6 Guidance for Applying the Sequential and Exception Tests

6.1 Sequential Test

The Sequential Test is a decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to sites at higher risk, so avoiding the development of sites that are inappropriate on flood risk grounds. Where this cannot be avoided, application of an Exception Test allows for the possibility of some development in flood risk areas taking place if flood risk is clearly outweighed by other sustainability drivers.

The Sequential Test is applied at all stages of the planning process, both between different Flood Zones and within a Flood Zone. All opportunities to locate new developments (except Water Compatible) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

6.2 Applying the Sequential Test – Plan-Making

For the Local Plan, SMDC (as LPA) must demonstrate that it has considered a range of possible options. The Flood Zone and vulnerability information from the SFRA allows these options to be Sequentially Tested in terms of flood risk and, where necessary, an Exception Test applied in the site allocation process.

Figure 6-1 illustrates the approach for applying the Sequential Test that SMDC should adopt in the preparation of the Local Plan. The Sequential Test should be undertaken by SMDC and accurately documented to ensure decision processes are consistent and transparent.

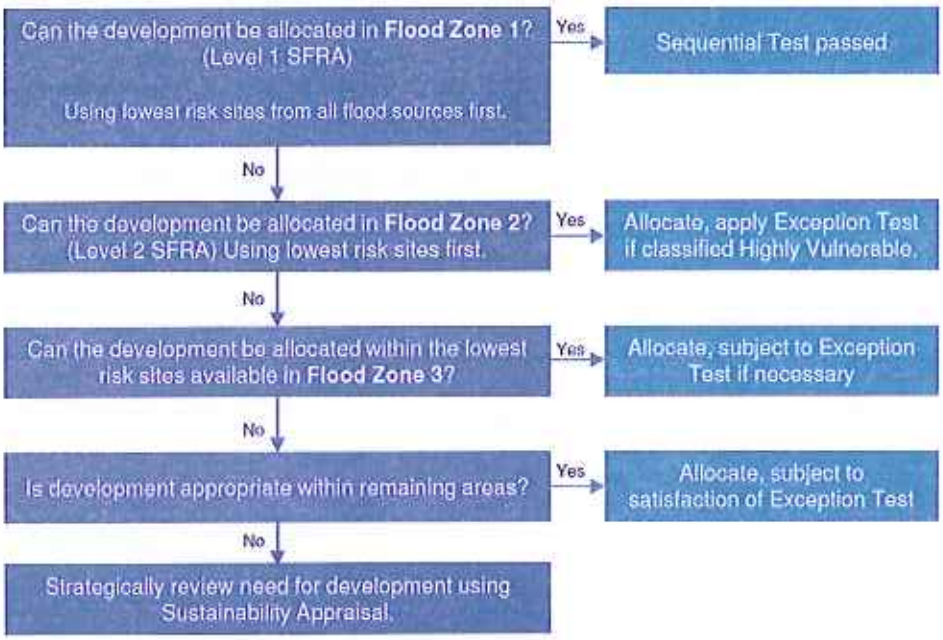

Figure 6-1: Application of Sequential Test for Local Plan Preparation

The Sequential Test requires an understanding of the Flood Zones in the District and the vulnerability classification of proposed forms of development. Flood Zone definitions are provided in and mapped in Appendix B Figures 6a – 6f (and the Flood Map for Planning (Rivers and Sea) on the Environment Agency's website). A summary of the vulnerability classifications, as defined in the PPG, is presented in Table 6-1.

Table 6-1: Flood Risk Vulnerability Classification (PPG, 2014)

VULNERABILITY CLASSIFICATION	DEVELOPMENT USES
Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure").
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 6-2 demonstrates which types of development are appropriate within each Flood Zone and where the Exception Test is required.

Table 6-2: Flood Risk Vulnerability and Flood Zone 'Compatibility' (PPG, 2014)

FLOOD RISK VULNERABILITY CLASSIFICATION		ESSENTIAL INFRASTRUCTURE	WATER COMPATIBLE	HIGHLY VULNERABLE	MORE VULNERABLE	LESS VULNERABLE
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test Required	✓	✓
	3a	Exception Test Required	✓	×	Exception Test Required	✓
	3b	Exception Test Required	✓	×	×	×

Notes to Table 6-2:

- ***This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;***
- *The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;*
- *Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.*

Key:

✓ - Development is appropriate

× - Development should not be permitted

† - In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

** - In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:*

- *remain operational and safe for users in times of flood;*
- *result in no net loss of floodplain storage;*
- *not impede water flows and not increase flood risk elsewhere.*

The NPPF acknowledges that some areas will (also) be at risk of flooding from sources other than fluvial. All sources must be considered when planning for new development including: flooding from land or surface water runoff; groundwater; sewers; and artificial sources.

If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.

Particular care should also be taken with the siting of Highly Vulnerable developments through Change of Use applications, whereby the Sequential and Exception Tests are not considered to apply. Consulting SCC and the Environment Agency in these circumstances is recommended.

6.2.1 Recommended stages for LPA application of the Sequential Test in Plan-Making

1. Assign potential developments with a vulnerability classification (Table 6-1). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.
2. The location and identification of potential development should be recorded.

3. The Flood Zone classification of potential development sites should be determined based on a review of the Flood Map for Planning (Rivers and Sea). Where these span more than one Flood Zone, all zones should be noted.
4. The design life of the development should be considered with respect to climate change:
   - 100 years up to 2115 for residential developments; and
   - Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.
5. Identify existing flood defences serving the potential development sites. However, it should be noted that for the purposes of the Sequential Test, Flood Zones ignoring defences should be used.
6. Highly Vulnerable developments to be accommodated within the LPA area should be located in those sites identified as being within Flood Zone 1. If these cannot be located in Flood Zone 1, either because the identified sites are unsuitable on other sustainability grounds, or there are insufficient sites in Flood Zone 1, then sites in Flood Zone 2 can then be considered. Highly Vulnerable developments in Flood Zone 2 will require application of the Exception Test. If sites in Flood Zone 2 are inadequate then the LPA may have to identify additional sites in Flood Zones 1 or 2 to accommodate development or seek opportunities to locate the development outside their administrative area. Within each Flood Zone Highly Vulnerable development should be directed, where possible, to the areas at lowest risk from all sources of flooding. Highly Vulnerable development is not appropriate in Flood Zones 3a and 3b.
7. Once all Highly Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as More Vulnerable. More Vulnerable development should be located in any unallocated sites in Flood Zone 1. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate More Vulnerable development, sites in Flood Zone 3a can be considered. More Vulnerable developments in Flood Zone 3a will require application of the Exception Test. As with Highly Vulnerable development, within each Flood Zone More Vulnerable development should be directed to areas at lowest risk from all sources of flooding. It should be noted that More Vulnerable development is not appropriate in Flood Zone 3b.
8. Once all More Vulnerable developments have been allocated to a development site, the LPA can consider allocating those development types defined as Less Vulnerable. In the first instance Less Vulnerable development should be located in any remaining unallocated sites in Flood Zone 1, continuing sequentially with Flood Zone 2, then Flood Zone 3a. Less Vulnerable development types are not appropriate in Flood Zone 3b (Functional Floodplain).
9. Essential Infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is satisfied.
10. Water Compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. The sequential approach should still be followed in the selection of sites; however it is appreciated that Water Compatible development by nature often relies on access and proximity to water bodies.
11. On completion of the Sequential Test, the LPA may have to consider the risks posed to a site within a Flood Zone in more detail in a Level 2 SFRA. By undertaking the Exception Test, this more detailed study should consider the detailed nature of flood hazard to allow a sequential approach to site allocation within a Flood Zone. Consideration of flood hazard within a Flood Zone would include:
    - Flood risk management measures,
    - The rate of inundation,
    - Flood water depth,
    - Flood water velocity.

