E.g. awaiting detailed design levels	
Justification for exclusion: • E.g. Other planning constraints – would not be in keeping with the character of the area	

Feature:	Included: Yes / No
Basins & Ponds	To be considered at next stage of design: Yes / No
	Excluded: Yes / No
Reasons for & issues to be considered at next stage of design: • E.g. awaiting plot-level masterplan to determine location & quantum • E.g. awaiting detailed design levels	
Justification for exclusion: • E.g. Other planning constraints – would not be in keeping with the character of the area	