    Where the development type is Highly Vulnerable, More Vulnerable, Less Vulnerable or Essential Infrastructure and a site is found to be impacted by a recurrent flood source (other than tidal or fluvial), the site and flood sources should be investigated further regardless of any requirement for the Exception Test.

The information required to address many of these steps is provided in the accompanying GIS layers and maps presented in Appendix B.

6.2.2 Windfall Sites

Windfall sites are those which have not been specifically identified through the Local Plan process. They are sites which do not have planning permission, but could be available for development. In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development, based on past trends and expected future trends. It is recommended that the acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms.

6.3 Applying the Sequential Test – Planning Applications

As illustrated in Figure 6-2 the flood risk Sequential Test can be considered adequately demonstrated if (1) the Sequential Test has already been carried out for the site for the same development type at the Local Plan level **and** (2) the development vulnerability is appropriate to the Flood Zone as set out in Figure 6-2.

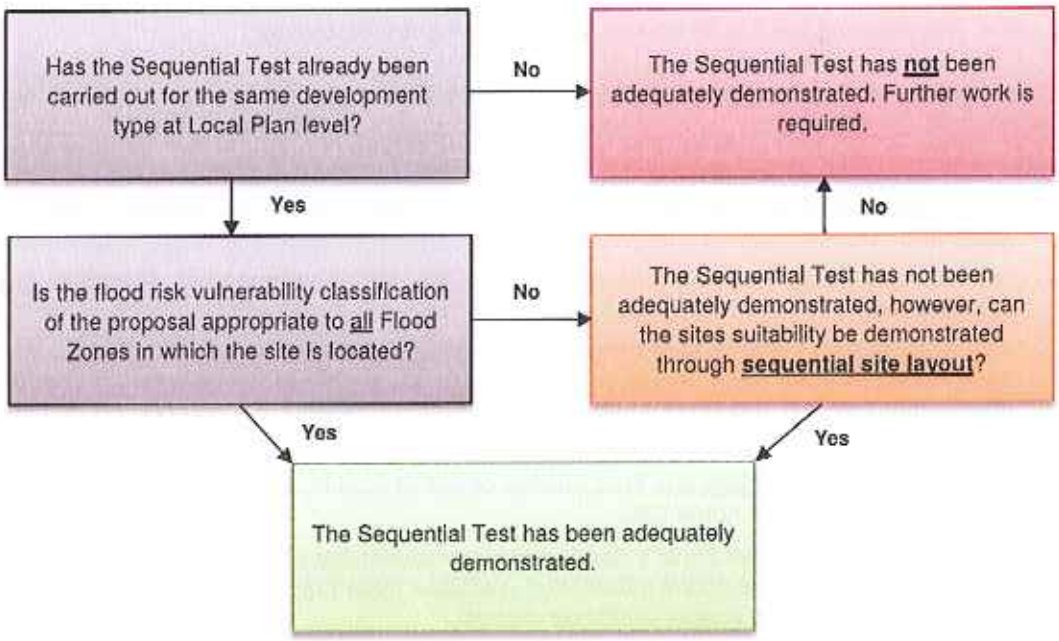

Figure 6-2: Determining when the Sequential Test is required for Planning Applications

If the answer to the first criteria is 'yes', but is 'no' for the second, it may be possible to make the site suitable for the proposed use by applying a sequential approach to the development site layout. Further guidance on how to apply a sequential approach is provided in Section 6.3.2.

If the answer to either of these two criteria is 'no', then it is necessary to undertake a Sequential Test for the site. The Environment Agency publication 'Demonstrating the Flood Risk Sequential Test for Planning Applications'[50] sets out the procedure as follows:

- Identify the geographical area of search over which the test is to be applied; this could be the District area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area identified for regeneration in Local Plan policies);
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan;
- State the method used for comparing flood risk between sites; for example the Environment Agency Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources;
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is

[50] Environment Agency (April 2012) Demonstrating the flood risk Sequential Test for Planning Applications, Version 3.1

allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s);

- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed;
- Where necessary, as indicated by Table 6-2, apply an Exception Test;
- Apply the Sequential approach to locating development within the site, as described in Section 6.2.

It should be noted that it is for LPAs, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The developer should justify with evidence to the LPA what area of search has been used when making the application. Ultimately SMDC needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere.

6.3.1 Sequential Test Exemptions

The Sequential Test does not need to be applied in the following circumstances:

- Individual developments proposed on sites which have been allocated in development plans through the Sequential Test.
- Minor development, which is defined in the NPPF as:
  - minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250 m^2;
  - alterations: development that does not increase the size of buildings e.g. alterations to external appearance;
  - householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats;
- Change of Use applications, unless it is for a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site;
- Development proposals in Flood Zone 1 (land with a low probability of flooding from rivers or the sea) unless the SFRA, or other more recent information, indicates there may be flooding issues now or in the future (for example, through the impact of climate change);
- Redevelopment of existing properties (e.g. replacement dwellings), provided they;
  - Will not be placed at an unacceptable level of flood risk, irrespective of the risk posed to the existing dwelling;
  - Do not increase the number of dwellings in an area of flood risk (i.e. replacing a single dwelling with an apartment block); and
  - Do not increase the net footprint of the building(s) unless accompanied by adequate floodplain compensation or suitable under floor voids.
- Redevelopment, for example replacement dwellings, will be expected to meet current Flood Risk Management best practice standards. Where this is not feasible due to conflicting planning reasons, designs should be as close to best practice as possible. Under no circumstances will a worsening of flood risk compared to the existing case be accepted.

6.3.2 Sequential Approach to Site Layout

It is important to acknowledge that some proposed development sites may only partially fall within Flood Zone 2, 3a or 3b, and as a result, may be discarded at an early stage of the Sequential Test. This Section provides some guidance on how allowances that could be made by identifying those portions of proposed development sites located within these Flood Zones.

The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas. Development should be sequentially allocated within the site boundary to areas firstly within Flood Zone 1 (Low Probability) and then Flood Zone 2 (Medium Probability) where 'less vulnerable' development uses would be more appropriate. Residential developments ('more vulnerable') should be restricted to areas at low probability of flooding and the following types of 'water compatible' development can be placed on lower ground with a higher probability of flooding (Flood Zones 3a and 3b):

- Car parks;
- Green infrastructure (i.e. open spaces, proposed landscaped areas, nature conservation);
- Outdoor sports and recreation;
- Flood control infrastructure; and
- Water and sewerage transmission infrastructure.

Should development pressure create a need to develop within the areas within Flood Zone 3 (plus an allowance for climate change) appropriate minimum floor levels to adopt in agreement with the Environment Agency should be determined. It is required that any flood volume displaced as a result of development within the entire Flood Zone 3 plus an allowance for climate change envelope (encapsulating Flood Zones 3a (High Probability) and 3b (Functional Floodplain)) be compensated for elsewhere within the site boundary on a 'level for level' and 'volume for volume' basis. Any proposed layout and location for such compensation should take into account the flow routing to ensure adequate conveyance.

Appropriate mitigation measures should be incorporated that do not increase the risk of flooding to surrounding areas, and where opportunity exists, aim to reduce flood risk to surrounding areas.

In additional to mitigating the impact of any fluvial flows displaced as described above, consideration should be given to the impact of any development on pluvial flow routes and areas susceptible to ponding (see Appendix B Figure 7a – 7f) informed by a review of the local topography, geology and any structures that may influence the movement of water over the surface. Following the sequential approach to the layout of buildings, provision of SuDS (see Section 8) will assist in mitigating any increase in risk from surface water to surrounding areas.

6.4 Exception Test

The Exception Test, as set out in paragraph 102 of the NPPF, is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

The purpose of an Exception Test is to ensure that certain new development (Table 6-2) is only permitted in Flood Zone 2 and Flood Zone 3 where flood risk is clearly outweighed by other sustainability factors and where the development will be safe during its lifetime, considering climate change.

Paragraphs 023 to 025 state that for the PPG states that or an Exception Test to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk; and
- A site-specific Flood Risk Assessment, informed by a Level 2 SFRA where one has been prepared, must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the test will have to be passed for development to be allocated or permitted in the Local Plan.

When determining planning applications, SMDC should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific FRA following the Sequential Test, and if required an Exception Test, it can be demonstrated that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and
- Development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of SuDS.

There are a number of ways a new development can be made safe:

- Avoiding flood risk by not developing in areas at risk from floods;
- Substituting higher vulnerability land uses for lower vulnerability uses in higher flood risk locations and locating higher vulnerability uses in areas of lower risk on a strategic scale, or on a site basis;
- Providing adequate flood risk management infrastructure which will be maintained for the lifetime of the development; and
- Mitigating the potential impacts of flooding through design and resilient construction.

In order to determine part 1) of an Exception Test, applicants should assess their scheme against the objectives within the Staffordshire Moorlands Core Strategy Sustainability Appraisal Report[51].

6.4.1 Exemptions

It is noted that applications for minor development and change of use are exempt from an Exception Test (see Notes to the Flood Risk Vulnerability and Flood Zone 'Compatibility' table (PPG, 2014)[2]); however site-specific FRAs are still required, as detailed in Section 7.

[51] SMDC (2014) Staffordshire Moorlands Core Strategy Sustainability Appraisal Report. Available at: http://www.staffsmoorlands.gov.uk/sites/default/files/documents/pages/Core%20Strategy%20Sustainability%20Appraisal%20Report%20March%202014.pdf

7 Guidance for Preparing Site-Specific FRAs

7.1 Overview

This Level 1 SFRA update provides a high level assessment of the flood risk posed to Staffordshire Moorlands. However, this document has a strategic scope and therefore it is essential that site-specific FRAs are also developed for individual development proposals where required, and that where necessary and appropriate, suitable mitigation measures are incorporated.

A site-specific FRA is a report suitable for submission with a planning application which provides an assessment of flood risk to and from a proposed development, and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and, where possible, will reduce flood risk overall in accordance with the NPPF and PPG.

7.2 When is a Flood Risk Assessment required?

The NPPF states that a site-specific FRA is required in the following circumstances:

- For proposals of 1 hectare or greater in Flood Zone 1;
- All proposals for new development (including minor development[52] and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency); and,
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

The Environment Agency Guidance Note[53] for FRAs in Flood Zone 1 should be consulted for advice on the approach and content of a site-specific FRA.

7.3 What should a Flood Risk Assessment address?

The NPPF states that site-specific FRAs should always be proportionate to the degree of flood risk and make optimum use of readily available information, for example the mapping presented within this SFRA. FRAs should also be appropriate to the scale, nature and location of the development.

The PPG outlines the objectives of a site-specific FRA are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- whether the development will be safe and pass the Exception Test, if applicable.

The CIRIA publication C624[54] presents a staged approach to the preparation of site-specific FRAs, and identifies typical sources of information that can be used. A summary of the three levels of FRAs is described in Table 7-1.

[52] According to the PPG, minor development means:
minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m^2.
alterations: development that does not increase the size of buildings e.g. alterations to external appearance.
householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.

[53] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/311502/LIT_9193.pdf

Table 7-1: Levels of Site-Specific Flood Risk Assessment

DESCRIPTION
Level 1 Screening study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information. The screening study will ascertain whether a FRA Level 2 or 3 is required. Typical **sources of information** include: • SFRA; • Flood Map for Planning (Rivers and Sea); • Local flood risk policy documentation (such as RBD Flood Risk Management Plan, Catchment Flood Risk Management Plan, Shoreline Management Plan and Local Flood Risk Management Strategy); and • Standing Advice: https://www.gov.uk/flood-risk-assessment-local-planning-authorities
Level 2 Scoping study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding, or the site may increase flood risk due to increased run-off. This study should confirm the sources of flooding which may affect the site. The study should include: • An appraisal of the availability and adequacy of existing information; • A qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; and • An appraisal of the scope of possible measures to reduce flood risk to acceptable levels. • The scoping study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.
Level 3 Detailed study to be undertaken if a Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The study should include: • Quantitative appraisal of the potential flood risk to the development; • Quantitative appraisal of the potential impact of the development site on flood risk elsewhere; and • Quantitative demonstration of the effectiveness of any proposed mitigations measures.

Table 7-2 is based on the checklist for site specific FRAs provided in the PPG. Where appropriate, references have been added to determine where the information can be found to support each required item.

Table 7-2: Site-Specific Flood Risk Assessment Checklist (Planning Practice Guidance)

1. Development description and location	
1a. What type of development is proposed (e.g., new development, an extension to existing development, a change of use etc.) and where will it be located?	☐
1b. What is its flood risk vulnerability classification? Refer to Section 6.2, Table 6-1.	☐
1c. Is the proposed development consistent with the Local Plan for the area? SDC is currently carrying out a review of the SDC Core Strategy and Development Policies and is due to start work on its Local Plan in 2015. The existing Core Strategy and Development Policies should be referred to on the SDC website: http://www.selby.gov.uk/core-strategy and seek advice from SMDC if necessary	☐
1d. What evidence can be provided that the Sequential Test and where necessary the Exception Test has/have been applied in the selection of this site for this development type? Consult SMDC to determine if the site has been included in the Sequential Test once this has been carried out. If not, refer to Section 6.3 for guidance on undertaking the Sequential Test for individual development sites and to determine whether the Exception Test is required.	☐
1e. Will your proposal increase overall the number of occupants and/or users of the building/land, or the nature or times of occupation or use, such that it may affect the degree of flood risk to these people? This is particularly relevant to minor developments (alterations & extensions) & changes of use.	☐
2. Definition of the flood hazard	
2a. What sources of flooding could affect the site? Refer to Section 4.	☐

[54] CIRIA, 2004, Development and flood risk – guidance for the construction industry C624.

2b. For each identified source under 2a above, can you describe how flooding would occur, with reference to any historic records where these are available? Refer to Section 4.	☐
2c. What are the existing surface water drainage arrangements for the site? Undertake a site survey to determine specific details and seek advice from Severn Trent Water and United Utilities.	☐
3. Probability	
3a. Which Flood Zone is the site within? Refer to Section 4.	☐
3b. Does the SFRA show the same or a different Flood Zone compared with the Environment Agency's flood map? Refer to the Flood Map for Planning (Rivers and Sea) on the Environment Agency's website http://maps.environment-agency.gov.uk/wiyby. If different you should seek advice from the local planning authority and, if necessary, the local Environment Agency office.	☐
3c. What is the probability of the site flooding, taking account of the maps of Flood Risk from Rivers and the Sea and from surface water, on the Environment Agency's website, and the SFRA, and of any further flood risk information for the site? Refer to mapping in Appendix B, as well as the Flood Map for Planning (Rivers and Sea) and the Flood Risk from Surface Water mapping (uFMfSW) on the Environment Agency's website http://maps.environment-agency.gov.uk/wiyby.	☐
3d. If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?	☐
4. Climate change	
How is flood risk at the site likely to be affected by climate change? Refer to Section 4.3.7 and 4.4.4 for a description of how climate change will impact fluvial and surface water flooding.	☐
5. Detailed development proposals	
Where appropriate, are you able to demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding (including providing details of the development layout)? Refer to Section 6.3 regarding the use of the sequential approach within development sites.	☐
6. Flood risk management measures	
How will the site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime? Refer to Section 7.5 for details regarding finished floor levels, basement dwellings, flood resilient design, car parking considerations, and provision of safe access / egress.	☐
7. Off-site impacts	
7a. How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?	☐
7b. How will you prevent run-off from the completed development causing an impact elsewhere? Refer to Section 5 regarding Flood Risk Management Objective 2. Refer to Section 8 regarding the use of specific types of SuDS throughout the district.	☐
7c. Are there any opportunities offered by the development to reduce flood risk elsewhere? Refer to Section 5 regarding Flood Risk Management Objective 2. Refer to Section 8 regarding the use of specific types of SuDS throughout the district.	☐
8. Residual risks	
8a. What flood-related risks will remain after you have implemented the measures to protect the site from flooding? In addition, how will implemented measures be maintained? See Sections 7.5, 8.5 and 8.6.	☐
8b. How, and by whom, will these risks be managed over the lifetime of the development? (E.g., flood warning and evacuation procedures). Refer to Section 7.5.12 for details regarding flood warning and flood evacuation plans.	☐

7.3.1 Proposed Development in Low Probability Flood Zone 1

FRAs within Flood Zone 1 should primarily take consideration of how the ability of water to soak into the ground may change with development, along with how the proposed layout of development may affect drainage systems. This is to ensure surface water generated by the site is managed in a sustainable manner and does not increase the burden on existing infrastructure and/or flood risk to neighbouring property. The assessment of surface water flood risk should take account for the impact of climate change over the lifetime of the development. SuDS techniques must be employed to ensure there is no increase in flooding elsewhere.

The uFMfSW dataset (Appendix B Figures 7a – 7f) should be used to indicate broad areas with a potential surface water flood risk. More detailed site investigations will also be required to determine local conditions and suitability of drainage techniques. Appendix B Figure 8 and Figure 9 should be used to provide an indication of areas where there may be a risk of groundwater flooding and where infiltration SuDS may be viable. The SFRA provides specific recommendations with respect to the provision of sustainable flood risk mitigation opportunities that will address both the risk to life and the residual risk of flooding to development within particular 'zones' of the area. These recommendations should form the basis for the site-specific FRA.

7.3.2 Proposed Development within Medium Probability Zone 2

For all sites within Medium Probability Flood Zone 2, a Level 2 Scoping FRA should be prepared based upon readily available existing flooding information, sourced from the Environment Agency. If a significant flood risk from other sources (e.g. surface water, groundwater or sewer flooding) is identified then a more detailed FRA should be prepared. It will be necessary to demonstrate that the residual risk of flooding to the property is effectively managed throughout, for example through the provision of raised floor levels and the provision of planned evacuation routes or safe havens.

SuDS techniques must be employed on all sites in line with paragraph 103 of the PPG, regardless of the Flood Zone that they sit within. If a site is located within Flood Zone 2 or 3, where possible the SuDS features associated with that site should be located outside of high risk fluvial Flood Zones to ensure sufficient capacity during surface water events which coincide with fluvial flooding.

7.3.3 Proposed Development in Flood Zone 3a High Probability

All FRAs supporting proposed development within High Probability Flood Zone 3a should assess the proposed development against all elements of the Council's flood policy, and include an assessment of the following:

- The vulnerability of the development to flooding from other sources (e.g. surface water drainage, groundwater) as well as from river flooding. This will require discussion with SMDC, the Environment Agency, SCC as the LLFA, ST and UU to confirm whether a localised risk of flooding exists at the proposed site.
- The vulnerability of the development to flooding over the lifetime of the development (including the potential impacts of climate change), i.e. maximum water levels, flow paths and flood extents within the property and surrounding area.
    - The design life of the proposed development should be considered with respect to climate change as 100 years (up to 2115) for residential developments. Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.
    - For sites within the floodplain of main rivers, applicants should consult the Environment Agency to obtain information on the modelled flood levels associated with these watercourses. Where this information is of suitable quality, modelled flood levels for the relevant annual probability events should be compared with site topographic information to more accurately determine the flood risk to the site.
- Where the quality and/or quantity of information for any of the flood sources affecting a site is insufficient to enable a robust assessment of the flood risk, further investigation may be required. For example, where hydraulic modelling is not available for ordinary watercourses, the scope of the FRA should be increased to include modelling to ensure details of flooding mechanisms are fully understood and that the proposed development incorporates appropriate mitigation measures;

- The potential of the development to increase flood risk elsewhere through the addition of hard surfaces, the effect of the new development on surface water runoff, and the effect of the new development on depth and speed of flooding to adjacent and surrounding property. This will require a detailed assessment to be carried out by a suitably qualified engineer;
- Opportunities for new developments to deliver reductions to wider flood risk issues where possible, e.g. larger developments may be able to make provisions for flow balancing within new attenuation SuDS features;
- The FRA should consider the vulnerability of those that could occupy and use the development including arrangements for safe access. The FRA should also take account of the vulnerability classification (Table 6-1) and the status of the site in relation to the Sequential and Exception Tests;
- The localised risk of flooding that may occur. This is typically associated with local catchment runoff following intense rainfall;
- A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account) are acceptable. Measures may include flood defences, flood resistant and resilient design, escape/evacuation, effective flood warning and emergency planning;
- Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum;
- It is essential that developers thoroughly review the existing and future structural integrity of informal defences, if present, upon which the development will rely (i.e. over the lifetime of the development), and ensure that emergency planning measures are in place to minimise risk to life in the unlikely event of a defence failure. This would be particularly important for development that could potentially be affected as a result of a breach of any reservoirs or canals in the District.
- SuDS techniques must be employed to ensure no worsening of existing flooding problems elsewhere within the area;
- At all stages, the LPA, and where necessary the Environment Agency, and/or the Statutory Water Undertaker should be consulted to ensure the FRA provides the necessary information to fulfil the requirements for Planning Applications.

7.4 Proposed Development in Flood Zone 3b Functional Floodplain

In line with the NPPF, development will not normally be allowed in the Functional Floodplain unless it is classified as a 'Water Compatible' or 'Essential Infrastructure' use. Table 6-1 from the NPPF (Section 6.2), details the type of developments classified as 'Water Compatible' or 'Essential Infrastructure.'

7.5 Guidance on Flood Risk Management Measures

7.5.1 Sequential approach within development sites

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development and to ensure flood risk is not increased elsewhere. Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas e.g. residential developments should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas can be placed on lower ground with a higher probability of flooding. Whilst traditionally applied to the risk of river flooding, this approach should also be implemented when considering the risk of surface water flooding across a site.

7.5.2 Finished Floor Levels

Where developing in fluvial flood risk areas is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) land uses, is to ensure internal floor levels are raised a freeboard distance above peak flood water levels. Finished floor levels should be set a minimum of 600 mm above the 1% AEP (1 in 100 chance of flooding in any one year) plus climate change peak flood level. The peak flood water level should be derived for the immediate vicinity of the site (i.e. relative to the extent of a site along a watercourse as flood levels are likely to vary with increasing distance downstream) as part of a site-specific FRA. In areas of surface water flood risk, finished floor levels should be set at 600 mm above the surrounding ground level as a precautionary measure unless evidence of the expected flood depths is provided.

The Environment Agency recommends finished flood levels are set at 600 mm above the 1% AEP plus climate change flood level for Less Vulnerable development in Flood Zones 2 and 3. Where this is not possible flood resilient/resistant measures should be incorporated to provide appropriate property-level protection. Requirements for a freeboard above the peak flood level for finished internal floor levels within Less Vulnerable commercial and industrial units vary, depending upon the proposals. For such land uses, finished internal floor levels may not be required to be raised. However, it is strongly recommended that internal access is provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. Such refuges will have to be permanent and accessible to all occupants and users of the site.

With respect to residential accommodation and in accordance with Tables 1, 2, and 3 of the PPG, basement accommodation, single storey accommodation, and multi-storey buildings with ground floor sleeping accommodation should not be permitted, or allocated, in Flood Zone 3. Sleeping accommodation should be restricted to the first floor or above to offer the required 'safe places'. However, internal ground floors below this level could be occupied by either Less Vulnerable commercial premises, garages or non-sleeping residential rooms (e.g. kitchen, study, lounge) (i.e. applying a sequential approach within a building).

Further consultation with the Environment Agency will therefore be required during the undertaking of any detailed FRA. For both Less and More Vulnerable developments where internal access to higher floors is provided, the associated plans showing this should be included within any site-specific FRA.

Hotels are classed as More Vulnerable land uses, however, where it is not viable to raise finished floor levels, internal access to higher floors must be provided to give safe refuge to all occupants during times of flood. Sleeping accommodation should be set a minimum of 300mm above the 0.1% AEP plus climate change peak flood level.

In certain situations (e.g. for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. In these cases, the Environment Agency should be approached to discuss options for a reduction in the minimum internal ground floor levels provided flood proofing (resistance) measures are implemented up to an agreed level. There are also circumstances where flood proofing (resilience) measures should be considered first. These are described further below.

7.5.3 Basement Dwellings

Basement dwellings are classified as Highly Vulnerable and as such they are not permitted within Flood Zones 3a and 3b. They must pass the Sequential and Exception Tests should they be proposed for Flood Zone 2. Basement dwellings should therefore be discouraged within areas at risk of fluvial, surface water or groundwater flooding. Where they are constructed, access must be situated 300mm above the design flood level, and waterproof construction techniques should be employed to avoid seepage during flood events. An assessment of groundwater conditions will also be required to inform the structural integrity of the basement construction. Similar problems can also occur where excessive surface water ponding occurs close to the sides of buildings, leading to significant infiltration. Surface water flow paths should be assessed to ensure that this does not occur, and to inform the strategic location of SuDS and techniques to route flows around the edge of buildings.

FRAs should address the potential impact of large basements on groundwater flooding. Below-ground structures have the potential to impede the flow of groundwater, increasing flood risk up-gradient.

7.5.4 Flood Resistant and Resilient Design

In order to mitigate any potential flood damage, there are a range of flood resilient construction techniques that can be implemented in new developments. The Department for Communities and Local Government (CLG) have published a document 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[55], the aim of which is to provide guidance to developers and designers on how to improve the resilience of new properties in low or residual flood risk areas, through the use of suitable materials and construction details. Figure 7-1 provides a summary of different design strategies depending on the depth of floodwater that could be experienced.

[55] CLG (2007) Improving the Flood Performance of New Buildings, Flood Resilient Construction

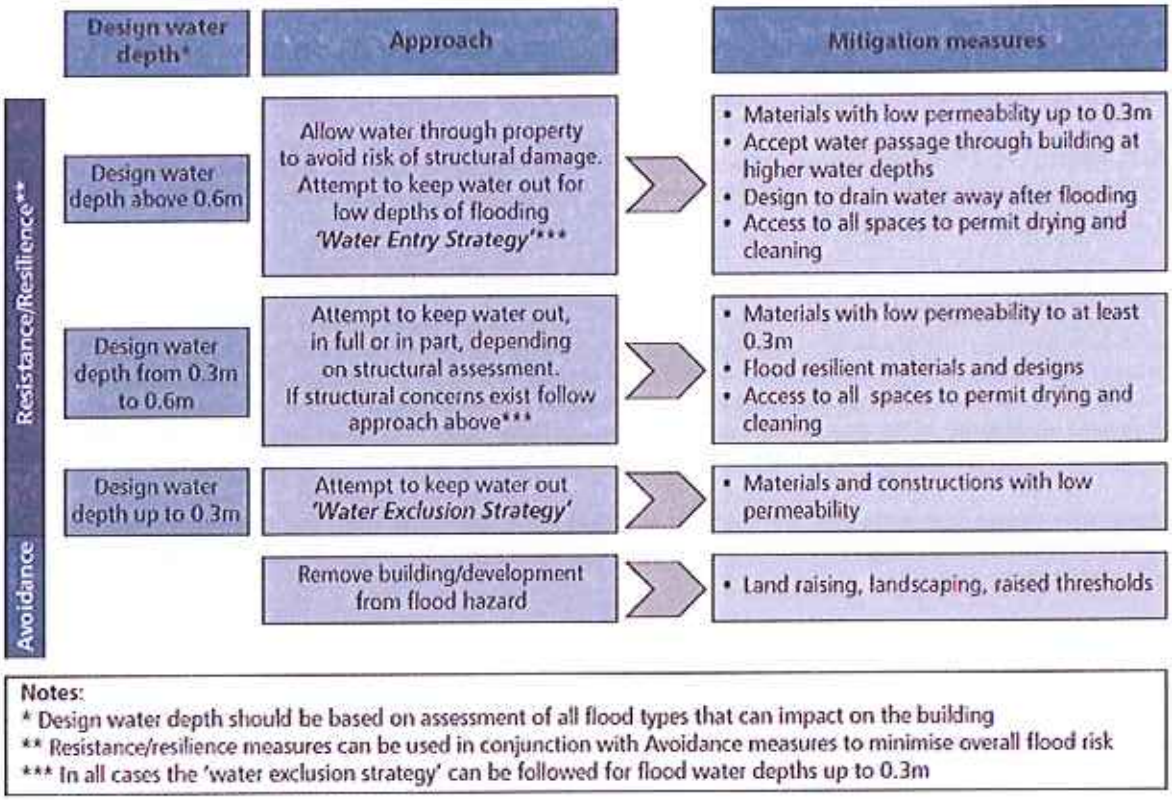

Figure 7-1: Rationale for Flood Resilient Design Strategies, Improving Flood Performance, (Figure 4.1 from CLG 2007)

A number of design strategies are detailed including the Water Exclusion Strategy and Water Entry Strategy. Resistance measures are aimed at preventing water ingress into a building (Water Exclusion Strategy); they are designed to minimise the impact of floodwaters directly affecting buildings and to give occupants more time to relocate ground floor contents. These measures will probably only be effective for short duration, low depth flooding, i.e. less than 0.3 m.

For flood depths greater than 0.6 m, it is likely that structural damage could occur in traditional masonry construction due to excessive water pressures. In these circumstances, the strategy should be to allow water into the building, i.e. the Water Entry Strategy.

The principle behind the Water Entry Strategy is not only to allow water through the property to avoid the risk of structural damage, but also to implement careful design in order to minimise damage and allow rapid re-occupancy of the building. The NPPF considers these measures to be appropriate for both changes of use and for Less Vulnerable uses where temporary disruption is acceptable and suitable flood warning is received.

Materials will be used which allow the passage of water whilst retaining their structural integrity and they should also have good drying and cleaning properties. Alternatively sacrificial materials can be included for internal and external finishes; for example the use of gypsum plasterboard which can be removed and replaced following a flood event. Flood resilient fittings should be used to at least 300 mm above the design flood level. Resilience measures are either an integral part of the building fabric or are features inside a building that will limit the damage caused by floodwaters.

Further specific advice regarding suitable materials and construction techniques for floors, walls, doors and windows and fittings can be found in 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' (CLG, 2007).

Where finished floor levels cannot be raised to the recommended height due to ridge height restriction or disabled access, the reasons for this should be clearly stated and appropriate flood resilient/resistant measures should be provided to 300 mm above the 1% AEP plus climate change flood level.

7.5.5 Green Infrastructure and Urban Blue Corridors

Urban Blue Corridors present the opportunity to link into existing networks of Green Infrastructure to provide dynamic hydraulic and ecological corridors in the urban environment and provide multifunctional use. This can be done in tandem with delivering environmental, social and economic benefits.

Green Infrastructure is defined as *"a network of multi-functional green space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities."*[56]

Definitions for Green Infrastructure vary in the degree to which they refer to 'Blue' Infrastructure elements. The Natural England Green Infrastructure Guidance[57] recognises rivers and streams within a Green Infrastructure typology, whereas other definitions make specific reference to water resources forming part of the Green Infrastructure network. Green Infrastructure elements or assets include individual sites or broader features such as urban squares, city parks, nature reserves, brown/green roofs, private gardens, railway corridors and woodland. Most assets can contribute to surface water management. However, whilst Green Infrastructure takes into account flood risk management, it does not, at present, include overland flow paths.

By linking with Green Corridors and Infrastructure, Urban Blue Corridors offer the opportunity to help align with national environmental aspirations. For example, Natural England, in their Position Statement on Urban Areas[58], states that:

- The natural environment in towns and cities is fundamental to sustaining urban life and should be integral to the way in which urban areas are planned and managed;
- The distinctive fabric of the natural environment in towns and cities makes a major contribution to urban landscape and sense of place and should be valued, conserved and enhanced;
- The natural environment in towns and cities should underpin their adaptation to a rapidly changing climate and provide environmental security for communities; and

People should have opportunities to readily access high quality natural environment in urban areas in order to enjoy the broad range of environmental and social benefits it offers.

Where proposed sites contain a main river or ordinary watercourse, conservation and restoration of the river corridor should be incorporated into the site layout, and if necessary a fluvial management strategy developed. Where possible, the post development situation should be better in terms of flood risk compared to the existing situation, by providing space for water to include an allowance for climate change, as well as improve ecology, water quality and amenity. In these instances, it may not be necessary to undertake a Sequential Test for the site, if all development can be shown to be within Flood Zone 1.

7.5.6 Car Parks

Where car parks are specified as areas for the temporary storage of floodwaters, flood depths should not exceed 300mm given that vehicles may be moved by water of greater depths. Where greater depths are expected, car parks should be designed to prevent the vehicles from floating out of the car park. Signs should be in place to notify drivers of the susceptibility of flooding and flood warning should be available to provide sufficient time for car owners to move their vehicles if necessary. The Environment Agency recommends that in areas where under croft parking is provided, occupants should also sign up to flood alerts. Due to the nature of flood warnings, it is possible that under croft parking areas may have flooded before a flood warning has been issued.

7.5.7 Structures

Structures such as (bus, bike) shelters, park benches and refuse bins (and associated storage areas) located in areas with a high flood risk should be flood resilient and be firmly attached to the ground.

7.5.8 Safe Access and Egress

Safe access and egress is required to enable the evacuation of people from the development, provide the emergency services with access to the development during times of flood and enable flood defence authorities to carry out any necessary duties during periods of flood.

[56] Department for Communities and Local Government (2008) Planning Policy Statement 12: Local Spatial Planning. *(Now redacted)*
[57] Natural England (2009) Green Infrastructure Guidance. Available at: http://publications.naturalengland.org.uk/publication/35033
[58] Natural England (24th February 2010) Natural England's Position on Urban Areas, Paper No. NEB PU19 11. Available at: http://www.naturalengland.org.uk/images/NEBPU1911_tcm6-17024.pdf

A safe access/egress route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances.

For developments located in areas at flood risk the Environment Agency consider 'safe' access/egress to be in accordance with 'FRA Guidance for new Developments FD 2320'[59]. The requirements for safe access and egress from new developments are as follows in order of preference:

- Safe, dry route for people and vehicles;
- Safe, dry route for people;
- If a dry route for people is not possible, a route for people where the flood hazard, in terms of depth and velocity of flooding, is low and should not cause risk to people; and
- If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles.

Flooding along the safe access/egress route should have a hazard no greater than very low in accordance with the Defra / Environment Agency guidance document FD2320 and entirely on publically accessible land. The route should be located entirely outside the 1% AEP plus climate change flood extent.

7.5.9 Floodplain Compensation Storage

Where proposed development results in an increase in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water and that it does not impact upon floodwater flow conveyance.

Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume of the floodplain storage is not reduced.

Floodplain compensation must be provided on a level for level, volume for volume basis on land which does not already flood and is within the site boundary. Where land is not within the site boundary, it must be in the immediate vicinity of the site and linked to the planning application. Floodplain compensation must be considered in the context of the 1 in 100 year (1% annual probability) flood level including an allowance for climate change.

The requirement for no loss of floodplain storage means that it is not possible to modify ground levels on sites which lie completely within the floodplain (when viewed in isolation), as there is no land available for lowering to bring it into the floodplain. It is possible to provide off-site compensation within the local area e.g. on a neighbouring or adjacent site, however, this would be subject to detailed investigations and agreement with the Environment Agency and SMDC to demonstrate that the proposals would improve and not worsen the existing flooding situation.

7.5.10 Flood Routing

In order to demonstrate that 'flood risk is not increased elsewhere', development in the floodplain will need to prove that flood routing is not adversely affected by the development, for example giving rise to backwater affects or diverting floodwaters onto other properties.

Potential overland flow paths should be determined through a detailed review of a sites' topography and that of neighbouring land uses, and appropriate solutions proposed to minimise the impact of the development, for example by configuring road and building layouts to preserve existing flow paths and improve flood routing, whilst ensuring that flows are not diverted towards other properties elsewhere.

Careful consideration should be given to the use of fences and landscaping walls so as to prevent causing obstruction to flow routes and increasing the risk of flooding to the site or neighbouring areas.

[59] Defra and Environment Agency (2005) Flood Risk Assessment Guidance for New Development FD 2320

7.5.11 Riverside Development

Under Section 109 of the Water Resources Act 1991 and/or Environment Agency Byelaws, any works on, over, under or near a statutory main river (both open channels and culverted sections), flood or sea defence, or to make changes to any structure that helps control floods requires Environment Agency consent. This includes any works (including temporary) that affect flow within the channel of any main river (such as in channel structures or diversion of watercourses) or may impede any drainage work.

In addition, the Environment Agency seek an 8 metre wide undeveloped buffer strip alongside main rivers and behind flood defences, and would also ask developers to explore opportunities for river restoration as part of any development. A buffer zone of 5 metres alongside ordinary watercourses is encouraged by the Environment Agency.

As of 6 April 2012 responsibility for the consenting of works by third parties on ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the FWMA) has transferred from the Environment Agency to SCC as the LLFA. SCC now has responsibility for the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. As with main rivers, this includes any permanent or temporary works that affect flow within the channel of any ordinary watercourse. Responsibility for consenting of third party works on main rivers is retained by the Environment Agency.

Consent is refused if the works would result in an increase in flood risk, a prevention of operational access to the watercourse, if they would damage an asset or cause bank instability issues and/ or they pose an unacceptable risk to nature conservation. Consent is required to ensure works do not increase flood risk, damage flood defences or harm the environment, fisheries or wildlife. Where development is proposed near a main river, we recommend that developers contact the Environment Agency as soon as possible to discuss their plans.

7.5.12 Flood Warning and Evacuation Plans

Evacuation is where flood alerts and warnings provided by the Environment Agency enable timely actions by residents or occupants to allow evacuation to take place unaided, i.e. without the deployment of trained personnel to help people from their homes, businesses and other premises. Rescue by the emergency services is likely to be required where flooding has occurred and prior evacuation has not been possible.

For all development proposed in Flood Zones 2 or 3a, a Flood Warning and Evacuation Plan should be prepared to demonstrate what actions site users will take before, during and after a flood event to ensure their safety, and to demonstrate their development will not impact on the ability of the local authority and the emergency services to safeguard the current population.

It may also be necessary to prepare a Flood Warning and Evacuation Plan for development in Flood Zone 1 where the area surrounding the site and/or any potential egress routes away from the site may be at risk of flooding during the 1% annual probability (1 in 100) flood event including an allowance for climate change.

Flood warning and evacuation plans should include:

- How flood warning is to be provided, such as:
  - Availability of existing flood warning systems;
  - Where available, rate of onset of flooding and available flood warning time; and
  - How flood warning is given.
- What will be done to protect the development and contents, such as:
  - How easily damaged items (including parked cars) or valuable items (important documents) will be relocated;
  - How services can be switched off (gas, electricity, water supplies);
  - The use of flood protection products (e.g. flood boards, airbrick covers);
  - The availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc.; and
  - The time taken to respond to a flood warning.

- Ensuring safe occupancy and access to and from the development, such as:
  - Occupant awareness of the likely frequency and duration of flood events, and the potential need to evacuate;
  - Safe access route to and from the development;
  - If necessary, the ability to maintain key services during an event;
  - Vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible; and
  - Expected time taken to re-establish normal use following a flood event (clean-up times, time to re-establish services etc.); and
  - Whether flooding might occur without a warning e.g. breach or surface water flooding.

The Environment Agency has a tool on their website to create a Personal Flood Plan[60]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details.

There is no statutory requirement for the Environment Agency or the emergency services to approve evacuation plans. The LPA is accountable via planning condition or agreement to ensure that plans are suitable. This should be done in consultation with the local authority emergency planning staff.

[60] Environment Agency (2015) Tool 'Make a Flood Plan'. Available at: https://www.gov.uk/government/publications/personal-flood-plan

8 Guidance for the Application of SuDS

8.1 Introduction

The PPG, which accompanies the NPPF, indicates that priority should be given to the use of SuDS in new developments. Appropriate deployment of SuDS within a development can offer benefits in terms of reductions in flood risk, improvements to water quality, quicker replenishment of groundwater and improved visual amenity. If SuDS are not going to be used then sufficient evidence should be provided to explain why, and it should be shown that traditional drainage methods can provide benefits above those that can be provided by SuDS.

SuDS are typically softer engineering solutions inspired by natural drainage processes, such as ponds and swales, which manage water as close to its source as possible. Wherever possible, a SuDS technique should seek to contribute to each of the three goals identified below with the preferred system contributing significantly to each objective. Where possible SuDS solutions for a site should seek to:

i. Reduce flood risk (to the site and neighbouring areas),
ii. Reduce pollution, and
iii. Provide landscape and wildlife benefits.

These goals can be achieved by utilising a management plan incorporating a chain of techniques, as outlined in the Interim Code of Practice for Sustainable Drainage Systems[61], where each component adds to the performance of the whole system:

Prevention	Good site design and upkeep to prevent runoff and pollution (e.g. limited paved areas, regular pavement sweeping).
Source Control	Runoff control at / near to source (e.g. rainwater harvesting, green roofs, pervious pavements).
Site Control	Water management from a multitude of catchments (e.g. route water from roofs, impermeable paved areas to one infiltration/holding site).
Regional Control	Integrate runoff management systems from a number of sites (e.g. into a detention pond).

The application of SuDS is not limited to a single technique per site. Often a successful SuDS solution will utilise a combination of techniques, providing flood risk, pollution and landscape/wildlife benefits. In addition, SuDS can be employed on a strategic scale, for example with a number of sites contributing to large scale jointly funded and managed SuDS. It should be noted, each development site must offset its own increase in runoff and attenuation cannot be "traded" between developments.

SuDS techniques can be used to reduce the rate and volume and improve the water quality of surface water discharges from sites to the receiving environment (i.e. natural watercourse or public sewer etc.). The SuDS Manual[62] identifies several processes that can be used to manage and control runoff from developed areas. Each option can provide opportunities for storm water control, flood risk management, water conservation and groundwater recharge.

- Infiltration: the soaking of water into the ground. This is the most desirable solution as it mimics the natural hydrological process. The rate of infiltration will vary with soil type and condition, the antecedent conditions and with time. The process can be used to recharge groundwater sources and feed baseflows of local watercourses, but where groundwater sources are vulnerable or there is risk of contamination,

[61] National SuDS Working Group (2004) Interim Code of Practice for Sustainable Drainage Systems
[62] CIRIA (errata 2007) SuDS Manual C697. http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

infiltration techniques are not suitable. Additionally shallow groundwater and low infiltration rates will prevent the application of infiltration SuDS.

- Detention/Attenuation: the slowing down of surface flows before their transfer downstream, usually achieved by creating a storage volume and a constrained outlet. In general, though the storage will enable a reduction in the peak rate of runoff, the total volume will remain the same, just occurring over a longer duration.
- Conveyance: the transfer of surface runoff from one place to another, e.g. through open channels, pipes and trenches.
- Water Harvesting: the direct capture and use of runoff on site, e.g. for domestic use (flushing toilets) or irrigation of urban landscapes. The ability of these systems to perform a flood risk management function will be dependent on their scale, and whether there will be a suitable amount of storage always available in the event of a flood.

8.2 Type of SuDS

SuDS designs should aim to reduce runoff by integrating storm water controls throughout the site in small, discrete units. Through effective control of runoff at source, the need for large flow attenuation and flow control structures becomes minimised.

As part of any SuDS scheme, consideration should be given to the long-term maintenance of the SuDS to ensure that it remains functional for the lifetime of the development. Table 8-1 has been reproduced from the SuDS Manual, CIRIA C697 and outlines typical SuDS options and details their typical components.

Table 8-1: Typical SuDS Components

*(Y = primary process, * = some opportunities, subject to design)*

TECHNIQUE	DESCRIPTION	CONVEYANCE	DETENTION	INFILTRATION	HARVESTING
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.		Y	Y	*
Filter Drains	Linear drains/trenches filled with a permeable material, often with perforated pipe in the base of the trench. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site.	Y	Y		
Filter Strips	Vegetated strips of gently sloping ground designed to drain water evenly from impermeable areas and filter out silt and particulates.	*	*	*	
Swales	Shallow vegetated channels that conduct and/or retain water, and can permit infiltration when unlined.	Y	Y	*	
Ponds	Depressions used for storing and treating water.		Y	*	Y
Wetlands	As ponds, but the runoff flows slowly but continuously through aquatic vegetation that attenuates and filters the flow. Shallower than ponds. Based on geology these measures can also incorporate some degree of infiltration.	*	Y	*	Y
Detention Basin	Dry depressions designed to store water for a specified retention time.		Y		
Soakaways	Sub-surface structures that store and dispose of water via infiltration.			Y	
Infiltration Trenches	As filter drains, but allowing infiltration through trench base and sides.	*	Y	Y	
Infiltration Basins	Depressions that store and dispose of water via infiltration.		Y	Y	

TECHNIQUE	DESCRIPTION	CONVEYANCE	DETENTION	INFILTRATION	HARVESTING
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation. It is noted that the use of brown/green roofs should be for betterment purposes and not to be counted towards the provision of on-site storage for surface water. This is because the hydraulic performance during extreme events is similar to a standard roof (CIRIA C697).		Y		
Rainwater Harvesting	Storage and use of rainwater for non-potable uses within a building, e.g. toilet flushing. It is noted that storage in these types of systems is not usually considered to count towards the provision of on-site storage for surface water balancing because, given the sporadic nature of the use of harvested water, it cannot be guaranteed that the tanks are available to provide sufficient attenuation for the storm event.	*	*	*	Y

When planning drainage requirements for new developments, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

As well as treating water quality before discharge to watercourses and sewers it may be necessary for surface water to pass through a series of treatment stages before infiltration.

For further guidance on SUDS, the following documents and websites are recommended as a starting point:

- Staffordshire LLFA;
- Defra Non-statutory Technical Standards for SuDS (March 2015)[63];
- The NPPF and associated Planning Policy Guidance technical notes;
- The SuDS Manual – CIRIA C697 (2007) provides the best practice guidance on the planning, design, construction, operation and maintenance of SuDS and facilitates their effective implementation within developments.
- CIRIA C644 – Green Roofs (2007)[64] provides guidance on the design, construction and operation of Green Roofs. The guidance also describes how 'quick wins' for biodiversity can be achieved in the built environment by incorporating nesting and roosting boxes for bird, bats and other animals.
- Interim Code of Practice for Sustainable Drainage Systems[65], National SuDS Working Group, 2004.
- www.ciria.org.uk/suds/
- Defra / Environment Agency Preliminary Rainfall Runoff Management Rev E[66] provides guidance on surface water drainage strategy for the Environment Agency, LPAs and developers.

[63] DEFRA (March 2015). Non-statutory technical standards for sustainable drainage systems. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf
[64] CIRIA (2007) Building Greener. Guidance on the use of green roofs, green walls and complementary features on buildings (C644)
[65] National SuDS Working Group. (2004). Interim Code of Practice for Sustainable Drainage Systems
[66] Defra / Environment Agency (2013). Rainfall runoff management for developments.

8.3 National SuDS Standards

A set of National non-statutory technical Standards[55] (NS) have been published which set the requirements for the design, construction, maintenance and operation of SuDS. The NS are intended to be used alongside the NPPF and PPG.

The NS that are of chief concern in relation to the consideration of flood risk to and from development relating to runoff destinations, peak flow control and volume control are presented below:

8.3.1 Peak Flow Control

SuDS NS2 – *"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 must not exceed the peak greenfield runoff rate for the same event".*

SuDS NS3 – *"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".*

8.3.2 Volume Control

SuDS NS4 – *"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".*

SuDS NS5 – *"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".*

SuDS NS6 – *"Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with SuDS NS4 or SuDS NS5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk".*

8.3.3 Flood Risk Within the Development

SuDS NS7 – *"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".*

SuDS NS8 – *"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".*

SuDS NS9 – *"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"*

8.4 Use of SuDS in Staffordshire Moorlands

As part of this SFRA, a high level assessment of the suitability of using SuDS techniques across the District has been undertaken. The Environment Agency Groundwater Vulnerability Map shown on Appendix B Figure 9 is largely based on the BGS Infiltration SuDS Suitability dataset.

Given the greenfield nature of many of the potential sites in Staffordshire Moorlands, there are significant opportunities for the development sites to adopt source control and site measures that are consistent with an overarching regional SuDS policy.

Site geology should be taken into account when deciding on suitable SuDS measures. Some SuDS systems rely on infiltration which in areas of low permeability may be technically unviable. If SuDS using infiltration are to be used, permeability tests should therefore be carried out to establish infiltration rates.

Any surface water management system should be implemented in accordance with relevant policy and guidance such as NPPF, National SuDS Working Group (2004), BRE365, CIRIA C522 for SUDS, CIRIA 523 (SuDS Best Practice Manual) and CIRIA C697 (the SUDS Manual).

Four categories have been identified by the BGS for suitability for infiltration SuDS:

1. **Highly compatible for Infiltration SuDS:** The subsurface is likely to be suitable for free-draining infiltration SuDS;
2. **Probably compatible for Infiltration SuDS:** The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions;
3. **Opportunities for bespoke Infiltration SuDS:** The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions; and
4. **Very significant constraints are indicated:** There is a very significant potential for one or more geo-hazards associated with infiltration.

The review of the BGS Compatibility with Infiltration SuDS map and Environment Agency Aquifer Designation maps suggest that infiltration SuDS techniques are probably compatible in large areas across the District. Very significant constraints are shown along the river corridors of the River Churnet (both the Valley and its headwaters east of Tittesworth Reservoir), Cecily Brook, Biddulph Brook, River Blithe and the Head of Trent. The BGS 'Depth to Water Table' map indicates that groundwater levels are likely to be shallow (<3 m) in these areas, likely to due to the low topography combined with the presence of superficial deposits, and therefore attenuation SuDS techniques may be more suitable.

The Environment Agency recommends that all new developments should incorporate SuDS, whereby infiltration systems should be the preferred means of surface water disposal, provided ground conditions are appropriate. Above ground attenuation such as balancing ponds should be considered in preference to below ground attenuation due to the water quality and biodiversity benefits they offer.

It should be noted that this is a high level assessment and only forms an approximate guide to infiltration SuDS suitability; an enhanced site investigation is required in all cases to confirm local conditions. The maximum likely groundwater levels should be assessed, to confirm that soakaways will continue to function even during prolonged wet conditions.

In addition any proposed infiltration SuDS should be located away from areas of historic landfill, known contamination or areas which are at risk of contamination. This is to ensure that the drainage does not re-mobilise latent contamination and exacerbate the risk to groundwater quality and down gradient receptors such as abstractors, springs and rivers. In such circumstances, a preliminary groundwater risk assessment may be required with the planning application.

8.5 Outline Planning Application Recommendations

To ensure a satisfactory consultation, SCC recommends the following information to be included in an outline planning application:

a) Site location and layout plans;

b) Topographical survey of the existing site's catchment to include contours at 1m interval and existing surface water flow routes, drains, sewers and watercourses;

c) Site plan showing areas of Main River and surface water flooding;

d) Flood Risk Assessment;

e) Site Drainage Strategy to include:

- SuDS proposals;
- Infiltration test results;
- Outfall locations and levels, including confirmation from relevant authorities that the proposed outfall location will be accepted;
- Rates of discharge including confirmation from relevant authorities that the proposed discharge rate will be accepted;
- On-site storage requirements including storage location indicated within the proposed development plan, confirmation that is it is to be located outside the existing 1% AEP+CC flood extent, and evidence that sufficient space is available; and

f) Maintenance, funding and operation proposals for the SuDS.

8.6 Full Planning Application, Reserved Matters, Discharge of Conditions Recommendations

To ensure a satisfactory consultation, the SCC recommends that the following information to be included in a full planning application, reserved matter and discharge of conditions:

a) Proposed site plan showing exceedance flow routes;

b) Drainage layout plan (to include SuDS, sewer, drains and watercourse);

c) A condition survey of any drainage assets, infrastructure or watercourse to be utilised;

d) Design calculations as necessary to demonstrate the functionality of the SuDS;

e) Detailed design drawings;

f) SuDS flow calculations (*.mdx files compatible with MicroDrainage software if that software has been used);

g) Cross sections including design levels;

h) Specification of materials;

i) Phasing of development including Construction Management Plan;

j) Construction phase Surface Water Management Plan;

k) Construction details;

l) Details of inlets and outlets and flow controls;

m) Whole life cycle costing for the SuDS to include replacement cost;

n) Details of the organisation responsible for the SuDS;

o) Details of funding arrangements for SuDS maintenance;

p) Maintenance and operation manual for the SuDS, to include physical access arrangements for maintenance and establishment of legal rights of access in perpetuity;

q) Health and Safety Risk Assessment for construction, operation and maintenance of the SuDS.